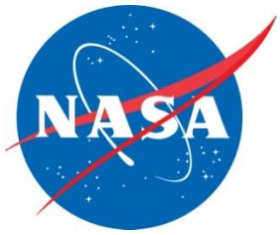
FINAL

FIRING RANGE 5 AND CONSTRUCTION DEBRIS PILE REMOVAL ACTION WORK PLAN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
PLUM BROOK STATION
SANDUSKY, OHIO



Prepared for:

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July 24, 2020

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

(*Included on CD except Attachment C*)

LIST OF ACRONYMS AND ABBREVIATIONS

95UCL	95 Percent Upper Confidence Limit
AASHTO	American Association of State Highway and Transportation Officials
ACM	Asbestos-Containing Material
AM	Action Memorandum
ARAR	Applicable or Relevant and Appropriate Requirement
Arrowhead	Arrowhead Contracting, Inc.
bgs	Below Ground Surface
BMP	Best Management Practice
CDP	Construction Debris Pile
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CoC	Chain-of-Custody
COC	Chemical of Concern
COMETS	Construction, Maintenance, Environmental, and Testing Services
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbon
CQAP	Construction Quality Assurance Plan
dbh	Diameter at Breast Height
DI	Deionized
DM	Debris Material
DOT	U.S. Department of Transportation
EMO	Environmental Management Office
Envirosafe	Services of Ohio, Inc.
EPM	Environmental Program Manual
ESE	Environmental Science and Engineering
ESV	Ecological Screening Value
EU	Exposure Unit
FANS	Firelake-Arrowhead NASA Services
FE	Federal Endangered
FM	Field Manager
FT	Federal Threatened
ft^2	Square Feet
ft^3	Cubic Feet
FTP	Field Technical Procedure
GRC	John H. Glenn Research Center
H&S	Health and Safety
HASP	Health and Safety Plan
HDPE	High-Density Polyethylene
ID	Identification
IDW	Investigation-Derived Waste
LBP	Lead-Based Paint
LCS	Laboratory Control Sample
LDPE	Low-Density Polyethylene
mg/kg	Milligram per Kilogram
mg/m^3	Milligram per Cubic Meter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

NCR	Non-Conformance Report
NPDES	National Pollutant Discharge Elimination System
NTCRA	Non-Time-Critical Removal Action
OAC	Ohio Administrative Code
Ohio EPA	Ohio Environmental Protection Agency
OHPO	Ohio Historic Preservation Office
OUPS	Ohio Utility Protection Services
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PBOW	Plum Brook Ordnance Works
PBS	Plum Brook Station
PCB	Polychlorinated Biphenyl
PFAS	Per- and Polyfluoroalkyl Substances
PM	Project Manager
POC	Point of Contact
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAAP	Quality Assurance Administrative Procedure
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCP	Quality Control Plan
RA	Removal Action
RAO	Removal Action Objective
RCI	Reactivity, Corrosivity, and Ignitability
RCRA	Resource Conservation and Recovery Act
RG	Remediation Goal
RSL	Regional Screening Level
SAIC	Science Applications International Corporation
SEC	Space Environments Complex
SI	Site Investigation
SL	Screening Level
SOP	Standard Operating Procedure
SOR	Sum-of-Ratios
SOW	Statement of Work
SPF	Space Power Facility
SSHO	Site Safety and Health Officer
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
THQ	Target Hazard Quotient
TM	Technical Monitor
TR	Target Risk
URS	URS Corporation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAP	Voluntary Action Program

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

VOC	Volatile Organic Compound
VSI	Visual Site Inspection
WOE	Weight-of-Evidence
WM	Waste Management
yd^3	Cubic Yards

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1. INTRODUCTION

The National Aeronautics and Space Administration (NASA) John H. Glenn Research Center (GRC) has contracted Firelake-Arrowhead NASA Services (FANS) to execute the statement of work (SOW) titled "Firing Range and Construction Debris Pile – Removal Action Implementation." Arrowhead Contracting, Inc. (Arrowhead) and Leidos are subcontracted to FANS to execute the remediation and environmental consulting, respectively. This work is being performed under a time and materials price basis under Prime Contract No. 80GRC018C0022, (Construction, Maintenance, Environmental, and Testing Services [COMETS] Contract), Subcontract No. FA8-1-S1, Task Order E124.

The work performed under this contract is for the completion of a non-time-critical removal action (NTCRA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements at Firing Range 5 and the Construction Debris Pile (CDP) located at NASA Plum Brook Station (PBS) in Sandusky, Ohio. The project includes two tasks from Phase 1 and four tasks from Phase 2. Leidos will work collaboratively with Arrowhead to complete the tasks. The scope of work includes:

- Phase 1
  - Task 1 – Assist in Response to Public Comments
  - Task 2 – Develop an Action Memorandum (AM)
- Phase 2
  - Task 3 – Develop a Removal Action (RA) Work Plan
  - Task 4 – Develop Health and Safety Plans (HASPs) and Quality Control Plans (QCPs)
  - Task 5 – Implement RA
  - Task 6 – Produce an RA Completion Report.

Task 1 concluded with the submittal of the *Revised Final Firing Range 5 and Construction Debris Pile Removal Site Evaluation Report* (hereafter referred to as the Removal Site Evaluation [RSE] Report) (Leidos 2019) to the Administrative Record and publication of the notice of availability with public comment period from January 17 to February 17, 2020. Task 2 was completed and documented in the *Final Action Memorandum for Firing Range 5 and Construction Debris Pile Removal Action* (Leidos 2020).

1.1 PURPOSE

The purpose of this RA Work Plan is to detail implementation of the RA specified in the RSE Report (Leidos 2019), which includes:

- Site preparation activities,
- Removal and disposal of debris containing asbestos-containing material (ACM),
- Removal and disposal of sand blasting piles containing lead-based paint (LBP) materials,
- Removal and disposal of construction debris,
- Excavation and disposal of impacted soils from Firing Range 5,
- Verification of removal activities,
- Backfilling and grading excavated areas, and
- Site restoration activities.

1.2 SCOPE

The scope of this Work Plan is to remove and dispose of three distinct debris piles, and then excavate and dispose of an estimated 602 tons of soil contaminated with chemicals of concern (COCs) that pose a threat to human health and the environment. These COCs include the carcinogenic polycyclic aromatic hydrocarbons (cPAHs) benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The three debris piles consist of one pile (Debris Pile 1) that contains approximately 667 cubic yards (yd^3) of primarily concrete rubble with reinforcing steel bars and some asbestos-containing material (ACM), and two piles (Debris Pile 2 and Debris Pile 3) that contain approximately 370 and 34 yd^3, respectively, of primarily sand blasting grit that includes paint chips, asphalt, and metal debris. The results of the 2006 and 2016 Site Investigations (SIs) and the 2017 RSE sampling activities were used to define the limits of the debris piles and impacted soils for the COCs identified during the RSE Report (Leidos 2019). The elevated concentrations of one COC, benzo(a)pyrene, were used as representative of the cPAH "hot spots" associated with asphalt debris or clay target fragments. The benzo(a)pyrene concentrations were above remediation goals (RGs) (residential regional screening levels [RSLs]) in three "hot spots" located adjacent to and immediately west of the Firing Range 5 Target Area impact berm. Note that one of the three hot spot excavations is currently within the footprint of Debris Pile 2.

The construction debris material (DM) and impacted soils will be removed and transported to an appropriate offsite waste disposal facility (Erie County Landfill) approved by NASA Waste Management (WM) . Waste characterization sampling will involve the collection of one five-part composite sample per every 100 yd^3 (to satisfy requirements of the receiving landfill) for the soil from the earthen berm and hot spot excavations and the sand blasting grit pile. The waste sampling frequency of one sample per every 100 yd^3 is a slightly more stringent requirement from the potential receiving landfill facility, as compared to the sampling frequency of one sample per every 150 yd^3 stated in the SOW. Waste characterization samples from the soil berm, soil hot spots, and sand blasting grit piles will be analyzed for toxicity characteristic leaching procedure (TCLP) semivolatile organic compounds (SVOCs); TCLP volatile organic compounds (VOCs); TCLP metals; TCLP pesticides; TCLP herbicides; total metals; total VOCs (includes F-listed VOCs); total SVOCs (includes F-listed SVOCs); polychlorinated biphenyls (PCBs); per- and polyfluoroalkyl substances (PFAS); paint filter liquids test; and reactivity, corrosivity, and ignitability (RCI). Hazardous waste, ACM, and LBP will be transported to the Envirosafe Services of Ohio, Inc. (Envirosafe) facility, which is a Resource Conservation and Recovery Act (RCRA) Subtitle C Treatment and Disposal facility; non-hazardous waste will be transported to the local Erie County Landfill; and WM will store PFAS-impacted wastes onsite unless otherwise directed. Arrowhead will notify NASA of the final selected disposal facility prior to the initiation of construction activities.

Verification sampling will be conducted to ensure all impacted soils above RGs have been removed. The samples will be analyzed for total concentrations of cPAHs (e.g., benzo[a]pyrene, benz[a]anthracene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) that are identified as COCs. Verification sample locations with soil COC concentrations greater than RGs will be excavated further and sampled until remediation goals are attained. A visual verification survey also will be conducted to verify that no ACM or LBP materials remain onsite. Soil sampling for ACM is not planned unless the Asbestos Hazard Abatement Evaluation Specialist observes any ACM breaking into small fragments onto the concrete rubble or ground during debris removal. Excavated areas will be regraded according to this RA Work Plan.

1.3 SITE DESCRIPTION

PBS is located in southern Erie County, Ohio, approximately 3 miles south of Sandusky, Ohio, and approximately 50 miles west of the NASA GRC at Lewis Field in Cleveland, Ohio (Figure 1). The PBS

facility encompasses approximately 6,470 acres (Leidos 2018) and is depicted in two adjacent U.S. Geological Survey (USGS) 7.5-minute series topographic maps: Sandusky Quadrangle (northern portion of facility) and Kimball Quadrangle (southern portion of facility). Most of PBS is in Perkins and Oxford Townships, with some lands in Huron and Milan Townships. The site boundaries are Bogart Road to the north, Mason Road to the south, U.S. Highway 250 to the east, and County Road 43 to the west. The northernmost point is at latitude 41°23'39"N and the southernmost point is at 41°20'04"N. The westernmost point is at longitude 82°43'12"W and the easternmost point is at 82°38'39"W (MK 1994).

PBS is located in an area known for its agricultural productivity and is bordered by farmland, some of which NASA leases to local farmers. The area surrounding PBS is largely rural and agricultural, with some recent development. Some food processing facilities, including dairy and meat processing operations, are located in the area. Tourism and recreation are important economic influences in the Sandusky area. The Erie County Perkins School District currently uses certain former NASA facilities, located near the former PBS main gate on Columbus Avenue and outside the fenced area, for transportation and storage purposes. Intensive commercial development, consisting of highway-oriented uses (e.g., motels, restaurants, and service stations) and shopping malls, predominate immediately to the north and east along U.S. Highway 250 and its intersections with Bogart Road and State Highway 2 in Sandusky. A U.S. Army Reserve Center is located adjacent to the southeastern corner of the property, just off Mason Road (Leidos 2018).

An 8-foot security fence surrounds approximately 5,845 acres of PBS (Leidos 2018). Most of the land at PBS consists of forestland and old fields with several streams that run across the property. An estimated 75 percent of NASA's property at PBS is considered unused. The remaining land is used for offices, test facilities, roads, and infrastructure. Public access is restricted at PBS, and access to the site is obtained through the security guard house on East Scheid Road, which was constructed in 2016. Armed guards staff the guard house 24 hours per day (Leidos 2016b). The former main gate located on Columbus Avenue is only open for emergency access by Perkins Township Police and Fire Departments, and exiting traffic at peak afternoon hours. During each 8-hour shift, a security guard patrols the inside perimeter road (Patrol Road) of the facility. Persons gain access to the station by showing the guard a badge that authorizes entry.

1.4 PLUM BROOK STATION HISTORY

PBS is operated as a satellite facility (or component installation) of NASA GRC. Use of PBS by the Federal Government began in 1941 when the U.S. Army established the Plum Brook Ordnance Works (PBOW) for the manufacture of munitions and related materials, including trinitrotoluene, dinitrotoluene, and pentolite (MK 1994). The PBOW facility consisted of 9,009 acres inland; 1.35 acres for 2 pumping stations on Lake Erie; and approximately 700 buildings. Munitions were produced from 1941 to 1945, after which buildings and production lines were decontaminated and decommissioned. Between 1941 and 1945, more than 1 billion pounds of ordnance are estimated to have been manufactured.

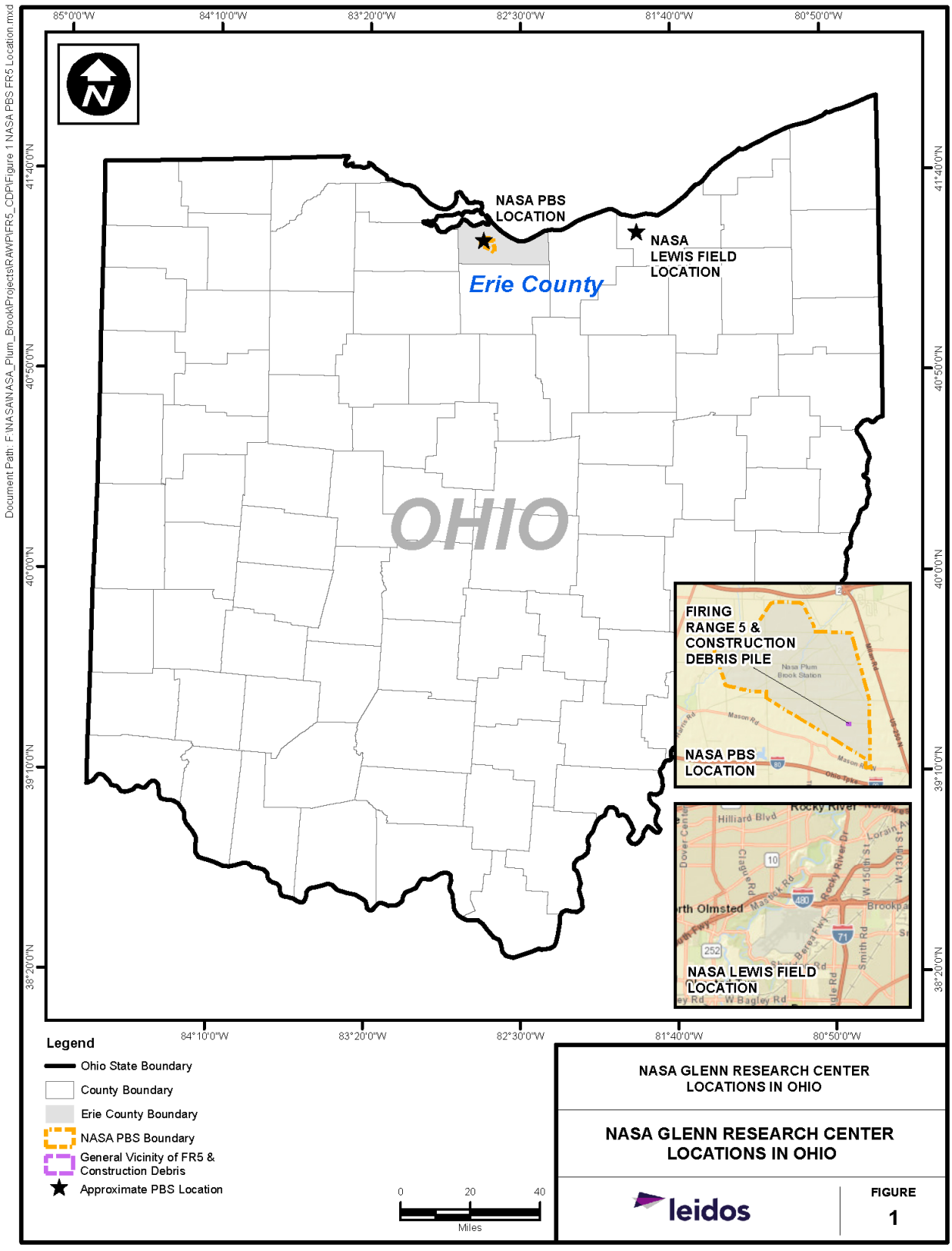

Figure 1. NASA Glenn Research Center Locations in Ohio

In 1956, the National Advisory Committee for Aeronautics (NACA) (later NASA) obtained 500 acres in the northern portion of the site for construction of a nuclear test reactor (MK 1994). This reactor was the first of 15 test facilities that NASA eventually constructed and operated from 1958 to 1973. Between 1958 and 1960, NASA demolished hundreds of buildings, renovated approximately 41 buildings, and utilized 99 magazines (Gray & Pape 2008). In 1963, NASA acquired an additional 6,000 acres of PBOW and took control over what currently is referred to as PBS (MK 1994). From 1967 through 1971, NASA purchased approximately 2,000 acres outside the fence line from local farmers as a "buffer."

On April 18, 1978, NASA declared approximately 2,152 acres of PBS as excess. This excess included approximately 1,500 acres outside the fence that were sold as farmland (Leidos 2018). The 46 acres outside the fence in the northeastern corner of PBS facility near the former main gate guard house on Columbus Avenue were conveyed to the Perkins Township Board of Education for use as a bus transportation area. In addition, the 2,152 acres of PBS declared as excess included a 604-acre parcel in the western part of the fenced area known as "Parcel 59." Although it was declared excess, this area was not transferred and remains under NASA control. However, three parcels have since been transferred, including Parcel 4 (3.0951 acres) in March 2016; Parcel 63 (Former Taylor Road Wastewater Treatment Plant, 11.5 acres) in June 2016; and Rye Beach Pump Station (1.35 acres) in December 2014 (Leidos 2018). NASA presently controls approximately 6,740 acres, including approximately 5,845 acres within the fence line and 895 acres outside the fence, which were leased for agricultural purposes.

NASA currently operates PBS as a space research facility in support of GRC. Most of the aerospace testing facilities built in the 1960s at PBS were demolished or are currently on standby or inactive status. Additional tenants at PBS include the U.S. Department of Agriculture, the U.S. Department of the Interior, the Federal Bureau of Investigation, and the Ohio Air National Guard. The Preliminary Assessment/Visual Site Inspection (PA/VSI) (Tech Law 1998) contains additional information on the site history.

1.5 FIRING RANGE 5 AND CONSTRUCTION DEBRIS PILE DESCRIPTION AND HISTORY

Firing Range 5 and the CDP are colocated near the Space Environments Complex (SEC), formerly known as the Space Power Facility (SPF), in the southeastern portion of PBS (Figure 2). The bullet impact area used at the firing range is an earthen berm. The majority of the CDP is crushed concrete and steel reinforcements (e.g., rebar); however, grit from a sand blasting operation also is associated with the debris pile (Leidos 2016a). The firing range and the construction pile have been overgrown with small trees and brush.

Firing Range 5 was constructed in 1982 and used by private security staff for practice and yearly qualification until 1986 (URS 1996). The backstop was constructed of earth and is approximately 146 feet long and 8 feet high. Targets were located approximately 5 feet from the backstop. Shooting areas were set up at 75 and 150 feet. Subsequently, the firing range was used as a dumping ground. Sand blasting grit, concrete rubble, reinforcing steel, and other construction debris have been deposited along the front edge of the backstop, the southern edge of the range, and in front of the 150-foot shooting area (Leidos 2016a).

The CDP was generated in the late 1970s during modification of the SEC Building. The pile is approximately 8 feet high and covers approximately 1 acre (Leidos 2016a). The pile was identified in the 1998 PA/VSI Report (Tech Law 1998) as the "solid waste management units (SWMUs) 8-Space Power Facility Rubble Pile." In addition, a 1991 PA (SAIC 1991) report identified sand blasting grit containing paint chips, asphalt, and metal debris at the end of the concrete pile. A portion of the debris pile also serves as the backstop for Firing Range 5. No other information is available about the pile.

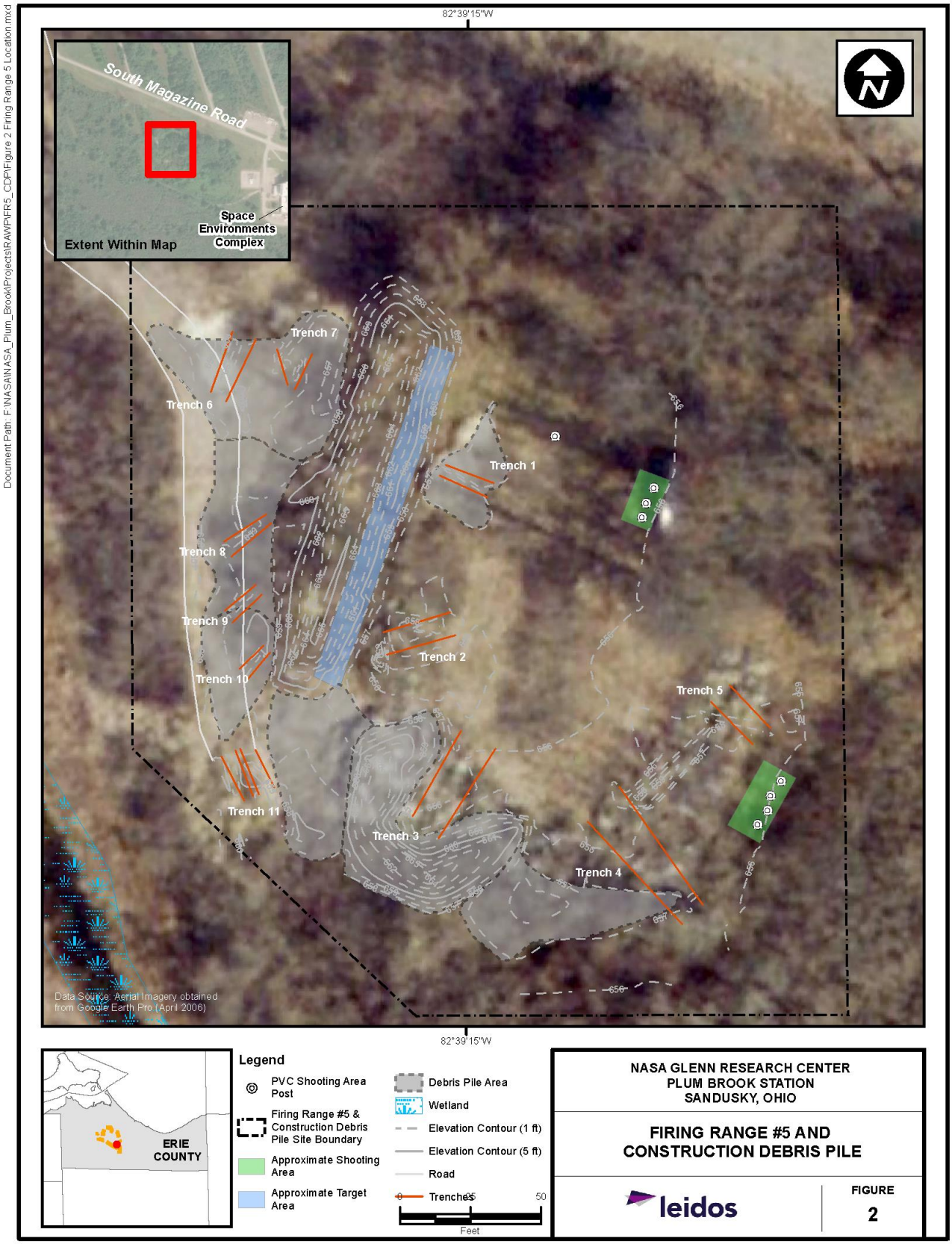

Figure 2. Firing Range 5 and Construction Debris Pile

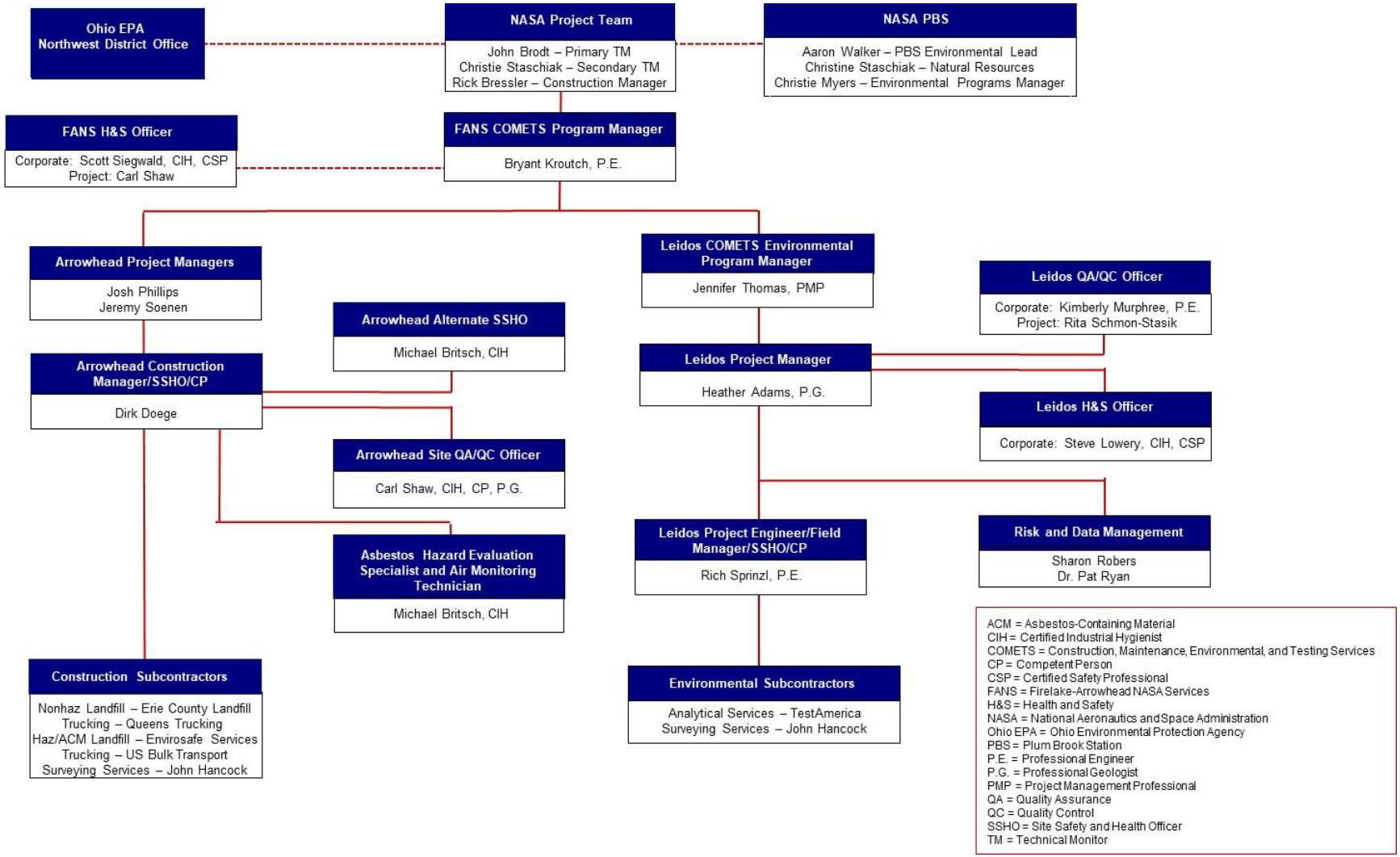

Figure 3. Organizational Chart for Implementation of the RA Work Plan for Firing Range 5 and Construction Debris Pile

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1.6 PROJECT MANAGEMENT

NASA GRC is the lead entity for this remedial project and is responsible for its implementation. NASA and the Ohio Environmental Protection Agency (Ohio EPA) have agreed to address further investigations and remediation at Firing Range 5 and the CDP under CERCLA. Furthermore, NASA will not require Ohio EPA's concurrence for any work conducted for this project due to communication between NASA and Ohio EPA in 2018. However, Ohio EPA will receive courtesy copies of project deliverables for the property Administrative Record. FANS will be responsible for managing the overall COMETS program. Arrowhead is the remedial subcontractor responsible for implementing this RA Work Plan, with environmental and technical support from Leidos. Figure 3 is an organizational chart for implementation of the RA Work Plan. Key personnel responsibilities are summarized in the following sections.

1.6.1 NASA Technical Monitor

The NASA Technical Monitor (TM) is responsible for the overall management and quality of implementing this RA Work Plan. This individual will ensure all project goals and objectives are met in a high-quality and timely manner. The NASA TM will coordinate with the FANS Program Manager, Arrowhead Project Manager (PM), and Leidos PM to address any quality assurance (QA) and non-conformance issues for this RA. The NASA TM also will have stop work authority.

1.6.2 NASA Construction Manager

The NASA Construction Manager provides day-to-day coordination and communication between the Contractor and the NASA TM. The NASA Construction Manager will serve as the onsite point of contact (POC) for contractors for all issues that affect NASA. The assigned NASA Construction Manager will supervise construction; ensure the quality of work; ensure safe working conditions that are in compliance with the approved HASPs; assist in permits, outages, and badging; and track submittals. The NASA Construction Manager will organize the Stormwater Pollution Prevention Plan (SWPPP) preconstruction meeting (Section 3.3) and witness daily safety and excavation permit briefings. The NASA Construction Manager also will have stop work authority.

1.6.3 FANS COMETS Program Manager

The FANS Program Manager is responsible for the overall execution of the COMETS contract. The FANS Program Manager will serve as the POC for the NASA Contracting Officer Representative. The FANS Program Manager is responsible for completing the program in accordance with the contract and regulatory requirements. The FANS Program Manager will accept or reject change requests based on specifications outlined in this RA Work Plan.

1.6.4 Leidos Environmental Program Manager

The Leidos COMETS Environmental Program Manager is responsible for the overall execution of environmental task orders under the COMETS contract and will be a POC to FANS and NASA. The Leidos Program Manager will manage the overall cost and schedule performance and will provide oversight on technical issues pertaining to implementing this RA Work Plan. The Program Manager will provide oversight to ensure all contractual requirements are properly satisfied; identify and prepare change requests for the project's scope of work, schedule, or budgetary baselines; and provide final resolution of any conflict identified during project performance.

1.6.5 Leidos Project Manager

The Leidos PM manages the overall performance and quality of implementing Leidos tasks under this RA Work Plan. The Leidos PM also is responsible for coordinating schedules, tracking costs, and preparing submittals. The Leidos PM oversees the Leidos Field Manager (FM) in meeting project goals and objectives in a high-quality and timely manner. This individual reports to the Leidos Environmental Program Manager. In coordination with the Leidos FM and the Leidos QA/Quality Control (QC) Officer, the Leidos PM will address issues including identification of non-conformances and verification of RA.

1.6.6 Leidos Project Engineer/Field Manager

The Leidos Project Engineer/FM also will serve as the Leidos Site Safety and Health Officer (SSHO) and will coordinate and manage onsite operations in accordance with the approved RA Work Plan, which includes providing QC oversight of Arrowhead and subcontractor activities, documenting and reporting field changes, and coordinating and controlling emergency response actions. The Leidos Project Engineer/FM also will support the Leidos PM in coordinating schedules, tracking costs, and preparing submittals. The Leidos Project Engineer/FM is responsible for ensuring the project is executed in accordance with applicable engineering and environmental regulations, requirements, and procedures of the State of Ohio, NASA, and Leidos.

1.6.7 Leidos Quality Assurance/Quality Control Officer

The Leidos QA/QC Officer will coordinate with the Leidos FM and PM to ensure the requirements of the RA Work Plan, Leidos QCP, and Construction Quality Assurance Plan (CQAP) are achieved for Leidos activities and inspections are conducted in accordance with the CQAP (Section 8).

The Leidos QA/QC Officer also will provide QC of sampling and sample handling (including sample custody, field testing, and coordinating QA/QC of the laboratory) and ensure the required submittals are on time and of high quality. The Leidos QA/QC Officer is responsible for reviewing and approving variances during field activities before work continues; approving, evaluating, and documenting the disposition of Non-Conformance Reports (NCRs); and designing and supervising the implementation of audit/surveillance plans. The Leidos QA/QC Officer reports directly to the Leidos PM and will inform the Leidos Program Manager and Leidos FM of all information and decisions reported.

1.6.8 Leidos Health and Safety Manager

The Leidos Health and Safety (H&S) Manager will establish H&S policies and procedures supporting project and office activities and verify safe work practices/conditions. The Leidos H&S Manager reports directly to the Leidos Program Manager and will inform the Leidos PM and Leidos FM/SSHO of all information and decisions reported.

1.6.9 Arrowhead Project Manager

The Arrowhead PM manages the overall performance and quality of implementing this RA Work Plan. The Arrowhead PM also is responsible for coordinating schedules, tracking costs, and preparing submittals. The Arrowhead PM oversees the Arrowhead Site Supervisor in meeting project goals and objectives in a high quality and timely manner and reports to the FANS Program Manager. In coordination with the Arrowhead Site QC Manager, Arrowhead Site Supervisor, Leidos PM, and Leidos FM, the Arrowhead PM will address issues including identification of non-conformances and verification of RA.

1.6.10 Arrowhead Site Supervisor

The Arrowhead Site Supervisor will implement specific contracted components of this RA Work Plan. The Arrowhead Site Supervisor is responsible for the proper performance of specified removal activities in accordance with this RA Work Plan, adherence to QA/QC field procedures, implementation of the HASP, coordination of field personnel activities, and field documentation. The Arrowhead Site Supervisor reports directly to the Arrowhead PM.

1.6.11 Arrowhead Site Safety and Health Officer

The Arrowhead SSHO is responsible for implementing and confirming that H&S procedures designed to protect personnel are followed strictly throughout the field activities conducted for this project. Strict adherence to the HASP will accomplish this objective. The SSHO will have the authority to halt fieldwork if H&S issues arise that are not immediately resolvable in accordance with the HASP. The SSHO reports to the Arrowhead Site Supervisor and Arrowhead PM. The Arrowhead Site Supervisor may serve as the alternate SSHO.

1.6.12 Arrowhead Quality Assurance/Quality Control Officer

The Arrowhead QA/QC Officer will coordinate with the Arrowhead PM and Site Supervisor to ensure the requirements of the RA Work Plan, CQAP, and Arrowhead QCP are achieved for removal activities and three-phase inspections are performed in accordance with the Arrowhead QCP and CQAP (Section 8).

The Arrowhead QA/QC Officer is responsible for reviewing and approving variances during field activities before work continues and approving, evaluating, and documenting the disposition of NCRs. The Arrowhead QA/QC Officer also will ensure the required submittals are on time and of high quality. The Arrowhead QA/QC Officer reports directly to the Arrowhead PM and will inform the Arrowhead PM and Arrowhead Site Supervisor of all information and decisions reported.

1.6.13 Asbestos Hazard Evaluation Specialist

The Asbestos Hazard Evaluation Specialist will monitor the construction debris removal activities and identify any asbestos-containing waste encountered. The Asbestos Hazard Evaluation Specialist is responsible for the identification, detection, and assessment (including sampling) of asbestos-containing waste; determination of appropriate response actions; and preparation of asbestos management plans to protect the public health from the hazards associated with exposure to asbestos. The Asbestos Hazard Evaluation Specialist works in conjunction with the Arrowhead Site Supervisor and SSHO to establish protective measures for dealing with asbestos-contaminated waste.

1.6.14 Asbestos Hazard Abatement Air-Monitoring Technician

The Asbestos Hazard Abatement Air-Monitoring Technician is responsible for environmental monitoring of work area clearance air sampling, including air monitoring performed to determine completion of response actions in accordance with 40 Code of Federal Regulations (CFR) 763, Subpart E, which the U.S. Environmental Protection Agency (USEPA) adopted pursuant to the "Asbestos Hazard Emergency Response Act of 1986"; this RA Work Plan and attachments; and the Arrowhead HASP.

1.7 PREVIOUS ACTIVITIES

This section summarizes historical information and previous activities supporting the evaluation and determination of the disposition of Firing Range 5 and the CDP.

1.7.1 Preliminary Assessments

Multiple environmental investigations have been conducted at NASA PBS and the former PBOW for numerous sites across the facility. These investigations provided limited information on Firing Range 5 and the CDP and no environmental sample analytical results. These reports included:

- The PBS PA (SAIC 1991), which SAIC conducted in accordance with USEPA regulations and guidance promulgated under CERCLA/Superfund Amendments and Reauthorization Act authority to determine if any release of hazardous substances from the facility posed a potential threat to human health and the environment. The PA included recommendations for further investigations for 13 Operable Units but did not include a recommendation for Firing Range 5. In addition, the PA identified sand blasting grit containing paint chips, asphalt, and metal debris at the end of the concrete debris pile, of which a portion serves as the backstop for Firing Range 5.
- In 1996, URS Corporation (URS) prepared the Work Plan for SI of PBS Firing Ranges (URS 1996), which provided information on the physical setting and history of Firing Range 5 and identified concrete rubble, large reinforcing steel, and other soil debris dumped along the front edge of the Firing Range 5 backstop, along the southern edge of the range, and in front of the 150-foot shooting area.
- The PA/VSI Report for NASA PBS (Tech Law 1998) presented cursory information on Firing Range 5 and the CDP and included a history of the operations at PBS and regulatory actions. The PA/VSI included recommendations for further investigation for 20 SWMUs.

1.7.2 Site Investigations

The first investigations that provided detailed information on Firing Range 5 and the CDP was the SI that SAIC conducted in 2006. The SI was conducted under one field investigation, as described in the *Site Investigation of NASA GRC Plum Brook Station Firing Ranges Sampling and Analysis Plan* (SAIC 2006) and the *NASA Plum Brook Station Firing Ranges and Construction Debris Pile Site Investigation Report* (SAIC 2010). The 2006 SI identified data gaps and recommended further evaluation of the PBS firing ranges. Leidos completed the additional data gap sampling in 2015; the results are presented in the *NASA Plum Brook Station Firing Range Site Investigation Report, Revision 1* (Leidos 2016a).

Soil sampling and analysis was performed for 78 sampling locations at the shooting area, target area, and off-set area at Firing Range 5 during the 2006 SI. The results of soil sampling conducted within the vicinity of Firing Range 5 provide evidence of lead-impacted soil associated with the 75-foot shooting position firing lanes (SAIC 2010, Leidos 2016a). Considering the extensive sampling that was conducted to characterize the soil in the vicinity of the impact berm, additional investigative sampling was not recommended in the SI. However, based on the results of the characterization sampling, further RA was anticipated. The results of soil characterization for SVOCs indicated polycyclic aromatic hydrocarbon (PAH) contamination potentially associated with a combination of asphalt debris, ubiquitous anthropogenic sources, and range activities (i.e., clay target fragments).

The CDP was trenched with a backhoe to the underlying soil surface in 11 locations to expose the profile of the pile and the soil surface. Soil samples were collected for analysis of metals and SVOCs from boring

locations within and adjacent to the CDP. The borings were located based on field observations such as stressed vegetation, ground discoloration, and/or DMs outside of the pile. The CDP was visually inspected to determine general content and to evaluate potential lead and asbestos contamination. DM samples were collected from suspected painted surfaces and suspected ACMs during the initial walkover of the CDP. Lead-covered asbestos panels were found throughout the CDP. Based on the analytical results for 20 paint chip samples, LBP was identified in seven samples. Based on the ACM analysis of 22 samples collected from the CDP, two samples exhibited ACM detections. The other samples collected and analyzed for ACM were primarily composed of non-fibrous material, cellulose, and/or fibrous glass.

The 2015 SI conclusions included the following:

- Evidence of lead-impacted soil associated with the 75-foot shooting position firing lanes, but it did not suggest the need for further investigation or remediation;
- Evidence of PAH contamination potentially associated with a combination of asphalt debris, ubiquitous anthropogenic sources, and Firing Range 5 activities; and
- Evidence that the debris pile has ACM and LBP items inter-dispersed throughout the pile and that the sand blasting grit has been contaminated with residual lead from LBP. Further evaluation (e.g., a remedial investigation or Removal Site Evaluation [RSE]) was recommended for Firing Range 5 soils along with the CDP underlying soils as these two areas may share a source of PAH contamination. Coordination with the NASA Engineering Management Board also was recommended for asbestos and lead abatement, asbestos and LBP WM, and final disposal of ACM and LBP-coated materials (Leidos 2016a).

1.7.3 Removal Site Evaluation

The RSE Report (Leidos 2019) presented the results from the 2006 and 2015 SIs and the 2017 RSE activities at Firing Range 5 and the CDP. The Leidos conducted the RSE to assess the potential threat to human health and the environment and to determine if a need for further action exists. The RSE Report (Leidos 2019) documented the historical and 2017 sampling results, the streamlined human health and ecological risk assessments, the basis for RA, and the recommended RA to attain unrestricted reuse conditions at Firing Range 5 and the CDP.

Leidos conducted the RSE sampling event in January 2017 in accordance with the *Multi-Site Remedial Investigation Sampling and Analysis Plan* (Leidos 2016b). During this effort, Leidos collected 20 soil and 3 groundwater samples, including 4 duplicates (2 each for groundwater and soil). Sample locations were selected based on SI analytical results in order to further evaluate potential risk to ecological receptors and human health and further define the extent of contamination. Soil samples were analyzed for metals and/or PAHs. As presented in the *Multi-Site Remedial Investigation Sampling and Analysis Plan* (Leidos 2016b), three temporary monitoring wells were to be installed at Firing Range 5 and the CDP to determine if contamination in groundwater is present. Three pilot borings were installed (two borings to 10 feet below ground surface [bgs] at Firing Range 5 and one boring to 7.75 feet bgs at the CDP) into unconsolidated soils using a Geoprobe®. No saturated zones were identified in the Firing Range 5 boring logs. A saturated zone was identified at 5.1 feet bgs in the CDP boring log. Temporary wells consisting of 1-inch polyvinyl chloride (PVC) with 5-foot screens were installed in the boreholes. The wells at Firing Range 5 were dry when Leidos inspected the day after installation, so they were allowed 5 days to accumulate water before sampling was attempted. Samples collected from Firing Range 5 during the RSE were analyzed for PAHs only. The samples collected from the CDP were analyzed for metals (filtered and unfiltered) and PAHs. The soil and groundwater SI and RSE sample analytical results and streamlined risk assessment conclusions provided evidence to conclude that the nature and extent of contamination at Firing Range 5 and the CDP has been sufficiently defined for these media (Leidos 2019).

1.7.3.1 Soil

Soil samples collected during the RSE were analyzed for metals and/or PAHs. Soil SI and RSE sample results were compared to background values, USEPA residential RSLs, and USEPA ecological screening values (ESVs). Soil at Firing Range 5 and the CDP was aggregated into five exposure units (EUs) based on past use for the streamlined human health evaluation and streamlined ecological evaluation. The five EUs included the Firing Range 5 Shooting Area, Firing Range 5 Target Area, Firing Range 5 Off-set Area, CDP Trench Debris, and CDP Soil.

The human health risk evaluation concluded no COCs requiring remediation are present in the soil at the Firing Range 5 Shooting Area, Firing Range 5 Off-set Area, CDP Trench Debris, and CDP Soil. However, COCs requiring remediation in soil are present in the Firing Range 5 Target Area (i.e., cPAHs). The sum-of-ratios (SOR) was used to account for potential additive effects from exposure to multiple chemicals that can cause the same effect (e.g., cancer) or affect the same target organ. The SOR method is based on the principle that a ratio less than or equal to one represents acceptable cumulative exposure. The SOR for carcinogens was five for the Firing Range 5 Target Area soils. The chemicals contributing significantly to this SOR are benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene; therefore, all five of these cPAHs were identified as COCs at the Firing Range 5 Target Area based on potential cumulative effects. Benzo(a)pyrene (used to represent cPAH concentrations) was detected above its RSL in 7 of 104 samples collected in the Firing Range 5 Target Area. These samples were collected from five locations (F5T-SB005, F5T-SB007, F5T-SB010, F5T-SB014, and FR5-5) on top of and to the west of the former impact berm (Leidos 2019). None of the other cPAHs listed above exhibited any exceedances above their respective RSLs.

The ecological evaluation concluded no COCs requiring remediation are present in soil at Firing Range 5 and the CDP. Although the evaluation concluded no direct remediation of soil is recommended for protection of ecological receptors at Firing Range 5 and the CDP, removal of the CDP and removal of soil exhibiting benzo(a)pyrene concentrations above human health screening criteria at the Firing Range 5 Target Area would secondarily protect ecological receptors (Leidos 2019).

1.7.3.2 Groundwater

Groundwater samples collected during the RSE from Firing Range 5 were analyzed for PAHs only and samples collected from the CDP were analyzed for metals (filtered and unfiltered) and PAHs. Extremely low yield and high turbidity were observed during sampling. Insufficient water did not allow proper development and purging for sampling in temporary wells FR5-MW1 and FR5-MW2; these wells were allowed to recharge 5 days prior to sampling. Temporary well CDP-MW1 was purged and stabilized prior to sampling. Groundwater sample results were compared to USEPA RSLs, USEPA maximum contaminant levels, and Ohio Water Quality Standards. The human health risk evaluation concluded no COCs requiring remediation are present in the groundwater at Firing Range 5 and the CDP.

1.7.4 Engineering Evaluation and Cost Analysis

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), an RA is selected when one or more of eight criteria (as listed in Section 300.415[b][2][i-viii] of the NCP) are satisfied. At Firing Range 5 and the CDP, the actual or potential exposure to contaminated soil at the earthen backstop berm and the presence of construction debris interspersed with ACM and LBP creates the site conditions that satisfy multiple criteria listed in the NCP. The RSE recommended an RA to minimize the risk and hazard associated with soil contamination (primarily benzo[a]pyrene) at isolated "hot spots" exceeding residential RSLs near the earthen berm and the presence of debris piles laden with ACM and LBP materials, in order to protect human and ecological receptors. A few additional cPAHs (i.e.,

benz[a]anthracene, benzo[b]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd)]pyrene) are also identified as COCs due to the potential cumulative risk under the SOR evaluation.

The selected RA includes the following: 1) remove soil at the isolated "hot spots" such that residential RSLs (i.e., RGs) are attained for benzo(a)pyrene contamination in soil, and 2) remove the earthen backstop berm at the Firing Range Target Area and the debris piles interspersed with ACM and LBP so that future potential impact to environmental media is prevented. In order to attain the RGs, the average COC concentration within the hot spots must be below the 2019 residential RSL or background screening level (SL). Completion of the RA will allow potential future unrestricted reuse at Firing Range 5 and the CDP site. Table 1-1 presents the soil RGs for Firing Range 5 and the CDP.

Table 1-1. RGs for COCs in Soil at Firing Range 5

COC	Residential RSL*	
	TR = 1E-5	**THQ = 1**
Benz(a)anthracene	11	--
Benzo(a)pyrene	1.1	18
Benzo(b)fluoranthene	11	--
Dibenz(a,h)anthracene	1.1	--
Indeno(1,2,3-cd)pyrene	11	--

All units are milligrams per kilogram (mg/kg).
*RSLs for soil are from the table published in May 2019 (USEPA 2019) unless otherwise noted corresponding to a TR of 1E-05 and a THQ of 1.
Bold value was used as the RG.

COC = Chemicals of Concern
RG = Remediation Goal
RSE = Removal Site Evaluation
RSL = Regional Screening Level
THQ = Target Hazard Quotient
TR = Target Risk
-- – No Value Available.

The removal action objectives (RAOs) identified in the RSE are to minimize the:

- Risk associated with soil contamination (benzo[a]pyrene and a few other cPAHs listed above) in and around the earthen backstop berm at Firing Range 5, and
- Potential risk and hazard associated with the debris piles that are interspersed with ACM and LBP materials.

To meet the RAOs, the RSE recommended the RA consisting of removing soil at the isolated "hot spots" and the earthen backstop berm at the Firing Range Target Area and the debris piles interspersed with ACM and LBP (Leidos 2019).

1.7.5 Firing Ranges Removal Action Kick-Off Meeting

On October 29, 2019, a kick-off meeting was conducted to discuss major elements of the RA approach, including:

- CERCLA NTCRA process;
- Overview of Firing Range 5 and the CDP locations and features;
- Previous investigations;

- COCs and the vertical and horizontal extents of contamination; and
- Recommended RA, construction approach, site restoration, and verification sampling.

Representatives from NASA GRC, Leidos, and Arrowhead attended the kick-off meeting. The results of the discussions and decisions agreed to during the meeting are presented in this RA Work Plan, where appropriate.

1.8 RA WORK PLAN ORGANIZATION

This RA Work Plan is composed of a Work Plan and design drawings. The remaining sections of the Work Plan are structured as follows:

- Section 2 presents the extent of COCs in soils,
- Section 3 discusses construction mobilization and site preparation,
- Section 4 describes soil excavation and removal activities,
- Section 5 details verification sampling approaches,
- Section 6 discusses waste characterization and disposal activities,
- Section 7 presents the site restoration activities,
- Section 8 presents CQAP and construction completion documentation requirements,
- Section 9 presents the reporting requirements and project schedule, and
- Section 10 lists the references used in preparing this document.
- Attachments:
  A. SWPPP for Firing Range 5 and CDP Removal Action
  B. Regulatory Notifications
  C. Design Drawings
  D. Leidos Standard Operating Procedures (SOPs)
  E. NASA GRC Specifications
  F. HASPs.

2. FIRING RANGE 5 AND CONSTRUCTION DEBRIS PILE COCS

This section summarizes the results and conclusions of analyses performed during the RSE and as reported in the Firing Range 5 and CDP RSE Report (Leidos 2019).

2.1 OIL COC EXTENT DELINEATION

As presented in Section 1.7, the streamlined human health risk and ecological evaluations concluded that no COCs that require remediation are present in the groundwater at Firing Range 5 and the CDP; however, COCs that require remediation were detected in soil at Firing Range 5. The streamlined ecological evaluation concluded no direct remediation of soil is recommended for protection of ecological receptors at Firing Range 5 and the CDP; however, removal of soil with human health screening level exceedances for cPAHs would secondarily protect ecological receptors (Leidos 2019). Soil at the firing ranges was aggregated into five EUs based on past use:

- Firing Range 5 Shooting Area,
- Firing Range 5 Target Area,
- Firing Range 5 Off-set Area,
- CDP Trench Debris, and
- CDP Soil.

Figure 4 shows the soil samples included in each of these EUs. Horizontal and vertical extents of COC-impacted soils at Firing Range 5 and the CDP were determined using soil samples collected during historical investigations and the 2017 RSE and comparing to risk-based SLs, as described in Section 1.7.

At the Firing Range 5 Shooting Area, thallium concentrations (1.4 and 1.8 milligrams per kilogram [mg/kg]) in two soil samples (F5S-SB003 at 0.0 to 1.0 and 1.0 to 2.0 feet bgs) slightly exceeded the RSL (0.78 mg/kg) and background (1.3 mg/kg); however, no source of thallium is present and the 95 percent upper confidence limit (95UCL) concentration for the shooting area is less than the background SL. Thallium was not identified as a COC requiring remediation for this EU based on the weight-of-evidence (WOE) presented in the RSE Report (Leidos 2019).

At the Firing Range 5 Target Area, thallium concentrations in 18 of 92 samples collected at 12 locations (ranging from 1.4 to 2.2 mg/kg) exceeded the RSL (0.78 mg/kg) and background (1.3 mg/kg); however, no source of thallium is present and the 95UCL concentration for the Firing Range 5 Target Area (1.2 mg/kg) is less than the background SL. Thallium was not identified as a COC requiring remediation for this EU based on the WOE presented in the RSE Report (Leidos 2019). Benzo(a)pyrene was detected above its RSL in 7 of 104 samples collected in the Firing Range 5 Target Area. These samples were collected from five locations (F5T-SB005 [0.0 to 1.0 and 1.0 to 2.0 feet bgs], F5T-SB007 [2.0 to 3.0 and 3.0 to 4.0 feet bgs], F5T-SB010 [0.0 to 1.0 feet bgs], F5T-SB014 [1.0 to 2.0 feet bgs], and FR5-5 [0.0 to 2.0 feet bgs]) on top of and to the west of the former impact berm. The cPAHs were COCs recommended for remediation at these locations, as these locations may represent isolated “hot spots” associated with asphalt debris or clay target fragments. Figure 4 shows the benzo(a)pyrene (used to represent cPAH concentrations) results (Leidos 2019).

At the Firing Range 5 Off-set Area, all detected concentrations of lead were less than the RSL. Lead was not identified as a COC (Leidos 2019).

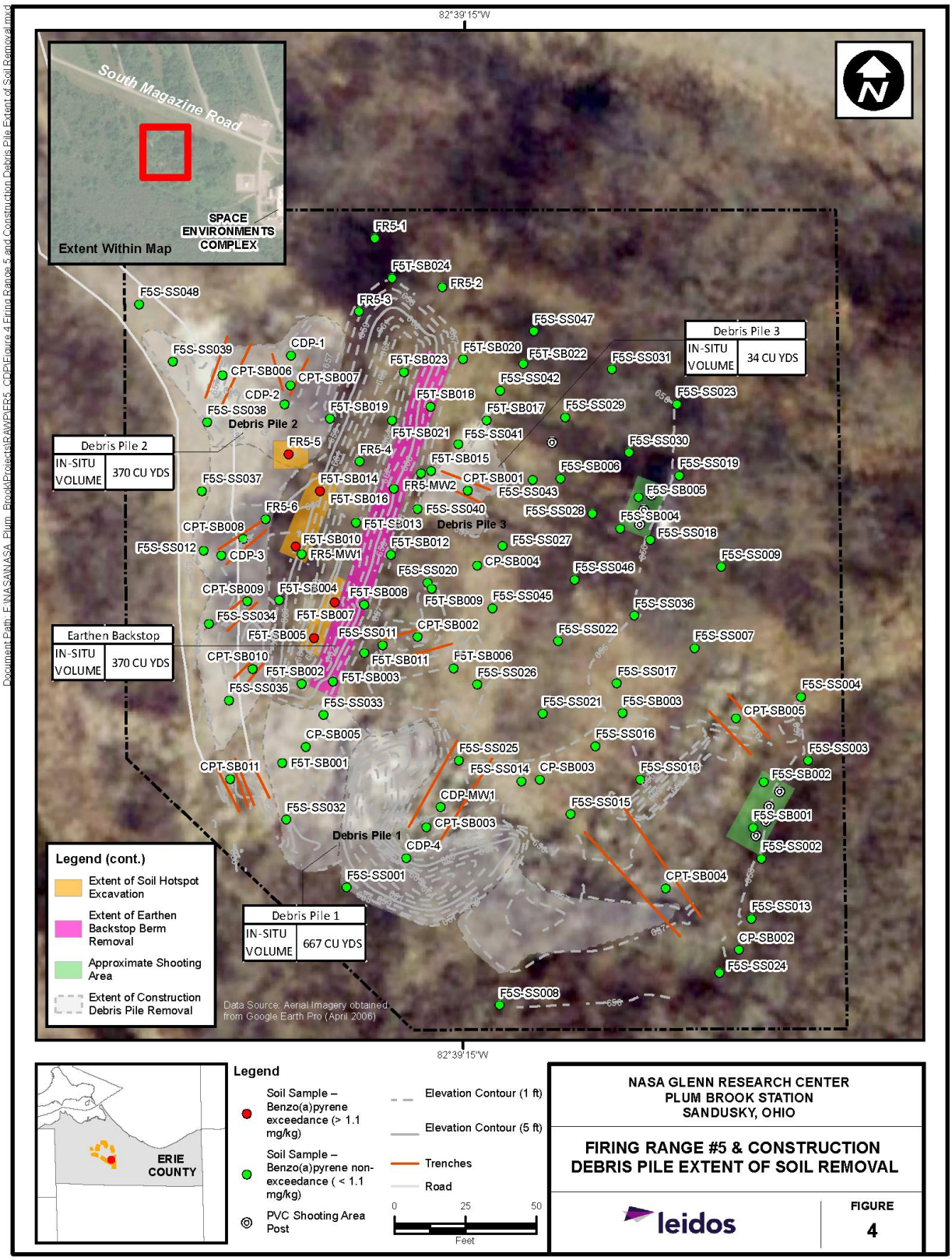

Figure 4. Firing Range 5 & Construction Debris Pile Extent of Soil Removal

At the CDP Trench Debris, all detected concentrations of cPAHs were less than the RSLs. All detected concentrations of metals were less than the background SLs and RSLs. No COCs were identified at the CDP Trench Debris (Leidos 2019).

At the CDP Soil, thallium concentrations (ranging from 1.5 to 1.8 mg/kg) exceeded the RSL (0.78 mg/kg) and background (1.3 mg/kg); however, no source of thallium is present. Thallium was not identified as a COC requiring remediation for this EU based on the WOE presented in the RSE (Leidos 2019).

Using the results of the COC extent delineation based on risk-based evaluations, the extent of soil removal was calculated and the removal areas are depicted in Figure 4. Based on visual survey and the surface contours map for the earthen backstop berm (Leidos 2016a), it is estimated that the earthen backstop berm is approximately 125 feet long, 8 feet high, and 10 feet wide. While the SI and RSE sampling results indicate the presence of metals and cPAH concentrations in the soil in the immediate vicinity of the earthen berm, the driver for RA is the contaminated soil exceeding residential RSLs for benzo(a)pyrene. The presence of bullet fragments and any potential residual metals and cPAH contamination in the earthen berm also provide a basis for removal of the earthen berm to prevent future impact to soil and groundwater media at the site (Leidos 2019). The estimated removal quantities include the soil contained in the backstop berm and additional excavation of isolated hot spot locations that exceed the site residential RSLs (i.e., FR5-5, F5T-SB005, F5T-SB007, F5T-SB010, and F5T-SB014). The area around F5T-SB010 and F5T-SB014 will be excavated to a depth of 2 feet bgs, immediately to the west of the earthen berm. Deeper samples at those locations exhibited no exceedances above SLs. In addition, the area around F5T-SB005 and F5T-SB007 will be excavated to a depth of 4 feet bgs to address benzo(a)pyrene exceedances in the 2- to 3- and 3- to 4-foot bgs depths at those locations. Location FR5-5 also will be excavated to a depth of 2 feet bgs to address the benzo(a)pyrene exceedance at that location. Table 2-1 presents the estimated volumes of soil to be removed from the backstop berm and hot spot locations.

2.2 CONSTRUCTION DEBRIS PILE

The CDP was visually inspected to determine general content and to evaluate potential lead and asbestos contamination. DM samples were collected from suspected painted surfaces and suspected ACM during the initial walkover of the CDP. Lead-covered asbestos panels were found throughout the CDP. Twenty paint chip samples were collected from the CDP and analyzed for LBP. The results of the LBP analysis ranged from 0.0015 to 11 percent by weight (or 15 to 110,000 mg/kg). NASA GRC guidelines (*Environmental Program Manual* [EPM] Chapter 13; now Chapter 5 of the *Occupational Health Programs Manual*) define LBP as paint containing lead greater than or equal to 0.06 percent by weight (600 parts per million). Based on these analytical results, LBP was identified in seven samples. Twenty-two samples were collected from the CDP and analyzed for ACM. ACM was detected in two samples. The other samples that were analyzed for ACM were primarily composed of non-fibrous material, cellulose, and/or fibrous glass. The results of the 2006 SI visual and land survey, and the debris samples collected from the CDP, provide evidence that the debris pile contains ACM and LBP items interspersed throughout the pile and that the sand blasting grit has been contaminated with residual lead from LBP (SAIC 2010, Leidos 2016a).

The CDP was land surveyed during the SI (SAIC 2010, Leidos 2016a) and was divided into three sub-piles. The first pile (Debris Pile 1) contains approximately 667 yd^3 all of the concrete rubble with reinforcing steel bars and ACM. The second pile (Debris Pile 2) contains approximately 370 yd^3 of sand/grit and is located behind the impact berm. The third pile (Debris Pile 3) contains approximately 34 yd^3 of sand/grit and is located in front of the impacted berm. The total amount of sand/grit is approximately 404 yd^3. Table 2-1 summarizes the estimated volumes of constructed debris to be removed from the CDP. Figure 4 presents the locations of the debris piles.

Table 2-1. Summary of Estimated Soil and Construction Debris Volumes and Associated Weights

Waste Material	Area (ft^2)	Height/Depth (ft)	Volume (ft^3)	Volume (yd^3)	Weight* (tons)
Earthen Backstop	1,250	8	10,000	370	500
Soil Hot Spot Excavation (F5T-SB005 through F5T-SB007)	250	4	1,000	37	50
Soil Hot Spot Excavation (F5T-SB010 through F5T-SB014)	300	2	600	22	30
Soil Hot Spot Excavation (FR5-5)	225	2	450	17	22
Debris Pile 1 (Concrete Construction Rubble with ACM and LBP Materials)	N/A	N/A	18,000	667	1,267
Debris Pile 2 (Sand Blasting Grit with LBP)	N/A	N/A	10,000	370	500
Debris Pile 3 (Sand Blasting Grit with LBP)	N/A	N/A	905	34	45
				Total Soil	602
				Total Construction Debris	1,812

*Assumed density of soil and sand/grit at 1.35 tons/yd^3 and density of concrete rubble at 1.9 tons/yd^3.

ACM = Asbestos-Containing Material
FR5 = Firing Range 5
ft = Feet
ft^2 = Square Feet
ft^3 = Cubic Feet
LBP = Lead-Based Paint
N/A = Not Applicable
yd^3 = Cubic Yard

3. CONSTRUCTION MOBILIZATION

This section describes construction mobilization and site preparation activities required to implement this RA Work Plan. Attachment C (Drawings C-3, C-4, and C-5) detail associated requirements and are referenced throughout this section.

The contractors responsible for implementing construction and sampling activities are required to prepare a HASP (under Task 1) in accordance with the NASA GRC Safety Manual requirements and Occupational Safety and Health Administration guidelines. The NASA GRC Safety Office's approval of the HASP is required prior to initiation of remedial activities. The approved HASP is included as Attachment F.

3.1 PERMIT AND NOTIFICATION REQUIREMENTS

NASA has authority under CERCLA as the lead agency to conduct a response action. Therefore, per CERCLA Section 121(e), NASA is not required to obtain external permits (local, state, or federal). However, NASA will coordinate and consult with the permitting authorities to facilitate the identification and compliance of federal and state applicable or relevant and appropriate requirements (ARARs). Any of the submittals listed below will be sent to the permitting authority as coordination and consultation (not as a permit application), and the correspondence will clearly state this objective. Based on a review of applicable requirements, the following NASA permits, consultations, and notifications are required prior to the RA:

- Consultation with the U.S. Fish and Wildlife Service (USFWS), if tree clearing needs to be conducted within the restricted time frame;
- Ohio State Historical Preservation Office notification (NASA will complete Section 106 Form and Native American consultation) for any ground disturbance below 0.5 feet bgs;
- NASA GRC Excavation Permit; and
- NASA Stormwater Program approval of SWPPP; and Ohio EPA requirements for Asbestos Emission Control and minimum 10-day notification prior to beginning ACM removal activities as per Ohio Administrative Code (OAC) Chapter 3745-20.

No other federal, state, or municipal permits, notifications, or requirements have been determined to be applicable for this RA. All signatory documentation (e.g., permits and manifests) will be obtained through NASA representatives.

3.1.1 Endangered Species Protection

Section (h) Endangered Species Protection of 40 CFR 6.302 prohibits federal agencies from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival. In 2016, EnviroScience conducted floristic and faunal surveys at NASA GRC (EnviroScience 2017). No federally listed species or Ohio listed species were identified at Firing Range 5 and the CDP. However, Firing Range 5 and the CDP lie within the range of the Indiana bat (*Myotis sodalis*), a federally listed endangered (FE) species, and the northern long-eared bat (*Myotis septentrionalis*), a federally listed threatened (FT) species.

Trees within the limits of construction will require felling to facilitate soil excavation and removal activities at Firing Range 5 and the CDP, which could potentially impact wildlife habitat, including that of the Indiana bat and northern long-eared bat. Consequently, NASA GRC coordinated with USFWS to determine the appropriate disposition of potential bat roosting trees (Attachment B). USFWS stated that summer habitat requirements for the species are not well defined, but believe the following are important:

- Dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas;
- Live trees (such as shagbark hickory), which have exfoliating bark;
- Stream corridors, riparian areas, and upland woodlots, which provide forage sites.

To protect the critical habitat for two bat species (Indiana bat [FE] and northern long-eared bat [FT]), the NASA TM has requested tree clearing should take place outside of the restricted time frame of April 1 through September 30. If clearing trees equal to or greater than3 inches in diameter at breast height (dbh) within the restricted time frame is required, additional coordination with USFWS will need to occur. The tree clearing and additional brush clearing are scheduled to be conducted in February/March 2020. Consultation with USFWS will be conducted if tree clearing within the restricted time frame is necessary. The final disposition of the tree segments is addressed in Section 3.2.3.

USFWS consultation recommended no tree clearing within 660 feet of a bald eagle nest or within a woodlot supporting a nest tree. As of January 2020, NASA indicated that no nests are within 660 feet of the project site (Attachment B).

3.1.2 Protection of Historic Properties – Ohio State Historic Preservation Office Consultation

On March 2, 2020, NASA completed an Ohio Historic Preservation Office (OHPO) Section 106 Form outlining the RA (for ground disturbance where no archaeological surveys have been conducted) and the determination of no effect on historic properties and sent it to OHPO for their review and concurrence. The OHPO concurrence letter, dated April 19, 2020, concurred with NASA's findings that the RA will have no adverse effect on historic properties. A copy of the OHPO concurrence letter is included in Attachment 1 of the *Final Action Memorandum for Firing Range 5 and Construction Debris Pile Removal Action* (Leidos 2020).

In addition, NASA completed Native American consultations for ground disturbing activity at Firing Range 5 and the CDP. The RA may begin once NASA receives responses or 30 calendar days have passed without a response or request for extension. Documentation of the Native American consultations is included in Attachment 1 of the *Final Action Memorandum for Firing Range 5 and Construction Debris Pile Removal Action* (Leidos 2020). With any ground-disturbing activity, the potential of an inadvertent discovery of human remains or funerary objects exists. If such items are encountered during the RA, excavation will immediately stop and the NASA GRC Cultural Resources Manager and NASA TM will be notified. Excavation will not resume until the NASA GRC Cultural Resources Manager releases the site.

3.1.3 Construction Stormwater Permit

The total area of construction within Firing Range 5 and the CDP is estimated to be 1.3 acres, which does require NASA GRC to develop a site-specific SWPPP under the Ohio EPA National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit No. OHC000005. Arrowhead prepared and submitted an SWPPP for the RA at Firing Range 5 and the CDP to NASA on January 8, 2020; NASA approved the SWPPP on January 10, 2020. Attachment A contains a copy of the approved SWPPP. Attachment C (Drawings C-4 and C-5) presents the best management practices (BMPs) to be followed prior to RA activities. NASA will submit a notification letter and SWPPP to the Erie County Engineer's Office and the Erie Soil and Water Conservation District. However, an Ohio EPA NPDES stormwater permit will not be required. Arrowhead will retain the SWPPP for 3 years after the project ends.

3.1.4 Asbestos Demolition and Renovation Notification

NASA/Arrowhead Contracting will submit a Notification of Asbestos Demolition and Renovation in accordance with OAC 3745-20-03, OAC 3745-22-04(C)(4), and 40 CFR 61.145(b). This notification will be submitted to the Ohio EPA Central Office – Division of Air Pollution Control a minimum of 10 working days before the RA ("abatement") begins. "Abatement" refers to any asbestos hazard abatement activity involving the removal, renovation, enclosure, repair, or encapsulation of reasonably related friable ACM in an amount greater than 50 linear feet or 50 square feet (ft^2). Per Ohio Revised Code 3745.11(G), NASA will pay the notification fees for an asbestos abatement project regulated under OAC 3745-20 when thresholds are greater than or equal to 260 linear feet, 160 ft^2, or 35 cubic feet (ft^3). Per OAC 3745-22-04(C), if the abatement project involves removal, encapsulation, enclosure, or repair of greater than 50 ft^2 or 50 linear feet of ACM, the licensed asbestos hazard abatement contractor is responsible for paying the separate notification fees.

3.1.5 NASA GRC Requirements

The contractor will notify NASA PBS employees of pending construction efforts, including firewood staging. Coordination with and notification to NASA PBS Security and WM will be arranged prior to the start of field activities. Finally, a NASA excavation permit will be obtained prior to field activities. As part of the Phase 2 excavation permit process, the contractor will provide qualifications for at least two excavation competent persons. NASA will conduct monthly oversight inspections in addition to the contractor's weekly and rain event inspections. Arrowhead and earth worker subcontractors are required to complete NASA-administered Erosion and Sediment Control training. NASA will lead an SWPPP preconstruction meeting prior to removal activities.

NASA GRC will manifest all waste shipments in accordance with NASA GRC's EPM, Chapter 20 (Handling, Reuse, and Disposal of Soil). ACM waste shipments also will contain a waste shipment record.

3.2 SITE PREPARATION

The contractor must perform site preparation prior to beginning excavation activities at the site. Site preparation activities consist of several elements designed to maximize access to the site and prevent migration of soil during excavation. Site preparation requirements include:

- Establishing site controls and site access,
- Installing stormwater controls,
- Setting up construction support facilities, and
- Utility survey and clearance.

3.2.1 Site Control and Access

NASA PBS traffic rules will be strictly obeyed (refer to Attachment C, Drawing C-8, Traffic Management Plan). NASA PBS roads will not be blocked and traffic will be maintained on at least half of the roadway width at all times. The NASA TM must grant approval prior to the start of any activity that will obstruct traffic. The contractor will not interfere with the peak traffic flows during normal operations at NASA PBS without notification to and approval by the NASA TM.

3.2.2 Construction Support Facilities

Construction support facilities for this RA will include:

- Sanitary facilities,
- Water storage tank (if necessary,
- Temporary haul road,
- ACM and sanitary trash roll-off containers,
- Equipment trailer, and
- Equipment staging area.

Attachment C (Drawings C-4 and C-5) detail the locations of these support facilities.

3.2.3 Clearing

Clearing activities will be required to facilitate equipment access and soil removal (Attachment C, Drawing C-4). Clearing will primarily involve felling and removing trees that are greater to or greater than 3 inches dbh prior to restricted time (between April 1 and September 30) to protect the critical habitat for two bat species (Indiana bat [FE] and northern long-eared bat [FT]). The trees are primarily located on and around the earthen berm and surrounding the CDP. The tree clearing and additional brush clearing were conducted in February/March 2020.

Felled large tree segments will be cut to short firewood sections (i.e., 2- to 3-foot length) and transferred to the designated firewood staging area (Attachment C, Drawing C-8). Smaller tree segments will be recycled into chipped wood mulch product and left onsite as ground cover. Tree stumps and associated roots within the remedial construction footprint will be placed in a roll-off box or haul truck (Attachment C, Drawing C-5). Any root balls will be pulled up, dried, and shaken to remove the bulk soil material, and the roots will be grinded up into mulch product.

3.2.4 Temporary Haul Road

A temporary haul road may be constructed from the stabilized construction entrance leading from South Magazine Road, as indicated in Attachment C (Drawing C-4). If necessary, topsoil will be scraped and stockpiled onsite for site restoration. Stone (American Association of State Highway and Transportation Officials [AASHTO] No. 2) and a non-woven geotextile fabric (e.g., Ohio Department of Transportation 712.09 Type D) will be placed to facilitate the loading of roll-off containers and on-road haul trucks. The temporary haul road will be maintained throughout the project (e.g., stone will be kept on the fabric and free of mud) to allow equipment to traverse safely and efficiently. If the Arrowhead Site Supervisor or SSHO observes that the equipment/haul trucks are generating visible dust, the contractor will employ dust-suppression measures (e.g., wetting).

3.2.5 Utilities

The contractor will coordinate with NASA to obtain the required utility clearance and excavation permit prior to commencing intrusive field activities. NASA will be responsible for underground utility clearance for excavation and sample locations on NASA PBS property. Ohio Utility Protection Services (OUPS) will not need to be contacted prior to commencing intrusive work.

In the event the contractor discovers unmarked utilities during removal activities, work will stop immediately and the activities will be reassessed. The NASA TM and Arrowhead Site Supervisor will be notified immediately. NASA PBS personnel will determine the disposition of the discovered utility, and NASA PBS and the contractor will make a joint determination regarding continuation of remedial activities. If the discovery of unmarked utilities results in a change to this RA's scope, objectives, or schedule, NASA

GRC will notify the FANS Program Manager for concurrence on proposed revisions and/or corrective actions.

3.3 STORMWATER POLLUTION PREVENTION

The estimated disturbed construction area is 1.3 acres; therefore, an SWPPP is required for this site. A copy of the NASA-approved SWPPP is included in Attachment A. The contractor will install stormwater run-on and runoff controls prior to initiating remedial activities, as detailed in Attachment C (Drawings C-4 and C-5). BMPs will be employed and monitored protecting the excavation area against stormwater run-on and runoff. Erosion and sedimentation controls will include both non-structural and structural BMPs. Non-structural BMPs at the project site will include:

- Minimizing disturbance,
- Phasing of construction operations, and
- Maintaining good housekeeping practices.

Structural BMPs at the site will include:

- Silt fence,
- Temporary stabilization measures, and
- Earthen berms.

In addition, to minimize the potential for erosion and sediment runoff, no work will be conducted during periods of inclement weather, as determined by the NASA TM or designee. The excavation areas will be opened and backfilled as quickly as possible during construction activities. Any water that accumulates in an excavation and comes into contact with impacted soils or stabilized soils will be classified as "Excavation Water." Excavation water will be allowed to infiltrate and/or evaporate within the excavation areas, if possible. If infiltration and/or evaporation is not possible due to the potential to affect excavation activities, Arrowhead, Leidos, and NASA GRC will evaluate alternate forms of removal (i.e., pump to the frac tank for storage before proper disposal). Erosion/sedimentation control features will remain in place until completion of restoration activities. The Arrowhead Site Supervisor will inspect the stormwater controls weekly and document the findings on the GRC stormwater inspection checklist (or similar). Stormwater controls also will be inspected within 24 hours of a 0.5-inch storm event or 2-inch snowmelt. These inspections will be performed in accordance with the CQAP (Section 8). NASA also will conduct a monthly stormwater controls inspection and inform the Arrowhead Site Supervisor if any corrective action is required.

If discolored (i.e., red) water is observed in any excavation, the contractor will immediately notify the NASA TM and Leidos PM.

Arrowhead and earth worker subcontractors are required to complete the NASA-administered Erosion and Sediment Control training. NASA will lead an SWPPP preconstruction meeting prior to removal activities.

3.4 DUST AND WIND CONTROLS

All excavations, haul routes, permanent access roads, waste areas, and all other work areas within the project boundaries will be maintained free from dirt that could cause a hazard or nuisance. Dust generation activities may occur during excavation, material handling, and truck transportation (on paved and board roads). A dust monitor, such as a DustTrak™ or MiniRAM™ (or equivalent) will be used to monitor fugitive dust during soil excavation and loading and construction debris removal and loading (the HASP

provides additional information). Dust control will be maintained by keeping traffic on improved roads, maintaining a 10-mile per hour speed limit on roads near the project site, and application of water, as required. If fugitive dust exceeds established limits (i.e., greater than or equal to 1 milligram per cubic meter [mg/m^3] for greater than 1 continuous minute), water spraying/misting will be used for dust control. Water used for dust control will be clean (i.e., obtained from onsite sources with the approval of the NASA TM or potable water obtained from an offsite source). The use of additives will not be permitted.

During instances of high winds resulting in excessive dust, NASA GRC reserves the right to require additional dust control measures or to stop work. The Arrowhead SSHO will be responsible for dust monitoring by a DustTrak™ or MiniRAM™ (or equivalent) and by visual indications. During soil excavation/ loading and construction debris removal/loading, dust monitoring using a MiniRAM™ will be performed for each work area continuously. In addition, the Arrowhead SSHO will conduct visual inspections daily, at a minimum, for visible fugitive dust emissions during normal representative operating conditions.

During removal of the construction debris that is interspersed with ACM, any ACM to be removed would be "adequately wet" (as per OAC 3745-20-01) to prevent release of particulates into the air. Upon evaluation, a certified Asbestos Hazard Evaluation Specialist will detail the specific dust and wind controls for ACM removal activity, including any air monitoring, as necessary. The HASP for the site will be appended if the Asbestos Hazard Evaluation Specialist identifies additional controls.

3.5 GOOD HOUSEKEEPING

Good housekeeping practices are designed to maintain a clean and orderly work environment and will include, at a minimum:

- Regular pick up and disposal of garbage and waste material;
- Routinely inspect for leaks or conditions that could lead to discharges of petroleum or chemicals, or contact of stormwater, with raw materials, intermediate materials, waste materials, or products;
- Perform preventive maintenance on equipment to ensure its proper operation and to detect potential leaks before they occur; and
- Ensure that employees, contractors, and/or subcontractors understand spill cleanup procedures and establish storage areas away from direct traffic routes to prevent accidental spills.

4. SOIL EXCAVATION AND CONSTRUCTION DEBRIS REMOVAL ACTIVITIES

This section describes the soil excavation and construction debris removal activities that will be conducted in support of this RA Work Plan at Firing Range 5 and the CDP:

- Removal and segregation of ACM waste from the CDP;
- Removal and segregation, as needed, of the debris;
- Excavation and removal of cPAH-impacted soils in hot spot excavations F5T-SB005 and F5T-SB007, F5T-SB010 and F5T-SB014, and FR5-5;
- Removal of the earthen berm (Target Area) at Firing Range 5;
- Surveying; and
- Equipment decontamination.

Attachment C (Drawings C-3 through C-5) detail requirements for performing the above-listed activities and are referenced as appropriate throughout this section. Section 6 discusses the transportation and disposal of impacted soils and construction debris. Verification sampling will be conducted in accordance with Section 5.1 prior to backfilling the excavation areas.

Arrowhead will implement the removal activities and bear responsibility for the excavation, characterization, disposal of impacted/stabilized soils and construction debris, backfill, and/or restoration activities. NASA GRC will oversee these activities. Implementation of these activities will meet the requirements of this RA Work Plan and associated HASP. In addition, all excavation and soil removal activities will be consistent with state and federal environmental laws and regulations.

If unexpected site conditions or materials are encountered during any phase of the remedial activities, construction activities will stop immediately to be reassessed in accordance with the HASP. The NASA TM, NASA Construction Manager, and Arrowhead Site Supervisor immediately will be notified about the situation. The conditions will be assessed and a joint determination made regarding continuation of remedial activities. Work will not resume until the NASA TM grants approval. If the discovery results in a change to the scope, objectives, or schedule of this RA Work Plan, the NASA TM will notify the Arrowhead PM and Leidos PM for concurrence on proposed revisions and/or corrective actions.

If artifacts (e.g., Early American) are unearthed, excavation will stop, the contractor will contact the NASA TM, and excavation will not begin again until a NASA GRC Cultural Resources Manager releases the area.

4.1 NASA GRC SOIL POLICY

Excavation and soil/construction debris removal activities from Firing Range 5 and the CDP will be consistent with state and federal environmental laws and regulations, and Chapter 20 of the NASA GRC EPM. Chapter 20 outlines the Handling, Reuse, and Disposal of Soil policy maintained and approved by NASA GRC's Environmental Management Office (EMO). The NASA GRC policy was established to:

- Evaluate the need for analyses on all soil prior to excavation;
- Minimize the volume and toxicity of waste soil generated by NASA GRC operations to the extent technically, legally, and economically possible;

- Reuse excavated soil as fill material at NASA GRC whenever possible; and
- Fulfill the requirements of solid and hazardous waste disposal facilities.

4.2 EXCAVATION ACTIVITIES

This section describes the soil and construction debris removal activities that will be performed in support of this RA Work Plan, including:

- Land surveys,
- ACM waste removal,
- Construction debris removal,
- Excavation of impacted soil, and
- Equipment decontamination

Excavation limits at each of the excavation areas will be constructed within a tolerance of greater than 0.5 feet except where dimensions or grades are shown or specified as minimum. Grading will be performed to maintain slopes and drainage. Excavation of any area or staging of backfill will be implemented to result in the minimum detrimental effects to natural environmental conditions (i.e., prevent sediment runoff to nearby drainage ditches).

The Arrowhead Site Supervisor will work with the excavator operators to determine the best positions for locating construction equipment, based on the area being excavated. During construction debris removal and soil excavation, care will be taken to not drop materials outside the work areas, overfill trucks, or drop materials onto the sides of the truck or the ground. Loaded trucks and the surrounding area will be inspected for spilled materials. Spilled materials will be collected immediately for load-out. The contractor will use "careful loading" practices such as:

- Haul trucks will be staged as close as practicable to materials being excavated and the contractor will spread plastic sheeting on the ground to catch loose soils.
- The excavator operator will stage impacted soils and construction debris within the excavation in close proximity to the haul trucks. This will minimize carrying distances and separate compacted/clods of soils, thereby ensuring a more fluid transfer from the bucket into haul trucks.
- The operator will shake the excavator bucket within the excavation to level the bucket's contents and dislodge any loose materials that could fall during transfer to the haul truck.
- The excavator bucket will be positioned within the excavations during excavator relocation to ensure any spillage occurs in the excavation/staging areas.
- The operator will lower the excavator/front-end loader bucket into the haul truck to minimize the vertical fall of materials during transfer. A spotter may be used to ensure the bucket's position is optimal.

Throughout excavation activities, the contractor will manage any water accumulating in the hot spot excavations in accordance with Section 3.3. Excavation water will be allowed to infiltrate and/or evaporate within the excavation areas, if possible. If infiltration and/or evaporation is not possible due to the potential to affect excavation activities, Arrowhead, Leidos, and NASA GRC will evaluate alternate forms of removal (i.e., pump to the frac tank for storage before proper disposal). Plastic sheeting will be used, if necessary, to cover the open excavations at the end of each day and during inclement weather.

While performing all work under this RA Work Plan, the contractor will not allow either on- or off-road haul trucks to track soil/mud onto NASA PBS roadways or public roadways. The contractor will inspect all of the haul trucks within the inspection area before release to PBS roads and public roads. All on-road haul trucks will be covered while transporting soils to the disposal facility and all transportation requirements (e.g., labeling and placards) will be followed. The contractor will use a skidsteer with sweeper attachment (or similar) to clean PBS roadways, if necessary.

4.2.1 Establishing Limits of Excavation

Land surveys will establish the horizontal limits of excavation. Excavation limits will be demarcated in accordance with Attachment C (Drawing C-3). Based on these limits, an estimated 102 tons of impacted soils from the hot spot excavations and 500 tons of soil from the earthen berm require removal.

4.2.2 Asbestos-Containing Waste Removal

The contractor will segregate exterior work areas with caution tape at an adequate distance from the regulated areas to deter unauthorized personnel from approaching the regulated areas. In addition, the contractor will use asbestos warning tape and appropriate signage to demarcate the exterior regulated areas and prevent accidental intrusion into regulated areas by non-authorized personnel. Prior to removal of the CDP, the contractor will inspect and mark the debris as suspected ACM waste, based on historical SI results. The ACM waste will be removed by hand or via means of heavy equipment using excavators with hydraulic thumb and skidsteer grapple attachments. All ACM waste will be segregated in a separate roll-off container that is appropriately placarded and manifested in accordance with Ohio EPA's ACM waste shipment requirements. After the initial round of removal, the debris will be continually monitored as concrete rubble and metal are removed and segregated. The removal of ACM encountered in the CDP also will trigger the requirements of OAC 3745-20-01 through 3745-20-05 as ARARs for asbestos emission control, demolition procedures, and standards for asbestos waste handling and disposal. Requirements under OAC 3745-22 also would be applicable to ensure that removal, handling, and disposal of ACM are conducted under the supervision of an appropriately licensed Asbestos Hazard Abatement Specialist. These regulations require that wastes containing asbestos be handled in a manner to prevent fugitive emissions from waste handling and transported to disposal in a sealed or contained manner (either sealed containers or transported in bulk by leak-tight transport vehicles or containers). In addition, a relevant and appropriate requirement can be invoked for this activity under OAC 3745-20-07(A)(1-3) to ensure no visible emissions are discharged to the outside air. The contractor will use a method to adequately wet asbestos-containing waste material and transfer to the roll-off container. The specific dust controls for ACM removal activity, including any air monitoring, are detailed in the HASP for the site and were evaluated by a licensed Asbestos Hazard Evaluation Specialist. The existing HASP for the site will be appended if additional controls are necessary due to changes in site conditions identified by the Asbestos Hazard Evaluation Specialist.

4.2.2.1 Loading and Labeling

The excavated material that is considered ACM will be loaded into roll-off containers or haul trucks. The roll-off containers or haul trucks will be lined with two 6-mil polyethylene liners (12-mil total per Ohio EPA regulations). Once filled, the liner will be sealed. The container either will be transported immediately to a disposal facility approved for accepting ACM or staged in the Construction Laydown Area (shown on Attachment C, Drawing C-4) to await transport to a disposal facility. Alternately, a combination of a 6-mil plastic bag and a leak-tight steel, plastic, or fiber drum, or reinforced disposal box, leak-tight polypropylene woven fabric bag, or similar suitable and durable container, may be used. For wrapped material or material to be transported off the facility site, the containers or wrapped material will be labeled with the name of the waste generator and the location at which the waste was generated. In addition, a label will be applied to the roll-off container stating:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

R.Q., ASBESTOS CLASS 9 NA 2212, III

For all asbestos-containing waste material transported off the facility site, each waste generator and owner, or operator, of a waste disposal site will maintain waste shipment records. The waste shipment record will be legible, complete, signed, and dated by the waste generator and waste disposal site operator.

4.2.2.2 Post-Removal Asbestos Survey

The post-removal asbestos survey is conducted to determine the presence or absence of ACM debris. As stated in Section 4.2.2, an Asbestos Hazard Evaluation Specialist licensed by the State of Ohio will conduct the evaluation, handling, and disposal of ACM waste. Following completion of the removal of all construction debris, the Asbestos Hazard Abatement Evaluation Specialist will complete a visual inspection of the entire work area to determine the presence or absence of surface ACM. No soil sampling is planned unless the Asbestos Hazard Abatement Evaluation Specialist observed the ACM breaking into small fragments onto the concrete rubble or ground during debris removal. Up to six contingency soil samples will be collected at a one sample per 1,000-ft^2 subarea. Within each of the sample subareas, soil aliquots will be collected from four randomly selected locations within the sample subarea. These four aliquots will be combined into one sample. The samples will be submitted to EMLab P&K (subcontracted to TestAmerica) for polarized light microscopy asbestos analysis using USEPA Method 600/R-93-116. If any of the samples exceed 1 percent asbestos, the subarea of that sample location will undergo soil excavation (estimated 0.5 feet bgs) until confirmed to be less than 1 percent asbestos. If the samples are below 1 percent asbestos, the subarea will be confirmed to meet remedial goals and can be backfilled or regraded. The Asbestos Hazard Abatement Specialist will provide a letter report confirming all ACM materials and ACM-impacted surface soils have been removed for inclusion in the RA Completion Report.

4.2.3 Construction Debris Removal Activities

Construction debris removal and segregation (as needed) activities will begin after construction site set-up and clearing has occurred. The appropriate equipment (e.g., excavator with hydraulic extension, skid steer) will be mobilized to the site for the removal activities. Based on the land survey results and mapping conducted during the SI (Leidos 2016a), it is estimated that approximately 1,267 tons of concrete rubble debris will be generated for offsite disposal, of which 5 percent (63 tons) is estimated to be segregated for ACM disposal and 1,203 tons will be disposed of as non-hazardous waste. Approximately 545 tons of sand blasting grit waste will be generated for disposal as hazardous waste. Any LBP materials encountered and segregated from the concrete rubble pile will be disposed of as hazardous waste along with the sand blasting grit waste. Debris will be saw cut or broken into 4-foot lengths per disposal facility requirements. During the removal activities, any construction debris observed beyond the extent of the defined debris piles (Attachment C, Drawing C-3) also will be removed from the site. Non-hazardous construction debris (e.g., concrete rubble) will be disposed of offsite at the Erie County Landfill in Huron, Ohio, and hazardous waste (e.g., sand blasting grit and ACM) will be disposed of offsite at the Envirosafe facility located

approximately 60 miles from NASA PBS. The Envirosafe facility is a RCRA Subtitle C Treatment and Disposal facility that accepts both non-hazardous and RCRA hazardous wastes, including ACM wastes.

4.2.4 Soil Excavation, Removal, and Load-Out Activities

Following removal of the CDP, the removal activities will proceed to removal of hot spot excavations and the earthen berm at Firing Range 5. Note that one of the three hot spot excavations is currently within the footprint of Debris Pile 2 (Attachment C, Drawing C-3).

Based on a visual survey and the surface contours map for the earthen backstop berm (Leidos 2016a), the earthen backstop berm is estimated to be approximately 125 feet long, 8 feet high, and 10 feet wide. The estimated removal quantities include the soil contained in the backstop berm and additional excavation of isolated hot spot locations that exceed the site RGs (i.e., FR5-5, F5T-SB005, F5T-SB007, F5T-SB010, and F5T-SB014). The area around F5T-SB010 and F5T-SB014 will be excavated to 2 feet bgs to address the benzo(a)pyrene exceedances at 0 to 2 feet bgs, immediately to the west of the earthen berm. Deeper samples at those locations exhibited no exceedances above SLs. In addition, the area around F5T-SB005 and F5T-SB007 will be excavated to a depth of 4 feet bgs to address benzo(a)pyrene exceedances in the 2- to 3- and 3- to 4-foot bgs depths at those locations. Location FR5-5 also will be excavated to 2 feet bgs to address the benzo(a)pyrene exceedance at that location (Leidos 2019) (Attachment C, Drawings C-3 and C-5). Based on the dimensions of the earthen berm and hot spot excavations to address benzo(a)pyrene exceedances at Firing Range 5, approximately 602 tons of soil waste will be generated for offsite disposal. All non-hazardous soil waste generated from removal of the earthen berm and hot spot soil excavations will be disposed of at the Erie County Landfill located approximately 5 miles from NASA PBS.

Land surveys or other depth measurements will be performed as required to monitor and direct the progress of excavation activities. When required excavation depths have been attained and load-out of all soils is complete, verification sampling will be conducted to confirm all impacted soils above remediation goals have been removed, as described in Section 5.1.

Upon completing the excavation, soil removal, and verification sampling activities, the contractor will backfill the excavation to achieve the final surrounding grades shown in Attachment C (Drawing C-3). Soils used for backfill will comply with the screening criteria provided by the NASA TM.

4.3 SURVEYING

Land surveys will be conducted prior to initiation of excavation activities to establish surface elevations and to demarcate areas to be excavated using the limits of excavation coordinates defined in Attachment C (Drawing C-3). The contractor will conduct land surveys during excavation activities and upon completion of final excavated grades. Horizontal and vertical measurement accuracy will be +/- 0.1 foot. Upon completion of all surveys, documentation of the extent, elevation, and grades will be submitted to the Arrowhead Site Supervisor and Leidos FM for inclusion in the RA Completion Report.

4.4 DECONTAMINATION

Contact with impacted materials will be actively minimized and measures will be taken to prevent tracking of material from the excavation. Equipment used to excavate impacted soils will be decontaminated prior to contact with other materials and/or prior to demobilization offsite. Equipment that comes into direct contact with impacted soils will be decontaminated as described below:

- The excavator bucket will be placed over an off-road haul truck (Note: only limited amounts of liquids [i.e., less than 30 gallons] will be used for decontamination activities performed over haul

trucks. Decontamination liquids will not change the chemical profile of the waste [i.e., addition of solvents or pH]).

- Other small equipment and hand tools will be placed within a portable PVC container (e.g., molded portable swimming pool).
- All loose soil will be removed using a stiff-bristle brush or other device to dislodge visible soil.
- Equipment will be steam cleaned using potable water.
- Equipment will be allowed to air dry as long as possible.
- Equipment will be placed on clean plastic if immediate use is anticipated, or wrapped in plastic to prevent contamination if longer-term storage is required.
- Loose soils and wash water will be mixed with soils and placed into a haul truck for disposal (decontamination liquids will consist of less than 30 gallons per truck and will not change the chemical profile of the waste).

If necessary, the contractor will construct a decontamination pad onsite using timbers and a 6-mil polyethylene liner. The integrity of the decontamination pad will be inspected daily and the polyethylene liner/timbers will be replaced as necessary.

At the end of each day, the contractor will park and maintain the excavator bucket in an excavation. If not feasible, the bucket will be wrapped with 6-mil low-density polyethylene (LDPE) sheeting and bound using duct tape and/or wire in a sufficient manner to prevent accidental loss during overnight/weekend weather conditions.

Upon completion of all work and verification sampling, the excavator bucket and lower boom (if it contacted waste material) will be decontaminated following the procedure listed above. After the final decontamination, the portable PVC container also will be disposed of with a soil/decontamination water mix. Because the rest of the excavator has not been in contact with any hazardous materials, all soil remaining on the equipment will be removed from the machine using track spades, brooms, or other suitable devices. This soil will be incorporated back into the final overburden used to restore the site. Prior to release of construction equipment from the site, the SSHO or designee will visually inspect the construction equipment, paying attention to the:

- Tires and wheels or tracks (as applicable);
- Undercarriage (e.g., frame, axles);
- Exterior surfaces (including steps, running boards);
- Engine compartment; and
- Operator compartment.

If, during excavation activities, information becomes available or site conditions indicate the excavator tracks contacted impacted soils, the contractor will construct a decontamination pad and the excavator will be decontaminated prior to release from the site. If required, the decontamination pad will be constructed (using the portable containment system) as near as possible to the “finish” location of the excavator, within the limits of construction (Attachment C, Drawing C-4). Decontamination of the excavator will include the use of steam cleaning devices, pressurized water sprays, biodegradable detergent solutions, and/or hand cleaning. The contractor will collect, containerize, characterize, and properly dispose of all wash water and solids generated during excavation activities (Section 6.2).

5. VERIFICATION SAMPLING

This section details verification sampling and visual asbestos surveying to be conducted onsite in support of RA activities. The objective of verification sampling is to confirm the removal of all impacted soils above remediation goals. Attachment C (Drawing C-6) details the verification sampling activities, which are described below. Sampling procedures will follow the requirements outlined in this section and in the Sampling Quality Assurance Project Plan (QAPP) (Section 5.3).

5.1 VERIFICATION SAMPLING

Following excavation activities at the hot spot excavation locations at Firing Range 5, the contractor will conduct verification sampling to ensure they have removed all impacted soils above remediation goals. The number of required soil samples for verification sampling was calculated using USEPA's *Methods for Evaluating the Attainment of Cleanup Standards* (USEPA 1989), as presented in Table 5-1. Given that the historical soil sampling results for sample locations within the earthen berm footprint at Firing Range 5 and the CDP sample locations did not exceed the RSL (RG) for any COCs, verification soil sampling is not necessary after the contractor removes the earthen berm and the debris piles.

Table 5-1. Summary of Verification Samples for Excavation Areas

Area	No. of Sampling Locations*		
	Excavation Floor	Excavation Walls	Total
Soil hot spot excavation (F5T-SB005, F5T-SB007)	1	3	4
Soil hot spot excavation (F5T-SB010, F5T-SB014)	1	4	5
Soil hot spot excavation (FR5-5)	1	4	5

***** Quantities are based on one floor or wall sample per approximately every 25 feet.

FR5-5 = Firing Range 5

To aid in spacing and locating sampling points and assist in follow-on verification sampling, sampling grids were developed, as shown in Attachment C (Drawing C-6). Verification soil samples will be collected from the locations shown on Drawing C-6 and analyzed by a licensed offsite analytical laboratory. Verification sample locations exhibiting COC concentrations greater than the RGs specified in Table 1-1 will be further excavated. The limits of contamination will be delineated based on the relative location of the sample (i.e., excavation floor or wall) and verification results at adjacent sample locations.

At each sample location where the remediation goals have been exceeded, an impacted area will be established by circumscribing an area halfway between the elevated sample location and the nearest non-elevated sample points. This impacted area will be excavated an additional 1 foot in depth. Three verification samples then will be collected from the newly excavated area and analyzed. The sampling/excavation process will continue until verification samples indicate remediation goals have been achieved or bedrock has been reached.

5.1.1 Verification Sampling Method

Verification samples will be collected at the approximate locations shown in Attachment C (Drawing C-6). Locations accessible to field personnel will be collected using stainless steel spoons and hand augers. Locations inaccessible to field personnel will be sampled remotely using an excavator bucket and lowered

to field personnel to collect samples with stainless steel spoons. Between uses, the stainless steel spoons, or hand auger, will undergo decontamination (Section 5.2). The spoons/hand augers will be allowed to air dry and wrapped in aluminum foil until needed again.

Verification samples from the excavation floor will be collected from the upper 6 inches of soil at each location. For samples collected from the excavation walls, a grab sample soil will be collected from the midpoint of the wall. Each soil sample will be placed in a stainless steel bowl and homogenized using a stainless steel spoon. Soil samples will be analyzed by a licensed offsite analytical laboratory in accordance with Table 5-2 and as shown in Attachment C (Drawing C-6). Verification soil samples will be collected for analysis of cPAHs at each excavation location to ensure all impacted soils have been removed from the site.

Table 5-2. Project Laboratory Analytical Summary

Type of Sample	Parameters	Methods	Samples
Soil Verification Samples			
Soil Verification	PAHs	SW-846, 8270C	14
Field Duplicate (1 per 10 soil samples)	PAHs	SW-846, 8270C	2
MS/MSD (1 per 20 soil samples)	PAHs	SW-846, 8270C	1
Solid Waste Characterization Samples			
Excavated Soil; Sand grit waste	TCLP RCRA metals + antimony + nickel + mercury	SW-846, 6010B/7470A	12
	TCLP Volatiles	SW-846, 8260B	10
	TCLP Semivolatiles	SW-846, 8270C/1311	10
	TCLP Pesticides	SW-846, 8081B	10
	TCLP Herbicides	SW-846, 8151A	10
	PAHs	SW-846, 8270C	10
	PCBs	8082	10
	Flashpoint	SW-846, 1010	10
	Total cyanide	SW-846, 9012A	10
	Total sulfide	SW-846, 9034	10
	PFAS	USEPA 537.1 (Modified)	10
Liquid IDW Characterization Samples			
Decontamination Water	Total Volatiles (includes F-listed VOCs)	SW-846 8260B, 8015M, 8015B, 8240	2
	Total RCRA Metals + Nickel	SW-846, 6010/7470A	2
	Total Semivolatiles (includes F-listed SVOCs)	SW-846, 8270D	2
	Flash Point	SW-846, 1010	2
	Total Cyanide/Sulfide	SW-846, 9030/9034/9012	2
	PFAS	USEPA 537.1 (Modified)	2

IDW = Investigation-Derived Waste
MS/MSD = Matrix Spike/Matrix Spike Duplicate
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
PFAS = Per- and Polyfluoroalkyl Substances
RCRA = Resource Conservation and Recovery Act
SVOC = Semivolatile Organic Compound
TCLP = Toxicity Characteristic Leaching Procedure
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

5.2 DECONTAMINATION OF ANALYTICAL SAMPLING EQUIPMENT

All non-dedicated sampling equipment that may come in direct contact with sampled media will be chemically decontaminated. Chemical decontamination is required to ensure sample quality and to prevent potential cross-contamination.

Equipment to be chemically decontaminated includes stainless steel bowls, stainless steel spoons, and hand augers. Equipment decontamination and "Cleaning and Decontaminating Sample Containers and Sampling Equipment" are described in the Leidos Field Technical Procedure (FTP)-400, *Equipment Decontamination* (Attachment D.2). Chemical decontamination will be conducted as follows:

- Initial wash with potable water and Alconox (or similar) detergent,
- Rinse with potable water,
- Rinse with 10 percent nitric acid solution,
- Rinse with deionized water (DI),
- Rinse with reagent-grade isopropanol,
- Rinse with DI, and
- Allow equipment to air-dry.

Upon completion of the above decontamination procedures, each item will be wrapped in plastic or aluminum foil to prevent subsequent contamination prior to use. Decontamination activities will be conducted in a manner that will allow for the containment and control of all waste decontamination fluids. Every effort will be made to minimize the quantity of waste fluids generated during decontamination activities. Chemical decontamination activities will be conducted in a non-contaminated location (i.e., site-specific or central staging area). Waste decontamination water from sampling equipment decontamination procedures will be transferred into U.S. Department of Transportation (DOT)-approved 55-gallon drums or other containers approved by NASA WM in accordance with Section 6.2.

5.3 SAMPLING QAPP

The following subsections outline the procedures to be followed to ensure proper analytical methods, QC, and sample handling methods are achieved for the RA to address the known COCs at Firing Range 5 and the CDP. Firing Range 5 and the CDP were identified as an area of potential concern during NASA's PFAS PA; therefore, waste characterization sampling at Firing Range 5 and the CDP also will include PFAS analysis. The latest available and accepted USEPA Method 537.1 (Modified) will be used for the PFAS analysis. The Leidos SOP for PFAS sampling is included in Attachment D.

5.3.1 Analytical Methods

Table 5-2 presents the analytical methods used to analyze samples collected during field activities and the sample quantities.

5.3.2 Level of Quality Control Effort

The QC effort for this task includes procedures for field sampling and laboratory analysis. The laboratory uses a variety of QC samples to quantitatively assess the quality of the data. The laboratory control sample (LCS) contains known concentrations of target analytes and is used to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch. Matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory duplicates, and surrogate spikes measure the

matrix component of measurement performance but also reflect laboratory performance. The laboratory will, at a minimum, analyze internal QC samples at the frequency specified by the analytical method.

The laboratory will analyze temperature blanks, field duplicate samples, and MS/MSD samples to assess the quality of the data resulting from the field sampling and analytical programs. QC samples will not be collected during waste characterization and verification sampling.

In the field, additional QC samples will be collected to assess field sampling techniques and environmental conditions during sample collection and transportation. The types and frequencies of QC samples that will be collected and analyzed are described below.

5.3.2.1 Equipment Rinse Blank

Equipment rinse samples will not be collected during excavation verification soil sampling or waste characterization sampling because excavation verification soil and waste characterization samples will be collected using dedicated sampling equipment.

5.3.2.2 Temperature Blank

A temperature blank consists of distilled or tap water and will be included in each container (e.g., cooler) used to ship samples to the analytical laboratory in order to provide the means to assess the temperature of the samples within the sample shipment.

5.3.2.3 Field Duplicate

A field duplicate sample is a second sample collected at the same location as the original sample in order to assess the representativeness of the sample. Duplicate samples are collected simultaneously, or in immediate succession, using identical recovery techniques and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification (ID) number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. One field duplicate sample will be collected for every 10 or fewer samples (10 percent).

5.3.2.4 MS/MSD

An MS/MSD is an aliquot of sample spiked with known concentrations of analytes to document the bias of a method due to sample matrix characteristics. The spiking occurs prior to sample preparation and analysis. The samples that are collected for MS/MSD analysis will be designated on the chain-of-custody (CoC). MS/MSD samples will be collected at a frequency of 1 per every 20 or fewer samples (5 percent).

5.3.3 Analytical Sample Management

Samples will be placed in laboratory-supplied containers appropriate for the intended analyses. Samples will be identified, handled, and shipped as described below.

5.3.3.1 Station and Sample Identification Numbering System

The field station and sample ID numbers are unique numbers that allow for the tracking and evaluation of each environmental sample collected during the project. The station ID number is specific to the site and sample station. The field sample ID number is medium-specific and increases consecutively throughout the entire project.

5.3.3.2 Station Identification System

Sample location stations will be recorded on the field CoC forms. The sample station will identify the areas and the specific location where the sample was collected and will consist of the following:

- Sample location area:
  - FR5CDP: Firing Range 5 and CDP
- Sample location type:
  - VS: Verification Soil Sample
  - WC: Waste Characterization.

Unlike laboratory sample ID numbers, sample station locations are not consecutive throughout the entire project and are area-specific only.

Examples of sample station locations are:

- FR5CDP-VS-001 = Firing Range 5 and CDP Verification Soil Sample Location #1
- FR5CDP-WC-001 = Waste Characterization Sample Location #1.

Note that multiple laboratory sample ID numbers may refer to a single sample station location. In addition, a sample station location cannot be determined from the laboratory sample ID number alone (or vice-versa). This information will be included on the field and laboratory CoCs, on the sample container label, and in electronic analytical data tracking files. The depth for each soil sample also will be recorded on field and laboratory CoCs.

5.3.3.3 Sample Identification System

The laboratory sample ID number is a unique number that allows for the tracking and evaluation of each environmental sample collected during sampling activities. The laboratory sample ID number is medium-specific and increases consecutively throughout the entire project. Laboratory sample ID numbers will consist of the following:

- Project ID Code: FR5CDP
- Sample Matrix Codes:
  - VS: Verification Soil
  - RS: Equipment Rinse
  - WL: Liquid Waste Characterization
  - WC: Soil Waste Characterization
- Sample Numbers:
  - 0001 through 8999: Regular Sample
  - 9000 through 9499: Duplicate Sample.

Sample ID numbers will not be duplicated from past Firing Range 5 and CDP field efforts but will commence at the next available sample number.

Examples of laboratory sample ID numbers are shown in Table 5-3.

Table 5-3. Example Station and Sample Numbers

Station Number	Sample Number	Description
FR5CDP-VS-001	FR5CDPVS0001	FR5CDP Site, Verification Soil Boring 1, Soil Sample 1
FR5CDP-WC-001	FR5CDP-WC-001	Soil Waste Characterization Sample 1

FR5CDP = Firing Range 5 and CDP

Sample location stations also will be recorded on the field CoC forms. The sample location station will identify the area and the specific location where the sample was collected. Unlike sample ID numbers, sample station locations are not consecutive throughout the entire project and are location-specific only.

5.3.3.4 Sample Containerization and Preservation

The subcontract analytical laboratory will determine the sample containers and chemical preservation/holding time requirements for soil samples collected during the RA activities. The laboratory also will estimate and supply the specific number of containers required. Additional containers will be provided, when necessary, for the collection of field QA/QC samples (e.g., field duplicates, MS/MSDs).

The subcontract analytical laboratory also will provide the required types and volumes of chemical preservatives. Temperature preservation will be maintained at 4°C (±2°C) from sample collection through laboratory receipt by placing the sample in a cooler with wet ice and storing the samples either in coolers with ice or in a refrigerator.

5.3.3.5 Sample Labels

A sample label will be affixed to each sample container sent to the laboratory. This ID label will be completed in indelible ink with the following information:

- Project name and location;
- Field sample location;
- Field sample ID number;
- Date and time of sample collection;
- Preservative used, if any;
- Name of collector;
- Media type;
- Type of sample (grab or composite); and
- Analyses requested.

5.3.3.6 CoC and Sample Shipment Records and Procedures

Samples will be collected under CoC protocols, including use of field logbooks, sample labels, CoC forms, sample ID, and custody seals. Samples will be labeled using standard procedures, including labeling sample bottles prior to collection, completing a CoC form prior to sample shipment, and using custody seals on coolers, in accordance with the Leidos Environmental Science and Engineering (ESE) FTP-625 (CoC procedure) and ESE FTP-1215 (use of logbooks).

5.3.3.7 Sample Packaging and Shipping Requirements

Environmental sample containers will be packaged in thermally insulated coolers. Sample packaging and shipping will be conducted in accordance with applicable DOT specifications. Packaging and shipping procedures to be used for samples collected during the project will include the following:

- Each sample container will be wrapped in bubble-wrap or similar protective material.
- Each sample container will be placed into a separate plastic bag that will then be sealed. As much air as possible will be squeezed from the sample container bags before sealing.
- Each sample container will be placed upright in the shipping cooler along with wet/chemical ice (when required) sealed in double plastic bags that will be placed around, among, and on top of the sample containers. For shipping with laboratory-provided couriers, the ice may be contained in single plastic bags.
- Before initial placement of samples into a rigid-body cooler, the cooler drain plug will be taped shut (inside and outside), and the cooler will be lined with a large plastic bag.
- Inert packing material will be placed into the cooler, if required, to prevent shifting of the sample containers during transport.
- All required laboratory paperwork, including laboratory CoC forms, will be placed inside a plastic bag and taped to the inside of the cooler lid. If a laboratory-provided courier is used, the paperwork will be attached to the outside of the cooler to facilitate exchange of sample custody.
- Upon completion of the packing process, the cooler lid will be sealed with duct tape and strapping tape and two signed/dated custody seals will be placed on the cooler, one across the front and one across the side.
- The commercial shipping documentation (when applicable) will be completed and attached to the top of the shipping box/cooler, which then will then be transferred to the courier for delivery to the laboratory.

All environmental samples collected during the project will be sent to the laboratory by courier or shipped as soon as possible to ensure compliance with analytical method holding times. During the time period between collection and shipment, all samples will be stored in ice-filled coolers or refrigerated (when required) and maintained in a secure area. All coolers containing environmental samples will be shipped overnight to the laboratory by commercial or laboratory courier.

5.3.4 Corrective Actions and Variances

Corrective actions may be required for two types of problems: analytical/equipment problems and non-compliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

Non-compliance with specified criteria and analytical/equipment problems will be documented through a formal corrective action program at the time the problem is identified. The person identifying the problem is responsible for notifying the Leidos FM and PM. When the problem is analytical in nature, information on the problem will be communicated promptly to the Leidos QA/QC Officer. Implementation of the corrective action will be confirmed in writing.

Any non-conformance or variance from the established procedures in this RA Work Plan will be identified and corrected in accordance with Leidos Quality Assurance Administrative Procedures (QAAPs) ESE A15.1 and A16.1 or established laboratory quality procedures. The Leidos FM or designee will issue a Field

Change Request for variances or NCR for each non-conforming condition. If a variance is anticipated (e.g., because of a change in the field instrumentation), the applicable procedure will be revised upon approval from the Leidos PM and QA/QC Officer, and the change will be noted in the field logbooks.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the Leidos PM and/or the NASA TM.

5.3.5 Field and Laboratory Instruments/Equipment

The following sections present information regarding the control, calibration, maintenance, and testing of field and laboratory instruments and equipment.

5.3.5.1 Field Equipment

Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturers. These procedures are included in the technical procedures governing the use of these instruments.

5.3.5.2 Laboratory Instruments

As part of the QA/QC Program, a routine preventive maintenance program will be conducted by all investigation-associated laboratories to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturer specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturer maintenance will be provided under a repair and maintenance contract with factory representatives or an authorized provider of such services.

6. WASTE CHARACTERIZATION AND DISPOSAL

This section describes waste characterization, transportation, and disposal activities that will be conducted in support of implementing this RA Work Plan.

6.1 WASTE TYPES

Waste generated during remedial activities will be managed to prevent the potential release of contamination. The following types of waste may be generated:

- Excavated soils (PAH impacted-soils);
- Sand blasting grit (containing LBP);
- Non-hazardous construction debris and ACM;
- Investigation-derived waste (IDW) [general trash and personal protective equipment (PPE)];
- Vegetation;
- Other materials, including unexpected materials (e.g., drums, containers, camper);
- Excavation water (surface and groundwater in direct contact with exposed impacted soils);
- Decontamination fluids (wash water generated during the decontamination of equipment);
- Plastic sheeting and vacuum hoses; and
- Stormwater controls (silt fence, inlet protection, and sand bags).

In general, proper waste minimization procedures will be employed to limit the volume of waste generated. These procedures will include:

- Reuse of materials that do not require decontamination, including mulch from cleared vegetation;
- Divert 50 percent of construction and demolition debris from landfills;
- Minimization of the volume of decontamination fluids;
- Minimization of contact with potentially contaminated materials;
- Minimization of foot and vehicle traffic through potentially contaminated areas; and
- Utilization of good housekeeping practices (as discussed in Section 3.5).

6.2 WASTE CHARACTERIZATION

Prior to initiating removal of the construction debris and impacted soil, waste characterization sampling will be conducted for the sand blasting grit piles, the soil contained within the earthen impact berm, isolated "hot spots," and concrete rubble. All waste storage containers will be of suitable size, leak proof, and constructed of materials compatible with the materials to be contained. Waste storage containers will be properly labeled prior to placement of material. Hazardous waste and ACM will be managed according to relevant RCRA requirements including, but not limited to, proper marking and labeling, approved containers, storage requirements, and documented inspections.

6.2.1 Excavated Soils

Soil from the earthen backstop berm and impacted soils from the hot spot excavations will be sampled for waste acceptance criteria (TCLP SVOCs, TCLP VOCs, TCLP RCRA metals (plus antimony and nickel),

TCLP pesticides, TCLP herbicides, total PAHs, PCBs, PFAS, paint filter liquids test, and RCI analysis) prior to RA mobilization. Five-part composite samples (total of six samples anticipated) will be collected from the soil in the earthen berm at a frequency of 1 sample per 100 yd^3. Samples will be collected at the earthen impact berm from 0 to 4 feet laterally (angled up to 30 degrees) into the midpoint and/or near the upper portion of the earthen berm face, unless refusal is encountered. Two "hot spots" on the earthen berm will be grouped as one sample and collected from 0 to 2 and 0 to 4 feet bgs. The third hot spot underlying Debris Pile 2 will be collected as a separate sample from 0 to 2 feet bgs (any sand blasting grit will be removed to the soil interface). Waste characterization sample location groups are illustrated in Figure 5. The soil samples will be collected with a hand auger and mixed in a disposable high-density polyethylene (HDPE) bag (PFAS-free), with the exception of VOCs.

Disposal facilities will be selected in accordance with regulatory requirements and NASA GRC's internal policies and procedures with concurrence from the NASA WM. The results of laboratory analyses specified by the designated disposal site will be forwarded to document the material meets the facility's waste acceptance criteria. We anticipate that the excavated soil will be classified as non-hazardous and disposed of at the local Erie County Landfill in Milan, Ohio. Prior to actual removal of the earthen berm and hot spot spoils, a clear determination will be made as to whether the soil will be classified as hazardous or non-hazardous for disposal purposes.

6.2.2 Excavated Sand Blasting Grit Piles

Similar to the excavated soils, five-part composite samples will be collected from the sand blasting grit piles at a frequency of 1 sample per 100 yd^3. The sand blasting grit pile samples (total of four samples anticipated) will be tested in the laboratory for TCLP SVOCs, TCLP VOCs, TCLP RCRA metals (plus antimony and nickel), TCLP pesticides, TCLP herbicides, total PAHs, PCBs, PFAS, paint filter liquids test, and RCI for hazardous waste determination. Aliquots will be collected through the sand blasting grit piles (Debris Pile 2 and Debris Pile 3) until native soil is encountered. Waste characterization subareas are illustrated in Figure 5. The sand blasting grit samples will be collected with a hand auger and mixed in a disposable HDPE bag (PFAS-free). If distribution of actual sand blasting grit piles differs from the historically demarcated sand blasting grit piles shown in Figure 5, the Leidos FM will determine if the location and number of five-part composite samples need to be adjusted accordingly to ensure that a frequency of 1 sample per 100 yd^3 is maintained.

Disposal facilities will be selected in accordance with regulatory requirements and NASA GRC's internal policies and procedures with concurrence from the NASA WM. The results of laboratory analyses specified by the designated disposal site will be forwarded to document the material meets the facility's waste acceptance criteria. We anticipate that the sand grit pile contents containing LBP will be classified as hazardous and disposed of at the Envirosafe facility in Oregon, Ohio, which is a RCRA Subtitle C Treatment and Disposal facility.

6.2.3 Asbestos-containing Waste

During debris removal activities, the ACM debris will be disposed of as asbestos-containing waste. This waste will be loaded into roll-off containers that will be double lined with 6-mil polyethylene plastic. The containers will be sealed to prevent leaking. The roll-off container may be temporarily stored at a staging area within the limits of work, pending acceptance from the disposal facility. The asbestos-containing waste will be transported to and disposed of at the Envirosafe facility in Oregon, Ohio, which is a RCRA Subtitle C Treatment and Disposal facility and the licensed disposal facility approved by NASA WM.

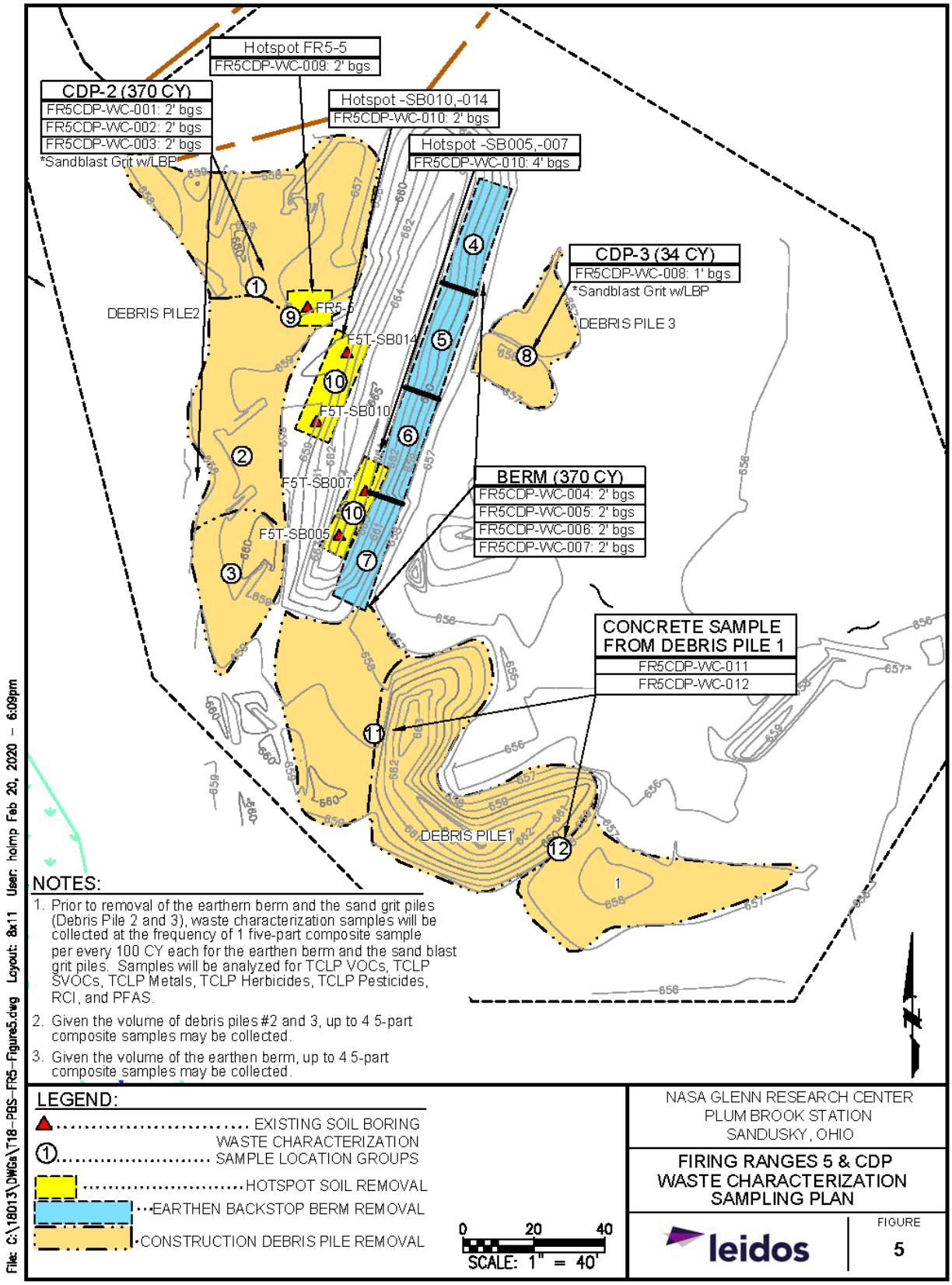

Figure 5. Waste Characterization Sampling Plan

6.2.4 Concrete and Metal Debris

Per requirements of the Erie County Landfill, two samples from the concrete rubble will be collected for TCLP metals analysis for hazardous waste determination only if the concrete surface is painted. If the concrete debris is bare clean concrete, the Erie County Landfill does not require analytical results to determine waste classification, and the landfill will classify the waste as non-hazardous based on the origin of the waste. Hand tools will be used to scrape or break off concrete fragments from Debris Pile 2. Particle size reduction may be required at the offsite laboratory. Approximate waste characterization locations are illustrated in Figure 5.

We anticipate that the concrete (and metal debris) will be classified as non-hazardous and recycled, if possible, in accordance with NASA GRC's sustainability goal or disposed of as construction debris at the local Erie County Landfill in Milan, Ohio. Painted concrete or other DM will be assumed to be LBP based on SI results (Section 2.2) and the painted debris segregated with the ACM or sand blasting grit piles for disposal at the Envirosafe facility in Oregon, Ohio, which is a RCRA Subtitle C Treatment and Disposal facility.

6.2.5 IDW

IDW such as PPE and disposable sampling equipment that contacted impacted material will be mixed in with impacted soils.

6.2.6 Vegetation

Smaller trees and brush will be mulched and left onsite as ground cover. Segments of large trees will be cut into lengths no longer than 3 feet and transported to the designated firewood staging area at PBS (Attachment C, Drawing C-8) in accordance with Section 3.2.3. Tree stumps and roots within excavation footprints will be placed in the on-road haul trucks or a roll-off box with impacted soils or sand blasting grit for offsite disposal.

6.2.7 Other Materials

If unexpected materials (e.g., drums, containers, historical artifacts) are encountered at any point during excavation activities, all excavation work will cease immediately and workers will be cleared from the immediate area. The Arrowhead Site Supervisor will immediately inform the SSHO, Leidos FM, and NASA TM. The NASA TM will notify the NASA GRC Cultural Resources Manager for historical artifacts. NASA GRC personnel will direct actions following discovery of unexpected materials. NASA WM will handle waste characterization testing and disposal. Work will not resume until the NASA TM grants approval.

6.2.8 Excavation Water

Containerized excavation water (in contact with impacted soils) liquid will be sampled and analyzed for waste characterization (total VOCs [includes F-listed VOCs], total SVOCs [includes F-listed SVOCs], total RCRA metals, PCBs, pesticides, herbicides, PFAS, and RCI analysis). All subsequent waste determination, transportation, and disposal will be coordinated with NASA WM. Disposal facilities will be selected in accordance with regulatory requirements and NASA GRC's internal policies and procedures with concurrence from the NASA WM and TM. The results of laboratory analyses specified by the designated disposal site will be forwarded to document the material meets the facility's waste acceptance criteria.

6.2.9 Decontamination Fluids

Water used to decontaminate construction and/or sample equipment will be collected, containerized, and labeled pending characterization. Containerized liquid will be sampled and analyzed for waste characterization (total VOCs [includes F-listed VOCs], total SVOCs [includes F-listed SVOCs], total RCRA metals, PCBs, pesticides, herbicides, and RCI analysis). NASA WM will manage all subsequent waste characterization, transportation, and disposal.

6.2.10 Plastic Sheeting and Vacuum Hoses

Plastic sheeting and pump hoses used during the RA will be disposed of with excavated soil if the soil is disposed of as waste material, and this material will be included in the excavated soil profile.

6.2.11 Stormwater controls

Stormwater control material, such as silt fencing and sand bags, will be recycled as much as possible. The contractor will dispose of non-recyclable stormwater materials as sanitary trash.

6.3 TRANSPORTATION AND DISPOSAL

The Arrowhead Site Supervisor will coordinate the management, transportation, and disposal of excavated soils and construction debris with the NASA TM and NASA WM. The Arrowhead Site Supervisor will prepare all transportation paperwork (manifests or shipping papers, ACM waste shipment record) in accordance with federal, state, and local regulatory requirements; disposal facility requirements; and NASA GRC policies. A draft of the transportation paperwork containing "base" information will be submitted to NASA WM for review and approval a minimum of 1 week prior to shipment of any material. The Arrowhead Site Supervisor then will complete the approved transportation paperwork in the field during excavation activities. An authorized employee of NASA GRC EMO will sign each manifest or shipping paper prior to transportation of the material.

Excavated soils and construction debris will be loaded into haul trucks and transported by licensed waste haulers to licensed offsite disposal facilities approved by the NASA WM. Excavation water will be pumped from the frac tank into water haul trucks, and transported by licensed waste haulers to the local wastewater treatment plant or disposal facility approved by NASA WM. All transportation requirements, including proper labeling and placarding, and weight limits will be followed. All manifests, shipping documents, and disposal facility approval letters will be provided to the NASA TM as part of the RA Completion Report.

All haul trucks will be weighed both empty and loaded at the PBS truck scale (Attachment C, Drawing C-8) and weight information will be recorded on the transportation paperwork. The contractor will comply with NASA PBS site access protocols, including government security measures, and will allow for minor delays accordingly (Attachment C, Drawing C-8).

All other waste types (e.g., IDW, other materials, and excavation water) will be transferred to NASA WM for management and disposal. All manifests and shipping documents for these wastes also will be provided to the NASA TM as part of the RA Completion Report. The containerized wastes will be secured on a flatbed truck, or similar vehicle, for transportation to Building 9206, after which NASA WM will coordinate the ultimate disposal of those wastes to the appropriate disposal facilities.

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7. SITE RESTORATION ACTIVITIES

This section describes the site restoration activities that will be conducted in support of the RA Work Plan. Attachment C (Drawing C-5) presents restoration plans for the Firing Range 5 and the CDP site, including regrading and seeding disturbed areas with PBS-approved native grasses (as specified in Drawing C-2).

The contractor will restore the site to the required condition, as set forth in Attachment C (Drawing C-5). At a minimum, this will include:

- Removing any temporary structures/support facilities (e.g., jersey barriers, earthen berms);
- Regrading the remaining soil pile to surrounding grades;
- Applying topsoil (top 0.5 feet); and
- Applying seed/straw mulch or hydro-seeding those areas affected by construction activities.

Based on available soil from the earthen mound, backfill soil will not be needed to regrade the site. An offsite source will be identified for topsoil. Topsoil will be tested by the contractor and approved by the NASA TM in accordance with the GRC backfill screening criteria and site-specific remediation goals (Table 5-2). Per Ohio EPA guidance, the contractor will collect one 10-part composite sample for every 4,000 yd^3 of topsoil used. This quantity of topsoil must come from the same source or an additional sample must be collected. The samples will be analyzed for the parameters identified in Table 7-1. Due to the current review and update of NASA GRC's Soil Policy (*Environmental Program Manual*, Chapter 20), the NASA TM, in consultation with Leidos, determined that the backfill screening criteria against which the analytical results will be evaluated include background screening levels (IT 1998); Ohio Voluntary Action Program (VAP) generic direct-contact soil standards, as listed in OAC rule 3745-300-08; and USEPA RSLs (USEPA 2019) corresponding to a target risk (TR) of 1E-06 and a target hazard quotient (THQ) of 0.1. The NASA TM will be notified of the potential borrow source a minimum of 20 days prior to placement of the material. The NASA TM will approve the use of the material prior to its use.

Table 7-1. Analytical Parameters for Borrow Source Sampling

Parameter	Methods
VOCs, TCL	SW-846 5030/8260B
SVOCs, TCL (include low-level PAHs)	SW-846 3540/8270D
Pesticides, TCL	SW-846 3540/8081A
PCBs	SW-846 3540/8082
Metals, TAL	SW-846 6020B/6010C/7471B
Explosives (nitroaromatics)	SW-846 8330B
pH	SW-846 9040/9045

PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
TAL = Target Analyte List
TCL = Target Compound list
VOC = Volatile Organic Compound

After the borrow material has been approved, the excavation site will be regraded to match the surrounding grade. A minimum of 6 inches of topsoil will be placed on top of the common fill and will be seeded and mulched. All disturbed areas will be seeded with PBS-approved native grasses (Attachment C, Drawing C-2) and in accordance with NASA GRC Specification 32 92 19.98, *Seeding* (Attachment E).

Erosion and sediment controls will remain in place during site restoration activities. Removal will occur when 70 percent coverage has been established in all disturbed areas with final inspection and approval from the NASA TM or designee. Any bare areas observed during post-restoration inspections will be reseeded.

8. CONSTRUCTION QUALITY ASSURANCE PLAN

This section presents the CQAP. The CQAP describes the inspection procedures and documentation required to ensure excavation, disposal, and restoration activities occur according to the requirements of this RA Work Plan. However, Arrowhead and Leidos will have separate QCPs submitted under Task 4, which will supplement this CQAP.

Protocols for reporting test results, certifying compliance with construction requirements, correcting construction deficiencies, and documenting such corrections are provided in the QCPs and summarized below. This section also addresses the review and documentation requirements necessary to comply with the site restoration details contained herein.

8.1 RESPONSIBILITY AND AUTHORITY

8.1.1 Responsibility

The organizational chart presented in Figure 3 outlines the management structure that will be used to implement the removal and disposal activities in accordance with this RA Work Plan. Functional responsibilities of key personnel were described Section 1.6. The assignment of personnel to each position was based on the following:

- Qualifications,
- Experience, and
- Training.

The Arrowhead Site QC Manager, Arrowhead Site Supervisor, and Leidos FM, in coordination with the NASA TM, will ensure the completed RA conforms to the RA Work Plan, design drawings, specifications, and any necessary permit conditions. The Arrowhead and Leidos PMs will verify completion of these activities.

The Arrowhead Site Supervisor will monitor excavation, removal, and site restoration activities. The Arrowhead Site Supervisor, or designee, will be onsite during work activities to ensure the fulfillment of all components of this RA Work Plan.

8.1.2 Administration and Operation

The Arrowhead Site QC Manager/Site Supervisor will administer the QA/QC organization. (Note: The Arrowhead Site Supervisor also will serve as the Arrowhead Site QC Manager for this project.) The Leidos FM and technical staff (engineers, scientists, and technicians) will support the Arrowhead Site Supervisor, as necessary.

All vendors supplying materials used for clean fill and site restoration will supply materials from manufacturing facilities with established QC programs. Results of the manufacturer QC procedures will be submitted to the Arrowhead Site QC Manager for review, evaluation, and documentation prior to beginning field activities.

8.2 PERSONNEL QUALIFICATIONS

All QA/QC personnel will be properly trained for their job function. The Arrowhead Site Supervisor and Site QC Manager are key to the three-phase inspection and certification program of the Arrowhead QCP. The Arrowhead Site Supervisor and Site QC Manager will have demonstrated knowledge of specific construction practices relating to earthwork, regulations and specifications, observation and testing procedures, and documentation procedures. The Arrowhead Site Supervisor also will be experienced in performing similar duties on previous jobs in which comparable construction activities were conducted.

8.3 DAILY PLANNING BRIEFINGS

In addition to daily tailgate briefings conducted in accordance with the HASP, the contractor will participate in daily planning briefings to determine the plan of action for the particular work day. This briefing will include at a minimum the following:

- A discussion of the planned activities for the work day;
- Planned area of excavation;
- Weather considerations;
- Deliveries;
- Transportation schedule;
- Schedule forecast; and
- Any issues that would result in an impact to the project.

The Arrowhead Site Supervisor will record this briefing with concurrence from the Leidos FM and any subcontractor(s).

8.4 INSPECTION ACTIVITIES

Inspections and field testing will be completed to:

- Verify PAH-impacted soil removal within defined limits has been achieved,
- Verify construction debris with ACM and LBP materials removal within defined limits has been achieved,
- Verify construction debris removal within defined limits has been achieved,
- Verify acceptability of materials,
- Verify the restoration activities were performed to specifications,
- Document decontamination activities,
- Prevent spills,
- Assess effectiveness of stormwater and dust generation controls, and
- Ensure all equipment remains in safe and proper working order.

The scope and frequency of each type of inspection or field test are described below.

8.4.1 Spill Control

Spill control measures will follow Chapter 8 (Spill Control) of the NASA GRC EPM. This manual provides contingency plans for spills of potentially hazardous materials, or if drums or other containers are encountered and release potentially hazardous materials during removal or subsequent handling.

The Arrowhead Site Supervisor will conduct daily inspections to verify spill equipment is maintained and no spills have occurred. During excavation, if any visual or olfactory indicators suggest the presence of potentially impacted soils and if any visual indicators suggest the presence or suspected presence of ACM, the employee will report to the Arrowhead Site Supervisor. Upon discovery of a spill, the employee also will contact NASA PBS Dispatch personnel (419.621.3222) and the Arrowhead PM. The contractor will provide all necessary onsite spill equipment (e.g., granulated clay, absorbent blankets, PPE, shovels, and containers) to limit spread of spill material and to containerize spilled material and spill-impacted material. The Arrowhead Site Supervisor or designee will work with NASA WM personnel to properly dispose of all spilled material. The contractor will be responsible for the cost of cleanup for spills caused by the contractor's actions and/or equipment. All onsite workers are responsible for maintaining good housekeeping practices (as discussed in Section 3.5).

8.4.2 Stormwater Control

Prior to construction activities, the Arrowhead Site Supervisor will inspect all stormwater controls (including the excavation water collection system, if necessary) and document proper placement in accordance with Attachment C (Drawing C-4) and the SWPPP (Attachment A). During excavation and removal activities, stormwater will be diverted around the excavation and debris staging areas using earthen berms and jersey barriers. Excavation water will be allowed to infiltrate and/or evaporate within the excavation areas if possible. If infiltration and/or evaporation is not possible due to the potential to affect excavation activities, Arrowhead, Leidos, and NASA GRC will evaluate alternate forms of removal (i.e., pump to the frac tank for storage before proper disposal).

All employees will practice due diligence to prevent any damage to the stormwater control measures. The contractor will inspect stormwater controls on a weekly basis. NASA will conduct inspections monthly. The contractor also will inspect stormwater controls within 24 hours of a storm event (0.5 inches or greater) or 2 inches of snowmelt. The Arrowhead Site Supervisor or designee will conduct routine walkovers during normal operations to evaluate the integrity of the berms, temporary roads, and stormwater collection system, and the effectiveness of these controls. Any deficiencies will be corrected immediately and documented in the daily report.

8.4.3 Dust Control

Dust generation may occur during excavation, stabilization, material handling, and truck transportation on paved and gravel roads. Dust control will be maintained by keeping all traffic on improved roads and applying water for dust suppression purposes, as required. Water used for dust control will be clean (i.e., obtained from onsite sources with approval of the NASA TM or potable water obtained from an offsite source). The use of additives will not be permitted. Engineering controls will be implemented to minimize the potential for dust generation. The Arrowhead SSHO will conduct daily inspections and real-time dust monitoring for fugitive dust emissions during representative, normal operating conditions, as described in Section 3.4 and the HASP.

During removal of the construction debris that is interspersed with ACM, any ACM to be removed would be "adequately wet" (as per OAC 3745-20-01) to prevent release of particulates into the air. The specific dust and wind controls for ACM removal activity, including any air monitoring, will be detailed further, as

necessary, upon evaluation by a certified Asbestos Hazard Evaluation Specialist. The existing HASP for the site would be appended if the Asbestos Hazard Evaluation Specialist identifies additional controls.

8.4.4 Survey

Upon completion of soil excavation and removal activities, the bottom and walls of excavations will be surveyed to document actual limits and elevations (i.e., horizontal and vertical extent). Extent of the debris pile removal also will be surveyed to document actual limits. The surveys will be conducted by a licensed surveyor in Ohio with the excavation limits included in as-built drawings in the RA Completion Report. Any deviations from plans and specifications will be noted.

8.4.5 Backfill, Topsoil, and Seed Material

Once excavation activities have been completed and approved by the Arrowhead Site Supervisor, in conjunction with the NASA TM, excavations will be regraded with remaining berm soils and additional soil from a NASA-approved offsite borrow source, if needed, and compacted with an excavator bucket in lift thickness no more than 12 inches throughout the excavated area. Common fill will have a minimum of 6 inches of vegetative cover (topsoil) placed throughout the excavated area. Regrading will be performed to match the original elevations and prevent ponding, as indicated in Section 7 and Attachment C (Drawing C-5). The Arrowhead Site Supervisor and NASA TM will review material certifications for the backfill material, topsoil, and native seed mixture in accordance with Section 7 and Attachment C (Drawings C-2 and C-5).

8.4.6 Equipment

The contractor will inspect equipment to ensure that it is in safe and proper working condition, at a minimum of the start of every work day. The contractor will repair equipment as necessary. The Arrowhead Site Supervisor or designee also will log reports and maintain records for inclusion in the final RA Completion Report. Each day, the contractor will inspect and calibrate all material and testing equipment, and the contractor or Arrowhead Site Supervisor will document this activity.

8.4.7 Decontamination

The Arrowhead Site Supervisor or designee will inspect all equipment that has contacts impacted soil during removal activities prior to the equipment being moved offsite or being used in another area onsite. The Arrowhead Site Supervisor or designee will observe and document proper decontamination techniques are used, as outlined in Section 4.4. The Arrowhead Site Supervisor or designee also will observe that the decontamination pad is properly constructed and used to collect decontamination water, and that wastewater is properly containerized and transferred to NASA WM.

8.5 VERIFICATION REQUIREMENTS

8.5.1 Verification of Achievement of Performance Criteria

Verification sampling will be performed in accordance with Section 5.1 to demonstrate achievement of the remediation goals. Verification samples will be analyzed for all COCs by an offsite analytical laboratory.

Analytical laboratory analysis will be expedited and provided to the Leidos FM upon receipt. The Leidos FM will verify the results meet the Firing Range's remediation goals. The NASA TM and Arrowhead Site Supervisor will be notified of the evaluations and results. If any samples do not meet remediation goals, the evaluation will include a description of the additional excavation based on the approach described in

Section 5.1. In coordination with the NASA TM, the identified area will be excavated in compliance with the established excavation procedures and additional verification samples collected from the area for comparison to remediation goals. Verification sampling results will be included in the RA Completion Report.

8.5.2 Verification of Achievement of Asbestos Removal

The Asbestos Hazard Abatement Evaluation Specialist will complete a post-removal ACM survey in accordance with Section 4.2.2.2. A copy of the survey report confirming all ACM materials and ACM-impacted surface soils have been removed from the site will be included in the RA Completion Report.

8.6 DOCUMENTATION

8.6.1 Field Documentation

This project will include daily inspection and quality summary reports, which the Arrowhead Site Supervisor/Site QC Manager will sign and date. These reports will be submitted to the Arrowhead PM, Arrowhead Site QC Manager, Leidos FM, Leidos PM, or NASA TM, as requested.

The daily reports may include:

- Summary of activities performed at the project site;
- Weather information;
- Departures from the approved RA Work Plan;
- Problems encountered during field activities;
- Equipment inspection logs;
- Subcontractor submittals; and/or
- Subcontractor certifications (e.g., H&S records, equipment training records).

The list of submittals/approvals includes, but is not limited to:

- Common fill;
- Seed material for vegetative cover;
- Disposal facilities;
- Silt fencing;
- HASPs;
- QCPs;
- Final land survey of excavation and removal limits and restored grades; and
- Final waste manifests for impacted soil, ACM and LBP materials, construction debris, and recycled materials.

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9. REPORTING REQUIREMENTS AND PROJECT SCHEDULE

9.1 REPORTING REQUIREMENTS

The contractor will provide two types of reports for this project, including:

- Daily progress reports and
- An RA Completion Report

9.1.1 Daily Progress Reports

The Arrowhead Site Supervisor will provide daily progress reports to the Arrowhead and Leidos PMs, NASA TM, and the NASA Construction Manager during implementation of this RA Work Plan. The progress reports will include the following:

- A description of the work performed during the reporting period and an estimate of percentage complete;
- Summaries of all findings and sampling during the reporting period;
- Summaries of all changes to the RA design during the reporting period;
- Summaries of all contacts with representatives of the local community, public interest groups, or government agencies during the reporting period;
- Summaries of all problems or potential problems encountered during the reporting period;
- Summaries of actions taken to achieve and maintain remediation standards and performance standards;
- Changes in personnel during the reporting period;
- Projected work for the next reporting period; and
- Copies of daily reports, inspection reports, sampling data, and laboratory/monitoring data.

9.1.2 RA Completion Report

Upon completion of soil and construction debris removal and disposal and all other construction activities performed in accordance with this RA Work Plan, an RA Completion Report will be prepared documenting these activities, and all modifications to the design (necessitated by field conditions, or NASA GRC), as well as the documentation of all regulatory reporting notices. Specifically, this report will document the following project tasks:

- Impacted soil and construction debris removal,
- Verification sampling and waste characterization results,
- Site restoration,
- WM and disposal,
- H&S,
- Construction QA material control and testing,
- As-built drawings, and
- Field changes.

A draft copy of the RA Completion Report will be produced for the NASA TM to review prior to its issuance to the Administrative Record and Ohio EPA.

9.2 PROJECT SCHEDULE

The project schedule for the NASA Firing Range 5 and CDP RA was completed under Task 1 and includes the following:

- RA Work Plan submittal,
- Vegetation clearing,
- Permit/notification requirements,
- Site preparation/set-up,
- Excavation and removal,
- Verification sampling,
- Soil and debris disposal,
- Site restoration, and
- Preparation of the RA Completion Report.

Generally, construction activities will occur only during daylight hours on a 5-day per week, 9 hours per day schedule. Tree clearing will be expedited in the winter of 2020 (estimated 2 weeks) prior to the restricted time frame (March 31). The RA will be implemented during the spring/summer of 2020. The RA is estimated to take 4.5 weeks to complete.

10. REFERENCES

EnviroScience. 2017. *Final Protected Species Management Strategy for NASA Glenn Research Center at Lewis Field and Plum Brook Station, Volumes I-III*. Prepared with assistance from and under contract to Leidos. March.

Gray & Pape. 2008. *Cultural Resources Management Plan for NASA Glenn Research Center at Lewis Field and Plum Brook Station*, Project No. 05-13101, Cleveland, Ohio.

IT (IT Corporation). 1998. *Site Investigation of Acid Areas, Plum Brook Ordnance Works, Sandusky, Ohio*. December.

Leidos. 2016a. *Final NASA Plum Brook Station Firing Range Site Investigation Report, Revision 1*. April 29.

Leidos. 2016b. *Final Multi-Site Remedial Investigation Sampling and Analysis Plan, National Aeronautics and Space Administration, Glenn Research Center – Plum Brook Station, Sandusky, Ohio*. November.

Leidos. 2018. *Final Environmental Resources Document for National Aeronautics and Space Administration (NASA) Glenn Research Center at Lewis Field and Plum Brook Station*. Revised April.

Leidos. 2019. *Revised Final Firing Range 5 and Construction Debris Pile Removal Site Evaluation Report, National Aeronautics and Space Administration, Plum Brook Station, Sandusky, Ohio*. December 13.

Leidos. 2020. *Final Action Memorandum for Firing Range 5 and Construction Debris Pile Removal Action, National Aeronautics and Space Administration, Plum Brook Station, Sandusky, Ohio*. March.

MK (Morrison–Knudsen Corporation). 1994. *Site Inspection Report, Plum Brook Station*. January 14, 1994.

NASA (National Aeronautics and Space Administration). 2019. *Statement of Work, Firing Range 5 and Construction Debris Pile – Removal Action Implementation.* March 26.

SAIC (Science Applications International Corporation). 1991. *Plum Brook Station Preliminary Assessment*. June.

SAIC. 2006. *Site Investigation of NASA GRC Plum Brook Station Former Firing Ranges Sampling and Analysis Plan*. March.

SAIC. 2010. *NASA Plum Brook Station Firing Ranges and Construction Debris Pile Site Investigation Report*. April.

Tech Law. 1998. *Preliminary Assessment/Visual Site Inspection Report for NASA Plum Brook Station.* August.

URS (URS Corporation). 1996. *Work Plan for Site Investigation of Plum Brook Station Firing Ranges*. February 12.

USEPA (U.S. Environmental Protection Agency). 1989. *Methods of Evaluating the Attainment of Cleanup Standards, Vol 1: Soils and Solid Media*. USEPA Office of Policy, Planning and Evaluation, Statistical Policy Branch, Washington, DC. February.

USEPA. 2019. EPA Regional Screening Level (RSL). U.S. Environmental Protection Agency, Washington, DC. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables, May.

ATTACHMENT A. SWPPP FOR FIRING RANGE 5 AND CDP REMOVAL ACTION

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Stormwater Pollution Prevention Plan

for:

Firing Range 5 and CDP Cleanup
NASA Plum Brook Station
Sandusky, Ohio
419-621-3222

Operator(s):

Arrowhead Contracting, Inc.
10981 Eicher Drive
Lenexa, Kansas 66219
913-814-9994
www.arrowhead.org

SWPPP Contact(s):

Arrowhead Contracting, Inc.
Carl Shaw
1009 S. Jefferson Way
Indianola, Iowa 50125
913-952-8398 Cell
515-961-8000 Office

SWPPP Preparation Date:

01/08/2020

Estimated Project Dates:

Project Start Date: 01/13/2020
Project Completion Date: 11/30/2020

Contents

SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information

Project/Site Name: Firing Range 5 and Construction Debris Piles (CDP)
Project Street/Location: South Magazine Road
City: Sandusky State: Ohio ZIP Code: 44870
County: Erie

Latitude/Longitude (Use **one** of three possible formats, and specify method)

Latitude:	Longitude:
1. _ _ º _ _ ' _ _" N (degrees, minutes, seconds)	1. _ _ º _ _ ' _ _" W (degrees, minutes, seconds)
2. _ _ º _ _ . _ _' N (degrees, minutes, decimal)	2. _ _ º _ _ . _ _' W (degrees, minutes, decimal)
3. 41.350340º N (decimal)	3. 82.652038º W (decimal)

Method for determining latitude/longitude:
☐ USGS topographic map (specify scale: _____) ☐ EPA Web site ☐ GPS
☒ Other (please specify): Bing Maps

Is this project considered a federal facility? ☒ Yes ☐ No

NPDES project or permit tracking number*:_____

**(This is the unique identifying number assigned to your project by your permitting authority after you have applied for coverage under the appropriate National Pollutant Discharge Elimination System (NPDES) construction general permit.)*

1.2 Contact Information/Responsible Parties

Operator(s):
Arrowhead Contracting, Inc.
10981 Eicher Drive
Lenexa, Kansas 66219
913-814-9994
www.arrowhead.org
Arrowhead Contracting, Inc.

Project Manager(s) or Site Supervisor(s):
Arrowhead Contracting, Inc.
Jeremy Soenen

1009 S. Jefferson Way
Indianola, Iowa 50125
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jsoenen@arrowhead-usa.com

SWP3 Contact(s):
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913-952-8398

1.3 Nature and Sequence of Construction Activity

The Firing Range 5 and CDP site is a former firing range that later included a dump for construction debris. The bullet impact area utilized at the firing range is an earthen berm and is

approximately 146 feet long and 8 feet high. The majority of the CDP is crushed concrete and steel reinforcements (e.g., rebar); however, grit from a sand blast operation is also associated with the debris pile. Small areas of the near surface soil are impacted with lead and benzo(a)pyrene. The construction debris contains asbestos-containing material and sand blast grit containing lead paint chips, asphalt, and metal debris. The site is being managed by the US Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The project involves clearing and grubbing the impacted areas, excavating the shallow soil, excavating the backstop berm, transporting the treated soil to a landfill for disposal, backfilling the shallow excavations with clean soil, and establishing vegetation in the affected areas. The CDP areas will be loaded and transported for disposal.

The clearing and grubbing will be conducted during the winter of 2020 to remove vegetation down to the ground surface. The ground will not be disturbed during clearing and grubbing and is likely to be frozen and covered with snow.

Excavation, soil treatment, transportation, backfilling, and establishing vegetation will be completed during spring, summer, and fall 2020. Each discrete area will be excavated and sampled (to ensure the remaining soil meets cleanup criteria) and then backfilled and stabilized as soon as possible. The next area will be excavated while the previously excavated area is being sampled, backfilled, and stabilized. Sampling will require that each excavation is open for about four weeks while the samples are collected, analyzed, and the results reviewed.

What is the function of the construction activity?

☐ Residential ☐ Commercial ☐ Industrial ☐ Road Construction ☐ Linear Utility

☒ Other (please specify): Federal Government

Estimated Project Start Date: 01/06/2020

Estimated Project Completion Date: 11/30/2020

1.4 Soils, Slopes, Vegetation, and Current Drainage Patterns

Soil type(s):

Silt loam

Current slope conditions and projected slope changes:

Flat (3% to 5%) with a berm used as a backstop for firing range. Three piles of construction debris are located near the backstop berm. Other than the removal of the berm and CDP, the slopes will not be changed.

Current site vegetative cover:

Small trees and brush

Description of unique features that are to be preserved:

None

Project site soils report is included in Appendix J.

1.5 Construction Site Estimates

The following are estimates of the construction site.

Total project area:	1.4 acres
Construction site area to be disturbed:	1.4 acres
Percentage impervious area before construction:	0%
Runoff coefficient before construction:	0.15
Percentage impervious area after construction:	0%
Runoff coefficient after construction	0.15

1.6 Receiving Waters

Name of receiving waters:

Unnamed Ditch, Kuebelar Ditch, Sawmill Creek, and Lake Erie

Owner and description of storm sewer systems:

None

Name & description of impaired waters or waters subject to TMDLs:

None

1.7 Site Features and Sensitive Areas to be Protected

There are no site features or sensitive areas to be protected, per Sections 1.9 and 1.10. No wetlands exist at Firing Range 5 and the CDP; however, two wetlands are delineated near the western boundary (0.372 and 0.135 acre) and one wetland near the eastern boundary (0.448 acre) of the site (presumably ditches) [EnviroScience 2012 and 2019]

1.8 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

- Excavating contaminated soil during remediation activities

- Stockpiling contaminated soil after it is excavated and prior to being removed from the site for disposal
- Loading and hauling contaminated soil, concrete-metal rubble, asbestos-containing material and sand blast grit piles for disposal

Potential pollutants and sources, other than sediment, to stormwater runoff:

- The contaminated soil contains lead, and benzo(a)pyrene. Benzo(a)pyrene is the greatest concern
- The construction debris piles contain asbestos and lead based paint.

1.9 Endangered Species Certification

Are endangered or threatened species and critical habitats on or near the project area?

☐ Yes ☒ No

Describe how this determination was made:

NASA Plum Brook personnel performed an endangered or threatened species and critical habitat inspection of the Plum Brook facility in Fall 2016 (EnviroScience 2017), including the area where this work will be conducted, and found no endangered or threatened species and no critical habitats.

There are no critical habitats on or near the project area.

If yes, describe the species and/or critical habitat:

None

If yes, describe or refer to documentation that determines the likelihood of an impact on identified species and/or habitat and the steps taken to address that impact.

None

1.10 Historic Preservation

Are there any historic sites on or near the construction site?

☐ Yes ☒ No

Describe how this determination was made:

The NASA Glenn Research Center Historic Preservation Office has determined that the proposed construction will have no adverse effect on historic properties to the construction area and received concurrence from the Ohio Historic Preservation Office.

If yes, describe or refer to documentation that determines the likelihood of an impact on this historic site and the steps taken to address that impact.

None

1.11 Applicable Federal, Tribal, State or Local Programs

Section 438 of the Energy Independence and Security Act (EISA)
Spill Pollution Control and Countermeasures (SPCC)

1.12 Maps

Site maps and figures can be found in Appendix A. The following is a list of each map and figure including a general description of the contents:

- Site Location Map – shows the location of the site and nearby geographic features
- Direction of Surface Water Flow Before Grading – shows the pre-excavation direction of surface water flow and the range of slopes
- Direction of Surface Water Flow After Grading – shows the post-excavation direction of surface water flow and the range of slopes. Note that the figures are the same because the grades will not change (other than removal of the berm and CDP) as a result of this work so the direction of surface water flow and the range of slopes does not change
- Areas of Clearing and Grubbing, Winter 2020 – shows the area that will be cleared of trees and brush during the first phase of the work completed during winter 2020. Note that there are no BMPs shown because the work will be done during the winter when the soil will likely be frozen and there may be snow on the ground
- Areas of Excavation, Transport, and Backfill; Spring, Summer, Fall 2020 – shows the area that will be excavated and the soil transported from the site. The excavations will be backfilled and stabilized after the excavations are completed. This work will be completed spring through fall 2020. The locations of BMPs (silt fence) are shown on the figure
- Areas that will not be Disturbed – shows the areas that are outside of the work and staging areas that will not be disturbed by this project
- Staging Area – shows the extent of the area used for parking, material storage, equipment storage, etc. located in the northwest area of the disturbed zone. The location of the stabilized construction entrance is also shown
- Surface Water (Blue) and Wetlands (Green) – shows the extent of the surface water body shown on the USGS Topographic Map

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

Erosion and sediment control BMPs will be implemented for each phase of the work, as recommended in the most current edition of Ohio's Rainwater and Land Development manual (ODNR 2006). The BMPs will be appropriate for the work that will be conducted during that phase. A summary of the BMPs that will be implemented is provided below.

Clearing and Grubbing Phase

Clearing and grubbing will be completed in the winter when the ground will likely be frozen and there may be snow on the ground. No intrusive activities will be conducted during this phase. The work will only involve using a brush hog type mowing device to remove above ground vegetation. The brush hog will be attached to either a skid steer loader or the end of an excavator boom. The mowed vegetative material that results from the clearing will be left on the ground surface until spring when the excavation activities begin. The vegetative material will be excavated along with the impacted soil for treatment and off-site disposal. The BMPs for the clearing and grubbing phase consist of the following:

- Minimize disturbance of the soil during clearing and grubbing. The soil will likely be frozen and covered with snow so normal clearing activities should not disturb the soil.
- Leave the mowed vegetative material where it falls to protect the soil from future erosion.
- Limit travel on the site to designated travel routes and to the areas that are actively being cleared to limit any possible water or wind erosion of site soils due to soil disturbance.
- Site conditions may warrant selection and installation of appropriate BMPS based on weather conditions.

Soil Excavation and Transport Phase

The excavation and soil transport phase will be conducted spring, summer, and fall of 2020. This phase will involve excavating impacted soil and sediment, and loading/transporting the contaminated material and concrete rubble to the landfill for disposal. Once the soil is removed from the excavation, samples will be collected and analyzed to ensure that the remaining soil meets the clean-up objective. The sampling, analysis, and data review will take about one month to complete. Once the excavation is confirmed to meet cleanup objectives, the excavation will be backfilled with imported common backfill and topsoil. The area will then undergo final stabilization of seed and hydromulch. The BMPs for the excavation, and soil transport phase consist of the following:

- 1,500 LF of silt fence
- 1.4 Acres of seed and hydromulch
- Limit travel on the site to designated travel routes and to the areas that are actively being cleared to limit any possible water or wind erosion of site soils due to soil disturbance.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

1. Methods of temporarily stabilizing soils and soil stockpiles:

    - Excavating and transporting impacted soil in the excavation areas may allow limited erosion to take place. The excavations will generally be lower than the surrounding undisturbed areas so there should be no transport of sediment out of the excavations. These areas will primarily be address through sediment controls such as silt fence and covering open excavations with poly sheeting held in place with sandbags. If not disturbed within 14 days, temporary stabilization measures will be implemented.

    - The soil stockpiles associated with the transportation areas may be subject to erosion. Erosion of the stockpiles will be addressed by limiting the period of time that the soil stockpiles are present and covering the soil stockpiles with poly sheeting held in place with sandbags. If not disturbed within 14 days, temporary stabilization measures will be implemented.

2. Methods of dissipating velocity along stormwater conveyance channels and at channel outlets:

    - There are no existing storm water conveyances or outlets

3. Methods to be used for stabilization of ditch and swale wetted perimeters:

    - There will be no modifications to existing ditches or swales associated with this work

4. Methods to be used for energy dissipation at pipe outlets:

    - There are no existing pipe outlets

5. Methods to be used to promote infiltration and sediment removal on the site prior to offsite discharge, unless infeasible:

    - Existing grass buffer zones surrounding the excavation work will be maintained

Describe timelines to be implemented at this site for completing the installation of the erosion prevention BMPs listed in I, ii, iii, and iv. (see Part IV. B. of the permit for minimum requirements). If applicable, include the timeline for completing soil stabilization for areas within 200 feet of a public water with work in water restrictions due to fish spawning time frames (Part IV.B.2.) and soil stabilization timelines for portions of the site that drain to special or impaired waters as required in Appendix A Part C. 1.a.:

- Silt fence will be installed in grass areas surrounding ongoing excavating and transporting activities prior to the start of work in that area. The silt fence will be maintained in good working order until backfilling is completed and stabilization measures are completed.

Describe additional erosion prevention measures that will be implemented at the site during construction:

- Soil will be disturbed and stockpiled for the minimum period of time needed to complete the work.

- The minimum area needed to complete the work will be disturbed during excavating and stockpiling activities.

- A vegetative buffer will be left in place surrounding the property.

2.2 Phase Construction Activity

Clearing and Grubbing Phase

Clearing and grubbing will be completed in January 2020 when the ground will likely be frozen and there may be snow on the ground. No intrusive activities will be conducted during the clearing and grubbing phase. The work will only involve using a brush hog type mowing device to remove above ground vegetation. The brush hog will be attached to either a skid steer loader or the end of an excavator boom. The mowed vegetative material that results from the clearing will be left on the ground surface until spring when the excavation activities begin.

Duration of phase

- Clearing and grubbing will be completed in January 2020 when the ground will likely be frozen and there may be snow on the ground. The work should take less than one month to complete

List BMPs associated with this phase

- Minimize disturbance of the soil during clearing and grubbing. The soil will likely be frozen and covered with snow so normal clearing activities should not disturb the soil.

- Limit travel on the site to designated travel routes and to the areas that are actively being cleared to limit any possible water or wind transport of site soils due to soil disturbance.

Describe stabilization methods for this phase

- Leave the mowed vegetative material where it falls to protect the soil from erosion and transport during the approximately two month period between the end of the clearing and grubbing phase and the start of the soil excavation, treatment, and transport phase.

Soil Excavation, Treatment, Transport, and Backfill Phase

Excavation, transportation, backfilling, and establishing vegetation will be completed during spring, summer, and fall 2020. The vegetative material generated during clearing and grubbing will be excavated along with the impacted soil and off-site disposal. Each discrete area will be excavated and sampled (to ensure the remaining soil meets cleanup criteria) and then backfilled and stabilized as soon as possible. The next area will be excavated while the previously excavated area is being sampled, backfilled, and stabilized. Sampling will require that each excavation is open for about four weeks while the samples are collected, analyzed, and the results reviewed.

Duration of phase (March 2020 through November 2020)

- Excavation, transportation, backfilling, and establishing vegetation will be completed during spring, summer, and fall 2020.

List BMPs associated with this phase

- Silt fence will be installed in grass areas prior to the start of work in that area. The silt fence will be maintained in good working order until backfilling is completed and stabilization measures are completed.

- Rain water in the excavations that is not in contact with contaminated soil or treated soil will be allowed to infiltrate into the ground. Rain water that is on top of poly sheeting or tarps and has not come in contact with contaminated soil or treated soil can be pumped off and allowed to infiltrate into the soil. Rain water that comes in contact with contaminated soil or treated soil will be collected, sampled, and disposed.

Describe stabilization methods for this phase

- After the excavation, and backfilling is completed at each excavation area, the area will be stabilized using seeding and hydromulch.

- The progress of germination will be tracked using weekly SWP3 inspections to ensure timely establishment of grass. Once the grass is established to at least 70% coverage, the silt fence will be removed.

2.3 Control Stormwater Flowing onto and through the Project

Little or no stormwater is expected to flow onto or through the site. There are no stormwater conveyances entering or leaving the site. In addition, the site is very flat with 3% to 5% grades so little or no precipitation will run off the site. Since there are no impervious surfaces, most precipitation should infiltrate into the soil.

2.4 Stabilize Soils

During clearing and grubbing, there will be no intrusive activities so the soil will not be disturbed and the plant roots will remain in place. Trees and brush debris from the brushhog mowing will be left on the ground surface to act as a mulch to help hold the soil in place.

During the excavation, and transportation phase, there should be little erosion because most of the activities will take place in shallow excavations and there will be no interim stabilization measures.

Temporary stabilization measures will be implemented for the following conditions:

- For disturbed areas within 50 feet of a stream remaining dormant over 14 days, temporary erosion controls will be applied within 2 days.

- For disturbed areas more than 50 feet away from a stream remaining dormant over 14 days temporary erosion controls will be applied within 7 days.

Final stabilization will include seeding and hydromulching disturbed areas as they are completed.

2.5 Protect Slopes

The site is very flat with 3% to 5% grades so there are no slopes to be protected.

2.6 Protect Storm Drain Inlets

There are no storm drains or inlets on the site.

2.7 Establish Perimeter Controls and Sediment Barriers

Silt fence will be installed at the perimeter of the work zones as shown on the drawings in Appendix A.

2.8 Retain Sediment On-Site

The site is very flat with 3% to 5% grades so erosion and sediment transport should not be an issue and sediment traps such as sediment basins will not be constructed for this site. However, the shallow excavation completed in the excavation and transport phase will act as sediment basins to catch any sediment eroded from the sidewalls of the excavation. Silt fence will also be utilized.

2.9 Establish Stabilized Construction Exits

There will be truck traffic in and out of the entrance onto South Magazine Road. A stabilized construction entrance consisting of crushed stone will be installed at this location to minimize

tracking soil off the site and onto public roads. See the drawings in Appendix A for location. See Appendix L for specifications.

2.10 Additional BMPs

There are no other BMP proposed for this site.

SECTION 3: GOOD HOUSEKEEPING BMPS

3.1 Material Handling and Waste Management

Solid waste generated during construction will be placed in a roll-off box as it is generated. The roll-off box will be stationed in the lay-down area. The roll-off box will be picked up as needed by the solid waste company for proper disposal in a licensed solid waste facility. Cover dumpsters at the end of the day and do not dispose of liquids in dumpsters.

Portable toilets will be provided by a vendor and will be stationed near the office trailers in the lay-down area. The vendor will service the portable toilets as needed. Any spills that occur will be cleaned up immediately upon discovery. Spills will be cleaned up using shovels, absorbent pads, oil dry, etc. and the used materials sealed in plastic garbage bags and transferred to NASA Waste Management (Building 9206) for proper disposal. All waste disposal will comply with applicable state or local waste disposal requirements. Open burning is not permitted.

For any chemical spills/releases, immediately contact PBS Emergency Dispatch at 419-621-3222.

3.2 Establish Proper Building Material Staging Areas

Building products will be stored at the lay-down yard or near where they will be used. Generally, building products will be brought to the site and used soon after arrival. Products that will be stored outside will be placed on a pallet and covered with a tarp or poly sheeting to isolate the material from the environment. This material will be stored away from drainage ditches.

3.3 Concrete Washout Areas

It is unlikely that concrete will be used during this project. However, if concrete is needed, the concrete waste from concrete truck wash-out and from clean-up of concrete finishing tools will be placed in the concrete wash out area. The concrete wash out area will be located near the area where the concrete will be poured but not where it will interfere with ongoing and future site activities. The concrete wash out material will be contained in a basin constructed above ground using sandbags to create a berm and then lining the berm with poly sheeting. Once the concrete hardens and the excess water evaporates, the concrete, poly sheeting, and other waste will be disposed in the roll-off box for disposal with the solid waste.

3.4 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

Fueling of on-site equipment will be either by commercial fueling truck or from a fuel cell in a company-owned pickup truck. If a temporary diesel AST is brought onsite, it will be double walled or placed within containment pad with at least 110% secondary containment capacity. Employees will use care when fueling to minimize the chance of a spill. A fire extinguisher and spill kit will be available while fueling. The spill kit will include oil dry, absorbent pads, and a container to contain used spill materials. Refueling takes place at either a temporary fuel tank located at the staging area or at the work zone where equipment will be refueled from a mobile fuel cell transported in the bed of a pickup truck (see site map in Appendix A).

Small leaks that are not reportable will be handled by on-site personnel as soon as the leak is discovered. The leak will be stopped if possible or will be contained (pans, poly sheeting, etc.). The spill kit will be used to clean up the spill.

Larger leaks will be address as soon as practical and only if the spill can be handled safely. For any fuel or chemical spills/releases, immediately contact PBS Emergency Dispatch at 419-621-3222. If possible, the source of the spill will be stopped and the spilled material will be contained at the source. The spilled material and any contaminated soil or other contaminated media will be collected in an appropriate container (drums, lined roll-off boxes, etc.). All contaminated material will be properly characterized, manifested, transported, and disposed through NASA Waste Management. NASA will notify any outside agencies if reportable quantities are released.

The Site Safety and Health Plan has additional information about addressing spills. The plan is kept at the site and will be reviewed by all employees prior to working at the site. In addition, tailgate safety meetings will be conducted at the start of each day and discussion topics will include spills and spill response.

3.5 Control Equipment/Vehicle Washing

Excavation equipment and off-road trucks that travel through, or work in, contaminated areas and treatment stockpiles will be power washed in decontamination pad(s). If equipment travels between contaminated areas that are separated by a clean area, then decon will be done upon exiting the contaminated zone. If off-road truck tires do not come in contact with contaminated areas, the tires do not need to be decontaminated but the beds will be decontaminated prior to leaving the site.

The decontamination pads will be designed to collect the water and material washed from the equipment. The plastic lining of the decon pad will be changed daily and as needed. The plastic sheeting and soil will be disposed with the soil. Water will be containerized in drum/tote/tank, sampled to determine the proper disposal, and transported for disposal.

Engine degreasing is not allowed on site.

3.6 Spill Prevention and Control Plan

NASA GRC has its own SPCC plan included in the Center Integrated Contingency Plan.

The following measures shall be taken to minimize the possibility of spills/discharges:

- Site security and controls are to be maintained so that only authorized personnel have access to work areas.
- Site personnel will be advised of appropriate spill/discharge control measures.
- Containers will remain closed except when adding/dispensing product.
- Containers will be stored upright and in an orderly fashion.
- Appropriate secondary containment structures will be used for storage of fluids on-site. If a temporary diesel AST is used onsite, it will be double walled or placed within containment pad with at least 110% secondary containment capacity (see staging area map in Appendix A).
- Storage containment will be examined daily.
- Small containers of chemical product will be stored inside the job box when not in use. Flammable products will be stored inside approved cabinets.

For any fuel or hazardous chemical spills/releases, immediately contact PBS Emergency Dispatch at 419-621-3222. An assessment will be made of the magnitude and potential impact of the release. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

- The spill or release area will be approached from upwind (if outside).
- Hazards will be identified based on available information from witnesses or material identification documents (i.e., placards, SDS). The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.
- If necessary, the spill area will be evacuated, isolated, and secured.
- The spill area will be sealed off using caution tape or other appropriate means.
- Entry to the spill area will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Hazardous spill containment and collection will be performed as follows:

- Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes. Cover or dike floor drains, storm drains, and other conduits for off-site migration of the spilled material.
- Control the spill at the source by plugging leaks, up-righting containers, over packing containers, or transferring contents of a leaking container.
- Collect the spilled material with shovels and other equipment as necessary.
- Store the spilled material in drums for further treatment or disposal.
- Decontaminate personnel and equipment after the response is complete.

If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. Upon arrival at the site, the Site Supervisor/SSO will brief emergency responders of the current status and potential hazards.

3.7 Any Additional BMPs

Contaminated soil will be excavated and loaded for transport off site during phase 2 of the work. Virtually all of the soil that will be moved during this work will be contaminated soil and construction debris. The same BMPs used to manage soil will be used to manage the contaminated soil. These BMPs are:

- Soil will be disturbed and stockpiled for the minimum period of time needed to complete the work.
- Open excavations and stockpiles will be covered with poly sheeting held in place with sandbags.
- The minimum area needed to complete the work will be disturbed during excavating and stockpiling activities.
- A vegetative buffer will be left in place between the excavating and stockpiling activities and the storm water detention pond located at the northeast corner of the property.

3.8 Allowable Non-Stormwater Discharge Management

There are no known non-stormwater discharges.

SECTION 4: SELECTING POST-CONSTRUCTION BMPs

The following is an overall description of the post-construction storm water management for the site:

- After the excavation, and backfilling is completed at each excavation area, the area will be stabilized using seeding and hydromulch.

4.1 Post-Construction Long-Term Operation & Maintenance

The progress of germination will be tracked using weekly SWP3 inspections to ensure timely establishment of grass. Once the grass is established, the silt fence will be removed.

SECTION 5: INSPECTIONS

5.1 Inspections

Inspections shall be performed once per week and after precipitation events of 0.5" and greater and/or 2" snowmelt over a 24-hour period. Once permanent stabilization of all disturbed areas has occurred the inspection frequency will be reduced to once per month. The SWP3 inspection frequency may also be reduced to once per month if the entire site is temporarily stabilized and NASA EMO concurs. Only qualified personnel will perform SWP3 inspections and records will be kept for 3 years by NASA EMO after the termination of construction activities.

Description of Record-Keeping Requirements and Content

Inspections will be documented on an inspection form and will include photographs to further document site conditions at the time of the inspection. The documentation on the inspection form will include:

- Date and time of inspection
- Name of person conducting the inspection
- Findings of inspections, including the specific location where corrective actions are needed, if any
- Corrective actions taken (including dates, times, and party completing maintenance activities)
- Date and amount of all rainfall events greater than 0.5 inches in 24 hours. Rainfall amounts will be obtained by a properly maintained rain gauge installed onsite, a weather station that is within 1 mile of the site location, or a weather reporting system that provides site specific data from radar summaries.
- If an discharge is observed to be occurring during the inspection, a record of all points of the property from which there is a discharge must be made, and the discharge should be described (i.e., color, odor, floating, settled, suspended solids, foam, oil sheen, and other obvious indicators of pollutants) and photographed.
- Any amendments to the SWPPP proposed as a result of the inspection will be documented within 7 calendar days.
- Repair/maintenance of BMPs that are non-sediment ponds must be completed within 3 days of an inspection and within 10 days for a sediment pond.

Frequency of Inspections

Inspections will be conducted every 7 days and within 24 hours of a rainfall event of 0.5 inches or greater and/or 2" snowmelt. If an inspection is conducted after a rainfall event, the next inspection will be conducted within 7 days of that inspection.

Any parts of the project that have permanent cover established and have NASA EMO concurrence, no longer have to be inspected and can be noted on the SWP3 redline drawing.

Per the Ohio CGP, inspections can be reduced to once per month during frozen conditions or if the entire site is temporarily stabilized. NASA EMO needs to concur to site conditions prior to decreasing inspections.

Areas to be Inspected and Maintained

Areas to be inspected and maintained for this project are:

- Open excavation areas
- Stockpile areas
- Turf areas that have been backfilled and restored but do not yet have 70%coverage
- Silt fence
- Roads within the site, the site entrance/exit, and nearby roads
- Material storage areas
- Infiltration areas, including ensuring that traffic is not driven across the area
- Fuel tanks, porta-potties, and oil/chemical storage areas if brought onsite

Inspection Form

The inspections will be documented on the NASA GRC inspection form, in Appendix E. Repair/maintenance of BMPs that are non-sediment ponds must be completed within 3 days of an inspection and within 10 days for a sediment pond.

5.2 Corrective Action Log

The Corrective Action Log will be completed as needed to document repair, replacement, and maintenance of BMPs undertaken as a result of the inspections and maintenance procedures described above. Actions related to the findings of inspections will reference the specific inspection report. The log describes actions taken, date completed, and notes the person or company that completed the work. A copy of the Corrective Action Log can be found in Appendix F.

SECTION 6: RECORDKEEPING

6.1 Recordkeeping

The following records will be kept at the project site and will be available for inspectors to review:

- Dates of grading, construction activity, and stabilization
- A copy of the Ohio NPDES Construction Storm Water General Permit (OH000005)
- Inspection Reports
- Corrective Action Log
- SWPPP Amendment Log
- Grading and Stabilization Activities Log
- Duty to Inform log

Records will be retained for a minimum period of at least 3 years after the permit is terminated.

6.2 Log of Changes to the SWPPP

Changes that are made to this SWPPP will be documented on the SWPPP Amendment Log. Possible changes to the SWPPP could include new BMPs, replacement of failed BMPs, significant changes to activities of the timing of the activities, changes to personnel, changes to inspection procedures, changes to maintenance procedures, updates to site maps, etc. The changes can also be documented on redline drawings, as appropriate. The SWPPP Amendment Log is included in Appendix G.

SECTION 7: FINAL STABILIZATION

For disturbed areas within 50 feet of a stream at final grade, permanent stabilization will be applied within 2 days of reaching final grade. Permanent stabilization will be applied to disturbed areas remaining dormant over 1 year or at final grade within 7 days of the most recent disturbance. (ODNR 2006)

Describe method of final stabilization of all disturbed areas:

- Seed with PBS approved seed mixture and hydromulch in all turf areas.

Describe procedures for completing final stabilization and terminating permit coverage:

- Install seed and hydromulch in all turf areas. Monitor and maintain turf areas until 70% coverage is attained (per most current edition of Ohio's Rainwater and Land Development manual (ODNR 2006)).

SECTION 8: CERTIFICATION AND NOTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Carl Shaw Title: Project Manager

Signature:  Date: 01/08/2020

Appendix A – Site Maps

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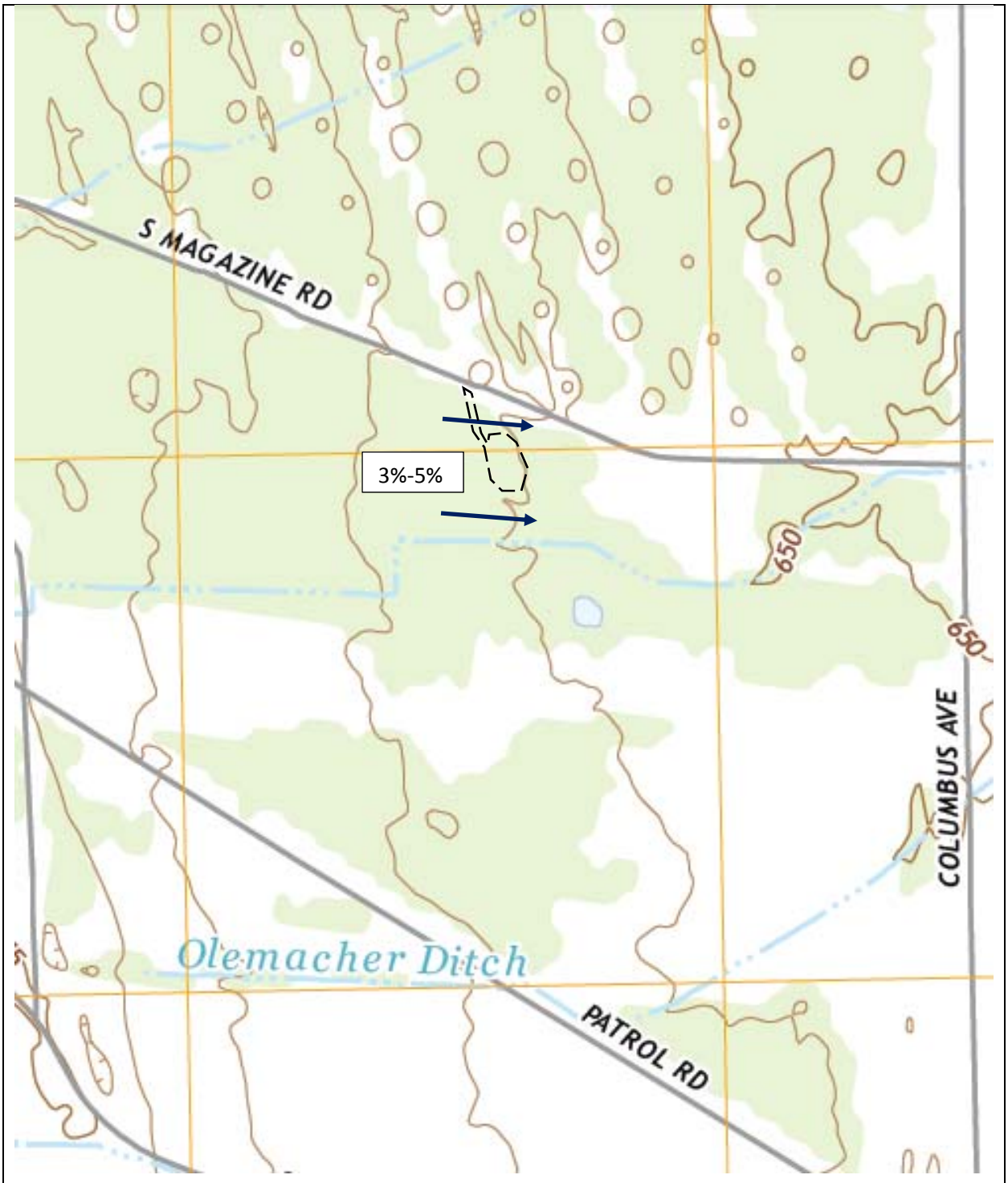
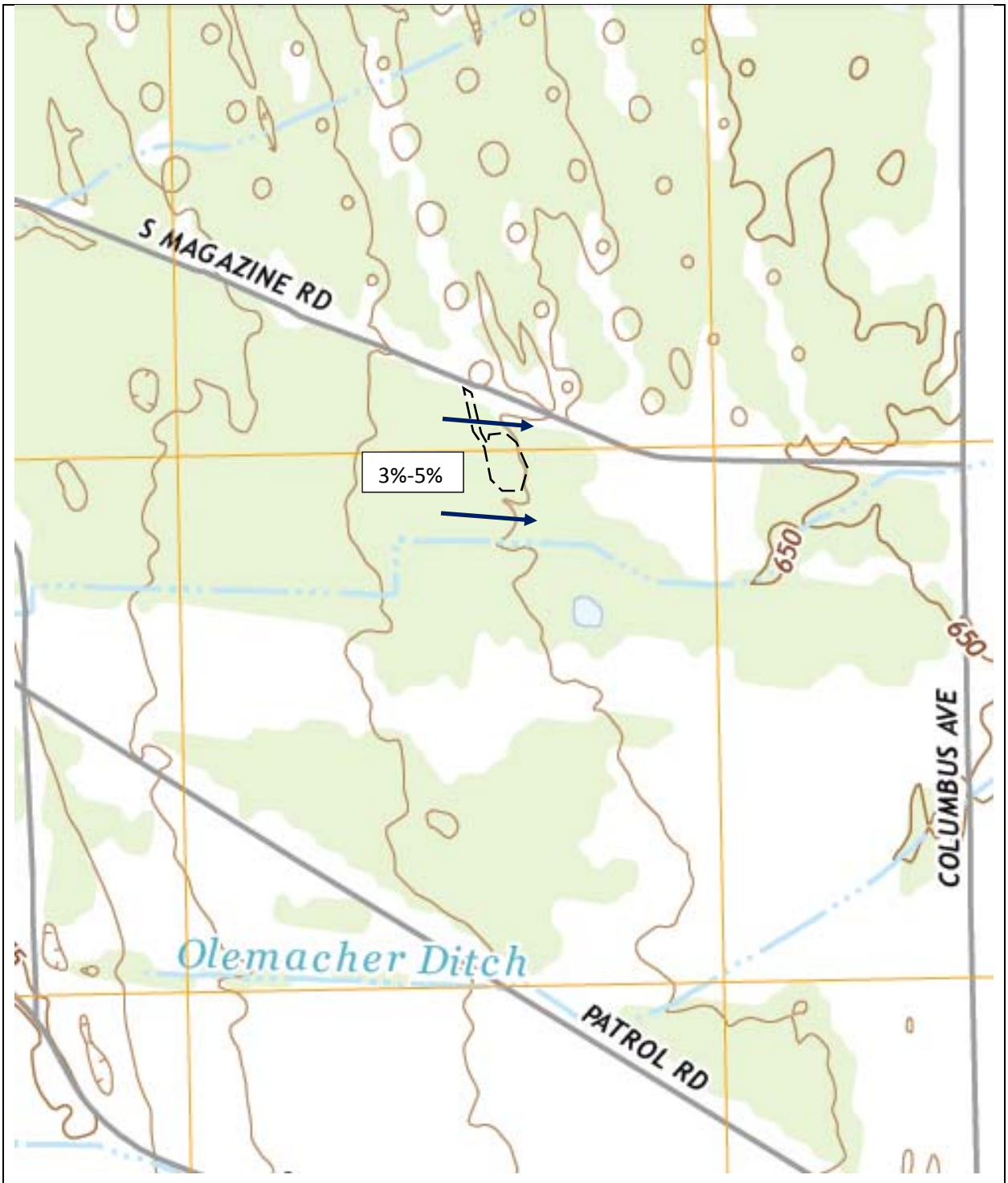
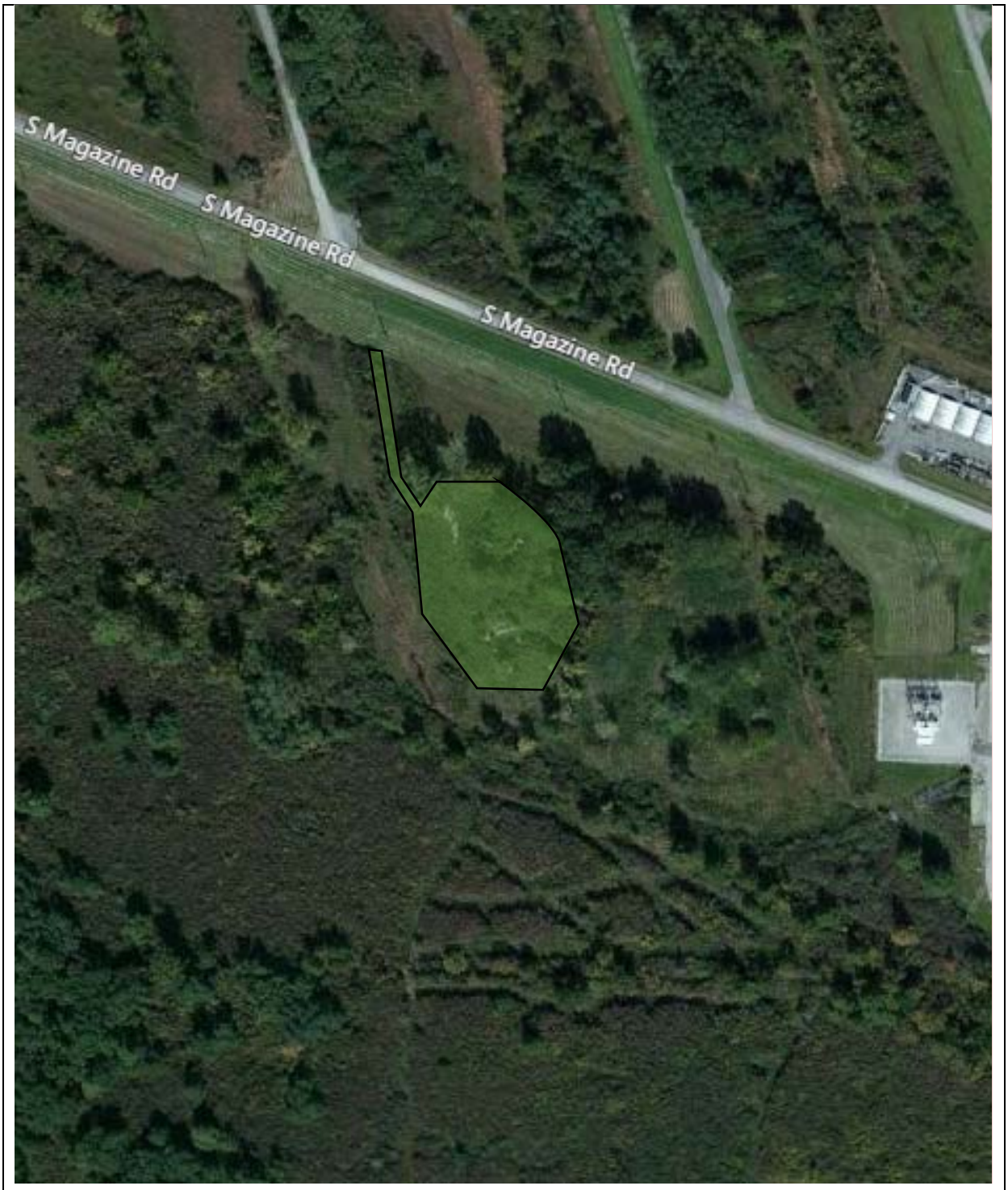
NASA Plum Brook Station Firing Range 5 and CDP Sandusky, Ohio	**Site Location Map**



NASA Plum Brook Station **Firing Range 5 and CDP** **Sandusky, Ohio**	**Direction of Surface Water Flow** **Before Grading**



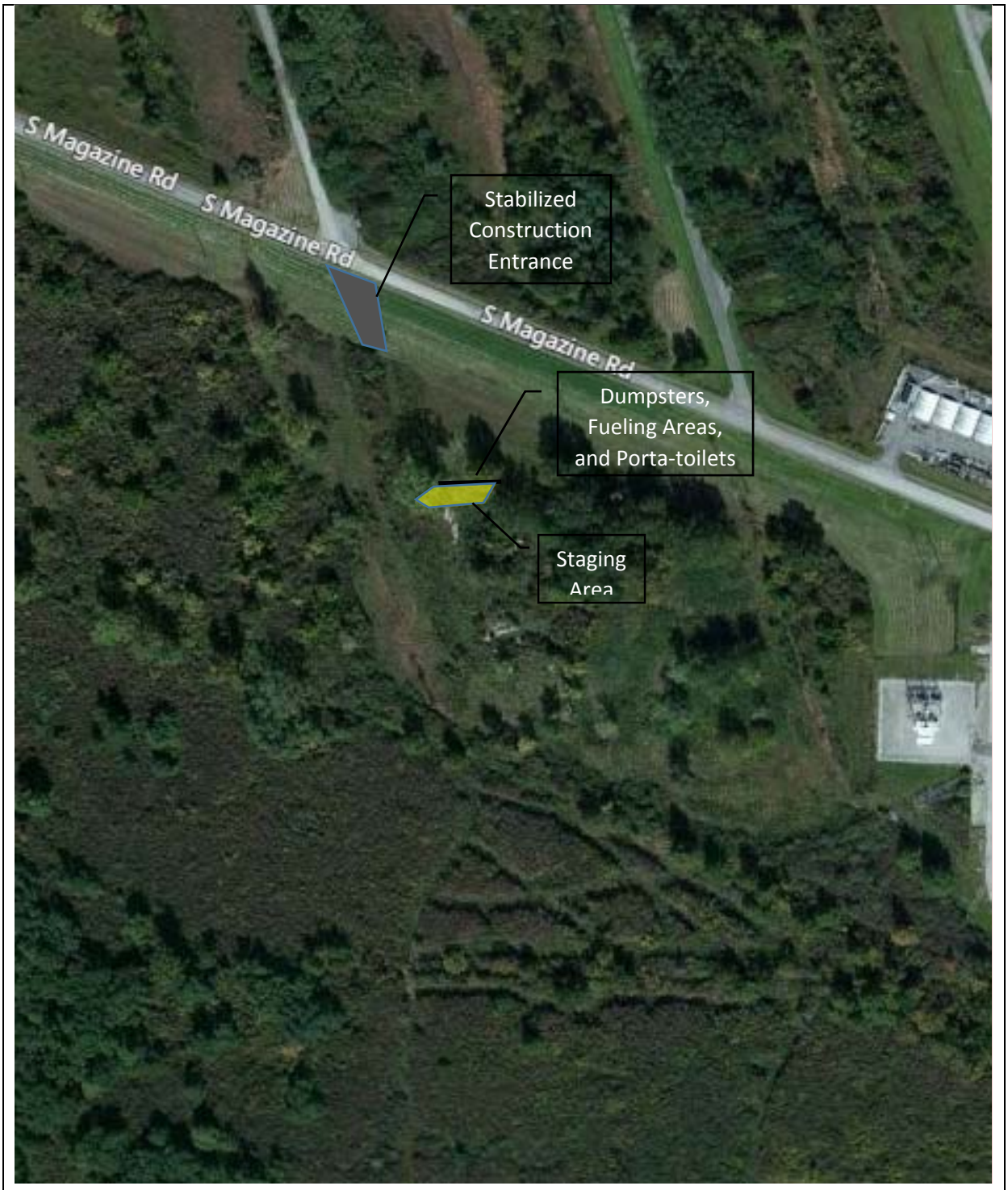
NASA Plum Brook Station **Firing Range 5 and CDP** **Sandusky, Ohio**	**Direction of Surface Water Flow** **After Grading**



NASA Plum Brook Station **Firing Range 5 and CDP** **Sandusky, Ohio**	**Clearing and Grugging Extent** **Winter 2020**

NASA Plum Brook Station Firing Range 5 and CDP Sandusky, Ohio	**Areas of Excavation, Treatment, Transport, and Backfill Spring, Summer, Fall 2020**

NASA Plum Brook Station **Firing Range 5 and CDP** **Sandusky, Ohio**	**Areas that will not be Disturbed**



NASA Plum Brook Station Firing Range 5 and CDP Sandusky, Ohio	**Staging Area**

NASA Plum Brook Station **Firing Range 5 and CDP** **Sandusky, Ohio**	**Surface Water (Blue)** **and Wetland (Green)**

Appendix B – Construction Sequence

Appendix B – Construction Sequence

The following outlines the construction sequence for the project:

Winter 2020

- Complete clearing and grubbing of existing trees and shrubs

Spring 2020

- Mobilize equipment and personnel
- Install stormwater BMPs such as silt fence and straw bails
- Inspect and maintain BMPs throughout project until final stabilization is complete
- Excavate impacted soil and berms and debris piles
- Treat the excavated soil (if required for non-hazardous disposal)
- Load and transport the treated soil
- Sample the sidewalls and bottom of the excavation
- Backfill the excavation with clean backfill and topsoil
- Grade, seed, and apply hydromulch for final stabilization

This work will be divided into manageable sized areas and each task listed above will be completed for each area. Generally, the work will begin farthest from the entrance to minimize traveling over completed areas. Once an area is excavated and the soil removed, the crew will move to the next area while the previous excavation area is sampled and analyzed (about 4 weeks). Once the excavation area is declared clean, it will be backfilled with clean fill and topsoil, graded, seeded, and hydromulched. Work will move from one area to the next completing all tasks until all areas are completed.

Appendix C – Ohio NPDES Construction Stormwater General Permit

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Issuance Date: April 23, 2018
Effective Date: April 23, 2018
Expiration Date: April 22, 2023

OHIO ENVIRONMENTAL PROTECTION AGENCY

GENERAL PERMIT AUTHORIZATION FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et. seq. hereafter referred to as "the Act") and the Ohio Water Pollution Control Act [Ohio Revised Code ("ORC") Chapter 6111], dischargers of storm water from sites where construction activity is being conducted, as defined in Part I.B of this permit, are authorized by the Ohio Environmental Protection Agency, hereafter referred to as "Ohio EPA," to discharge from the outfalls at the sites and to the receiving surface waters of the state identified in their Notice of Intent ("NOI") application form on file with Ohio EPA in accordance with the conditions specified in Parts I through VII of this permit.

It has been determined that a lowering of water quality of various waters of the state associated with granting coverage under this permit is necessary to accommodate important social and economic development in the state of Ohio. In accordance with OAC 3745-1-05, this decision was reached only after examining a series of technical alternatives, reviewing social and economic issues related to the degradation, and considering all public and intergovernmental comments received concerning the proposal.

This permit is conditioned upon payment of applicable fees, submittal of a complete NOI application form, development (and submittal, if applicable) of a complete Storm Water Pollution Prevention Plan (SWP3) and written approval of coverage from the director of Ohio EPA in accordance with Ohio Administrative Code ("OAC") Rule 3745-38-02.

Craig W. Butler
Director

Total Pages: 60

TABLE OF CONTENTS

PART I. COVERAGE UNDER THIS PERMIT

A. Permit Area.

This permit covers the entire State of Ohio. Appendices A and B of this permit contain additional watershed specific requirements for construction activities located partially or fully within the Big Darby Creek Watershed and portions of the Olentangy River Watershed. Projects within portions of the Olentangy River watershed shall seek coverage under this permit following the expiration of OHCO00002 (May 31, 2019).

B. Eligibility.

1. Construction activities covered. Except for storm water discharges identified under Part I.B.2, this permit may cover all new and existing discharges composed entirely of storm water discharges associated with construction activity that enter surface waters of the state or a storm drain leading to surface waters of the state.

   For the purposes of this permit, construction activities include any clearing, grading, excavating, grubbing and/or filling activities that disturb one or more acres. Discharges from trench dewatering are also covered by this permit as long as the dewatering activity is carried out in accordance with the practices outlined in Part III.G.2.g.iv of this permit.

   Construction activities disturbing one or more acres of total land or will disturb less than one acre of land but are part of a larger common plan of development or sale that will ultimately disturb one or more acres of land are eligible for coverage under this permit. The threshold acreage includes the entire area disturbed in the larger common plan of development or sale.

   This permit also authorizes storm water discharges from support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) provided:

   a. The support activity is directly related to a construction site that is required to have NPDES permit coverage for discharges of storm water associated with construction activity;

   b. The support activity is not a commercial operation serving multiple unrelated construction projects and does not operate beyond the completion of the construction activity at the site it supports;

   c. Appropriate controls and measures are identified in a storm water pollution prevention plan (SWP3) covering the discharges from the support activity; and

   d. The support activity is on or contiguous with the property defined in the NOI (offsite borrow pits and soil disposal areas, which serve only one project, do not have to be contiguous with the construction site).

2. Limitations on coverage. The following storm water discharges associated with construction activity are not covered by this permit:

a. Storm water discharges that originate from the site after construction activities have ceased, including any temporary support activity, and the site has achieved final stabilization. Industrial post-construction storm water discharges may need to be covered by an NPDES permit;

b. Storm water discharges associated with construction activity that the director has shown to be or may reasonably expect to be contributing to a violation of a water quality standard; and

c. Storm water discharges authorized by an individual NPDES permit or another NPDES general permit.

3. Waivers. After March 10, 2003, sites whose larger common plan of development or sale have at least one, but less than five acres of land disturbance, which would otherwise require permit coverage for storm water discharges associated with construction activities, may request that the director waive their permit requirement. Entities wishing to request such a waiver must certify in writing that the construction activity meets one of the two waiver conditions:

a. Rainfall Erosivity Waiver. For a construction site to qualify for the rainfall erosivity waiver, the cumulative rainfall erosivity over the project duration must be five or less and the site must be stabilized with a least a 70 percent vegetative cover or other permanent, non-erosive cover. The rainfall erosivity must be calculated according to the method in U.S. EPA Fact Sheet 3.1 Construction Rainfall Erosivity Waiver dated January 2001 and be found at: http://epa.ohio.gov/portals/35/permits/USEPAfact3-1_s.pdf. If it is determined that a construction activity will take place during a time period where the rainfall erosivity factor is less than five, a written waiver certification must be submitted to Ohio EPA at least 21 days before construction activity is scheduled to begin. If the construction activity will extend beyond the dates specified in the waiver certification, the operator must either: (a) recalculate the waiver using the original start date with the new ending date (if the R factor is still less than five, a new waiver certification must be submitted) or (b) submit an NOI application form and fee for coverage under this general permit at least seven days prior to the end of the waiver period; or

b. TMDL (Total Maximum Daily Load) Waiver. Storm water controls are not needed based on a TMDL approved or established by U.S. EPA that addresses the pollutant(s) of concern or, for non-impaired waters that do not require TMDLs, and equivalent analysis that determines allocations for small construction sites for the pollutant(s) of concern or that determines that such allocations are not needed to protect water quality based on consideration of existing in-stream concentrations, expected growth in pollutant contributions from all sources, and a margin of safety. The pollutant(s) of concern include sediment or a parameter that addresses sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any water body that will receive a discharge from the construction activity. The operator must certify to the director of Ohio EPA that the construction activity will take place, and storm water discharges will occur, within the drainage area addressed by the TMDL or equivalent analysis. A written waiver certification must be submitted to Ohio EPA at least 21 days before the construction activity is scheduled to begin.

4. Prohibition on non-storm water discharges. All discharges covered by this permit must be composed entirely of storm water with the exception of the following: discharges from firefighting activities; fire hydrant flushings; potable water sources including waterline flushings; irrigation drainage; lawn watering; routine external building washdown which does not use detergents; pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; uncontaminated ground water from trench or well point dewatering and foundation or footing drains where flows are not contaminated with process materials such as solvents. Dewatering activities must be done in compliance with Part II.C and Part III.G.2.g.iv of this permit. Discharges of material other than storm water or the authorized non-storm water discharges listed above must comply with an individual NPDES permit or an alternative NPDES general permit issued for the discharge.

   Except for flows from firefighting activities, sources of non-storm water listed above that are combined with storm water discharges associated with construction activity must be identified in the SWP3. The SWP3 must identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

5. Spills and unintended releases (Releases in excess of Reportable Quantities). This permit does not relieve the permittee of the reporting requirements of Title 40 of the Code of Federal Regulations ("CFR") Part 117 and 40 CFR Part 302. In the event of a spill or other unintended release, the discharge of hazardous substances in the storm water discharge(s) from a construction site must be minimized in accordance with the applicable storm water pollution prevention plan for the construction activity and in no case, during any 24-hour period, may the discharge(s) contain a hazardous substance equal to or in excess of reportable quantities.

   40 CFR Part 117 sets forth a determination of the reportable quantity for each substance designated as hazardous in 40 CFR Part 116. The regulation applies to quantities of designated substances equal to or greater than the reportable quantities, when discharged to surface waters of the state. 40 CFR Part 302 designates under section 102(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, those substances in the statutes referred to in section 101(14), identifies reportable quantities for these substances and sets forth the notification requirements for releases of these substances. This regulation also sets forth reportable quantities for hazardous substances designated under section 311(b)(2)(A) of the Clean Water Act (CWA).

C. Requiring an individual NPDES permit or an alternative NPDES general permit.

1. The director may require an alternative permit. The director may require any operator eligible for this permit to apply for and obtain either an individual NPDES permit or coverage under an alternative NPDES general permit in accordance with OAC Rule 3745-38-02. Any interested person may petition the director to take action under this paragraph.

The director will send written notification that an alternative NPDES permit is required. This notice shall include a brief statement of the reasons for this decision, an application form and a statement setting a deadline for the operator to file the application. If an operator fails to submit an application in a timely manner as required by the director under this paragraph, then coverage, if in effect, under this permit is automatically terminated at the end of the day specified for application submittal.

2. Operators may request an individual NPDES permit. Any owner or operator eligible for this permit may request to be excluded from the coverage of this permit by applying for an individual permit. The owner or operator shall submit an individual application with reasons supporting the request to the director in accordance with the requirements of 40 CFR 122.26. If the reasons adequately support the request, the director shall grant it by issuing an individual NPDES permit.

3. When an individual NPDES permit is issued to an owner or operator otherwise subject to this permit or the owner or operator is approved for coverage under an alternative NPDES general permit, the applicability of this permit to the individual NPDES permittee is automatically terminated on the effective date of the individual permit or the date of approval for coverage under the alternative general permit, whichever the case may be.

D. Permit requirements when portions of a site are sold

If an operator obtains a permit for a development, and then the operator (permittee) sells off lots or parcels within that development, permit coverage must be continued on those lots until a Notice of Termination (NOT) in accordance with Part IV.B is submitted. For developments which require the use of centralized sediment and erosion controls (i.e., controls that address storm water runoff from one or more lots) for which the current permittee intends to terminate responsibilities under this permit for a lot after sale of the lot to a new owner and such termination will either prevent or impair the implementation of the controls and therefore jeopardize compliance with the terms and conditions of this permit, the permittee will be required to maintain responsibility for the implementation of those controls. For developments where this is not the case, it is the permittee's responsibility to temporarily stabilize all lots sold to individual lot owners unless an exception is approved in accordance with Part III.G.4. In cases where permit responsibilities for individual lot(s) will be terminated after sale of the lot, the permittee shall inform the individual lot owner of the obligations under this permit and ensure that the Individual Lot NOI application is submitted to Ohio EPA.

E. Authorization

1. Obtaining authorization to discharge. Operators that discharge storm water associated with construction activity must submit an NOI application form and Storm Water Pollution Prevention Plan (SWP3) if located within the Big Darby Creek watershed or portions of the Olentangy watershed in accordance with the requirements of Part I.F of this permit to obtain authorization to discharge under this general permit. As required under OAC Rule 3745-38-06(E), the director, in response to the NOI submission, will notify the applicant in writing that he/she has or has not been granted general permit coverage to discharge storm water associated with construction activity under the terms and conditions of this permit or that the applicant must apply for an individual NPDES permit or coverage under an alternate general NPDES permit as described in Part I.C.1.

2. No release from other requirements. No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations. Other permit requirements commonly associated with construction activities include, but are not limited to, section 401 water quality certifications, isolated wetland permits, permits to install sanitary sewers or other devices that discharge or convey polluted water, permits to install drinking water lines, single lot sanitary system permits and disturbance of land which was used to operate a solid or hazardous waste facility (i.e., coverage under this NPDES general permit does not satisfy the requirements of OAC Rule 3745-27-13 or ORC Section 3734.02(H)). The issuance of this permit is subject to resolution of an antidegradation review. This permit does not relieve the permittee of other responsibilities associated with construction activities such as contacting the Ohio Department of Natural Resources, Division of Water, to ensure proper well installation and abandonment of wells.

F. Notice of Intent Requirements

1. Deadlines for notification.

   a. Initial coverage: Operators who intend to obtain initial coverage for a storm water discharge associated with construction activity under this general permit must submit a complete and accurate NOI application form, a completed Storm Water Pollution Prevention Plan (SWP3) for projects within the Big Darby Creek and portions of the Olentangy river watersheds and appropriate fee at least 21 days (or 45 days in the Big Darby Creek watershed and portions of the Olentangy watershed) prior to the commencement of construction activity. If more than one operator, as defined in Part VII of this general permit, will be engaged at a site, each operator shall seek coverage under this general permit prior to engaging in construction activities. Coverage under this permit is not effective until an approval letter granting coverage from the director of Ohio EPA is received by the applicant. Where one operator has already submitted an NOI prior to other operator(s) being identified, the additional operator shall request modification of coverage to become a co-permittee. In such instances, the co-permittees shall be covered under the same facility permit number. No additional permit fee is required.

   b. Individual lot transfer of coverage: Operators must each submit an individual lot notice of intent (Individual Lot NOI) application form (no fee required) to Ohio EPA at least seven days prior to the date that they intend to accept responsibility for permit requirements for their portion of the original permitted development from the previous permittee. Transfer of permit coverage is not granted until an approval letter from the director of Ohio EPA is received by the applicant.

2. Failure to notify. Operators who fail to notify the director of their intent to be covered and who discharge pollutants to surface waters of the state without an NPDES permit are in violation of ORC Chapter 6111. In such instances, Ohio EPA may bring an enforcement action for any discharges of storm water associated with construction activity.

3. How to submit an NOI. Operators seeking coverage under this permit must submit a complete and accurate Notice of Intent (NOI) application using Ohio EPA's electronic application form which is available through the Ohio EPA eBusiness Center at: **https://ebiz.epa.ohio.gov/**. Submission through the Ohio EPA eBusiness Center will

require establishing an Ohio EPA eBusiness Center account and obtaining a unique Personal Identification Number (PIN) for final submission of the NOI. Existing eBusiness Center account holders can access the NOI form through their existing account and submit using their existing PIN. Please see the following link for guidance: **http://epa.ohio.gov/dsw/ebs.aspx#170669803-streams-guidance**. Alternatively, if you are unable to access the NOI form through the agency eBusiness Center due to a demonstrated hardship, the NOI may be submitted on a paper NOI form provided by Ohio EPA. NOI information shall be typed on the form. Please contact Ohio EPA, Division of Surface Water at (614) 644-2001 if you wish to receive a paper NOI form.

4. Additional notification. NOIs and SWP3s are considered public documents and shall be made available to the public in accordance with Part III.C.2. The permittee shall make NOIs and SWP3s available upon request of the director of Ohio EPA, local agencies approving sediment and erosion control plans, grading plans or storm water management plans, local governmental officials, or operators of municipal separate storm sewer systems (MS4s) receiving drainage from the permitted site. Each operator that discharges to an NPDES permitted MS4 shall provide a copy of its Ohio EPA NOI submission to the MS4 in accordance with the MS4's requirements, if applicable.

5. Re-notification. Existing permittees having coverage under the previous generations of this general permit shall have continuing coverage under OHC000005 with the submittal of a timely renewal application. Within 180 days from the effective date of this permit, existing permittees shall submit the completed renewal application expressing their intent for continued coverage. In accordance with Ohio Administrative Code (OAC) 3745-38-02(E)(2)(a)(i), a renewal application fee will only apply to existing permittees having general permit coverage for 5 or more years as of the effective date of this general permit. Permit coverage will be terminated if Ohio EPA does not receive the renewal application within this 180-day period.

Part II. NON-NUMERIC EFFLUENT LIMITATIONS

You shall comply with the following non-numeric effluent limitations for discharges from your site and/or from construction support activities. Part III of this permit contains the specific design criteria to meet the objectives of the following non-numeric effluent limitations. You shall develop and implement the SWP3 in accordance with Part III of this permit to satisfy these non-numeric effluent limitations.

A. Erosion and Sediment Controls. You shall design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, such controls shall be designed, installed and maintained to:

1. Control storm water volume and velocity within the site to minimize soil and stream erosion;

2. Control storm water discharges, including both peak flowrates and total storm water volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion;

3. Minimize the amount of soil exposed during construction activity;

4. Minimize the disturbance of steep slopes;

5. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls shall address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting storm water runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site;

6. If feasible, provide and maintain a 50-foot undisturbed natural buffer around surface waters of the state, direct storm water to vegetated areas to increase sediment removal and maximize storm water infiltration. If it is infeasible to provide and maintain an undisturbed 50-foot natural buffer, you shall comply with the stabilization requirements found in Part II.B for areas within 50 feet of a surface water; and

7. Minimize soil compaction and, unless infeasible, preserve topsoil.

B. Soil Stabilization. Stabilization of disturbed areas shall, at a minimum, be initiated in accordance with the time frames specified in the following tables.

Table 1: Permanent Stabilization

Area requiring permanent stabilization	Time frame to apply erosion controls
Any areas that will lie dormant for one year or more	Within seven days of the most recent disturbance
Any areas within 50 feet of a surface water of the state and at final grade	Within two days of reaching final grade
Other areas at final grade	Within seven days of reaching final grade within that area

Table 2: Temporary Stabilization

Area requiring temporary stabilization	Time frame to apply erosion controls
Any disturbed areas within 50 feet of a surface water of the state and not at final grade	Within two days of the most recent disturbance if the area will remain idle for more than 14 days
Any disturbed areas that will be dormant for more than 14 days but less than one year, and not within 50 feet of a surface water of the state	Within seven days of the most recent disturbance within the area For residential subdivisions, disturbed areas must be stabilized at least seven days prior to transfer of permit coverage for the individual lot(s).
Disturbed areas that will be idle over winter	Prior to the onset of winter weather

Where vegetative stabilization techniques may cause structural instability or are otherwise unobtainable, alternative stabilization techniques must be employed. Permanent and temporary stabilization are defined in Part VII.

C. **Dewatering.** Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, are prohibited unless managed by appropriate controls.

D. **Pollution Prevention Measures.** Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. At a minimum, such measures must be designed, installed, implemented and maintained to:

1. Minimize the discharge of pollutants from equipment and vehicle washing, wheel washwater, and other washwaters. Washwaters shall be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;

2. Minimize the exposure of construction materials, products, and wastes; landscape materials, fertilizers, pesticides, and herbicides; detergents, sanitary waste and other materials present on the site to precipitation and to storm water; and

3. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.

E. **Prohibited Discharges.** The following discharges are prohibited:

1. Wastewater from washout of concrete, unless managed by an appropriate control;

2. Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;

3. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; and

4. Soaps or solvents used in vehicle and equipment washing or all other waste water streams which could be subject to an individual NPDES permit (Part III.G.2.g).

F. **Surface Outlets**. When discharging from sediment basins utilize outlet structures that withdraw water from the surface, unless infeasible. (Note: Ohio EPA believes that the circumstances in which it is infeasible to design outlet structures in this manner are rare. Exceptions may include time periods with extended cold weather during winter months. If you have determined that it is infeasible to meet this requirement, you shall provide documentation in your SWP3 to support your determination.)

G. **Post-Construction Storm Water Management Controls**. So that receiving stream's physical, chemical and biological characteristics are protected, and stream functions are maintained, post-construction storm water practices shall provide long-term management of runoff quality and quantity.

PART III. STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Storm Water Pollution Prevention Plans.

A SWP3 shall be developed for each site covered by this permit. For a multi-phase construction project, a separate NOI shall be submitted when a separate SWP3 will be prepared for

subsequent phases. SWP3s shall be prepared in accordance with sound engineering and/or conservation practices by a professional experienced in the design and implementation of standard erosion and sediment controls and storm water management practices addressing all phases of construction. The SWP3 shall clearly identify all activities which are required to be authorized under Section 401 and subject to an antidegradation review. The SWP3 shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges associated with construction activities. The SWP3 shall be a comprehensive, stand-alone document, which is not complete unless it contains the information required by Part III.G of this permit. In addition, the SWP3 shall describe and ensure the implementation of best management practices (BMPs) that reduce the pollutants and impact of storm water discharges during construction and pollutants associated with the post-construction land use to ensure compliance with ORC Section 6111.04, OAC Chapter 3745-1 and the terms and conditions of this permit.

B. Timing.

An acceptable SWP3 shall be completed and submitted to the applicable regulated MS4 entity (for projects constructed entirely within a regulated MS4 area) prior to the timely submittal of an NOI. Projects within the Big Darby Creek and portions of the Olentangy watersheds must submit a SWP3 with the NOI. The SWP3 shall be updated in accordance with Part III.D. Submission of a SWP3 does not constitute review and approval on the part of Ohio EPA. Upon request and good cause shown, the director may waive the requirement to have a SWP3 completed at the time of NOI submission. If a waiver has been granted, the SWP3 must be completed prior to the initiation of construction activities. The SWP3 must be implemented upon initiation of construction activities.

In order to continue coverage from the previous generations of this permit, the permittee shall review and update the SWP3 to ensure that this permit's requirements are addressed within 180 days after the effective date of this permit. If it is infeasible for you to comply with a specific requirement in this permit because (1) the provision was not part of the permit you were previously covered under, and (2) because you are prevented from compliance due to the nature or location of earth disturbances that commenced prior to the effective date of this permit, you shall include documentation within your SWP3 of the reasons why it is infeasible for you to meet the specific requirement.

Examples of OHC000005 permit conditions that would be infeasible for permittees renewing coverage to comply with include:

- OHC000005 post-construction requirements, for projects that obtained NPDES construction storm water coverage and started construction activities prior to the effective date of this permit;

- OHC000005 post-construction requirements, for multi-phase development projects with an existing regional post-construction BMP issued under previous NPDES post-construction requirements. This only applies to construction sites authorized under Ohio EPA's Construction Storm Water Permits issued after April 20, 2003;

- OHC000005 post-construction requirements, for renewing or initial coverage and you have a SWP3 approved locally and you will start construction within 180 days of the effective date of this permit;

- Sediment settling pond design requirements, if the general permit coverage was obtained prior to April 21, 2013 and the sediment settling pond has been installed; or

- Case-by-case situations approved by the Director.

C. SWP3 Signature and Review.

1. Plan Signature and Retention On-Site. The SWP3 shall include the certification in Part V.H, be signed in accordance with Part V.G., and be retained on site during working hours.

2. Plan Availability

   a. On-site: The plan shall be made available immediately upon request of the director or his authorized representative and MS4 operators or their authorized representative during working hours. A copy of the NOI and letter granting permit coverage under this general permit also shall be made available at the site.

   b. By written request: The permittee must provide the most recent copy of the SWP3 within 7 days upon written request by any of the following:

      i. The director or the director's authorized representative;

      ii. A local agency approving sediment and erosion plans, grading plans or storm water management plans; or

      iii. In the case of a storm water discharge associated with construction activity which discharges through a municipal separate storm sewer system with an NPDES permit, to the operator of the system.

   c. To the public: All NOIs, general permit approval for coverage letters, and SWP3s are considered reports that shall be available to the public in accordance with the Ohio Public Records law. The permittee shall make documents available to the public upon request or provide a copy at public expense, at cost, in a timely manner. However, the permittee may claim to Ohio EPA any portion of an SWP3 as confidential in accordance with Ohio law.

3. Plan Revision. The director or authorized representative may notify the permittee at any time that the SWP3 does not meet one or more of the minimum requirements of this part. Within 10 days after such notification from the director or authorized representative (or as otherwise provided in the notification), the permittee shall make the required changes to the SWP3 and shall submit to Ohio EPA the revised SWP3 or a written certification that the requested changes have been made.

D. Amendments.

The permittee shall amend the SWP3 whenever there is a change in design, construction, operation or maintenance, which has a significant effect on the potential for the discharge of pollutants to surface waters of the state or if the SWP3 proves to be ineffective in achieving the

general objectives of controlling pollutants in storm water discharges associated with construction activity. Amendments to the SWP3 may be reviewed by Ohio EPA in the same manner as Part III.C.

E. Duty to inform contractors and subcontractors.

The permittee shall inform all contractors and subcontractors not otherwise defined as "operators" in Part VII of this general permit who will be involved in the implementation of the SWP3 of the terms and conditions of this general permit. The permittee shall maintain a written document containing the signatures of all contractors and subcontractors involved in the implementation of the SWP3 as proof acknowledging that they reviewed and understand the conditions and responsibilities of the SWP3. The written document shall be created, and signatures shall be obtained prior to commencement of earth disturbing activity on the construction site.

F. Total Maximum Daily Load (TMDL) allocations.

If a TMDL is approved for any waterbody into which the permittee's site discharges and requires specific BMPs for construction sites, the director may require the permittee to revise his/her SWP3. Specific conditions have been provided in Appendix A (for the Big Darby Creek Watershed) and Appendix B (for portions of the Olentangy river watershed).

G. SWP3 Requirements.

Operations that discharge storm water from construction activities are subject to the following requirements and the SWP3 shall include the following items:

1. Site description. Each SWP3 shall provide:

    a. A description of the nature and type of the construction activity (e.g., low density residential, shopping mall, highway, etc.);

    b. Total area of the site and the area of the site that is expected to be disturbed (i.e., grubbing, clearing, excavation, filling or grading, including off-site borrow areas);

    c. A measure of the impervious area and percent imperviousness created by the construction activity (existing, new and total impervious area after construction);

    d. Storm water calculations, including the volumetric runoff coefficients for both the pre-construction and post- construction site conditions, and resulting water quality volume; design details for post-construction storm water facilities and pretreatment practices such as contributing drainage areas, capacities, elevations, outlet details and drain times shall be included in the SWP3; and if applicable, explanation of the use of existing post-construction facilities. Ohio EPA recommends the use of data sheets (see Ohio's Rainwater and Land Development manual and Ohio EPA resources for examples);

    e. Existing data describing the soil and, if available, the quality of any discharge from the site;

f. A description of prior land uses at the site;

g. A description of the condition of any on-site streams (e.g. prior channelization, bed instability or headcuts, channels on public maintenance, or natural channels);

h. An implementation schedule which describes the sequence of major construction operations (i.e., designation of vegetative preservation areas, grubbing, excavating, grading, utilities, infrastructure installation and others) and the implementation of erosion, sediment and storm water management practices or facilities to be employed during each operation of the sequence;

i. The name and/or location of the immediate receiving stream or surface water(s) and the first subsequent named receiving water(s) and the areal extent and description of wetlands or other special aquatic sites at or near the site which will be disturbed, or which will receive discharges from disturbed areas of the project. For discharges to an MS4, the point of discharge to the MS4 and the location where the MS4 ultimately discharges to a stream or surface water of the state shall be indicated;

j. For subdivided developments, a detail drawing of individual parcels with their erosion, sediment or storm water control practices and/or a typical individual lot showing standard individual lot erosion and sediment control practices.

   A typical individual lot drawing does not remove the responsibility to designate specific erosion and sediment control practices in the SWP3 for critical areas such as steep slopes, stream banks, drainage ways and riparian zones;

k. Location and description of any storm water discharges associated with dedicated asphalt and dedicated concrete plants covered by this permit and the best management practices to address pollutants in these storm water discharges;

l. A cover page or title identifying the name and location of the site, the name and contact information of all construction site operators, the name and contact information for the person responsible for authorizing and amending the SWP3, preparation date, and the estimated dates that construction will start and be complete;

m. A log documenting grading and stabilization activities as well as amendments to the SWP3, which occur after construction activities commence; and

n. Site map showing:

   i. Limits of earth-disturbing activity of the site including associated off-site borrow or spoil areas that are not addressed by a separate NOI and associated SWP3;

   ii. Soils types for all areas of the site, including locations of unstable or highly erodible and/or known contaminated soils;

iii. Existing and proposed contours. A delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed, in acres;

iv. The location of any delineated boundary for required riparian setbacks;

v. Conservation easements or areas designated as open space, preserved vegetation or otherwise protected from earth disturbing activities. A description of any associated temporary or permanent fencing or signage;

vi. Surface water locations including springs, wetlands, streams, lakes, water wells, etc., on or within 200 feet of the site, including the boundaries of wetlands or stream channels and first subsequent named receiving water(s) the permittee intends to fill or relocate for which the permittee is seeking approval from the Army Corps of Engineers and/or Ohio EPA;

vii. Existing and planned locations of buildings, roads, parking facilities and utilities;

viii. The location of all erosion and sediment control practices, including the location of areas likely to require temporary stabilization during site development;

ix. Sediment traps and basins noting their sediment storage and dewatering (detention) volume and contributing drainage area. Ohio EPA recommends the use of data sheets (see Ohio EPA's Rainwater and Land Development manual and website for examples) to provide data for all sediment traps and basins noting important inputs to design and resulting parameters such as their contributing drainage area, disturbed area, detention volume, sediment storage volume, practice surface area, dewatering time, outlet type and dimensions;

x. The location of permanent storm water management practices (new and existing) including pretreatment practices to be used to control pollutants in storm water after construction operations have been completed along with the location of existing and planned drainage features including catch basins, culverts, ditches, swales, surface inlets and outlet structures;

xi. Areas designated for the storage or disposal of solid, sanitary and toxic wastes, including dumpster areas, areas designated for cement truck washout, and vehicle fueling;

xii. The location of designated construction entrances where the vehicles will access the construction site; and

xiii. The location of any areas of proposed floodplain fill, floodplain excavation, stream restoration or known temporary or permanent stream crossings.

2. Controls. In accordance with Part II.A, the SWP3 shall contain a description of the controls appropriate for each construction operation covered by this permit and the operator(s) shall implement such controls. The SWP3 shall clearly describe for each major construction activity identified in Part III.G.1.h: (a) appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented; and (b) which contractor is responsible for implementation (e.g., contractor A will clear land and install perimeter controls and contractor B will maintain perimeter controls until final stabilization). The SWP3 shall identify the subcontractors engaged in activities that could impact storm water runoff. The SWP3 shall contain signatures from all of the identified subcontractors indicating that they have been informed and understand their roles and responsibilities in complying with the SWP3. Ohio EPA recommends that the primary site operator review the SWP3 with the primary contractor prior to commencement of construction activities and keep a SWP3 training log to demonstrate that this review has occurred.

   Ohio EPA recommends that the erosion, sediment, and storm water management practices used to satisfy the conditions of this permit should meet the standards and specifications in the most current edition of Ohio's Rainwater and Land Development (see definitions) manual or other standards acceptable to Ohio EPA. The controls shall include the following minimum components:

   a. Preservation Methods. The SWP3 shall make use of practices which preserve the existing natural condition as much as feasible. Such practices may include: preserving existing vegetation, vegetative buffer strips, and existing soil profile and topsoil; phasing of construction operations to minimize the amount of disturbed land at any one time; and designation of tree preservation areas or other protective clearing or grubbing practices. For all construction activities immediately adjacent to surface waters of the state, the permittee shall comply with the buffer non-numeric effluent limitation in Part II.A.6, as measured from the ordinary high water mark of the surface water.

   b. Erosion Control Practices. The SWP3 shall make use of erosion controls that provide cover over disturbed soils unless an exception is approved in accordance with Part III.G.4. A description of control practices designed to re-establish vegetation or suitable cover on disturbed areas after grading shall be included in the SWP3. The SWP3 shall provide specifications for stabilization of all disturbed areas of the site and provide guidance as to which method of stabilization will be employed for any time of the year. Such practices may include: temporary seeding, permanent seeding, mulching, matting, sod stabilization, vegetative buffer strips, phasing of construction operations, use of construction entrances and the use of alternative ground cover.

      i. **Stabilization.** Disturbed areas shall be stabilized in accordance with Table 1 (Permanent Stabilization) and Table 2 (Temporary Stabilization) in Part II.B of this permit.

      ii. **Permanent stabilization of conveyance channels**. Operators shall undertake special measures to stabilize channels and outfalls and prevent erosive flows. Measures may include seeding, dormant seeding (as defined in the most current edition of the Rainwater and Land

Development manual), mulching, erosion control matting, sodding, riprap, natural channel design with bioengineering techniques or rock check dams.

c. Runoff Control Practices. The SWP3 shall incorporate measures which control the flow of runoff from disturbed areas so as to prevent erosion from occurring. Such practices may include rock check dams, pipe slope drains, diversions to direct flow away from exposed soils and protective grading practices. These practices shall divert runoff away from disturbed areas and steep slopes where practicable. Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel to provide non-erosive flow velocity from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

d. Sediment Control Practices. The plan shall include a description of structural practices that shall store runoff allowing sediments to settle and/or divert flows away from exposed soils or otherwise limit runoff from exposed areas. Structural practices shall be used to control erosion and trap sediment from a site remaining disturbed for more than 14 days. Such practices may include, among others: sediment settling ponds, sediment barriers, earth diversion dikes or channels which direct runoff to a sediment settling pond and storm drain inlet protection. All sediment control practices must be capable of ponding runoff in order to be considered functional. Earth diversion dikes or channels alone are not considered a sediment control practice unless those are used in conjunction with a sediment settling pond.

The SWP3 shall contain detail drawings for all structural practices.

i. **Timing.** Sediment control structures shall be functional throughout the course of earth disturbing activity. Sediment basins and perimeter sediment barriers shall be implemented prior to grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is stabilized with permanent cover. As construction progresses and the topography is altered, appropriate controls shall be constructed, or existing controls altered to address the changing drainage patterns.

ii. **Sediment settling ponds.** A sediment settling pond is required for any one of the following conditions:

- Concentrated or collected storm water runoff (e.g., storm sewer or ditch);
- Runoff from drainage areas, which exceed the design capacity of silt fence or other sediment barriers; or
- Runoff from drainage areas that exceed the design capacity of inlet protection.

The permittee may request approval from Ohio EPA to use alternative controls if the permittee can demonstrate the alternative controls are equivalent in effectiveness to a sediment settling pond.

In accordance with Part II.F, if feasible, sediment settling ponds shall be dewatered at the pond surface using a skimmer or equivalent device. The sediment settling pond volume consists of both a dewatering zone and a sediment storage zone. The volume of the dewatering zone shall be a minimum of 1800 cubic feet (ft^3) per acre of drainage (67 yd^3/acre) with a minimum 48-hour drain time. The volume of the sediment storage zone shall be calculated by one of the following methods:

Method 1: The volume of the sediment storage zone shall be 1000 ft^3 per disturbed acre within the watershed of the basin. OR

Method 2: The volume of the sediment storage zone shall be the volume necessary to store the sediment as calculated with RUSLE or a similar generally accepted erosion prediction model.

Accumulated sediment shall be removed from the sediment storage zone once it exceeds 50 percent of the minimum required sediment storage design capacity and prior to the conversion to the post-construction practice unless suitable storage is demonstrated based upon over-design. When determining the total contributing drainage area, off-site areas and areas which remain undisturbed by construction activity shall be included unless runoff from these areas is diverted away from the sediment settling pond and is not co-mingled with sediment-laden runoff. The depth of the dewatering zone shall be less than or equal to five feet. The configuration between inlets and the outlet of the basin shall provide at least two units of length for each one unit of width (≥ 2:1 length:width ratio); however, a length to width ratio of 4:1 is recommended. When designing sediment settling ponds, the permittee shall consider public safety, especially as it relates to children, as a design factor for the sediment basin and alternative sediment controls shall be used where site limitations would preclude a safe design. Combining multiple sediment and erosion control measures in order to maximize pollutant removal is encouraged.

iii. **Sediment Barriers and Diversions.** Sheet flow runoff from denuded areas shall be intercepted by sediment barriers or diversions to protect adjacent properties and water resources from sediment transported via sheet flow. Where intended to provide sediment control, silt fence shall be placed on a level contour downslope of the disturbed area. For most applications, standard silt fence may be substituted with a 12-inch diameter sediment barrier. The relationship between the maximum drainage area to sediment barrier for a particular slope range is shown in the following table:

Table 3 Sediment Barrier Maximum Drainage Area Based on Slope

Maximum drainage area (in acres) to 100 linear feet of sediment barrier	Range of slope for a particular drainage area (in percent)
0.5	< 2%
0.25	≥ 2% but < 20%
0.125	≥ 20% but < 50%

Placing sediment barriers in a parallel series does not extend the size of the drainage area. Storm water diversion practices shall be used to keep runoff away from disturbed areas and steep slopes where practicable. Diversion practices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres.

iv. **Inlet Protection.** Other erosion and sediment control practices shall minimize sediment laden water entering active storm drain systems. All inlets receiving runoff from drainage areas of one or more acres will require a sediment settling pond.

v. **Surface Waters of the State Protection.** If construction activities disturb areas adjacent to surface waters of the state, structural practices shall be designed and implemented on site to protect all adjacent surface waters of the state from the impacts of sediment runoff. No structural sediment controls (e.g., the installation of silt fence or a sediment settling pond) shall be used in a surface water of the state. For all construction activities immediately adjacent to surface waters of the state, the permittee shall comply with the buffer non-numeric effluent limitation in Part II.A.6, as measured from the ordinary high water mark of the surface water. Where impacts within this buffer area are unavoidable, due to the nature of the construction (e.g., stream crossings for roads or utilities), the project shall be designed such that the number of stream crossings and the width of the disturbance within the buffer area are minimized.

vi. **Modifying Controls**. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the permittee shall replace or modify the control for site conditions.

e. Post-Construction Storm Water Management Requirements. So that receiving stream's physical, chemical and biological characteristics are protected, and stream functions are maintained, post-construction storm water practices shall provide long-term management of runoff quality and quantity. To meet the post-construction requirements of this permit, the SWP3 shall contain a description of the post-construction BMPs that will be installed during construction for the site and the rationale for their selection. The rationale shall address the anticipated impacts on the channel and floodplain morphology, hydrology, and water quality. Post-construction BMPs cannot be installed within a surface water of the state (e.g., wetland or stream) unless it is authorized by a CWA 401 water quality certification, CWA 404 permit, or Ohio EPA non-jurisdictional wetland/stream program approval. Note: local jurisdictions may have more stringent post-construction requirements.

Detail drawings and maintenance plans shall be provided for all post-construction BMPs in the SWP3. Maintenance plans shall be provided by the permittee to the post-construction operator of the site (including homeowner associations) upon completion of construction activities (prior to termination of permit coverage). Maintenance plans shall ensure that pollutants collected within structural post-construction practices are disposed of in accordance with local, state, and federal regulations. To ensure that storm water management systems function as

designed and constructed, the post-construction operation and maintenance plan shall be a stand-alone document which contains: (1) a designated entity for storm water inspection and maintenance responsibilities; (2) the routine and non-routine maintenance tasks to be undertaken; (3) a schedule for inspection and maintenance; (4) any necessary legally binding maintenance easements and agreements; (5) construction drawings or excerpts showing the plan view, profile and details of the outlet(s); (6) a map showing all access and maintenance easements; and (7) for table 4a/4b practices, provide relevant elevations and associated volumes that dictate when removal of accumulated sediments must occur. Permittees are responsible for assuring all post-construction practices meet plan specifications and intended post-construction conditions have been met (e.g., sediment removed from, and sediment storage restored to, permanent pools, sediment control outlets removed and replaced with permanent post-construction discharge structures, and all slopes and drainageways permanently stabilized), but are not responsible under this permit for operation and maintenance of post-construction practices once coverage under this permit is terminated.

Post-construction storm water BMPs that discharge pollutants from point sources once construction is completed may in themselves need authorization under a separate NPDES permit (one example is storm water discharges from regulated industrial sites).

Construction activities that do not include the installation of any impervious surface (e.g., park lands), abandoned mine land reclamation activities regulated by the Ohio Department of Natural Resources, stream and wetland restoration activities, and wetland mitigation activities are not required to comply with the conditions of Part III.G.2.e of this permit. Linear construction projects (e.g., pipeline or utility line installation) which do not result in the installation of additional impervious surface are not required to comply with the conditions of Part III.G.2.e of this permit. However, linear construction projects shall be designed to minimize the number of stream crossings and the width of disturbance, and to achieve final stabilization of the disturbed area as defined in Part VII.M.1.

For all construction activities that will disturb two or more acres of land or will disturb less than two acres that are part of a larger common plan of development or sale which will disturb two or more acres of land, the post construction BMP(s) chosen shall be able to manage storm water runoff for protection of stream channels, stream stability, and water quality. The BMP(s) chosen must be compatible with site and soil conditions. Structural post-construction storm water treatment practices shall be incorporated into the permanent drainage system for the site. The BMP(s) chosen must be sized to treat the water quality volume (WQ_v) and ensure compliance with Ohio's Water Quality Standards in OAC Chapter 3745-1. The WQ_v shall be equivalent to the volume of runoff from a 0.90-inch rainfall and shall be determined using the following equations:

$$WQ_v = Rv * P * A / 12 \quad \text{(Equation 1)}$$

where:
WQ_v = water quality volume in acre-feet
Rv = the volumetric runoff coefficient calculated using equation 2
P = 0.90 inch precipitation depth
A = area draining into the BMP in acres

$$Rv = 0.05 + 0.9i \quad \text{(Equation 2)}$$

where i = fraction of post-construction impervious surface

An additional volume equal to 20 percent of the WQ_v shall be incorporated into the BMP for sediment storage. Ohio EPA recommends BMPs be designed according to the methodology described in the most current edition of the Rainwater and Land Development manual or in another design manual acceptable for use by Ohio EPA.

The BMPs listed in Tables 4a and 4b below are considered standard BMPs approved for general use. However, communities with a regulated MS4 may limit the use of some of these BMPs. BMPs shall be designed such that the drain time is long enough to provide treatment but short enough to provide storage for successive rainfall events and avoid the creation of nuisance conditions. The outlet structure for the post-construction BMP shall not discharge more than the first half of the WQv in less than one-third of the drain time. The WQv is the volume of storm water runoff that must be detained by a post-construction practice as specified by the most recent edition of the Rainwater and Land Development manual.

Post-construction practices shall be sized to treat 100% of the WQv associated with their contributing drainage area. If there is an existing post-construction BMP that treats runoff from the disturbed area and the BMP meets the post-construction requirements of this permit, no additional post-construction BMP will be required. A regional storm water BMP may be used to meet the post-construction requirement if: (1) the BMP meets the design requirements for treating the WQv; and (2) a legal agreement is established through which the regional BMP owner or operator agrees to provide this service in the long term. Design information for such facilities such as contributing drainage areas, capacities, elevations, outlet details and drain times shall be included in the SWP3.

Table 4a Extended Detention Post-Construction Practices with Minimum Drain Times

Extended Detention Practices	Minimum Drain Time of WQv
Wet Extended Detention Basin[1,2]	24 hours
Constructed Extended Detention Wetland[1,2]	24 hours
Dry Extended Detention Basin[1,3]	48 hours
Permeable Pavement – Extended Detention[1]	24 hours
Underground Storage – Extended Detention[1,4]	24 hours
Sand & Other Media Filtration - Extended Detention[1, 5]	24 hours

Notes:

1. The outlet structure shall not discharge more than the first half of the WQv in less than one-third of the drain time.
2. Provide a permanent pool with a minimum volume equal to the WQv and an extended detention volume above the permanent pool equal to 1.0 x WQv.
3. Dry basins must include a forebay and a micropool each sized at a minimum of 0.1 x WQv and a protected outlet, or include acceptable pretreatment and a protected outlet.
4. Underground storage must have pretreatment for removal of suspended sediments included in the design and documented in the SWP3. This pretreatment shall concentrate sediment in a location where it can be readily removed. For non-infiltrating, underground extended detention systems, pretreatment shall be 50% effective at capturing total suspended solids according to the testing protocol established in the Alternative Post-Construction BMP Testing Protocol.
5. The WQv ponding area shall completely empty between 24 and 72 hours.

Table 4b Infiltration Post-Construction Practices with Maximum Drain Times

Infiltration Practices	Maximum Drain Time of WQv
Bioretention Area/Cell[1,2]	24 hours
Infiltration Basin[2]	24 hours
Infiltration Trench[3]	48 hours
Permeable Pavement – Infiltration[3]	48 hours
Underground Storage – Infiltration[3,4]	48 hours

Notes:
1. Bioretention soil media shall have a permeability of approximately 1 – 4 in/hr. Meeting the soil media specifications in the Rainwater and Land Development manual is considered compliant with this requirement. Bioretention cells must have underdrains unless in-situ conditions allow for the WQv (surface ponding) plus the bioretention soil (to a depth of 24 inches) to drain completely within 48 hours.
2. Infiltrating practices with the WQv stored aboveground (bioretention, infiltration basin) shall fully drain the WQv within 24 hours to minimize nuisance effects of standing water and to promote vigorous communities of appropriate vegetation.
3. Subsurface practices designed to fully infiltrate the WQv (infiltration trench, permeable pavement with infiltration, underground storage with infiltration) shall empty within 48 hours to recover storage for subsequent storm events.
4. Underground storage systems with infiltration must have adequate pretreatment of suspended sediments included in the design and documented in the SWP3 in order to minimize clogging of the infiltrating surface. Pretreatment shall concentrate sediment in a location where it can be readily removed. Examples include media filters situated upstream of the storage or other suitable alternative approved by Ohio EPA. For infiltrating underground systems, pretreatment shall be 80% effective at capturing total suspended solids according to the testing protocol established in the Alternative Post-Construction BMP Testing Protocol.

Small Construction Activities. For all construction activities authorized under this permit which result in a disturbance less than 2 acres, a post-construction practice shall be used to treat storm water runoff for pollutants and to reduce adverse impacts on receiving waters. The applicant must provide a justification in the SWP3 why the use of table 4a and 4b practices are not feasible. The justification must address limiting factors which would prohibit the project going forward should table 4a and 4b practices be required. Please note that additional practices selected will require approval from the regulated MS4. The use of green infrastructure BMPs such as runoff reducing practices is also encouraged.

Transportation Projects. The construction of new roads and roadway improvement projects by public entities (i.e., the state, counties, townships, cities, or villages) may implement post-construction BMPs in compliance with the current version (as of the effective date of this permit) of the Ohio Department of Transportation's "Location and Design Manual, Volume Two Drainage Design" that has been accepted by Ohio EPA as an alternative to the conditions of this permit.

Offsite Mitigation of Post-Construction. Ohio EPA may authorize the offsite mitigation of the post-construction requirements of Part III.G.2.e of this permit on a case by case basis provided the permittee clearly demonstrates the BMPs listed in Tables 4a and 4b are not feasible and the following criteria are met: (1) a maintenance agreement or policy is established to ensure operations and treatment long-term; (2) the offsite location discharges to the same HUC-12 watershed unit; and (3) the mitigation ratio of the WQv is 1.5 to 1 or the WQv at the point of retrofit, whichever is greater. Requests for offsite mitigation must be received prior to receipt of the NOI application.

Previously Developed Areas - Ohio EPA encourages the redevelopment of previously graded, paved or built upon sites through a reduction of the WQv treatment requirement. For a previously developed area, one or a combination of the following two conditions shall be met:

- A 20 percent net reduction of the site's volumetric runoff coefficient through impervious area reduction with soil restoration or replacing impervious roof area with green roof area (for these purposes green roofs shall be considered pervious surface) or
- Treatment of 20 percent of the WQv for the previously developed area using a practice meeting Table 4a/4b criteria.

Where there is a combination of redeveloped areas and new development, a weighted approached shall be used with the following equation:

$$WQv = P * A * [(Rv_1*0.2) + (Rv_2 - Rv_1)] / 12 \qquad \text{(Equation 3)}$$

where

P = 0.90 inches
A = area draining into the BMP in acres
Rv_1 = volumetric runoff coefficient for existing conditions (current site impervious area)
Rv_2 = volumetric runoff coefficient for proposed conditions (post-construction site impervious area)

Post-construction practices shall be located to treat impervious areas most likely to generate the highest pollutant load, such as parking lots or roadways, rather than areas predicted to be cleaner such as rooftops.

Runoff Reduction Practices. The size of structural post-construction practices used to capture and treat the WQv can be reduced by incorporating runoff

reducing practices into the design of the site's drainage system. The approach to calculate and document runoff reduction is detailed in the Rainwater and Land Development Manual. BMP-specific runoff reduction volumes are set by specifications in the Rainwater and Land Development Manual for the following practices:

- Impervious surface disconnection
- Rainwater harvesting
- Bioretention
- Infiltration basin
- Infiltration trench
- Permeable pavement with infiltration
- Underground storage with infiltration
- Grass swale
- Sheet flow to filter strip
- Sheet flow to conservation area

A runoff reduction approach may be used to meet the groundwater recharge requirements in the Big Darby Creek Watershed. The runoff reduction practices used for groundwater recharge may be used to reduce the WQv requirement, see appendix A for details on groundwater recharge requirements.

In order to promote the implementation of green infrastructure, the Director may consider the use of runoff reducing practices to demonstrate compliance with Part III.G.2.e of this permit for areas of the site not draining into a common drainage system of the site, e.g., sheet flow from perimeter areas such as the rear yards of residential lots, low density development scenarios, or where the permittee can demonstrate that the intent of pollutant removal and stream protection, as required in Part III.G.2.e of this permit is being addressed through non-structural post-construction BMPs based upon review and approval by Ohio EPA.

Use of Alternative Post-Construction BMPs. This permit does not preclude the use of innovative or experimental post-construction storm water management technologies. Alternative post-construction BMPs shall previously have been tested to confirm storm water treatment efficacy equivalent to those BMPs listed in Tables 4a and 4b using the protocol described in this section. BMP testing may include laboratory testing, field testing, or both.

Permittees shall request approval from Ohio EPA to use alternative post-construction BMPs on a case-by-case basis. To use an alternative post-construction BMP, the permittee must demonstrate that use of a BMP listed in Tables 4a and 4b is not feasible and the proposed alternative post-construction BMP meets the minimum treatment criteria as described in this section. The permittee shall submit an application to Ohio EPA for any proposed alternative post-construction BMP. Where the development project is located within a regulated municipal separate storm sewer system (MS4) community, the use of an alternative practice requires pre-approval by the MS4 before submittal of the

Ohio EPA permit application. Ohio EPA requires that approvals for alternative post-construction BMPs are finalized before permittees submit an NOI for permit coverage.

In addition to meeting sediment removal criteria, the discharge rate from the proposed alternative practice shall be reduced to prevent stream bed erosion and protect the physical and biological stream integrity unless there will be negligible hydrological impact to the receiving surface water of the state. Discharge rate is considered to have a negligible impact if the permittee can demonstrate that one of the following three conditions exist:

i. The entire WQv is recharged to groundwater;
ii. The larger common plan of development or sale will create less than one acre of impervious surface;
iii. The storm water drainage system of the development discharges directly into a large river with drainage area equal to 100 square miles or larger upstream of the development site or to a lake where the development area is less than 5 percent of the watershed area, unless a TMDL has identified water quality problems into the receiving surface waters of the state.

If the conditions above that minimize the potential for hydrological impact to the receiving surface water of the state do not exist, then the alternative post-construction BMP must prevent stream erosion by reducing the flow rate from the WQ_V. In such cases, discharge of the WQ_V must be controlled. A second storm water BMP that provides extended detention of the WQv may be needed to meet the post-construction criteria.

Alternative Post-Construction BMP Testing Protocol. For laboratory testing, the alternative BMP shall be tested using sediment with a specific gravity of 2.65, a particle size distribution closely matching the distribution shown in Table 5, and total suspended sediment (TSS) concentrations within 10% of 200 mg/L (180 mg/L – 220 mg/L TSS). For an alternative BMP to be acceptable, the test results must demonstrate that the minimum treatment rate is 80% TSS removal at the design flow rate for the tested BMP.

Table 5 Particle Size Distribution for Testing Alternative Post-Construction BMPs

Particle Size (microns)	Percent Finer (%)
1,000	100
500	95
250	90
150	75
100	60
75	50
50	45
20	35
8	20
5	10
2	5

- For field testing, the alternative BMP shall be tested using storm water runoff

from the field, not altered by adding aggregate or subjecting to unusually high sediment loads such as those from unstabilized construction disturbance. The storm water runoff used for field testing shall be representative of runoff from the proposed installation site for the alternative BMP after all construction activities have ceased and the ground has been stabilized. The influent and effluent TSS concentrations of storm water runoff must be collected in the field. For an alternative BMP to be acceptable, the test results must demonstrate the minimum treatment rate is 80% TSS removal for influent concentrations equal to or greater than 100 mg/L TSS. If the influent concentration to the proposed alternative BMP is less than 100 mg/L TSS in the field, then the BMP must achieve an average effluent concentration less than or equal to 20 mg/L TSS.

- Testing of alternative post-construction BMPs shall be performed or overseen by a qualified independent, third-party testing organization;

- Testing shall demonstrate the maximum flow rate at which the alternative post-construction BMP can achieve the necessary treatment efficacy, including consideration for the potential of sediment resuspension;

- Testing shall demonstrate the maximum volume of sediment and floatables that can be collected in the alternative post-construction BMP before pollutants must be removed to maintain 80% treatment efficacy;

- Testing shall indicate the recommended maintenance frequency and maintenance protocol to ensure ongoing performance of the alternative post-construction BMP.

The alternative post-construction BMP testing protocol described in this section is similar to testing requirements specified by the New Jersey Department of Environmental Protection (NJDEP) for storm water Manufactured Treatment Devices (MTD) and therefore testing results certified by NJDEP shall be accepted by Ohio EPA. For examples of BMPs that have been tested using New Jersey Department of Environmental Protection's procedures, see the website: www.njstormwater.org.

Another nationally recognized storm water product testing procedure is the Technology Assessment Protocol – Ecology (TAPE) administered by the State of Washington, Department of Ecology. The TAPE testing procedure describes testing to achieve 80% TSS removal using a sediment mix with a particle size distribution with approximately 75% of the mass of the aggregate with particle diameters less than 45 microns. Overall, this particle size distribution is finer than the distribution in Table 5. Therefore, if TAPE testing results are available for a proposed alternative post-construction BMP, those results shall be accepted by Ohio EPA. The State of Washington, Department of Ecology website is https://ecology.wa.gov/.

Alternative BMPs that utilize treatment processes such as filtering or centrifugal separation, rather than a detention and settling volume, must be designed to ensure treatment of 90 percent of the average annual runoff

volume. For the design of these BMPs, the water quality flow rate (WQF) considered equivalent to the Water Quality Volume (WQv) shall be determined utilizing the Rational Method (Equation 4) with an intensity (i) appropriate for the water quality precipitation event. This intensity shall be calculated using the table given in Appendix C.

$$WQF = C * i * A \qquad \text{(Equation 4)}$$

Where

WQF = water quality flow rate in cubic feet per second (cfs)
C = rational method runoff coefficient
i = intensity (in/hr)
A = area draining to the BMP (acres)

Alternative post-construction BMPs may include, but are not limited to: vegetated swales, vegetated filter strips, hydrodynamic separators, high-flow media filters, cartridge filters, membrane filters, subsurface flow wetlands, multi-chamber treatment trains, road shoulder media filter drains, wetland channels, rain barrels, green roofs, and rain gardens. The Director may also consider non-structural post-construction approaches.

f. Surface Water Protection. If the project site contains any streams, rivers, lakes, wetlands or other surface waters, certain construction activities at the site may be regulated under the CWA and/or state isolated wetland permit requirements. Sections 404 and 401 of the Act regulate the discharge of dredged or fill material into surface waters and the impacts of such activities on water quality, respectively. Construction activities in surface waters which may be subject to CWA regulation and/or state isolated wetland permit requirements include, but are not limited to: sewer line crossings, grading, backfilling or culverting streams, filling wetlands, road and utility line construction, bridge installation and installation of flow control structures. If the project contains streams, rivers, lakes or wetlands or possible wetlands, the permittee shall contact the appropriate U.S. Army Corps of Engineers District Office. (CAUTION: Any area of seasonally wet hydric soil is a potential wetland - please consult the Soil Survey and list of hydric soils for your County, available at your county's Soil and Water Conservation District. If you have any questions about Section 401 water quality certification, please contact the Ohio Environmental Protection Agency, Section 401 Coordinator.)

U.S. Army Corps of Engineers (Section 404 regulation):

- Huntington, WV District (304) 399-5210 (Muskingum River, Hocking River, Scioto River, Little Miami River, and Great Miami River Basins)
- Buffalo, NY District (716) 879-4330 (Lake Erie Basin)
- Pittsburgh, PA District (412) 395-7155 (Mahoning River Basin)
- Louisville, KY District (502) 315-6686 (Ohio River)

Ohio EPA 401/404 and non-jurisdictional stream/wetland coordinator can be contacted at (614) 644-2001 (all of Ohio)

Concentrated storm water runoff from BMPs to natural wetlands shall be converted to diffuse flow before the runoff enters the wetlands. The flow should be released such that no erosion occurs downslope. Level spreaders may need to be placed in series, particularly on steep sloped sites, to ensure non-erosive velocities. Other structural BMPs may be used between storm water features and natural wetlands, in order to protect the natural hydrology, hydroperiod, and wetland flora. If the applicant proposes to discharge to natural wetlands, a hydrologic analysis shall be performed. The applicant shall attempt to match the pre-development hydroperiods and hydrodynamics that support the wetland. The applicant shall assess whether their construction activity will adversely impact the hydrologic flora and fauna of the wetland. Practices such as vegetative buffers, infiltration basins, conservation of forest cover, and the preservation of intermittent streams, depressions, and drainage corridors may be used to maintain wetland hydrology.

g. Other controls.

i. **Non-Sediment Pollutant Controls.** In accordance with Part II.E, no solid (other than sediment) or liquid waste, including building materials, shall be discharged in storm water runoff. The permittee must implement all necessary BMPs to prevent the discharge of non-sediment pollutants to the drainage system of the site or surface waters of the state or an MS4. Under no circumstance shall wastewater from the washout of concrete trucks, stucco, paint, form release oils, curing compounds, and other construction materials be discharged directly into a drainage channel, storm sewer or surface waters of the state. Also, no pollutants from vehicle fuel, oils, or other vehicle fluids can be discharged to surface waters of the state. No exposure of storm water to waste materials is recommended. The SWP3 must include methods to minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, and sanitary waste to precipitation, storm water runoff, and snow melt. In accordance with Part II.D.3, the SWP3 shall include measures to prevent and respond to chemical spills and leaks. You may also reference the existence of other plans (i.e., Spill Prevention Control and Countermeasure (SPCC) plans, spill control programs, Safety Response Plans, etc.) provided that such plan addresses conditions of this permit condition and a copy of such plan is maintained on site.

ii. **Off-site traffic.** Off-site vehicle tracking of sediments and dust generation shall be minimized. In accordance with Part II.D.1, the SWP3 shall include methods to minimize the discharge of pollutants from equipment and vehicle washing, wheel washwater, and other washwaters. No detergents may be used to wash vehicles. Washwaters shall be treated in a sediment basin or alternative control that provides equivalent treatment prior to discharge.

iii. **Compliance with other requirements.** The SWP3 shall be consistent with applicable State and/or local waste disposal, sanitary sewer or septic system regulations, including provisions prohibiting waste disposal by

open burning and shall provide for the proper disposal of contaminated soils to the extent these are located within the permitted area.

iv. **Trench and ground water control**. In accordance with Part II.C, there shall be no turbid discharges to surface waters of the state resulting from dewatering activities. If trench or ground water contains sediment, it shall pass through a sediment settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by dewatering into a sump pit, filter bag or comparable practice. Ground water which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

v. **Contaminated Sediment.** Where construction activities are to occur on sites with contamination from previous activities, operators shall be aware that concentrations of materials that meet other criteria (is not considered a Hazardous Waste, meeting VAP standards, etc.) may still result in storm water discharges in excess of Ohio Water Quality Standards. Such discharges are not authorized by this permit. Appropriate BMPs include, but are not limited to:

- The use of berms, trenches, and pits to collect contaminated runoff and prevent discharges;
- Pumping runoff into a sanitary sewer (with prior approval of the sanitary sewer operator) or into a container for transport to an appropriate treatment/disposal facility; and
- Covering areas of contamination with tarps or other methods that prevent storm water from coming into contact with the material.

Operators should consult with Ohio EPA Division of Surface Water prior to seeking permit coverage.

h. Maintenance. All temporary and permanent control practices shall be maintained and repaired as needed to ensure continued performance of their intended function. All sediment control practices must be maintained in a functional condition until all up-slope areas they control are permanently stabilized. The SWP3 shall be designed to minimize maintenance requirements. The applicant shall provide a description of maintenance procedures needed to ensure the continued performance of control practices.

i. Inspections. The permittee shall assign “qualified inspection personnel” to conduct inspections to ensure that the control practices are functional and to evaluate whether the SWP3 is adequate and properly implemented in accordance with the schedule proposed in Part III.G.1.h of this permit or whether additional control measures are required. At a minimum, procedures in a SWP3 shall provide that all controls on the site are inspected:

- after any storm event greater than one-half inch of rain per 24-hour period by the end of the next calendar day, excluding weekends and holidays unless work is scheduled; and
- once every seven calendar days.

The inspection frequency may be reduced to at least once every month for dormant sites if:

- the entire site is temporarily stabilized or
- runoff is unlikely due to weather conditions for extended periods of time (e.g., site is covered with snow, ice, or the ground is frozen).

The beginning and ending dates of any reduced inspection frequency shall be documented in the SWP3.
Once a definable area has achieved final stabilization, the area may be marked on the SWP3 and no further inspection requirements shall apply to that portion of the site.

Following each inspection, a checklist must be completed and signed by the qualified inspection personnel representative. At a minimum, the inspection report shall include:

i. the inspection date;
ii. names, titles, and qualifications of personnel making the inspection;
iii. weather information for the period since the last inspection (or since commencement of construction activity if the first inspection) including a best estimate of the beginning of each storm event, duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any discharges occurred;
iv. weather information and a description of any discharges occurring at the time of the inspection;
v. location(s) of discharges of sediment or other pollutants from the site;
vi. location(s) of BMPs that need to be maintained;
vii. location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
viii. location(s) where additional BMPs are needed that did not exist at the time of inspection; and
ix. corrective action required including any changes to the SWP3 necessary and implementation dates.

Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of or the potential for pollutants entering the drainage system. Erosion and sediment control measures identified in the SWP3 shall be observed to ensure that those are operating correctly. Discharge locations shall be inspected to ascertain whether erosion and sediment control measures are effective in preventing significant impacts to the receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site vehicle tracking.

The permittee shall maintain for three years following the submittal of a notice of termination form, a record summarizing the results of the inspection, names(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWP3 and a certification as to whether the facility is in compliance with the SWP3 and the permit and identify any incidents of non-compliance. The record and certification shall be signed in accordance with Part V.G. of this permit.

i. **When practices require repair or maintenance.** If the inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment settling pond, it shall be repaired or maintained within 3 days of the inspection. Sediment settling ponds shall be repaired or maintained within 10 days of the inspection.

ii. **When practices fail to provide their intended function.** If the inspection reveals that a control practice fails to perform its intended function and that another, more appropriate control practice is required, the SWP3 shall be amended and the new control practice shall be installed within 10 days of the inspection.

iii. **When practices depicted on the SWP3 are not installed.** If the inspection reveals that a control practice has not been implemented in accordance with the schedule contained in Part III.G.1.h of this permit, the control practice shall be implemented within 10 days from the date of the inspection. If the inspection reveals that the planned control practice is not needed, the record shall contain a statement of explanation as to why the control practice is not needed.

3. Approved State or local plans. All dischargers regulated under this general permit must comply, except those exempted under state law, with the lawful requirements of municipalities, counties and other local agencies regarding discharges of storm water from construction activities. All erosion and sediment control plans and storm water management plans approved by local officials shall be retained with the SWP3 prepared in accordance with this permit. Applicable requirements for erosion and sediment control and storm water management approved by local officials are, upon submittal of a NOI form, incorporated by reference and enforceable under this permit even if they are not specifically included in an SWP3 required under this permit. When the project is located within the jurisdiction of a regulated municipal separate storm sewer system (MS4), the permittee shall certify that the SWP3 complies with the requirements of the storm water management program of the MS4 operator.

4. Exceptions. If specific site conditions prohibit the implementation of any of the erosion and sediment control practices contained in this permit or site-specific conditions are such that implementation of any erosion and sediment control practices contained in this permit will result in no environmental benefit, then the permittee shall provide justification for rejecting each practice based on site conditions. Exceptions from implementing the erosion and sediment control standards contained in this permit will be approved or denied on a case-by-case basis.

The permittee may request approval from Ohio EPA to use alternative methods to satisfy conditions in this permit if the permittee can demonstrate that the alternative methods are sufficient to protect the overall integrity of receiving streams and the watershed. Alternative methods will be approved or denied on a case-by-case basis.

PART IV. NOTICE OF TERMINATION REQUIREMENTS

A. Failure to notify.

The terms and conditions of this permit shall remain in effect until a signed Notice of Termination (NOT) form is submitted. Failure to submit an NOT constitutes a violation of this permit and may affect the ability of the permittee to obtain general permit coverage in the future.

B. When to submit an NOT.

1. Permittees wishing to terminate coverage under this permit shall submit an NOT form in accordance with Part V.G. of this permit. Compliance with this permit is required until an NOT form is submitted. The permittee's authorization to discharge under this permit terminates at midnight of the day the NOT form is submitted. Prior to submitting the NOT form, the permittee shall conduct a site inspection in accordance with Part III.G.2.i of this permit and have a maintenance plan in place to ensure all post-construction BMPs will be maintained in perpetuity.

2. All permittees shall submit an NOT form within 45 days of completing all permit requirements. Enforcement actions may be taken if a permittee submits an NOT form without meeting one or more of the following conditions:

    a. Final stabilization (see definition in Part VII) has been achieved on all portions of the site for which the permittee is responsible (including, if applicable, returning agricultural land to its pre-construction agricultural use);

    b. Another operator(s) has assumed control over all areas of the site that have not been finally stabilized;

    c. A maintenance plan is in place to ensure all post construction BMPs are adequately maintained in the long-term;

    d. For non-residential developments, all elements of the storm water pollution prevention plan have been completed, the disturbed soil at the identified facility have been stabilized and temporary erosion and sediment control measures have been removed at the appropriate time, or all storm water discharges associated with construction activity from the identified facility that are authorized by the above referenced NPDES general permit have otherwise been eliminated. (i)For residential developments only, temporary stabilization has been completed and the lot, which includes a home, has been transferred to the homeowner; (ii) final stabilization has been completed and the lot, which does not include a home, has been transferred to the property owner; (iii) no stabilization has been implemented on a lot, which includes a home, and the lot has been transferred to the homeowner; or

e. An exception has been granted under Part III.G.4.

C. How to submit an NOT.

To terminate permit coverage, the permitee shall submit a complete and accurate Notice of Termination (NOT) form using Ohio EPA's electronic application form which is available through the Ohio EPA eBusiness Center at: https://ebiz.epa.ohio.gov/. Submission through the Ohio EPA eBusiness Center will require establishing an Ohio EPA eBusiness Center account and obtaining a unique Personal Identification Number (PIN) for final submission of the NOT. Existing eBusiness Center account holders can access the NOT form through their existing account and submit using their existing PIN. Please see the following link for guidance: **http://epa.ohio.gov/dsw/ebs.aspx#170669803-streams-guidance**. Alternatively, if you are unable to access the NOT form through the agency eBusiness Center due to a demonstrated hardship, the NOT may be submitted on paper NOT forms provided by Ohio EPA. NOT information shall be typed on the form. Please contact Ohio EPA, Division of Surface Water at (614) 644-2001 if you wish to receive a paper NOT form.

PART V. STANDARD PERMIT CONDITIONS.

A. Duty to comply.

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of ORC Chapter 6111 and is grounds for enforcement action.

Ohio law imposes penalties and fines for persons who knowingly make false statements or knowingly swear or affirm the truth of a false statement previously made.

B. Continuation of an expired general permit.

An expired general permit continues in force and effect until a new general permit is issued.

C. Need to halt or reduce activity not a defense.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to mitigate.

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Duty to provide information.

The permittee shall furnish to the director, within 10 days of written request, any information which the director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee

shall also furnish to the director upon request copies of records required to be kept by this permit.

F. Other information.

When the permittee becomes aware that he or she failed to submit any relevant facts or submitted incorrect information in the NOI, SWP3, NOT or in any other report to the director, he or she shall promptly submit such facts or information.

G. Signatory requirements.

All NOIs, NOTs, SWP3s, reports, certifications or information either submitted to the director or that this permit requires to be maintained by the permittee, shall be signed.

1. These items shall be signed as follows:

    a. For a corporation: By a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

        i. A president, secretary, treasurer or vice-president of the corporation in charge of a principal business function or any other person who performs similar policy or decision-making functions for the corporation; or

        ii. The manager of one or more manufacturing, production or operating facilities, provided, the manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

    b. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

    c. For a municipality, State, Federal or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes (1) the chief executive officer of the agency or (2) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of U.S. EPA).

2. All reports required by the permits and other information requested by the director shall be signed by a person described in Part V.G.1 of this permit or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Part V.G.1 of this permit and submitted to the director;

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of manager, operator of a well or well field, superintendent, position of equivalent responsibility or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

c. The written authorization is submitted to the director.

3. Changes to authorization. If an authorization under Part V.G.2 of this permit is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part V.G.2 of this permit must be submitted to the director prior to or together with any reports, information or applications to be signed by an authorized representative.

H. Certification.

Any person signing documents under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I. Oil and hazardous substance liability.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject under section 311 of the CWA or 40 CFR Part 112. 40 CFR Part 112 establishes procedures, methods and equipment and other requirements for equipment to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable surface waters of the state or adjoining shorelines.

J. Property rights.

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

K. Severability.

The provisions of this permit are severable and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

L. Transfers.

Ohio NPDES general permit coverage is transferable. Ohio EPA must be notified in writing sixty days prior to any proposed transfer of coverage under an Ohio NPDES general permit. The transferee must inform Ohio EPA it will assume the responsibilities of the original permittee transferor.

M. Environmental laws.

No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations.

N. Proper operation and maintenance.

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of SWP3s. Proper operation and maintenance requires the operation of backup or auxiliary facilities or similar systems, installed by a permittee only when necessary to achieve compliance with the conditions of the permit.

O. Inspection and entry.

The permittee shall allow the director or an authorized representative of Ohio EPA, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;

2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment); and

4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

P. Duty to Reapply.

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

Q. Permit Actions.

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

R. Bypass.

The provisions of 40 CFR Section 122.41(m), relating to "Bypass," are specifically incorporated herein by reference in their entirety. For definition of "Bypass," see Part VII.C.

S. Upset.

The provisions of 40 CFR Section 122.41(n), relating to "Upset," are specifically incorporated herein by reference in their entirety. For definition of "Upset," see Part VII.GG.

T. Monitoring and Records.

The provisions of 40 CFR Section 122.41(j), relating to "Monitoring and Records," are specifically incorporated herein by reference in their entirety.

U. Reporting Requirements.

The provisions of 40 CFR Section 122.41(l), relating to "Reporting Requirements," are specifically incorporated herein by reference in their entirety.

PART VI. REOPENER CLAUSE

If there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with construction activity covered by this permit, the permittee of such discharge may be required to obtain coverage under an individual permit or an alternative general permit in accordance with Part I.C of this permit or the permit may be modified to include different limitations and/or requirements.

Permit modification or revocation will be conducted according to ORC Chapter 6111.

PART VII. DEFINITIONS

A. "Act" means Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117 and Pub. L. 100-4, 33 U.S.C. 1251 et. seq.

B. "Bankfull channel" means a channel flowing at channel capacity and conveying the bankfull discharge. Delineated by the highest water level that has been maintained for a sufficient period of time to leave evidence on the landscape, such as the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial or

the point at which the clearly scoured substrate of the stream ends and terrestrial vegetation begins.

C. "Bankfull discharge" means the streamflow that fills the main channel and just begins to spill onto the floodplain; it is the discharge most effective at moving sediment and forming the channel.

D. "Best management practices (BMPs)" means schedules of activities, prohibitions of practices, maintenance procedures and other management practices (both structural and non-structural) to prevent or reduce the pollution of surface waters of the state. BMP's also include treatment requirements, operating procedures and practices to control plant and/or construction site runoff, spillage or leaks, sludge or waste disposal or drainage from raw material storage.

E. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

F. "Channelized stream" means the definition set forth in Section 6111.01 (M) of the ORC.

G. "Commencement of construction" means the initial disturbance of soils associated with clearing, grubbing, grading, placement of fill, or excavating activities or other construction activities.

H. "Concentrated storm water runoff" means any storm water runoff which flows through a drainage pipe, ditch, diversion or other discrete conveyance channel.

I. "Director" means the director of the Ohio Environmental Protection Agency.

J. "Discharge" means the addition of any pollutant to the surface waters of the state from a point source.

K. "Disturbance" means any clearing, grading, excavating, filling, or other alteration of land surface where natural or man-made cover is destroyed in a manner that exposes the underlying soils.

L. "Drainage watershed" means for purposes of this permit the total contributing drainage area to a BMP, i.e., the "watershed" directed to the practice. This would also include any off-site drainage.

M. "Final stabilization" means that either:

1. All soil disturbing activities at the site are complete and a uniform perennial vegetative cover (e.g., evenly distributed, without large bare areas) with a density of at least 70 percent cover for the area has been established on all unpaved areas and areas not covered by permanent structures or equivalent stabilization measures (such as the use of mulches, rip-rap, gabions or geotextiles) have been employed. In addition, all temporary erosion and sediment control practices are removed and disposed of and all trapped sediment is permanently stabilized to prevent further erosion; or

2. For individual lots in residential construction by either:

   a. The homebuilder completing final stabilization as specified above or

   b. The homebuilder establishing temporary stabilization including perimeter controls for an individual lot prior to occupation of the home by the homeowner and informing the homeowner of the need for and benefits of, final stabilization. (Homeowners typically have an incentive to put in the landscaping functionally equivalent to final stabilization as quick as possible to keep mud out of their homes and off sidewalks and driveways.); or

3. For construction projects on land used for agricultural purposes (e.g., pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its pre-construction agricultural use. Areas disturbed that were previously used for agricultural activities, such as buffer strips immediately adjacent to surface waters of the state and which are not being returned to their pre-construction agricultural use, must meet the final stabilization criteria in (1) or (2) above.

N. "General contractor" – for the purposes of this permit, the primary individual or company solely accountable to perform a contract. The general contractor typically supervises activities, coordinates the use of subcontractors, and is authorized to direct workers at a site to carry out activities required by the permit.

O. "Individual lot NOI" means a Notice of Intent for an individual lot to be covered by this permit (see Part I of this permit).

P. "Larger common plan of development or sale"- means a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan.

Q. "MS4" means municipal separate storm sewer system which means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) that are:

1. Owned or operated by the federal government, state, municipality, township, county, district(s) or other public body (created by or pursuant to state or federal law) including special district under state law such as a sewer district, flood control district or drainage districts or similar entity or a designated and approved management agency under section 208 of the act that discharges into surface waters of the state; and
2. Designed or used for collecting or conveying solely storm water,
3. Which is not a combined sewer and
4. Which is not a part of a publicly owned treatment works.

R. "National Pollutant Discharge Elimination System (NPDES)" means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits and enforcing pretreatment requirements, under sections 307, 402, 318 and 405 of the CWA. The term includes an "approved program."

S. "Natural channel design" means an engineering technique that uses knowledge of the natural process of a stream to create a stable stream that will maintain its form and function over time.

T. "NOI" means notice of intent to be covered by this permit.

U. "NOT" means notice of termination.

V. "Operator" means any party associated with a construction project that meets either of the following two criteria:

1. The party has day-to-day operational control of all activities at a project which are necessary to ensure compliance with a SWP3 for the site and all permit conditions including the ability to authorize modifications to the SWP3, construction plans and site specification to ensure compliance with the General Permit, or

2. Property owner meets the definition of operator should the party which has day to day operational control require additional authorization from the owner for modifications to the SWP3, construction plans, and/or site specification to ensure compliance with the permit or refuses to accept all responsibilities as listed above (Part VII.V.1).

Subcontractors generally are not considered operators for the purposes of this permit. As set forth in Part I.F.1, there can be more than one operator at a site and under these circumstances, the operators shall be co-permittees.

W. "Ordinary high water mark" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

X. "Owner or operator" means the owner or operator of any "facility or activity" subject to regulation under the NPDES program.

Y. "Permanent stabilization" means the establishment of permanent vegetation, decorative landscape mulching, matting, sod, rip rap and landscaping techniques to provide permanent erosion control on areas where construction operations are complete or where no further disturbance is expected for at least one year.

Z. "Percent imperviousness" means the impervious area created divided by the total area of the project site.

AA. "Point source" means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or the floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

BB. "Qualified inspection personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls, who possesses the skills to assess all conditions at the construction site that could impact storm water quality and to assess the effectiveness of any sediment and erosion control measures selected to control the quality of storm water discharges from the construction activity.

CC. "Rainwater and Land Development" is a manual describing construction and post-construction best management practices and associated specifications. A copy of the manual may be obtained by contacting the Ohio Department of Natural Resources, Division of Soil & Water Conservation.

DD. "Riparian area" means the transition area between flowing water and terrestrial (land) ecosystems composed of trees, shrubs and surrounding vegetation which serve to stabilize erodible soil, improve both surface and ground water quality, increase stream shading and enhance wildlife habitat.

EE. "Runoff coefficient" means the fraction of total rainfall that will appear at the conveyance as runoff.

FF. "Sediment settling pond" means a sediment trap, sediment basin or permanent basin that has been temporarily modified for sediment control, as described in the latest edition of the Rainwater and Land Development manual.

GG. "State isolated wetland permit requirements" means the requirements set forth in Sections 6111.02 through 6111.029 of the ORC.

HH. "Storm water" means storm water runoff, snow melt and surface runoff and drainage.

II. "Steep slopes" means slopes that are 15 percent or greater in grade. Where a local government or industry technical manual has defined what is to be considered a "steep slope," this permit's definition automatically adopts that definition.

JJ. "Stream edge" means the ordinary high water mark.

KK. "Subcontractor" – for the purposes of this permit, an individual or company that takes a portion of a contract from the general contractor or from another subcontractor.

LL. "Surface waters of the state" or "water bodies" means all streams, lakes, reservoirs, ponds, marshes, wetlands or other waterways which are situated wholly or partially within the boundaries of the state, except those private waters which do not combine or effect a junction with natural surface or underground waters. Waters defined as sewerage systems, treatment works or disposal systems in Section 6111.01 of the ORC are not included.

MM. "SWP3" means storm water pollution prevention plan.

NN. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment

facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

OO. "Temporary stabilization" means the establishment of temporary vegetation, mulching, geotextiles, sod, preservation of existing vegetation and other techniques capable of quickly establishing cover over disturbed areas to provide erosion control between construction operations.

PP. "Water Quality Volume (WQ_v)" means the volume of storm water runoff which must be captured and treated prior to discharge from the developed site after construction is complete.

Appendix A
Big Darby Creek Watershed

CONTENTS OF THIS APPENDIX

A.1 Permit Area.

This appendix to Permit OHC00005 applies to the entire Big Darby Creek Watershed located within the State of Ohio. Please see Attachment A for permit area boundaries.

A.2 TMDL Conditions.

This general permit requires control measures/BMPs for construction sites that reflect recommendations set forth in the U.S. EPA approved Big Darby Creek TMDL.

A.3 Sediment Settling Ponds and Sampling

Sediment settling ponds additional conditions. The sediment settling pond shall be sized to provide a minimum sediment storage volume of 134 cubic yards of effective sediment storage per acre of drainage and maintain a target discharge performance standard of 45 mg/l Total Suspended Solids (TSS) up to a 0.75-inch rainfall event within a 24-hour period. Unless infeasible, sediment settling ponds must be dewatered at the pond surface using a skimmer or equivalent device. The depth of the sediment settling pond must be less than or equal to five feet. Sediment must be removed from the sediment settling pond when the design capacity has been reduced by 40 percent (This is typically reached when sediment occupies one-half of the basin depth).

Silt Fence and Diversions. For sites five or more acres in size, the use of sediment barriers as a primary sediment control is prohibited. Centralized sediment basins shall be used for sites 5 or more acres in size. Diversions shall direct all storm water runoff from the disturbed areas to the impoundment intended for sediment control. The sediment basins and associated diversions shall be implemented prior to the major earth disturbing activity.

The permittee shall sample in accordance with sampling procedures outlined in 40 CFR 136. Sampling shall occur as follows:

i. Occur at the outfall of each sediment settling pond associated with the site. Each associated outfall shall be identified by a three-digit number (001, 002, etc.);

ii. The applicable rainfall event for sampling to occur shall be a rainfall event of 0.25-inch to a 0.75-inch rainfall event to occur within a 24-hour period. Grab sampling shall be initiated at a site within 14 days, or the first applicable rainfall event thereafter, once upslope disturbance of each sampling location is initiated and shall continue on a quarterly basis. Quarterly periods shall be represented as January - March, April - June, July - September and October - December. Sampling results shall be retained on site and available for inspection.

If any sample is greater than the performance standard of 45 mg/l TSS, the permittee shall modify the SWP3 and install/implement new control practice(s) within 10 days to ensure the TSS performance standard is maintained. Within 3 days of improvement(s), or the first applicable rainfall event thereafter, the permittee shall resample to ensure SWP3 modifications maintain the TSS performance standard target.

For each sample taken, the permittee shall record the following information:

- the outfall and date of sampling;
- the person(s) who performed the sampling;
- the date the analyses were performed on those samples;
- the person(s) who performed the analyses;
- the analytical techniques or methods used; and
- the results of all analyses.

Both quarterly and sampling results following a discharge target exceedance shall be retained on site and available for inspection.

A.4 Riparian Setback Requirements.

The SWP3 shall clearly delineate the boundary of required stream setback distances. No construction activity shall occur, without appropriate mitigation, within the delineated setback boundary except activities associated with restoration or recovery of natural floodplain and channel form characteristics as described in Attachment B, storm water conveyances from permanent treatment practices and approvable utility crossings. Such conveyances must be designed to minimize the width of disturbance. If intrusion within the delineated setback boundary is necessary to accomplish the purposes of a project, then mitigation shall be required in accordance with Appendix A.5 of this permit. Streams requiring protection under this section are defined as perennial, intermittent or ephemeral streams with a defined bed, bank or channel. National Resources Conservation Service (NRCS) soil survey maps should be used as one reference and the presence of a stream requiring protection should also be confirmed in the field. Any required setback distances shall be clearly displayed in the field prior to any construction related activity.

Riparian setbacks distance shall be delineated based upon one of the following two methods:

i. The setback distance shall be sized as the greater of the following:

1. The regulatory 100-year floodplain based on FEMA mapping;

2. A minimum of 100 feet from the top of the streambank on each side; or

3. A distance calculated using the following equation:

$$W = 133DA^{0.43} \qquad \text{(Equation 1, Appendix A)}$$

where:
DA = drainage area (mi^2)
W = total width of riparian setback (ft)

W shall be centered over the meander pattern of the stream such that a line representing the setback width would evenly intersect equal elevation lines on either side of the stream.

If the DA remains relatively constant throughout the stretch of interest, then the DA of the downstream edge of the stretch should be used. Where there is a significant increase in the DA from the upstream edge to The downstream edge of the area of interest, the setback width shall increase accordingly.

ii. **Stream Restoration with 100 feet (each side) Riparian Setback**. Each stream segment within the proposed site boundaries can be assessed in accordance with Attachment B, Part 1. In the event the stream segment is classified as a "Previously Modified Low Gradient Headwater Stream", the permittee has the option to restore the stream segment in accordance with Attachment B and include a 100-foot water quality setback distance from the top of the streambank on each side. In the event the stream segment exceeds the minimum criteria in Attachment B to be classified as a "Previously Modified Low Gradient Headwater Stream," this Appendix A, Attachment B may be considered on a case-by-case basis.

No structural sediment controls (e.g., the installation of sediment barriers or a sediment settling pond) or structural post-construction controls shall be used in a surface water of the State or the delineated setback corridor.

Previously developed projects (as defined in Part III.G.2.e.) located within the delineated setback boundary are exempt from Riparian Setback Mitigation (A.5) provided the proposed project does not further intrude into the delineated setback boundary.

Linear transportation projects which are caused solely by correcting safety related issues, mandates of modern design requirements and/or resulting from other mitigation activities are exempt from Riparian Setback Mitigation (Appendix A, A.5) if less than one acre of total new right-of-way is associated with the project.

A.5 Riparian Setback Mitigation.

The mitigation required for intrusion into the riparian setback shall be determined by the horizontal distance the intrusion is from the stream. Up to three zones will be used in determining the required mitigation. Zone 1 extends from 0 to 25 feet from the stream edge. Zone 2 extends from 25 to 100 feet from the stream edge, and Zone 3 extends from 100 feet to the outer edge of the setback corridor. Intrusion into these zones will require the following mitigation within the same Watershed Assessment Unit (12-digit HUC scale):

i. Four times the total area disturbed in the stream and within Zone 1 of the site being developed shall be mitigated within Zone 1 of the mitigation location.

ii. Three times the area disturbed within Zone 2 of the site being developed shall be mitigated within Zones 1 and/or 2 of the mitigation location.

iii. Two times the area disturbed within Zone 3 of the site being developed shall be mitigated within any zone of the mitigation location.

In lieu of mitigation ratios found within in this section, linear transportation projects which result in total new right-of-way greater than one acre and less than two acres, which are caused solely by correcting safety related issues, mandates of modern design requirements and/or resulting from other mitigation activities, shall provide Riparian Setback Mitigation at a ratio of 1.5 to 1.

All mitigation shall, at a minimum, include conserved or restored setback zone and should be designed to maximize the ecological function of the mitigation. Including mitigation at the stream edge along with associated setback areas is one way to maximize ecological function. Mitigation shall be protected in perpetuity by binding conservation easements or environmental covenants which must be recorded within 6 months of receiving permit authorization. Granting of binding conservation easements or environmental covenants protected in perpetuity for land outside of disturbed area but within a required riparian setback counts towards required mitigation.

Mitigation may also be satisfied by approved pooled mitigation areas and in-lieu fee sponsored mitigation areas. Mitigation resulting from State or Federal environmental regulations may be adjusted in recognition of these requirements.

A.6 Groundwater Recharge Requirements.

The SWP3 shall ensure that the overall site post-development groundwater recharge equals or exceeds the pre-development groundwater recharge. The SWP3 shall describe the conservation development strategies, BMPs and other practices deemed necessary by the permittee to maintain or improve pre-development rates of groundwater recharge. Pre-development and post-development groundwater recharge shall be calculated using the following equation:

i. $Vre_x = A_x * Dre_x / 12$ (Equation 2, Appendix A)

where:
X = represents a land use and hydrologic soil group pair
Vre_x = volume of total annual recharge from land use-soil group X (in acre-ft)
Dre_x = depth of total annual recharge associated with land use-soil group X from Tables 1 or 2 (in inches)
A_x = area of land use-soil group X (in acres)

Table A-1 values should be used for land where the underlying geology indicates a potential for downward migration of groundwater. Table A-1 values represent the combined total groundwater recharge potential including groundwater contribution to stream baseflow and to the underlying bedrock aquifer. The potential for downward migration can be determined from a comparison of the potentiometric maps for the glacial and bedrock aquifers. Use Table A-2 when this potential is unlikely to exist. Detailed potentiometric maps for the Franklin county portion of the Darby watershed, and coarse potentiometric maps for the Darby watershed outside of Franklin County and hydrologic soil group data are available at: http://www.epa.state.oh.us/dsw/permits/GP_ConstructionSiteStormWater_Darby.aspx.

Table A-1 (Appendix A) Annual Average Expected Total Groundwater Recharge[3]

Land Use	Density (DU[1]/acre)	% Impervious	Recharge (inches) by Hydrologic Soil Group2			
			A	B	C	D
Woods / Forest	-	-	17.0	16.6	15.6	14.6
Brush	-	-	17.0	16.6	15.6	14.6
Meadow	-	-	17.0	16.5	15.4	14.4
Managed Wood	-	-	16.9	16.0	14.7	13.4
Pasture	-	-	16.5	15.9	14.4	13.0
Row Crop	-	-	15.8	14.2	11.9	8.1
Urban Grasses	-	-	15.7	15.7	14.2	12.7
Low Density Residential	0.5	12%	15.7	15.7	14.2	12.7
Low Density Residential	1	20%	14.8	14.8	13.7	12.2
Medium Density Residential	2	25%	11.5	11.5	11.5	11.5
Medium Density Residential	3	30%	11.2	11.2	11.2	11.2
Medium Density Residential	4	38%	9.6	9.6	9.6	9.6
High Density Residential	≥5	65%	7.3	7.3	7.3	7.3
Commercial & Road Right-of-Way[4]	-	90%	4.3	4.3	4.3	4.3

[1] DU = Dwelling Units
[2] Hydrologic soil group designations of A/D, B/D, and C/D should be considered as D soils for this application.
[3] These values apply when recharge of the aquifer is expected; recharge to the bedrock aquifer can be expected when the potentiometric head of the glacial aquifer is greater than the bedrock aquifer.
[4] The 4.3 infiltration value may only be used for an area as a whole (includes impervious and pervious areas) which includes a minimum of 10 percent pervious area. If all land uses (pervious and impervious) are tabulated separately, then impervious areas have 0 inches of recharge.

Table A-2 (Appendix A) Annual Average Expected Baseflow Recharge[3]

Land Use	Density (DU[1]/acre)	% Impervious	Recharge (inches) by Hydrologic Soil Group2			
			A	B	C	D
Woods / Forest	-	-	11.8	11.4	10.7	9.9
Brush	-	-	11.7	11.4	10.7	9..9
Meadow	-	-	11.8	11.3	10.6	9.8
Managed Wood	-	-	11.7	11.0	10.0	9.1
Pasture	-	-	11.3	11.0	9.9	8.9
Row Crop	-	-	11.1	10.1	9.0	6.2
Urban Grasses	-	-	11.2	11.2	10.3	9.3
Low Density Residential	0.5	12%	11.2	11.2	10.3	9.3
Low Density Residential	1	20%	9.5	9.5	9.0	8.6
Medium Density Residential	2	25%	7.8	7.8	7.8	7.8
Medium Density Residential	3	30%	7.6	7.6	7.6	7.6
Medium Density Residential	4	38%	6.5	6.5	6.5	6.5
High Density Residential	≥5	65%	5.0	5.0	5.0	5.0
Commercial & Road Right-of-Way[4]	-	90%	2.9	2.9	2.9	2.9

[1] DU = Dwelling Units
[2] Hydrologic soil group designations of A/D, B/D, and C/D should be considered as D soils for this application.
[3] These values apply when no recharge of the aquifer is expected.
[4] The 2.9 infiltration value may only be used for an area as a whole (includes impervious and pervious areas) which includes a minimum of 10 percent pervious area. If all land uses (pervious and impervious) are tabulated separately, then impervious areas have 0 inches of recharge.

Table A-3 (Appendix A) Land Use Definitions

Land Use	Definition
Woods / Forest	Areas dominated by trees. Woods are protected from grazing and litter and brush adequately cover the soil.
Brush	Brush, weeds, grass mixture where brush is the major element and more than 75% of the ground is covered.
Meadow	Continuous grass, protected from grazing, generally mowed for hay.
Managed Wood	Orchards, tree farms, and other areas planted or maintained for the production of fruits, nuts, berries, or ornamentals.
Pasture	Pasture, grassland, or range where at least 50% of the ground is covered and the area is not heavily grazed.
Row Crop	Areas used to produce crops, such as corn, soybeans, vegetables, tobacco, and cotton.
Urban Grasses	Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.
Residential	Areas with a mixture of constructed materials and vegetation; the average % imperviousness and number of dwelling units per acre to determine the appropriate density is specified.
Commercial	Includes infrastructure (e.g. roads, railroads, etc.) and all highly developed areas not classified as High Intensity Residential.

ii. The pre-development ground water recharge volume shall be calculated by determining the area of each land use-soil type pairing on the site of interest. The recharge associated with each such pairing multiplied by the area will give the pre-development volume of total groundwater

recharge. The same shall be done for the post-development land use-soil type pairings.

Any activity that is expected to produce storm water runoff with elevated concentrations of carcinogens, hydrocarbons, metals, or toxics is prohibited from infiltrating untreated storm water from the area affected by the activity. The groundwater recharge mitigation requirement for areas affected by such activities must be met by methods which do not present a risk of groundwater contamination. The following land uses and activities are typically deemed storm water hotspots:

Vehicle salvage yards and recycling facilities

- vehicle service and maintenance facilities (i.e. truck stops, gas stations)
- fleet storage areas (i.e. bus, truck)
- industrial sites subject to industrial storm water permitting requirements
- bulk terminals
- marinas
- facilities that generate or store hazardous materials
- other land uses and activities as designated by individual review

The following land uses and activities are not normally considered hotspots:

- residential streets and rural highways
- residential development
- institutional development
- commercial and office developments
- non-industrial rooftops
- pervious areas, except golf courses and nurseries

The applicant may use structural BMPs within drinking water source protection areas for community public water systems only to the extent that the structural BMP(s) does not cause contaminants in the recharge waters to impact the ground water quality at levels that would cause an exceedance of the drinking water Maximum Contaminant Levels (OAC Section 3745-81 and 3745-82). To obtain a map of drinking water source protection areas for community public water systems contact Ohio EPA's Division of Drinking and Ground Waters at (614) 644-2752.

Linear transportation projects which are caused solely by correcting safety related issues, mandates of modern design requirements and/or resulting from other mitigation activities are exempt from Groundwater Recharge Mitigation (Appendix B, A.7) if less than one acre of total new right-of-way is associated with the project.

Protection of open space (infiltration areas) shall be by binding conservation easements that identify a third-party management agency, such as a homeowners' association/condominium association, political jurisdiction or third-party land trust.

A.7 Groundwater Recharge Mitigation.

If the post-development recharge volume is less than the pre-development recharge volume, then mitigation will be required. Two options are available for most applications:

i. The preferred method is to convert additional land to land use with higher recharge potential. The difference in groundwater recharge between the existing and converted land use recharge is the amount which can be used as recharge credit. Off-site Groundwater Recharge Mitigation shall occur within the same Watershed Assessment Unit (12-digit HUC scale) as the permitted site and preferably up-gradient and within a 2-mile radius.

Mitigation shall be protected in perpetuity by binding conservation easements or environmental covenants which must be recorded within 6 months of receiving permit authorization. Granting of binding conservation easements or environmental covenants protected in perpetuity for land outside of the disturbed area, but within a required riparian setback counts towards required mitigation.

Mitigation may also be satisfied by approved pooled mitigation areas and in-lieu fee sponsored mitigation areas.

ii. On-site structural and non-structural practices may also be used to achieve groundwater mitigation requirements by retaining and infiltrating on-site a minimum volume of storm water runoff based on the area and hydrologic soil groups of disturbed soils. If these infiltrating practices are incorporated upstream of the water quality volume treatment practice, the volume of groundwater being infiltrated may be subtracted from the water quality volume for the purpose of meeting post-construction requirements. The on-site retention requirement is determined by the following formula:

$$V_{retention} = A_{HSG\text{-}A}*0.90 \text{ in} + A_{HSG\text{-}B}*0.75 \text{ in} + A_{HSG\text{-}C}*0.50 \text{ in} + A_{HSG\text{-}D}*0.25 \text{ in}$$

(Equation 3, Appendix A)

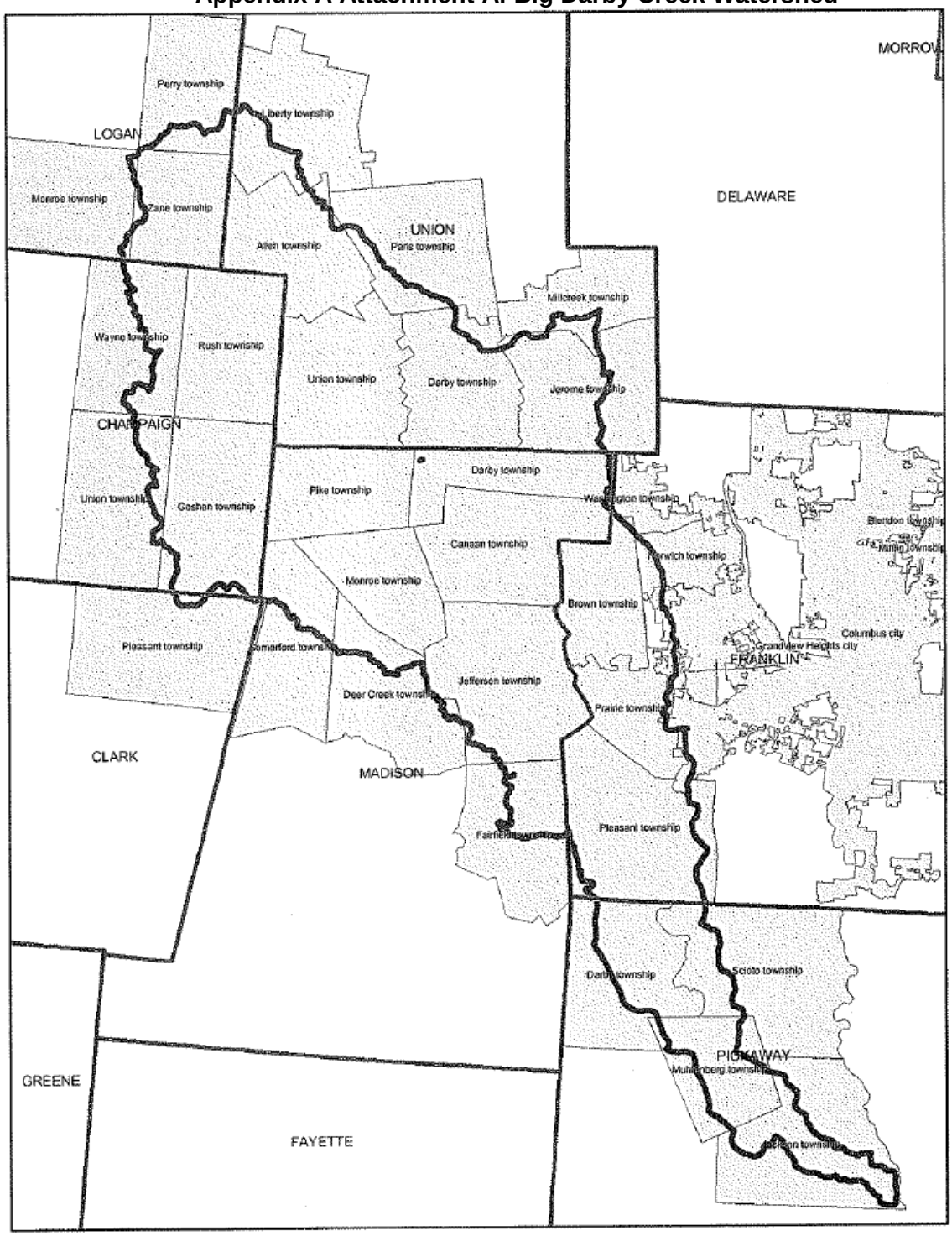
Where,
$V_{retention}$ = volume of runoff retained onsite using an approved infiltration practice
$A_{HSG\text{-}x}$ = area of each hydrologic soil group within the disturbed area

Table A-4: Hydrologic Soil Groups and On-site Retention Depth per Acre

Hydrologic Soil Group	HSG A	HSG B	HSG C	HSG D
Retention Depth (inches)	0.90	0.75	0.50	0.25

Retention volume ($V_{retention}$) provided by selected practices shall be determined using the runoff reduction method criteria as outlined in Part III.G.2.e, Ohio EPA's Runoff Reduction spreadsheet and supporting documentation in the Rainwater and Land Development manual. Hydrologic soil group (HSG) areas are to be determined by using the current version of SURRGO or Web Soil Survey soils information.

Appendix A Attachment A: Big Darby Creek Watershed



A more detailed map can be viewed at:
http://www.epa.state.oh.us/dsw/permits/GP_ConstructionSiteStormWater_Darby.aspx

Appendix A Attachment B

Part 1 Stream Assessment

This assessment will determine if a stream is considered a previously channelized, low-gradient headwater stream (a drainage ditch) which would be applicable for stream restoration in lieu of protecting a setback as per Appendix A. A.4.i and ii.

In the event the assessment of the stream, meets all the criteria listed below, restoration (provided 401/404 permits are authorized) as depicted in Part 2 of this attachment, may be a means of reducing the setback distance required by A.4.i. (Appendix A).

Previously Channelized Low-Gradient Headwater Streams (drainage ditches) shall for the purposes of this permit be defined as having all of the following characteristics:

- Less than 10 square miles of drainage area
- Low gradient and low stream power such that despite their straightened and entrenched condition incision (down-cutting) is not evident
- Entrenched, entrenchment ratio < 2.2
- Straight, sinuosity of the bankfull channel < 1.02

Part 2 Restoration

Restoration shall be accomplished by any natural channel design approach that will lead to a self-maintaining reach able to provide both local habitat and watershed services (e.g. self-purification and valley floodwater storage).

a. Construction of a floodplain, channel and habitat via natural channel design;
b. Floodplain excavation necessary to promote interaction between stream and floodplain;
c. Include a water quality setback of 100 feet from top of the streambank on each side.

The primary target regardless of design approach shall be the frequently flooded width, which shall be maximized, at 10 times the channel's self-forming width. Five times the self-forming channel width may still be acceptable particularly on portions of the site if greater widths are achieved elsewhere.

Appendix B
Olentangy River Watershed

CONTENTS OF THIS APPENDIX

B.1 Permit Area.

This appendix to Permit OHC00005 applies to specific portions of the Olentangy River Watershed located within the State of Ohio. The permit area includes the following 12-digit Hydrologic Unit Codes (HUC-12) within the Olentangy River Watershed:

12-Digit Hydrologic Unit Codes

12-Digit Hydrologic Unit Codes (HUC)	Narrative Description of Sub-Watershed
05060001 09 01	Shaw Creek
05060001 09 02	Headwaters Whetstone Creek
05060001 09 03	Claypool Run-Whetstone Creek
05060001 10 07	Delaware Run-Olentangy River
05060001 11 01	Deep Run-Olentangy River
05060001 11 02 (Only portion as depicted in Attachment A)	Rush Run-Olentangy River

Please see Attachment A (Appendix B) for permit area boundaries. An electronic version of Attachment A can be viewed at
http://epa.ohio.gov/dsw/permits/GP_ConstructionSiteStormWater_Olentangy.aspx

B.2 TMDL Conditions.

This general permit requires control measures/BMPs for construction sites that reflect recommendations set forth in the U.S. EPA approved Olentangy TMDL.

B.3 Riparian Setback Requirements.

The permittee shall comply with the riparian setback requirements of this permit or alternative riparian setback requirements established by a regulated MS4 and approved by Ohio EPA. The SWP3 shall clearly delineate the boundary of required stream setback distances. The stream setback shall consist of a streamside buffer and an outer buffer. No construction activity shall occur, without appropriate mitigation, within the streamside buffer except activities associated with storm water conveyances from permanent treatment practices, approvable utility crossings and restoration or recovery of floodplain and channel form characteristics as described in Attachment B. Storm water conveyances must be designed to minimize the width of disturbance.

Construction activities requiring mitigation for intrusions within the outer buffer for the Olentangy River mainstem and perennial streams are described in Appendix B.4.

If intrusion within the delineated setback boundary is necessary to accomplish the purposes of a project, then mitigation shall be required in accordance with Appendix B.3. of this permit. Streams requiring protection under this section have a defined bed and bank or channel and are defined as follows:

- The Olentangy River mainstem;
- Perennial streams have continuous flow on either the surface of the stream bed or under the surface of the stream bed;
- Intermittent streams flow for extended periods of time seasonally of a typical climate year; and
- Ephemeral streams are normally dry and only flow during and after precipitation runoff (episodic flow).

National Resources Conservation Service (NRCS) soil survey maps should be used as one reference and the presence of a stream requiring protection should also be confirmed in the field. Any required setback distances shall be clearly displayed in the field prior to any construction related activity.

Riparian setbacks shall be delineated based upon one of the following two methods:

i. The required setback distances shall vary with stream type as follows:

a. The setback distances associated with the mainstem of the Olentangy River shall consist of:

(1) A streamside buffer width of 100 feet as measured horizontally from the ordinary high water mark per side; and

(2) An outer buffer width sized to the regulatory 100-year floodplain based on FEMA mapping. No impervious surfaces shall be constructed without appropriate mitigation and moderate to substantial fill activities with no impervious surface may require appropriate mitigation pending an individual approval by Ohio EPA.

b. The setback distance associated with perennial streams, other than the Olentangy mainstem, shall consist of:

(1) A streamside buffer width of 80 feet per side measured horizontally from the ordinary high water mark; and

(2) An outer buffer width sized to the regulatory 100-year floodplain based on FEMA mapping. In the event the regulatory 100-year floodplain is not established, the outer buffer width shall be calculated using the following equation and measured horizontally from the ordinary high water mark. No impervious surfaces, structure, fill, or activity that would impair the floodplain or stream stabilizing ability of the outer buffer shall occur without appropriate mitigation:

$W = 143DA^{0.41}$ (Equation 1 Appendix B)

where:
DA = drainage area (mi^2)
W = total width of riparian setback (ft)

W shall be centered over the meander pattern of the stream such that a line representing the setback width would evenly intersect equal elevation lines on either side of the stream.

If the DA remains relatively constant throughout the stretch of interest, then the DA of the downstream edge of the stretch should be used. Where there is a significant increase in the DA from the upstream edge to the downstream edge of the area of interest, the setback width shall increase accordingly.

c. The setback distance associated with intermittent streams and ephemeral streams shall be a streamside buffer width of 30 feet per side measured horizontally from the centerline of the stream. No outer buffer is required for intermittent and ephemeral streams.

ii. Stream Restoration with 100 feet (each side) Riparian Setback. Each stream segment within the proposed site boundaries can be assessed in accordance with Attachment B. In the event the stream segment is classified as a "Previously Modified Low Gradient Headwater Stream", the permittee has the option to restore the stream segment in accordance with Attachment B and include a 100 feet water quality setback distance from the top of the streambank on each side. In the event the stream segment exceeds the minimum criteria in Attachment B to be classified as a "Previously Modified Low Gradient Headwater Stream", this may be considered on a case-by-case basis.

No structural sediment controls (e.g., the installation of sediment barriers or a sediment settling pond) or structural post-construction controls shall be used in a stream or the streamside buffer. Activities and controls that would not impair the floodplain or stream stabilizing ability of the outer buffer can be considered.

Redevelopment projects (i.e., developments on previously developed property) located within the delineated setback boundary is exempt from Riparian Setback Mitigation (B.3) provided the proposed project does not further intrude the delineated setback boundary.

B.4 Riparian Setback Mitigation.

The mitigation required for intrusion into the riparian setback of the **Olentangy River mainstem or perennial streams** shall be determined by the horizontal distance the intrusion is from the stream. Up to three zones will be used in determining the required mitigation. Zone 1 extends from 0 to 30 feet from the stream edge. Zone 2 extends

from 30 feet to the outer edge of the streamside buffer. Zone 3 extends from the outer edge of the streamside buffer to the outer edge of the outer buffer. Intrusion into these zones will require the following mitigation within the same Watershed Assessment Unit (12-digit HUC scale). Alternative mitigation, within the permit area, may be considered on a case-by-case basis:

1. Four (4) times the total area disturbed in the stream within Zone 1 of the site being developed shall be mitigated; or, two (2) times the total area disturbed in the stream within Zone 1 shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected by binding conservation easements or environmental covenants.

2. Three (3) times the area disturbed within Zone 2 of the site being developed shall be mitigated within Zones 1 and/or 2 of the mitigation location; or, one and one-half (1.5) times the total area disturbed within Zone 2 shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

3. Two (2) times the area to be mitigated within Zone 3 of the site being developed shall be mitigated within any Zone of the mitigation location; or, one (1) times the total area to be mitigated within any zone shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

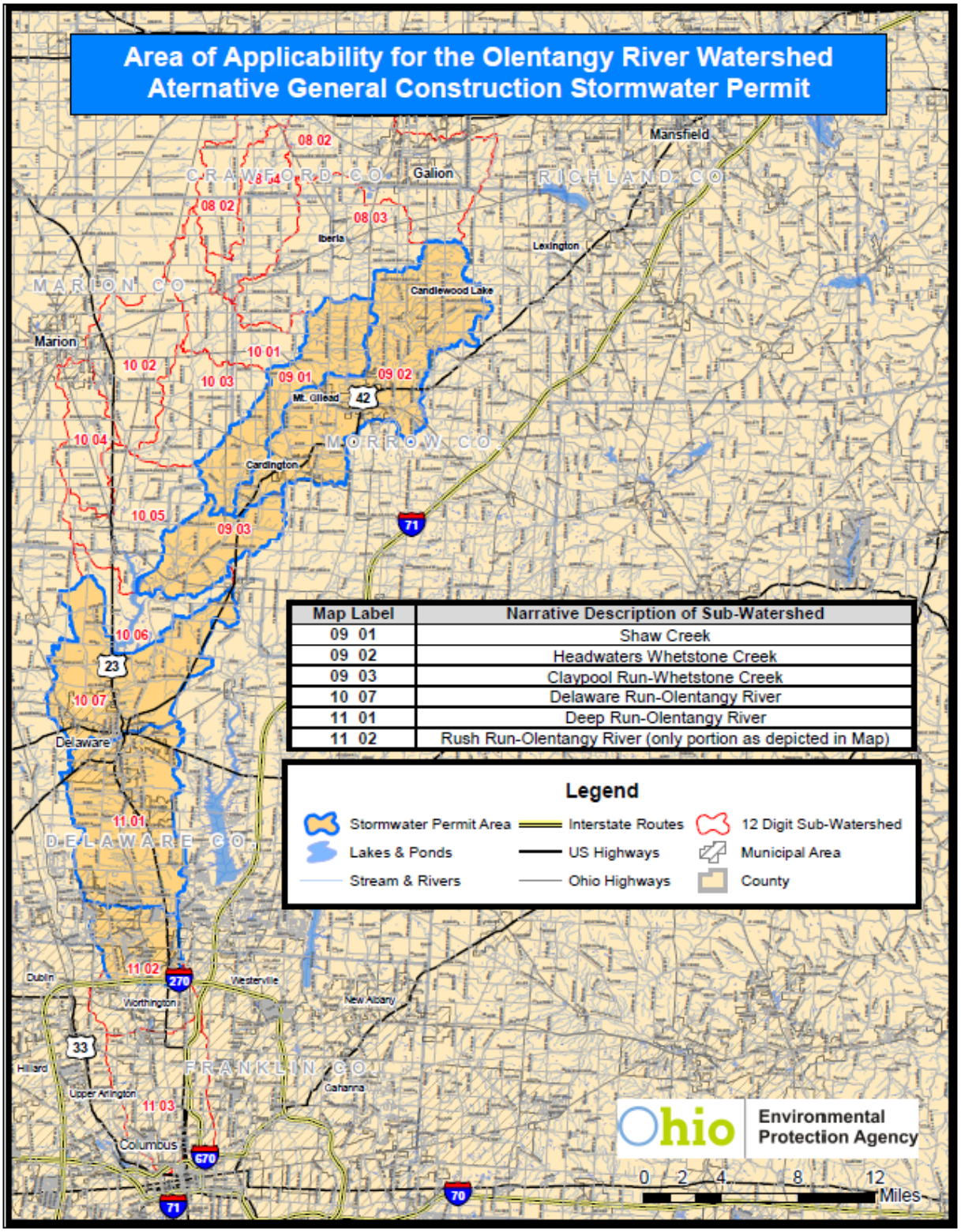
The mitigation required for intrusion into the riparian setback of an **intermittent stream** shall be four (4) times the total area disturbed within the riparian setback of the site being developed shall be mitigated; or two (2) times the total area disturbed within the riparian setback shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

The mitigation required for intrusion into the streamside buffer of an **ephemeral stream** shall be two (2) times the total area disturbed within the riparian setback of the site being developed shall be mitigated; or one (1) times the total area disturbed within the riparian setback shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

All mitigation shall, at a minimum, include conserved or restored setback zone, and should be designed to maximize the ecological function of the mitigation. Including mitigation at the stream edge along with associated setback areas is one way to maximize ecological function. Mitigation shall be protected in perpetuity by binding conservation easements or environmental covenants which must be recorded within 6 months of permit authorization. Granting of binding conservation easements or environmental covenants protected for land outside of disturbed area, but within a required riparian setback counts towards required mitigation.

Mitigation may also be satisfied by approved pooled mitigation areas and in-lieu fee sponsored mitigation areas. Mitigation resulting from State or Federal environmental regulations may be adjusted in recognition of these requirements.

Appendix B Attachment A Applicable Portions of the Olentangy Watershed



A more detailed map can be viewed at:
http://epa.ohio.gov/dsw/permits/GP_ConstructionSiteStormWater_Olentangy.aspx

Appendix B Attachment B

Part 1 Stream Assessment

This assessment will determine if a stream is considered a previously channelized, low-gradient headwater stream (a drainage ditch) which would be applicable for stream restoration in lieu of protecting an outer 'no build' setback as per Appendix B B.2i. and ii.

In the event the assessment of the stream meets all the criteria listed below, restoration as depicted in Part 2 of this attachment or natural channel design could be performed, provided 401/404 permits are authorized, and may be a means of reducing the setback distance required by B.2.i. (Appendix B).

Previously Modified, Low-Gradient Headwater Streams shall, for the purposes of this permit, be defined as having all of the following characteristics:

- Less than 10 square miles of drainage area;
- Low gradient and low stream power such that incision (down-cutting) is not evident;
- Entrenched such that the ratio of the frequently flooded width to the bankfull width is less than 2.2; and
- Straight with little or no sinuosity present such that the ratio of the bankfull channel length to the straight-line distance between two points is less than 1.02.

Part 2 Restoration

Restoration shall be accomplished by any natural channel design approach that will lead to a self-maintaining reach able to provide both local habitat and watershed services (e.g. self-purification and valley floodwater storage).

a. Construction of a floodplain, channel and habitat via natural channel design;
b. Floodplain excavation necessary to promote interaction between stream and floodplain;
c. Include a water quality setback of 100 feet from top of the streambank on each side.

The primary target shall be a frequently flooded width of 10 times the channel's self-forming width. Five times the self-forming channel width may be acceptable if sufficient elements of natural channel design are included in the restoration project.

Appendix C Rainfall Intensity for Calculation of Water Quality Flow (WQF)

DURATION t_c (minutes)	WATER QUALITY INTENSITY [i_{wq}] (inches/hour)	DURATION t_c (minutes)	WATER QUALITY INTENSITY [i_{wq}] (inches/hour)
5	2.37	33	0.95
6	2.26	34	0.93
7	2.15	35	0.92
8	2.04	36	0.90
9	1.94	37	0.88
10	1.85	38	0.86
11	1.76	39	0.85
12	1.68	40	0.83
13	1.62	41	0.82
14	1.56	42	0.80
15	1.51	43	0.78
16	1.46	44	0.77
17	1.41	45	0.76
18	1.37	46	0.75
19	1.33	47	0.74
20	1.29	48	0.73
21	1.26	49	0.72
22	1.22	50	0.71
23	1.19	51	0.69
24	1.16	52	0.68
25	1.13	53	0.67
26	1.10	54	0.66
27	1.07	55	0.66
28	1.05	56	0.65
29	1.03	57	0.64
30	1.01	58	0.64
31	0.99	59	0.63
32	0.97	60	0.62

Note: For t_c < 5 minutes, use i = 2.37 in/hr; for t_c > 60 minutes, use i = 0.62 in/hr. For all other t_c, use the appropriate value from this table.

Appendix D – NOI and Acknowledgement Letter from OEPA

(If Needed)

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Appendix E – Inspection Reports

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PROJECT NAME: **PERMIT #:**
PRIME CONTRACTOR: **APPROVAL DATE:**

GRC Construction Storm Water Site Inspection Form

INSPECTIONS SHALL BE CONDUCTED ONCE EVERY 7 DAYS AND WITHIN 24 HOURS OF 0.5" OR GREATER OF RAINFALL AND/OR 2" OF SNOW MELT.

INSPECTION DATE: _____ **INSPECTOR NAME:** _____

INSPECTOR TITLE/QUALIFICATIONS: _____

PROJECT LOCATION (if multiple areas are to be inspected): _____

WEATHER INFORMATION:

- **Weather since last inspection:** _____
- **Estimated last storm event duration (min) and rainfall amount (inches):** _____/_____
- **Had any stormwater discharges from the site occurred (yes/no):** _____
- **If yes, describe discharge and where onsite it was observed:** _____

SILT FENCING / DIVERSIONS	YES	NO	N/A
1. Silt fencing is entrenched at least 6" into the ground and backfilled and compacted?			
2. Silt fencing is pulled tight so it will not sag when water accumulates behind it?			
3. Ends of silt fencing are brought up slope from the rest of the silt fencing?			
4. Are all sections of silt fencing free of gaps, tears, and/or damage?			
5. Is the silt fencing able to control the run-off from the drainage area?			
6. Is silt and sediment more than a third of the way up the visible silt fencing height?			
7. Are other diversionary BMPs utilized working properly?			
8. Are other diversionary BMPs needed to keep sediment on site?			

INLET PROTECTION	YES	NO	N/A
1. Are all inlets receiving run-off from the construction site protected?			
2. Are the inlet windows (where applicable) also protected?			
3. Does water pond around the inlet when it rains?			
4. Has accumulated sediment been removed on a frequent basis?			
5. Are high amounts of sediment accumulating at the protected inlet?			
6. Is ponding in the area due to the inlet protection a potential flooding concern?			
7. Is the inlet protection free of holes, tears, and other damage?			

CONSTRUCTION ENTRANCE	YES	NO	N/A
1. Is the construction entrance sized to prevent tracking of sediments off-site?			
2. Is the construction entrance becoming overburdened with sediment?			
3. Is sediment leaving the construction entrance when it rains?			
4. Are any repairs or the addition of more stone needed?			
5. Are the adjacent streets to the construction entrance being kept clean?			

PROJECT NAME: **PERMIT #:**
PRIME CONTRACTOR: **APPROVAL DATE:**

SEDIMENT TRAPS, PONDS, and BIORETENTION GARDENS	YES	NO	N/A
1. Is concentrated flow of run-off being directed to a sediment trap or pond?			
2. Is the pond or trap able to adequately retain the run-off being directed to it?			
3. For sediment traps, are the stone spill ways holding up and not overburdened?			
4. Is it time to clean-out the sediment pond/trap to restore it to its original capacity?			
5. Has removed sediments been disposed of properly or seeded if kept onsite?			
6. Is the bioretention garden being protected from sediment during installation?			

TEMPORARY STABILIZATION	YES	NO	N/A
1. Are there any areas that are disturbed, but will lie dormant for more than 14 days?			
2. Have all dormant, yet disturbed areas been temporarily stabilized as required?			
3. Are there any soil stockpiles that will lie dormant for more than 14 days?			
4. Have these stockpiles been covered or actions to temporarily stabilize started?			
5. If seeded, has the temporary stabilization been established adequately?			
6. Are there any areas that require re-seeding, re-mulching, or re-tarped?			
7. If out of the growing season, have other stabilization measures been utilized?			
8. Are there any areas of washout that may need additional erosion controls?			

PERMANENT STABILIZATION	YES	NO	N/A
1. Are there any areas at final grade?			
2. Has the soil been properly prepared to accept permanent seeding (per spec)?			
3. Has rainfall or manual watering been adequate to establish grass?			
4. Have slopes been reinforced with adequate erosion controls?			
5. Are there any areas that require repairs and reseeding?			
6. Has the area reached full stabilization (or 70% stabilization)?			
7. Are there any areas of washout that may need additional erosion controls?			

NON-SEDIMENT POLLUTION CONTROLS	YES	NO	N/A
1. Is the concrete washout properly retaining the concrete slurry and water?			
2. Does the concrete washout still have adequate capacity?			
3. Is the concrete washout being kept covered to minimize rainwater accumulation?			
4. Are dumpsters being properly utilized for the wastes generated?			
5. Are the dumpsters located in their designated locations?			
6. Are there any leaks of chemicals or other liquids coming from the dumpsters?			
7. Is any of the heavy equipment leaking fluids such as hydraulic oil or fuel?			
8. Are spill kits visible onsite where hydraulic equipment or fuels are used and stored?			
9. Are spill kits adequately stocked?			
10. Are fuels, oils, and chemicals stored at least 9 feet from inlets and ditches?			
11. Is dewatering of water from trenches and excavations necessary?			
12. If yes, has EMO been contacted to verify where the water may be discharge to?			

NOTES OF REPAIRS AND MAINTENANCE NEEDED: _____

_____

_____

_____

_____

Appendix F – Corrective Action Log

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Appendix F – Corrective Action Log

Project Name:
SWP3 Contact:

Inspection Date	Inspector Name(s)	Description of BMP Deficiency	Corrective Action Needed (including planned date/responsible person)	Date Action Taken/Responsible person

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Appendix G – SWPPP Amendment Log

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Appendix G – SWP3 Amendment Log

Project Name:

SWP3 Contact:

Amendment No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

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Appendix H – Duty to Inform Log and

NASA GRC SWPPP Concurrence Form

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NASA Glenn Research Center

Storm Water Management Program

Duty to Inform

Project Name:

This document, per requirements of the Ohio EPA Construction General Permit: OHC000005, shall be maintained by the permittee (NASA) and contain the signatures of all contractor and subcontractor supervisors involved in the implementation of the Storm Water Pollution Prevention Plan (SWP3) designated for this project.

By signing this "Duty to Inform" document, you are acknowledging that you have reviewed and understand the conditions and responsibilities of the SWP3 for this project.

Printed Name:	Signature:	Company Name:

Storm Water Pollution Prevention Plan Forms

Storm Water Pollution Prevention Plan (SWP3) Concurrence

NASA Glenn Research Center
Storm Water Management Program - Construction
Storm Water Pollution Prevention Plan (SWP3) Concurrence
Ohio EPA General Construction Permit

Location/Facility Name	**Date Submitted for Review**
NASA FD Project Manager	**Phone #**
Prime Contractor (Responsible for SWP3 Implementation)	**Phone #**
NASA EMO Reviewer Name	**Phone #**

In conformance with the requirements set forth in the form Notice of Intent (NOI) for Coverage Under Ohio EPA General NPDES Permit (Form EPA 4493) a storm water pollution prevention plan (SWP3) has been prepared. The project shall not create a soil disturbance until Ohio EPA issues a permit number.

Completion of this form constitutes an understanding that the Prime Contractor hereby assumes site responsibilities formally managed by the NASA Facilities Division.

SWP3 Completion Signatures:

NASA FD Project Manager	**Date:**
NASA FD Civil Systems Manager	**Date:**
Prime Contractor Representative and Title	**Date:**
NASA EMO SWP3 Reviewer	**Date:**

The completed form will be managed by the EMO and filed with the specific project's records. Revised 10/14/16

Appendix I – Grading and Stabilization Activities Log

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Appendix I – Grading and Stabilization Activities Log

Project Name:
SWP3 Contact:

Date Grading Activity Initiated	Description of Grading Activity	Date Grading Activity Ceased (Indicate Temporary or Permanent)	Date When Stabilization Measures are Initiated	Description of Stabilization Measure and Location

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Appendix J – Soils Reports

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Erie County, Ohio

December 12, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,570 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Erie County, Ohio
Survey Area Data: Version 18, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Mar 4, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FrA	Fries silty clay loam, 0 to 1 percent slopes	6.8	20.2%
MsA	Miner silt loam, shale substratum, 0 to 2 percent slopes	17.1	50.3%
PcA	Pewamo silty clay loam, 0 to 1 percent slopes	2.9	8.5%
UdB	Udorthents, loamy, 0 to 6 percent slopes	7.1	21.0%
Totals for Area of Interest		**33.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Erie County, Ohio

FrA—Fries silty clay loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 5s3x
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Fries and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fries

Setting

Landform: Flats on lake plains, drainageways on lake plains, depressions on lake plains
Parent material: Till over residuum weathered from shale

Typical profile

H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 28 inches: clay
H3 - 28 to 30 inches: weathered bedrock

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: Wet Acidic Depression (F139XY012OH)
Hydric soil rating: Yes

Minor Components

Hornell soils on rises

Percent of map unit: 10 percent
Landform: Till plains
Hydric soil rating: No

Pewamo

Percent of map unit: 5 percent
Landform: Depressions on lake plains

Hydric soil rating: Yes

Bedrock at 40 to 60 inches

Percent of map unit:
Landform: Drainageways on lake plains, flats on lake plains, depressions on lake plains
Hydric soil rating: Yes

Lighter colored surface layer

Percent of map unit:
Landform: Drainageways on lake plains, flats on lake plains, depressions on lake plains
Hydric soil rating: Yes

MsA—Miner silt loam, shale substratum, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2v03p
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Miner, shale substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Miner, Shale Substratum

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Till over shale bedrock

Typical profile

Ap - 0 to 8 inches: silt loam
Btg1 - 8 to 13 inches: silty clay
Btg2 - 13 to 22 inches: silty clay
Btg3 - 22 to 36 inches: silty clay
C - 36 to 50 inches: silty clay loam
2Cr - 50 to 60 inches: bedrock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: Wet Acidic Depression (F139XY012OH)
Hydric soil rating: Yes

Minor Components

Trumbull

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Allis

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

PcA—Pewamo silty clay loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 5s4x
Elevation: 600 to 1,400 feet
Mean annual precipitation: 27 to 40 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 130 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Pewamo and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pewamo

Setting

Landform: Drainageways on ground moraines, drainageways on lake plains, flats on ground moraines, flats on lake plains, depressions on ground moraines, depressions on lake plains
Parent material: Till

Typical profile

H1 - 0 to 12 inches: silty clay loam
H2 - 12 to 33 inches: clay loam
H3 - 33 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 30 percent
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: Wet Calcareous Depression (F139XY011OH)
Hydric soil rating: Yes

Minor Components

Bennington soils on slight rises

Percent of map unit: 5 percent
Landform: Flats on ground moraines, flats on end moraines, rises on ground moraines, rises on end moraines
Landform position (two-dimensional): Summit, shoulder
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Elliott soils on slight rises

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Less clay in the subsoil

Percent of map unit:
Landform: Flats on lake plains, depressions on ground moraines, depressions on lake plains, drainageways on ground moraines, drainageways on lake plains, flats on ground moraines
Hydric soil rating: Yes

Bedrock at 40 to 80 inches

Percent of map unit:

Landform: Depressions on ground moraines, depressions on lake plains, drainageways on ground moraines, drainageways on lake plains, flats on ground moraines, flats on lake plains

Hydric soil rating: Yes

UdB—Udorthents, loamy, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 5s5q
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Typical profile

H1 - 0 to 80 inches: variable

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Undisturbed soils at the edge of units

Percent of map unit: 5 percent
Hydric soil rating: No

Small urban areas intermixed throughout the units

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrops intermixed throughout the units

Percent of map unit: 5 percent
Hydric soil rating: No

Stockpiles of disturbed soil material

Percent of map unit:

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix K- Post-Construction Calculations and Erosion & Sediment Control BMP Calculations

Appendix K – Calculations

The work that will be performed will not substantially change the pre-construction hydrologic characteristics after the work is completed. Therefore, there is no need to provide calculations described in the General Permit, Part III, G, 1, d. Note the following:

- The slopes of the work area will not change except for minor changes due to removal of berms and debris piles
- The percentage of impervious area is 0% before construction and will remain 0% after construction
- The runoff coefficient is 0.15 before construction and will remain 0.15 after construction
- Wetlands and water bodies will not be modified as a result of the construction
- There are no existing stormwater features within the construction area
- There are no post-construction stormwater facilities

Appendix L

Best Management Practices

Silt Fence

Straw Bales

Construction Entrance

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6.31 Treatment Measures: SILT FENCES

DESCRIPTION AND PURPOSE

A silt fence is a temporary sediment barrier consisting of a geotextile, which is attached to supporting posts trenched into the ground. Sediment-laden runoff ponds uphill from the silt fence and runoff is filtered as it passes through the geotextile (see Figure 6.31-1 for a typical installation of a silt fence).

Silt fences are intended to intercept and detain small amounts of sediment from disturbed areas in order to keep the sediment from leaving the site. Silt fences can also prevent sheet erosion by decreasing the velocity of runoff. In some instances, straw or hay bales could be used; however, their failure rate is high (see Figure 6.31-2 for a detail of silt fences on a slope).

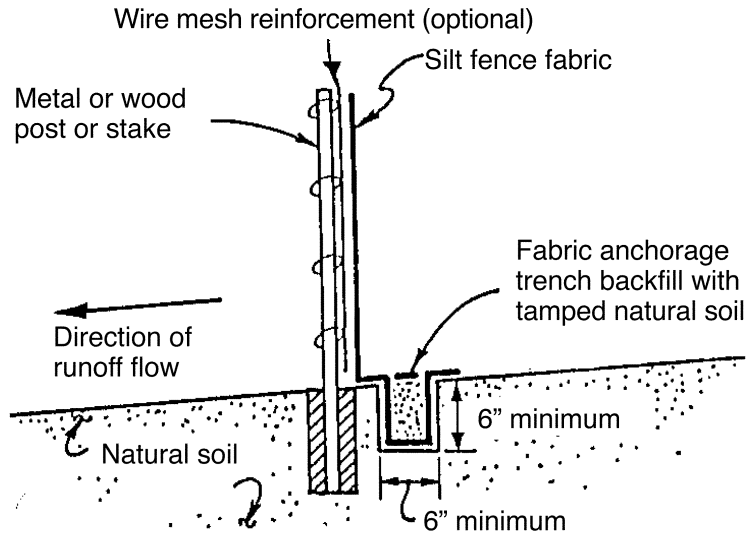
The use of silt fences as a sediment barrier is not recommended in areas of concentrated flow, such as ditches; in those cases, soil berms, silt dikes, straw waddles and excelsior logs, or rock check dams should be used.

PLANNING CONSIDERATIONS

A silt fence is a permeable barrier that should be planned as a system to retain sediment on the construction site. The fence retains sediment primarily by retarding flow and promoting deposition behind the fence. In operation, the fence generally becomes clogged with fine particles, which in turn reduces the flow rate. This causes a pond to develop more quickly behind the fence. The designer should anticipate ponding and provide sufficient storage areas and overflow outlets to prevent flows from overtopping the fence. Since silt fences are not designed to withstand high standing water, locate them so that only shallow pools can form. Tie the ends of a silt fence into the landscape to prevent flow around the end of the fence before the pool reaches design level. Often a crescent shape will perform better than the traditional straight line. Provide stabilized outlets to protect the fence system and release storm flows that exceed the design storm.

Deposition occurs as the storage pool forms behind the fence. The designer can direct flows to specified deposition areas through appropriate positioning of the fence or by providing an excavated area behind the fence. Plan deposition areas at accessible points to facilitate routine cleanout and maintenance. Show deposition areas in the erosion-and-sedimentation-control plan. A silt fence acts as a diversion if placed slightly off the contour. This may be used by the designer to control shallow, uniform flows from small, disturbed areas and to deliver sediment-laden water to deposition areas.

Silt fences serve no function along ridges or near drainage divides where there is little movement of water. Confining or diverting runoff unnecessarily with a silt fence may create erosion and sedimentation problems that would not otherwise occur.



(Note: Depending upon configuration, attach fabric to wire mesh with hog rings, steel posts with tie wires, or wood posts with staples.

Figure 6.31-1 Typical installation for silt fence

DESIGN RECOMMENDATIONS

1. Silt fences should be installed on the contour (as opposed to up and down a hill) and constructed so that flow cannot bypass the ends.

2. Ensure that the drainage area is no greater than 1/4 acre per 100 ft of fence.

3. Make the fence stable for the 10-year peak storm runoff.

4. Where all runoff is to be stored behind the silt fence, ensure that the maximum slope length behind the fence does not exceed the specifications shown in Table 6.31-1.

5. By design, ensure that the depth of impounded water does not exceed 2 ft at any point along the fence.

Table 6.31-1 Maximum slope length and slope for which silt fence is applicable

		By Calculation	By Calculation	By Accepted Design Practices
Slope H:V	**Percent**	**Silt fence storage equals 2 ft for a 100-year event**	**Silt fence storage equals 2 ft for a 2-year event or 3 ft for a 100-year event**	
100:1	1%	400 ft	900 ft	100 ft
50:1	2%	200 ft	450 ft	75 ft
25:1	4%	100 ft	225 ft	75 ft
20:1	5%	80 ft	180 ft	75-50 ft
17:1	6%	67 ft	150 ft	50 ft
12.5:1	8%	50 ft	112 ft	50 ft
10:1	10%	40 ft	90 ft	50-25 ft
5:1	20%	20 ft	45 ft	25-15 ft
4:1	25%	16 ft	36 ft	15 ft
2:1	50%	8 ft	18 ft	15 ft

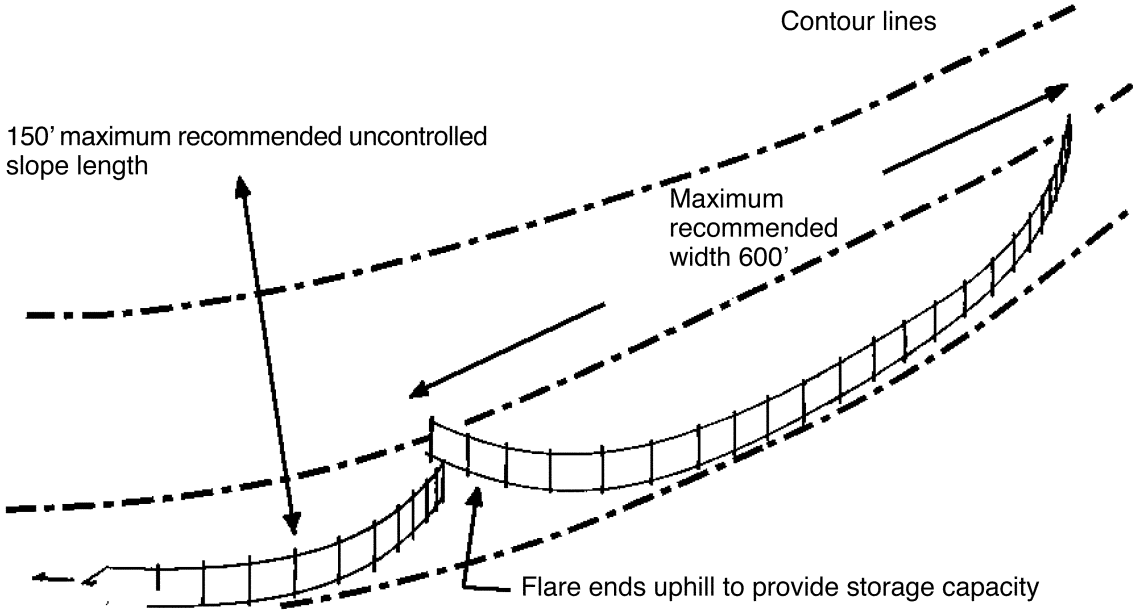


Figure 6.31-2 Typical silt fence layout

CONSTRUCTION SPECIFICATIONS

SILT FENCE

This description covers silt fence for use in retaining sediment and preventing off-site sedimentation. The following types are provided for specific uses:

Heavy Duty	General use during site grading, to protect critical areas and bodies of water. This type has metal posts and woven wire fence material as backing for the geotextile material.
Standard	Light-duty applications, to protect temporary construction or to supplement the other types of silt fence. This type is installed with plow type equipment with stakes spread at 8 ft intervals.
Preassembled	Light-duty applications, to protect temporary construction or to supplement the other types of silt fence. This type often has posts pre-attached to the silt fence geotextile.
Machine-sliced Installation	For most applications

The following describes the components of the silt fence which consists of a geotextile, which may have wire backing, and posts. (See Table 6.31-2 for further specifications)

GEOTEXTILE

Geotextile should be uniform in texture and appearance and have no defects, flaws or tears that would affect its physical properties. It should contain sufficient ultraviolet (UV) ray inhibitor and stabilizers to provide a minimum two-year service life outdoors.

Backing

Wire mesh backing is required with heavy duty silt fence. Use three vertically placed wire fasteners ("hog rings") to fasten the geotextile woven wire fence material at a minimum spacing of 2 ft.

Posts

Steel posts are used for heavy duty silt fence and machine sliced method of installation. Standard applications may use wooden posts, which should have a sharpened end and should be set in the ground at least 1.5 ft deep. Each post should be securely fastened to the geotextile and net backing by ties or staples suitable for such purpose.

FIELD ASSEMBLY

The geotextile should be attached to the upstream side of the post and any backing. The bottom edge of the geotextile should be buried at least 6 inches deep in a vertical slot or trench, with the soil pressed firmly against the embedded geotextile.

MACHINE SLICE INSTALLATION

A geotextile fabric should be inserted in a slit in the soil (6-12 inches deep) so that no flow can pass under the silt fence. The slit should be created such that a horizontal chisel point, at the base of a soil-slicing blade, slightly disrupts soil upward as the blade slices through the soil. This upward disruption minimizes horizontal compaction and creates an optimal soil condition for mechanical compaction against the geotextile. The geotextile should be mechanically inserted directly behind the soil-slicing blade in a simultaneous operation, achieving consistent placement and depth. No turning over (plowing) of soil is allowed for the slicing method.

The contractor should compact the soil immediately next to the silt fence fabric with the wheels of a tractor, skid steer or roller. Drive over each side of the silt fence two to four times.

Each post should be tied in three places with 50 lb plastic zip ties. Position the post with the projections, or nipples, facing away from the silt fence fabric. Place all three ties within the top 8 inches of fabric, puncturing holes vertically a minimum of 1 inch apart. Position each tie diagonally through the fabric so that it rests on top of a post nipple and tighten.

MATERIALS

General

Use a synthetic geotextile fabric which is certified by the manufacturer or supplier as conforming to the requirements shown in Table 6.31-2.

Table 6.31-2 Specifications for 3 types of silt fence

Description	Heavy Duty	Standard	Machine Slice
Geotextile			
Type	Woven	Woven	Monofilament
Width	48 inches	36 inches	36 inches
Grab Tensile Strength ASTM D 4632	100 lb Min.	100 lb Min.	130 lb
Apparent Opening Size AOS ASTM D 4751	20-70 Sieve	20-70 Sieve	30-40 Sieve
UV Stability ASTM D 4355 500 hr.	70% Min.	70% Min.	70% Min.
Top-fastening Component	Overlap Around Woven-wire Backing	Sewn-in Cord	
Net Backing			
Material	Woven Wire		
Min. Weight	14-1/2 gauge		
Min. Mesh Opening	2 inches		
Max. Mesh Opening	6 inches		
Min. Width	30 inches		
Tensile Strength ASTM D 4595	100 lb/ft		
UV Stability ASTM D 4355 500 h	70% Min.		
Posts	(E)		
Material	Metal	Wood	Metal
Min. Size	1.25 lb/ft	1.5 inch by 1.5 inch	1.25 lb/ft
Min. Length	5 ft	4 ft	5 ft
Min. Embedment	2 ft	1.5 ft	2 ft
Max. Spacing	8 ft	8 ft	6 ft
Type of Post Fasteners	U-shaped clips No. 16 gauge wire	Gun staples 0.5 inch long	Plastic zip ties (50-lb tensile strength)
Min. Fasteners Per Post	3	5	3

Geotextile fabric should contain UV ray inhibitors and stabilizers to provide a minimum of two years of expected usable construction life at a temperature range of 0 to 120° F.

Ensure that posts for silt fences are either 1.5-inch hardwood with a minimum length of 4 ft or 1.25 lb/linear ft steel, with a minimum length of 5 ft. Make sure that steel posts have projections to facilitate fastening the fabric. Post spacing will be site specific, but under all condition 6-8 ft. on center is a standard maximum.

INSTALLATION

1. Silt fence that is inadequately embeded in the ground will blow out, releasing water and sediment under the fence. Failure to properly install, inspect and maintain are the primary causes of this failure.

2. Silt fences can also be overtopped by sediment build up over several storm events. The silt fence must be maintained when sediment reaches 1/3 the height of the silt fence. For a 3 ft silt fence, cleaning should be conducted whenever there is on 1 ft of silt build up.

3. Another primary area of failure is for silt fences to be overtopped in a concentrated flow area. The silt fence is not meant to be placed in concentrated flow areas, and slope length calculations of Table 6.31-1 do not apply to concentrated flows.

4. Silt fences are not terraces; they cannot be put in sequence to extend the slope length allowable. Other methods must be used if the allowable distance is exceeded.

5. Another area of failure is for the silt fence to be eroded around the ends. The fence must be tied into the slope so that the base of the fence is above the design storage depth.

6. Construct the silt fence from a continuous roll of geotextile if possible. Cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the geotextile fabric. It is preferred that the material be overlapped to the next post or geotextile may be wrapped together around posts.

7. For heavy duty use support standard strength silt fence by woven wire mesh fastened securely to the upslope side of the posts using hog rings and tie wires. Extend the wire mesh support to the bottom of the trench. Woven wire is not required with the standard silt fence or slicing method of installation.

8. When a wire-mesh support fence is used, space posts no more than 8 ft apart. Support posts should be driven securely into the ground to a minimum of 2 ft.

9. Unless machine-slice methods are used, excavate a trench approximately 6 inches wide and 6 inches deep along the proposed line of posts and upslope from the barrier.

10. Backfill the trench with compacted soil or gravel placed over the geotextile.

11. Never attach silt fence to trees.

MAINTENANCE

1. Inspect silt fences at least once a week and after each rainfall, or as required by permits. Make any required repairs immediately. Repair scoured areas on the back side of fence at this time to prevent future problems.

2. Should the fabric of a silt fence collapse, tear, decompose or otherwise become ineffective, replace it within 24 hours of discovery.

3. Remove silt deposits once they reach one-third the height of the fence to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

4. Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.

Note: Other specifications are acceptable, make sure your project specifications are appropriate for your project

6.34 Treatment Measures: STRAW (OR HAY) BALE SEDIMENT BARRIERS

Note: Straw (or hay) bale sediment barriers are effective sediment-control practices only when they are used in appropriate locations and properly installed and maintained. Generally, alternatives, such as stone check dams, or silt fences should be used, especially in areas of concentrated flow. In many cases, installation or maintenance conditions are not met and the practice fails.

This practice is only recommended when proper planning is used and adequate construction supervision is available to ensure that the structure is installed and maintained correctly. Check dams (see part 6.3.) are more reliable and should be used if possible

DESCRIPTION AND PURPOSE

A straw (or hay) bale sediment trap is a row of entrenched and anchored bales, which are installed so that they detain and filter sediment-laden runoff.

This type of sediment trap is intended to remove coarse sediment from small amounts of runoff before it leaves the site.

The use of straw bales for a sediment trap is not recommended in areas of concentrated flow, such as ditches; instead, rock check dams should be used.

EFFECTIVENESS

Straw bales are moderately effective for trapping medium and coarse-grained sediment particles. They are generally not effective for trapping fine silt or clay particles in runoff. And, if straw bales are improperly installed, they can actually increase the amount of erosion by concentrating runoff and causing gully erosion.

PLANNING CONSIDERATIONS

Straw bale sediment traps are generally used in locations where silt fences could be used. Silt fences are almost always preferable to straw bales because they have a lower failure rate, are more effective and have a longer life. Because straw bale sediment traps have been widely used in the past, their proper use and installation is presented here for the planner's consideration.

DESIGN RECOMMENDATIONS

1. The slope length above the bales should be 100 ft or less.

2. The bales should be installed on the contour with their ends flared upslope, as shown in Figure 6.34-1.

3. The bales should be composed of clean straw or hay.

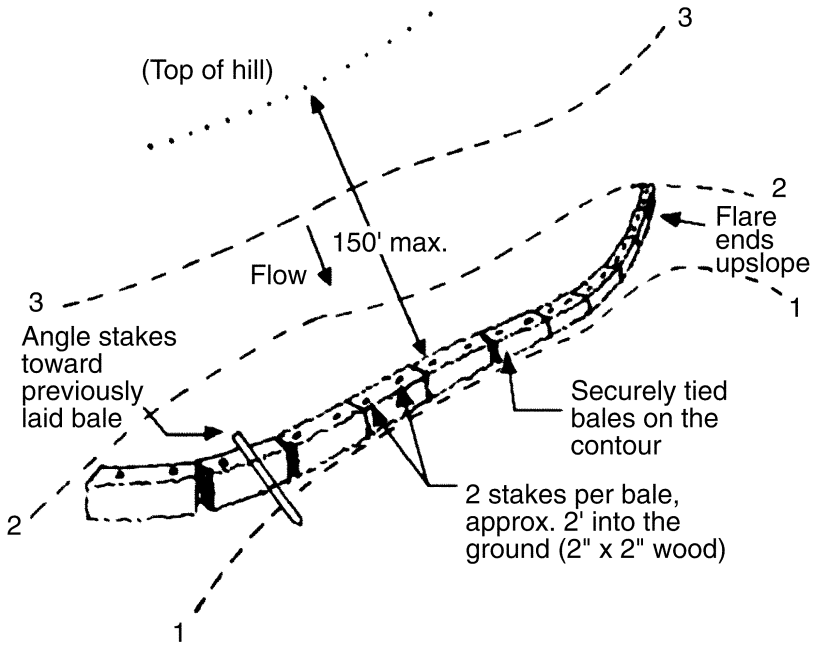


Figure 6.34-1 Placement and anchoring detail for straw bale sediment trap

4. The bales should be trenched 4 inches into the ground and should be staked with steel fence posts or 2" x 2" wood stakes. The stakes should be angled toward the previously laid bale.

5. Soil should be compacted on the upslope side of bales as shown in Figures 6.34-2 and 6.34-3. Loose straw should be wedged between the bales.

MAINTENANCE

Straw bale sediment traps should be inspected after every significant runoff event. Sediment deposits should be removed from behind the barrier as needed. Sediment should not be allowed to accumulate to a depth of more than one-half the height of the bales. Damaged, destroyed or rotted bales should be replaced immediately.

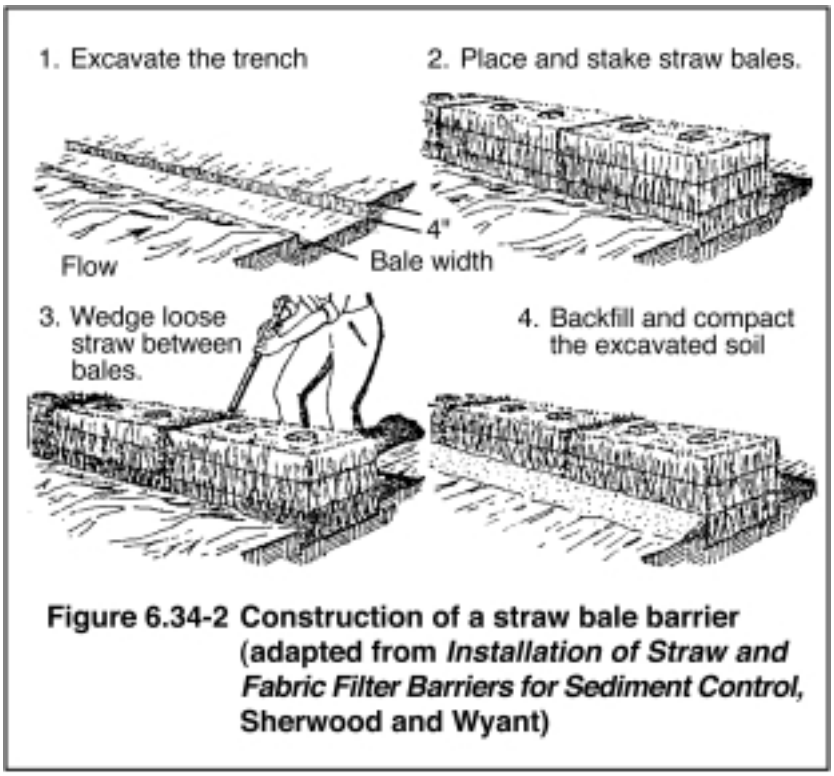


Figure 6.34-2 Construction of a straw bale barrier (adapted from *Installation of Straw and Fabric Filter Barriers for Sediment Control,* Sherwood and Wyant)

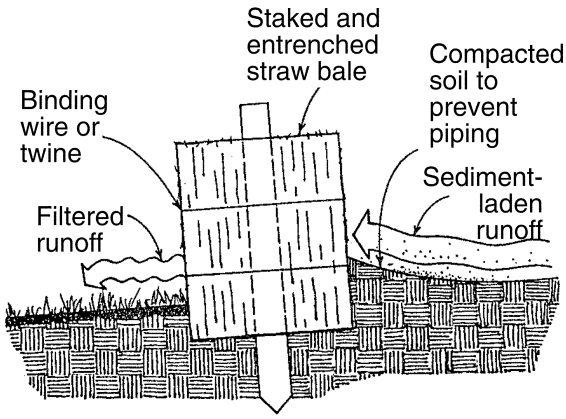
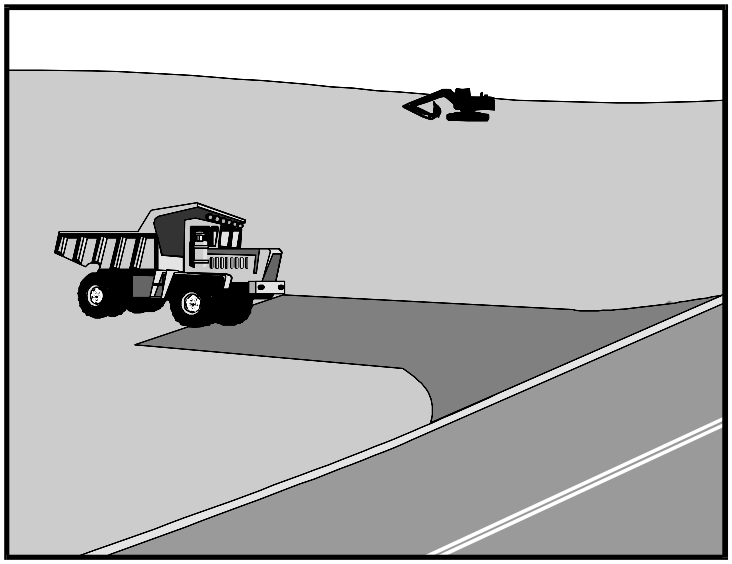
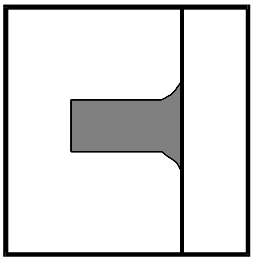


Figure 6.34-3 Cross section of a properly installed straw bale (source: *Michigan Soil Erosion and Sedimentation Control Guidebook*, 1975)

Stabilized Construction Entrance/Exit TC-1





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ● Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A stabilized construction access is a defined point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Appropriate Applications

- Use at construction sites:
  - where dirt or mud is tracked onto public roads.
  - adjacent to water bodies.
  - where poor soils are encountered.
  - where dust is a problem during dry weather conditions.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Site conditions will dictate design and need.

Design Guidelines and Considerations

- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.

- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment-trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. The use of asphalt concrete (AC) grindings for stabilized construction access/roadway should be approved by the MDT Environmental Services Bureau.
- Use of constructed or constructed/manufactured steel plates with ribs for entrance/exit access is allowed with written approval of the Engineer.
- Designate combination or single purpose entrances and exits to the construction site. Require all employees, subcontractors and others to use them.

Maintenance, Inspection, and Removal

- Inspect routinely for damage and assess effectiveness of the BMP. Repair if access is clogged with sediment or as directed by the Engineer.
- Keep all temporary roadway ditches clear.

SYMBOL: ——————— CELL SCEE

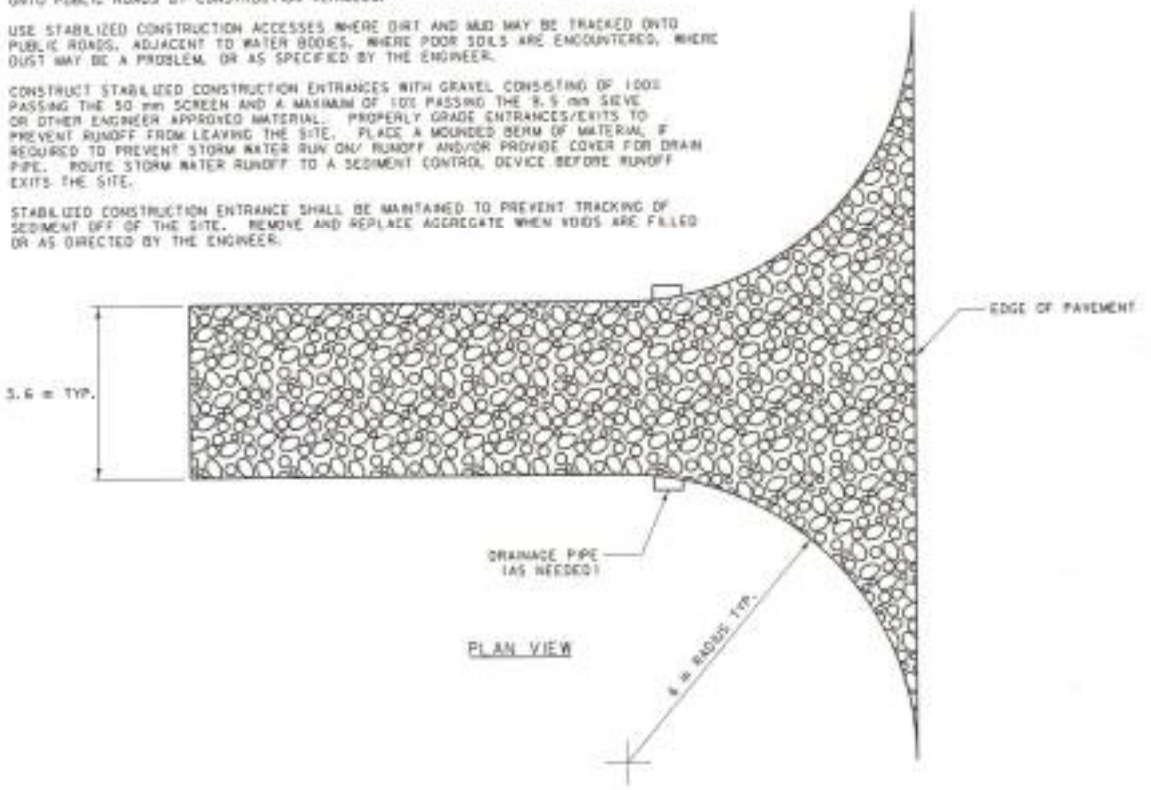
STABILIZED CONSTRUCTION ENTRANCE/EXIT TC-1:

A STABILIZED CONSTRUCTION ACCESS IS A DEFINED POINT OF ENTRANCE/EXIT TO A CONSTRUCTION SITE THAT IS STABILIZED TO REDUCE THE TRACKING OF MUD AND DIRT ONTO PUBLIC ROADS BY CONSTRUCTION VEHICLES.

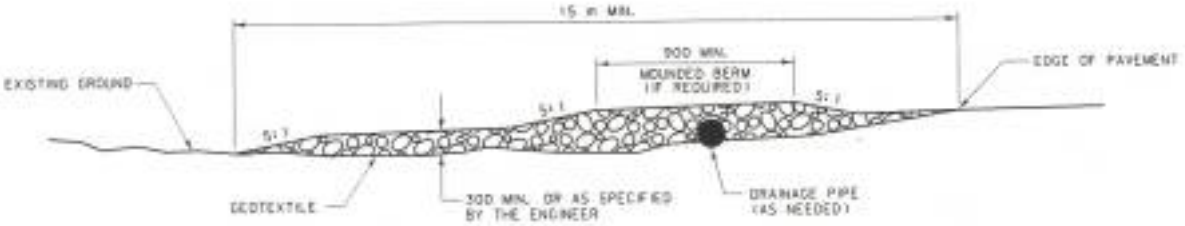
USE STABILIZED CONSTRUCTION ACCESSES WHERE DIRT AND MUD MAY BE TRACKED ONTO PUBLIC ROADS, ADJACENT TO WATER BODIES, WHERE POOR SOILS ARE ENCOUNTERED, WHERE DUST MAY BE A PROBLEM, OR AS SPECIFIED BY THE ENGINEER.

CONSTRUCT STABILIZED CONSTRUCTION ENTRANCES WITH GRAVEL CONSISTING OF 100% PASSING THE 50 mm SCREEN AND A MAXIMUM OF 10% PASSING THE 9.5 mm SIEVE OR OTHER ENGINEER APPROVED MATERIAL. PROPERLY GRADE ENTRANCES/EXITS TO PREVENT RUNOFF FROM LEAVING THE SITE. PLACE A MOUNDED BERM OF MATERIAL IF REQUIRED TO PREVENT STORM WATER RUN ON/ RUNOFF AND/OR PROVIDE COVER FOR DRAIN PIPE. ROUTE STORM WATER RUNOFF TO A SEDIMENT CONTROL DEVICE BEFORE RUNOFF EXITS THE SITE.

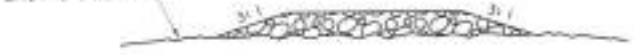
STABILIZED CONSTRUCTION ENTRANCE SHALL BE MAINTAINED TO PREVENT TRACKING OF SEDIMENT OFF OF THE SITE. REMOVE AND REPLACE AGGREGATE WHEN VOIDS ARE FILLED OR AS DIRECTED BY THE ENGINEER.



PLAN VIEW



PROFILE VIEW



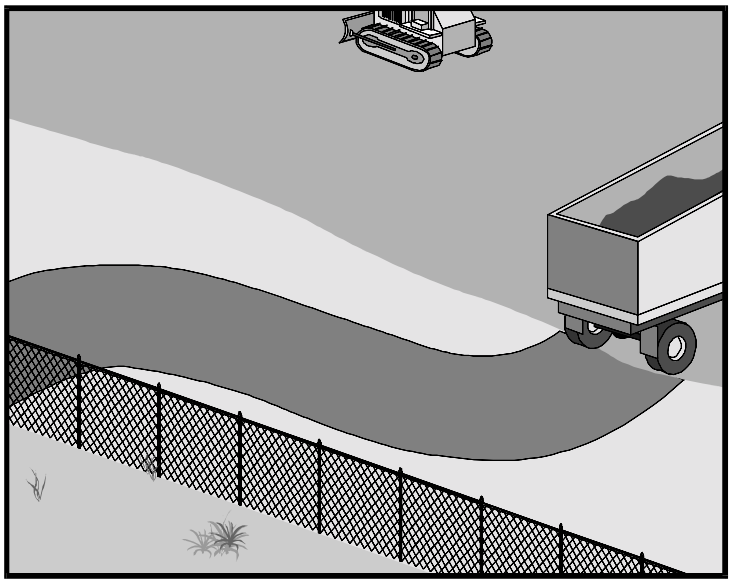
END VIEW

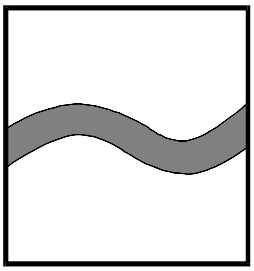
ALL DIMENSIONS ARE MILLIMETERS (mm) UNLESS OTHERWISE NOTED.

PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
STABILIZED CONSTRUCTION ENTRANCE/EXIT (TC-1)	
EFFECTIVE:	
CDM Camp Dresser & McKee Inc.	

Stabilized Construction Roadway TC-2





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ● Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A stabilized construction roadway is a temporary access road connecting existing public roads to a remote construction area. It is designed for the control of dust and erosion created by vehicular tracking.

Appropriate Applications

- Construction roadways and short-term detour roads:
  - Where mud tracking is a problem during wet weather.
  - Where dust is a problem during dry weather.
  - Adjacent to water bodies.
  - Where poor soils are encountered.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Materials will likely need to be removed prior to final project grading and stabilization.
- Site conditions will dictate design and need.
- May not be applicable to very short duration projects.
- Limit speed of vehicles to control dust.

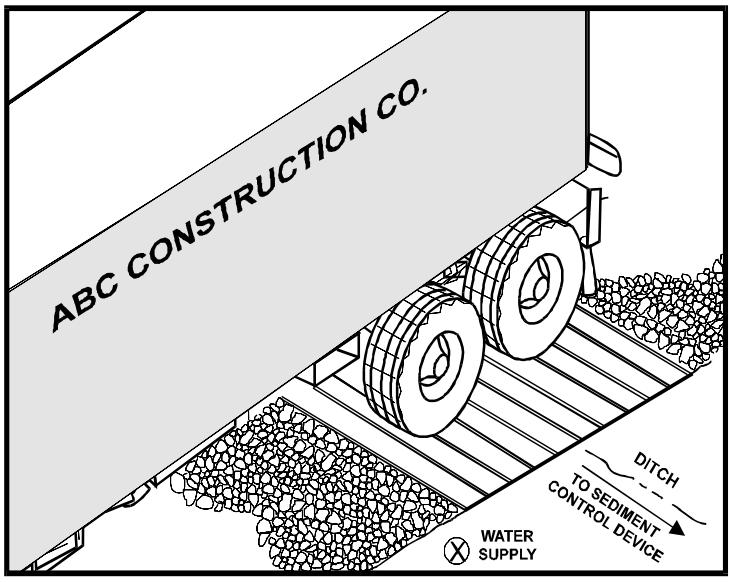
Design Guidelines and Considerations

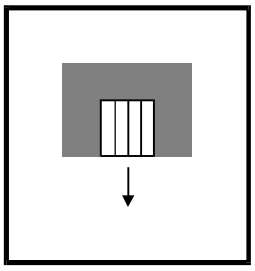
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.
- Stabilize roadway, using aggregate, AC, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or AC grindings for stabilized construction roadway should be approved by the MDT Environmental Services Bureau.
- Coordinate materials with those used for stabilized construction entrance/exit points.

Maintenance, Inspection, and Removal

- Inspect routinely for damage and repair as needed, or as directed by the Engineer.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.

Entrance/Outlet Tire Wash TC-3





BMP Objectives
- ● Soil Stabilization
- ● Sediment Control
- ● Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriage, and to prevent sediment from being transported onto public roadways.

Appropriate Applications

- Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Engineer.

Limitations

- Requires a supply of wash water.
- Requires a turnout or doublewide exit in order to keep entering vehicles from having to drive through the wash area.

Design Guidelines and Considerations

- Incorporate with a stabilized construction entrance/exit. See BMP TC-1, "Stabilized Construction Entrance/Exit."
- Construct on level ground when possible, on a pad of coarse aggregate, greater than 75 mm (3 in) but smaller than 150 mm (6 in).
- Wash rack shall be designed and constructed/manufactured for anticipated traffic loads.

- Provide a drainage ditch that will convey the runoff from the wash area to a sediment sump device. The drainage ditch shall be of sufficient grade, width, and depth to carry the wash runoff.

- Require that all employees, subcontractors, and others that leave the site with mud-caked tires and/or undercarriages use the wash facility.

- Constructed/Manufactured steel-ribbed plates may be used in lieu of rock.

Maintenance, Inspection, and Removal

- Remove accumulated sediment in wash rack and/or sediment sump to maintain system performance.

- Inspect routinely for damage and repair as needed.

SYMBOL: ———————— CELL EOTW

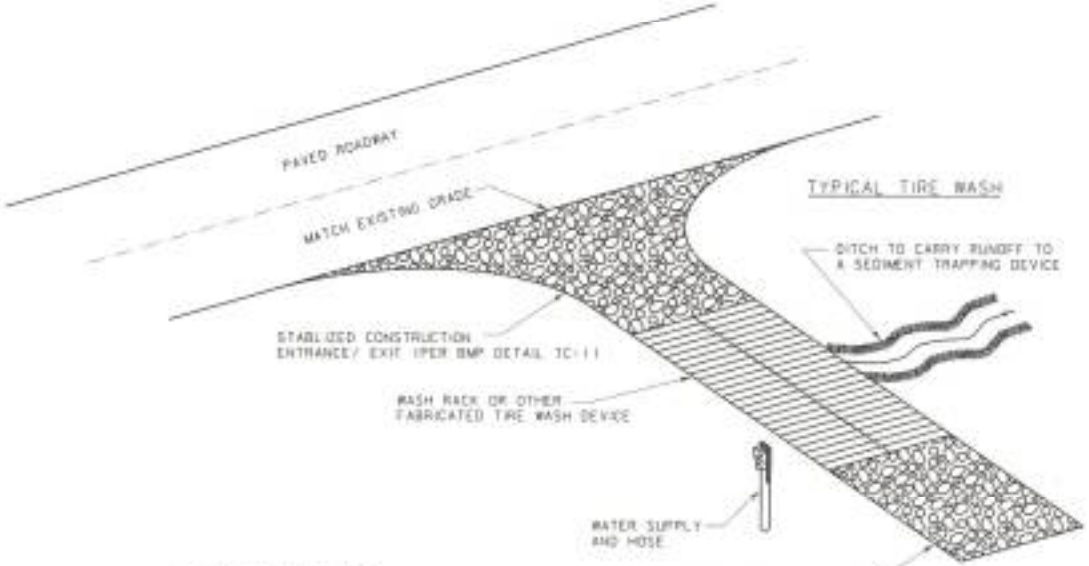
ENTRANCE/OUTLET TIRE WASH TC-3

A TIRE WASH IS AN AREA LOCATED AT A STABILIZED CONSTRUCTION ACCESS POINT WHERE PRESSURIZED WATER IS USED TO REMOVE SEDIMENT FROM TIRES AND UNDERCARRIAGE, AND TO PREVENT SEDIMENT FROM BEING TRANSPORTED ONTO PUBLIC ROADWAYS.

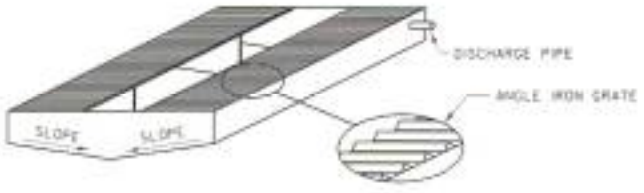
TIRE WASHES ARE MEANT TO BE USED ON A PROJECT-BY-PROJECT BASIS AND REQUIRES APPROVAL BY THE ENGINEER. THESE DEVICES REQUIRE A SUPPLY OF WASH WATER AND MAY REQUIRE A TURNOUT OR DOUBLE WIDE ACCESS.

FOLLOW BMP TC-1 FOR STABILIZED CONSTRUCTION ENTRANCES/EXITS. PROVIDE WASH RACK SUITABLE FOR SUPPORTING TRAFFIC LOADS. DIRECT WASH WATER FROM THE RACK, THROUGH A DRAINAGE DITCH, TO A SEDIMENT TRAP DEVICE. ENGINEERS APPROVAL IS REQUIRED PRIOR TO CONSTRUCTION.

TIRE WASH DEVICES OTHER THEN THOSE SHOWN MAY BE USED AS APPROVED BY THE ENGINEER.



STEEL GRATE WASH RACK



SELF-CONTAINED STEEL TIRE WASH

PRELIMINARY

REFERENCE STANDARD SPEC. SECTION 208	DWG. NO. 208-77
ENTRANCE/OUTLET TIRE WASH ITC-31	
EFFECTIVE:	

CDM Camp Dresser & McKee Inc.

ATTACHMENT B. REGULATORY NOTIFICATIONS

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United States Fish and Wildlife Service – Indiana Bat Tree Guidance

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From: Bressler, Richard Alan. (GRC-FDP0)[Firelake Arrowhead] <richard.bressler@nasa.gov>
Sent: Wednesday, January 15, 2020 4:34 PM
To: Sprinzl, Rich E. [US-US]
Subject: FW: GRC New Tree Clearing Reporting Requirement for USFWS
Attachments: Tree clearing tracking log.xlsx

FYI…

Rick Bressler | Firelake Construction, Inc.
Construction Manager | NASA Facilities Division
office: 419.621.2244 | mobile: 216.409.6698
email: richard.bressler@nasa.gov

From: Staschiak, Christine C. (GRC-FE00)
Sent: Tuesday, December 31, 2019 11:06 AM
To: Bronczek, Michael T. (GRC-FDO0) <michael.t.bronczek@nasa.gov>; Micham, Michael A. (GRC-FDO0) <michael.a.micham@nasa.gov>; Keating, Thomas C. (GRC-H000)[HX5 Sierra] <thomas.c.keating@nasa.gov>; Bressler, Richard Alan. (GRC-FDP0)[Firelake Arrowhead] <richard.bressler@nasa.gov>
Cc: DeGreen, John J. (GRC-FDS0) <john.degreen@nasa.gov>; Evanina, Ransook C. (GRC-FE00) <ransook.c.evanina@nasa.gov>; Myers, Christie J. (GRC-FE00) <christie.myers@nasa.gov>; Walker, Aaron M. (GRC-FE00) <aaron.m.walker@nasa.gov>; Doglio, James A. (GRC-FDP0) <james.a.doglio@nasa.gov>
Subject: GRC New Tree Clearing Reporting Requirement for USFWS

Good afternoon,

I wanted to reach out and provide a few details regarding the annual tree removal consultation I completed with USFWS for FY20. This consultation is completed for both LF and PBS indicating trees ≥3 inches dbh are only removed between October 1 and March 31 (excluding the specific clearance alongside the LF hill). A few new requirements (**) have been provided by USFWS which I have broken down below. Please let me know if you have any questions regarding the information.

LF:

- Clearing outside of the timeframe of October 1 – March 31 must await consultation with USFWS (exempting the 123 acres following the 2019 survey expiring 3.31.2024)
    - Requirements provided earlier this year for the exempted area still apply
- USFWS will provide guidance of whether an emergence survey or mist net survey is required
- **Any trees cut during the unrestricted timeframe must be reported to me in order to conduct an annual consultation summary. This includes date of removal, location, number/acreage of trees removed and the reason for removal

PBS:

- Clearing outside of the timeframe of October 1 – March 31 is not allowed due to the positive identification of the federally endangered Indiana bat. Clearance could result in the incidental take, resulting in a violation of the Endangered Species Act (civil & criminal penalties)

- **Any trees cut during the unrestricted timeframe must be reported to me in order to conduct an annual consultation summary. This includes date of removal, location, number/acreage of trees removed and the reason for removal
- **Work that is within 660 feet of an eagle's nest or within direct line-of-site of a nest is restricted from January 15 - July 31 (egg-laying period until the young fledge).
    - Nest located on Ransom Rd and near Magazine 9189 (41°21'52.65"N, 82°39'46.58"W)
    - If this request cannot be met, a take permit for the project may be necessary
- **USFWS recommends no tree clearing within 660 feet of a bald eagle nest or within woodlot supporting a nest tree

As noted above, both sites must report the quantity of trees removed as part of GRC's annual consultation. Without this information I will not be able to renew our consultation, therefore, limiting future tree removal. I have attached a spreadsheet that can be utilized to log this information.

Please filter this email as deemed appropriate.

Thanks in advance and happy holidays!

Christine Staschiak
Environmental Management Office
NASA Glenn Research Center
21000 Brookpark Rd. MS 6-7
Cleveland, OH 44135
Office: 216-433-6662

Date	Location	Activity/Project	Acreage	# of trees removed (> 3 dbh)	Comments
1.14.20-1.22.20	Map provided	Firing Ranges 3 & 4 Remediation Project	0.58	14	Mostly Brush
1.21.20-2.21.20	Map provided	ECCL Remediation Project	20.79	387	Mostly Brush
3.2.20-3.9.20	Map provided	Firing Range 5 & CDP	1.38	29	Mostly Brush

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From: Staschiak, Christine C. (GRC-FE00) <christine.c.staschiak@nasa.gov>
Sent: Friday, January 17, 2020 2:26 PM
To: Sprinzl, Rich E. [US-US]
Cc: Brodt, John P. (GRC-FE00); Bressler, Richard Alan. (GRC-FDP0)[Firelake Arrowhead]; Dirk Doege; Jeremy Soenen; Adams, Heather R. [US-US]; Lowak, David J. [US-US]
Subject: RE: GRC New Tree Clearing Reporting Requirement for USFWS

Hi Rich,

Yes, all three remediation sites are clear from the two known eagle nests.

Have a great weekend!
Christine

From: Sprinzl, Rich [mailto:RICHARD.E.SPRINZL@leidos.com]
Sent: Friday, January 17, 2020 2:19 PM
To: Staschiak, Christine C. (GRC-FE00) <christine.c.staschiak@nasa.gov>
Cc: Brodt, John P. (GRC-FE00) <john.p.brodt@nasa.gov>; Bressler, Richard Alan. (GRC-FDP0)[Firelake Arrowhead] <richard.bressler@nasa.gov>; Dirk Doege <dirk4work@yahoo.com>; Jeremy Soenen <jsoenen@arrowhead-usa.com>; Adams, Heather R. <HEATHER.R.ADAMS@leidos.com>; Lowak, David J. <DAVID.J.LOWAK@leidos.com>
Subject: [EXTERNAL] RE: GRC New Tree Clearing Reporting Requirement for USFWS

Christine,
Please provide confirmation that Firing Range 3&4, Firing Range 5/CDP, and ECCL Firing Range (see attached site map) are clear from known eagle nests.

-nest near Magazine 9189 appears to be >1 mile away.
-Nearest Ransom Road intersection is >1 mile from Firing Range 3&4.

Field crews will be made aware to notify NASA (you) if any eagles or suspect nests are observed during clearing or soil removal.

Thank you,
Rich Sprinzl, P.E. | Leidos
Environmental Engineer | Environmental Planning and Restoration Portfolio
phone: 330.405.5808
mobile: 330.348.1378
richard.e.sprinzl@leidos.com | leidos.com/civil

From: Staschiak, Christine C. (GRC-FE00)
Sent: Tuesday, December 31, 2019 11:06 AM
To: Bronczek, Michael T. (GRC-FDO0) <michael.t.bronczek@nasa.gov>; Micham, Michael A. (GRC-FDO0) <michael.a.micham@nasa.gov>; Keating, Thomas C. (GRC-H000)[HX5 Sierra] <thomas.c.keating@nasa.gov>; Bressler, Richard Alan. (GRC-FDP0)[Firelake Arrowhead] <richard.bressler@nasa.gov>

Cc: DeGreen, John J. (GRC-FDS0) <john.degreen@nasa.gov>; Evanina, Ransook C. (GRC-FE00) <ransook.c.evanina@nasa.gov>; Myers, Christie J. (GRC-FE00) <christie.myers@nasa.gov>; Walker, Aaron M. (GRC-FE00) <aaron.m.walker@nasa.gov>; Doglio, James A. (GRC-FDP0) <james.a.doglio@nasa.gov>
Subject: GRC New Tree Clearing Reporting Requirement for USFWS

Good afternoon,

I wanted to reach out and provide a few details regarding the annual tree removal consultation I completed with USFWS for FY20. This consultation is completed for both LF and PBS indicating trees ≥3 inches dbh are only removed between October 1 and March 31 (excluding the specific clearance alongside the LF hill). A few new requirements (**) have been provided by USFWS which I have broken down below. Please let me know if you have any questions regarding the information.

LF:

- Clearing outside of the timeframe of October 1 – March 31 must await consultation with USFWS (exempting the 123 acres following the 2019 survey expiring 3.31.2024)
    - Requirements provided earlier this year for the exempted area still apply
- USFWS will provide guidance of whether an emergence survey or mist net survey is required
- **Any trees cut during the unrestricted timeframe must be reported to me in order to conduct an annual consultation summary. This includes date of removal, location, number/acreage of trees removed and the reason for removal

PBS:

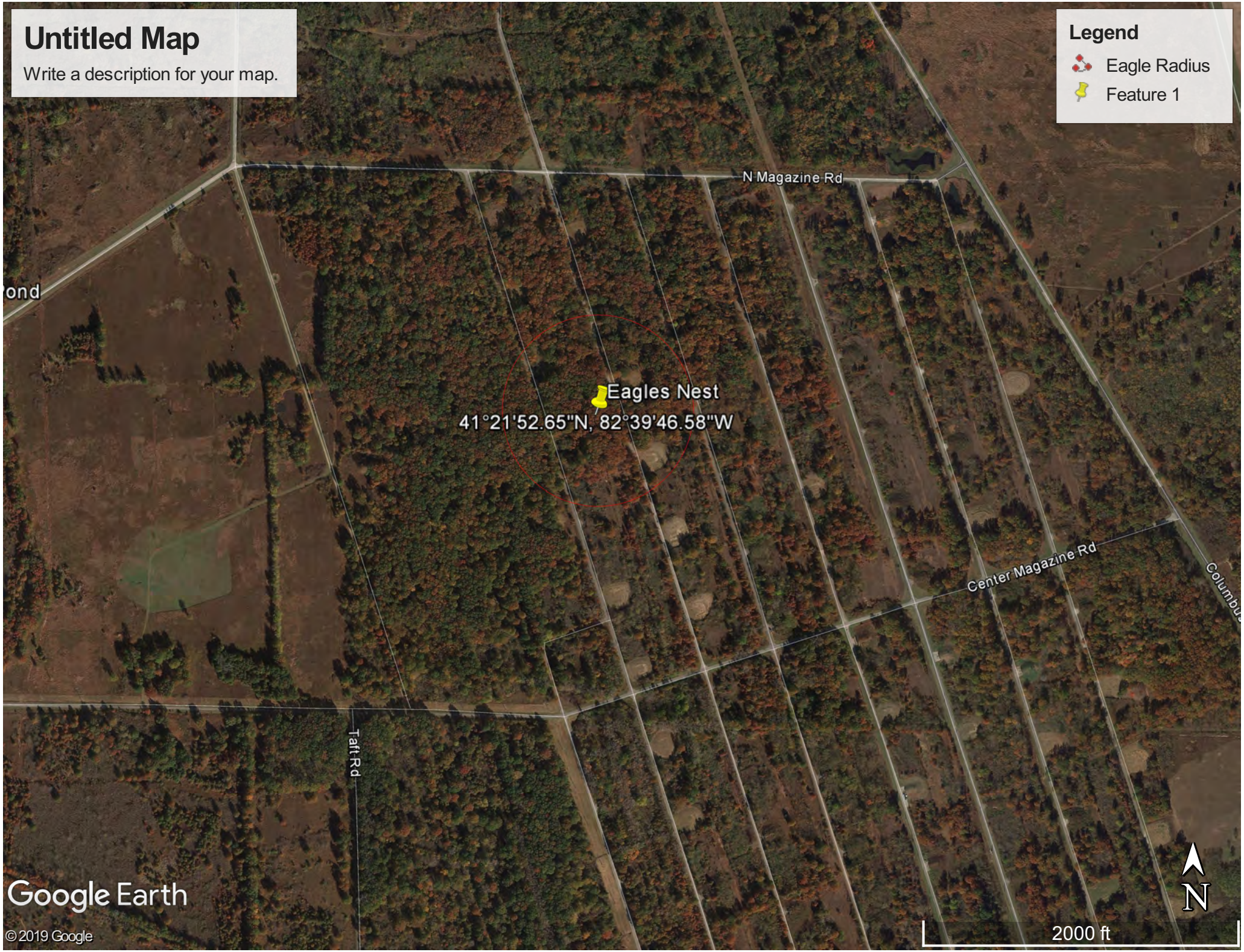
- Clearing outside of the timeframe of October 1 – March 31 is not allowed due to the positive identification of the federally endangered Indiana bat. Clearance could result in the incidental take, resulting in a violation of the Endangered Species Act (civil & criminal penalties)
- **Any trees cut during the unrestricted timeframe must be reported to me in order to conduct an annual consultation summary. This includes date of removal, location, number/acreage of trees removed and the reason for removal
- **Work that is within 660 feet of an eagle's nest or within direct line-of-site of a nest is restricted from January 15 - July 31 (egg-laying period until the young fledge).
    - Nest located on Ransom Rd and near Magazine 9189 (41°21'52.65"N, 82°39'46.58"W)
    - If this request cannot be met, a take permit for the project may be necessary
- **USFWS recommends no tree clearing within 660 feet of a bald eagle nest or within woodlot supporting a nest tree

As noted above, both sites must report the quantity of trees removed as part of GRC's annual consultation. Without this information I will not be able to renew our consultation, therefore, limiting future tree removal. I have attached a spreadsheet that can be utilized to log this information.

Please filter this email as deemed appropriate.

Thanks in advance and happy holidays!

Christine Staschiak
Environmental Management Office
NASA Glenn Research Center
21000 Brookpark Rd. MS 6-7
Cleveland, OH 44135
Office: 216-433-6662


Untitled Map
Write a description for your map.
Legend
Eagle Radius
Feature 1
N Magazine Rd
Eagles Nest
41°21'52.65"N, 82°39'46.58"W
Center Magazine Rd
Taft Rd
Google Earth
© 2019 Google
N
2000 ft

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ATTACHMENT C. DESIGN DRAWINGS

List of Design Drawings:

- Drawing C-1. Title Sheet
- Drawing C-2. General Notes
- Drawing C-3. Extent of Impacted Soils Removal and Construction Debris Removal
- Drawing C-4. Site Preparation Plan & Construction Site Plan
- Drawing C-5. Removal and Restoration Plan for Earthen Berm, CDP, and Hot Spot Excavations
- Drawing C-6. Verification Sampling Plan
- Drawing C-7. Details
- Drawing C-8. Traffic Management Plan

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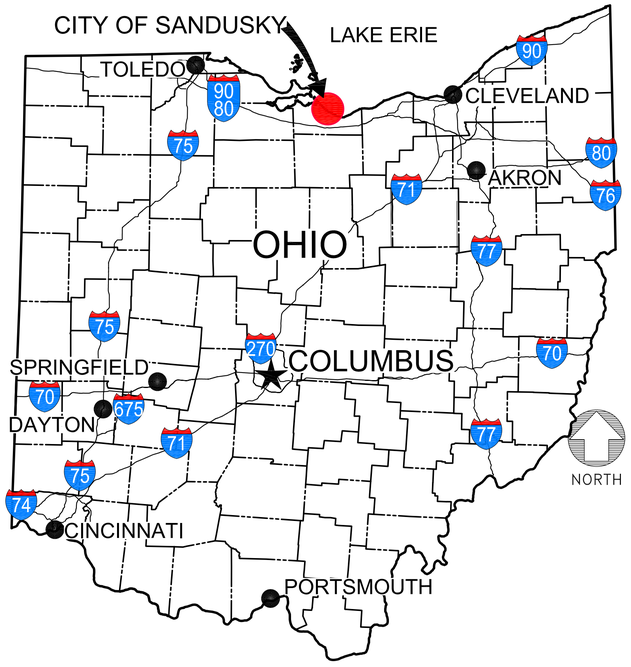
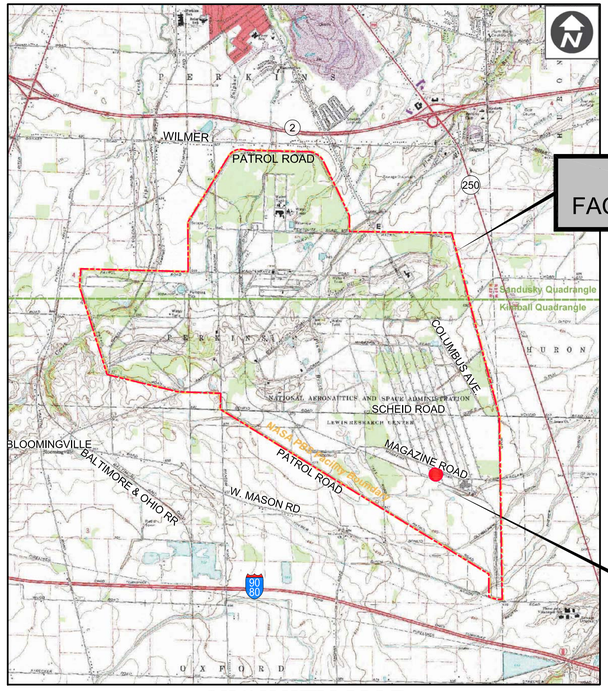
PLUM BROOK STATION FIRING RANGE 5 AND CONSTRUCTION DEBRIS PILE REMOVAL ACTION WORK PLAN SANDUSKY, OHIO



LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

THIS DESIGN PACKAGE ADDRESSES EXCAVATION, AND OFF-SITE DISPOSAL OF APROXIMATELY 602 TONS OF SOIL AND 1,812 TONS OF CONSTRUCTION DEBRIS, AS STATED IN THE SELECTED ALTERNATIVE IN THE FINAL RANGE 5 AND CDP REMOVAL SITE EVALUATION REPORT, NASA PLUM BROOK STATION, SANDUSKY, OHIO (DATED DECEMBER 13, 2019, AND SET FORTH IN THE FINAL ACTION MEMORANDUM.

SCOPE OF WORK

National Aeronautics and Space Administration
Plum Brook Station
Sandusky, Ohio

leidos

DESIGNED BY: R. SPRINZL
DRAWN BY: P. HOLM
CHECKED BY: A. MODAK
APPROVED BY:
DATE: 2/6/20
DRAWING NO: C:\18013\DWGS T18-PBS-FR5-C-1

REV.	DATE	DESCRIPTIONS	DRAWN BY	CHECKED BY

PROJECT: FIRING RANGE 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: TITLE SHEET

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLUM BROOK STATION

leidos

C-1
DRAWING NUMBER

GENERAL NOTES

1. HEREINAFTER, THE TERM "CONTRACTOR" IN THESE DESIGN DRAWINGS SHALL REFER TO THE ENTITIES (I.E., THE CONTRACTOR AND/OR ITS SUBCONTRACTOR[S]) IMPLEMENTING THE FIRING RANGE 5 & CDP REMOVAL ACTION DESIGN UNLESS OTHERWISE NOTED.
2. THE CONTRACTOR SHALL COMPLETE ALL ACTIVITIES ASSOCIATED WITH THE PROJECT IN COMPLIANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS AND REQUIREMENTS.
3. THE CONTRACTOR SHALL EXECUTE ALL REMEDIAL ACTIVITIES IN ACCORDANCE WITH THE FIRING RANGE 5 & CDP REMOVAL ACTION WORK PLAN, DRAWINGS, AND ATTACHMENTS.
4. THE CONTRACTOR SHALL PARTICIPATE IN WEEKLY PROJECT STATUS MEETINGS WITH THE NASA GRC TECHNICAL MONITOR (TM).
5. THE CONTRACTOR SHALL SUPPLY ALL EQUIPMENT, MATERIALS, AND LABOR TO PERFORM THE CONTRACT REQUIREMENTS INCLUDING ALL WORKER SAFETY EQUIPMENT.
6. THE CONTRACTOR SHALL COMPLY WITH NASA GRC SITE ACCESS PROTOCOLS.
7. ACCESS TO NASA GRC SHALL BE THROUGH THE MAIN GATE LOCATED OFF SCHEID ROAD/ROUTE 250 . THIS GATE IS GUARDED AND SHALL REQUIRE ADDITIONAL TIME TO GAIN ACCESS. THE CONTRACTOR SHALL BE REQUIRED TO ALLOW FOR DELAYS WITHOUT ADDITIONAL CHARGES TO NASA GRC.
8. TOPOGRAPHIC MAPPING DATA IS BASED ON NASA GRC'S UNDERGROUND RECORD DRAWINGS CONSISTENT WITH NASA GRC'S LOCAL GRID COORDINATE SYSTEM. MINOR DISCREPANCIES BETWEEN DRAWINGS AND ACTUAL FIELD CONDITIONS SHALL NOT BE CAUSE FOR ADDITIONAL PAYMENT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY EXISTING CONDITIONS, ELEVATIONS, AND DIMENSIONS PRIOR TO THE START OF CONSTRUCTION AND NOTIFY NASA GRC IF THERE IS A CONFLICT.
9. ALL EXISTING GRADE DIMENSIONS AND EVALUATIONS ARE IN FEET AND ARE APPROXIMATE.
10. THE CONTRACTOR SHALL INSTALL CONSTRUCTION SIGNS AT THE LOCATIONS INDICATED ON DRAWING C-8 THREE DAYS PRIOR TO INITIATION OF SITE PREPARATION ACTIVITIES.
11. THE CONTRACTOR SHALL CONTACT THE NASA GRC TM AT LEAST 14 DAYS PRIOR TO CONSTRUCTION ACTIVITIES TO COORDINATE UTILITY SURVEY AND CLEARANCES. THE IDENTIFICATION AND LOCATION OF UTILITIES ON THESE DRAWINGS IS BASED ON BEST AVAILABLE INFORMATION AT TIME OF PREPARATION.
12. EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO INITIATION OF ANY CONSTRUCTION ACTIVITY THAT MAY CAUSE EROSION OR SEDIMENTATION. EROSION CONTROL MEASURES SHALL BE MAINTAINED AND REINSTALLED AS NECESSARY THROUGHOUT THE DURATION OF CONSTRUCTION AND RESTORATION ACTIVITIES.
13. AT A MINIMUM THE CONTRACTOR SHALL PLACE EROSION CONTROLS WHERE INDICATED ON THE DRAWINGS. ADDITIONAL CONTROLS MAY BE REQUIRED, DEPENDING ON SITE CONDITIONS. EROSION CONTROL MEASURES SHALL MEET ALL FEDERAL AND STATE REQUIREMENTS.
14. THE CONTRACTOR SHALL OBTAIN POTABLE WATER FOR CONSTRUCTION PURPOSES FROM EXISTING NASA GRC FACILITIES. ANY HOSE CONNECTED TO A FIXED POTABLE WATER SUPPLY MUST BE EQUIPPED WITH BACKFLOW PREVENTION IN ACCORDANCE WITH NASA GRC REQUIREMENTS. COORDINATION WITH THE NASA GRC TM SHALL BE INITIATED DURING MOBILIZATION IN ORDER TO PROVIDE SUFFICIENT TIME TO OBTAIN ACCESS TO THE IDENTIFIED POTABLE WATER SUPPLY.
15. IF UNEXPECTED MATERIALS ARE DISCOVERED DURING REMEDIAL ACTIVITIES, THE CONTRACTOR SHALL STOP WORK IMMEDIATELY AND NOTIFY THE NASA GRC TM. THE CONTRACTOR SHALL NOT RESUME WORK UNTIL APPROVAL IS GRANTED BY THE NASA GRC TM AND SITE SAFETY AND HEALTH OFFICER.
16. SHOULD THE CONTRACTOR DISCOVER UTILITIES NOT SHOWN ON THE DRAWINGS, EXCAVATION ACTIVITIES SHALL STOP IMMEDIATELY AND THE CONTRACTOR SHALL NOTIFY THE NASA GRC TM. NASA GRC PERSONNEL SHALL DETERMINE THE DISPOSITION OF THE DISCOVERED UTILITY. THE CONTRACTOR SHALL NOT RESUME WORK UNTIL APPROVAL IS GRANTED BY THE NASA GRC TM.
17. NO WORK SHALL TAKE PLACE DURING INCLEMENT WEATHER TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT RUNOFF. THE CONTRACTOR SHALL BE REQUIRED TO ALLOW FOR DELAYS WITHOUT ADDITIONAL CHARGES TO NASA GRC.
18. DURING INSTANCES OF HIGH WINDS, WHICH RESULT IN EXCESSIVE DUST, NASA GRC RESERVES THE RIGHT TO REQUIRE ADDITIONAL DUST CONTROL OR TO STOP WORK. THE CONTRACTOR SHALL BE REQUIRED TO ALLOW FOR DELAYS WITHOUT ADDITIONAL CHARGES TO NASA GRC.
19. ALL ON-ROAD HAUL TRUCKS WILL ADHERE TO ODOT TRANSPORTATION GUIDELINES. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING AND VERIFYING TRUCKS DO NOT LEAVE THE PROJECT SITE IN EXCESS OF 80,000 LBS GROSS WEIGHT. ALL TRUCKS WILL BE WEIGHED EMPTY ANF FULL USING NASA PBS TRUCK SCALE NEAR MAIN GATE. PORTABLE SCALE WILL BE PROVIDED BY THE CONTRACTOR IF NECESSARY.
20. THE CONTRACTOR SHALL NOT ALLOW HAUL TRUCKS TO TRACK SOIL/MUD ONTO NASA GRC OR PUBLIC ROADWAYS. THE CONTRACTOR SHALL INSPECT ALL HAUL TRUCKS WITHIN THE INSPECTION AREA BEFORE RELEASE TO PUBLIC ROADS.
21. THE CONTRACTOR IS RESPONSIBLE FOR IMMEDIATELY REMOVING ANY MATERIAL INCIDENTALLY SPILLED ON ROADWAYS OR TRACKED BY EQUIPMENT AND TRUCKS RELATED TO THE IMPLEMENTATION OF THIS SOIL REMOVAL DESIGN.
22. THE CONTRACTOR SHALL COORDINATE ALL WASTE MANAGEMENT ACTIVITIES WITH THE NASA GRC TM AND THE NASA GRC WASTE MANAGEMENT TEAM. WASTE HANDLING AND DISPOSAL ACTIVITIES SHALL BE CONDUCTED IN ACCORDANCE WITH APPLICABLE STATE AND FEDERAL REGULATIONS FOR WASTE MATERIALS.
23. ALL EXCAVATED SOIL AND CONSTRUCTION DEBRIS WASTE SHALL BE DISPOSED AT AN APPROPRIATE LANDFILL FACILITY APPROVED BY NASA.
24. ALL HAUL TRUCKS TRAVELING ON PUBLIC ROADS TO A DISPOSAL FACILITY SHALL HAVE A BILL OF LADING OR MANIFEST SIGNED BY THE APPROPRIATE NASA GRC PERSONNEL.
25. THE CONTRACTOR RESPONSIBLE FOR IMPLEMENTING CONSTRUCTION ACTIVITIES IS REQUIRED TO PREPARE AN ADDENDUM TO THE SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP) IN ACCORDANCE WITH NASA GRC TEMPLATE AND OSHA GUIDELINES. THE ADDENDUM SHOULD BE SUBMITTED FOR REVIEW AT LEAST 10 DAYS PRIOR TO INITIATION OF ANY REMEDIAL ACTION ACTIVITIES. THE ADDENDUM SHALL BE REVIEWED AND APPROVED BY NASA GRC PRIOR TO INITIATION OF ANY REMEDIAL ACTION ACTIVITIES.
26. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEDERAL, STATE, AND LOCAL SAFETY REQUIREMENTS FOR THE PROTECTION OF ALL PERSONS (INCLUDING EMPLOYEES) AND PROPERTY. IT IS ALSO THE CONTRACTOR'S RESPONSIBILITY TO INITIATE, MAINTAIN, AND SUPERVISE ALL SAFETY REQUIREMENTS, PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK AND IN ACCORDANCE WITH THE FIRING RANGE 5 & CDP REMOVAL ACTION DESIGN HASP.
27. ALL CONTRACTOR EMPLOYEES WORKING ON-SITE MUST ATTEND DAILY HEALTH AND SAFETY TAILGATE MEETINGS PRIOR TO THE START OF THE DAY'S CONSTRUCTION ACTIVITIES.
28. IF THE CONTRACTOR STORES FUEL ON SITE, THAT FUEL SHALL BE STORED WITHIN A DOUBLE CONTAINMENT VESSEL MANUFACTURED FOR FUEL STORAGE. PLASTIC LINED STRUCTURES ARE NOT ACCEPTABLE FOR THE DOUBLE CONTAINMENT. FUEL STORAGE SHALL COMPLY WITH CHAPTER 22 OF THE NASA GRC ENVIRONMENTAL PROGRAMS MANUAL AND NASA GRC TECHNICAL STANDARD 8719.11.
29. CONTAINERS WILL BE DOUBLE LEAK-PROOF WITH A REGULATORY STANDARD AMOUNT OF FREE-BOARD. ALL FUEL CONTAINERS AND/OR TANKS WILL BE PROPERLY PLACARDED AND SECURED ACCORDING TO OSHA AND DOT REGULATIONS AND ADEQUATE SPILL CLEANUP EQUIPMENT AND MATERIALS WILL BE MAINTAINED AT THE FUEL-STORAGE SITE.
30. THE CONTRACTOR WILL PROVIDE ALL NECESSARY ON-SITE SPILL EQUIPMENT (E.G., ABSORBENT BLANKETS, PPE, SHOVELS, CONTAINERS). ALL CONTRACTOR EMPLOYEES ON-SITE SHALL BE TRAINED ON PROPER USE OF SPILL EQUIPMENT AND CLEAN-UP OF MATERIAL IMPACTED BY A SPILL.
31. A SPILL KIT AND FIRST AID KIT SHALL BE MAINTAINED ON-SITE BY THE CONTRACTOR DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR IS RESPONSIBLE FOR KEEPING THE SPILL KIT AND FIRST AID KIT SUPPLIED.
32. THE CONTRACTOR IS TO ENSURE THIS REMEDIAL DESIGN AND HASP IS PRESENT AT ALL TIMES ON-SITE DURING CONSTRUCTION ACTIVITIES.
33. THE CONTRACTOR WILL USE A PBS APPROVED SEED MIXTURE FOR PERMANENT COVER OF PROJECT SITE DISTURBED DURING REMOVAL ACTION ACTIVITIES. PBS APPROVED SEED MIXTURE PRESENTS THE SEED MIXTURE AND APPLICATION SPECIFICATIONS.

MATERIAL NOTES

1. BACKFILL

BACKFILL MATERIAL WILL MEET NASA GRC ENVIRONMENTAL PROGRAMS MANUAL CHAPTER 20 (HANDLING, REUSE, AND DISPOSAL OF SOIL).

2. BACKFILLING

BACKFILLING SHALL BE COMPLETED AS NOTED IN SECTION 7 OF THIS FIRING RANGE RA WORK PLAN AND ON DRAWING C-5.

3. EROSION AND SEDIMENTATION CONTROL MEASURES ON DRAWINGS C-4 & C-7.

PLACEMENT AND ANCHORING OF EROSION AND SEDIMENTATION CONTROL STRUCTURES SHALL BE COMPLETED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND DRAWINGS C-4 AND C-7.

PBS APPROVED SEED MIXTURES

SEED TYPE	MIXTURE %	SEED RATE (lbs/acre)	lbs/1000 ft^2
CREEPING RED FESCUE	50	25 - 50	1 - 1-1/4
DOMESTIC ANNUAL RYEGRASS	50	25 - 50	1 - 1-1/4

SPECIFICATIONS:

1. ADD 20 LBS/ACRE OF ANNUAL RYEGRASS (LOLIUM MULTIFLORUM) TO THE BROADCAST MIX.
2. MULCH WITH A MINIMUM OF 3 BALES OF STRAW PER 1,000 SF. OR ALTERNATE METHOD CAN BE HYDROMULCH.

BACKFILL AND MISCELLANEOUS MATERIALS

TOTAL BACKFILL MATERIAL (yd^3)		CLEAN FILL (yd^3)	TOP SOIL (6")(yd^3)
EARTHEN BACKSTOP BERM	23	0	23
HOTSPOTS	76	62	14

NO. 2 GRANULAR FILL	CUBIC YARDS (yd^3)
TRUCK TURN AROUND (12")	40

SILT FENCE	LINEAR FEET
	1,500
SAFETY FENCE	150

LEGEND

- ROADWAY
- GRAVEL ROAD
- WETLAND AREA
- DRAINAGE DITCH
- SOIL BORING WHERE EXCEEDED RSL
- P-1 PHOTOGRAPH WITH VIEW DIRECTION
- 1 COORDINATE LOCATION WITH POINT NO.
- HOTSPOT SOIL REMOVAL AREA
- EARTHEN BACKSTOP REMOVAL
- SF SF SILT FENCE
- SAFETY FENCE
- CONSTRUCTION LAYDOWN AREA
- 1 / C-7 DETAIL WITH DRAWING SHEET NUMBER

DRAWING INDEX

SOIL REMOVAL - VOLUME ESTIMATES

EARTHEN BACKSTOP REMOVAL	Height (ft)	Width (ft)	Length (ft)	Area (SF)	Volume (CF)	Volume (CY)	Tons**	COCs
Earthen Backstop	8	10	125	1250	10,000	370*	500	cPAHs
						Subtotal	**500**	

HOT SPOT SOIL REMOVAL	Depth bgs (ft)	Width (ft)	Length (ft)	Area (SF)	Volume (CF)	Volume (CY)	Tons**	COCs
Soil hotspot excavation (F5T-SB005, -SB007)	4	10	25	250	1,000	37	50	cPAHs
Soil hotspot excavation (F5T-SB010, -SB014)	2	10	30	300	600	22	30	cPAHs
Soil hotspot excavation (FR5-5)	2	15	15	225	450	17	5	cPAHs
						Subtotal	**102**	

CONSTRUCTION DEBRIS PILE	Depth bgs (ft)	Width (ft)	Length (ft)	Area (SF)	Volume (CF)	Volume (CY)	Tons**	COCs
Debris Pile 1 (Concrete Construction Rubble w/ ACM & LBP Materials)	NA	NA	NA	NA	18,000	667	1,267	ACM & LBP
Debris Pile 2 (Sandblast Grit w/LBP)	NA	NA	NA	NA	10,000	370	500	LBP
Debris Pile 3 (Sandblast Grit w/LBP)	NA	NA	NA	NA	905	34	45	LBP
						Subtotal	**1,812**	

*BASED ON THE ACTUAL SLOPE VARIATION ALONG THE LENGTH OF THE BACKSTOP AND ACCOUNTING FOR SOIL BULKING (SWELL) FACTOR OF UP TO 30%, THE ACTUAL AMOUNT OF SOIL REMOVED FROM THE BACKSTOP MAY BE LOWER (E.G., 275 - 300 CY). THE 370 CY ESTIMATED FOR REMOVAL INCLUDES ADDITIONAL CONTINGENCY TO ACCOUNT FOR ANY UNEXPECTED SITE CONDITIONS.

** ASSUMES DENSITY OF SOIL AND SAND/GRIT AT 1.35 TONS/CY AND DENSITY OF CONCRETE RUBBLE AT 1.9 TONS/CY

Total Soil (tons)	**602**
Total Construction Debris (tons)	**1,812**

DESIGNED BY: R. SPRINZL
DRAWN BY: P. HOLM
APPROVED BY:
CHECKED BY: A. MODAK

REV.	DATE	DESCRIPTIONS	DRAWN BY	CHECKED BY

DATE: 2/21/20
DRAWING NO: C:\18013\DWGS T18-PBS-FR5-C-2

FIRING RANGE 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: GENERAL NOTES

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
PROJECT: PLUM BROOK STATION

leidos

C-2

DRAWING NUMBER

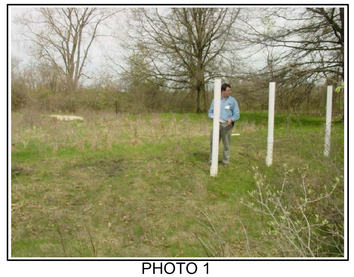


PHOTO 1
(PCV Pipe Marking 75 ft Shooting Area at FR-5 Impact Berm in background)

PHOTO 2
(Construction Debris Pile Rubble at FR-5)

PHOTO 3
(Lead-Covered Asbestos Panels found in Construction Debris Pile)

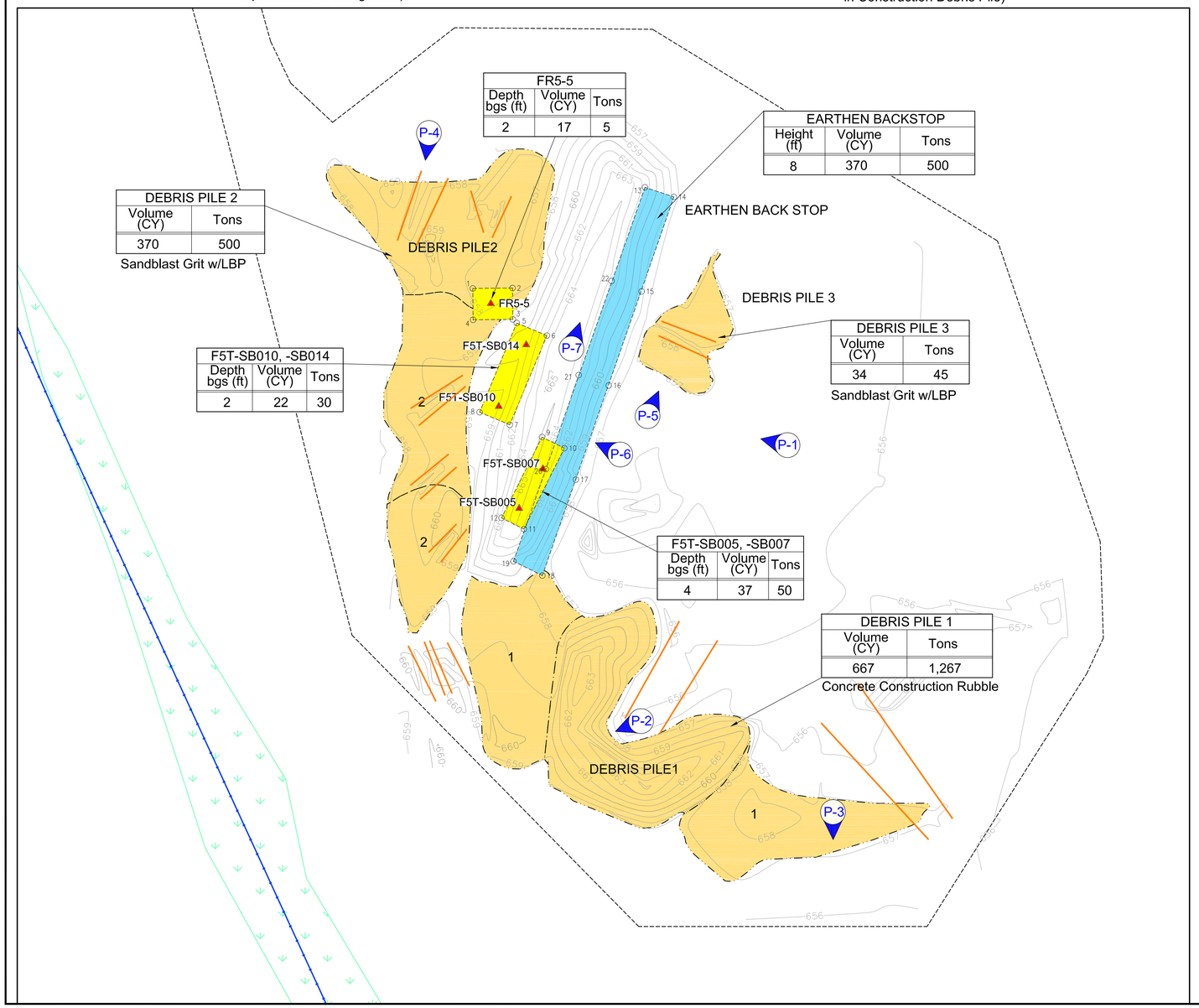


PHOTO 4
(CDP Trench Through Spent Sand Blasting Grit at FR-5)

PHOTO 5
(Sand Blasting Grit at CDP 3)

PHOTO 6
(FR-5 Impact Berm)

PHOTO 7
(Top of FR-5 Impact Berm)

LEGEND:

- WETLAND AREA
- DRAINAGE DITCH
- TRENCH
- SOIL BORING WHERE EXCEEDED RSL
- P-1 PHOTOGRAPH WITH VIEW DIRECTION
- 1 COORDINATE LOCATION WITH POINT NO.

REMOVAL AREAS

- HOTSPOT SOIL REMOVAL AREA
- EARTHEN BACKSTOP BERM REMOVAL
- CONSTRUCTION DEBRIS PILE REMOVAL

NOTE:

1. LIMITS OF EXCAVATION ARE BASED ON MODELED EXTENTS OF CONTAMINATION AS SHOWN IN FIGURE 4 OF THIS FIRING RANGE REMOVAL ACTION WORK PLAN. THE EXCAVATION LIMITS HAVE BEEN MODIFIED FOR CONSTRUCTABILITY.
2. REMOVE ADDITIONAL CONSTRUCTION DEBRIS OBSERVED BEYOND THE EXTENT OF THE DEFINED DEBRIS PILES.

AREA DESCRIPTION	POINT NO.	EASTING	NORTHING
FR5-5	1	1926105.60	613570.30
	2	1926118.11	613570.43
	3	1926118.21	613560.56
	4	1926105.70	613560.43
F5T-SB010, -SB014	5	1926119.44	613559.41
	6	1926128.93	613555.45
	7	1926117.24	613527.38
	8	1926107.74	613531.33
F5T-SB005, -SB007	9	1926127.39	613523.52
	10	1926134.42	613520.01
	11	1926121.69	613494.55
	12	1926114.65	613498.07
EARTHEN BACK STOP	13	1926159.81	613602.13
	14	1926168.90	613599.10
	15	1926158.74	613569.36
	16	1926148.39	613539.75
	17	1926138.04	613510.14
	18	1926127.50	613479.95
	19	1926118.42	613484.39
	20	1926128.58	613513.42
	21	1926138.93	613543.03
	22	1926149.28	613572.64

COORDINATES ARE IN OHIO STATE PLANE, NAD 83 NORTH FEET.

N

0 5 10 20 40
SCALE: 1" = 20'

DESIGNED BY: R. SPRINZL | APPROVED BY:
DRAWN BY: P. HOLM | CHECKED BY: A. MODAK
DATE: 2/14/20
DRAWING NO: C:\18013\DWGS T18-PBS-FR5-C-3
REV. | DATE | DESCRIPTIONS | DRAWN BY | CHECKED BY

PROJECT: FIRING RANGE 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: EXTENT OF IMPACTED SOILS REMOVAL AND CONSTRUCTION DEBRIS REMOVAL

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLUM BROOK STATION

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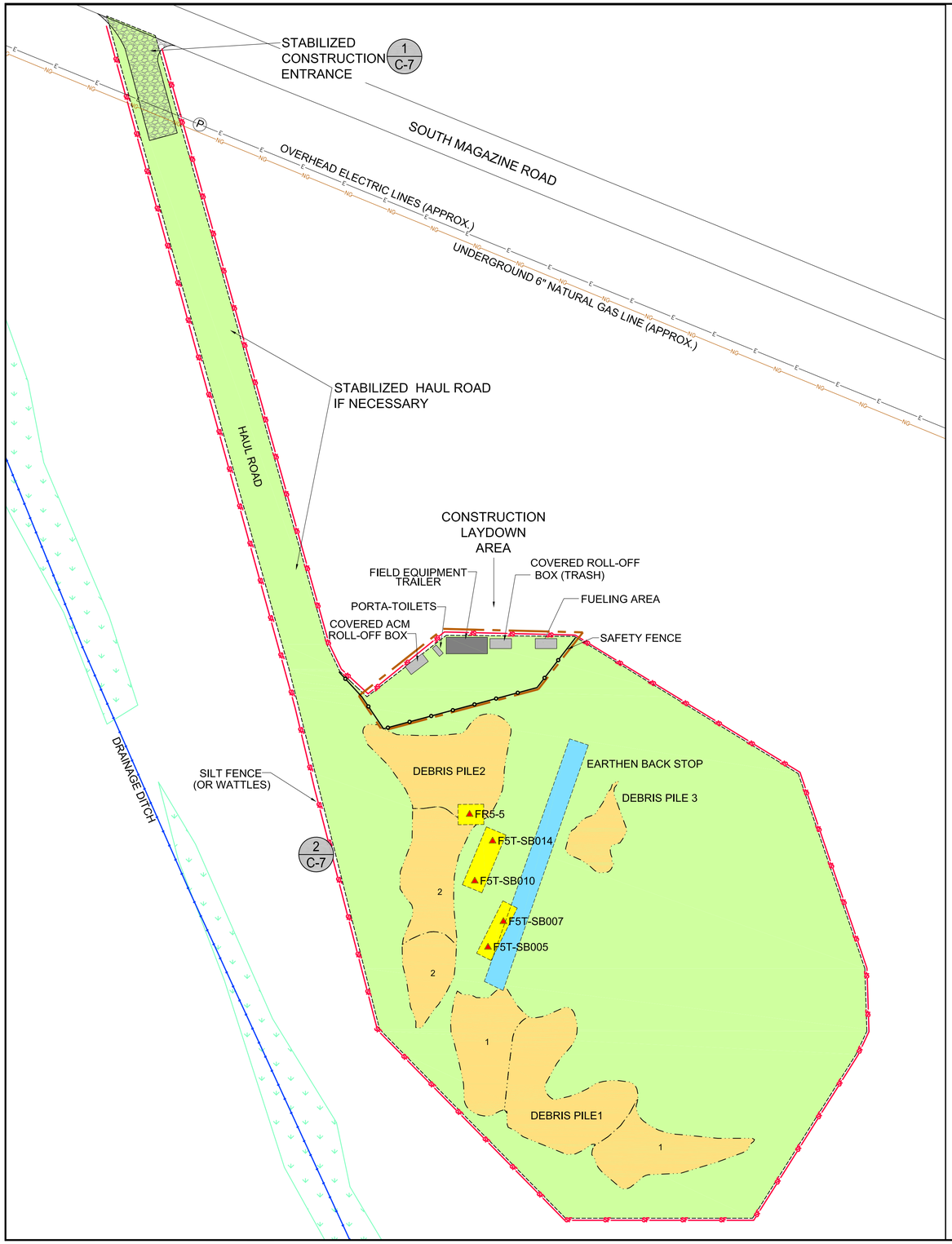
C-3

DRAWING NUMBER



LEGEND:

- ROADWAY
- GRAVEL ROAD
- WETLAND AREA
- DRAINAGE DITCH
- SOIL BORING WHERE EXCEEDED RSL
- CLEARING EXTENT
- CONSTRUCTION LAY DOWN AREA
- S F — SILT FENCE OR WATTLES
- SAFETY FENCE
- E — E — ELECTRIC LINE (APPROX.)
- NG — NG — NATURAL GAS LINE (APPROX.)
- 1 / C-7 — DETAIL IDENTIFICATION & DRAWING NO.

REMOVAL AREAS

- HOTSPOT SOIL REMOVAL AREA
- EARTHEN BACKSTOP BERM REMOVAL
- CONSTRUCTION DEBRIS PILE REMOVAL

SITE PREPARATION

1. THE CONTRACTOR SHALL SET CONSTRUCTION SUPPORT FACILITIES (E.G. FIELD TRAILER) AT APPROXIMATE LOCATIONS WITHIN THE CONSTRUCTION LAY DOWN AREA.
2. THE CONTRACTOR SHALL INSTALL SILT FENCE AT LOCATIONS INDICATED ON THIS DRAWING IN ACCORDANCE WITH THE SPECIFICATIONS ON DRAWING C-7.
3. THE CONTRACTOR SHALL CLEAR AND GRUB TREES (INCLUDING FELLED TREES) IN AREAS NOTED ON THIS DRAWING. STUMPS MAY BE LEFT IN AREAS OUTSIDE OF ACCESS ROAD AND EXCAVATION AREAS.
4. TREE ROOTS WITHIN THE EXCAVATION AREA SHALL BE REMOVED DURING EXCAVATION ACTIVITIES AS DESCRIBED IN DRAWING C-5.
5. TREES AND VEGETATION MATERIALS SHALL BE MANAGED IN ACCORDANCE WITH SECTION 3.2.3 OF THIS FIRING RANGE 5 & CDP RA WORK PLAN.
6. THE CONTRACTOR SHALL CONTROL SITE ACCESS AT INGRESS/EGRESS.
7. WHEREVER POSSIBLE, THE CONTRACTOR SHALL NOT DISTURB NATIVE VEGETATION OUTSIDE OF THE DEFINED CLEARING AREAS.
8. TOPSOIL OVERBURDEN MAY BE USED TO CONSTRUCT EARTHEN BERMS.
9. THE CONTRACTOR SHALL HAVE TANK ON STANDBY FOR DELIVERY AND SETUP, IF NEEDED, FOR MANAGING EXCAVATION WATER.
10. DEWATERING LINES SHALL BE PROTECTED FROM DAMAGE BY HEAVY EQUIPMENT.
11. AN EXCLUSION ZONE SHALL BE ESTABLISHED TO SURROUND OPEN AND ACTIVE EXCAVATION AREAS. PERSONNEL AND EQUIPMENT ACCESS TO THE EXCLUSION ZONE SHALL BE LIMITED TO AUTHORIZED INDIVIDUALS/EQUIPMENT TO MINIMIZE DIRECT CONTACT WITH CONTAMINATED SOILS. CONTAMINATION REDUCTION AND SUPPORT ZONES SHALL BE ESTABLISHED WITHIN THE LIMITS OF CONSTRUCTION. TRUCK/EQUIPMENT EXITING THE CONTAMINATION REDUCTION ZONE SHALL BE INSPECTED AND CLEANED AT THE ESTABLISHED INSPECTION ZONE.
12. CONTRACTOR SHALL USE CAUTION DURING VEGETATION CLEARING TO AVOID ABANDONED ELECTRICAL AND FENCE POSTS. CAUTION TAPE OR SAFETY FENCE WILL BE PLACED AROUND POSTS.

SEQUENCE OF CONSTRUCTION:

1. SET UP CONSTRUCTION SUPPORT FACILITIES (E.G. FIELD AND EQUIPMENT TRAILER, SANITARY FACILITIES, ETC.)
2. INSTALL STORMWATER CONTROLS AS INDICATED ON DRAWING.
3. CLEAR AND GRUB AREAS AS INDICATED ON DRAWING.
4. A LAND SURVEY OF THE EXCAVATION AREAS INDICATED ON DRAWING C-2 SHALL BE PERFORMED. THE SURVEYED EXCAVATION AREAS SHALL BE STAKED, FLAGGED, AND ROPED OFF TO PREVENT UNAUTHORIZED CONSTRUCTION ACTIVITIES IN THESE AREAS.
5. THE CONTRACTOR SHALL CONSTRUCT AN CONSTRUCTION ENTRANCE AS INDICATED ON DRAWING C-7.
6. THE CONTRACTOR SHALL INSTALL SAFETY FENCE BETWEEN STAGING AREA AND REMOVAL AREA.

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CHECKED BY:
APPROVED BY:

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DRAWING NO. C:\18013\DWGS T18-PBS-FR5-C-4

PROJECT: FIRING RANGE 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: SITE PREPARATION PLAN AND CONSTRUCTION SITE PLAN

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLUM BROOK STATION

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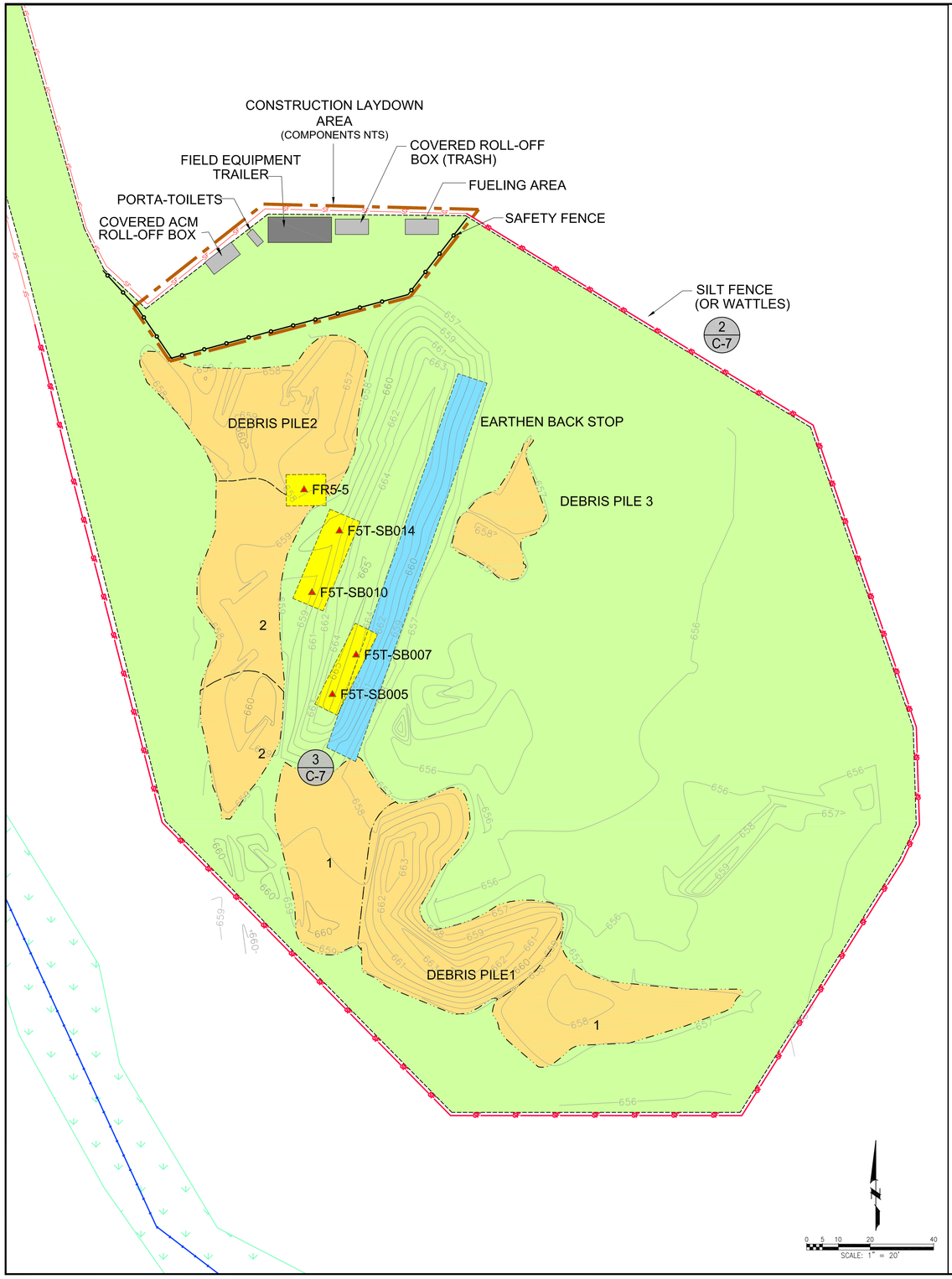
C-4

DRAWING NUMBER



LEGEND:

- ROADWAY
- GRAVEL ROAD
- WETLAND AREA
- DRAINAGE DITCH
- SOIL BORING WHERE EXCEEDED RSL
- CLEARING EXTENT
- CONSTRUCTION LAY DOWN AREA
- S F — SILT FENCE
- SAFETY FENCE
- 1 / C-7 — DETAIL IDENTIFICATION & DRAWING NO.

REMOVAL AREAS

- HOTSPOT SOIL REMOVAL AREA
- EARTHEN BACKSTOP BERM REMOVAL
- CONSTRUCTION DEBRIS PILE REMOVAL

REMOVAL PLAN:

1. THE CONSTRUCTION DEBRIS PILES (CDPs) WILL BE INSPECTED FOR LBP COVERED MATERIALS AND ACM MATERIALS PRIOR TO ANY DEBRIS REMOVAL AND ACM REMOVAL. CDP WILL BE INSPECTED FOR ADDITIONAL ACM THAT MAY BE BURIED IN THE CDP.
2. THE CDPs WILL BE REMOVED. ACM MATERIALS WILL BE SEGREGATED, APPROPRIATELY CONTAINERIZED, PLACARDED, MOVED TO COVERED ROLL-OFF BOX WHILE THE CDPs WILL BE REMOVED, AND LOADED ON TO HAUL-TRUCKS FOR OFF-SITE DISPOSAL.
3. PRIOR TO REMOVAL OF THE EARTHEN BERM, AND SAND PLAST GRIT PILES, WASTE CHARACTERIZATION SAMPLES WILL BE COLLECTED FROM THE EARTHEN BERM AT A FREQUENCY OF 1 FIVE-PART COMPOSITE PER 100 CY AND ANALYZED FOR TCLP VOCS, TCLP SVOCS, TCLP METALS, TCLP HERBICIDES, TCLP PESTICIDES, RCI, AND PFAS IN ACCORDANCE WITH SECTION 6.2 OF THIS FIRING RANGE 5 AND CDP RA WORK PLAN.
4. MISTING WILL BE EMPLOYED TO MINIMIZE DUST GENERATION. IF DUST ACTION LIMITS IN HASP EXCEEDED USING REAL-TIME DUST MONITOR. SOILS SHALL BE PROPERLY DISPOSED IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS.
5. EARTHMOVING EQUIPMENT, SUCH AS AN EXCAVATOR, SHALL BE USED TO EXCAVATE THE SOILS AT THE EARTHEN BERM AND HOT SPOTS. EXCAVATED SOILS SHALL BE LIVE-LOADED DIRECTLY INTO HAUL TRUCKS AND MOVED TO STOCKPILE. EXCAVATED SOIL AND CONSTRUCTION DEBRIS WILL BE LIVE-LOADED INTO HAUL TRUCKS FOR OFF-SITE DISPOSAL.
6. EQUIPMENT TRACKS AND/OR TIRES SHALL NOT CONTACT IMPACTED SOILS WITHIN THE EXCAVATION. BOARD ROADS SHALL THEN BE PLACED OVER THE HOT SPOT EXCAVATIONS WITHIN THE GRAVEL ROAD TO ALLOW THE EXCAVATOR TO WORK WITHOUT CONTACTING IMPACTED SOILS.
7. TREE ROOT BALLS SHALL BE REMOVED BY THE EXCAVATOR AND PLACED IN A ROLL OFF BOX OR SOIL TRUCKS.
8. LIMITS OF SOIL REMOVAL ARE REFERENCED ON DRAWING NUMBER C-3.
9. OPEN EXCAVATIONS SHALL BE COVERED AT THE END OF EACH WORK DAY AND DURING INCLEMENT WEATHER.

SEQUENCE OF CONSTRUCTION

1. ESTABLISH LIMITS OF EARTHEN BERM REMOVAL, HOT SPOT EXCAVATION, AND CONSTRUCTION DEBRIS PILE REMOVAL AS INDICATED ON DRAWING C-3.
2. CONSTRUCT STORMWATER CONTROLS (EARTHEN BERMS, ETC.) AS INDICATED ON DRAWING C-4.
3. INSPECT, REMOVE AND CONTAINERIZE ACM & LBP MATERIALS INTO A COVERED ROLL-OFF BOX.
4. LOADOUT CONSTRUCTION DEBRIS INTO ON-ROAD HAUL TRUCKS FOR TRANSPORTATION TO APPROVED DISPOSAL FACILITY.
5. FOLLOWING REMOVAL OF CDPs, SOIL WILL BE REMOVED FROM EARTHEN BERM AND HOT SPOT EXCAVATIONS, DIRECT LOADED FOR TRANSPORTATION TO APPROVED DISPOSAL FACILITY.

FINAL GRADING AND RESTORATION:

1. THE HOT SPOT EXCAVATIONS AND THE DISTURBED FOOTPRINTS OF THE EARTHEN BERM AND CONSTRUCTION DEBRIS PILES SHALL BE GRADED TO EXISTING UNDISTURBED GROUND ELEVATIONS OR BACKFILLED WITH CLEAN SOILS IN ACCORDANCE WITH NASA GRC ENVIRONMENTAL PROGRAM MANUAL, CHAPTER 20-HANDLING, REUSE, AND DISPOSAL OF SOIL AND ALL APPLICABLE REGULATIONS AND GUIDANCE.
2. THE REMAINING EARTHEN BERM WILL BE REGRADED TO SURROUNDING GROUND ELEVATIONS.
3. AREAS WITH REGRADED SOIL WILL BE COVERED WITH 6 INCHES OF APPROVED TOPSOIL.

SEQUENCE OF CONSTRUCTION:

1. REMOVE ALL EQUIPMENT FROM AREAS TO BE REVEGETATED PRIOR TO RESTORATION ACTIVITIES.
2. BACKFILL AND GRADE ALL EXCAVATIONS AND RESTORATION AREAS. UPPER 6" WILL BE TOPSOIL.
3. CONDUCT TOPOGRAPHIC LAND SURVEY OF BACKFILLED AND GRADED AREAS AFTER GRADING IS ACCEPTED BY NASA TM OR DESIGNEE.
4. REVEGETATE (HYDROSEED OR SEED/MULCH).
5. HYDROSEED STABILIZED SOIL STAGING AREA AND LAYDOWN AREAS.
6. SILT FENCING OR WATTLES SHALL BE REMOVED BY SUBCONTRACTOR AFTER SEED HAS TAKEN ROOT AND THE NASA TM APPROVES REMOVAL OF SILT FENCE. AREAS WHERE SEED DID NOT PROVIDE ADEQUATE COVERAGE SHALL BE RESEEDED. SILT FENCE REMOVAL SHALL BE DETERMINED BY THE NASA TM. SILT FENCING REMOVAL AND RESEEDING ACTIVITIES SHALL NOT NEGATIVELY IMPACT FINAL GRADING.

DESIGNED BY: R. SPRINZL	DRAWN BY: P. HOLM	CHECKED BY:	APPROVED BY:

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PROJECT: FIRING RANGE 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: REMOVAL AND RESTORATION PLAN FOR EARTHERN BERM, CONSTRUCTION DEBRIS PILES, AND HOT SPOT EXCAVATIONS

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLUM BROOK STATION

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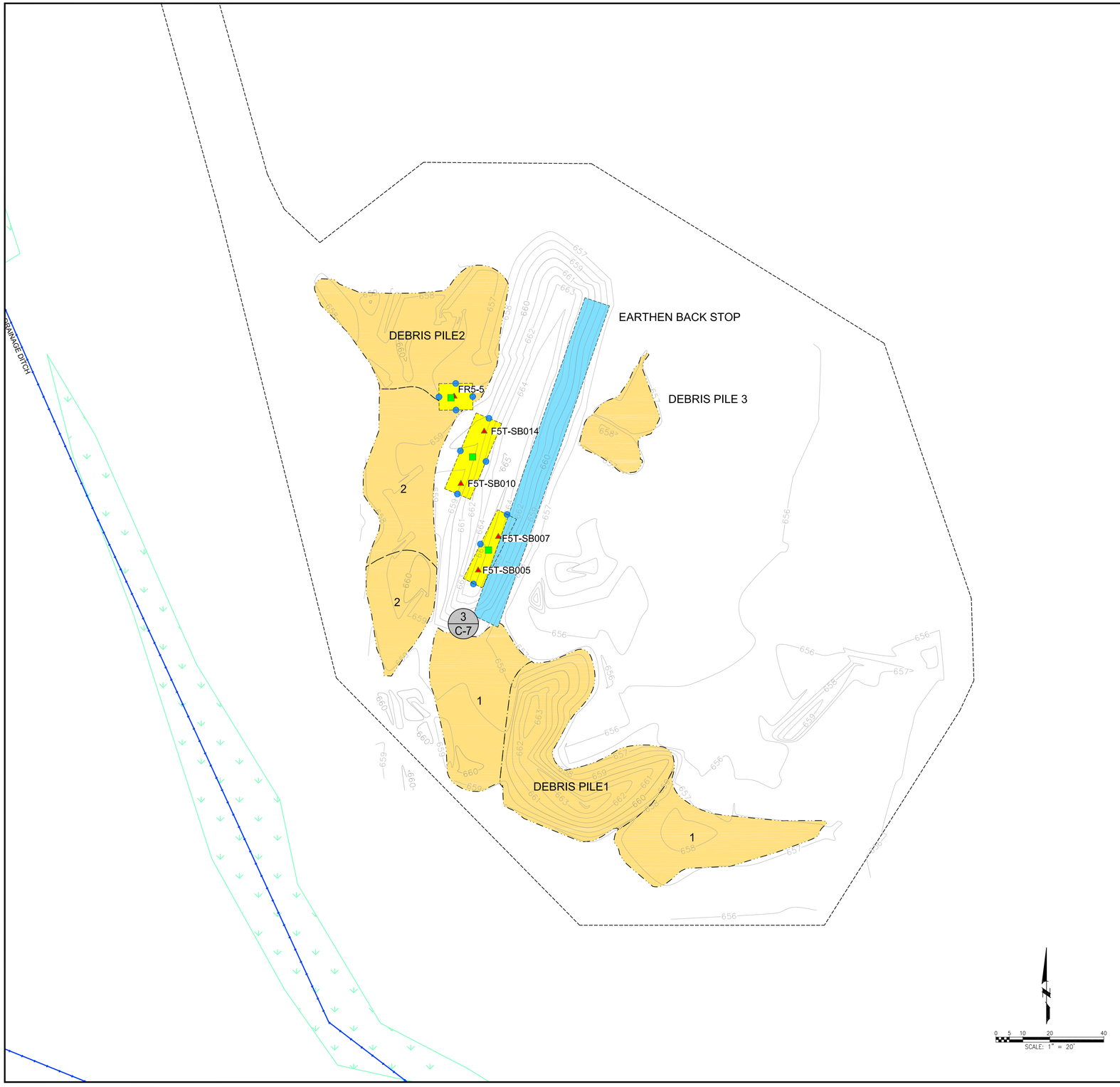
C-5

DRAWING NUMBER



LEGEND:

- WETLAND AREA
- DRAINAGE DITCH
- SOIL BORING WHERE EXCEEDED RSL
- PROPOSED FLOOR SAMPLE
- PROPOSED WALL SAMPLE

REMOVAL AREAS

- HOTSPOT SOIL REMOVAL AREA
- EARTHEN BACKSTOP BERM REMOVAL
- CONSTRUCTION DEBRIS PILE REMOVAL

EXCAVATION VERIFICATION SAMPLING:

1. EXCAVATION VERIFICATION SAMPLING SHALL BE CONDUCTED TO CONFIRM ALL IMPACTED SOILS ARE REMOVED FROM HOT SPOT EXCAVATIONS IN ACCORDANCE WITH SECTION 5 OF THIS FIRING RANGE 5 AND CDP RA WORK PLAN.
2. VERIFICATION SAMPLES SHALL BE OBTAINED AT THE LOCATIONS INDICATED ON THE DRAWING.
3. VERIFICATION SAMPLES WILL BE ANALYZED IN THE LABORATORY FOR FIVE CPAHS [BENZO(A)PYRENE, BENZO(A)ANTHRACENE, BENZO(B)FLUORANTHENE, DIBENZO(A,H)ANTHRACENE, AND INDENO(1,2,3-CD)PYRENE] THAT ARE COCS FOR THIS SITE.
4. VERIFICATION SAMPLES WILL BE COLLECTED AT THE MIDPOINT OF THE WALL AND FROM THE UPPER 6-INCHES OF THE SOIL AT THE EXCAVATION FLOOR.

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DRAWN BY: P. HOLM
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APPROVED BY:

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PROJECT: FIRING RANGE 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: VERIFICATION SAMPLING PLAN

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLUM BROOK STATION

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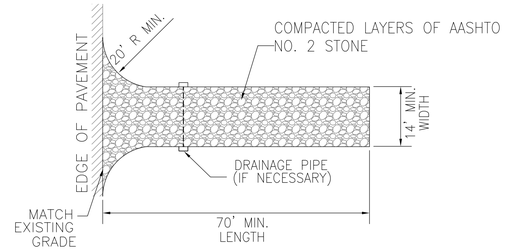
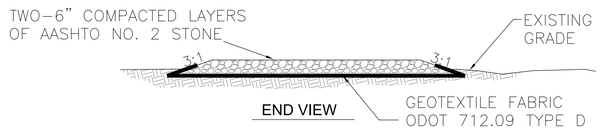
C-6

DRAWING NUMBER



PLAN VIEW



END VIEW

1 C-4 CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE

CONSTRUCTION ENTRANCE:

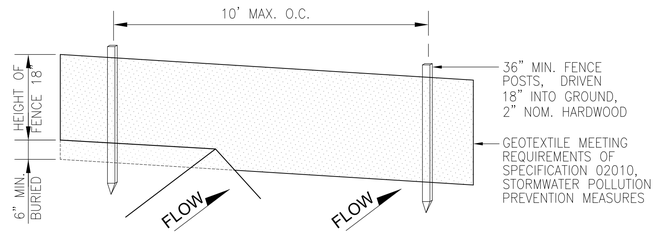
1. THE CONTRACTOR SHALL CONSTRUCT A CONSTRUCTION ENTRANCE/TRUCK TURN AROUND TO FACILITATE LOADOUT OF CONSTRUCTION DEBRIS AND SOILS FROM EARTHEN BERM AND HOT SPOT EXCAVATIONS INTO HIGHWAY HAUL TRUCKS.

2. THE CONTRACTOR SHALL USE COMPACTED GRANULAR MATERIAL (AASHTO SIZE NO. 2 OR SIMILAR).

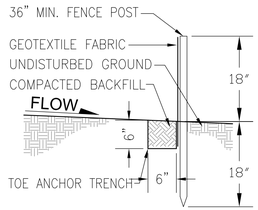
3. THE CONTRACTOR SHALL LEAVE CONSTRUCTION ENTRANCE AND RESTORE THE AREA TO PRE-CONSTRUCTION CONDITIONS IN ACCORDANCE WITH DRAWING C-4 AND AS NOTED IN SECTION 7 OF THIS FIRING RANGE 5 AND CDP RA WORK PLAN.

NOTES:

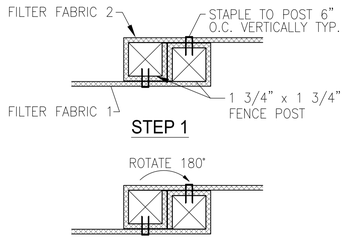
1. THE CONTRACTOR SHALL PROVIDE SILT FENCES (SEE DETAIL) AS A TEMPORARY STRUCTURE TO MINIMIZE EROSION AND SEDIMENT RUNOFF. SILT FENCES SHALL BE PROPERLY INSTALLED TO EFFECTIVELY RETAIN SEDIMENT. SILT FENCES SHALL BE INSTALLED AT THE LOCATIONS SHOWN ON DRAWING C-4 CONSTRUCTION SITE PLAN.
2. THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES WEEKLY AND WITHIN 24 HOURS OF A STORM EVENT (GREATER THAN 0.5" RAIN OR 2" SNOWMELT). ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.



PERSPECTIVE VIEW

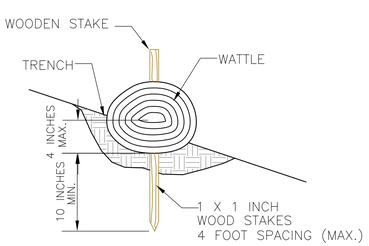


FENCE SECTION



① ROTATE BOTH POST WITH FABRIC CLOCKWISE AT LEAST 180°
② EMBED BOTH POST INTO GROUND PER APPLICABLE FILTER FENCE SPECIFICATIONS

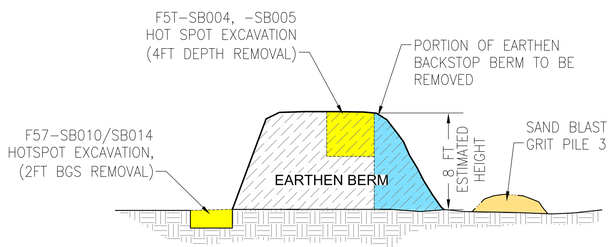
SILT FENCE CONNECTION POINT



WATTLE DETAIL
STRAW OR WOOD

2 C-4,-5 SILT FENCE AND WATTLE DETAILS

NOT TO SCALE



3 C-5,-6 PROFILE OF BERM REMOVAL

NOT TO SCALE

DESIGNED BY: R. SPRINZL
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APPROVED BY:

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FIRING RANGES 5 AND CDP REMOVAL ACTION WORK PLAN

DRAWING TITLE: DETAILS

CLIENT: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
PROJECT: PLUM BROOK STATION

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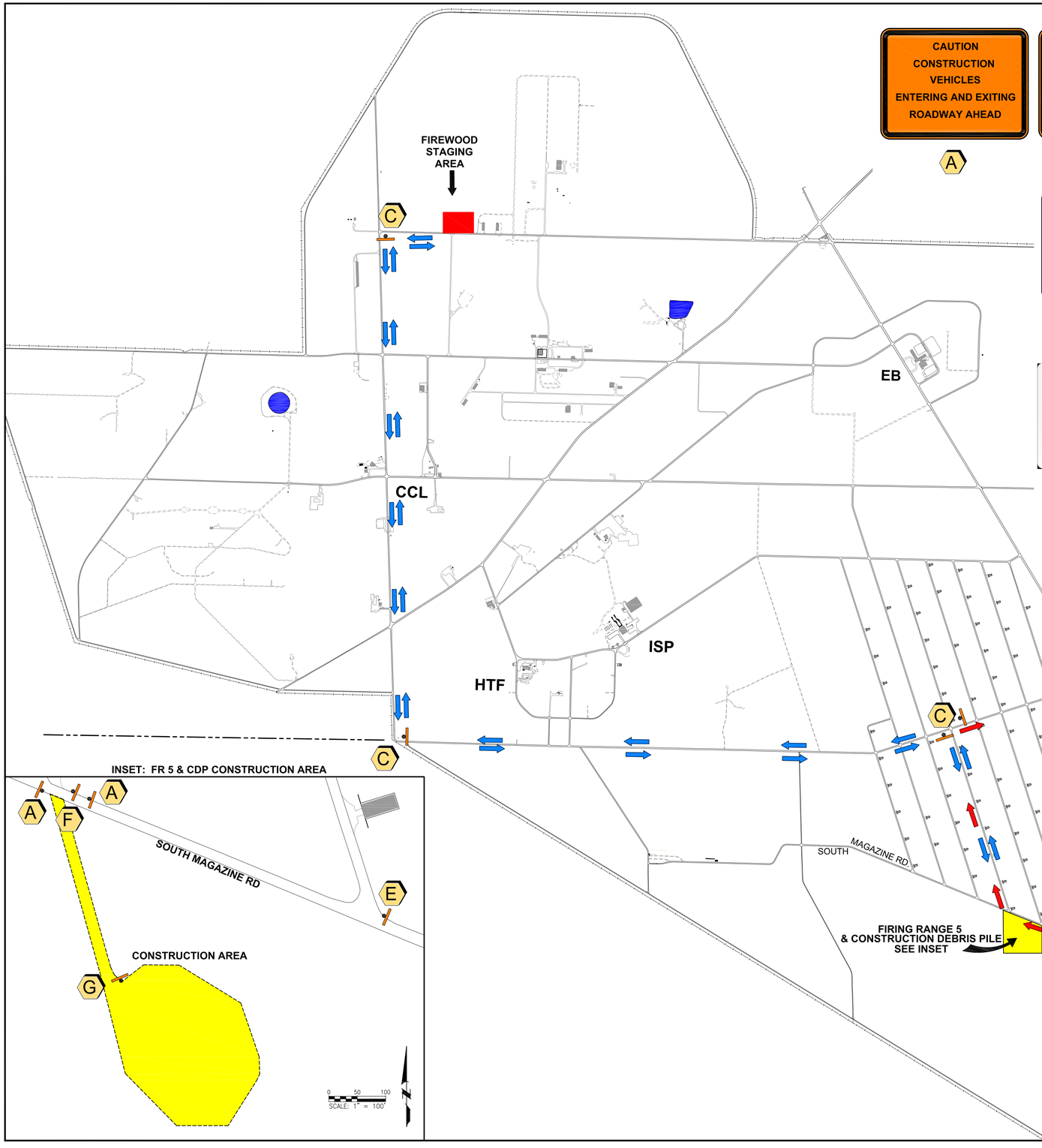
C-7

DRAWING NUMBER



A

B

NOTE: ARROW DIRECTION WILL REFLECT ACTUAL TRAFFIC ROUTE

C

NOTE: ARROW DIRECTION WILL REFLECT ACTUAL TRAFFIC ROUTE

D

NOTE: ARROW DIRECTION WILL REFLECT ACTUAL TRAFFIC ROUTE

E

F

G

LEGEND:

- FENCE
- ROADWAY
- PROJECT SITE
- SOIL TRUCK TRAFFIC ARROW
- FIREWOOD TRUCK TRAFFIC ARROW
- TRAFFIC SIGN
- E — TRAFFIC SIGN TYPE

NOTES:

1. ALL VEHICLES MUST ENTER NASA PLUM BROOK STATION (PBS) THROUGH THE MAIN GATE (3597 E. SCHIED ROAD, SANDUSKY, OHIO).
2. ALL VEHICLES AND CONTENTS ARE SUBJECT TO SEARCH AND INSPECTION.
3. NO WEAPONS, LIGHTERS OR SIMILAR FIRE STARTERS, OR ALCOHOL ARE PROHIBITED ONSITE. PROHIBITED ITEMS MAY BE LEFT WITH SECURITY WHILE ONSITE. SECURITY WILL CONFISCATE ANY PROHIBITED ITEMS DISCOVERED DURING INSPECTIONS.
4. ALL PERSONNEL ENTERING PBS MUST COMPLETE THE PBS SECURITY ACCESS FORM AND SUBMIT IT TO NASA TM FOR ACCESS TO THE FACILITY. NASA TM WILL COORDINATE WITH THE PBS SECURITY WHO WILL APPROVE ALL ACCESS TO THE FACILITY. ACCESS MUST BE COORDINATED AT LEAST 48 HOURS IN ADVANCE. ALL WEEKEND AND HOLIDAY WORK MUST BE PREAPPROVED BY PBS SECURITY.
5. ALL ON-ROAD HAUL TRUCKS WILL ADHERE TO ODOT TRANSPORTATION GUIDELINES. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING AND VERIFYING TRUCKS DO NOT EXCEED 80,000 LBS. GROSS WEIGHT, USING PBS TRUCH SCALE. IF NECESSARY, PORTABLE SCALE WILL BE PROVIDED BY THE CONTRACTOR.
6. ALL HAUL TRUCKS WILL HAVE OPERATIONAL LOAD COVERS IN GOOD CONDITION (I.E., FREE OF HOLES, TEARS). LOADS WILL BE COVERED PRIOR TO DEPARTING THE PROJECT AREAS AND WILL STAY IN PLACE UNTIL UNLOADING AT THE APPROVED DISPOSAL SITE.
7. ON-ROAD HAUL TRUCKS HAULING HAZARDOUS WASTE SHALL BE LINED AND PLACARDED IN ACCORDANCE WITH THE APPROVED DISPOSAL FACILITY REQUIREMENTS.
8. ROADS SHALL NOT BE BLOCKED. PBS TRAFFIC SHALL BE MAINTAINED ON AT LEAST ONE HALF OF THE ROADWAY WIDTH AT ALL TIMES.
9. CONTRACTOR SHALL CONFIRM NO OVERHEAD HAZARDS (I.E., POWER LINES), MANHOLES, AND WATER VALVES WILL IMPEDE REMEDIAL ACTIVITIES.
10. SIGN LETTERING SHALL BE BLACK ON A FLUORESCENT ORANGE BACKGROUND WITH A BAKED ENAMEL FINISH. LETTERING SHALL NOT BE LESS THAN 2 INCHES HIGH. SIGNS WILL BE CONSTRUCTED AS AN A-FRAME STYLE SUCH THAT THEY CAN BE EASILY PLACED AND REMOVED BY THE CONTRACTOR.
11. SIGNS WILL BE PLACED ALONG ROADWAYS DURING CONSTRUCTION MOBILIZATION. SIGNS WILL BE WEIGHED DOWN TO ENSURE THE SIGNS DO NOT MOVE DURING HIGH WIND EVENTS, DURING EXTENDED TIME AWAY FROM THE PROJECT SITE (E.G. DURING CONFIRMATION SAMPLE ANALYSIS). THE SIGNS WILL BE REMOVED FROM THE ROADWAY AND PLACED IN STORAGE.
12. THE CONTRACTOR SHALL BE RESPONSIBLE TO REPAIR ANY DAMAGES TO PBS ROADS AS A RESULT OF HIS OR HER CONTRACTORS ACTIONS.

DESIGNED BY: R. SPRINZL
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DRAWING TITLE:
FIRING RANGE 5 AND CDP
REMOVAL ACTION WORK PLAN

TRAFFIC MANAGEMENT PLAN

CLIENT: PROJECT:
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
PLUM BROOK STATION

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C-8
DRAWING NUMBER

ATTACHMENT D. LEIDOS STANDARD OPERATING PROCEDURES

Attachment D.1. Leidos Standard Operating Procedure for PFAS Sampling

Attachment D.2. Leidos Field Technical Procedure FTP-400, Equipment Decontamination

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Attachment D.1

Leidos Standard Operating Procedure for PFAS Sampling

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GLENN RESEARCH CENTER

STANDARD OPERATING PROCEDURE

PFAS Site Inspection Sampling

Effective February 2020

Approved By: _____

Heather Adams
Program Manager

_____

Rita M. Schmon-Stasik
Project QA Officer

TABLE OF CONTENTS

1. PURPOSE

This Standard Operating Procedure (SOP) provides a summary of precautions that must be taken when collecting samples of any matrix for the analysis of perfluorinated chemicals, also referred to as per- and poly-fluoroalkyl substances (PFAS), in particular during the Site Inspection activities at National Aeronautics and Space Administration (NASA) Glenn Research Center (GRC), Cleveland, Ohio.

1.1 Scope and Limitations

The guidance provided in this procedure is meant to be used in conjunction with project-specific Quality Assurance Project Plans (QAPP) and Field Sampling Plans (FSP) as well as matrix-specific sample collection procedures (e.g., “Soil Sampling” ESE FTP-525; “Groundwater Sampling from Wells” ESE FTP-600; “Surface Water Sampling” ESE FTP-603; etc.).

The procedures described herein are to be used when collecting and handling samples in the field by Leidos personnel and subcontractors. If personnel determine that the methods described herein are inappropriate, inadequate or impractical, variant methods will be identified and documented in the field logbook. A description of the circumstances requiring the variant method shall also be recorded in the field logbook. The mention of trade names or commercial products in this procedure does not constitute an endorsement or recommendation for its exclusive use.

1.2 Regulations or Standards

As an emerging contaminant, PFAS sampling procedures, as well as analytical methods, are currently being evaluated and are subject to significant regulatory revision(s) in the future. EPA has several cross-agency workgroups (Kavlok 2017) that are evaluating method development for non-drinking water matrices, data quality issues, and health issues, as are various state agencies. EPA Method 537.1 (Shoemaker, 2018) is applicable only to drinking water. As such, sampling guidelines for other aqueous media as well as solid matrices have not been widely or uniformly established, but are developed on a project basis or from specific regulatory agencies (MassDEP 2017, Navy 2015, MHDES 2016/2017). This SOP is a compilation of Best Practices from the various resources available.

The current applicable regulation(s) or standard(s) included below may not be a complete list of regulations or standards applicable to the activity described in this SOP. It is the responsibility of the Project Manager to verify that applicable or new regulations and standards are implemented as necessary.

- *Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)*, EPA Method 537.1 Version 1.0, EPA/600/R-18/352, November 2018.

1.3 Definitions / Acronyms

Decontamination – The process of cleaning dirty sampling equipment to the degree to which it can be reused in the field.

Equipment Blank – Also known as a rinsate blank, a sample of analyte-free media that has been used to rinse the sampling equipment. It is collected after completion of

decontamination and prior to sampling. This blank is useful in documenting adequate decontamination of sampling equipment.

Field Duplicate – Independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process.

FRB – Field reagent blank

FSP – Field Sampling Plan

Headspace – The volume left at the top of an almost filled container before sealing.

Matrix Spike – An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Matrix Spike Duplicates – Intra-laboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

QAPP – Quality Assurance Project Plan

Sampling and Analysis Plan (SAP) – A plan that documents the procedural and analytical requirements for a project that involves the collection of samples to characterize potential areas of contamination. This may be a stand-alone plan or included as a section in another site- or project-specific plan.

Temperature Blank – A vial of water that accompanies the samples that will be opened and tested upon arrival at the laboratory to verify that contents of the sampling shipping container was received at a temperature within the required parameters.

Trip Blank – A sample of analyte-free media transported with the sample bottles from the laboratory to the sampling site, then returned with the samples to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.

2. QUALIFICATIONS AND RESPONSIBILITIES

2.1 Qualifications

Staff shall be trained to this procedure prior to conducting field activities and that training shall be documented.

2.2 Responsibilities

Project and/or Program Managers (PMs)

- Communicating client- or project-specific requirements, general and project-specific goals, and locations to the Field Manager.
- Assigning appropriately experienced field personnel to conduct required testing.
- Verifying that personnel performing the activity described herein are trained to this procedure as well as other applicable Federal, State, or local requirements, and that the training is documented.

Field Manager

- Completing the Checklist attached to this procedure.
- Overall management of field activities related to PFAS sampling.
- Correctly identifying and verifying locations to be sampled.
- Communicating, in coordination with the Site Safety and Health Officer, health and safety protocols to field staff.
- Communicating client- or project-specific requirements to the field staff.
- Identifying and acquiring appropriate sampling equipment (pumps, tubing, bottles, etc.) and materials to perform work.
- Verifying equipment decontamination and investigation-derived waste protocols are in place and communicated to field staff.

Site Safety and Health Officer

- Providing guidance on health and safety requirements.

Field Staff

- Following the requirements of this procedure, especially in terms of personal care products.
- Conducting sampling per the FSP.
- Documenting field conditions including problems encountered, timing, and sequence of events as per ESE FTP-1215, “Field Activity Documentation.”

3. HEALTH AND SAFETY

Standard safe operating practices should be followed, such as minimizing contact with potential contaminants by using appropriate personal protective equipment.

Depending on the type of contaminants expected, the following safe work practices will be employed at a minimum:

- Avoid skin contact with sample matrices.
- Use protective gloves.
- Avoid skin contact with water from preserved sample bottles.
- Avoid inhaling fumes from preserved sample bottles.

Implement stop work authority (EHS-48) any time an activity potentially poses an uncontrolled risk to human health or the environment.

Refer to the site- or project-specific Health and Safety Plan for relevant health and safety requirements. Questions, comments, or concerns should be directed to the Field Manager and/or Site Safety and Health Officer.

4. EQUIPMENT AND SUPPLIES

PFAS compounds are prevalent in many commonly used, everyday items and there are numerous potential sources for trace contamination of samples during a field event. Therefore the major difference between sampling for PFAS vs other environmental parameters (collected in accordance with standard Leidos Field Technical Procedures [FTPs]) is the need to control and minimize the potential for trace level contamination. The integrity of the sample collection process is maintained and the impact of trace

contamination is limited by imposing restrictions on the materials and equipment employed during the field event.

Table 1 summarizes the field equipment containing materials which are prohibited as well as personal products and clothing that are to be avoided when sampling for PFAS. Allowable alternative materials are listed in the table.

The Field Manager must complete the checklist attached to this SOP, verifying that the above precautions and exclusions have been implemented, prior to beginning any PFAS sample collection and each day sampling is conducted.

5. PROCEDURE

Samples for PFAS analysis will be collected in accordance with the procedures described in the QAPP and FSP, with the appropriate modifications as described herein. The precautions to be taken regarding potential PFAS-containing materials, as discussed above, requires that sampling protocols based on standard Leidos FTPs be supplemented when sampling for PFAS as follows:

- Frequent changing of unpowdered nitrile gloves is critical to minimize the possibility of contamination; new gloves must be used between every task as needed and a fresh pair must be donned prior handling any equipment that will contact the sample matrix (e.g., hand augers, pump tubing, etc.), before handling sample bottles and immediately prior to collecting each sample.
- As much as possible, use single-use, dedicated, or disposable equipment of appropriate materials (e.g., silicone tubing) per Table 1. If equipment decontamination is required, equipment rinsate blanks must be collected between two locations (after performing the decontamination procedure using the allowable cleaning solutions).
- Aqueous matrix samples: Uncap the sample bottle immediately prior to beginning PFAS sample collection, being careful not to touch the inside of the cap. When collecting aqueous samples, collect the PFAS sample first, filling the PFAS sample bottle(s) before any other parameter (including VOCs; this change in order is predicated on decreasing the potential for contamination of the PFAS sample by collecting it first). Bottles for PFAS analysis do not need to be headspace free. Cap the sample and place the bottle in a Ziploc® bag, which is then placed in a cooler with ice (not blue ice, per Table 1). Then continue filling the remaining sample bottles for that location.
- Solid matrix samples: Uncap the sample bottle immediately prior to beginning PFAS sample collection, being careful not to touch the inside of the cap. When collecting solid samples, collect VOCs (if they are being sampled), then PFAS. Bottles for PFAS analysis do not need to be headspace free. Cap the sample and place the bottle in a Ziploc® bag, which is then placed in a cooler with ice (not blue ice, per Table 1). Then continue filling the remaining sample bottles for that location.
- Thermal preservation of the samples is important; sufficient ice must be used to ensure the samples are maintained at <10 degrees C, which must be documented at time of receipt at lab.

- Field filtering of aqueous samples is not recommended (glass fiber can potentially absorb PFAS)

6. QUALITY ASSURANCE / QUALITY CONTROL

Quality assurance/quality control for groundwater sampling requires that this SOP be followed as written unless project-specific deviations are detailed in the FSP or as authorized and documented by the Project Manager. In addition, samples must be collected in accordance with method requirements for the parameters of interest for sample volumes, containers and preservatives or as specified in the FSP.

Other quality assurance considerations for groundwater sampling are as follows:

- Evaluate if the results generated by these procedures are reproducible by obtaining Field QC samples (per below).
- Properly preserving, packaging, and shipping samples.

Field QC samples must be prepared the same as regular investigation samples with regard to sample volume, containers and preservation. The chain of custody procedures (ESE FTP-625 “Sample Chain of Custody”) for the QC samples shall be identical to the field groundwater samples. The following samples are to be included in the sampling plan for groundwater PFAS:

- Field Duplicates (FD): Field samples are collected in duplicate at a frequency of one in 20 primary samples or according to guidance documents associated with the clients sampling program by filling a separate container for each analysis immediately following the collection of the primary sample (e.g., PFAS sample, PFAS duplicate sample; VOC sample, VOC duplicate sample).
- Equipment Blanks (EB): Also referred to rinsate blanks, these samples are collected using an aliquot of the water used for final decon poured over all re-usable sampling equipment (e.g., non-disposable bailers) to evaluate the equipment decontamination procedures and the potential for cross-contamination between sample locations. For PFAS sample collection an EB should be collected each day samples are collected (compared to other environmental parameters for which a single EB per sampling event is often sufficient).
- Field Reagent Blanks: The field reagent blank (FRB) sample bottle will be filled (by the receiving laboratory) with reagent water (and preservatives when applicable), sealed, and shipped to the sampling site along with the sample bottles. For each FRB shipped, an empty sample bottle (no preservatives) must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the preserved reagent water into the empty shipped sample bottle, seal it, and then label this bottle as the field reagent blank. The FRB is shipped back to the laboratory with the field samples. The purpose of the FRB is to determine if method analytes or other interferences are introduced throughout the entire shipping, sampling, and analyzing process. Generally one FRB per sampling event is required, however a different frequency may be specified in the FSP or QAPP.
- Matrix spike/matrix spike duplicates (MS/MSD): Extra sample volume should collected for laboratory QC purposes at a frequency specified in the FSP or QAPP.

7. RECORDS

Records generated as a result of this procedure shall be submitted to the designated electronic record system in accordance with ESE A17.1, "Project Records Management."

8. REFERENCES

- ESE A17.1, Project Records Management
- ESE FTP-400, Equipment Decontamination
- ESE FTP-525, Soil Sampling
- ESE FTP-600, Groundwater Sampling from Wells
- ESE FTP-601, Groundwater Sampling Using a Hydropunch II
- ESE FTP-603, Surface Water Sampling
- ESE FTP-625, Sample Chain of Custody
- ESE FTP-1215, Field Activity Documentation
- EHS-48, Stop Work Authority
- Shoemaker (2018). Shoemaker, J. and Dan Tettenhorst. Method 537.1: Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, D.C., 2018.

Refer to https://apps.prism.leidos.com/eiapps/qa for the current version of ESE referenced procedures. The most current Environmental Health and Safety (EHS) procedures may be found at https://prism.leidos.com/docs/DOC-34213.

9. ATTACHMENTS

- Attachment 1. Sampling Checklist (Example)

10. DOCUMENT CHANGE RECORD

- Revision 0, dated February 2020, is the original version of this procedure issued under Leidos for the NASA project.

Table 1: Common Sampling Equipment and Materials to Use and to Avoid*

MATERIALS RELATED TO SAMPLING ACTIVITIES		
Category	**PROHIBITED Materials/Products**	**Alternative ALLOWABLE Material(s) / Product(S)**
Sampling equipment (1)	• Teflon™ or other fluoropolymers • Aluminum Foil	• High-density polyethylene [HDPE], low-density polyethylene [LDPE] (2) or silicone (tubing) • Nitrile gloves (powderless) • Thin sheets of HDPE
Sample bottles (3)	• LDPE and Glass bottles • Teflon™-lined caps • Chemical ice packs (i.e., Blue ice®)	• HDPE or polypropylene containers with HDPE or polypropylene caps • Regular ice in Zip-loc bags
Field documentation	• Waterproof/treated paper or field books (e.g., Rite in the Rain®) • Plastic clipboards • Sharpie® markers • Post-its, other adhesive paper products	• Loose plain paper • Metal clipboard • Ballpoint pens
Decontamination procedures	• Decon 90	• Alconox® or Liquinox®
MATERIALS RELATED TO FIELD STAFF CLOTHING AND PERSONAL CARE		
Category	**PROHIBITED Materials/Products**	**Alternative ALLOWABLE Material(s) / Product(S)**
Clothing	• Clothing or boots with Gore-Tex® or other synthetic water-resistant and/or stain-resistant (e.g., ScotchGuard®) materials (Tyvek®, Gore-tek™) • Fabric softener	• Clothing made of cotton preferred (laundered multiple [6+] times without fabric softener) • Rain gear from polyurethane or wax coated materials • Polyurethane/PVC boots (preferably well-worn) or untreated leather boots • Vehicle seats that have been treated to be stain-resistant should be covered with a well-washed cotton blanket or sheets
Personal Care products	• Cosmetics, moisturizers, hand cream, sunscreen, and other related products	• Recommended sunscreen: Alba Organics Natural, Yes to Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, Baby-safe sunscreens • Recommended insect repellants: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, Avon Skin So Soft Bug Guard-SPF 30, Sawyer Permethrin clothing sprays, InsectShield clothing, OFF! Deep Woods
Food/ beverage	• Pre-packaged food, fast food wrappers or containers	• Should not be anywhere near sampling site except for hydration fluids (e.g., bottled water, Gatorade®, etc.) • NOTE: Wash hands after eating

**Table adapted from New Hampshire Department of Environmental Services HWRB-21*

NOTES:
(1) Includes but is not limited to pumps, tubing, tapes, and o-rings [if in contact with sample].
(2) Several sources prohibit the use of LDPE Hydrasleeves; however, the use of LDPE is otherwise not prohibited.
(3) Sample bottles for collection of municipal drinking water that may contain residual chlorine will require preservation with Trizma.

ATTACHMENT 1

FIELD CHECKLIST FOR PFAS SAMPLE COLLECTION

PROJECT:
SITE:

Reviewed with the Following Field Staff:

Date:
Conditions:

MATERIALS TO AVOID: SAMPLING ACTIVITIES	
Verified:	**Sampling Equipment:**
	NO Teflon (or other fluoropolymers)
	NO aluminum foil
	Only HDPE/LDPE/silicone in use
	Only nitrile gloves (changed often)
Verified:	**Sample Bottles:**
	NO glass or LDPE bottles
	NO Teflon-lined caps
	NO chemical ice packs/NO blue ice
	Only HDPE bottle with poly/HDPE caps (bottles will be preserved with Trizma if residual chlorine expected)
	Only regular ice in Zip-loc bags
Verified:	**Field Documentation**
	NO waterproof/treated paper or field books
	NO Rite-in-the-Rain notebooks
	NO plastic clipboards
	NO Post-it notes or other adhesive papers
	NO Sharpies
	Only loose, plain paper
	Only metal clipboards
	Only ballpoint pens
Verified:	**Decontamination Procedures**
	NO Decon 90 (or other flouro-containing detergents
	Only Alconox or Liquinox
MATERIALS TO AVOID: FIELD STAFF CLOTHING/PERSONAL CARE	
Verified:	**Clothing Worn by Field Crew**
	NO clothing or boots with Gore-Tex or other synthetic, resistant fabrics (e.g., Tyvek)
	NO clothing with stain-resistant materials or treatments (e.g., Scotch-Guard) [Note1]
	NO clothing washed with fabric softener
	Only cotton clothing (laundered multiple times w/out fabric softener)
	Only rain gear made from polyurethane or wax-coated material
	Only polyurethane/PVC boots or untreated leather boots
Verified:	**Personal Care Products Used by Field Crew**
	NO cosmetics, moisturizers, lotions, etc.
	Only APPROVED sunscreen: See Table 1 of SOP
	Only APPROVED insect repellant: See Table 1 of SOP

FIELD CHECKLIST FOR PFC SAMPLE COLLECTION

PROJECT: *pg 2 of 2*

MATERIALS TO AVOID: FIELD STAFF CLOTHING/PERSONAL CARE (continued)	
Verified:	**Food/Beverage**
	NO food/beverages on-site with the exception of water/hydration fuids
	AVOID pre-packaged food, fast food wrappers/containers
	Wash hands after eating

NOTE 1: This includes covering any vehicle seating that is stain resistant or has been treated to be stain-resistant with a well-washed cotton blanket or sheet.

Detail below any items which cannot be verified:

_____

_____

_____

_____

_____

_____

_____

Provide details of corrective action(s) taken in response to above items:

_____

_____

_____

_____

_____

_____

_____

Field manager (print): _____

Field Mgr Signature: _____

Date / Time: _____

Attachment D.2

Leidos Field Technical Procedure FTP-400
Equipment Decontamination

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ENVIRONMENTAL SCIENCE & ENGINEERING OPERATION

STANDARD OPERATING PROCEDURE

Equipment Decontamination

FTP-400, Rev 0

Effective 31 Jan 2015

Approved By: Laura M. Obloy

Laura M. Obloy, Operations Manager

Kimberly C. Murphree

Kimberly C. Murphree, QA/QC Manager

TABLE OF CONTENTS

1. PURPOSE

This Standard Operating Procedure (SOP) describes the requirements for the decontamination of equipment during field sampling activities. The objective of decontamination is to:

- Remove physical, chemical and radiological contamination from surfaces;
- Minimize the spread of contamination to uncontaminated surfaces;
- Avoid cross-contamination of samples; and,
- Minimize personnel exposures.

The intent is to accomplish the required level of decontamination while minimizing the generation of additional solid and liquid waste.

1.1 Scope and Limitations

This SOP describes general decontamination requirements to be followed when field decontaminating sampling equipment (e.g., vehicles, drilling equipment, sampling equipment, well materials) for both reuse in the field as well as final decontamination prior to equipment storage or leaving the site. This procedure does not apply to health and safety equipment and personal protective equipment.

Decontamination procedures may be subject to Federal, State, or local regulations and/or client specific requirements. If a determination is made that any of the procedures described herein are inappropriate, inadequate or impractical and that other procedures must be used to decontaminate sampling equipment at a particular site, the variant process shall be authorized by the Project Manager (with concurrence from other appropriate personnel such as the Site Safety and Health Officer). Deviations identified before fieldwork begins shall be clearly documented in the Sampling and Analysis Plan (SAP) or other appropriate project-specific document. Deviations identified during fieldwork shall be documented in the field logbook with a description of the circumstance requiring its use.

1.2 Regulations or Standards

Not Applicable.

1.3 Definitions/Acronyms

Decontamination – Removal of substances from skin, clothing, or equipment to the extent necessary to preclude the occurrence of foreseeable health effects, environmental effects, or sampling and testing effects.

Deionized Water (DI Water) – Tap water that has been treated to remove ions. Generally, the term “DI Water” is used to refer to water that has been purified in some method to remove contaminants that may interfere with sample analysis. Essentially, water used for the final rinse step in decontamination procedures must not contain any contaminant at a concentration high enough to introduce a false positive into the analytical results of a sample. Rinsate Blanks can be used to provide verification.

Equipment – Those items (variously referred to as “field equipment” or “sampling equipment”) necessary for sampling activities.

Field Blank – A sample of DI Water poured into a sample container in the field, preserved and shipped to the laboratory with field samples. Field blanks are used to

assess contamination (vehicle exhaust, airborne contaminants, etc.) from field conditions during sampling.

Laboratory Detergent – A standard brand of phosphate-free laboratory detergent, such as Liquinox®, or equivalent.

Organic-Free Water – Tap water that has been purified specifically to remove organic compounds. One of the most common treatment methods is to filter the water through activated carbon. Similar to the DI water definition, organic-free water is required in situations where organic contaminants in the water may introduce false positives into the analytical results when analyzing for organics.

Rinsate Blank – A sample of DI water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples. The rinsate water is collected and placed into appropriate sample containers, preserved, and shipped to the lab for analysis as part of the field sampling program. Rinsate blanks are used to assess the adequacy of the decontamination process. Rinsate blanks are sometimes referred to as equipment blanks.

Sampling and Analysis Plan (SAP) – A plan that documents the procedural and analytical requirements for a project that involves the collection of samples to characterize potential areas of contamination. This may be a stand-alone plan or included as a section in another site- or project-specific plan.

Solvent – Pesticide-grade isopropanol is the standard solvent used for decontamination in most instances. The use of any other solvent must be justified and approved by the Project Manager and documented in the field logbook.

Tap Water – Water from any potable, municipal water system.

Trip Blank – A clean sample of a matrix that is taken from the laboratory to the sampling site and transported back to the laboratory without being exposed to sampling procedures. Trip blanks are typically only analyzed for volatile compounds, and are used to assess contamination introduced during shipping and field handling procedures.

2. QUALIFICATIONS AND RESPONSIBILITIES

2.1 Qualifications

Staff shall be trained to this procedure prior to conducting applicable activities and that training shall be documented.

2.2 Responsibilities

Project and/or Program Managers (PMs)

- Verifying that all personnel, including subcontractors, are properly trained to perform their assigned duties.
- Approving deviations from this procedure, in coordination with the Site Safety and Health Officer, and verifying deviations are properly documented.

Field Manager (FM)

- Verifying that all personnel, including subcontractors, perform their assigned duties in accordance with this procedure when it is applicable.
- Verifying compliance with the SAP during fieldwork.

- Selecting, in coordination with the Site Safety and Health Officer, the appropriate decontamination method that complies with SAP guidelines and regulatory requirements (if applicable).
- Verifying that equipment decontamination is performed in accordance with requirements and that the decontamination method selected is appropriate for the contaminant present as well as the surface and/or material to be decontaminated.
- Managing all fieldwork.

Site Safety and Health Officer

- Assisting the Field Manager in determining appropriate decontamination methods to be used.
- Providing guidance on and answering questions about health and safety requirements.
- Assisting the Project Manager in approving required deviations from this procedure on a project-by-project basis.

Field Staff

- Performing all decontamination activities in accordance with this procedure and requirements identified in the SAP or other site- or project-specific document.
- Communicate any issues encountered to the Field Manager and Project Manager.

3. HEALTH AND SAFETY

Proper safety precautions must be observed when field cleaning or decontaminating field equipment. Decontamination procedures may involve exposure to impacted surface waters or soils via routes of dermal contact and inhalation. Refer to the site- or project-specific Health and Safety Plan for specific guidance on safety precautions. Any questions and/or comments regarding health and safety will be directed to the Site Safety and Health Officer and/or the Field Manager. At a minimum, the following precautions shall be taken during decontaminating operations:

- Safety glasses or goggles, and nitrile (or equivalent) gloves will be worn while decontaminating equipment.
- No eating, smoking, drinking, chewing, or hand to mouth contact will be permitted during decontamination activities.

4. EQUIPMENT AND SUPPLIES

Required decontamination supplies and equipment are dependent upon the nature of the contaminant and the decontamination method use. The list below includes typical equipment and supplies necessary for general decontamination activities. Refer to the project SAP for specific details regarding required equipment and supplies for project-specific decontamination activities.

- Aluminum Foil
- Brushes
- Chain of Custody forms (for rinsate/equipment blanks)
- Coolers (for storage and shipment)
- DI Water

- Drums
- Emery cloth
- Field Logbook / Field Forms (See ESE FTP-1215 “Field Activity Documentation”)
- High-pressure washer
- Laboratory Grade Detergent (non-phosphate)
- Labels
- Organic-free water
- Paper towels
- Plastic bags
- Plastic Sheeting
- PPE (Check project-specific Health and Safety Plan for details; however, PPE generally includes, but is not limited to, eye, hand, foot, hearing, and head protection.)
- Sample containers for rinsate/equipment blanks
- Sand-blaster
- Sawhorses/racks (not wood)
- Solvent(s)
- Solvent squeeze bottle/dispenser
- Spray Bottles
- Steam Machine
- Table (not wood)
- Tap water
- Tape
- Trash bags
- Trash container(s)
- Tubs or buckets
- Writing Utensils (indelible ink, black preferred)

5. PROCEDURE

5.1 Overview

A decontamination plan should be developed and sufficiently scoped to address all the expected types and levels of contaminants at a site and the methods used to investigate them. The decontamination plan is typically included in the SAP. Until proven otherwise, the decontamination plan should assume that all personnel and equipment exiting the area of potential contamination are contaminated and, therefore, comprehensive decontamination procedures must be implemented. The plan should address the number, locations, and layout of decontamination stations; which decontamination apparatus is required; appropriate decontamination methods; and methods for disposal of contaminated equipment and waste liquids. The level of effort required for decontamination of equipment should be determined prior to beginning fieldwork.

All reusable equipment employed in the collection of environmental samples shall be cleaned prior to use to minimize the possibility of introducing contaminants with the potential to bias sample analysis. All sampling activities must be conducted with the utmost care because field contamination has the potential to significantly bias analytical

results. Reusable equipment must also be decontaminated between samples to prevent cross-contamination.

Cleaning techniques shall be commensurate with the type of equipment in use, generally consisting of washing with a laboratory grade detergent followed by subsequent rinses of tap water and DI water. Equipment used for sample portions that will be analyzed for metals may require a nitric acid rinse followed by a DI water rinse. Sampling equipment to be used to collect samples for organic compounds shall also be rinsed with an appropriate organic solvent. Note that pesticide-grade isopropanol is the standard solvent used for decontamination in most instances. The use of any other solvent must be justified and approved by the Project Manager and documented in the field logbook.

When equipment is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the equipment several times with an approved solvent (one which meets the requirements of the SAP) before initiating decontamination. Extreme cases may require more aggressive methods (e.g., steam clean, wire brush, or sandblasting). If the equipment cannot be adequately cleaned utilizing these means, it will be properly discarded.

For any specific decontamination method used, the substitution of higher-grade water is permitted (e.g., the use of organic-free water in place of DI water). However, it must be noted that DI water and organic-free water are less effective than tap water in rinsing away the detergent film during the initial rinse.

If an item has not been successfully decontaminated or cannot be monitored due to its shape (such as inside of a pipe), a decision as to further decontamination measures is made by the Field Manager.

Any deviations from the requirements specified in this procedure must be justified to and authorized by the Project Manager. All deviations must be sufficiently documented in the field logbook to allow recreation of the modified process.

The following information is intended only as a general guideline for understanding the relevant concerns pertaining to field equipment and sample device decontamination. The actual selection of all decontamination methods and schedules must be based on requirements within the site- or project-specific SAP.

5.2 Determining Appropriate Decontamination Methods

Each decontamination task must be individually assessed based on the characteristics and use of the equipment to be cleaned, including:

- Surfaces and materials of the equipment
- Size of equipment
- Fragility of equipment
- Equipment purpose/use

Assessment will also be based on the characteristics of the media to be removed by contamination (e.g., oily sludge, heavy clay, etc.). The assessment must take into account the potential contaminants of concern (e.g., radioactive versus chemical contaminants), levels of contamination, sensitivity of sample analysis, and related health and safety issues.

The FM , in coordination with the Site Safety and Health Officer if necessary, selects the decontamination method (as defined herein or in the SAP) deemed most appropriate for a particular task. If results are unsatisfactory, proceed step-by-step in selecting a more extensive method, as required, to successfully complete the decontamination. Deviation from plans will be documented in the field logbook and by a field change process if appropriate.

5.2.1 Equipment Categories

It is helpful to discriminate among three categories of field equipment when making decisions regarding decontamination requirements. These three categories of equipment are distinguished by the degree to which they may encounter contaminated media and their potential to indirectly affect sample integrity. Consequently, each of these three categories will usually require different consideration in terms of decontamination schedules and methods used. The table below identifies the three categories and indicates appropriate decontamination methods.

Category	Definition	Type of Decon	Example(s)
1	• Equipment that will not contact the sample • Should not affect sample integrity • Need not contact the contaminated media	Avoid decontamination by keeping clean equipment away from incidental contact with contaminated media (e.g., placing equipment on clean plastic drop cloths, baggies, etc.).	• Ambient air thermometers • Emergency equipment • Field support equipment
2	• Equipment that will not contact the sample • Should not affect sample integrity • Will contact the contaminated media	Decontamination between sample locations and decontaminated or packaged before being removed from the site.	• Flow meter used in conjunction with surface water sampling
3	• Equipment that may have an impact on sample integrity due to its function in close proximity to the sample before and during sample collection	Usually decontaminated prior to arrival on site, between sample locations, and most often between samples to avoid cross-contamination (e.g. drilling and digging through area of possible or known contamination.	• Drill rig • Drill rod • Augers • Flights • Sampling tools

Other factors influencing the selection of decontamination procedures and schedules include:

- Consideration of the effect of various decontamination solutions on the equipment and sampling device materials(s). Before selecting a cleaning method for specific field equipment, consult the manufacturer's instructions in order to avoid the possibility of damage to instrument components. The FM is responsible for verifying that the decontamination method selected is appropriate for the contaminant present and the surface and/or material being decontaminated.

- A distinction should be made between requirements for decontamination in the field between sample locations and the requirements for decontamination prior to storage.

5.2.2 Chemical Contamination

Equipment that contacts known or suspected chemical contaminants is considered chemically contaminated. The item is typically released for unrestricted use if, after decontamination, it is free of visible contamination. If organic contamination is a concern, the equipment and/or sampling device will be scanned with appropriate instruments (e.g., Photo Ionization Detector or Flame Ionization Detector) before release in accordance with pre-defined site- or project-specific criteria. Refer to the SAP or other site- or project-specific plans for specific criteria for decontaminating chemically contaminated equipment and release requirements.

5.2.3 Radioactive Contamination

The method for decontamination of equipment and the exterior of sample containers that have been exposed to radioactive material is based on the material contaminated, the sample medium, the radiation levels, and the specific radionuclides to be removed.

Criteria for releasing decontaminated equipment for unrestricted use is contained in site- or project-specific criteria, typically defined in a SAP. Attachment 1 is an example of standard criteria for release of materials exposed to surface radioactive contamination.

Porous materials (e.g., wood, hollow concrete block, rubberized coatings, etc.) and equipment with surfaces inaccessible for a survey (e.g., electric motors, small diameter pipes, etc.) and items with surface coatings that could bind or cover the contamination are considered on a case-by-case basis and released by authorized personnel in accordance with SAP or other site- or project-specific criteria.

5.3 Precautions for Storage and Handling

5.3.1 Handling Practices and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated. Storage and application containers must be constructed of the proper materials to ensure their integrity. Containers must be properly labeled with the contents. Safety Data Sheets must be available for any solutions or solvents used or stored. Following are acceptable materials used for containing the specified cleaning solutions:

- Laboratory detergent must be kept in clean plastic, metal, or glass containers until used. It should be poured directly from the container during use.
- Tap water may be kept in tanks, hand pressure sprayers, squeeze bottles, or applied directly from a hose.
- Deionized water must be stored in clean glass or plastic containers that can be closed when not in use. It can be applied from plastic squeeze bottles.
- Organic-free water must be stored in clean glass or Teflon® containers prior to use. It may be applied using Teflon® squeeze bottles.
- Solvents must be stored out of direct sunlight in the unopened original containers until used. They may be applied using Teflon squeeze bottles.

Hand pump sprayers are generally not acceptable storage or application containers for the materials defined above (with the exception of tap water). This also applies to

stainless steel sprayers. All hand sprayers have internal oil coated gaskets and black rubber seals that may contaminate the solutions.

Solvents, laboratory detergent, and rinse water used to clean equipment shall not be reused during field decontamination.

5.3.2 Disposal of Cleaning Solutions

Procedures for the safe handling and disposition of investigative derived waste, including wash water and rinse water, are in the EHS-280 “Investigative Derived Waste” procedure. The SAP, and/or the project-specific Waste Management Plan may also include information for proper handling and disposal of these materials.

5.3.3 Handling Decontaminated Equipment

After decontamination, equipment shall be handled only by personnel wearing clean gloves to prevent re-contamination. In addition, the equipment shall be moved away (preferably upwind) from the decontamination area to prevent re-contamination. If the equipment is not to be immediately reused it should be covered with plastic sheeting, wrapped in aluminum foil, or bagged to prevent re-contamination. The area where equipment is stored for reuse must be free of contaminants.

5.4 Pre-Sampling Requirements

5.4.1 Specifications for Designated Decontamination Area

Sufficient decontaminated equipment should be transported to the field so that daily work can be conducted without the need for field decontamination. When equipment must be decontaminated in the field, the following procedures are to be utilized for establishing a designated decontamination area.

The designated decontamination area shall be downwind of the location where clean equipment, clean sample devices, and samples containers are stored. This area shall also be in an area free of direct exposure to airborne and radiological surface contaminants.

Decontamination pads constructed for field cleaning of equipment should meet the following minimum requirements:

- The decontamination pad shall be constructed in an area known or believed to be free of surface contamination.
- The pad shall not leak. If the decontamination pad is found to be leaking at any time, the FM and PM shall be notified immediately.
- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined.
- Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above ground to prevent equipment from being splashed. These sawhorses/racks should not be constructed of wood.
- Decontamination water shall be removed from the decontamination pad frequently.
- A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be easily replaced (disposable) or repairable.

- At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material, but only after all waste/rinse water has been pumped into containers for disposal. See EHS-280 “Investigative Derived Waste”, the SAP, and/or the project-specific Waste Management Plan for proper handling and disposal of these materials.

On small projects, a decontamination pad may not be necessary. Where only “hand” sampling or other small equipment work is being conducted, several small washtubs may be sufficient for decontamination.

5.4.2 Preliminary Cleaning Requirements

All sampling equipment, including drill rigs, should be clean of any contaminants that may have been transported from off-site to minimize the potential for cross-contamination. All sampling equipment brought on-site shall meet these minimum requirements:

- All downhole augering, drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning or wire brushing. Sandblasting should be performed prior to arrival on site, or well away from the decontamination and sampling areas.
- Any portion of the drilling equipment that is over the borehole (kelly bar, mast, buckets, platform, hoist, spindles, cathead, etc.) shall be steam cleaned and wire brushed to remove all rust, soil, and other material that may have come from other areas before being brought on site.
- Painting and/or writing on well casing, tremie tubing, etc., should be removed before use. Emery cloth or sand paper can be used to remove printing and/or writing. Most well material suppliers can provide materials without printing and/or writing if requested when ordered. Items that cannot be cleaned are not acceptable and should not be used.
- The drill rig and equipment associated with the drilling and sampling activities must be inspected to verify that all oils, greases, hydraulic fluids, etc., on the surface of the equipment have been removed, and all seals and gaskets are intact with no fluid leaks. This inspection must be documented (field logbook, inspection log, maintenance log, etc.).
- PVC or plastic materials shall be inspected. Reusable Items that cannot be cleaned are not acceptable and should not be used.

5.5 Drilling Equipment Decontamination

The following procedures are presented as a function of the level of contaminant concentration and are intended as general guidelines. Appropriate requirements should be established based on the individual site characteristics and type of investigation performed.

- Low to Moderate Contaminant Concentration
    - Steam or water rinse with tap water to remove mud or dirt.
    - Steam or hot water wash with a mixture of detergent and tap water or other type of decontamination solution.
    - Steam or hot water rinse with clean, tap water.
    - Air dry on a clean, plastic- or aluminum foil-lined surface.

- High Contaminant Concentration
    - Steam rinse with tap water to remove mud or dirt.
    - Rinse critical pieces of sampling or drilling equipment with organic solvent and/or acid solution.
    - Steam wash with a mixture of detergent and tap water or other type of decontamination solution.
    - Steam rinse with clean, tap water.
    - Air dry on a clean, plastic- or aluminum-lined surface.

During decontamination of drilling equipment and accessories, clean the inside of hollow-stem auger flights, drill rods and drill bits (particularly roller bits), as well as all couplings and threads. Generally, decontamination can be limited to the back portion of the drill rig and those parts that come in direct contact with samples or casing, or drilling equipment that is placed into or over the borehole.

Mud pumps, kelly, swivel, kelly hoses, and suction hoses on rotary drill rigs shall be cleaned by circulating a sufficient volume of clean water and cleaning solution through the system followed by a clean water rinse through the system.

Water or grout pumps may be sufficiently decontaminated by flushing with water. However, if high concentration of contaminants or visible product is known to exist, then disassembly and thorough cleaning of internal parts is required prior to removal of the equipment from the site.

Some items of drilling equipment cannot typically be decontaminated. These include wood materials, porous hoses, etc. These items should not be removed from the site until they are ready for disposal in an appropriate manner.

5.6 Sampling Equipment Decontamination

All reusable sampling equipment which may contribute to the potential contamination of a sample must be thoroughly decontaminated prior to its initial use (unless specific documentation exists that the sampling equipment has been pre-cleaned or decontaminated) and between uses while actively sampling.

Generally, sampling equipment can be cleaned by hand. The following procedure is provided as a typical sequence that may be modified appropriately to be consistent with site conditions:

- Scrub with tap water to remove mud and residue.
- Scrub with a non-phosphate detergent/tap water solution or other decontamination solution as appropriate using a hard bristle brush.
- Rinse with clean tap water.
- Rinse with DI water
- If required by the SAP, rinse equipment being used for sampling metals with an approved acid solution (e.g., 10% nitric acid) followed by another DI rinse.
- If required by the SAP, rinse equipment being used for sampling organic parameters with an approved organic solvent. Note: Do not solvent rinse PVC or plastic items.
- Air dry on a clean, plastic- or aluminum foil-lined surface.

- Package and seal equipment in plastic bags or other appropriate containers to prevent recontamination.

Use of high-pressure steam or hot water may be substituted for hand scrubbing if it effectively removes contaminants and soil and can be done safely without burning or contaminating personnel. Racks should be used to hold equipment while high-pressure washing.

Split-spoon, split-barrel, and Shelby tube samplers are commonly used to obtain soil samples. Most samplers contain a ball-check valve above the sample barrel that shall be thoroughly decontaminated prior to use/reuse.

Steel tapes, water probes, transducers, thermometers and water quality meters shall be rinsed in deionized water (demonstrated analyte-free) or cleaned in a non-phosphate detergent solution and rinsed once in deionized water after each use.

5.7 Well Materials Decontamination

Well-casing, regarding of material, must be cleaned thoroughly before installation. The well casing supplier should provide documentation of cleanliness. In lieu of supplier documentation, the following decontamination procedure will generally be used or adapted as appropriate for site conditions:

- High-pressure hot water steam wash with a non-phosphate detergent and tap water solution, organic or acid rinses (if appropriate) or other types of decontamination solution.
- High-pressure hot water or steam rinse with clean tap water.
- Air dry on a clean, plastic- or aluminum foil-lined surface or wipe dry.
- Wrap with to prevent contamination before use.

5.8 Miscellaneous Equipment Decontamination

Step-by-step decontamination procedures for other typical sampling equipment are provided in Attachment 2. This information provided in Attachment 2 is not intended to be an exhaustive list of the type of equipment that may be utilized or that may require decontamination. Additionally, if site conditions or contaminants dictate a more specific decontamination procedure than those listed in Attachment 2, those alternate procedures shall be used. Any alternate or additional decontamination procedure must be documented and approved by the Project Manager.

6. QUALITY ASSURANCE / QUALITY CONTROL

Effectiveness of the decontamination procedures is monitored by submitting rinse water to the laboratory for low-level analysis of the parameters of interest. The rinsate blank provides information on the effectiveness of the decontamination process in the field. When used in conjunction with the field blanks and trip blanks, a rinsate blank can detect contamination during sample handling storage and sample transportation to the laboratory. A rinsate blank consists of a sample of analyte-free (i.e., deionized) water which is passed over and through a field decontaminated sampling device and placed in a clean sample container. Rinsate blanks should be run for all parameters of interest at a rate a frequency appropriate for the project. Especially in the case of sampling events that occurred over multiple days or longer, the analytical results for the rinsate blanks should be evaluated as soon as possible to confirm that the decontamination procedure is effective. This frequency should be defined in the SAP.

In the event that rinsate blanks indicate a potential problem with the decontamination procedure, the quality of the DI and organic-free water used may be verified by collecting samples in standard, pre-cleaned sample containers and submitting them to the laboratory for analysis. Organic-free water should be submitted for low-level pesticide, herbicide, extractable, or purgeable compounds analyses, as appropriate.

All samples sent to a laboratory shall comply with ESE FTP-650 “Labeling, Packaging and Shipping Environmental Field Samples” and ESE FTP-625 “Sample Chain of Custody.”

7. RECORDS

Records generated as a result of this procedure shall be submitted to the designated electronic record system in accordance with ESE A17.1 “Project Records Management”.

8. REFERENCES

- ESE FTP-625, Sample Chain of Custody
- ESE FTP-650, Labeling, Packaging and Shipping Environmental Samples
- ESE FTP-1215, Field Activity Documentation
- ESE A17.1, Project Records Management
- EHS-280, Investigative Derived Waste, Revision 0, 9/30/2013
- Field Branches Quality System and Technical Procedures, U.S. Environmental Protection Agency
- US NRC Regulatory Guide 1.86, June 1974

Refer to https://horizon.leidos.com/eiapps/qa/ for the current version of ESE referenced procedures.

9. ATTACHMENTS

- Attachment 1. Surface Radioactivity Guides
- Attachment 2. Miscellaneous Equipment Decontamination

10. DOCUMENT CHANGE RECORD

- Revision 0, dated 31 Jan 2015, is the original version of this procedure issued under Leidos.

ATTACHMENT 1

Surface Radioactivity Guides

Nuclide	Average [b, c] (dpm/100 cm^2)	Maximum [b, d] (dpm/100 cm^2)	Removable [b, e] (dpm/100 cm^2)
U-nat, U-235, U-238, and associated decay products	5,000 alpha	15,000 alpha	1,000 alpha
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
Th-nat, Th-232, Sr-90,Ra-223, Ra-234, U-232, I-126, I-131, I-133	1000	3000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 beta-gamma	15,000 beta-gamma	1,000 beta-gamma

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive contamination per 100 cm^2 of the surface area should be determined by wiping the area with dry filter paper or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface area should be wiped.

Source: US NRC Regulatory Guide 1.86, June 1974

ATTACHMENT 2

Miscellaneous Equipment Decontamination

The following are guidelines for decontaminating typical equipment used for environmental field sampling. Not all sampling equipment is listed here. Additionally, if site conditions or contaminants dictate a more specific decontamination procedure than those listed here, those alternate procedures shall be used. Any alternate decontamination procedure must be documented and approved by the Project Manager.

Well Sounders or Tapes

- Wash with laboratory detergent and tap water
- Rinse with tap water
- Rinse with DI water
- Allow to air dry overnight (does not apply to field cleaning)
- Wrap equipment in aluminum foil with shiny side of the foil facing outward (with tab for easy removal), seal in plastic, and date.

Submersible Pumps and Hoses Used to Purge Ground Water Wells

This method applies whether this equipment is decontaminated in the field or in the field equipment warehouse.

- Pump a sufficient amount of soapy water through the hose to flush out any residual purge water.
- Using a brush, scrub the exterior of the contaminated hose and pump with soapy water.
- Rinse the soap from the exterior of the hose with tap water.
- Rinse the exterior of the hose with DI water.
- Pump a sufficient amount of tap water (approximately one gallon) through the hose to flush out the soapy water.
- Pump a sufficient amount of DI water through the hose to flush out the tap water and then purge the pump in reverse mode.
- Rinse the outside of the pump housing and hose with DI water (approximately ¼ gallon).
- Equipment will be placed in a polyethylene bag or wrapped with polyethylene film to prevent contamination during storage or transit. Ensure that a set of rotors, fuses, and cables are attached to each cleaned pump.

Engines for Portable Power Augers such as the Little Beaver

- The engine and power head will be cleaned with a power washer, steam jenny, or hand washed with a brush using detergent. Detergent does not have to be a laboratory detergent but it should not be a degreaser. Remove oil, grease, and hydraulic fluid from the exterior of the unit.
- Rinse thoroughly with tap water.

ISCO Flow Meters, Field Analytical Equipment, and other Field Instrumentation

Before selecting a cleaning method for specific field instruments, consult the manufacturer's instructions to avoid the possibility of damage to instrument components.

- Wash exterior of sealed, watertight equipment (such as ISCO Flow Meters) with a mild detergent (such as liquid dishwashing detergent).
- Rinse with tap water.
- Interiors of such equipment may be wiped with a damp cloth if necessary.
- Flow measuring equipment such as weirs, staff gages, and velocity meters may be cleaned with tap water after use between measuring locations.
- Other field instrumentation should be wiped with a clean, damp cloth. pH meter probes, conductivity probes, DO meter probes, etc., will be rinsed with DI water before storage.
- The desiccant in flow meters and other equipment will be checked and replaced if necessary each time the equipment is cleaned.

Ice Chests and Reusable Shipping Containers

- Wash with laboratory detergent (interior and exterior).
- Rinse with tap water
- Air dry before storage

Drill Rigs and Associated Equipment

No oils or grease will be used to lubricate drill stem threads or any other drilling equipment that is used over the borehole or in the borehole without documented prior approval from the client. If drill stems tend to tighten during drilling, Teflon string can be used on the drill stem threads.

Any portion of the drill rig, backhoe, etc., that is over the borehole should be steam-cleaned (detergent and high-pressure hot water) between boreholes.

In addition, all downhole drilling and associated equipment that will come in contact with the downhole equipment and sample medium will be cleaned and decontaminated by the following methods:

- Clean with tap water and laboratory grade, phosphate-free detergent, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high-pressure hot water with detergent) may be necessary to remove matter that is difficult to remove with a brush. Auger flights and drill rods that are used to drill down in preparation for sample collection must be decontaminated thoroughly both on the outside and inside, as applicable. The steam cleaner and/or high-pressure hot water washer will be capable of generating at least 2500 psi of pressure and 200 degree F or greater water temperatures.
- Rinse thoroughly with tap water. Tap water may be applied with a pump sprayer. All other decontamination liquids (DI water, organic-free water, and solvents) must be applied with non-interfering containers. These containers will be made of glass, Teflon®, or stainless steel. This aspect of the decontamination procedures used by the driller will be inspected by the Field Manager and/or other responsible person prior to beginning of operations. Remove from the decontamination area and cover with clean, unused plastic. If stored overnight, the plastic should be secured so it stays in place.

Sample Container Exteriors

Decontamination of sample container exteriors must occur before placing the sample container in the sample cooler or shipping container.

- Wipe the exterior surfaces of the sample container with disposable rags/towels or rinse with DI water.
- After rinsing with DI water, if applicable, dry the exterior of the sample container with disposable rags/towels.
- All visible dirt, droplets of liquid, or other extraneous materials must be removed.
- For containers used in controlled access areas, or where the sample media is difficult to remove (e.g., sludge), a more rigorous cleaning and/or radiation monitoring may be required. Refer to site- or project-specific plans for details.

Stainless Steel, Teflon, or Metal Sampling Equipment (Trace Organic/Metal Samples)

The following procedure is for decontaminating stainless steel, Teflon, or metal sampling equipment used to collect samples for trace organic compounds and/or metals analyses:

- Clean with tap water and laboratory detergent solution. Use phosphate-free detergent, such as Liquinox®, or equivalent. Use a brush to remove particulate matter and surface film.
- Rinse thoroughly with organic-free water.
- Rinse twice with solvent (pesticide-grade isopropanol).
- Allow to air dry for 24 hours, if possible.
- If it is not possible to air dry for 24 hours, then rinse twice with organic-free water and allow to air dry as long as possible.
- Wrap sampling equipment with aluminum foil (with shiny side facing outward). This is done to prevent contamination of sampling equipment during transport and storage.

Stainless Steel or Metal Sampling Equipment (Radioactive Samples)

- Clean with tap water and detergent solution. Use phosphate-free detergent, such as Liquinox®, or equivalent. Use brush to remove particulate matter and surface film, as necessary.
- Rinse with tap water.
- Drying sampling equipment prior to reuse.

Glass Sampling Equipment

The following describes the methods for decontaminating glass sampling equipment used to collect samples for trace organic compounds and/or metals analyses:

- Wash thoroughly with laboratory detergent and hot tap water using a brush to remove any particulate matter or surface film.
- Rinse thoroughly with hot tap water.
- Rinse thoroughly with tap water.
- Rinse twice with an appropriate solvent and allow to air dry for at least 24 hours.
- Wrap with aluminum foil (with shiny side facing outward). This is to prevent contamination during storage and/or transport to the field.

Silastic Rubber Pump Tubing (used in Automatic Samplers and other Peristaltic Pumps)
New clean tubing must be used for each automatic sampler set-up. The silastic rubber pump tubing need not be replaced in peristaltic pumps where the sample does not contact the tubing or where the pump is being used for purging purposes (i.e., not being used to collect samples). New tubing (certified clean by the manufacturer or medical grade) may be used in lieu of cleaning. New tubing may be dedicated to a well or new tubing used for each sampling event or location.

- Flush tubing with hot tap water and phosphate-free laboratory detergent.
- Rinse tubing thoroughly with hot tap water.
- Rinse tubing with DI water.

Teflon Sample Tubing
Only new Teflon sample tubing, decontaminated as follows, may be used for collection of samples for organic compounds analyses:

- Teflon tubing may be pre-cut in convenient lengths before cleaning to simplify handling.
- Rinse outside of tubing with an appropriate solvent.
- Flush interior of tubing with an appropriate solvent.
- Dry overnight using a drying oven, if applicable.
- Wrap tubing and cap ends with aluminum foil, or store in a plastic bag to prevent contamination during storage.

Polyvinyl Chloride (PVC) Sample Tubing
Only new PVC tubing shall be used and decontaminated as follows:

- Tubing will be stored in its original container and not removed from this container until needed.
- The tubing will be flushed immediately before use to remove any residues from the manufacturing or extruding process.
- Discard tubing after use in sampling.

Stainless Steel Tubing

- Wash with laboratory detergent and water using a long, narrow, bottle brush. Use hot water, if available.
- Rinse thoroughly with tap water. Use hot water, if available.
- Rinse thoroughly with DI water.
- Rinse twice with an appropriate solvent.
- Allow to air dry for 24 hours, if possible.
- If it is not possible to air dry for 24 hours, then rinse thoroughly with organic-free water and allow to dry for as long as possible.
- Wrap with aluminum foil (with the shiny side facing outward). This is done to prevent contamination of tubing during transport and storage.

Glass Tubing

Use only new glass tubing, decontaminated prior to use as follows:

- Rinse thoroughly with approved solvent.
- Air dry for at least 24 hours.
  Wrap with aluminum foil (with the shiny side facing outward) to prevent contamination during transport and storage.

ATTACHMENT E. NASA GRC SPECIFICATIONS

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PROJECT TABLE OF CONTENTS

-- End of Project Table of Contents --

SECTION 01 35 26.98

GENERAL SAFETY REQUIREMENTS
03/18

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 REFERENCES

The documents listed below are incorporated by reference into this contract as if fully rewritten herein.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA NPR 8621.1	(2006b; Change 7) NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping
NASA NPR 8715.3	(2008c; Change 9) NASA General Safety Program Requirements
GLM-QS-1700.1	Glenn Research Center, Safety Manual
GLM-QS-1800.1	Glenn Research Center, Occupational Health Programs Manual

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Records shall be submitted in accordance with paragraph entitled, "Gas Protection," of this section.

SD-07 Certificates

Statements shall be submitted for the following items in accordance with paragraphs entitled, "Safety Plan" and "Protection Plan," of this section.

Site Specific Health and Safety Plan; G

Protection Plan; G
Construction Project Training Summary Report; G

Construction Project Training Summary Report; G

Training certifications for fall protection competent person.

Steel Erection Plan; G

1.3.1 Site Specific Health and Safety Plan

Contractor shall submit a site specific safety plan to the Contracting Officer for approval within 10 working days after award of contract and it shall be approved prior to notice to proceed. Compliance to the safety plan is mandatory. A copy of this approved plan shall be maintained on the construction site.

The Site Specific Health and Safety plan shall include, as a minimum, the following:

a. Health and Safety program objectives.

b. Description of work.

c. Methods to attain safety objectives.

d. Responsibility of key personnel for the Contractor.

e. List of subcontractors and their competent persons.

f. Safety meetings, surveys, inspections, and reports.

g. Identification of safety hazards and mitigation plan to allow for safe conduct of work. If the hazard cannot be mitigated, include specific PPE that shall be worn. When selecting hazard control methods and personal protective equipment (PPE) to limit workers exposures the most restrictive occupational exposure limits (OELs) shall be used. The most restrictive OELs of the following shall be used: OSHA permissible exposure limit (PEL), ACGIH threshold limit value (TLV), and American Industrial Hygiene Association (AIHA) workplace environmental exposure limits (WEELs)

h. Emergency plan including emergency number and muster locations.

i. Lists of key personnel to be contacted in times of emergency.

j. Program to show compliance with Federal OSHA Safety and Health Standards 29 CFR 1910 and 29 CFR 1926 and various safety requirements of NASA NPR 8715.3. This shall include an overall site Fall Protection Plan that demonstrates that the requirements and criteria for fall protection in construction workplaces covered under 29 CFR part 1926 will be met for every activity taking place during the project.

k. Methods to comply with the requirement for immediate reporting of mishaps to the Contracting Officer in accordance with NASA NPR 8621.1. This document is available at:

http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_8621_001B_&page_name=main

l. Procedures for emergency actions to be taken to secure dangerous conditions, to protect personnel, and secure work areas in the event of accident or an act of nature.

m. Procedures for securing the mishap site so that the area remains secure until arrival of a safety investigator. Mishap site will remain secured until released by the Contracting Officer.

n. Provide MSDS sheets for all chemicals which will be used. Methods for handling and storage shall be identified.

o. Identify the competent person and the competent person for specific activities as required by 29 CFR 1926.

p. The Health and Safety plan shall be reviewed and signed by all site personnel.

q. Daily documented site safety inspections shall be performed and documented.

r. A C-979 Fall Prevention Plan form shall be completed if the workers are working at a height of 6 feet or greater.

s. If the prime contractor is writing the HASP for a subcontractor, then the subcontractor shall submit documentation on company letterhead indicating that they concur with the HASP and are able to comply with all controls and personal protective equipment requirements as specified by the prime contractor.

1.3.2 Protection Plan

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent shall be protected against damage.

1.3.3 Construction Project Training Summary Report

The contractor shall provide a submittal of an up-to-date Construction Project Training Summary Report containing worker's names, employers, assigned tasks, qualifying training, certifications, and dates of training for a prime and subcontractor workers to be on site. The submittal shall include a statement from the prime contractor stating that the construction workers have undergone a qualifications review and verified as being qualified for assigned tasks while at the GRC construction site. The Construction Project Training Summary Report shall be updated and submitted monthly. The Construction Project Training Summary Report shall be reviewed and accepted by the Project Team through the Contracting Officer's Representative (COR) and then to the Contracting Officer (CO). The status of the Construction Project Training Summary Report shall be incorporated into the project meeting minutes and shall document any Project Team comments.

1.3.4 Steel Erection

Provide a steel erection plan per 29 CFR 1926.752 prior to the beginning of any steel erection operation.

1.4 SAFETY SUPERVISION

Contractor's Safety Supervisor shall ensure that:

a. NASA fall protection requirements are included in work instructions where NASA employees and/or contractors will be working in situations that require fall protection.

b. Ensure that anyone who is identified as a qualified person (per ANSI/ASSE Z359.0-2007, paragraph 2.109) to serve as a subject matter expert in fall protection has an engineering degree or access to a person with an engineering degree to identify and to evaluate unique situations and nonstandard equipment and has been trained by an industry-recognized trainer, NASA-recognized trainer/training center, or NASA-developed training program equivalent to ANSI- and OSHA-compliant training (Ref: ANSI/ASSE Z359.2 -2007 Section C.5).

c. For each situation that requires fall protection, ensure that there is a competent person (per ANSI/ASSE Z359.0-2007, paragraph 2.27) assigned responsibility for the immediate application of fall protection work where fall protection is required whose education and training has been administered by an industry-recognized trainer, NASA-recognized trainer/training center, or NASA-developed training program equivalent to ANSI and OSHA compliant training. Fall protection competent person shall be on site 100% of the time active fall protection is being used.

d. Construction personnel are performing work in compliance with the approved site specific health and safety plan.

1.5 GENERAL SAFETY PROVISIONS

The GRC Safety Manual, GLM-QS-1700.1, is available online at http://smad-ext.grc.nasa.gov/shed/pub/gsm/gsm-manual.pdf.

The GRC Occupational Health Programs Manual, GLM-QS-1800.1, is available on-line at http://smad-ext.grc.nasa.gov/shed/pub/ohpm/ohpm-manual.pdf

These documents are incorporated by reference into this contract as if fully rewritten herein.

The Contractor and all subcontractors are subject to applicable federal, state, and local laws, regulations, ordinances, codes, and orders relating to safety and health in effect on the date of this Contract.

During the performance of work under this Contract, the Contractor shall comply with procedures prescribed for control and safety of persons visiting the project site. Contractor is responsible for his personnel and for familiarizing each of his subcontractors with safety requirements. Contractor shall advise the Contracting Officer of any special safety restriction he has established so that Government personnel can be notified of these restrictions.

All contractor and subcontractor employees shall sign the HASP to document that they understand and will comply with the contents.

Contractor shall comply with the requirements of NASA NPR 8715.3. This document is available at http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_8715_003C_&page_name=main
The contractor shall protect workers who may be exposed to a fall of six feet or greater to a lower level for construction activities. This requirement is more stringent in some cases than that required by 29 CFR 1926, such as for steel erection.

1.6 SAFETY LOCKOUT/TAGOUT PROCEDURES

Contractor shall ensure that each employee is familiar with and complies with these procedures as listed in Chapter 9 Lockout/Tagout of the Glenn Safety Manual, GLM -QS -1700.1,and 29 CFR 1910.147.

Contracting Officer or designee shall, at the Contractor's request, have proper isolation of sources of hazardous energy performed by on-site personnel because of the experience and knowledge necessary to make the particular equipment safe to work on. The contractor shall then perform the required lockout/tagout using red bodied locks and, GRC furnished, GRC946A Danger Do Not Operate tags, at all final points of isolation.

No person, regardless of position or authority, shall operate any switch, valve, or equipment that has an official lockout/tagout red lock and tag attached to it, nor shall such locks and/or tags be removed except by the employee that attached them (Except in an emergency situation, see Chapter 9 Lockout/Tagout of the Glenn Safety Manual, GLM -QS -1700.1).

No person shall work on any equipment that requires a lockout/tagout red lock and tag unless he/she has placed their personal, red bodied, lock at the final point of isolation.

Any individual, regardless of position or authority, who is required to be protected by lockout/tagout shall place their personal, red bodied, lock at the final point of isolation.

Identification markings on building light and power distribution circuits shall not be relied on for established safe work conditions. An established safe work condition exists when (1) sources have been isolated, (2) lockout/tagout has been performed, (3) verification using the hot-dead hot method has been accomplished, and (4) grounding (if required) has been completed.

Before clearance will be given on any equipment, the apparatus, valves, electrical circuits, or systems shall be secured in a passive condition with the appropriate vents, pins, and/or locks.

Pressurized or vacuum systems shall be vented to relieve differential pressure completely.

Vent valves shall be tagged and locked open during the course of the work.

Where dangerous gas or fluid systems are involved, or in areas where the environment may be oxygen deficient, system or areas shall be purged, ventilated, or otherwise made safe prior to entry.

1.7 ACCIDENT TREATMENT AND RECORDS

Contractor shall post emergency first aid and ambulance information at project site.

Emergency response shall require the Contractor to call 911 on a NASA phone or 216 433-8888 (LF) or 419-621-3222 (PBS)on an outside line.

1.8 FIRE PREVENTION AND PROTECTION

Open-flame heating devices will not be permitted except by approval in writing from the Authority Having Jurisdiction (AHJ) at GRC. Approval for the use of open fires and open-flame heating devices will not relieve the Contractor from the responsibility for any damage incurred because of fires.

Burning trash, brush, or wood on the project site shall not be permitted.

All hot work operations shall comply with NASA GRC Safety Manual, Chapter 28, Hot Work Authorization. Prior to hot work, a C-7a Hot Work Authorization Permit shall be issued by the Safety, Health and Environmental Division. Immediately prior to hot work operations, a C-7b form and associated inspection shall be completed by the responsible person.

Contractor shall discontinue burning, welding, or cutting operations 1 hour prior to the end of the normal work day. A workman shall remain at the site for 1 hour after discontinuing these operations to make thorough inspection of the area for possible sources of latent combustion. The Contractor shall be equipped with the appropriate fire extinguishers and shall be trained in the proper use of fire extinguishers. Any unsafe conditions shall be reported to SHED. (Telephone: (216) 433-2088)

1.9 ELECTRICAL

Contractor shall appoint an individual responsible for the electrical safety of each work team to restrict entry to dangerous locations to those authorized by him jointly with the Government.

1.10 UNDERGROUND UTILITIES

A Confined Space Entry Permit, NASA C-199, as per Chapter 16 of the Glenn Safety Manual is required before any Contractor personnel enters a manhole. Contractor shall contact the Contracting Officer for support services by calling (216) 433-8888 at least 72 hours in advance.

Contractor shall be responsible for removing water and debris before commencement and during execution of work in manholes.

1.11 RADIATION SAFETY REQUIREMENTS

License Certificates for radioactive materials (RAM)and equipment shall be submitted for all specialized material and equipment per Chapter 8 of the Glenn Occupational Programs Manual. As a Federal facility, GRC falls under the jurisdiction of the NRC. Radiography companies shall possess an NRC license or NRC reciprocity for their state license. Individuals performing source radiography shall have a radiography license issued by the NRC to perform such work at GRC, a Federal reservation. Alternatively, a state

license with a reciprocity agreement from the NRC shall be acceptable. Portable nuclear moisture/density gauge users shall have a RAM license issued by the NRC, or alternatively, by a comparable state agency with an NRC reciprocity agreement.

Operations performed by the Contractor which utilize nuclear density gauges and/or source radiography shall be included in the HASP. The NASA GRC Radiation Safety Officer shall review and approve aspects of the contractor's HASP or "radiation safety plan" related to using RAM.

Workers shall be protected from radiation exposure in accordance with 10 CFR 20. Standards for Protection Against Radiation

Loss of radioactive material shall be reported immediately to the Contracting Officer.

Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 5 p.m. on weekdays.

In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, no assumptions shall be made as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, a fully instructed employee shall be positioned inside such building or area to prevent exiting while external radiographic operations are in process.

1.12 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer. Any closure of a road, sidewalk or parking spots requires submittal of a Barricade Request Form.

1.13 DIGGING, TRENCHING, AND/OR EXCAVATION

Prior to performing any excavation work or any surface penetrations on any ground surface, the Contractor shall obtain from the Facilities Division an Excavation Permit (C 927). The Contractor shall comply with GRC Safety Manual, Chapter 35, Digging, Trenching, & Excavating Procedure and Requirements.

Contractors must obtain a C927 Excavation Permit for any penetration into surface at GRC. Each permit is limited to a 400 linear foot section or approximately 1 acre as determined by the COR and NASA Civil Systems Manager. The permit will only be valid for 3 months or after work is complete within the permit defined area, whatever comes first. The government shall be responsible to fill out part A. The Prime Contractor and Excavation Contractor shall be responsible to fill out portions B-C of permit when required by COR.

The contractor shall be required to acquire a Professional Ohio Surveyor to stake out all proposed infrastructure work. The contractor shall also be required to mark excavation with white temporary marking paint prior to receiving approved Excavation C927 Permit.

Permit portion B1 is the Utility Verification and Marking log. The contractor is required to track utility markings and request them every two weeks or sooner if necessary. See GRC Excavation Manual for further information.

Permit Portion B2 is the Potholing log. The contractor is required to verify (pothole) all utilities as identified on the Underground Record Drawing (URD) prior to completing infrastructure excavation. This log verifies all utilities are properly identified and protected. See GRC Excavation Manual and GRC Safety Manual for further information on Potholing requirements.

Permit portion C is Daily Field Tag Up Meetings. The contractor is required to hold daily coordination meetings with excavation personnel to coordinate work activities for the day witnessed by NASA Construction Manager and/or Inspector. During these meetings the area of work shall be addressed. The contractor will be limited to this area as discussed during the day. See GRC Excavation Manual for further information.

The Requestor is a member of GRC organization or support service contractor which will monitor the excavation activities. The requestor shall:

Initiate a NASA Form filling out Part A step 1 of the GRC927, Digging, Trenching, and Excavating on Permit, and submitting it electronically using the GRC927 submit button function.

Ensure the Contractor Competent Person designated for this activity has the NASA GRC Excavation Manual and has read the manual thoroughly and verify the competent person has the knowledge and training required by the GRC Excavation Manual.

Ensure the Contractor Excavator operator has NASA GRC Excavation Quick Reference card and understands all utility markings.

Ensure that all personnel working at the jobsite are trained and aware of the hazards of digging, trenching, excavating and ground penetration. Ensure that all items outlined in the permit are properly defined and resolved prior to operations involving digging, trenching, excavating activities to avoid damage to utilities and structures identified on the construction drawings.

Notify the Emergency Dispatch and their supervisor (if a civil servant) or their COR (if a contractor) if an unexpected underground utility or structure is found during the activity or if an underground utility or structure is hit or broken during the activity (The requestor shall notify the emergency dispatch at 911 if using a NASA internal telephone or if using a cell phone dial 216-433-8888 at Lewis Field or 419-621-3222 at Plum Brook Station.) It is the Supervisor's or COR's responsibility to notify SHeD.

Comply with all the requirements of the above listed reference documents and other regulations in regard to safe performance of the job.

Coordinate their work with the lab utilities to assure that related activities such as utility shutdown are addressed

Attends daily tag up meetings held by contractor competent person, and contractors excavation personnel to ensure all aspects of excavation work are discussed and coordinated all portions of C927 and filled out properly;

Ensure all work ceases if problems are found until such time as the excavation is made safe again for entry

The Contractor performing the excavation and/or utility work shall ensure a competent person to oversee each permitted excavation (GRC927). This person shall be at the physical excavation site 100% of the time comparing construction documents to the Underground Record Drawings (URD), auditing the excavation process, evaluating utility markings, evaluating symbols versus details and ensuring the permit process is followed. The contractor shall submit an official document stating the compliance and qualifications of competent persons. The excavation competent person period will expire at the end of each contract and/or every three years, whatever is more stringent. The following are minimum requirements:

Excavation Competent Person Mandatory Qualifications:

a. Has a working knowledge of trenching, excavation, horizontal directional drilling, underground construction, shoring, and soil types as appropriate to the assigned task.

b. Has the ability to assure that all underground utilities are located, field verified, and clearly marked prior to excavation.

c. Is knowledgeable in applicable excavation regulations to include OSHA 29CFR1926. Have knowledge of trench collapse prevention, ventilation and air monitoring requirements (where applicable), ground water control, personal protective equipment, and emergency procedures as they pertain to underground construction and utility work. A minimum 5 years excavating experience is required.

d. Has the ability to notify the prime contractor or Government (as applicable) of any nonconformance issues and document them; and to provide any corrective actions to mitigate hazards or nonconformance issues.

e. Successful completion of GRC Excavation 101 Course GRC-012-15.

Utility Competent Person Mandatory Qualifications:

a. Has a working knowledge of trenching, excavation, horizontal directional drilling, underground construction, shoring, and soil types as appropriate to the assigned task.

b. Has the ability to assure that all underground utilities are located, field verified, and clearly marked prior to excavation for proposed infrastructure or infrastructure repair.

c. Is knowledgeable in applicable excavation regulations to include OSHA 29CFR1926. Have knowledge of trench collapse prevention, ventilation and air monitoring requirements (where applicable), ground water control, personal protective equipment, and emergency procedures as

they pertain to underground construction and utility work. A minimum 5 years excavating experience is required.

d. Has the ability to notify the prime contractor or Government (as applicable) of any nonconformance issues and document them; and to provide any corrective actions to mitigate hazards or nonconformance issues.

e. Has the ability to review, understand, and interpret Underground Record Drawings, contract drawings, and specifications.

f. Successful completion of GRC Excavation 101 Course GRC-012-15.

g. Has the ability to oversee and witness underground construction and utility work to ensure that established processes are followed. A minimum of 5 years utility installation experience is required.

h. Has working knowledge of hydro-testing and pigging, as well as welding and fusion procedures, as appropriate to the assigned task.

i. Is knowledgeable in applicable rules and regulations to include 29CFR1926 and installation of utilities such as domestic water (i.e. fire hydrants, thrust blocks, testing, cleaning and chlorination), sewers, duct banks, natural gas, and other pressure pipes, as appropriate to the assigned task.

j. Is capable of identifying existing and predictable hazards in the surroundings of underground utility construction and understanding the corrective measures to eliminate them.

Excavations greater than 4 ft in depth may be considered to be confined spaces. As such, these shall be evaluated by SHED with regard to existing and potential hazards to determine if the excavation shall be considered a permit-required confined space. Further regulations regarding confined spaces follow:

Below 4 and 20 ft, SHED shall evaluate and determine if an excavation is to be considered a permit-required confined space based upon the known and potential hazards.

Below 20 ft in depth, all excavations shall be considered to be permit-required confined spaces and the requirements of the Glenn Safety Manual, Chapter 16, Confined Space Entry, shall be in effect.

Confined Space Entry Training shall be required if an excavation has been determined to be a Permit-Required Confined Space. Employees who work in or around excavations must be provided training according to their work activities.

GRC adheres to ORC 3781.30, in addition GRC has established a tolerance zone surrounding all underground utilities. The tolerance zone is the total width of the underground utility plus 18 inches on each side. The vertical tolerance zone extends from the elevation shown on the utility profile and/or underground record drawing to 24 inches above the tope edge and 24 inches below the bottom edge of the utility.

Methods of excavation within the tolerances zones are hand digging, vacuum excavation, and hydro excavation. Potholing of all utilities for verification is required prior to infrastructure excavation. The GRC Civil Systems Manager may grant a waiver for potholing however the contractor is still required to excavate in accordance with the tolerance zone requirements. See NASA GRC Excavation manual for further information.

NASA Civil System Manager, NASA COR, and the NASA Health and Safety Office will strictly monitor digging, excavation, trenching and ground penetration activities to ensure compliance with the Excavation permit. Significant discrepancies shall be documented in the SHETrak System.

All permits and associated documentation issued for the purpose of controlling digging, trenching, excavating and ground penetration activities shall be considered part of the construction and/or task documentation. Records retention requirements shall be governed by those of the construction and/or task documents or contract.

Completed Excavation Permits shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES, in sufficient detail to show full compliance with the specification. Contractor is responsible to submit the permit in its entirety as a submittal to the Government once the permit is expired and/or terminated along with all associated subsurface infrastructure as-built information installed and obtained as part of this permit. Permit and as-built submittal is required 10 business days after permit expiration or termination.

The contractor shall submit the utility as-builts for newly installed utilities and surface features along with any existing utility information collected as part of the excavation permit process. The applicable as-builts shall be submitted to the government for approval within 10 days after each completion of the excavation permit (GRC 927). A complete set of as builts will be required at completion of project. The As-Built redlines must be completed on official construction drawings. Lines, letters, and details shall be sharp, clear, and legible. Additions or corrections to the drawings shall be drawn to the scale of the original drawing.

1.14 GAS PROTECTION

Contractor shall have one or more employees properly trained in operation of gas testing equipment and formally qualified as gas inspectors who shall be on duty during times workmen are in confined spaces. Their primary functions shall be to test for gas and operate testing equipment. Unless equipment of constant supervisory type with automatic alarm is employed, gas tests shall be made at least every 2 hours or more often when character of ground or experience indicates gas may be encountered. A gas test shall be made before workmen are permitted to enter the excavation after an idle period exceeding one-half hour.

Readings shall be permanently recorded daily, indicating the concentration of gas, number and location of drilled piers, point of test, date, and time of test.

All gas detection equipment shall be calibrated as per the manufacturer's requirements. Documentation of this calibration shall be made available to the Government upon request.

Special requirements, coordination, and precautions will apply to areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. The contractor shall not enter a confined space that is oxygen deficient or may be immediately dangerous to life and health.

1.15 ROOFING AND COATING

At the beginning of each work day the Contractor shall check with the Contracting Officer before proceeding to work on the roof to ensure safe work conditions.

1.16 HIGH NOISE LEVEL PROTECTION

Operations performed by the Contractor that involve the use of equipment with output of high noise levels (jackhammers, air compressors, and explosive device activated tools) shall be scheduled for after duty working hours. Use of any such equipment shall be approved in writing by the Contracting Officer prior to commencement of work.

1.17 LASER

Operations performed by the Contractor which utilize lasers shall be included in the HASP. Laser operations shall only be performed during daylight hours. For further requirements, see GRC Occupational Health Program Manual Chapter 13, "Laser Safety," at http://smad-ext.grc.nasa.gov/shed/pub/ohpm/ohpm13-laser.pdf .

1.18 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor shall:

a. Secure outside equipment and materials and place materials possible to damage in protected locations.

b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

1.19 CONFINED SPACE

Comply with the requirements in Chapter 16 of the GRC Safety Manual, 29 CFR 1910.146.

Prior to a permit required confined space entry, a confined space permit C-199 form shall be submitted for approval from SHED. All contractors involved with entry into or working in confined spaces shall have training in confined space entry.

a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are

controlled or eliminated and documented. (See SHED for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee.

b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained.

c. Manholes and excavations require continuous atmosphere monitoring with audible alarm for toxic gas detection and low oxygen levels.

d. Include training information for employees who will be involved as entrant attendants for the work.

e. Entry Permit. Use C-199 , completed by the qualified person. Post the permit in a conspicuous place close to the confined space entrance.

1.20 MISHAP INVESTIGATIONS

Refer to the Glenn Safety Manual, Chapter 21. If a mishap occurs during the project that requires investigation per Chapter 21, the mishap site, which may include the entire construction work area, may be secured by NASA and not released to the Contractor for up to 75 working days. **Contractor shall not be entitled to additional payment for any expenses incurred as a result of the investigation.** Contractor shall submit a schedule recovery plan once the site is release back to the Contractor showing how the remaining work will be accomplished within the current contract period. If the Contractor determines the schedule cannot be recovered within the current contract period, a contract extension may be negotiated at no cost to the Government.

1.21 FALL PROTECTION

It is NASA's policy to provide fall protection for any walking working surface where a person is exposed to a fall to a lower level. Fall protection programs shall focus on eliminating the fall hazard before an individual is exposed to the hazard.

a. Fall protection programs shall protect workers who may be exposed to a fall six feet or greater to a lower level for all construction activities - including steel erection.

b. For work within 6 feet of an edge, on low-slope roofs, protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and it not authorized.

c. "Fall hazards” from any height to lower level shall require protection if the work is over a collateral hazard (e.g. moving machinery, chemicals, electrical hazards, impalement hazards).

Competent person: For each situation that requires fall protection at GRC, there is a competent person (per ANSI/ASSE Z359.0-2007, paragraph 2.27) assigned responsibility for the immediate application of fall protection work where fall protection is required whose education and training has been administered by an industry-recognized trainer.

The fall protection competent person shall be on the construction site 100% of the time that active fall protection is being used.

Written Fall Protection Plan: specific fall protection requirements, including rescue plans, shall be developed and submitted to NASA for approval, using the C-979 Fall Prevention Plan form, as an appendix to the Health and Safety Plan.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 35 43.98

ENVIRONMENTAL PROTECTION PROCEDURES
12/14

PART 1 GENERAL

1.1 SUMMARY

The pollution prevention, environmental compliance, and sustainability provisions described in this section apply to all work under this contract.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1910.1200	Hazard Communication
29 CFR 1910	Occupational Safety and Health Standards
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 112	Oil Pollution Prevention
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 265.16	(2003) Personnel Training
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.3	Standards for Universal Waste Management - Pesticides
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 173	(2005) Shippers -- general requirements for shipments and packagings
40 CFR 177	(2005) Carriage by public highway

40 CFR 178	(2005) Specifications for packaging
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 100-185	(2002) Transportation
49 CFR 171	General Information, Regulations, and Definitions
50 CFR 17	(2002) Endangered and Threatened Wildlife and Plants

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES, in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Environmental protection plan; G

[Dirt and dust control plan]; [G]

[Request for Wastewater Discharge, at least 7 days before commencement of discharge. The request shall include the estimated discharge volume, discharge rate, source of the wastewater and the duration of discharge. EEMO written approval shall be obtained before commencement of discharge. Analysis of the wastewater might be needed to obtain the discharge approval. EEMO approval may take longer than 7 days when analysis of wastewater and/or coordination with outside agencies is required.]

Hazardous Materials Inventories Statement (HMIS) and Safety Data Sheets (SDS), at project commencement and as necessary to reflect changes in materials stored; G.

A copy of the Hazard Communication Written Program per 29 CFR 1910.1200(e); G.

SDSs of all products before bringing these materials on-site; G.

List of Solid Waste, Hazardous Waste, Construction Debris (CD) and Commercial/Industrial Fill (CIF) Subcontractors four weeks prior to removal from site; G.

[Storm Water Pollution Prevention Plan. See Section 01 57 23.98 TEMPORARY STORM WATER POLLUTION CONTROL].

Treatment, Storage and Disposal Facility List: The Contractor shall submit a list of storage and disposal facilities (TSDF) that perform treatment, storage, or disposal services under this contract. Each facility shall have, as a minimum, EPA RCRA interim status or state approval as a treatment of disposal facility and be in good standing with regulatory community. Recycling facilities shall meet all

federal, state and local regulations. The Contractor shall not use a facility other than those initially approved for use under this contract without first obtaining the written approval of the COR.

SD-06 Test Reports

Site Inspection Checklists, every week for projects handling hazardous materials.

RCRA 90-Day Waste Accumulation Site Inspection Checklists, weekly for all hazardous waste storage areas for the duration of the on-site project work.

Hazardous Waste Profiles, and supporting analytical data four weeks prior to disposal for NASA GRC Waste Management (WM) to review prior to Energy & Environmental Management Office (EEMO) signature.

Laboratory analysis

Disposal Requirements

SD-07 Certificates

TSDF Letter of Acceptance and Hazardous Waste Manifests 3 weeks prior to shipment and for review by WM and signature by NASA GRC EEMO immediately prior to shipment.

Final, signed hazardous waste manifests completed by the contractor and disposal facility in accordance with 40 CFR 261. NASA GRC Waste Management shall receive the final signed manifest directly from the disposal facility. In the event the contractor receives the final signed manifest, it shall be immediately forwarded to NASA Waste Management. For Solid Waste/CD/CIF all documents shall be forwarded to NASA Waste Management.

SD-11 Closeout Submittals

Some of the records listed below are also required as part of other submittals. For the "Records" submittal, maintain on-site a separate three-ring Environmental Records binder and submit at the completion of the project. Make separate parts to the binder corresponding to each of the applicable sub items listed below.

Preconstruction survey

Waste determination documentation

Disposal documentation for solid, hazardous, and regulated waste

Contractor employee training records in compliance with 40 CFR 265.16, 29 CFR 1910.120, 29 CFR 1910.1200 and 40 CFR 82.

Regulatory notification

Erosion and sediment control inspection reports

Solid waste disposal report

Contractor Hazardous Material Inventory Log

Hazardous Waste/Debris Management

Reclamation of Equipment Containing Hazardous Waste Residues: The Contractor shall submit to NASA Waste Management the facility to which equipment containing hazardous material residues are shipped for reclamation, such as electrical wrapped with asbestos and electrical panels containing asbestos. The disclosure shall be documented on the Bill of Lading or by other written means. This process shall be managed by NASA GRC Management.

Disposal of Non-Hazardous Waste Containing Hazardous Material Residue: The Contractor shall submit to the NASA Waste Management the facility to which equipment containing hazardous material residues are shipped for disposal, such as steel coated with lead paint. The disclosure shall be documented on the Bill of Lading or by other written means. Supporting analytical data shall be included to document the equipment is not hazardous waste.

1.4 GENERAL RESPONSIBILITIES

Conduct project activities in a manner that protects surface/ground water and air quality, conserves resources, and minimizes the use of toxic chemicals and hazardous materials.

Minimize environmental pollution and damage that may occur as the result of construction and demolition operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State, or local environmental laws or regulations, permits, GRC Environmental Policy, and Federal Executive Orders. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer in consultation with EEMO. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extension shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation of Federal Law.

The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local environmental laws and regulations.

1.5 CONSTRUCTION AND DEMOLITION DEBRIS (C&DD) MANAGEMENT

Any removed or demolished item that meets the definition of C&DD shall be evaluated for reuse and/or recycling. The Contractor shall reuse or recycle any item that can be segregated from the waste stream and reused or recycled in a cost effective manner. NASA GRC WM manages the Construction Waste Management Program. All reuse, recycling and disposal activities shall be coordinated with the NASA GRC WM. The Contractor shall submit a manifest for

any C&DD materials that will be reused off site, recycled or disposed of to the COR, which will then be reviewed and approved by NASA GRC WM for transportation off-site. Materials that will be reused or recycled shall be segregated and manifested individually. NASA has specifically targeted the following materials for reuse or recycling: Asphalt, Concrete, Gravel/Stone, Commercial/Industrial Fill Soil, Topsoil, Trees/Bushes, Ferrous and Non-Ferrous Metals, Concrete Block, Bricks, Carpeting, and Ceramic Tiles.

1.6 DEFINITIONS

Construction and Demolition Debris - Those materials resulting from the alteration, construction, destruction, rehabilitation, or repair of any manmade physical structure, including, without limitation, houses, buildings, industrial or commercial facilities, or roadways. "Construction and demolition debris" does not include materials identified or listed as solid wastes, infectious wastes, or hazardous wastes pursuant to Chapter 3734 of the Revised Code and rules adopted under it; or materials from mining operations, nontoxic fly ash, spent nontoxic foundry sand, and slag; or reinforced or non-reinforced concrete, asphalt, building or paving brick, or building or paving stone that is stored for a period of less than two years for recycling into a usable construction material. For the purpose of this definition, "materials resulting from the alteration, construction, destruction, rehabilitation, or repair of any manmade physical structure," are those structural and functional materials comprising the structure and surrounding site improvements, such as brick, concrete and other masonry materials, stone, glass, wall coverings, plaster, drywall, framing and finishing lumber, roofing materials, plumbing fixtures, heating equipment, electrical wiring and components containing no hazardous fluids or refrigerants, insulation, affixed carpeting, asphalt substances, metals incidental to any of the above, and weathered railroad ties and utility poles. "Materials resulting from the alteration, construction, destruction, rehabilitation, or repair" do not include materials whose removal has been required prior to demolition, and materials which are otherwise contained within or exist outside the structure such as solid wastes, yard wastes, furniture, and appliances. Also excluded in all cases are liquids including containerized or bulk liquids, fuel tanks, drums and other closed or filled containers, tires, and batteries.

"Clean hard fill" - C&DD which consists only of reinforced or non-reinforced concrete, asphalt concrete, brick, block, tile, and/or stone which can be reutilized as construction material. Brick in clean hard fill includes but is not limited to refractory brick and mortar. Clean hard fill does not include materials contaminated with solid wastes, hazardous wastes, or infectious wastes.

Hazardous Material - Any material that poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Common examples are oil, fuel, caustic and acid cleaners, mineral spirits, petroleum distillate based solvents, oil based paints, aerosol spray paints, coolants and antifreeze, and solvents/cleaners containing chlorinated compounds.

Hazardous Waste - As defined in 40 CFR 261.3.

Non-Hazardous Solid Waste - Includes rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, construction, and agricultural operations, and from community activities.

Also includes soil with contaminant levels above Voluntary Action Program (VAP) commercial/industrial fill standards.

Non-Sewerable - Wastewater that contains at least one contaminant above the allowable discharge limit set by the Publicly Owned Treatment Works (POTWs) for discharge to the sanitary sewer.

Reclamation - A process to recover or regenerate a usable product. Examples are recovery of lead from spent batteries and regeneration of spent solvents.

Recycling - In general, the use of discarded materials and objects in original or changed form rather than disposing of them. Examples include paper, cardboard boxes, empty containers and certain elements of Construction and Demolition Debris, including but not limited to metal building materials, piping, electrical, wiring, concrete, and masonry building materials, gypsum products and various floor coverings.

Solid Waste - As defined in 40 CFR 261.2.

Surface Discharge - implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "waters of the United States" and may require a permit to discharge water from the State of Ohio.

Universal Waste - Universal Waste means any of the following hazardous wastes that are subject to the universal waste requirements of 40 CFR part 273:

(1) Batteries as described in 40 CFR 273.2
(2) Pesticides as described in 40 CFR 273.3
(3) Thermostats as described in 40 CFR 273.4; and
(4) Lamps as described in 40 CFR 273.5.

1.7 NATURAL AND CULTURAL RESOURCES

The Contractor shall conduct activities in a manner that does not unnecessarily negatively impact fauna or flora, and in accordance with 50 CFR 17. The Contractor shall minimize interference with, disturbance to, and damage to all fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, and local laws and regulations.

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to any human skeletal remains or burials, artifacts, shell, midden (refuse heap), bone, charcoal, or other deposits, rock or coral alignments, pavings, wall, or other constructed features, and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons form trespassing on, removing, or otherwise disturbing such

resources. The Contractor may proceed with work in areas devoid of cultural resources.

1.8 WASTEWATER DISCHARGE

The Contractor shall submit a Request for Incidental Sewer Discharge to the Contracting Officer prior to the planned discharge of contaminated groundwater or other wastewater. The Contracting Officer will inform the EEMO of this request and obtain approval for discharge. The request shall include the estimated discharge volume, discharge rate, source of the wastewater and the duration of discharge. Analyses may be needed to obtain discharge approval from EEMO.

With the exception of non-contaminated groundwater from an excavation, wastewater from Contractor operations shall be containerized by the Contractor until the Contractor is notified of discharge approval.

The Contractor shall record and submit information specified in the EEMO approval for discharge issued to the project including, but not limited to, the location of discharge, dates of discharge, quantity of water discharged, source of the wastewater, dates wastewater was sampled and analyzed (if required), and filtering method (if required).

Non-sewerable wastewater that is hazardous waste shall be managed and disposed of properly by the Contractor in coordination with NASA Waste Management. Non-sewerable wastewater that is nonhazardous waste shall be managed and disposed of properly by the Contractor in coordination with NASA Waste Management.

1.9 AIR QUALITY

An Air Permit review from the EEMO is required for activities adding, removing or modifying an air pollution source.

Construction operations and materials used on the project shall be in compliance with federal, state, and local air pollution standards, rules and regulations.

Chlorofluorocarbons (CFCs), Hydrochlorofluorocarbon (HCFC), Other Ozone Depleting Substances (ODS) and their substitutes.

Class I Ozone Depleting Substances shall not be used in the performance of this contract, nor be provided as part of the equipment without prior written permission from the EEMO. This prohibition shall prevail over any other provision, specification, drawing, or referenced documents. A list of Class I ODS may be obtained from US EPA or their web page at http://www.epa.gov/ozone/ods.html.

Class II Ozone Depleting Substances shall not be used in the performance of this contract, nor be provided as part of the equipment without prior written permission from the EEMO. This prohibition shall prevail over any other provision, specification, drawing, or referenced documents. A list of Class II ODS may be obtained from US EPA or their web page at http://www.epa.gov/ozone/ods2.html.

Chemicals used in lieu of ozone depleting substances (Substitutes or alternatives) must conform with US EPA's Significant New Alternatives

Policy (SNAP) program. These rules are summarized on the US EPA web page at http://www.epa.gov/ozone/snap/lists/index.html.

Service, maintain, renovate, and demolish ODS and ODS Substitute containing equipment in accordance with 40 CFR 82. The Contractor shall ensure that ODS refrigerants and their substitutes are handled by a certified technician. The recovery equipment shall meet applicable EPA requirements and be certified with US EPA.

Hazardous Air Pollutants (HAPs).

The list of specific chemicals and compounds defined as HAPs in Section 112b of the 1990 Clean Air Act Amendments is available from Ohio EPA on-line at: http://www.epa.state.oh.us/dapc/general/haplist.html. This listing is subject to change and only the currently listed items require tracking.

The use of HAPs and materials containing HAPs is allowed at GRC however the airborne release of HAPs shall be minimized at all times.

Records of the use of HAPs and materials containing HAPs must be provided to the CO for forwarding to the Environmental Management Branch. At a minimum, this should include Material Safety Data Sheets and quantities of each HAP and materials containing HAPs used.

Product and waste HAPs and materials containing HAPs must be stored in such a way as to prevent their release to the atmosphere.

Prohibition of Air Pollution Nuisances

No air pollution generating activity shall be allowed if it is expected to cause an air pollution nuisance.

No air pollution generating activity shall be allowed to continue if it is found to be an air pollution nuisance.

1.10 HAZARDOUS WASTE LIABILITY

Hazardous Waste Liability - For the purpose of this contract, the Contractor shall be responsible for any release or threatened release of the materials or substances handled under this contract, as well as any liabilities resulting or arising from or related to this contract, and shall bear all costs pertaining to such releases including, but not limited to, responses, remediation, testing, or disposal costs, and further shall defend and indemnify the Government for any costs including, but not limited to, any judgments, penalties, assessments, litigation, or attorney fees.

1.11 HAZARDOUS WASTE TRANSPORTATION

Certified Waste Haulers shall be utilized. Government directed waste shall be transported to the disposal facility or interim storage facility without delay, in accordance with Department of Transportation (DOT) manifest regulations. The Contractor shall notify the Government if 10 days or more have a elapsed during shipment.

1.12 SUSTAINABILITY

The Contractor shall conduct its activities in a manner that conserves resources and minimizes pollution in accordance with Executive Order 13101 "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition" and Executive Order 13123 "Greening the Government Through Efficient Energy Management".

Minimize the amount of energy required during construction and operation by using resource efficient construction techniques, building systems (including HVAC, heating, electrical, water, lighting, heat-pumps and boilers), insulation, fixtures, appliances, and controls.

Whenever possible, utilize energy efficient office equipment through the Environmental Protection Agency's Energy Star labeling program (@ http://www.epa.gov/energystar/).

Use automated monitors and controls for energy, water, waste, temperature, moisture, and ventilation.

Conserve water with systems that reduce consumption and recycle water through reclamation and treatment systems.

Maximize the reduction, reuse, recycling or composting of waste and scrap materials.

Minimize waste, spillage, pilferage, spoil, and misuse of building materials.

Follow federal Comprehensive Procurement Guidelines (@ http://www.epa.gov/epaoswer/non-hw/procure/) for building materials and products, and select materials that have a long-life cycle; select least toxic materials; select recyclable materials; select materials that are resource-efficient; select materials with the maximum recycled content; select materials harvested on a sustained yield basis; select products causing the least pollution during their manufacture, use and reuse.

1.13 TRAINING REQUIREMENTS

Personnel handling hazardous materials shall have received Hazard Communication Training per 29 CFR 1910.1200(h), and personnel handling hazardous waste shall have received appropriate DOT and Hazardous Waste and Emergency Response Operations (HAZWOPER) Emergency Response Awareness Level Training per 29 CFR 1910.120. Employee training documents shall be kept at the jobsite.

Personnel containing spills or conducting cleanup of small spills shall have received First Responder Operators level training per 29 CFR 1910.120. (Note: Personnel with First Responder Operators level training can contain a spill to stop its spread from a safe distance. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures.

Personnel generating hazardous waste shall have receive training on the proper management of hazardous waste per 40 CFR 265.16.

Personnel Handling Refrigerants shall have training in accordance with 40 CFR 82.

1.14 CHEMICAL USAGE, STORAGE, AND HANDLING

Hazardous material shall be used only as described on the Safety Data Sheet and/or Contractor's written instructions. The Contractor shall wear the protective equipment recommended by the manufacturer of the hazardous material. Containers of hazardous materials and hazardous wastes shall be kept closed except when in use. Containers of liquid hazardous materials shall be stored in secondary containment at the end of each work shift on an impervious surface.

1.14.1 Hazardous Materials Storage

Hazardous materials storage shall be in accordance with Federal, State, and local regulations, and the General Storm Water Permit. Hazardous materials shall be handled in a manner that minimizes the potential for releases. All liquid hazardous materials must be secondarily contained on an impervious surface. Adequate spill response equipment shall be readily available.

Hazardous materials and hazardous wastes shall be labeled, handled properly, and stored in secondary containment at the end of each work day. Secondary containment shall be of adequate size and compatible with the materials stored. Storage areas shall be properly labeled and secured. Storage areas shall be in accordance with Section 01 57 23.98, Storm Water Pollution Prevention.

At the beginning of the project, an accurate inventory of hazardous materials and hazardous wastes to be generated including the estimated maximum quantity of each hazardous material to be brought on-site shall be provided to the COR. Safety Data Sheets (SDSs) for hazardous materials shall be maintained by the Contractor so they are immediately available to assist emergency response personnel in the event of a hazardous materials incident. Copies of the SDSs shall be provided in the Health and Safety Plan (HASP).

1.14.2 Refuse Bins

Refuse bins shall not be overloaded. Liquid materials shall not be placed in dumpsters or bins. Leaking dumpsters shall be replaced. Dumpsters and bins shall not be cleaned on-site. Dumpsters shall remain covered except when actively being loaded.

1.14.3 Site Inspections

The project site and storage areas shall be inspected weekly to ensure compliance. Compliance status shall be verified by the Contractor. The checklists shall be submitted to the COR, within 48 hours following the inspection.

1.14.4 Labeling

Containers, drums, vessels, tanks, and associated piping containing hazardous materials shall be labeled in accordance with 29 CFR 1910.1200 (f).

Hazardous material labels must have a description of the contents (including percentages of components for compounds), an appropriate hazard warning and the name and address of the manufacturer or other responsible party.

Hazardous waste and solid waste containers shall be appropriately marked, pending analysis, in accordance with 40 CFR 262 with, at a minimum, accumulation start date and contents and documented during weekly inspections.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 SITE OPERATIONS AND MAINTENANCE

Site Operations shall be conducted in accordance with the Clean Water Act and GRC Storm Water Pollution Prevention Plan. For projects over 1 acre (total) in size, a Storm Water Pollution Prevention Plan (SWP3) must be submitted to the EEMO 2 months prior to project commencement for review and approval. Time to receive an approved permit from Ohio EPA may take longer than 2 months from the submittal of the SWP3 to EEMO. [See Storm Water Pollution Prevention Section 01 57 23.98.]

Equipment Fueling and Maintenance - Equipment fluid changes and fueling shall be conducted over drip pans to prevent spilled materials from contacting the ground surface. The operator of leaking equipment shall contain and control the leak. All storm drains in close proximity shall be protected with absorbent socks. The Contractor shall contact NASA GRC Waste Management through the Contracting Officer to coordinate proper disposal of waste materials generated during equipment maintenance.

When operating any hydraulic equipment all storm drains in close proximity shall be protected with absorbent socks.

3.1.1 Paint Clean-up

Painting operations must be conducted in accordance with GRC Storm Water Pollution Prevention Plan and applicable State of Ohio requirements.

Water Based Paints:

The Contractor shall paint out as much excess paint as possible from brushes, rollers, and equipment before starting clean up. Rinse brushes, rollers, and other tools over a sink that drains to the sanitary sewer using water only. Tools and equipment shall not be cleaned into streets, gutters, storm drains, or creeks. Dispose of dry brushes, rollers, rags, and drop cloths as solid waste.

Disposal of containers with any liquids as a solid waste is prohibited. These materials must be used elsewhere or handled as a regulated waste and disposed of in accordance with paragraph entitled Contractor Disposal. All empty paint containers and surplus paint shall be turned over to the government via a NASA C260A form along with the product's SDS.

Oil Based Paints:

The Contractor shall paint out as much excess paint as possible from brushes, rollers, and equipment before starting clean up. Cleaning solutions shall be containerized and disposed of as hazardous waste. Reuse thinners and solvents by pouring back into original container through a filter.

Dispose of waste thinners, solvents, paint sludge, and solutions from cleaning of equipment and tools as hazardous waste. Containers with residual product shall be managed as a hazardous waste and disposed of. All empty paint containers and surplus paint shall be turned over to the government via a NASA C260A form along with the product's SDS.

3.1.2 Concrete/Asphalt Cutting and Core Drilling

The Contractor shall prevent not allow slurry run-off from saw cutting or core drilling to enter the storm or sanitary sewer collection systems. Catch basins and drains shall be protected.

3.1.3 Sweeping

Roadways and on-site paved areas impacted by the project shall be cleaned to the satisfaction of the COR and swept at the end of each phase or at project completion. Hosing down paved areas and streets is prohibited.

3.1.4 Sewage Sludge

Sewage Sludge and Compost Materials containing human waste is prohibited from use at GRC.

3.1.5 Draining, Tanks, Piping, and Equipment

Tanks, piping, and equipment shall be drained as required. Devices to properly contain the product shall be provided by the Contractor. Storm drains in the vicinity shall be covered during drainage operations.

The Government will obtain the necessary sanitary sewer discharge permits if the discharge is sewerable. Non-sewerable water shall be treated to a level to allow discharge to the sanitary sewer or managed and disposed of properly by the Government.

3.1.6 Monitoring Wells

Monitoring Wells shall not be disturbed for any reason. If they are disturbed, inadvertently or not, the contractor shall incur all costs associated with the abandonment (i.e. removal) of the well in accordance with Ohio EPA requirements.

3.2 SOIL MANAGEMENT

The Contractor shall immediately stop work and notify the COR if soil appears discolored or has an odor different from what is expected.

No excavation shall proceed without an approved excavation permit and a soil determination checklist issued by the EEMO.

3.3 PCBS/PCB CONTAMINATED EQUIPMENT

All PCB-contaminated material shall be handled in accordance with 40 CFR 761.

The Contractor shall dial 911 from any NASA phone or 216-433-8888 from an outside phone to inform Emergency Dispatch of any spills or leaks of PCB-contaminated material.

The contractor shall notify the Contracting Officer of any PCB-contaminated material that needs disposal.

3.4 SPILL PREVENTION, CONTROL AND REPORTING

All liquid petroleum products must be secondarily contained in accordance with Annex Q of GRC's Emergency Preparedness Plan and 40 CFR 112. Spill clean-up materials (such as rags, absorbent booms/pads), and tools (such as shovels and brooms) shall be maintained at the project site and be readily accessible. Releases of hazardous materials to the environment shall be contained and measures implemented to prevent leaks and spills from entering storm drains.

Dial 911 from any NASA phone or 216-433-8888 from an outside phone to inform Emergency Dispatch of any spills or leaks.

If the contractor stores fuel on site, that fuel shall be stored within a double containment vessel manufactured for fuel storage. Plastic lined structures are not acceptable for the double containment. Fuel storage shall comply with Chapter 31 of the NASA GRC Safety Manual, Chapter 22 of the GRC Environmental Programs Manual and NASA technical standard 8719.11. Tank shall not be sited near a storm sewer.

3.5 HAZARDOUS WASTE DISPOSAL

The Contractor shall label, package, and secondarily contain hazardous waste in accordance with 40 CFR 173, 40 CFR 177, 40 CFR 178 and 49 CFR 171. [Refer to Section 02 61 00.98 REMOVAL AND DISPOSAL OF CONTAMINATED SOILS for hazardous waster soils disposal.]

Storage of hazardous waste shall not exceed 90 days from the date of generation in accordance with 40 CFR 262. Hazardous waste shall be shipped for disposal no later than 90 days from the date of generation/accumulation start date.

No hazardous material or waste shall remain at the worksite upon completion of the project unless specified otherwise.

3.5.1 Hazardous Waste Manifest

NASA Glenn Research Center shall be designated as the generator on the manifest and only approved GRC EEMO personnel shall sign any shipping documents, including Uniform Hazardous Waste Manifests.

NASA Glenn Research Center EEMO shall be designated as the emergency contact.

The Contractor shall perform transportation services in compliance with 49 CFR 100-185.

The Contractor shall use only disposal facilities that have a valid permit to manage hazardous waste, and shall be responsible for determining that permit allows for the type of management and disposal intended for that waste. The Contractor shall be responsible for ensuring that any party handling hazardous waste, including subcontractors, transporters, and TSDF Letter of Acceptance and Hazardous Waste Manifests are in compliance with applicable federal, state, and local regulations. GRC EEMO shall have final approval of TSDFs.

3.5.2 Containerized Hazardous Waste

Hazardous wastes and other materials shipped by the Contractor with wastes from other facilities shall not be commingled.

3.5.3 Bulk Hazardous Waste

Bulk hazardous waste shipments shall be weighed to confirm shipping weight.

3.5.4 Miscellaneous Hazardous Waste

Fluorescent light tubes, mercury containing items (batteries, emergency and exit lights) and PCB lighting ballasts and thermostats shall be turned over to the Government for recycling.

-- End of Section --

SECTION 01 45 00.98

QUALITY CONTROL
12/12

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Contractor shall submit the following items in accordance with the paragraph entitled, "Records," of this section.

Quality Control Data
Quality Control Coordinating Actions
Quality Control Training
Inspection Records
Letters of Authority or Delegation
Field Tests
Factory Tests

SD-07 Certificates

Contractor shall submit a detailed written statement describing procedures that will be implemented to achieve quality on the project according to the paragraph entitled, "Quality Assurance (QA) Plan," of this section.

Contractor shall submit the following in accordance with the paragraph entitled, "Qualifications," of this section.

Contractor's Quality Representative Qualifications Special Certifications

1.2.1 Quality Assurance (QA) Plan

QA plan shall address the following:

Description of the authority, responsibilities and coordinating procedures, of an-site/off-site quality assurance personnel, including those QA personnell not under direct control of the Contractor.

QA plan shall list personnel designated by the Contractor to accomplish the work required by the contract.

QA plan shall also contain an appendix with a copy fo each form, report format, or similar record to be used in the QA program.

Contractor's organization that handles construction contract activities.

Contractor's operational plan for accomplishing and reviewing work controls, fabrication controls, certifications, and dcumentation of quality control operations, inspections, and test records, including those for subcontractors.

These provisions shall include the methods to be used during the procurement cycle (order to delivery) for these materials or equipment that require source inspections, shop fabrications, or similar operations located separately from the work site.

Description of on site personnel training.

Certifications(s) of personnel, procedures, processes, and equipment.

Nondestructive testing requirements.

Identification of independent certifying and testing laboratories.

1.2.2 Records

Records shall include all quality control data; factory tests or manufacturer's certifications, quality control coordinating actions; records of quality control training/certifications as well as routine hydrostatic, electrical continuity, grounding, welding, line cleaning, field tests and similar tests. Quality records shall be available for examination by the Contracting Officer.

Legible copies of the test and inspection records shall be furnished to the Contracting Officer. Records shall cover work placement traceable to the contract schedule, specifications and drawings, and shall be verified by the Contractor.

Contractor shall submit for approval, the narrative description of an inspection system which provides for compliance with the quality requirements and technical ceriteria of the contract within 7 calendar days after notice to proceed.

Contractor shall submit a monthly performance report that summarize the quality operations. This report shall identify inspections made, tests performed, nonconformances, corrective actions taken, status of plans/procedures being developed, and statue of open items/problems in work.

Contractor shall submit Letters of Authority or Delegation outlining the authority and responsibilities of quality control personnel along with a copy of the letter of delegation to the Contracting Officer that defines delegated duties and responsibilities.

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

Contractor's Quality Representative Qualifications shall be submitted to the Contracting Officer for approval. Quality Representative may be assigned to more than one contract provided that the assigned contracts are located at the same site.

When approval or certifiation of special processes, operating personnel, and special equipment or procedures is required by the specifications, the Contractor shall obtain necessary approvals or special certifications prior to starting the work.

1.3.2 Quality Control Requirements

Contractor shall provide a quality control program encompassing: selection of construction materials and sources; suppliers; subcontractors; on site and off site fabrication of Contracting furnished assemblies; on site and off site assembly; erection; work procedures; workmanship; inspection; and testing.

Contractor's program shall provide document systems ensuring that quality provisions of contract schedule, specificaitons, and drawings have been performed.

1.3.2.1 Management and Organization

The Quality Program Manager shall report to the Contractor's management and shall have the necessary authority to discharge contractual responsibilities.

1.3.2.2 Identification and Data Retrieval

Contractor shall have an identification and data retrieval system.

Records, drawings, submittals, and equipment shall be identified by referencing the Contract Number; Contract Specification Number; Contract Drawing Number; Submittal Document Number: Contract Change Number; and the Contractor's Drawing Number System.

1.3.2.3 Procurement

Contractor shall be responsible for controlling procurement sources and those of his subcontractors to ensure that each purchase meets quality requirements.

1.3.2.4 Receiving Inspection System

Contractor shall maintain a site receiving inspection system that ensures procured materials and equipment are inspected and tested.

Receiving inspection records shall accompany each procurement delivery to the construction site. Records of site receiving inspections shall be maintained by the Contractor.

Records shall show defects, discrepancies, dispositions, and waivers, including evidence of Government source inspection.

1.3.2.5 Nonconforming Articles and Material Control

The Contractor shall control nonconformances discovered by the Contractor, subcontractors, suppliers or Government quality representatives to prevent their use and to correct deficient operations.

a. Contractor shall prepare a "nonconformance" report for each instance comprising:

(1) Identification of the nonconforming article or material.

(2) A description of the nonconformance and the applicable requirement.

(3) Cause or reason for the nonconformance.

(4) Remedial actions taken or recommended.

(5) Disposition of the nonconforming article or material.

b. The Contractor shall identify and mark each nonconforming article for removal from the work area.

c. The Contractor shall monitor and correct deficient operations.

1.3.2.6 Fabrication, Process, and Work Control

Contractor's procedures and controls shall ensure compliance with requirements in contract specifications and drawings.

Contractor shall establish in-process inspections, to ensure compliance with quality requirements.

1.3.2.7 Quality Control Records

Quality control records shall be maintained at a central on-site location. Maintenance of quality control records shall not relieve the Contractor from submitting samples, test data, detail drawings, material certificates, or other information required by each section in the specification.

Contractor shall ensure each record is identified and traceable to specific requirements in the specifications and drawings.

1.3.2.8 Drawings and Change Control

Drawing-control system shall be maintained to provide revised drawings and ensure continuous removal of obsolete drawings from work areas. Changes involving interface with other work areas, or affecting materials controlled by others shall be controlled by the Contractor. This system shall be integrated with the document requirements of the contract.

Drawing changes shall be clearly annotated. Implemented changes shall be clearly identified and associated drawings shall be revised accordingly. Drawings that have been approved, or approved as noted, by the Contracting Officer shall be used for fabrication and inspection.

1.3.3 Quality Inspections

1.3.3.1 Government Inspections

Work performed under this contract will be subject to inspection by the Contracting Officer. Changes to the specifications or drawings will not be allowed without written authorization of the Contracting Officer.

When the Contracting Officer determines that inspected work needs to be corrected, the Contracting Officer will be allowed [24] [_____] [hours] [_____] to complete reinspection of the corrected work.

Contracting Officer shall be notified before backfilling or encasing any [underground] utility so that work may be inspected. Failure to notify the Contracting Officer before backfill or encasement occurs shall require the work be uncovered at no additional cost to the Government.

Contractor's program is subject to continuous evaluation, review, and verification by the Contracting Officer. Contractor will be notified in writing of any noncompliance and will be given [_____] calendar days to correct identified deficiencies.

1.3.3.2 Contractor's Quality Inspections

Contractor shall implement an inspection system. Documentation shall indicate quality control through records of inspections, tests, and procedures.

Contractor's quality assurance system shall include the following:

a. Contractor's representative responsible for on-stie communication and operation of the inspection program.

b. Purchasing control system documenting project procurement to drawings, specifications, and approved submittals.

c. Receiving inspection system documenting inspections for each procurement.

d. Documentation for handling and disposing of nonconforming components and materials.

e. Inspection records for each specific section of the specification and drawings.

f. Identification of test(s) to be performed, test procedures, records, and independent organizations used.

g. Documenting and maintaining certification or re-certification of procedures.

h. Management of government-furnished equipment, components, and materials.

i. Calibration of gages, tools, measuring instruments, and independent laboratories used.

Contractor shall establish a system of scheduled or random audits to ensure task completion.

1.3.4 Field Services

1.3.4.1 Responsibility for Inspection and Testing

Contractor shall be responsible for all inspections and tests, and the accompanying documentation for each inspection and test. Contractor may utilize independent inspection and testing laboratories or services as approved by the Contracting Officer.

Contractor shall also be responsible for tests of construction materials utilizing the services of an approved independent testing laboratory.

1.3.4.2 Inspection and Test Records

Contractor shall provide on-site records of each inspection and test performed throughout the life of the contract. Records shall include, but not be limited to, factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved, identification of operators and inspectors, result of inspections or tests, nature of defects, causes for rejection, proposed remedial action, and corrective actions taken.

Inspection records, test procedures, test results, and associated forms be verified by and provided to the Contracting Officer. Final test data shall have a cover letter/sheet clearly marked with the system name, date, and the words "Final Test Data".

1.4 HANDLING AND STORAGE

Contractor shall provide controls, procedures and documentation with each shipment, that meet requirements of each section of the specifications.

The Contractor shall include documentation with each shipment. The data shall consist of documentation required by the contract along with specifications required to identify, store, preserve, operate, and maintain the items shipped.

1.5 SEQUENCING AND SCHEDULING

Contractor shall notify the Government at least [_____] hours prior to scheduled inspections and tests.

Contractor shall provide [24] [_____] hour notice to the Government of the date when the contract work will begin at the site.

When Contractor suspends work for [_____] calendar days or longer prior to completion, the Contracting Officer shall be notified. Work shall not resume without notification of the Contracting Officer.

Contracting Officer shall be notified at least 48 hours in advance of backfilling or encasing any underground utility.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 57 23.98

TEMPORARY STORM WATER POLLUTION CONTROL
08/12

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4439	(1997) Standard Terminology for Geosynthetics
ASTM D 4491	(1996) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1996)) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1995) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(1995) Identification, Storage, and Handling of Geosynthetic Rolls

1.2 GENERAL

The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of Section 01 35 43 98 ENVIRONMENTAL PROTECTION PROCEDURES, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit attached to that Section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Mill Certificate or Affidavit; [_____],

Certificate attesting that the Contractor has met all specified requirements.

1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented shall include [temporary seeding,] [mulching,] [geotextiles,] [sod stabilization,] [vegetative buffer strips,] [erosion control matts,] [protection of trees,] [preservation of mature vegetation,] [etc]. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., [clearing] [and grubbing,] [excavation,] [embankment,] [and] [grading]); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have [temporarily or] permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity [temporarily or] permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices. [Location and details of installation and construction are shown on the drawings.]

1.4.2.1 [Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fences shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.]

1.4.2.2 [Straw Bales

The Contractor shall provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. Bales shall be properly

placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Final removal of straw bale barriers shall be upon approval by the Contracting Officer. Rows of bales of straw shall be provided as follows:

a. Along the downhill perimeter edge of all areas disturbed.

b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.

c. Along the toe of all cut slopes and fill slopes of the construction areas.

d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Rows shall be spaced [a maximum of [_____] feet apart] [as shown on the drawings].

e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Rows shall be spaced [a maximum of [_____] feetapart] [as shown on the drawings].

f. At the entrance to culverts that receive runoff from disturbed areas.

g. [_____].]

1.4.2.3 [Diversion Dikes

Diversion dikes shall have a maximum channel slope of 2 percent and shall be adequately compacted to prevent failure. The minimum height measured from the top of the dike to the bottom of the channel shall be 18 inches. The minimum base width shall be 6 feet and the minimum top width shall be 2 feet. The Contractor shall ensure that the diversion dikes are not damaged by construction operations or traffic. Diversion dikes shall be located as shown on the drawings.]

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	100 lbs. min.
Elongation (%)		30 % max.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 14 inches by 18 inches. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 2 inches x 2 inches in cross section and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 3 feet.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be

from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18 inches deep into the ground to securely anchor the bales.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall [receive erosion control if required by Section [02___ EROSION CONTROL]], paragraph [AREAS TO RECEIVE EROSION CONTROL] [be seeded in accordance with Section [02___]] [ESTABLISHMENT OF TURF], [except that the coverage requirements in paragraph ESTABLISHMENT do not apply].

3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales,

end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section [02___] TURF.

3.3.3 Diversion Dike Maintenance

Diversion dikes shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged diversion dikes and necessary repairs shall be accomplished promptly. When diversion dikes are no longer required, they shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section [02___] TURF.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas [and areas used for material storage that are exposed to precipitation] shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

3.4.4 [Monthly Inspection Report and Certification Form for Erosion and Sediment Controls

On the first working day of each month the Contractor shall complete, sign, and submit the original form to the State of [____], [Office of Pollution Control (OPC)] at the following address:

Chief, [_____]
[_____]
[_____]
[_____]

A copy of the State of [_____]'s [Monthly Inspection Report and Certification Form for Erosion and Sediment Controls] is attached to the end of this section. On the first working day of each month the Contractor shall also furnish one copy of the form submitted to the [OPC] to the Contracting Officer as part of the Contractor's daily CQC Report and attach a copy of the completed form to the Plan. Unless otherwise notified by the [OPC], the Contractor shall submit the [Monthly Inspection Report and Certification Forms] for an additional two months after the final completion of all storm water pollution prevention measures required in this contract have been implemented.]

-- End of Section --

SECTION 02 61 00.98 00

REMOVAL AND DISPOSAL OF CONTAMINATED SOILS
09/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Statements shall be submitted for the following items in accordance with paragraphs entitled, "Site Specific Health and Safety Plan" and "Site Specific Work Plan," of this section.

Site Specific Health and Safety Plan G
Site Specific Work Plan G

1.2.1 Site Specific Health and Safety Plan

For companies performing contaminated waste soil operations, a Detailed Description of the work to be performed shall be submitted. The plan shall include but not be limited to objectives, methods, resources and personnel required to complete the task and shall evaluate the potential hazards of the chemical contaminants and explain how workers shall be protected from those hazards. Personnel performing [solid and]hazardous waste activities

shall be trained pursuant to 29 CFR 1910, Hazardous Waste Operations and Emergency Response (HAZWOPER) and 49 CFR 172, Transportation of Hazardous Materials. For all workers and supervisors performing [solid and] hazardous waste activities, include 40-hour HAZWOPER training certificates. Employees handling hazardous materials shall be trained in compliance with 49 CFR 172, and the Work Plan shall include evidence of such training. For companies performing hazardous waste operations, a copy of the Contractor's Hazard Communication Program shall be attached to the Site Specific Health and Safety Plan as an Appendix. The Program shall address the evaluation of the potential hazards of chemicals in the work place, communicating information concerning these hazards to employees and descriptions of appropriate measures. Six (6) copies of the Site Specific Health and Safety Plan (including the Hazard Communication Program if required) shall be submitted at least three (3) weeks prior to beginning excavation activities.

1.2.2 Site Specific Work Plan

For contaminated waste soil operations, a Detailed Description of the work to be performed shall be submitted. The work plan shall include but not be limited to objectives, methods, resources and personnel required to complete the task including plans for the decontamination of equipment and personnel. The following shall be included:

1. Licenses/Permits - Provide the name and licenses for the waste hauler and the disposal facility.

2. Container Sizes and Suppliers - Provide sizes and suppliers of drums, roll-offs, dump trailers, dump trucks, tanker trucks and frac tank.

3. Profiles - Provide completed Waste Profile Sheets, Waste Product Questionnaires, or Waste Characterization Reports describing the type of solid or hazardous waste generated, volume, frequency, generator name and address, broker and certification statement. Land Disposal Restriction Notification forms shall be included if applicable. Analytical data, to be provided by NASA, shall accompany the Waste Profile. The COR will obtain the required NASA signatures on the Waste Profiles.

4. Draft Manifests - Provide completed DRAFT Hazardous Waste and Solid Waste Manifests describing the waste being disposed of in accordance with 40 CFR 261.

5. A description of how stormwater and surface runoff will be prevented from entering the excavation shall also be included.

6. If Hazardous Waste soils are to be excavated, a description of the Hazardous Waste Zones Implementation shall be included (see paragraph 3.3 of this specification section).

Six (6) copies of the Site Specific Work Plan shall be submitted at least three (3) weeks prior to beginning excavation activities.

1.3 NOTIFICATIONS

1.3.1 Landfill Approval Letter

Letters, forms, or other written documents supplied to the Contractor from the facility designated for the disposal of hazardous or solid waste

acknowledging the wastes are acceptable for disposal. All approvals shall be on company letterhead and bear the signature of an authorized representative of the disposal facility. Provide approval letters at least one week (1) prior to beginning excavation activities. No excavation activities shall be permitted prior to NASA's receipt and acknowledgement of the landfill approval letter.

1.3.2 Disposal Records

Provide Disposal Tickets, Weigh Tickets or other records supplied by the disposal facility documenting the weight of waste material disposed of at the disposal facility.

Provide disposal records to NASA within one (1) week of receipt by the Contractor.

1.3.3 Final Manifests

Provide Final, Signed Hazardous Waste and Solid Waste Manifests completed by the Contractor and the disposal facility in accordance with 40 CFR 261. The NASA Waste Management Team (WMT) (address: Glenn Research Center, Mail Stop 6-1, 21000 Brookpark Road, Cleveland, Ohio 44135) shall receive the final signed Manifest directly from the disposal facility. In the event that the Contractor receives the Final signed manifests, it shall be immediately forwarded to the NASA WMT.

1.4 QUALITY ASSURANCE

No contaminated soil shall be removed from the site without written authorization from the Government in the form of completed and signed Waste Manifests and Property Passes.

The COR will obtain the required NASA signature on all waste profiles, (Land Disposal Restriction Forms, if applicable), property passes and manifests for contaminated waste soil shipments.

The COR may perform inspections of containers intended for the storage or transportation of soils at any time, and will perform weekly inspections of all containers storing contaminated waste soils.

PART 2 PRODUCTS

2.1 DRUMS

Metal and fiberglass drums shall comply with 49 CFR 178.

Drums shall be marked with the manufacturer's certification, specification, approval, or exemption mark.

Reconditioned drums shall be free of old labels and markings.

Containers shall be of a suitable size and constructed of material which is compatible with the waste being placed in them. Containers shall be leak proof, sift proof and lined with 10 mil (minimum) plastic liner to prevent materials from coming into contact with the inner surface of the container.

Drums shall be identified with number provided by the COR.

2.2 ROLL-OFFS

Containers shall be leak proof, sift proof and lined with 10 mil (minimum) plastic liner to prevent materials from coming into contact with the inner surface of the container.

Containers shall be constructed of materials which are compatible with the waste being placed in them.

Containers shall be covered with leak proof tarpaulin and secured at all times except when being loaded so that no foreign materials, debris, or rainwater enters the container.

Rolloff boxes shall be identified with number provided by the COR.

2.3 DUMP TRAILERS AND SUMP TRUCKS

Containers shall be leak proof, sift proof and lined with 10 mil (minimum) plastic liner to prevent materials form coming into contact with the inner liner surface of the container.

Containers shall be covered with a tarpaulin and secured at all times except when loaded so that no foreign materials, debris, or rainwater enters the container.

2.4 TANKER TRUCKS

Inner and outer valves shall be in working condition with visible means of secure closure to prevent leakage.

2.5 FRAC TANKS

Inner and outer valves shall be in working condition with visible means of secure closure to prevent leakage.

Holding tanks used for the temporary storage shall be made of material which are compatible with the liquid waste.

2.6 CONTAINERS

All containers used for storage and transportation of hazardous waste soils shall meet the requirements of 49 CFR 178. Containers and liners shall also meet the requirements of the disposal facility. Containers used for the transportation of hazardous waste soils shall be labeled in accordance with 49 CFR 171 and 49 CFR 172.

PART 3 EXECUTION

3.1 STORAGE AND TRANSPORTATION

The Contractor shall obtain approval from the COR for the location of any temporary stored soils and containers.

Excavated solid waste soil shall be placed directly into containers or trucks to prohibit infusion of rainwater or foreign debris. Excavated solid waste soils shall not be permitted to be stockpiled.

Excavated hazardous waste soil shall be placed directly into a container or truck and covered to prohibit infusion of rainwater or foreign debris. Excavated hazardous waste soils shall not be permitted to be stockpiled.

All containers shall be properly labeled and marked prior to filling. If the soil is non-hazardous solid waste, the standard green non-hazardous waste label shall be used. If the soil is hazardous waste, the standard red and white Environmental Protection Agency (EPA)/ Department of Transportation (DOT) label shall be used until shipped. At the time of shipping, the yellow and red hazardous waste label shall be placed over the red and white label and completely filled out. Labels shall include, at a minimum, the date of generation, the project title, the Contractor's name and phone number, and the COR's name and phone number.

Storage of any hazardous waste soil shall not exceed 90 days from the date of generation in accordance with 40 CFR 262.

Vehicles transporting waste soils for disposal shall be weighed on NASA scales located at Building 119. Vehicles shall be weighed by the Government prior to and after loading of excavated materials. The resulting weight of the waste shall be recorded on the Waste Manifests.

Vehicles transporting waste soils for disposal shall not leave NASA without a completed and signed Property Pass, and completed, numbered and signed Waste Manifest. This paperwork is required for each load leaving GRC. NASA employees are the only ones legally authorized to sign a manifest on the Government's behalf. The Contractor shall not sign any Waste Manifests. The COR shall also obtain manifest numbers for each document. The top white copy of the Property Pass with the actual signature shall be surrendered to the Security Guards at the Main Gate when exiting the Glenn Research Center.

3.2 DISPOSAL

All soil designated as a solid waste shall be disposed of at an OEPA licensed solid waste facility. The Contractor shall comply with the requirements of the disposal facility. Soil has been designated a solid waste [in areas shown on drawings][location] due to [describe contamination].

All soil designated as a hazardous waste shall be disposed of at a state permitted hazardous waste facility. The Contractor shall comply with the requirements of the disposal facility. Soil has been designated a hazardous waste in [in areas shown on drawings][location] due to the presence of [describe contamination] which requires the soil to be considered as a RCRA listed hazardous waste with a waste code of [FO02] [_____]

3.3 HAZARDOUS WASTE OPERATIONS

To reduce the spread of hazardous waste soil form contaminated areas, the Contractor shall delineate zones on the site where different types of operations will occur. The flow of personnel among these zones shall be controlled. This information shall be provided in the Work Plan.

The site shall be divided into at least 3 zones.

1. Exclusion Zone - This is the area where most of the work is accomplished and contamination is present. The outer boundary shall be identified as

the Hotline. The Hotline shall be marked by hazard tape, signs, barricades and fences. Flow of personnel and equipment shall be controlled.

2. Containment Reduction Zone - This is the transition area between the contamination area and the clean area. Decontamination of personnel and equipment shall take place in this area. The outer boundary shall be identified as Contamination Control Line.

3. Support Zone - This is the outermost area. No contamination of any kind shall exist in this area. Administrative and support functions shall be performed in this area.

3.4 STORM AND SURFACE WATER

The Contractor shall prevent Storm Water runoff from entering any open Solid Waste or Hazardous Waste excavation. The Contractor shall notify the COR of the presence of Storm Water in excavations. Any Storm Water that accumulates in such an excavation shall be considered as a solid waste or a hazardous waste liquid and shall be containerized by the Contractor for analysis. The Contractor shall obtain sampling and analysis of the liquid in accordance with the Northeast Ohio Regional Sewer District (NEORSD) Pre-Treatment Standards. The Contractor shall coordinate the sampling and analytical through the COR. Once the data is available, NASA will coordinate with the COR, and shall be in accordance with this Section. If NEORSD determines that the liquid meets the Pre-Treatment Standards, NASA will direct the Contractor on the appropriate method of discharge to the Sanitary Sewer System. With either determination, the Contractor shall be responsible for all costs associated with the sampling, analysis, containerizing, transportation and disposal of the Storm Water Runoff.

3.5 GROUNDWATER

The Contractor shall notify the COR of the presence of groundwater in excavations. Any groundwater that accumulates in such an excavation shall be considered as a solid waste or a hazardous waste liquid and shall be containerized for analysis. NASA shall obtain sampling and analysis of the liquid in accordance with the Northeast Ohio Regional Sewer District (NEORSD) Pre-Treatment Standards and shall coordinate the sampling and analytical. Once the data is available, NASA will coordinate with the NEOSRD and determine the disposition of the water. If NEORSD determines that a liquid does not meet the Pre-Treatment Standards, all subsequent transportation and disposal shall be coordinated with the COR, and shall be in accordance with this Section. If NEORSD determines that the liquid meets the Pre-Treatment Standards, NASA will direct the Contractor on the appropriate method of discharge to the Sanitary Sewer System. With either determination, NASA shall be responsible for all costs associated with the sampling, analysis, containerizing, transportation and disposal of the groundwater.

3.6 DIFFERING SITE CONDITIONS

There is the possibility that the Contractor, in the execution of the Work, may encounter a pre-existing soil or groundwater contamination, of which NASA is unaware. If a condition occurs where contamination appears that is different than the contamination expected, the Contractor shall stop work within the immediate area of the impact and notify the COR. The Contractor shall isolate the impacted area of the differing site condition to the

smallest possible footprint, and may continue work in areas outside of the impacted area.

-- End of Section --

SECTION 31 00 00.98

EARTHWORK
01/18

PART 1 GENERAL

1.1 RELATED REQUIREMENTS (LEED)

Section 01 35 43.98 ENVIRONMENTAL PROTECTION PROCEDURES for disposal of construction and demolition waste.

Section 32 92 19 SEEDING for topsoil placement.

Section 32 93 00 EXTERIOR PLANTS for planting soil mixture placement.

1.2 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Dewatering is the responsibility of the contractor regardless of when water is encountered.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 103	(2008) Standard Method of Test for Soundness of Aggregates by Freezing and Thawing
AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 2	(2000) Sampling of Aggregates
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test
AASHTO T 87	(1986; R 2000) the Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 2216	(2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2005) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2940/D 2940M	(2009) Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT)

ODOT	(2008) Construction and Material Specifications

1.4 DEFINITIONS FOR GENERAL EARTHWORK

1.4.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, SW, SP, SM, SW-SM, SP-SM, CL, ML, and CL-ML. Satisfactory materials for grading comprise stones less than 8 inches, except for fill material for pavements which comprise stones less than 3 inches in

any dimension. Satisfactory materials for filling and backfilling comprise fill materials able to be compacted as specified and approved by the geotechnical engineer for the specific purpose.

1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, and CL. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.4.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.4.5 Topsoil

All topsoil shall be stockpiled and used in grass areas per ODOT Item 651.02. Material suitable for topsoils obtained from excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7. All preparation of topsoil areas to be per ODOT Item 659.10. All landscape bed areas and parking lot grass islands shall use natural screened topsoil approved by NASA and NASA testing requirements.

1.4.6 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of

hard material will not be considered rock excavation because of intermittent drilling that is performed merely to increase production.

1.4.7 Unstable Material

Unstable material are too wet to properly support the utility pipe, conduit, or appurtenant structure or to be properly compacted.

1.4.8 Select Granular Material

1.4.8.1 General Requirements

All aggregate to meet ODOT 703 and must be limestone, except slag will not be permitted.

1.4.9 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 3 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.4.10 Soils

All earthwork activities shall be per ODOT Items 203 and 204 wherever applicable.

1.5 SYSTEM DESCRIPTION

Subsurface soil boring logs and subsoil investigation report are appended to the SPECIAL CONTRACT REQUIREMENTS. The data represents the best subsurface information available; however, variations may exist in the subsurface between boring locations. This information is provided for informational purposes only.

1.5.1 Classification of Excavation

Finish the specified excavation on a classified basis, in accordance with the following designations and classifications.

1.5.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.2 Blasting

Blasting will not be permitted.

1.5.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.6 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Utilization of Excavated Materials
Opening of any Excavation or Borrow Pit

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Advance notice on the opening of excavation or borrow areas.

SD-06 Test Reports

Testing; G
Borrow Site Testing; G

Within 24 hours of conclusion of physical tests, 6 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing; G

Qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities.

Qualifications of Contractor's geotechnical engineer.

1.7 SAMPLING AND TESTING

1.7.1 Tests for Proposed Soil Materials

Materials shall be approved by the Contracting Officer prior to start of work.

Soil materials proposed for use in the work shall be tested as follows.

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Satis-factory soil materials	Sampling	AASHTO T 2	One from each source of materials to determine con-formance to definition of satisfactory soil materials; additional tests whenever there is any apparent change
	Preparation of samples	AASHTO T 87	
	Sieve analysis is of fine and coarse aggre-gates	ASTM C 136	
	Amount of material pass-ing No. 200	ASTM C 117	

sieve		
Liquid limit	ASTM D 4318	
Plastic limit and plasticity index	ASTM D 4318	
Mechanical analysis	ASTM D 422	
Moisture-density relations	ASTM D 1557	As required to determine moisture-density requirement of materials from each source
Los Angeles abrasion of coarse aggregates	ASTM C 131	One for each soil material from each source if called for in reference specification
Freezing and thawing soundness of aggregates	AASHTO T 103	
Magnesium Sulfate Soundness Test	ASTM C 88	

1.7.2 Quality Control Testing During Construction

Soil materials shall be tested during construction as follows:

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Soil materials specified	Sieve analysis of fine and coarse aggregates	ASTM C 136	One daily for each soil material from each source; additional test whenever there is any apparent change
	Amount of material passing No. 200 sieve	ASTM C 117	
	Moisture content of subbase	ASTM D 2216	

	material		
Soil materials prior to compaction	Moisture-density relations of soil	ASTM D 1557	One of each type of subgrade soil material except under backfill for structures; one for each backfill and fill material from each source
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556, Sand Cone Method or ASTM D 2922, Nuclear Method (when approved by Contracting Officer)	At least three daily for each subgrade soil material and for each layer of backfill and fill material; additional test whenever there is any change in moisture conditions

1.7.3 Test Reports

No soil material shall be used until test reports have been reviewed and approved.

1.7.4 Evaluation of Test Results

Results of density of soil-in-place tests shall be considered satisfactory if the average of any group of four consecutive density tests which may be selected is in each instance equal to or greater than the specified density, and if not more than one density test in five has a value more than 2 percentage points below the specified density.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

2.1.1 Requirements for Offsite Soils

All testing shall conform to NASA Environmental and SHED standards. The testing for the soil shall be per contractor at no additional cost to the Government. All testing and offsite soil shall be approved by NASA. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.1.2 Environment Testing Requirements

. Contractor shall provide the source of the soil. If the soil is taken from multiple areas and then taken to the suppliers site to manufacture soil then a list of locations that the soil was sourced from will be required.

. Contractor shall provide chemical analysis of the soil coming into NASA GRC. The parameters that the soil shall be tested for are as follows:

> Volatile Organic Compounds (VOCs)
> Semi-Volatile Organic Compounds (SVOCs)
> RCRA Metals
> Polychlorinated Biphenyl (PCBs)

. For non-manufactured soil from a single virgin source, existing soil analysis data may be used if it meets the list of analysis parameters above. If no analytical data exists, the contractor may need to have a sample analyzed for the parameters listed above. If Phase 1 Environmental Site Assessment (ESA) and Phase 2 ESA reports exist then this data may be supplied to NASA for review to determine if the soil meets NASA GRC's Environmental Standards. If data is not acceptable by NASA GRC, soil tests must be completed at no additional cost to the government.

> NASA GRC base line levels in Appendix "Z". Levels must be less than or equal to numbers provided.

2.2 SOIL MATERIALS

2.2.1 RIP-RAP

All material shall conform to ODOT Item 600; however no concrete shall be used.

2.2.2 Bedding Material

All items shall meet ODOT specifications. Stone backfill shall conform to ODOT 703.01. All sand shall conform to ODOT 703.06.

2.2.3 Engineered Fill

Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2 inch sieve and not more than 12 percent passing a No. 200 sieve.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, completely strip topsoil. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inch in diameter, and other materials that would interfere with planting and maintenance operations. Stockpile in locations indicated any surplus of topsoil from excavations and gradings.

3.2 FILLING OF SITE

3.2.1 Preparation of Ground Surface to Receive Fill

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the placement of fills. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stripped, or broken up in such manner that fill material will bond with the existing material.

When the ground surface has a density less than that specified for the particular area classification, the ground surface shall be broken up, pulverized, moisture-conditioned to near optimum moisture content of the soil material, and compacted to the required depth and percentage of maximum density.

3.2.2 Placement and Compaction

Fill materials shall be placed in layers not more than 8 inches in loose depth. Before compaction, each layer of fill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material and shall then be compacted to the percentage of maximum density for each area classification as specified. Testing is required for each lift. Fill material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Place and compact fill material in layers to required elevations as follows:

Under grass and planted areas, use satisfactory soil material.

Under walks and pavements, use satisfactory soil material.

Under steps and ramps, use satisfactory soil material.

Under building footprint, use satisfactory soil material.

Under footings and foundations, use satisfactory soil material.

Fill materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated elevations.

Compaction adjacent to structures, within a horizontal distance from the face of the structure equal to the depth of fill material (measured from the bottom of footing or bottom of foundation or retaining wall) to final grade, shall be done with power-driven hand tampers.

3.3 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as

replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.3.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on grading plan. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.3.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.3.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.3.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the

water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 2 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.

3.3.5 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Contractor is required to contact NASA to mark all utilities prior to commencing site work. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer. Damage to Government utility/property by the contractor due to heavy equipment shall be repaired to the satisfaction of the Government and at no cost to the Government.

3.3.6 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Geotechnical Engineer and Contracting Officer prior to concrete placement.

3.4 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.5 OPENING AND DRAINAGE OF EXCAVATION

Notify the Contracting Officer sufficiently in advance of the opening of any excavation to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.6 GEOTECHNICAL ENGINEER

Hire a Professional Geotechnical Engineer licensed in the State of Ohio to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.7 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory materials as specified. A Soil Relocation Permit will be required. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.8 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.9 GROUND SURFACE PREPARATION

3.9.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inch before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inch, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inch and compact it as specified for the adjacent fill.

3.9.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to plus or minus 2 percent of optimum moisture.

3.10 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.11 COMPACTION OF SOIL FILLS

Place fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

Compact soil materials to not less than the following percentages of maximum dry unit weight according to Paragraph 1.4.4 Degree of Compaction.

Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of fill soil material at 98 percent.

Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of fill soil material at 95 percent.

Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of fill soil material at 90 percent.

3.11.1 Moisture Control

Moisture content in soil material at time of compaction shall be within limits specified.

Where the moisture content of a layer of soil material is below optimum before compaction, the required amount of water shall be uniformly applied to the surface of the layer of soil material and the layer of soil disked or otherwise mixed until a uniform moisture content is reached.

Moisture of a layer of soil material that is above optimum shall be removed by drying.

3.12 EARTHWORK EMBANKMENTS

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 8 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise brake up each layer; moisten or aerate as necessary; thoroughly mix; and compact as indicated above. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.13 SUBGRADE PREPARATION

3.13.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the existing subgrade with six passes of a 20 ton tandem axle dump truck at speeds between 2.5-3.5 mph. Notify the Geotechnical Engineer and Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material as directed by the Contracting Officer and replace with fill and backfill with fabric and 1's and 2's 6" thick. Prepare bids based on replacing approximately 100 square yards, with an average depth of 6 inch at various locations.

3.13.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inch below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with approved materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.13.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.14 SHOULDER CONSTRUCTION

Construct shoulders of approved excavated or borrow material or as otherwise shown or specified. Construct shoulders immediately after adjacent paving is complete. In the case of rigid pavements, do not construct shoulders until permission of the Contracting Officer has been obtained. Compact the entire shoulder area to at least the percentage of maximum density as specified for specific ranges of depth below the surface of the shoulder. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Finish shoulder construction in proper sequence in such a manner that adjacent ditches will

be drained effectively and that no damage of any kind is done to the adjacent completed pavement. Align the completed shoulders true to grade and shaped to drain in conformity with the cross section shown.

3.15 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated. Finish gutters and ditches in a manner that will result in effective drainage and no puddling occurs. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.15.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do no disturb the finished subgrade by traffic or other operation. Protect and maintain the finsihed subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.16 TESTING

Perform testing by the Contractor's validated testing facility. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, NASA validated and approved by the Contracting Officer.

3.16.1 Fill and Backfill Material Gradation

Random testing of stockpiled or in-place source material shall be completed. Determine gradation of fill and backfill material in accordance with ASTM D 422. The testing can be requested by NASA if stockpiled soil is in question for use of fill/backfill.

3.17 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall be removed from Government property as directed by the Contracting Officer to a NASA approved disposal site. All materials removed from site shall be approved by NASA GRC Waste Management.

3.18 FIELD QUALITY CONTROL

Special Inspections: Geotechnical engineer will perform the following special inspections and report findings to the Contracting Officer:

Determine prior to placement of fill that site has been prepared in compliance with requirements.

Determine that fill material and maximum lift thickness comply with requirements.

Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

Geotechnical engineer to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities.

When Geotechnical engineer reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

-- End of Section --

SECTION 31 23 01.98

EXCAVATING, BACKFILLING, AND COMPACTING FOR STRUCTURES
01/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145	(1991; R 2012) Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 103	(2008) Standard Method of Test for Soundness of Aggregates by Freezing and Thawing
AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 2	(2000) Sampling of Aggregates
AASHTO T 87	(1986; R 2000) the Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 32	(2009) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 387	(2000e1) Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete

ASTM C 88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D 2216	(2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 226	(2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 227	(2003) Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 2729	(2003) Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 2922	(2005) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(2010) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.652	Safety and Health Regulations for Construction; Subpart P, Excavations; Requirements for Protective Systems

1.2 RELATED REQUIREMENTS (LEED)

Section 01 35 43.98 ENVIRONMENTAL PROTECTION PROCEDURES for disposal of construction and demolition waste.

Section 31 00 00.98 EARTHWORK

Section 31 23 23.33 98 FLOWABLE FILL

Section 32 92 19.98 SEEDING

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor shall record Existing Conditions prior to starting work in accordance with the paragraph entitle, "Existing Conditions," of this section.

SD-03 Product Data

Local/Regional Materials; (LEED)

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-06 Test Reports

Test Reports shall be submitted for Soil Test results within 7 calendar days. Test reports shall be submitted according to paragraph entitled, "Quality Control Testing During Construction," of this section.

SD-07 Certificates

Certificates of Compliance for Proposed Soil Materials shall be submitted according to paragraph entitled, "Tests for Proposed Soil Materials," of this section.

Certificates of Compliance for Compost shall be submitted indicating grade and compliance with state and local regulations.

1.4 LIMITS OF CONSTRUCTION

Work in this section relates to excavation, fill, and backfill to a point 5 feet beyond the building or structure line.

1.5 SAMPLING AND TESTING

1.5.1 Soil Test and Inspection Service

Soil survey for satisfactory soil materials and samples of soil materials shall be furnished by the Contractor. A certified soil-testing service approved by the Contracting Officer shall be provided by the Contractor. Testing shall include soil survey for satisfactory soil materials; sampling and testing soil materials proposed for use in the work, and field-testing facilities for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

1.5.2 Tests For Proposed Soil Materials

Materials shall be approved by the Contracting Officer prior to start of work.

Soil materials proposed for use in the work shall be tested as follows.

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Satis-factory soil materials	Sampling	AASHTO T 2	One from each source of materials to determine con-formance to definition of satisfactory soil materials; additional tests whenever there is any apparent change
	Preparation of samples	AASHTO T 87	
	Sieve analysis is of fine and coarse aggre-gates	ASTM C 136	
	Amount of material pass-ing No. 200 sieve	ASTM C 117	
	Liquid limit	ASTM D 4318	
	Plastic limit and plasticity index	ASTM D 4318	
	Mechanical analysis	ASTM D 422	
	Moisture-density relations	ASTM D 1557	As required to determine moist-ure-density re-quirement of materials from each source
	Los Angeles abrasion of coarse aggre-gates	ASTM C 131	One for each soil material from each source if called for in reference specification
	Freezing and thawing sound-ness of aggre-gates	AASHTO T 103	
	Magnesium Sul-	ASTM C 88	

	fate Soundness Test		

1.5.3 Quality Control Testing During Construction

Soil materials shall be tested during construction as follows:

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Soil materials specified	Sieve analysis of fine and coarse aggregates	ASTM C 136	One daily for each soil material from each source; additional test whenever there is any apparent change
	Amount of material passing No. 200 sieve	ASTM C 117	
	Moisture content of subbase material	ASTM D 2216	
Soil materials prior to compaction	Moisture-density relations of soil	ASTM D 1557	One of each type of subgrade soil material except under backfill for structures; one for each backfill and fill material from each source
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556, Sand Cone Method or ASTM D 2922, Nuclear Method (when approved by Contracting Officer)	At least three daily for each subgrade soil material, and for each layer of backfill and fill material; additional test whenever there is any change in moisture conditions

1.5.4 Test Reports

No soil material shall be used until test reports have been reviewed and approved.

1.5.5 Evaluation of Test Results

Results of density of soil-in-place tests shall be considered satisfactory if the average of any group of four consecutive density tests which may be selected is in each instance equal to or greater than the specified density, and if not more than one density test in five has a value more than two percentage points below the specified density.

1.6 EXISTING CONDITIONS

Existing Conditions shall be recorded, in the presence of the Contracting Officer, and shall include all structures and other facilities adjacent to areas of alteration or removal. Such records shall contain the location of existing utilities, the elevation of the top of foundation walls, the location and extent of cracks and other damage, and a description of surface conditions that exist prior to the start of work. Copies of the record shall be submitted and the conditions prior to starting work shall be verified.

PART 2 PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

Materials for backfill and fill shall be free of clay clods, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, and other deleterious matter and shall be satisfactory soil materials as follows and as defined in Section 31 00 00 EARTHWORK:

AREA CLASSIFICATION	BACKFILL OR FILL MATERIALS
In excavations, unless otherwise specified	Excavated or borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material"
Against face of structures where footing drains from top of porous fill for footing drains to indicated elevation, and from face of structure a distance equal to three footing drain diameters	Filtering material
Against surfaces having applied waterproofing for a distance of at least 6 inches from surface	Sand
In foundation subdrain trenches over porous fill drain pipe	Filtering material
Directly under building slabs	Drainage fill

2.1.1 Satisfactory Materials

Non-expansive materials; Pyritic and/or potential expansive materials, such as mine tailings and slag are not satisfactory material, contain less than 3 percent by weight of organic matter, waste construction debris, or other deleterious materials. Standard Proctor maximum dry density greater than 110 pounds per cubic foot (pcf), an Atterberg Liquid Limit less than 40, a Plasticity Index of less than 15, and a maximum particle size of 2 inches or less.

2.1.2 Unsatisfactory Materials

Pyritic and/or potentially expansive materials, such as mine tailings and slag. Standard Proctor maximum dry density less than 110 pounds per cubic foot (pcf), and Atterberg Liquid Limit greater than 2 inches. Peat and other highly organic soil, and soil materials of any classification that have moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.2 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam.

The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable materials larger than 2 inches in any dimension. Topsoil used on-site must also comply with Section 32 92 19 "Seeding".

2.3 COMPOST

Compost shall be yard trimmings or yard waste compost processed and graded according to state and local regulations. Compost shall be grade A.

Compost shall be well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content less than 2.5 decisiemens/m and less than 1.25 decisiemens/m where seeds, young seedings, or salt sensitive plants are used; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.4 TOPSOIL BLEND

Where insufficient topsoil is removed from the project site the topsoil removed shall be stockpiled and blended with compost at the site to achieve the required volume.

2.5 COHESIONLESS AND COHESIVE MATERIALS

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be

identified as cohesive only when the fines have a plasticity index greater than zero.

2.6 SUBBASE MATERIAL

Subbase material shall be a naturally or artificially graded mixture of natural or crushed gravel, crushed stone, or sand.

2.7 DRAINAGE FILL

Drainage fill shall be #57 stone per ODOT 703.01. Drainage fill shall be a washed, uniformly graded mixture of crushed stone or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 4 sieve.

2.8 FILTERING MATERIAL

Filtering material shall conform to ASTM C 33 and shall be a uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand, with 100 percent passing 3/8-inch sieve and 2 to 10 percent passing a No. 100 sieve or per ODOT 703.02.

2.9 SAND

Sand shall be natural sand per ODOT 703.06.

2.10 DRAINAGE PIPE AND FITTINGS

Drainage pipe shall be perforated, PVC sewer pipe, underdrainage pipe of size indicated, and shall conform to ASTM D 2729.

Fittings shall be of corresponding weight and quality as drainage pipe.

2.11 SEWER BRICK AND MORTAR MATERIALS

Sewer brick shall be standard brick size and shall conform to ASTM C 32, Grade MM.

Mortar materials shall be dry packaged, proportioned for Type M unit masonry mortar, and shall conform to ASTM C 387.

Mixing water for mortar shall be potable.

2.12 FABRIC

Provide a pervious sheet of polyester, nylon, glass or polypropylene, ultraviolet resistant filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength. Fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D 4759:

	Class A	Class B
a. Grab tensile strength (ASTM D 4632) machine and transversed direction	min. 180	80 lbs.
b. Grab elongation (ASTM D 4632)	min. 15	15 percent

machine and transverse direction

c.	Puncture resistance (ASTM D 4833)	min. 80	25 lbs.
d.	Mullen burst strength (ASTM D 3786)	min. 290	130 psi.
e.	Trapezoidal Tear (ASTM D 4533)	min. 50	25 lbs.
f.	Apparent Opening Size (ASTM D 4751)	See Criteria Below	
	(1) Soil with 50 percent or less particles by weight passing US No. 200 Sieve, AOS less than 0.6 mm (greater than #30 US Std. Sieve)		
	(2) Soil with more than 50 percent particles by weight passing US No. 200 Sieve, AOS less than 0.297 mm (greater than #50 US Std. Sieve)		
g.	Permeability (ASTM D 4491)	0.5 sec -1	0.2 sec -1
h.	Ultraviolet Degradation (ASTM D 4355)	70 percent Strength retained at 150 hours	

PART 3 EXECUTION

3.1 PREPARATION

Before earthwork is started, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

Prior to starting any excavation work, Contractor shall submit NASA form C-927 "Digging, Trenching, and Excavating Permit" to the COR.

All excavation shall be done in accordance with Chapter 35 - Digging, Trenching, and Excavation Procedures, of Glenn Research Center, Glenn Safety Manual.

3.2 UNAUTHORIZED EXCAVATION

Unauthorized excavation shall consist of removal of materials beyond indicated subgrade elevations or side dimensions specified without specific direction and shall be replaced as specified at no additional cost to the Government.

Unauthorized excavation under foundations or retaining walls shall be filled by lowering the bottom elevation of the footing or base to the excavation bottom without altering the approved top elevation.

Elsewhere unauthorized excavations shall be backfilled and compacted as specified for authorized excavations of the same classification.

3.3 SHORING AND BRACING

Contractor shall follow OSHA regulations, 29 CFR 1926.652 for "Excavation, Trenching, and Shoring" requirement for the protection of personnel.

Shoring and bracing in excavations shall be maintained regardless of the length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

Wherever subsequent removal of sheet piling could permit the lateral movement of soil under adjacent structures, steel sheet piling or pressure-creosoted timber sheet piling shall be used and left permanently in place, cut off as required.

3.4 WATER REMOVAL

Water shall not be permitted to accumulate in excavations, or flood the site and surrounding area. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

Dewatering shall be in the Base Bid.

3.5 MATERIAL STORAGE

Excavated materials classified as satisfactory soil material shall be stockpiled, where directed, until required for backfill or fill. Stockpiles shall be placed, graded, and shaped for proper drainage.

Materials required in the work shall be located and retained a sufficient distance from the edge of excavations to prevent overloading, slides, and cave-ins.

3.6 EXCAVATION FOR STRUCTURES

Excavation for structures shall conform to the dimensions and elevations indicated within a tolerance of plus or minus 0.10 foot and shall extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall be done just before concrete is placed. Bottoms shall be trimmed to the required lines and grades to leave a solid bed to receive concrete.

3.7 EXCAVATION FOR FOUNDATION SUBDRAINAGE SYSTEM

Contractor shall adhere to and enforce precautions as outlined in OSHA Regulations, 29 CFR 1926.

Excavation for foundation subdrainage system, except for footing drains located in the excavations for footings and foundations, shall have vertical sides for a vertical dimension above the bottom of the trench not less than two times the outside dimension of the drain pipe, and shall have a clear horizontal distance between the drain pipe barrel and the trench wall, on both sides, of not less than 6 inches nor more than 9 inches. Bottom of the trench excavations shall be graded to obtain the required slope and shall be tamped to provide a firm bed for the drain pipe bedding material.

3.8 REMOVAL OF UNSATISFACTORY SOIL MATERIALS

Unsatisfactory soil materials encountered that extend below the required elevations shall be excavated to the depth directed.

3.9 REMOVAL OF EXISTING UNDERGROUND UTILITIES

Existing underground utilities indicated to be removed shall be demolished and completely removed from the excavation.

3.10 CLOSING ENDS OF ABANDONED UNDERGROUND UTILITIES

Open ends of abandoned underground utilities to remain shall be closed to prevent water that may accumulate in such utilities from flowing into excavated areas. Closures shall withstand any hydrostatic or earth pressure that may result after ends of the abandoned utilities have been closed.

Open ends of metallic conduit and pipe shall be closed with threaded galvanized metal caps or plastic plugs or other approved method suitable for the type of material and size of pipe. Wood plugs will not be permitted.

3.11 FOUNDATION SUBDRAINAGE SYSTEM

Foundation subdrainage system outlets shall drain by gravity to free outfall until connected to the storm-drainage system.

3.11.1 Impervious Fill At Footings

After concrete footings have been cured as specified, impervious fill at least 6 inches in depth and 12 inches in width shall be placed on the subgrade adjacent to the bottom of footing and shall be compacted at optimum moisture content by means of hand tampers to not less than the density specified for cohesive material. Impervious fill shall be clayey soil material conforming to AASHTO M 145, Soil Classification Groups A-2-6 and A-2-7.

3.11.2 Laying Drain Pipe

Drain pipe shall be laid with the perforations down and firmly bedded in specified drainage fill material, with each pipe section having full bearing throughout its length to true grades and alignment and continuous fall in the direction of flow. One-eighth bends shall be used for changes in direction; Y-fittings shall be used at intersections. Drain pipe joints shall be closed.

Recesses in the excavation bottom shall be excavated to receive bells for drain pipe having bell and spigot ends. Such pipe shall be laid with bells facing up the slope and with spigot end entered fully into the adjacent bell.

3.11.3 Testing Drain Lines

Drain lines shall be tested with water before backfilling to ensure free flow. Any obstruction encountered shall be removed, damaged components replaced, and system retested until satisfactory. Test to be witnessed and approved by the Contracting Officer.

3.11.4 Porous Fill Over Drain Pipe

After drain lines have been tested, drain pipe shall be backfilled to a width of at least 4 inches on sides and 12-inches above the top of pipe with specified drainage fill material. Fill material shall be placed in layers not exceeding 3 inches in loose depth and compacted with not less than two passes of a hand-operated platetype vibrating compactor. Fill material shall be overlaid with one layer of 15-pound per 100 square foot asphalt or tar-saturated felt conforming to ASTM D 226 or ASTM D 227, respectively.

3.12 FILLING AND BACKFILLING

3.12.1 Preparations Prior to Backfill Placement

Excavations shall be backfilled as promptly as the work permits but not until completion of the following:

Approval of construction below finish grade

Inspection, testing, approval, and recording location of underground utilities

Removal of concrete formwork

Removal of shoring and bracing; backfilling of voids with satisfactory soil material; temporary sheet piling driven below bottom of structures; and cutting off and removing of utilities in a manner that prevents settlement of the structure or utilities

Removal of trash and debris

Completion of concrete waterproofing

3.12.2 Placement and Compaction

Backfill materials shall be placed in layers not more than 8 inches in loose depth. Before compaction, each layer of backfill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material and shall then be compacted to the percentage of maximum density for each area classification as specified. Testing is required for every other lift. Backfill material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Backfill materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated elevations.

Compaction adjacent to structures, within a horizontal distance from the face of the structure equal to the depth of backfill material (measured from the bottom of footing or bottom of foundation or retaining wall) to final grade, shall be done with power-driven hand tampers.

3.13 COMPACTION

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in AASHTO T 180, Methods B or D.

3.13.1 Percentage of Maximum Density Requirements

Actual density of each layer of soil material-in-place shall be not less than the following percentages of the maximum density of the same soil material determined by the moisture-density test specified.

AREA CLASSIFICATION	PERCENT MAXIMUM DENSITY COHESIONLESS SOIL MATERIAL	COHESIVE SOIL MATERIAL
Structures		
Each layer of backfill material in 8" Lifts	98	98
Building slabs and steps		
Drainage fill	98	

3.13.2 Moisture Control

Moisture content in soil material at time of compaction shall be within limits specified.

Where the moisture content of a layer of soil material is below optimum before compaction, the required amount of water shall be uniformly applied to the surface of the layer of soil material and the layer of soil disked or otherwise mixed until a uniform moisture content is reached.

Moisture of a layer of soil material that is above optimum shall be removed by drying.

3.14 GRADING

Areas within the limits of grading under this section, including adjacent transition areas, shall be uniformly graded. Finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

3.14.1 Grading Outside Building Lines

Areas outside the building lines for each structure shall be hand-graded to drain away from the structure and to prevent ponding of water after rains. Finished surface shall be within the tolerance specified below for each area

classification, compacted as specified, and free from irregular surface changes.

Grassed or planted areas:

Finished surface of areas to receive topsoil shall be not more than 0.10 foot above or below the indicated finish elevations. In all cases, the minimum slope shall be 1.5% in grass and planted areas. Grades shall promote positive flow away from building.

Walks:

Surface of areas under walks shall be shaped to line, grade, and cross section; finished surface shall be not more than 0.0 foot above or 0.10 foot below the indicated finish elevation. In all cases, the minimum slope shall be 1% and the maximum slope shall be 2%. Grades shall promote positive flow away from building.

Pavements:

Surface of areas under pavements shall be shaped to line, grade, and cross section; the finished surface shall be not more than 1-inch above or below the indicated finish elevation when tested with a 10-foot straightedge applied both parallel with and at right angles to the centerline of the area. Finished surface shall vary no more than 1 inch. In all cases, slopes shall be 1% minimum to 3% maximum unless otherwise noted. Handicapped accessible areas shall be 2% maximum slope. Grades shall promote positive flow away from building.

3.14.2 Grading Surface of Fill Under Structures

Surface of fill under building slabs shall be smooth and even, free of voids, compacted as specified and to indicated grade within the specified tolerances. When tested with a 10-foot straightedge, parallel with and at right angles to the building lines, the finished surface shall show no deviation in excess of 1 inch.

3.15 MAINTENANCE

3.15.1 Protection of Graded Areas

Newly graded areas shall be protected from traffic and erosion and shall be maintained free of trash and debris.

3.15.2 Reconditioning Compacted Areas

Where approved compacted areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified, reshaped, and compacted as specified to the required density prior to further construction.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall be removed from Government property as directed by the Contracting Officer to a NASA approved disposal site. The Contractor, with the assistance of the COR,

shall obtain the required NASA signatures on all soil manifests and property passes. All materials removed from site shall be approved by NASA GRC Waste Management.

The Contractor shall pay all permits and fees for disposal.

In no case shall the excavated soil be allowed to come into contact with a waterway.

-- End of Section --

SECTION 32 92 00.98

TURF AND GRASSES
12/12

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT)

ODOT 659	(2010) Seeding and Mulching; and Subparts as Specified

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00.98 SUBMITTAL PROCEDURES:

SD-03 Product Data

Laboratory Analysis of Grass Seed for percent pure, percent germination, and percent weed seed, along with laboratory analysis of Proposed Top Soil shall be submitted.

1.3 SAMPLING AND TESTING

Sampling and testing of grass seed and topsoil shall be by an approved testing service and show compliance with all specified requirements.

1.4 DELIVERY AND STORAGE

1.4.1 Seed and Fertilizer

Grass seed and fertilizer shall be delivered in sealed containers or bags, each labeled in accordance with the applicable federal and state regulations and bearing the name, trade name or trademark, and certification of the producer.

Packaged materials shall be stored off the ground, under watertight cover, and away from damp surfaces.

1.5 WEATHER LIMITATIONS

Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry or in a condition detrimental to grass seed planting or finish grading.

Seeding shall be done between August 15 and October 1, or between April 1 and May 30 unless otherwise permitted by the COTR.

PART 2 PRODUCTS

2.1 TOPSOIL

Topsoil previously removed and stockpiled shall be used in the work. Topsoil shall be free from subsoil, litter, and other objectionable material.

Topsoil shall be fertile, friable, natural surface soil obtained from well-drained areas and possessing characteristics of representative soils in the project vicinity that produce heavy growths of crops, grass, or other vegetation. Topsoil shall be free of material that might be harmful to plant growth or hindrances to planting or maintenance operations.

Chemical and physical properties of topsoil proposed for use in the work shall be as follows:

Organic matter shall be at least 6 percent, but not more than 20 percent, as determined by loss on ignition of moisture-free samples of topsoil.

The pH range shall be from 5.0 to 7.0.

The physical analysis of the topsoil shall be within the following limits:

SIEVE SIZE	PERCENT PASSING
	97 to 100
No. 100	40 to 60
No. 200	20 to 40

2.2 GRASS SEED

Grass seed for lawn areas shall be as follows:

KIND OF GRASS SEED	GRASS SEED IN MIXTURE BY WEIGHT PERCENTAGE	GRASS SEED PURITY MINIMUM PERCENTAGE	GRASS SEED GERMINATION MINIMUM PERCENTAGE
Kentucky Bluegrass	40	98	90
Creeping Red Fescue	40	98	90
Annual Ryegrass	20	98	90

Grass seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable.

2.3 LIME

Lime shall conform to ODOT 659.03.

2.4 FERTILIZER

Fertilizer shall conform to ODOT 659.04

2.5 MULCH

Mulch shall be fresh, shredded straw of wheat, rye, oats, or barley and shall be clean and free of seeds.

Mulch that is fresh and excessively brittle or that is in such an advanced stage of decomposition as to smother or retard the growth of grass will not be acceptable.

PART 3 EXECUTION

3.1 TOPSOIL PREPARATION

3.1.1 Subgrade

Before topsoil is placed, the subgrade surface shall be cleared of all materials that might hinder the performance of the work or subsequent maintenance operations.

3.1.2 Grading

Grades on areas that have been previously established shall be maintained in a true and even condition.

Where grades have not been established and where improperly graded, areas shall be uniformly graded. Finished surfaces shall be smooth within a tolerance of 30.5 mm above or below the indicated subgrade elevations, with uniform levels or slopes between the points where elevations are indicated or between such points and existing grades and free from irregular surface changes to prevent the formation of depressions where water will accumulate.

3.1.3 Tillage

Immediately prior to placing the topsoil, the subgrade, wherever excessively compacted by traffic or other cause, shall be loosened to a depth of at least by plowing, discing, harrowing, or other approved means.

3.1.4 Placing Topsoil

Suitable topsoil shall be placed in the top 75 mm of all grassed areas stripped under this project. All areas to receive topsoil, including cut and fill areas, shall be shaped to provide a minimum of 75 mm topsoil. Prior to placement of the topsoil, the subgrade shall be scarified to a depth of 76.2 mm. The topsoil shall be uniformly distributed and evenly spread to an average thickness of 75 mm. The spreading shall be performed in such a manner that planting can proceed with little additional soil preparation or tillage, and the area shall be left smooth and suitable for lawns. Irregularities in the surface from topsoiling or other operations shall be corrected so as to prevent the formation of depressions where water will stand. Topsoil shall not be hauled and placed when wet or when the subgrade is frozen, excessively wet, extremely dry or in a condition otherwise detrimental to the proposed planting or to proper grading. Topsoil shall be spread uniformly but shall not be compacted. Where any portion of the surface becomes gullied or otherwise damaged, the affected area shall be

repaired to establish the condition and grade prior to topsoiling, and then shall be re-topsoiled.

3.1.5 Application of Lime

The application of lime shall conform to ODOT 659.03.

Lime shall be uniformly distributed over the topsoil surface at a rate of and incorporated into the topsoil to a depth of at least 76.2 mm by discing, harrowing, or other approved means.

3.1.6 Application of Fertilizer

The application of fertilizer shall conform to ODOT 659.04.

Fertilizer shall be uniformly distributed over the topsoil surface at a rate of , and incorporated into the topsoil to a depth of at least 76.2 mm by discing, harrowing, or other approved means.

Fertilizer may be applied mixed with seed and water as specified in paragraph entitled, "Seeding."

3.1.7 Smooth Grading

Undulations or irregularities in the topsoil surface resulting from operations shall be leveled.

The topsoil surface shall be made smooth and uniform.

3.1.8 Cleanup

After smooth grading, the topsoil surface shall be cleared of stones or other objects that might be a hindrance to planting or maintenance operations.

Topsoil or other material that has been brought upon the surfacing of paved areas by operations shall be removed daily.

3.2 HYDROSEEDING

3.2.1 Preparation of Seedbed

Preparation of seedbed shall conform to ODOT 659.10 for residential and commercial properties.

Seedbed shall be loose and porous at the time of seeding. The seedbed shall be loosened to a depth of at least by harrowing or other suitable means and the surface smooth-graded and cleared of objectionable material as specified.

3.2.2 Mixture Preparation

Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into momogenous slurry suitable for hydraulic application.

Mix slurry with nonasphaltic tackifier.

Type A fertilizer (5:10:10) shall be mixed in the slurry to be

broadcast at the rate of 20 kilograms per 100 square meter.

3.2.3 Planting

Apply slurry uniformly to all areas to be seeded in a one-step process. apply mulch at the minimum rate of 16.5 kilograms per 100 square meter (1,500 pounds per acre) dry weight, but not less than the rate required to obtain 17.1 kilograms per 100 square meter seed-sowing rate.

Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at the minimum rate of 5.5 kilograms per 100 square meter (500 pounds per acre) dry weight, but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 11 kilograms per 100 square meter (1,000 pounds per acre).

All structures, buildings, walks, roads, and plant materials shall be brushed or swept to remove any mulch impinged thereon.

3.3 MULCHING

3.3.1 Placing Mulch

Placement, repair and maintenance of mulch shall conform to ODOT 659.13 through 659.20.

Hydro-mulch shall be applied at recommended rates, when hydraulic methods are employed for grass seed application.

Where grass seed is applied, areas shall be covered immediately with a uniform blanket of straw mulch not exceeding a loose depth of .

Straw mulch shall be applied by hand or approved equipment.

3.3.2 Anchoring of Mulch

Where straw mulch is employed, straw mulch shall be anchored with tacking agents noted in ODOT 659.14, or approved fiber mesh netting.

3.4 GRASS ESTABLISHMENT

3.4.1 General

The period of grass establishment shall begin immediately after the completion of mulching in an area and shall continue for a period of 2-months after the completion of seeding on the entire project unless the desired grass cover is established in a shorter period of time and shortening of the grass-establishment period is authorized.

3.4.2 Watering

Immediately after the completion of mulching in an area, the area shall be moistened to a depth of 75 millimeter or more.

After the initial watering, the seeded areas shall be watered as required to maintain the soil in a moist condition for the entire grass-establishment period.

Watering shall conform to ODOT 659.17.

The Contractor shall provide and maintain temporary piping and lawn-watering equipment required to convey water from the water source to uniformly water the seeded areas. Water shall be free from substances detrimental to the growth of vegetation. Water sources located on Government property will be subject to approval prior to use. Temporary watering equipment shall be removed after grass area acceptance.

Watering schedules shall be arranged and lawn-watering equipment laid out in a manner to avoid the necessity of walking over muddy and newly seeded areas.

Watering shall be done in a manner to prevent the displacement of seed and mulch and to prevent puddling and water erosion.

3.4.3 Weeding

Weeds or other undesirable vegetation that threaten to smother the grass shall be uprooted and removed from the area.

3.4.4 Reseeding

After the first mowing, bare areas shall be reseeded.

Reseeding shall be with the grass seed specified for each seeded area and shall be sown at the rate specified and in a manner that will cause a minimum of disturbance to the existing stand of grass and mulch.

3.4.5 Remulching

In areas where mulch has been disturbed sufficiently to nullify its purpose, new mulch shall be added and anchored as specified.

3.4.6 Refertilizing

After the first mowing and during a period when the grass is dry, fertilizer shall be uniformly distributed over the seeded area at a rate of of actual nitrogen per 93 square meter. Fertilizer shall be as specified.

3.5 ACCEPTANCE PROVISIONS

3.5.1 Acceptance Requirements

Completed grass areas shall have been recently mowed and be covered with a uniform stand of the specified grass, be free of rank growths of weeds or other undesirable vegetation, and be free of irregular surface changes and other depressions where water will accumulate.

Scattered bare spots not larger than 152.4 mm in any dimension will be allowed, up to a maximum of 3 percent of any grass area.

The condition of grass areas at the time of inspection will be noted and a determination, made whether the grass-establishment period shall be extended for any area.

3.5.2 Repairs

If, before completion and acceptance of the entire work, portions of the surface become gullied or otherwise damaged following seeding or the grass seedings have been destroyed, the affected area shall be repaired to re-establish the condition and grade of the soil prior to seeding and then re-seeded, remulched, and the grass established as specified.

3.6 PROTECTION

Seeded areas shall be protected against traffic or other use by erecting barricades around each area immediately after seeding is completed and by placing warning signs of an approved type on each seeded area.

-- End of Section --

SECTION 32 92 19.98

SEEDING
4/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 602	(2007) Agricultural Liming Materials
ASTM D 4427	(2007) Peat Samples by Laboratory Testing
ASTM D 4972	(2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf or Lawn

95 percent ground cover of the established species. Contractor is responsible to reseed until 95% of grass is established.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 93 00 EXTERIOR PLANTS applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for all submittals. The following shall be submitted in accordance with Section 01 33 00.98 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch

Erosion Control Mesh

Fertilizer

Include physical characteristics, and recommendations.

LEED Submittals

Data for Credits MR 4.1 and MR 4.2 (Recycled Content): For products having pre-consumer and/or post-consumer recycled content, submit documentation indicating:

Description of product.
Manufacturer/Vendor.
Product Cost (excluding labor and equipment).
Cut sheets or manufacturer's letters documenting percentages by weight of post-consumer and/or pre-consumer recycled content.
Source of the recycled content data.

Data for Credits MR 5.1 and MR 5.2 (Regional Materials): For products that are extracted/harvested/recovered and manufactured within 500 miles of the project site, submit documentation indicating:

Product name.
Manufacturer/Vendor.
Product cost (excluding labor and equipment.
Percentage of product by weight that meet both the extraction and manufacture criteria.
Distance between the project site and extraction/harvest/recovery site.
Distance between the project site and the final manufacturing location.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

State certification and approval for seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum, Sulfur, Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer gypsum sulphur iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer, Gypsum, Sulfur, Iron and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Contractor shall scarify soil to 4" depth prior to seeding.

Prior to installing stockpiled topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit or below 45 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer.

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	April 15 to June 20
Season 2	September 20 to November 1
Temporary Seeding	April 1 to November 1

2.1.3 Seed Purity and Mixture by Weight

JMD COMPANY, 1290 Highland Rd, Macedonia, OH 44056
Product: PENN STATE LAWN MIX
LOT NUMBER: JMDB-080413

Percent Purity	Common Name	Origin	Min Percent Germination & Hard Seed
19.77	Top Hat 2 Perennial Ryegrass	OR	90%
19.75	All Star 2 Perennial Ryegrass	OR	90%
19.38	Gator 3 Perennial Ryegrass	OR	90%
18.81	Kentucky Bluegrass 85/80	WA	80%
9.86	Maxima Creeping Red Fescue	DNMK	85%
9.76	Boreal Creeping Red Fescue	CAN	85%
0.34	Other Crop		
2.94	Inert Matter		
0.03	Weed Seed	Noxious Weed NONE FOUND	

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available, topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.5

Soluble Salts	600 ppm maximum

Contractor to adhere to 31 00 00 EARTHWORK Sections 2.1.1 and 2.1.2 "Requirements for Off Site Soil".

2.3 SOIL CONDITIONERS

Add conditioners to topsoil per topsoil analysis recommendations.

2.3.1 Lime

Commercial grade hydrated limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 110 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427 as modified herein. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.7.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.7.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.8 Gypsum

Coarsely ground gypsum from recycled scrap gypsum board, comprised of calcium sulfate dihydrate 61 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.9 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing minimum percentages, by weight, of plant food nutrients, as recommended by topsoil composition test.

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing minimum percentages, by weight, of plant food nutrients, as recommended by topsoil composition test.

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2 . Use with hydraulic application of grass seed and fertilizer.

2.5.2 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.6 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.7.1 Erosion Control Fiber Mesh

Biodegradable jute mesh, a minimum of 0.92 lbs./sq. yd., with 50-64 percent open area.

Basis of Design: North America Green Bionet SC150BN.

2.7.2 Erosion Control Material Anchors

Erosion control anchors shall be steel wire staples as recommended by the manufacturer for 2:1 slopes, 6 inches minimum.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Extent of Work

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 6 inches of on-site topsoil with supplemental topsoil from off-site sources if required due to insufficient quantities of on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters and soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Lime pounds per acre 50 pounds per 1000 square feet.

Peat 3 cubic yards per 1000 square feet.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

Organic Granular Fertilizer: Per manufacturer's recommendations for new lawns.

Hydroseeding Fertilizer: Per manufacturer's recommendations for new lawns.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy, frozen, snow covered, or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be hand broadcasted in the stormwater detention basin on 2:1 slopes, or hydroseeding for all other locations.

3.2.2.1 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate of per paragraph 2.1.3. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.2.2 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of per paragraph 2.1.3. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.2.3 Straw Mulching

Straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continue uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored with one-year, biodegradable mesh immediately following spreading or sprayed with government approved tackifier. The tackifier must be environmentally safe. It shall be the responsibility of the contractor to maintain the mulch at no additional cost to the government.

3.2.3 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.4 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.3.1 Overseeding

Apply seed in accordance with applicable portions of paragraph entitled "Seed Application Method" at rates in accordance with paragraph entitled "Seed Composition."

3.4 RESTORATION

Restore existing turf areas which have been damaged during construction operations and areas that did not germinate at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

ATTACHMENT F. HEALTH AND SAFETY PLANS

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FINAL

SITE SAFETY AND HEALTH PLAN ADDENDUM
for
FIRING RANGES 3, 4, 5, AND CONSTRUCTION DEBRIS PILE REMOVAL ACTION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
PLUM BROOK STATION
SANDUSKY, OHIO

Prepared for:

NASA Glenn Research Center
21000 Brookpark Road
Cleveland, OH 44135

Prepared by:

Leidos
8866 Commons Blvd., Suite 201
Twinsburg, OH 44087

February 28, 2020

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SITE SAFETY AND HEALTH PLAN ADDENDUM

This is an addendum to the Construction, Maintenance, Environmental, and Testing Services (COMETS) SSHP prepared by the Prime Contractor, Firelake-Arrowhead NASA Services (FANS), in May 2018 for activities under Contract No. 80GRC018C0022, and was approved by NASA Safety and Health Division (SHeD). Leidos has added the following activities to this SSHP Addendum:

- Site walk and inspections
- Site surveying
- Environmental Sampling (including characterization soil and groundwater sampling)
- Oversight of asbestos waste removal [*performed by licensed Arrowhead Contracting personnel or subcontractor*]
- Oversight of monitoring well installation and abandonment via hollow-stem auger (HSA) drilling with air rotary capabilities [*performed by Subcontractor*]
- Oversight of soil and sediment removal, and treatment via mechanical excavation (i.e., hydraulic excavators, backhoes) [*Arrowhead Contracting will perform excavation activities*]
- Confirmation soil sampling via hand auger.

Activity Hazard Analyses (AHAs) have been added to this SSHP Addendum for the activities to be completed by Leidos, including oversight of subcontractor activities.

Additional activities will be performed by Leidos subcontractors and Arrowhead Contracting (remedial subcontractor under FANS) under separate SSHP addendums.

Contractor Name: Leidos (Subcontractor to Firelake-Arrowhead)

Contract No: 80GRC018C0022 [COMETS) Contract], Subcontract No. FA8-1-S1

Project Name: FIRING RANGES 3&4 AND FIRING RANGE 5 / CONSTRUCTION DEBRIS PILE REMOVAL ACTIONS (RA)

Work Location: NASA Glenn Research Center, Plum Brook Station (PBS), Sandusky, Ohio

Task Name: Removal Action Implementation

Task Order: E117 / E124

Projected Job Start Date: Firing Ranges 3&4 July 2020 / Firing Range 5 and CDP August 2020

Projected Job Finish Date: Firing Ranges 3&4 August 2020 / Firing Range 5 and CDP

September 2020

Prepared by: Lindsey Moyer Phone: (717) 395-7404 Date Submitted: 02/28/2020

Leidos Approvals: Signature below indicates review and approval of the plan and agreement that the anticipated hazards are correct and that planned hazard controls are sufficient.

Heather Adams, Leidos Project Manager	**2/25/2020** Date	Rich Sprinzl, Leidos FM/SSHO	**2/25/2020** Date
Stephen Lowery, CIH, CSP FE&E Health and Safety Manager	**2/25/2020** Date		

Subcontractor Concurrence:
Leidos Subcontractor is in concurrence with the provisions of this Site Safety and Health Plan Addendum and will ensure conformance by employees performing work at the NASA Glenn Research Center (GRC).

Authorized Representative	Date	Company Name
Authorized Representative	Date	Company Name
Authorized Representative	Date	Company Name

IN CASE OF EMERGENCY CALL 419-621-3222

EMERGENCY CONTACTS

Emergency	Responder	Location	NASA Phone*	Mobile/Other Phone
Fire	NASA PBS Fire Department	Building 7233	911	419-621-3222
Police	NASA PBS Security	Building 7233	911	419-621-3222
Ambulance	NASA PBS Security	Building 7233	911	419-621-3222
Hospital	Firelands Regional Medical Ctr.	1111 Hayes Ave	(419) 557-7455	(419) 557-7455

*Dialing 911 from the NASA GRC phone system will connect to NASA emergency assistance. From a PAYPHONE OR cellular phone, dial **(419) 621-3222**.

Map and directions to Firelands Medical Ctr. and the nearest WorkCare Clinic are located on the following page.

NASA NON-EMERGENCY CONTACTS

	Plum Brook Station
NASA Dispatch	419-621-3326 or 419-621-3221
Environmental, Health, and Safety (EHS) Helpline (for reporting non-emergencies)	216-433-8848
NASA Health and Safety Division POC	
Joyce Jordan	216-433-3873
Leidos WorkCare Incident Intervention	888-449-7787

On Site phone dial "8" to obtain an outside line

PROJECT CONTACT NUMBERS

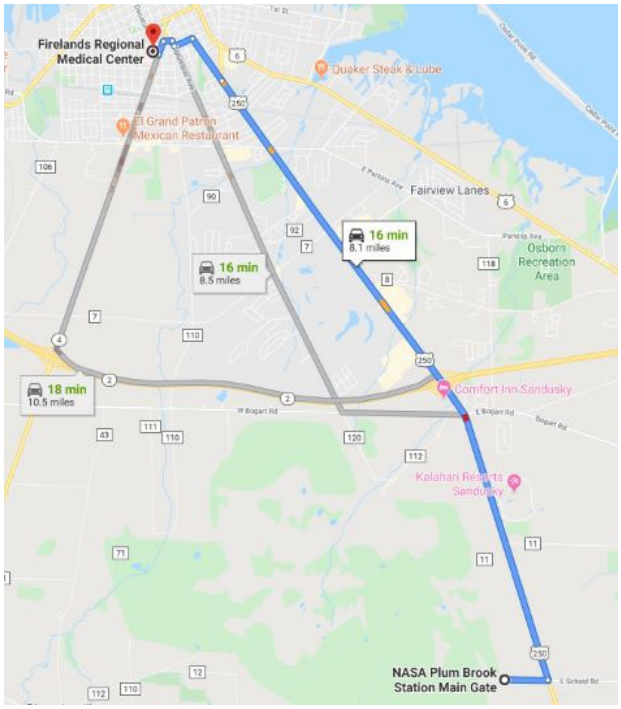
Leidos COMETS Environmental Program Manager Jen Thomas	Work: (216) 433-3184 Cell: (216) 854-6219
Leidos Project Manager Heather Adams, PG	Work: (330) 405-5814 Cell: (330) 573-8571
Leidos Field Manager/Site Safety and Health Officer/Competent Person Rich Sprinzl, PE	Work: (330) 405-5808 Cell: (330) 348-1378
Leidos Geologist/Competent Person Jasmine Stefansky Alternate: Charles Spurr	Work: (865) 481-8565 Cell: (865) 228-1367 Work: (330) 405-5809 Cell: (216) 317-5726
Leidos FEE Health & Safety Manager Stephen Lowery, CIH, CSP	Work: (571) 526-6659 Cell: (405) 919-4176
NASA GRC Representative(s) John Brodt Christie Myers	Work: (216) 433-6028 Cell: (216) 299-8628 Work: (216) 433-8874 Cell: (216) 315-0390

PROJECT CONTACT NUMBERS

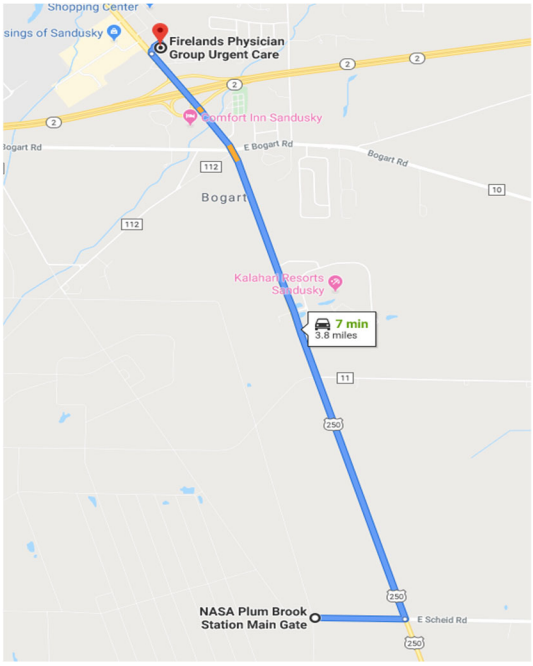
NASA Natural Resources Manager Christine Staschiak	Work: (216) 433-6662
NASA PBS Construction Manager Rick Bressler	Work: (419) 621-2244 Cell: (216) 409-6698
Subcontractor Field Manager (Driller)/Drilling Competent Person - TBD TTL Associates Inc.	TBD (prior to mobilization)
Arrowhead Project Manager Jeremy Soenen	Work: (515) 961-8000 Cell: (515) 664-7308
Arrowhead Site Supervisor Dirk Doege	Cell: (567) 274-1557

MAP FOR HOSPITAL AND WORK CARE CLINIC

Firelands Regional Medical Center, 1111 Hayes Ave, Sandusky, OH, 419-557-7400
After leaving the site from the Main Gate on Scheid Road, turn left onto Route 250. Turn left onto Bogart Road. Turn right onto County Rd 120/Columbus Ave. Turn left onto Townsend St. Turn left onto Hayes Ave. Firelands Regional Medical Center is on the right.



Nearest WorkCare Clinic: Firelands Physician Group Urgent Care - Corporate Health Center, 5420 Milan Road, Sandusky, OH, 419-557-6490
After leaving the site from the Main Gate on Scheid Road, turn left onto US-250 W/Milan Rd. Firelands Physician Group Urgent Care will be on the right.



SAFETY PLAN ACKNOWLEDGMENT:

I hereby acknowledge that I have read and understand the attached safety and health plan and I agree to perform work on this task in accordance with this plan, safe work practices and OSHA regulations. I further acknowledge that I have received a Plum Brook Station safety orientation in the form of either a safety video viewing or a presentation by Safety Office personnel.

Employee:	**Company:**	**Date:**
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
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INTRODUCTION: The purpose of this Site Safety and Health Plan (SSHP) Addendum is to set forth, in an orderly and logical fashion, appropriate health and safety (H&S) procedures to be followed during onsite investigation and construction activities at National Aeronautics and Space Administration (NASA) John H. Glenn Research Center (GRC), Plum Brook Station (PBS) in Sandusky, Ohio. This SSHP Addendum identifies potential hazards which personnel may be exposed to, during the performance of this Task. Leidos personnel shall not participate in this Task without having read this plan in its entirety. This plan has been developed to be as complete as possible; however, should conditions dictate revisions or additions to this plan, amendments shall be drafted, added, and distributed to all persons involved with this plan. This plan works in concert with the "Safety and Health Plan," the NASA GRC Safety Manual, Occupational Health Manual and Environmental Programs Manual, Occupational Safety and Health Administration (OSHA) standards, *Code of Federal Regulations* (*CFR*) 1926, United States Environmental Protection Agency regulations, National Fire Protection Association Codes, and any other applicable codes stated in the NASA contract. It shall be the prime contractor's responsibility to ensure that all of its subcontractors comply with the provisions set forth in this plan.

STATEMENT OF COMPANY'S SAFETY GOALS AND OBJECTIVES:
It is the policy of Leidos that all accidents and environmental regulatory violations are preventable. In keeping with this policy, a goal of zero accidents has been adopted. The safety and health of employees, subcontractors, visitors, customers, and the public as well as protection of the environment is a core value incorporated into the performance of all work. Safety is planned into all work and documented through procedures, procurement documents, activity hazard analyses (AHAs), H&S plans, and other equivalent means, as appropriate. It is Leidos policy to operate in compliance with all environmental, health and safety (EH&S) rules and regulations, and to comply with our client's policies and procedures. Leidos will cooperate with NASA to ensure that every precaution is taken in establishing a safe working environment for employees.

DESCRIPTION OF WORK:
The work performed under this contract is for removal actions (RAs) at the Firing Ranges 3 and 4 and Firing Range 5/Construction Debris Pile (CDP) at PBS. Leidos will work collaboratively with Arrowhead Contracting to complete the tasks. The scope of work under this addendum includes: (1) implement the RA plan in conjunction with Arrowhead, including tree and brush clearing and removal of debris and soil; (2) Leidos will conduct quality control oversight, waste characterization soil sampling, verification soil sampling, and confirmation soil sampling; (3) install monitoring wells using a hollow-stem auger (HSA) with air rotary capabilities; (4) perform groundwater well abandonment; and (6) Arrowhead will perform construction activities under a separate SSHP. This contract is also for the RA at Firing Range 5 and the CDP. The scope of work includes work in conjunction with Arrowhead for brush clearing and tree removal, excavation of concrete debris and soil, and restoration of the site. Leidos will perform waste characterization sampling prior to removal of the earthen berm backstop and sandblast grit piles. Leidos will collect composite soil samples per 100 cubic yards for the soil from the earthen berm and the sandblast grit pile. Post-RA confirmatory sampling will be performed.

EMPLOYEE AWARENESS OF SAFETY: (Describe methods used to foster or promote employee awareness of health and safety matters (e.g., safety meetings, incentives, etc.)
Employees are trained and qualified to perform their work safely and are held accountable for intentional or negligent noncompliance. Each employee is empowered and expected to stop his or her own work or the work of co-workers if any person's safety or the environment is at risk. The Field Manager (FM) is expected to support and reinforce this expectation. Stopped work shall not resume until the hazard has been controlled and a review has been performed. In addition, all employees are encouraged to seek ways to enhance the effectiveness of the EH&S Program.

The Site Safety and Health Officer (SSHO) shall ensure that at the start of each work day, a tailgate safety briefing is performed that reviews the AHAs applicable to the daily activities, unique site conditions, personal protective equipment (PPE), applicable emergency information, and stop work authority (SWA). The SSHO shall ensure all site personnel involved attend the tailgate briefing and that they sign as having attended. If personnel do not attend the tailgate briefing, the SSHO shall approach personnel when they arrive onsite, provide them with an individual tailgate briefing, and have them sign as attending.

Project training shall include at least the following. The FM and SSHO shall have current hazardous waste safety training (40-hour Hazardous Waste Operations and Emergency Response [HAZWOPER], 3 days of on-the-job training [OJT], and 8-hour refresher within the past 12 months); hazardous waste supervisor training; Excavation-Competent Person training; and sufficient experience to understand the potential hazards. All other field personnel, including subcontractors, shall have current hazardous waste safety training, including 40-hour HAZWOPER, 3 days OJT, and current 8-hour refresher course. The FM shall present a project kick-off safety briefing to cover this plan, physical hazards, safe work zones, hazardous contaminants (lead) and chemicals, required hazard controls, emergency contacts, and additional safety briefings as needed (at least once per week). At least two people onsite shall have current first aid and cardiopulmonary resuscitation (CPR) training. The FM shall maintain documentation of completed training onsite (or readily available via online database). See corporate EH&S Procedures 8.0 and 20.0 for details. Additional training may include, but not be limited to, Lead Awareness Training (as required in corporate EH&S Procedure 29.0), Asbestos Awareness Training (as required in corporate EH&S Procedure 29.0), and Hearing Conservation (as required in corporate EH&S Procedure 15.0). Field personnel shall be enrolled in a medical surveillance program and have current hazardous waste medical clearance (corporate EH&S Procedures 12.0 and 20.0). Excavation-Competent Person qualifications will be submitted to NASA's Facilities Division as part of their excavation permit review process.

In addition, all personnel onsite shall be required to view the NASA PBS construction safety video or presentation.

POSITION & RESPONSIBILTIES	Name
Field Manager	Rich Sprinzl
Site Safety and Health Officer	Rich Sprinzl
Corporate H&S Manager	Steve Lowery
Project Manager:	Heather Adams

COMPETENT PERSONS: Identify the Qualified and/or certified person(s) responsible for oversight of a particular hazardous operation. The Competent Person is required to conduct daily, documented site inspections.

Competent Person(s)

Rich Sprinzl, PE
Heather Adams, PG
Jasmine Stefansky
Alternates: Heather Adams, PG; Charles Spurr

SUBCONTRACTORS

This plan has been prepared for the use of Leidos employees to identify potential hazards and required controls necessary to provide a safe work environment. This plan identifies the minimum hazard controls that shall be implemented and addressed in Leidos subcontractors' safety plans and procedures. Leidos subcontractors are required to provide trained, experienced personnel and to operate equipment as required by the manufacturer's procedures, or the subcontractor's written standard operating procedures, and are required to supplement the requirements of this plan as necessary to ensure that their employees perform their specific tasks safely. Leidos will provide subcontractors with a copy of this plan; Leidos subcontractors are solely responsible for ensuring their onsite activities are conducted safely and in conformance with applicable requirements specified in this plan, Leidos Civil EH&S Procedure 2.0, *Subcontractor Environmental Compliance and Health and Safety,* and all applicable laws and regulations. Any other person or entity relying on this plan hereby acknowledges they do so at their own risk, and Leidos has no responsibility or liability for the consequences thereof. The Subcontractor will submit an Addendum to this SSHP for review by the Leidos FEE H&S Manager and NASA GRC Safety Office.

Subcontractors to complete site activities include the following:

- TTL Associates Inc. (drilling, monitoring well installation/abandonment)
- John Hancock and Associates (well surveying)

Each Subcontractor is required to provide a Subcontractor FM and Competent Person for this project. These two positions will be determined and evaluated by the Leidos SSHO prior to mobilization.

WORK ACTIVITIES

Firing Ranges 3, 4, and 5 and CDP RA task activities include:

- Site walk and inspections
- Site surveying
- Environmental sampling (including characterization soil and groundwater sampling)

- Oversight of asbestos waste removal [*performed by licensed Arrowhead personnel*]
- Monitoring well installation and abandonment via HSA/air rotary drilling (*performed by Subcontractor*)
- Oversight of soil and sediment removal, and treatment via mechanical excavation (e.g., heavy equipment such as hydraulic excavators, backhoes) [excavation performed by Arrowhead]
- Confirmation soil sampling via hand auger.

POTENTIAL HAZARDS: (Identify those hazards that relate to the work activity)

X	Chemicals or Flammables	___	Scaffolding	___	Traffic Control
X	Spills or Leaks	___	Ladders	X	Barricading
___	Hazardous Energy (Lockout/Tagout)	X	Demolition	___	Cranes/Aerial
X	Eye, Face, or Head Hazards (PPE)	X	Power Tools	___	Falls (Heights > 6 feet)
X	Respiratory Hazards	X	Excavation (Permit Req'd)	___	Radiation (Contact Health Physics @3173)
X	General Maintenance Checkout	X	Noise	X	Biological
X	Sanitation	___	Egress	___	Road Blockage
___	Utility Service Interruption (May be Req'd)			___	High-Pressure Systems
___	Hot Work (Permit Req'd)			___	Cryogenic Spills, Burns
___	Confined-Space Entry (Permit Req'd)			X	Temperature Extremes/Weather
X	Special Hazards – **lead, asbestos, PAHs**				

Other: Dust hazards (containing lead) from large equipment movement and mixing treatment stockpiles; physical hazards associated with mechanical excavation and treating/stockpiling. Lead maximum concentrations are 767 to 44,000 ppm at the Firing Range 3 and 4 target area, and 71,800 ppm in the Firing Range 3 shooting area. **Total dust/particulate action levels will be set as 0.34 mg/m^3 in the Firing Range 3 and 4 target areas and 0.21 mg/m^3 in the Firing Range 3 shooting area.** Monitoring of Firing Ranges 4 (shooting area), 5, and the CDP is not required. If practical, use water spray to reduce dust/particulates as needed. Results for polycyclic aromatic hydrocarbons (PAHs) were too low to represent an airborne exposure health risk.

Contaminants of Concern:

Contaminant	Max Conc. (ppm)	PEL/TLV	IDLH	Warning	Signs, Symptoms
Lead	44,000 (FR 3&4 target) 71,800 (FR 3 shooting area)	0.05 mg/m^3	100 mg/m^3	Dust	Weakness, lassitude, Central Nervous System, blood, kidney, reproductive effects
Benzo(a)pyrene (and other similar PAHs)	39 (FR 3&4 Target Area) 3.9 (Firing FR 5 Target Area	PEL: 0.02 mg/m^3 TLV: 0.1 mg/m^3	80 mg/m$^{3;}$	Dust	Suspected carcinogen per NIOSH, dermatitis, bronchitis
Asbestos	90% chrysotile (CDP)	0.1 f/cc	Carcinogen	Fiber	Dyspnea, restricted pulmonary function

PROPOSED CONTROLS: (Work practices, PPE, training, and/or emergency procedures that will be used to ensure the safety of workers, and onsite personnel, against the hazards identified above.)
***Please see AHAs in Appendices B and D (Subcontractor Job Safety Analyses) for proposed controls to the above-listed potential hazards.**

Project Management Review
Project Leaders, Group Supervisors, Managers who review the work site are to acknowledge so at least once per day for the duration of the project.

Date	Time	Name	Activity	Issues/Comments

Overall Comments:

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APPENDIX A
SUMMARY OF LEIDOS ENVIRONMENTAL, HEALTH & SAFETY PROCEDURES

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Summary of Leidos Corporate Environmental, Health & Safety Procedures

A summary of the Leidos Corporate Environmental, Health and Safety (EH&S) Procedures are presented below. As stated previously, since essentially all contract requirements take place on the National Aeronautics and Space Administration (NASA) John H. Glenn Research Center (GRC) facility, following NASA programs provides a framework consistent with the location of the work. To the extent that Leidos requirements may extend beyond the NASA programs, Leidos personnel located at NASA GRC will conform to those additional requirements.

1. ***EH&S Program Responsibilities and Implementation****
Identifies responsibilities for the implementation of an EH&S Program in order to ensure statutory and regulatory requirements are met, and to support adherence to the requirements of the Leidos EH&S Policy, LP-LG-11 Environmental, Health and Safety.

2. ***Emergency Action & Fire Prevention****
Defines requirements and establishes responsibilities for the creation and maintenance of emergency action and fire prevention plans (emergency response procedures) at all locations where Leidos employees are permanently assigned, and for fire safety plans for work aboard vessels or in shipyards. Minimum elements for the plan(s) are outlined, as are the requirements for information and training of affected employees, and for the maintenance of related records. Establishes initial reactionary procedures to be followed in the event of reasonably anticipated emergency events (e.g., fire, medical emergencies, weather-related emergencies, hazardous material releases, etc.) likely to impact employee health or safety, and to establish procedures for the control of potential fire related hazards.

3. ***EH&S Workplace Inspections****
This procedure defines responsibilities and establishes requirements for planned and informal workplace inspections in order to identify and ensure timely correction of unsafe conditions and/or work practices.

4. ***Incident Reporting & Investigation****
This procedure defines responsibilities and establishes requirements for the reporting and investigation of "incidents" and "close call incidents" as defined herein, in order to decrease the probability of future similar incidents. Specific actions required by this procedure are: (1) reporting incidents immediately, (2) investigation of incidents by the responsible manager, (3) identifying underlying incident causes, (4) identifying corrective actions to address direct causes and underlying factors, and (5) tracking execution of those actions to closure.

5. ***EH&S Training****
Defines responsibilities and establishes minimum requirements for providing new employees with information on Leidos' environmental, health, and safety compliance programs and resources. Describes the responsibilities and procedures related to EH&S training and how all Leidos personnel assigned to non-office type work activities or exposures (e.g., work involving hazardous materials, warehousing, machine tools, hazardous field activities, etc.) will be instructed in the recognition and avoidance of unsafe conditions and the regulations applicable to his/her work environment to control or eliminate any hazards or other exposure to illness or injury.

6. ***OSHA Recordkeeping and Reporting****
This procedure defines responsibilities and establishes requirements for the recordkeeping and reporting of work-related injuries, illnesses, and fatalities, in accordance with company management requirements and those of the Occupational Safety and Health Administration (OSHA) at 29 *Code of Federal Regulations* (*CFR*) Part 1904.

7. ***Hazardous Waste Management***
Establishes company policies and procedures for managing hazardous waste. In addition, this section provides instructions for identifying, storing, and disposing/recycling hazardous waste. Locations that generate hazardous waste are required to modify and implement this procedure to ensure compliance with local, state, and federal environmental regulations.

8. ***Hazard Communication Program***
Establishes a program for informing employees of the hazards associated with hazardous chemicals through container labeling and other forms of warning, safety data sheets (SDSs), and training.

9. ***Respiratory Protection***
This procedure defines responsibilities and establishes minimum requirements for the use of a respirator either on a voluntary basis or when such equipment is necessary to protect the health of an employee.

10. ***Confined Space Entry***
Establishes minimum requirements for the safe performance of confined space entry operations by Leidos or Leidos contractors/subcontractors. This includes establishing minimum requirements for: identifying permit- and non-permit required confined spaces; entrance into permit-required confined spaces; contracting and/or subcontracting confined space entry work; conducting confined space entries at client facilities; annual program reviews; training; and recordkeeping.

11. ***Lock Out/Tag Out***
Establishes minimum program requirements to ensure that machinery or equipment is isolated from all potentially hazardous energy, and locked out and tagged out before employees perform any servicing or maintenance activities where the unexpected energization, start-up, or release of stored energy could cause injury. This includes, except in specified circumstances, development and utilization of machine or equipment-specific energy control procedures. Corporate/Group/Operation EH&S Officials are responsible for ensuring energy control procedures are developed, periodic inspections of energy control procedures are conducted, all required training is provided and properly documented, and that all required program records are maintained.

12. ***Medical Clearance and Surveillance***
This procedure defines responsibilities and identifies requirements for obtaining medical clearances or performing medical surveillance on employees with occupational exposures to hazardous agents, or where otherwise required by applicable regulations.

13. ***Personal Protective Equipment***
Defines responsibilities and establishes minimum requirements for: (i) conducting a workplace hazard assessment to determine personal protective equipment (PPE) requirements; (ii) the selection and payment of PPE; and (iii) training employees on the use, care, maintenance, and limitations of PPE.

14. ***Chemical Hygiene Plan and Laboratory Safety Program***
Summarizes and implements the OSHA standard for laboratory safety. This procedure includes guidelines for making determinations on hazard identification, employee exposure to hazardous and toxic substances, required use of respirators, and medical consultation and examinations. The Corporate/Group/Operation EH&S Official is responsible for training and education concerning chemical hygiene and safety, and coordination with the EH&S Director, examining physicians, and affected employees. The Corporate/Group/Operation EH&S Official must also maintain a reporting and recordkeeping system and periodically monitor laboratory operations and working conditions.

15. ***Hearing Conservation and Noise Control***
This procedure defines responsibilities and establishes minimum requirements for assessing noise exposures and, where required, implementing noise control strategies and/or hearing conservation program elements.

16. ***Injury and Illness Prevention Program (California Only)***
This program taken together with other defined elements of the Corporate EH&S Program outlines methods for communicating with and training employees on matters relating to occupational safety and health, assessing and controlling work place hazards, and ensuring employees comply with safe and healthy work practices.

17. ***Laser Safety***
This procedure defines responsibilities and establishes requirements for the use of lasers and laser systems, including requirements for user training and, in specified instances, the development, implementation and maintenance of standard operating, maintenance, and service procedures (standard operating procedures [SOPs]) for the control of laser related hazards.

18. ***Environmental, Health and Safety Records Management***
Presents internal corporate procedures for the preparation, control, storage, and retrieval of EH&S records in compliance with the United States Environmental Protection Agency (USEPA), OSHA, and other regulatory agencies' requirements. Corporate/Group/Operation EH&S Officials must ensure the provision of all relevant EH&S records to the EH&S Records Retention Center, and further ensure that all records are complete and accurate.

19. ***Radiation Protection***
Sets forth Nuclear Regulatory Commission (NRC), OSHA, and Leidos standards for occupational radiation protection to ensure that employee radiation exposure is minimized to doses as low as reasonably achievable, and that releases of radioactive materials are within regulatory and permit limits. This procedure requires the designation of a local Radiation Safety Officer who is responsible for preparing and implementing a radiation protection program, to include periodic surveys, training, investigation, and reporting requirements.

20. ***Hazardous Waste Operations***
Implements OSHA requirements for the protection of workers engaged in hazardous waste operations. The procedure includes guidelines for proper training of covered employees, preparation of site-specific health and safety plans (HASPs), compliance with applicable medical surveillance and care requirements, and recordkeeping. The Group/Operation EH&S Official, in concert with each designated site Health and Safety Officer (SHSO), is responsible for implementing the procedure.

21. ***Regulatory Agency Inspections and Related Reporting***
This procedure defines responsibilities and establishes requirements related to the handling and reporting of regulatory agency inspections or other regulatory enforcement related events (e.g., receipt of a formal complaint, notice of violation, or other code citation or enforcement mechanism).

22. ***Powered Industrial Trucks***
This procedure defines responsibilities and establishes minimum requirements for the safe use and maintenance of powered industrial trucks.

23. ***Universal Waste Management***
Establishes minimum requirements for the management of universal wastes (e.g., waste fluorescent lamps, batteries, pesticides, and thermostats) from Leidos facilities and/or activities. Corporate/Group/Operation EH&S Officials are responsible for ensuring that site-specific universal waste management programs are established addressing accumulation and labeling, off-site shipment, training, and recordkeeping.

24. ***Hazardous Material Transportation***
This procedure defines responsibilities and establishes minimum requirements for company employees involved in the offering or preparation of hazardous material for transportation, or the self-transportation of hazardous material meeting the "material of trade" exception.

25. ***Commercial Motor Vehicle Operation***
This procedure defines responsibilities and establishes minimum requirements for the operation of commercial motor vehicles by company employees, including but not limited to: (i) the qualification, hiring, investigation, and testing of commercial motor vehicle drivers ("driver" herein); (ii) the identification, inspection, and maintenance of commercial motor vehicles; and (iii) the creation and maintenance of individual driver trip (i.e., hours of service) records.

26. ***Electrical Safety***
Establishes procedures to protect Leidos employees and contractors from potential electrical hazards. The program focuses on safe work practices along with application of engineering controls, administrative controls, and use of PPE. Employees working on electrical conductors or circuit parts that have not been put into an "electrically safe working condition" must be qualified persons and trained to understand the hazards and to select and use safe work practices as well as personal and other protective equipment.

27. ***Fall Protection, Ladders & Scaffolds***
Establishes procedures to ensure compliance with the OSHA Fall Protection standard (29 *CFR* 1926, Subpart M, Fall Protection) through fall hazard identification and evaluation and use of fall protection systems. Establishes fall protection training requirements and requirements for work on ladders and scaffolds.

28. ***Construction Operations***
Specifies requirements applicable to construction operations performed by Leidos. Covers training, staffing, management of design/build project safety, and health and safety plan requirements.

29. ***Substance-Specific Hazardous Materials***
Establishes minimum requirements and responsibilities for the control of heavy metal exposure [i.e., arsenic, cadmium, chromium (VI), and lead], benzene, asbestos, hydrogen sulfide, silica, and ammonia during work conducted by Leidos employees. Applies to employees engaged in work-related activities where the likelihood for exposure to these materials at or above established exposure limits exists.

30. ***Heat Illness Prevention***
Provides a description of illness associated with heat stress and preventive measures to be used where Leidos employees are exposed to heat temperature extremes.

31. ***Cold Stress Prevention***
Provides a description of illness associated with cold stress and preventive measures to be used where Leidos employees are exposed to cold temperature extremes.

32. ***Vehicle Operations***
Describes requirements for operation of Leidos vehicles. It is intended to minimize the probability of work-related vehicle accidents. The procedure applies to Leidos use of vehicles. Vehicle use covered by this procedure includes any operation by Leidos personnel of Leidos owned leased, and rented vehicles, and personal vehicles when operated on Leidos business.

33. ***Subsurface Asset and Hazard Avoidance***
Establishes the minimum requirements for avoiding damage to subsurface assets and harm to employees or others from unintentional contact with buried utilities when performing drilling or excavation. This procedure applies to Leidos work that involves penetrating the soil surface with hand or powered equipment.

34. ***Heavy/Mobile Equipment Operation***
Describes procedures that will be followed when heavy equipment is in use at Leidos project sites. Requires subcontractors to provide information demonstrating that their employees are qualified by training or experience to operate equipment at the site.

35. ***Excavation Operations***
Provides procedures to ensure that all excavation, shoring, and trenching activities performed by Leidos are conducted in accordance with the requirements outlined in this section and Subpart P of 29 *CFR* Part 1926. Requires that subcontractors performing excavation operations provide an individual capable of performing competent person duties as described in this procedure.

36. ***Project Site Spill and Fire Prevention and Control***
Specifies general requirements for maintaining appropriate spill and fire protection and prevention on Leidos projects. Discusses fire extinguishers, incipient firefighting, flammables, secondary containment, and smoking/open flames.

37. ***Welding, Cutting and Hot Work***
Describes Leidos welding, cutting, and hot work requirements at Leidos locations and where the client or site owner does not have requirements in place or when welding. Covers equipment operation and training, equipment maintenance, ventilation, PPE, first aid, gas welding safety, arc welding safety, confined spaces, storage and handling of compressed gas cylinders, fire protection, and permitting procedures.

38. ***Machine Shop, Hand and Power Tool Safety***
Describes requirements for machine shops, tool selection and use, housekeeping, and PPE that must be followed by all Leidos and subcontractor personnel when utilizing hand (includes open-blade knifes) or power tools.

39. ***Lifting and Rigging***
Specifies requirements necessary to lift and move heavy loads safely. Includes specifications for chains, hoists, and rigging, as well as safe lifting practices and employee training.

40. ***Aerial Lifts***
Outlines safe operating rules and the minimum requirements to be completed by employees prior to operating or conducting work from a boom-supported aerial work platform (aerial lift).

41. ***Automated External Defibrillator (AED) Program***
Establishes a consistent guideline for the selection, placement, care, and maintenance of AEDs for voluntary use in the event of a sudden cardiac arrest emergency.

42. ***First Aid and Emergency Rinse Equipment***
Specifies requirements for first aid at Leidos project sites. Specifies assignment of personnel certified in first aid, first aid kit requirements, transportation of injured personnel, and eyewash/quick drench requirements.

43. ***Bloodborne Pathogens Exposure Control***
Describes Leidos procedures for eliminating or minimizing the danger of exposure to human blood or other potentially infectious materials in compliance with the OSHA Bloodborne Pathogens Standard, 29 *CFR* Part 1910.1030. The procedure is intended to cover Leidos employees trained in first aid operations and personnel performing activities with potential exposure to human blood of other potentially infectious materials.

44. ***Process Safety Management***
Describes responsibilities and requirements for Leidos when working at facilities that are covered by the OSHA Process Safety Management Standard, 29 *CFR* 1910.119. This section focuses on training and reporting requirements applicable to contractors.

45. ***Project Site Emergency Planning and Response***
Describes responsibilities and requirements for Leidos regarding emergency planning and response at client facilities. This section covers emergency response plans and procedures, training, protective clothing, post-emergency response, and medical surveillance.

46. ***Management of Waste Generated at Project Sites***
Establishes management practices to ensure that all wastes generated from Leidos activities at project sites involving hazardous substances are properly managed in accordance with all applicable environmental laws and regulations. The procedure provides direction and guidance on specific contract language [to ensure that Leidos does not perform any activities which may pose potential liability under the Resource Conservation and Recovery Act of 1976 (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or any equivalent state laws, as a generator of hazardous waste or an arranger of hazardous substance transportation, treatment, or disposal on a client's behalf], as well as on the development of management plans for project generated waste.

47. ***Naturally Occurring Radioactive Material***
This procedure establishes the minimum requirements that Leidos projects must meet to protect personnel where naturally occurring radioactive material (NORM) exposure may occur. Compliance with this program is mandatory and is applicable to all company employees who work in an environment where NORM may be present in any amount.

48. ***Stop Work Authority***
Every Leidos employee has the responsibility and authority to stop work immediately, without fear of reprisal, when perceived that a situation places themselves, their coworkers, or the environment in danger, or when the work will result in an unacceptable product. This procedure describes the steps and requirements for employees to implement "Stop Work Authority" (SWA).

49. ***Short Service Employees***
This program is utilized for project sites where Leidos client require contractors to implement their own Short Service Employee (SSE) program and Leidos has employee(s) or temporary employees with less than six months service with Leidos working at the project site. The purpose of the program is to ensure that the SSE is oriented to the client's EH&S, quality, and technical requirements prior to working at a client location and is working under the direct onsite supervision of a designated contractor employee who also serves as a mentor/trainer.

50. ***Manual Lifting***
Establishes guidelines, minimum requirements, and responsibilities for the control of hazards associated with manual lifting. The primary requirements are:

- The responsible manager must assess the lifting tasks performed by his/her employees and ensure the safety of those lifts.
- Fifty pounds is the maximum limit for individual lifts

51. ***Fatigue Management***
Provides minimum requirements to minimize the risk associated with fatigue when employees are performing field work on Leidos projects. The program addresses employee hours of service requirements as well as other general requirements to ensure employees are fit for duty.

52. ***Working Near Open Water***
Provides minimum requirements including life-saving equipment and pre-planning to minimize the risk of drowning when employees are performing field work near open water during Leidos projects.

53. ***Permit to Work***
Describes process for eliminating incidents associated with inadequately planned work by serving as an administrative control to prevent unauthorized work; and identifying all precautions and restrictions necessary to perform the work safely. The permit to work (PTW) process is applicable at all Leidos project sites with high-risk tasks where workers/subcontractors are exposed, or potentially exposed, to dangerous physical, chemical, or environmental conditions.

54. ***UXO/MEC/CWM Safety***
Establishes responsibilities for unexploded ordnance (UXO) personnel and minimum requirements under which field work that may involve exposure to UXO, munitions and explosives of concern (MEC), or chemical warfare materials (CWM) may be performed. This procedure applies to Leidos and Leidos subcontractor field activities involving potential exposure to UXO/MEC/CWM.

SUMMARY OF LEIDOS CIVIL GROUP's SUPPLEMENTAL ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURES

CV-1. ***Behavior-Based Safety Process***
A behavior-based safety process (BBSP) has been developed by Leidos to reduce at risk practices that lead to incidents and to promote safety as an organizational value. A BBSP provides an avenue for employee involvement and a systematic approach to identify and correct practices and conditions that lead to employee injuries. It includes elements for personal task analysis, job safety analysis, observation and feedback, incident investigation, and BBSP administration.

CV-2. ***Subcontractor Environmental, Health and Safety***
Establishes minimum requirements and responsibilities for the evaluation and selection of subcontractors and defines the Environmental, Health and Safety (EH&S) requirements applicable to field work or construction work subcontracted by Leidos.

CV-3. ***Injury/Illness Management***
Provides requirements regarding work-related injury/illness management at Leidos including the utilization of WorkCare, a national occupational health-consulting firm, to provide work-related injury/illness management services.

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APPENDIX B
ACTIVITY HAZARD ANALYSIS

CONSTRUCTION SITE INSPECTIONS/NON-INTRUSIVE PHYSICAL SURVEYS

ENVIRONMENTAL SAMPLING/MONITORING

OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELL USING HOLLOW-STEM AUGER/AIR ROTARY DRILL RIG

WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING

EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES

GATOR/MULE ATV VEHICLE USE

DRUM SAMPLING AND IDW MANAGEMENT

EQUIPMENT DECONTAMINATION

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ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: CONSTRUCTION SITE INSPECTIONS / NON-INTRUSIVE PHYSICAL SURVEYS (e.g., UTILITY CLEARANCES, SITE RECONNAISSANCE, WELL SURVEY)		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Overboots/disposable booties if walking through disturbed contaminated areas or stockpiles.
Hard Hat	X	If near operating heavy equipment or overhead hazards are present.
Safety Glasses With Side Shields	X	
Fire-Resistant Clothing		
Face Shields		
Goggles		
Lifeline/Body Harness		
Hearing Protection	X	As required, if posted or if exposed to noise greater than or equal to 82 dBA.
Air-Purifying Respirator		
Supplied Air Respirator – SCBA		
Personal Floatation Device	X	If within 6 feet of unguarded water 2 feet or more in depth.
Gloves	X	Nitrile, PVC, or similar for potentially contaminated material. Heavy-duty work gloves for material handling.
Other:		
Safety Cones/Barricades	X	As needed, to control/alert traffic and exclude unauthorized personnel.
High-Visibility Vest/Clothing	X	As necessary for traffic safety.
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel.
Competent Person	Rich Sprinzl, Leidos	
Subcontractor	John Hancock and Associates	

WORK ACTIVITY: CONSTRUCTION SITE INSPECTIONS / NON-INTRUSIVE PHYSICAL SURVEYS (e.g., UTILITY CLEARANCES, SITE RECONNAISSANCE WELL SURVEY)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilization to site and around site.	Vehicle accident	Compliance with Leidos Corporate EH&S Procedure 32, *Vehicle Operations* (valid driver's license, seat belt use, routine vehicle inspections, and no cell phone use while driving).
Inspection of construction site	General hazards	Employees shall be alert to their surroundings and take suitable precautions if unexpected conditions are encountered. Inspect the immediate and surrounding work area for potential hazards and take prudent corrective actions or stop work, as needed. Review any applicable hazard analysis or safety permits for the work being inspected and adhere to requirements.
	Slips, trips, and falls	Keep walking surfaces free of hazards such as slippery surfaces, holes, and trip hazards. Maintain good housekeeping. Keep eyes on path and/or task and keep a hand on handrail when ascending/descending stairs. Wear footwear suitable for setting. Flat-soled shoes with separate heel and a non-slip sole or sturdy boots with lugged sole in construction or field settings. Protective-toe footwear if required by site. Wear ice cleats when there is potential for ice or frozen snow. Maintain a safe distance from trenches, holes, pits, etc. Avoid areas that have debris or where footing may shift. Avoid unstable slopes or steep slopes. Walk around if possible.
	Pinch hazards	Keep all body parts clear of all articulated or moving parts. Guards shall be maintained for all machinery representing a pinch hazard. Inspection of equipment with articulating or moving parts shall be performed only after control keys have been put under control by competent mechanics/operators only.
	Noise	Hearing protection required within 25 feet of operating gasoline-powered generators, or if posted or if exposed to noise greater than or equal to 82 dBA (where voice has to be raised to be heard).
	Fire or other emergencies	Identify location of fire extinguishers onsite and posted evacuation routes. Follow Site Health and Safety Plan Emergency and Evacuation procedures.

WORK ACTIVITY: CONSTRUCTION SITE INSPECTIONS / NON-INTRUSIVE PHYSICAL SURVEYS (e.g., UTILITY CLEARANCES, SITE RECONNAISSANCE WELL SURVEY)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Inspection of construction site (continued)	Biological hazards	Inspect area for hazardous plants and organism conditions. Avoid such areas if possible. Wear clothing that covers potentially affected body parts. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots, or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip-lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes.

WORK ACTIVITY: CONSTRUCTION SITE INSPECTIONS / NON-INTRUSIVE PHYSICAL SURVEYS (e.g., UTILITY CLEARANCES, SITE RECONNAISSANCE WELL SURVEY)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Inspection of construction site (continued)	Chemical hazards	If working near intrusive activities, monitor total dust/particulate levels with a direct reading total dust/particulate monitor. Stop work and leave the area if established total dust/particulate action levels are exceeded. **Total dust/particulate action levels are set at 0.34 mg/m^3 in the Firing Range 3 and 4 Target Area and 0.21 mg/m^3 in the Firing Range 3 Shooting Area (based on lead concentrations).** Disposable booties will be worn (or decontaminate boots) within disturbed contaminated areas.
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning inspection. Suspend field work if thunder is heard (lightning hazard) or tornado warning issued. Do not work in areas subject to flash flooding (arroyo, ditch, etc.) if rain is forecast in immediate area or upstream of site.
	Electrical/energized sources	Avoid exposed energized components. No contact with exposed wiring or circuits. Wear appropriate PPE (hard hat as required, safety glasses, gloves, work boots, or shoes). Refer to Glenn Safety Manual Chapter 8, "Electrical Systems Safety," Chapter 9, "Lockout/Tagout," and Leidos Corporate EHS Procedure 26.0, *Electrical Safety*.
	Heavy equipment	Maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times.
	Drowning	If water > 2 feet at bank, USCG minimum Class II PFD is required. Do not enter water if fast flowing or approximately knee deep. Buddy system to be utilized.
	Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Lifting/musculoskeletal injuries	Compliance with Corporate EH&S Procedure 50.0, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning. Take occasional breaks from repetitive tasks to change body position and stretch. Keep joints in "neutral" position to minimize stress (i.e., wrists straight, not tilted); never lift and twist but rather move feet to turn and lift and place containers.

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Overboots/disposable booties if walking through disturbed contaminated areas or stockpiles.
Hard Hat	X	If within 25 ft of operating heavy equipment or if overhead hazards are present.
Safety Glasses With Side Shields	X	If sampling or performing intrusive work (e.g., disturbing soil).
Fire-Resistant Clothing		
Face Shields		
Goggles	X	If splash potential, pouring corrosives or free product recovery.
Lifeline/Body Harness		
Hearing Protection	X	As required, if posted or if exposed to noise greater than or equal to 82 dBA.

Half- or Full-Face Air-Purifying Respirator		If established total dust/particulate action levels, as measured with a direct reading total dust/particulate monitor, are exceeded. **Total dust/particulate action levels are set at 0.34 mg/m^3 in the Firing Range 3 and 4 Target Area and 0.21 mg/m^3 in the Firing Range 3 Shooting Area (based on lead concentrations).**
		
		Each employee who will use respiratory protection will follow the requirements in their employer's respiratory protection program and must comply with the following requirements:
		
		• The worker will be assigned a respirator; the respirator may not be used by another worker.
		• The worker must be medically certified as being capable of wearing a respirator.
		• The worker will only use a well-maintained, NIOSH-approved respirator for which he/she has passed a qualitative fit test (manufacturer, model, and size) within the past 12 months.
		• The worker must have no facial hair that touches the sealing surface of his/her respirator.
		• The worker will verify that the cartridges that will be used on his/her respirator are P100 cartridges.
		• Respirator cartridges will be disposed at the end of each work shift (not to exceed eight [8] hours of continuous or intermittent use). Cartridges may be disposed more frequently if one of more of the following conditions is noted:
		  o A cartridge has become damaged.
		  o A cartridge has become clogged or blocked, causing additional resistance to breathing.
		• The worker will inspect his/her respirator for damage prior to use and perform a positive and negative pressure test upon donning his/her respirator.

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
		The worker will inspect his/her respirator for damage after each use and will clean and disinfect the respirator. After each use, the respirator will be cleaned using a disinfecting/ cleansing wipe. At the end of each work day, the respirator will be disinfected by disassembling the respirator (including removing the cartridges) and washing the facepiece and associated parts in warm, sanitizing solution. The respirator will be rinsed with clean, warm water and allowed to air-dry in a clean area. The respirator will be reassembled and stored in a clean, dry plastic bag (a "zipper"-type or equivalent bag) or airtight container. The respirator must be stored in an area that is out of direct sunlight.
Supplied Air Respirator – SCBA		
Personal Floatation Device	X	If within 6 feet of unguarded water 2 feet or more in depth, or on a boat.
Gloves	X	Nitrile, PVC, or similar for potentially contaminated material. Heavy-duty work gloves for material handling.
Other	X	Use total dust/particulate monitor during blast wall soil removal. Wear respirator if breathing zone reading for total dust is greater than 0.34 mg/m^3 (voluntary if below action level). Wear Tyvek coveralls/booties during waste characterization sampling.
Safety Cones/Barricades	X	If needed to control/alert traffic and exclude unauthorized personnel. All traffic cones must be at least 36 inches tall.
High-Visibility Vest/Clothing	X	As necessary for traffic safety.
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel.
		`
Competent Person		Rich Sprinzl, Leidos
Subcontractor		TTL Associates Inc.

WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilize to work site	Traffic accident	Compliance with Leidos Corporate EH&S Procedure 32, *Vehicle Operations* (valid driver's license, seat belt use, routine vehicle inspections, and no cell phone use while driving).
Environmental sampling or monitoring	Being struck by vehicles	Traffic control by traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High-visibility safety vests in traffic areas. Flashing rotating beacon in high-traffic parking areas or brief roadwork. *Manual on Uniform Traffic Control Devices* (MUTCD)-compliant traffic control plan for work in road/street, roadside parking strip, sidewalk, or shoulder. Artificial lighting provided for work after twilight.
	General hazards, slips, and trips	Avoid areas that have debris or where footing may shift. Wear footwear suitable for setting. Flat-soled shoes with separate heel and a non-slip sole or sturdy boots with lugged sole in construction or field settings. Wear ice cleats when there is potential for ice or frozen snow. Protective-toe footwear if required by site. Avoid unstable slopes or steep slopes. Walk around if possible. Inspect the immediate and surrounding work area for potential hazards and take prudent corrective actions or stop work, as needed. The use of safety vests or shirts, as well as hard hats, will be employed when working in any construction zone in addition to any other required PPE.
	Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Electric shock	Portable electrical tools and all portable electrical equipment that poses a shock hazard must be connected through ground fault circuit interrupters (GFCIs). Reference Glenn Safety Manual Chapter 8, "Electrical Systems Safety," and Chapter 9, "Lockout/Tagout." Refer to Leidos Corporate EH&S Procedure 26.0, *Electrical Safety*.
	Battery fire/explosion	Use only batteries that are not installed in vehicles and are not being charged during use for powering equipment. If no other battery is available, use vehicle battery by making the final connection away from the battery.
	Fire or other emergency	Identify location of fire extinguishers onsite and posted evaluation routes. Follow Emergency and Evacuation procedures set forth by Site Safety and Health Plan. Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all fuel use areas. Allow gasoline-powered equipment to cool prior to fueling.

WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Environmental sampling or monitoring (continued)	Chemical exposure	Monitor total dust/particulates during soil sampling activities with direct reading total dust/particulate monitor. **Total dust/particulate action levels are set at 0.34 mg/m^3 in the Firing Range 3 and 4 Target Area and 0.21 mg/m^3 in the Firing Range 3 Shooting Area (based on lead concentrations).** Use water spray to reduce dust/particulate levels if needed and where practical. Don half- or full-face respirators equipped with P100 cartridges if established total dust/particulate action levels, as measured with a direct reading total dust/particulate monitor, are exceeded. Disposable booties will be worn (or decontaminate boots) within disturbed contaminated areas. Current medical clearance and 40-hour HAZWOPER for hazardous waste work. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. A 15-minute eyewash must be within 20 feet if pouring corrosives. Eyewash bottle must be within 10 feet if adding water samples to pre-preserved containers.
	Contact with buried structures or utilities	NASA digging permit obtained. Pin flags will not be set deeper than 6 inches. Wooden or plastic stakes will be used if greater depth required. If penetrating more than 1 foot during sampling, NASA will clear area for underground utilities before work begins. Follow Leidos Corporate EH&S Procedure 33.0, *Subsurface Assess and Hazard Avoidance*.
	Noise	Hearing protection required within 25 feet of operating gasoline-powered generators, or if posted or if exposed to noise greater than or equal to 82 dBA (where voice has to be raised to be heard).
	Falls	Compliance with Leidos Corporate EH&S Procedure 27, *Fall Protection*. Working at heights above 4 feet (unless on a construction project) requires fall protection.

WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Environmental sampling or monitoring (continued)	Biological hazards	Inspect area for hazardous plants and organism conditions. Avoid such areas if possible. Wear clothing that covers potentially affected body parts. Seal pants legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample table. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots, or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.
	Severe weather	Locate nearest severe weather shelter/strong structure before beginning field work. Suspend field work if thunder is heard (lightning hazard) or tornado warning issued. Do not work in areas subject to flash flooding (arroyo, ditch, etc.) if rain is forecast in immediate area or upstream of site.
	Pinch points	Keep hands from between components. Keep fingers out of all openings.

WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Environmental sampling or monitoring (continued)	Drowning	If water > 2 feet at bank, USCG minimum Class II PFD is required. Do not enter water if fast flowing or approximately knee deep. Buddy system to be utilized.
	Spill control	Basic spill kit suitable for handling small spills of decontamination fluids, hydraulic fluid, or fuels and containing absorbent pads, tubes, and nitrile or similar gloves.
X-Ray fluorescence (XRF) lead in soil	General hazards using XRF	Operation in accordance with all manufacturers' specifications. Experienced operators only. All personnel using the XRF analyzer will be required to take the online equipment-specific training for the XRF model, which is provided by the manufacturer. Verify that all XRF equipment is inspected by trained operators prior to use.
	Exposure to radiation	All personnel using XRF equipment with a sealed radioactive source (cobalt-57 or cadmium-109) will be required to take the manufacturer's online radiation safety course. This documentation will be recorded and maintained by the SSHO to ensure that only trained personnel use the XRF equipment. In addition, all personnel using the XRF equipment must participate in a medical monitoring program. Check areas behind walls/below table to be surveyed to make sure they are clear of occupants. Keep track of XRF equipment at all times, keep locked when not in use, and never visible in employee vehicle. The XRF unit is calibrated by the manufacturer in accordance with industry guidelines and is registered in the State of Ohio as a radioactive source. Regularly scheduled wipe tests of the unit are performed in accordance with licensing requirements to ensure the integrity of the device's housing.
	Chemical exposure	Wear nitrile gloves and avoid contact with dust. Minimize handling of soil samples, particularly dry or dried samples. Wash hands before eating or drinking. Hazard communication labels required on all chemical containers. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. Current 40-hour HAZWOPER and medical clearance for hazardous waste work.
	Burns	Use oven mitts while transferring hot tray of dried samples from toaster oven to XRF testing table. Allow samples (and foil cups if used) to cool before handling.
Containing and managing soil, decon fluids, purge water, and other IDW	General safety hazards (lifting equipment, manual lifting, slips, etc.)	Equipment will be operated per subcontractor's standard procedures or per manufacturer's directions. Unnecessary personnel will stay well clear of operating equipment.
	Temperature extremes	Temperature stress controls as in "Environmental Sampling or Monitoring" step above.
	Chemical exposure	Chemical exposure controls as in "Environmental Sampling or Monitoring" step above.
	Lifting (musculoskeletal injury)	Lifting (musculoskeletal injuries) controls as in "Environmental Sampling or Monitoring" step above.

WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
	Drum handling	Evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help or mechanical aids will be obtained by workers onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Pinch points	Pinch point controls as in "Environmental Sampling or Monitoring" step above.
	Exposure to chemicals	Nitrile gloves for chemical/contaminant contact. Wash hands before eating or drinking. Hazard communication labels on all chemical containers. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. Current 40-hour HAZWOPER and medical clearance for hazardous waste work.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure that storage area provides adequate protection against physical damage or disturbance. Work in conjunction with NASA WM personnel.
	Spill control	Spill controls as in "Environmental Sampling or Monitoring" step above.
Equipment decontamination by washing and water rinse	Lifting (musculoskeletal injury)	Lifting (musculoskeletal injuries) controls as in "Environmental Sampling or Monitoring" step above.
	Temperature stress	Temperature stress controls as in "Environmental Sampling or Monitoring" step above.
	Electric shock	Electric shock controls as in "Environmental Sampling or Monitoring" step above.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all fuel/flammable liquid use areas.
	Chemical exposure	Current 40-hour HAZWOPER and medical clearance for hazardous waste work. Nitrile gloves for chemical/contaminant contact. Wash hands before eating or drinking. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. A 5-minute eyewash must be within 20 feet if pouring corrosives. Eyewash bottle must be within 10 feet if adding water samples to pre-preserved containers.
	IDW control	IDW controls as in "Containing and managing soil cuttings, decon fluids, purge water and other IDW" step above.
Shipping/packing environmental samples	Hazardous material shipping/ transportation regulatory violation or spill	Notify Leidos H&S prior to shipment. Ensure United States Department of Transportation/International Air Transport Association compliance if shipping chemicals or other hazardous materials or samples. Hazardous material shippers must be trained and certified. Compliance with Leidos Field Technical Procedure (FTP)-651.

WORK ACTIVITY: ENVIRONMENTAL SAMPLING AND MONITORING (e.g., SOIL SAMPLING, GROUNDWATER SAMPLING, MISCELLANEOUS SAMPLING, FIELD OBSERVATIONS)		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
	Lifting	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight > 50 pounds or has to be moved by maneuvering through awkward positioning

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER /AIR ROTARY DRILL RIG		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Protective toe footwear
Hard Hat	X	Within 25 feet of rig or other overhead hazards.
Safety Glasses With Side Shields	X	
Fire-Resistant Clothing		
Face Shields		If air excavating, grinding, pavement saw cutting, welding, or if splash potential exists.
Goggles		If splash potential exists.
Lifeline/Body Harness		
Hearing Protection	X	When within 25 feet of hollow-stem auger rig, or air rotary rig.
Air-Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		If hot work performed.
Welding/Pipe Clothing		If hot work performed.
Welding Mask/Goggles		If hot work performed.
Personal Floatation Device		If within 6 feet of unguarded water 3 feet or more in depth.
Gloves	X	Nitrile or PVC for potentially contaminated material. Heavy-duty work gloves for material handling.
Other	X	Use four-way gas meter (calibration checked daily and documented during bedrock drilling - deep well installation). Stop work if breathing zone readings exceed 5 parts per million (ppm) [H_2S or CO]; or 10 percent lower explosion limit (LEL); or <19.5 or > 23.5 percent oxygen for more than one minute.
Fall restraint/arrest PPE	X	If working from elevated surface $\geq$ 6 feet above next lower level.
Safety Cones/Barricades	X	As needed, to control/alert traffic and exclude unauthorized personnel.
High-Visibility Vest/Clothing		If near active traffic areas.
Knee Pads		
Caution/Danger Tape	X	As needed, to exclude unauthorized personnel.
Competent Person	Jasmine Stefansky, Alternates: Charles Spurr - Leidos	
Subcontractor	TTL Associates Inc.	

WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER / AIR ROTARY DRILL RIG		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilize to work site	Traffic accident	Compliance with Leidos Corporate EH&S Procedure 32, *Vehicle Operations* (valid driver's license, seat belt use, routine vehicle inspections, and no cell phone use while driving).
Oversight of rig set-up	Being struck by moving equipment	Leidos personnel will stay out of immediate work area. Rig equipped with functional back-up alarm.
	Contact with overhead structures or utilities	FM shall survey location and ensure absence of obstructions and overhead utilities prior to rig set-up. Rig shall not be allowed to come within 10 feet of overhead power lines. Ensure that at the time the mast is towered up, drill crew members should not be engaged in any other activity; the task at that time is to assist in towering up in the safest manner possible. Ensure that at the time the mast is towered down, other drill crew members should not be engaged in any other activity; the task at that time is to assist in towering down in the safest manner possible. The mast of the drill rig shall be towered down before moving to the next location.
	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or if tornado warning is issued until 30 minutes after last lightning or thunder.
	Biological hazards	Inspect area for hazardous plants and organisms. Wear clothing that covers potentially affected body parts. Seal pant legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample table. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the

WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER / AIR ROTARY DRILL RIG		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of rig set-up (continued)		tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip-lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.
	Lifting (musculoskeletal injuries) hazards	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.

WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER / AIR ROTARY DRILL RIG		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of boring and addition/ manipulation of drill string	Rotating and/or moving equipment	Leidos employees will stay out of immediate area of drill rig. Only experienced operators. Rigs shall be operated per subcontractor's standard procedures or per manufacturer's directions; all hoses and cables shall be visually inspected daily. Rigs shall have, at a minimum, two functional kill switches or "dead-man" control, which will be checked daily. At no time should anyone work in proximity to rotating augers.
	Kickback	Leidos employees will stay out of immediate area of operation.
	Falling equipment	Leidos employees will stay out of immediate area of operation. No workers under suspended loads. Exclusion zone around drill rig.
	Pinch/laceration	Leidos employees will stay out of immediate area of mobile drill rig. Keep hands from between drill string components. Keep fingers out of all openings. Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect all hand or power tools prior to use and remove all damaged equipment from site. Select only the best tool for the job.
	Pressurized lines	Leidos employees will stay out of the immediate area of operation. Hoses and connections should be inspected daily and whip checks maintained as appropriate.
	Subsurface utilities (electric shock, fire, or damage to utilities)	Obtain NASA dig permit; utilities located and cleared. FM shall ensure that each boring location has been cleared to preclude contact with buried utilities through compliance with Leidos Corporate EH&S Procedure 33, *Subsurface Asset/Hazard Avoidance*.
	Noise	Hearing protection when within 25 feet unless equipment-specific monitoring indicates that noise levels are less than 82 decibels. Hearing protection required when operating drill rig hammer.
	Drowning	If water > 2 feet at bank, USCG minimum Class II PFD is required. Do not enter water if fast flowing or approximately knee deep. Buddy system to be utilized.
	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or if tornado warning is issued.
	Biological hazards	Inspect area for hazardous plants and organisms. Wear clothing that covers potentially affected body parts. Seal pant legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use

WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER / AIR ROTARY DRILL RIG		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of boring and addition/ manipulation of drill string (continued)		insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample table. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip-lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.

WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER / AIR ROTARY DRILL RIG		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of boring and addition/ manipulation of drill string (continued)	Lifting (musculoskeletal injuries) hazards	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in work areas. Ensure any onsite fueling happens when equipment is cool and off, preferably prior to work activities occurring for the day. DOT-approved portable fuel containers will not exceed 25 gallons. Combustible gas action level is 10% of LEL.
	Chemical exposure	Breathing zone monitoring with 4-way gas meter (calibration checked daily and documented) during bedrock drilling (deep well installation). Stop work if breathing zone readings exceed 5 ppm (H_2S or CO); or 10% LEL; or <19.5 or > 23.5% oxygen for more than one minute. Evaluate relocating monitoring well. Wet methods (water spray) shall be utilized to prevent dust during drilling. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Nitrile gloves and safety glasses for chemical/contaminant contact. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.
Oversight of well construction or abandonment	Slips/trips/falls	Observe area ahead for hazards before proceeding. Ensure subcontractor maintains good housekeeping in work area. Avoid trip hazards and wet surfaces. Do not walk backwards.
	Silica/particulate exposure	Restrict access to the work area to only personnel involved in the mixing operations. All other personnel shall stay at least 5 feet away from the operations. Ensure workers tip bags of cement/grout contents gently – never dump. Bags should be emptied with the open end facing away. Use water sprays to control dust emissions. Bag crushing creates a lot of dust. Workers should gently roll up empty bags. In order to dispose of empty bags without creating dust, drop them into a large plastic sack supported and held open by a metal frame. When it is full,

WORK ACTIVITY: OVERSIGHT OF INSTALLATION AND ABANDONMENT OF GROUNDWATER MONITORING WELLS USING HOLLOW-STEM AUGER / AIR ROTARY DRILL RIG		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
		seal the sack and dispose of it in a suitable waste container. Do not let the waste sack overflow. Clean work area on a regular basis. Deal with spills immediately. Do not clean up with a dry methods - use vacuum or wet cleaning methods.
Containing and managing soil cuttings, decon fluids, and other IDW	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Pinch/laceration	Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect all hand or power tools prior to use and remove all damaged equipment from site. Select the best tool for the job. Keep hands from between IDW containers (e.g., drums). Keep fingers out of all openings.
	Electric shock	Comply with Leidos Corporate EH&S Procedure 26, *Electrical Safety*. Inspect all electrical cords and tools prior to use and remove all damaged equipment from site. Connect all electrical cords through GFCI. Portable electrical tools and all portable electrical equipment shall be connected through ground-fault circuit interrupters.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all work areas.
	Chemical exposure	Handle carefully to avoid dust generation. Current medical clearance for hazardous waste work. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure storage area provides adequate protection against physical damage or disturbance.

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat		If within 25 feet of an operating rig or other overhead hazards.
Safety Glasses With Side Shields	X	
Fire-Resistant Clothing		
Face Shields		If air excavating, grinding, pavement saw cutting, welding, or splash potential exists.
Goggles		If splash potential exists.
Lifeline/Body Harness		
Hearing Protection	X	When within 25 feet of DPT/hollow-stem auger/air rotary rig during hammer operation.
Air-Purifying Respirator		
Supplied Air Respirator – SCBA		
Personal Floatation Device		If within 6 feet of unguarded water 3 feet or more in depth.
Gloves	X	Nitrile or PVC for potentially contaminated material. Heavy-duty work gloves for material handling. Leather for hot work.
Other		
Fall restraint/arrest PPE		If working from elevated surface ≥ 6 feet above next lower level.
Safety Cones/Barricades	X	As needed, to control/alert traffic and exclude unauthorized personnel.
High-Visibility Vest/clothing		If near active traffic areas.
Knee Pads		
Caution/Danger Tape	X	As needed, to exclude unauthorized personnel.

Competent Person	Jasmine Stefansky, Charles Spurr, Leidos
Subcontractor	TTL Associates Inc.

WORK ACTIVITY: WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilize to work site	Traffic accident	Compliance with Leidos Corporate EH&S Procedure 32, *Vehicle Operations* (valid driver's license, seat belt use, routine vehicle inspections, and no cell phone use while driving).
Well development and purging equipment set-up	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or tornado warning issued.
	Biological hazards	Inspect area for hazardous plants and organisms. Wear clothing that covers potentially affected body parts. Seal pant legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample area. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip-lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

WORK ACTIVITY: WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Well development and purging equipment set-up (continued)		(7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.
	Musculoskeletal injuries (fatigue, strains, and lifting)	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning. Avoid jerking movements if operating bailer or surge block, and take breaks as appropriate.
	Pinch	Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect all hand or power tools prior to use and remove all damaged equipment from site. Select only the best tool for the job. Keep hands from between IDW containers (e.g., drums). Keep fingers out of all openings and fittings. Keep hands from between monitoring well lids. Use correct tools to open monitoring well lids. Keep head away from well cap when removing as cap may release under pressure. Do not use fixed-open blade knives to cut rope or tubing. Do not over-tighten sample containers.
	Electric shock	Comply with Leidos Corporate EH&S Procedure 26, *Electrical Safety*. Inspect all electrical cords and tools prior to use and remove all damaged equipment from site. Portable electrical tools and all portable electrical equipment shall be connected through GFCIs.
	Chemical exposure	Current medical clearance for hazardous waste work. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Safety glasses and nitrile gloves for chemical/contaminant contact. Disposable booties will be worn (or decontaminate boots) within disturbed contaminated areas. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.

WORK ACTIVITY: WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Groundwater development, purging, and sampling	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or tornado warning issued.
	Biological hazards	Inspect area for hazardous plants and organisms. Wear clothing that covers potentially affected body parts. Seal pant legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample area. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip-lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and

WORK ACTIVITY: WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Groundwater development, purging, and sampling (continued)		symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.
	Pinch	Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect all hand or power tools prior to use and remove all damaged equipment from site. Select only the best tool for the job. Keep hands from between IDW containers (e.g., drums). Keep fingers out of all openings and fittings. Keep hands from between monitoring well lids. Use correct tools to open monitoring well lids. Keep head away from well cap when removing as cap may release under pressure. Do not use fixed-open blade knives to cut rope or tubing. Do not over-tighten sample containers.
	Electric shock	Comply with Leidos Corporate EH&S Procedure 26, *Electrical Safety*. Inspect all electrical cords and tools prior to use and remove all damaged equipment from site. Portable electrical tools and all portable electrical equipment shall be connected through GFCIs.
	Musculoskeletal injuries (fatigue, strains, and lifting)	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning. Avoid jerking movements if operating bailer or surge block, and take breaks as appropriate.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all work areas.
	Chemical exposure	Current medical clearance for hazardous waste work. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Disposable booties will be worn (or decontaminate boots) within disturbed contaminated areas. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.

WORK ACTIVITY: WELL DEVELOPMENT, WELL PURGING, AND GROUNDWATER SAMPLING		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Containing and managing purge, development water, and other IDW	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Electric shock	Comply with Leidos Corporate EH&S Procedure 26, *Electrical Safety*. Inspect all electrical cords and tools prior to use and remove all damaged equipment from site. Portable electrical tools and all portable electrical equipment shall be connected through ground-fault circuit interrupters.
	Chemical exposure	Current medical clearance for hazardous waste work. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.
	Pinch	Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect all hand or power tools prior to use and remove all damaged equipment from site. Select only the best tool for the job. Keep hands from between IDW containers (e.g., drums). Keep fingers out of all openings.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure storage area provides adequate protection against physical damage or disturbance.

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Overboots/disposable booties if walking through disturbed excavation areas or stockpiles.
Hard Hat	X	Within 25 feet of excavation equipment or if overhead hazards are present.
Safety Glasses With Side Shields	X	If sampling or performing intrusive work (e.g., disturbing soil).
Fire-Resistant Clothing		
Face Shields		
Goggles		
Lifeline/Body Harness		
Hearing Protection	X	As required, if posted or if exposed to noise greater than or equal to 82 dBA.
Full- or Half-Face Air-Purifying Respirator Equipped with P100 Cartridges		If established total dust/particulate action levels, as measured with a direct reading total dust/particulate monitor, are exceeded. **Total dust/particulate action levels will be set as 0.34 mg/ m^3 in firing range 3 & 4 target areas and 0.21 mg/m^3 in firing range 3 shooting area.** Arrowhead will evaluate method of excavation and use of respirators. If greater than 0.34 mg/m^3 during removal of blast wall, a respirator will be worn by the Leidos sampler and Arrowhead operator (if equipment not enclosed cab equipped with HEPA air filter). Each employee who will use respiratory protection will follow the requirements in their employer's respiratory protection program and must comply with the following requirements: • The worker will be assigned a respirator; the respirator may not be used by another worker. • The worker must be medically certified as being capable of wearing a respirator. • The worker will only use a well-maintained, NIOSH-approved respirator for which he/she has passed a qualitative fit test (manufacturer, model, and size) within the past 12 months. • The worker must have no facial hair that touches the sealing surface of his/her respirator. • The worker will verify that the cartridges that will be used on his/her respirator are P100 cartridges. • Respirator cartridges will be disposed at the end of each work shift (not to exceed eight [8] hours of continuous or intermittent use). Cartridges may be disposed more frequently if one of more of the following conditions is noted: o A cartridge has become damaged. o A cartridge has become clogged or blocked, causing additional resistance to breathing.

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
		• The worker will inspect his/her respirator for damage prior to use and perform a positive and negative pressure test upon donning his/her respirator. The worker will inspect his/her respirator for damage after each use and will clean and disinfect the respirator. After each use, the respirator will be cleaned using a disinfecting/cleansing wipe. At the end of each work day, the respirator will be disinfected by disassembling the respirator (including removing the cartridges) and washing the facepiece and associated parts in warm, sanitizing solution. The respirator will be rinsed with clean, warm water and allowed to air-dry in a clean area. The respirator will be reassembled and stored in a clean, dry plastic bag (a "zipper"-type or equivalent bag) or airtight container. The respirator must be stored in an area that is out of direct sunlight.
Supplied Air Respirator – SCBA		
Personal Floatation Device		
Gloves	X	Fit-for-use gloves (nitrile, cut-resistant, or similar for potentially contaminated material; heavy-duty work gloves for material handling).
Other	X	Dust monitoring (visual and real-time readings). Mitigate dust/particulate readings greater than 0.34 mg/ m^3 in the Firing Range 3 and 4 target areas and 0.21 mg/m^3 in the Firing Range 3 shooting area (water misting/wetting). Tyvek/booties during berm trench sampling.
Safety Cones/Barricades	X	If needed to control/alert traffic and exclude unauthorized personnel. All traffic cones must be at least 36 inches tall.
High-Visibility Vest/Clothing	X	As necessary for traffic safety.
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel.
Competent Person	Rich Sprinzl, Leidos	
Subcontractor	(Arrowhead is lead on excavation)	

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilize to work site	Traffic accident to/from site	Compliance with Corporate EH&S Procedure 32.0, *Vehicle Operations* (valid driver's license, seat belt use, routine vehicle inspections, and no cell phone use while driving). Refer to Glenn Safety Manual Chapter 19 "Vehicle and Pedestrian Safety."
	Unauthorized personnel	Posted exclusion zone around work area.
Oversight of vegetation clearing (*to be performed by Arrowhead*)	Heavy equipment operation	Heavy equipment operated in accordance with 29 *CFR* 1926, Subpart O. Only experienced operators. Personnel are to remain in the field of vision of the operator and remain clear of moving parts. Never walk directly behind or to the side of heavy equipment without the operator's knowledge. Be knowledgeable of/mark "swing zones" for rotating equipment (e.g., backhoes).
	Incorrectly functioning equipment/fluid release from equipment	Verify that a visual inspection of all equipment has been performed prior to its initial use. Discuss the need for plastic sheeting or other methods to contain drips (e.g., hydraulic oil, motor oil) to determine if measures are needed to prevent releases to the ground. Verify that all hydraulic lines and fittings on equipment have been inspected prior to each daily use.
	Rotating and/or moving equipment	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times. The exclusion zone will be delineated by at least 4-foot-high, orange, HDPE construction fencing and postings.
	Unguarded equipment	Only experienced operators. Guards kept in place.
	Pinch and crush	Inspect equipment for articulated or moving/rotating pinch points prior to use. Use two-person lift for heavy/unwieldy objects. Keep hands and feet from between equipment or surfaces. Keep hands and fingers from between articulated parts. Protective toe footwear required for all tasks. Maintain situational awareness/avoid distractions.
	Broken, damaged, or unsuitable hand tools	Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect tools prior to use for damage or defects; remove damaged tools from use. Use tools only for their intended purpose (e.g., no "cheater bars," use of pliers in place of wrench). Hand or lower tools from person to person or one working level to another; do not throw. Always cut, hammer, screw, or drill away from the body. Use scissors and self-retracting utility blades where appropriate. Wear cut-resistant gloves.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of vegetation clearing (continued)	Musculoskeletal injuries from twisting or repetitive motion/overexertion	Use proper form when manipulating hand tools; rotate from the hips and not the back. Exercise patience and smooth application of force; avoid jerking and straining. Avoid working overhead for prolonged periods. Do not attempt to yank or force unwieldy vegetation or roots. Take breaks or alternate personnel if needed.
	Eye injury (from vegetation strike)	Safety glasses with side shields required when clearing. Wear safety glasses with side shields when working in or near eye level vegetation or where others are clearing. Maintain distance from other personnel and avoid bent limbs that could spring back; remain cognizant of surrounding personnel before bending or releasing branches. Do not throw downed branches.
	Skin abrasions (from sharp vegetation)	Wear Level D PPE, including long sleeves and work gloves (e.g., leather or mechanics). Remain cognizant of surrounding vegetation types; do not try to force oneself through bushes or pick up a bundle of vegetation that may contain broken or sharp tips or thorns. Wear work gloves and grip the branch with fingers in an open location between thorns.
	Tool strike	Position personnel with twice the swing radius of any tool in hand. Maintain distance from other personnel and continue checking for proper distance. Do not enter swing radius of anyone using a machete. Use tools only for their intended purpose; do not swing a saw like a machete or use a knife to cut tree limbs.
Oversight of asbestos waste removal (*removal to be performed only by licensed Arrowhead personnel at Firing Range 5/Construction Debris Pile*)	General hazards	Employees shall be alert to their surroundings and take suitable precautions if unexpected conditions are encountered. Inspect the immediate and surrounding work area for potential hazards and take prudent corrective actions or stop work, as needed. Review any applicable hazard analysis or safety permits for the work being inspected and adhere to requirements.
	Asbestos exposure	Only Ohio Department of Health Certified Asbestos Hazard Evaluation Specialist shall perform asbestos removal, or air monitoring. Board Certified Industrial Hygienist (CIH) may perform asbestos air monitoring. Inspectors shall be in the Medical surveillance program if sampling more than 30 days per year. All Asbestos inspections must follow OSHA 1926.1101 and AHERA training protocols for sampling. Respiratory Protection where potential for airborne exposure to asbestos fibers during sampling. Utilize controls such as wet methods to prevent airborne fiber generation. Leidos will keep away and upwind of removal area. Wash hands prior to hand to mouth contact.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of excavation, loading, and restoration	Being struck by vehicles	Traffic control by traffic cones, barricade tape, and/or sawhorse barricades (more substantial barriers required as traffic hazard increases). Vehicle(s) placed between workers and oncoming traffic. High-visibility safety vests worn in traffic areas. Flashing rotating beacon in high-traffic parking areas or brief roadwork.
	Heavy equipment operation	Heavy equipment operated in accordance with 29 *CFR* 1926, Subpart O. Only experienced operators. No workers beneath lifted loads. Personnel are to remain in the field of vision of the operator and remain clear of moving parts. Never walk directly behind or to the side of heavy equipment without the operator's knowledge. Be knowledgeable of/mark "swing zones" for rotating equipment (e.g., backhoes).
	Incorrectly functioning equipment/fluid release from equipment	Verify that a visual inspection of all equipment has been performed prior to its initial use. Discuss the need for plastic sheeting or other methods to contain drips (e.g., hydraulic oil, motor oil) to determine if measures are needed to prevent releases to the ground. Verify that all hydraulic lines and fittings on equipment have been inspected prior to each daily use.
	Rotating and/or moving equipment	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times. The exclusion zone will be delineated by at least 4-foot-high, orange, HDPE construction fencing and postings.
	Unguarded equipment	Only experienced operators. Guards kept in place.
	Excavation collapse	Do not enter any excavation or trench that is deeper than 4 feet from ground surface. Keep equipment away from the edge of a trench or excavation to prevent collapse of the wall of the excavation. Do not stand or walk within 6 feet of the edge of any excavation, unless the Excavation Competent Person has established a different 'safe' distance for the excavation. The Excavation Competent Person will be onsite at all times during excavation. Daily inspection of excavation or after any rain/frost. Do not enter excavation if accumulated water. Work activities will be in compliance with Leidos Corporate EH&S Procedure 35.0, *Excavation Safety* and Glenn Safety Manual Chapter 35, "Digging, Trenching, and Excavating."
	Falling equipment	No workers under suspended loads. Exclusion zone around heavy equipment.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of excavation, loading, and restoration (continued)	Unauthorized person in work zone	If structures or public access areas fall within radius of raised boom, establish a work schedule to minimize hazard to public, establish an exclusion zone boundary that unauthorized personnel cannot cross, and position heavy equipment so as to minimize inclusion of public access areas within work zone.
	Drowning	If water > 2 feet at bank, USCG minimum Class II PFD is required. Do not enter water if fast flowing or approximately knee deep. Buddy system to be utilized.
	General hazards, slips, and trips	Avoid areas that have debris or where footing may shift. Wear footwear suitable for setting. Flat-soled shoes with separate heel and a non-slip sole or sturdy boots with lugged sole in construction or field settings. Protective-toe footwear if required by site. Wear ice cleats when there is potential for ice or frozen snow. Avoid unstable slopes or steep slopes. Walk around if possible. Inspect the immediate and surrounding work area for potential hazards and take prudent corrective actions or stop work, as needed. The use of safety vests or shirts, as well as hard hats, will be employed when working in any construction zone in addition to any other required PPE.
	Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Lifting (musculoskeletal injuries)	Compliance with Leidos Corporate EH&S Procedure 50.0, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning. Refer to GRC Occupational Health Program Manual Chapter 15, "Ergonomics."
	Electrical shock	Portable electrical tools and all portable electrical equipment that poses a shock hazard must be connected through ground fault circuit interrupters. Reference Glenn Safety Manual Chapter 8, "Electrical Systems Safety," and Chapter 9, "Lockout/Tagout."
	Fire or other emergency	Identify location of fire extinguishers onsite and posted evacuation routes. Follow Emergency and Evacuation procedures set forth by Glenn Safety Manual Chapter 27, "Building Emergency Evacuation Plan Program." Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all fuel use areas. Allow gasoline-powered equipment to cool prior to fueling.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of excavation, loading, and restoration (continued)	Chemical exposure	Leidos employees will stay upwind of excavation and trenching operations, and monitor atmospheric conditions (wind speed and direction, humidity). Perform real-time monitoring with a total dust/particulate meter during heavy equipment operations. Stop work if established total dust/particulate action levels, as measured with a direct reading total dust/particulate monitor, are exceeded. **Total dust/particulate action levels are set at 0.34 mg/ m^3 in the Firing Range 3 and 4 target areas and 0.21 mg/m^3 in the Firing Range 3 shooting area.** Arrowhead will take action (e.g., misting/wetting) to suppress if dust/particulate action levels are reached. Half- or full-face respirator equipped with P100 cartridges must be worn by operator (following Arrowhead Respiratory Protection Program) during berm trenching and excavator bucket decontamination unless excavator has enclosed cab and HEPA air filter. Current medical clearance and 40-hour HAZWOPER for hazardous waste work. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Tyvek coveralls/booties will be worn during berm trench sampling; booties within disturbed excavation areas. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. A 15-minute eyewash must be within 20 feet if pouring corrosives. Eyewash bottle must be within 10 feet if adding water samples to pre-preserved containers.
	Contact with overhead utilities or high-voltage equipment	Survey location and ensure absence of obstructions and overhead utilities prior to set-up. Minimum safe distance for equipment operation will be in accordance with Leidos Corporate EH&S Procedure 26.0, *Electrical Safety*, guidance.
	Contact with buried structures or utilities	NASA digging permit obtained and have site utilities located. Ensure that each location has been cleared to preclude contact with buried utilities through compliance with Corporate EH&S Procedure 33.0, *Subsurface Asset and Hazard Avoidance*. Reference Glenn Safety Manual Chapter 35, "Digging, Trenching, and Excavating."
	Noise	Hearing protection required within 25 feet of operating gasoline powered generators or heavy equipment, or if posted or if exposed to noise greater than or equal to 82 dBA. If employees are exposed to sound levels exceeding 85 dBA, TWA 8 hours, the employees will be added to GRC's hearing conservation program, and hearing protection will be worn as required. Follow posted noise signs and wear appropriate noise protection when inspection areas contain noise hazards. Refer to GRC Occupational Health Program Manual Chapter 3, "Hearing Conservation."
	Falls	Compliance with Leidos Corporate EH&S Procedure 27.0, *Fall Protection, Ladders & Scaffolds*. Working at heights above 4 feet (unless on a construction project) requires fall protection. Refer to Glenn Safety Manual Chapter 34, "Fall Protection."

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of excavation, loading, and restoration (continued)	Biological hazards	Inspect area for hazardous plants and organism conditions. Avoid such areas if possible. Wear clothing that covers potentially affected body parts. Seal pants legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample table. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Oversight of excavation, loading, and restoration (continued)	Severe weather	Locate nearest severe weather shelter/strong structure before beginning field work. Suspend field work if thunder is heard (lightning hazard) or tornado warning issued until 30 minutes after last thunder or lighting or warning cancelled. Do not work in areas subject to flash flooding (arroyo, ditch, etc.) if rain is forecast in immediate area or upstream of site.
	Pinch points	Keep hands from between components. Keep fingers out of all openings.
	Spill control	Basic spill kit suitable for handling small spills of decontamination fluids, hydraulic fluid, or fuels and containing absorbent pads, tubes, and nitrile or similar gloves.
Soil Sampling	Rotating and/or moving equipment	Keep clear of all rotating/moving equipment components.
	Falling equipment	No workers under suspended loads. Sampling areas to be staged outside of any potential fall areas.
	Noise	Leidos employees will stay out of immediate area of excavation equipment. Hearing protection when within 25 feet unless equipment-specific monitoring indicates that noise levels are less than 85 decibels.
	Temperature extremes	If temperature is above 80 °F or below 40 °F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or if tornado warning is issued. Do not resume work until 30 minutes after last lighting or thunder or until the warning is cancelled.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Soil sampling (continued)	Biological hazards	Inspect area for hazardous plants and organisms. Wear clothing that covers potentially affected body parts. Seal pant legs against contact with plants and to prevent access by organisms. Pretreat clothing with permethrin. Use insect/tick repellant (> 30% DEET or > 10% picaridin) to supplement. Use insect/tick repellant whenever possible. Pretreat drop cloth for area around sample table. Additional tick control measures include the following: (1) Seal bottoms of pants legs with tape, tuck into boots or use permethrin-treated tick/chigger gaiters; tuck in shirt tails. (2) Inspect for ticks on clothing during work. Inspect for ticks on skin at least once a day and more often if ticks are prevalent. (3) Take hot showers as soon after as possible. (4) If ticks are prevalent, consider wearing white Tyvek pants or other non-porous, slick, light-colored outer garments. (5) If bitten by a tick, use fine-tipped tweezers. When possible, avoid removing ticks with bare hands. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms. After removing the tick, thoroughly disinfect the bite site and wash hands thoroughly with soap and water. Disinfect the tweezers. (6) Save the tick for identification in case illness occurs. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip lock bag with a wet cotton ball. Write the date of the bite on a piece of paper with a pencil and place it in the bag. (7) Medical Follow-Up – Contact WorkCare if an embedded tick is found. In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, WorkCare will set up a clinic visit for further medical evaluation if any signs and symptoms of tick-borne disease develop over the weeks following the tick bite. Use the buddy system and inform co-workers of any potential allergic condition, and instruct the co-worker on actions if an allergic reaction occurs and use of prescribed medication for the affected individual. Review route to hospital if allergic to insect/spider sting/bite. Wear snake chaps if probability of encountering snakes. Review route to hospital if allergic to insect/spider sting/bite. Do not touch face before thoroughly washing hands with detergent if working in poison ivy/oak/sumac.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Soil sampling (continued)	Lifting (musculoskeletal injuries) hazards	Compliance with Leidos Corporate EH&S Procedure 50, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Electric shock	Comply with Leidos Corporate EH&S Procedure 26, *Electrical Safety*. Inspect all electrical cords and tools prior to use and remove all damaged equipment from site. Connect all electrical cords through GFCI. Portable electrical tools and all portable electrical equipment shall be connected through GFCIs.
	Pinch/laceration	Comply with Leidos Corporate EH&S Procedure 38, *Machine Shop, Hand and Power Tool Safety*. Inspect all hand or power tools prior to use and remove all damaged equipment from site. Select the best tool for the job. Keep fingers out of all openings.
	Cuts/contusions	Use dedicated tube cutter or hooked safety blades when opening polymer sample tubes. Wear cut-resistant gloves when opening polymer sample tubes. Keep fingers from between split-spoon halves.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all work areas.
	Chemical exposure	Use real-time total dust/particulate meter during heavy equipment operations. Water spray shall be utilized to prevent airborne dust during DPT or drilling. Stop work if established total dust/particulate action levels, as measured with a direct reading total dust/particulate monitor, are exceeded. **Total dust/particulate action levels are set at 0.34 mg/m^3 in the Firing Range 3 and 4 target areas and 0.21 mg/m^3 in the Firing Range 3 shooting area.** Personnel will don half- or full-face respirators equipped with P100 cartridges (Leidos' Respiratory Protection Program) if established total dust/particulate action levels, as measured with a direct reading total dust/particulate monitor, are exceeded. Disposable booties will be worn (or decontaminate boots) within disturbed contaminated areas. Current medical clearance for hazardous waste work. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Nitrile gloves for chemical/contaminant contact. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.
Containing and managing decon fluids and other IDW	General safety hazards (Lifting equipment, manual lifting, slips, etc.)	Equipment will be operated per subcontractor's standard procedures or per manufacturer's directions. Unnecessary personnel will stay well clear of operating equipment.
Containing and managing decon	Temperature extremes	Temperature stress controls as in "Oversight of excavation and loading" step above.

WORK ACTIVITY: TECHNICAL OVERSIGHT OF EXCAVATION OR CONSTRUCTION AND COLLECTION OF SOIL SAMPLES		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
fluids and other IDW (continued)	Chemical exposure	Chemical exposure controls as in "Oversight of excavation and loading" step above.
	Lifting (musculoskeletal injury)	Lifting (musculoskeletal injuries) controls as in "Oversight of excavation and loading" step above.
	Drum handling	Evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help or mechanical aids will be obtained by workers onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Pinch points	Pinch point controls as in "Oversight of excavation and loading" step above.
	Exposure to chemicals	Nitrile gloves for chemical/contaminant contact. Wash hands before eating or drinking. Hazard communication labels on all chemical containers. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. Current 40-hour HAZWOPER and medical clearance for hazardous waste work.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure that storage area provides adequate protection against physical damage or disturbance. Work in conjunction with NASA WM personnel.
	Spill control	Spill controls as in "Oversight of excavation and loading" step above.
Equipment decontamination by washing	Lifting (musculoskeletal injury)	Lifting (musculoskeletal injuries) controls as in "Oversight of excavation and loading" step above.
	Temperature stress	Temperature stress controls as in "Oversight of excavation and loading" step above.
	Electrical shock	Electrical shock controls as in "Oversight of excavation and loading" step above.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all fuel/flammable liquid use areas.
	Chemical exposure	Current 40-hour HAZWOPER and medical clearance for hazardous waste work. Nitrile gloves for chemical/contaminant contact. Wash hands before eating or drinking. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling. A 5-minute eyewash must be within 20 feet if pouring corrosives. Eyewash bottle must be within 10 feet if adding water samples to pre-preserved containers.
	IDW Control	IDW controls as in "Containing and managing soil cuttings, decon fluids, excavation water and other IDW" step above.

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: GATOR / MULE ATV VEHICLE USE		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	Overboots/disposable booties if walking through disturbed excavation areas or stockpiles.
Hard Hat	X	Within 25 feet of excavation equipment or if overhead hazards are present.
Safety Glasses With Side Shields	X	
Fire-Resistant Clothing		
Face Shields		
Goggles		
Lifeline/Body Harness		
Hearing Protection	X	As required, if posted or if exposed to noise greater than or equal to 85 dBA.
Air-Purifying Respirator		Stop work if dust/particulate monitoring action level (visible) is exceeded and dust/particulate mitigation (water misting/wetting) is not adequate. Arrowhead will evaluate method of excavation and use of respirators. Each employee who will use respiratory protection will follow the requirements in their employer's respiratory protection program and must comply with the following requirements: • The worker will be assigned a respirator; the respirator may not be used by another worker. • The worker must be medically certified as being capable of wearing a respirator. • The worker will only use a well-maintained, NIOSH-approved respirator for which he/she has passed a qualitative fit test (manufacturer, model, and size) within the past 12 months. • The worker must have no facial hair that touches the sealing surface of his/her respirator. • The worker will verify that the cartridges that will be used on his/her respirator are P100 cartridges. • Respirator cartridges will be disposed at the end of each work shift (not to exceed eight [8] hours of continuous or intermittent use). Cartridges may be disposed more frequently if one of more of the following conditions is noted: o A cartridge has become damaged. o A cartridge has become clogged or blocked, causing additional resistance to breathing. • The worker will inspect his/her respirator for damage prior to use and perform a positive and negative pressure test upon donning his/her respirator. The worker will inspect his/her respirator for damage after each use and will clean and disinfect the respirator. After each use, the respirator will be cleaned using a disinfecting/cleansing wipe. At the end of each work day, the respirator will be

ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: GATOR / MULE ATV VEHICLE USE		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
		disinfected by disassembling the respirator (including removing the cartridges) and washing the facepiece and associated parts in warm, sanitizing solution. The respirator will be rinsed with clean, warm water and allowed to air-dry in a clean area. The respirator will be reassembled and stored in a clean, dry plastic bag (a "zipper"-type or equivalent bag) or airtight container. The respirator must be stored in an area that is out of direct sunlight.
Supplied Air Respirator – SCBA		
Personal Floatation Device		
Gloves	X	Fit-for-use gloves (nitrile, cut-resistant, or similar for potentially contaminated material; heavy-duty work gloves for material handling).
Other		Dust monitoring (visual and real-time readings, if visible). Mitigate visible dust/particulate (water misting/wetting).
Safety Cones/Barricades	X	If needed to control/alert traffic and exclude unauthorized personnel. All traffic cones must be at least 36 inches tall.
High-Visibility Vest/Clothing	X	As necessary for traffic safety.
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel.
Competent Person	Rich Sprinzl, Leidos	
Subcontractor	Not Applicable	

WORK ACTIVITY: GATOR / MULE ATV VEHICLE USE		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Inspecting gator/mule	General safety hazards (unexpected movement of vehicle, hand and eye injuries)	Place wheel chocks to prevent movement while inspecting. Wear hard hat, leather gloves, safety shoes, etc., as specified in this AHA. Vehicle must be turned off with key removed from ignition. Wear leather gloves. Identify pinch points before performing inspection. Ensure the hood and seat latches are secured before placing fingers, hands, or arms in these areas. Wear safety glasses with side shields and stand to the side of the tire when checking tire pressure. Ensure the vehicle meets the manufacturer's guidelines before operating. If anything is in question, issue a stop work authorization and contact supervisor. Do not operate the vehicle. Note it on the daily inspection sheet.
Starting and warming	Movement of vehicle	Perform walk-around inspection before entering the vehicle and starting the engine. Look for obstructed objects that might be hidden in the grass, weeds, etc., and mark these objects where their location can be seen before proceeding. Do not disengage the emergency brake until ready to move the vehicle to prevent unexpected movement. Wear seat belt, hard hat, and leather gloves at all times. Do not carry extra passengers without seat belts. Everyone must have a manufacturer-installed seat belt. Start and warm the engine per manufacturer's requirements.
Operating	Struck by injuries or property damage from contact with other vehicles or pedestrians, obstacles, or traffic; tip over; or falling out of vehicle	Experienced operator. No bystanders in area. Perform walk-around inspection. Use spotter when backing every time. Backup alarm must be audible. Watch for low-hanging limbs or other fixed obstacles. Clear them out or mark them before work begins. Follow established traffic routes. Use a spotter when entering or exiting the work shop every time. Rollover protection system use. Travel up and down slopes, never across slopes. Do not exceed 15 mph and reduce speed according to conditions such as rough, uneven, or slippery terrain. Make turns slowly and cautiously, never in a hurry. Secure cargo and do not exceed cargo weight limit per manufacturer's guidelines. Reduce speed when loaded with cargo. Cargo must be centered over the axle. Keep head, hands, arms, and legs inside vehicle at all times. Avoid sudden starts, stops, and turns. Remain seated and wear seat belt. Keep both hands on steering wheel. No passengers in the cargo area. No horseplay. Before beginning work and throughout the day, remove debris from the floorboard. Place wheel chocks whenever leaving the operator's seat.

WORK ACTIVITY: GATOR / MULE ATV VEHICLE USE		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Fueling	Fire or explosion	When refueling, use a UL-approved metal container. Set the container on the ground before fueling to eliminate static discharge. Inspect the area to make sure there is nothing that could produce a spark. Do not smoke or use electrical or electronic devices, including cell phones, while refueling (the use of cell phones and other electronic devices is prohibited). Allow engine to cool for at least 5 minutes before fueling. Fire extinguisher must be located in the vehicle and in the fueling area.
	Chemical exposure or spill	When fueling, proceed slowly, do not rush. Wear safety glasses with side shields, face shield, and chemical-resistant gloves. First aid kit contains eye wash solution in the event of an emergency. Watch fuel level while filling the tank. Fill to only 90% full to prevent spillage. Clear hose before removing so that no fuel drips. Replace the fuel cap tightly. Keep spill kit in the area. If spill occurs, contain the spill, and contact supervisor immediately. Avoid driving where contaminated soil is disturbed or saturated, unless equipment/tires are decontaminated to prevent tracking outside of excavation area.

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ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: DRUM SAMPLING AND IDW MANAGEMENT		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat		If near operating heavy equipment or overhead hazards are present.
Safety Glasses With Side Shields	X	
Fire-Resistant Clothing		
Face Shields		
Goggles		
Lifeline/Body Harness		
Hearing Protection		As necessary.
Air-Purifying Respirator		
Supplied Air Respirator – SCBA		
Personal Floatation Device		
Gloves	X	Nitrile, PVC, or similar for potentially contaminated material. Heavy-duty work gloves for material handling.
Other:		
Safety Cones/Barricades	X	As needed, to control/alert traffic and exclude unauthorized personnel.
High-Visibility Vest/Clothing		As necessary for traffic safety.
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel.
Competent Person	Rich Sprinzl, Leidos	
Subcontractor	TTL Associates Inc.	

WORK ACTIVITY: DRUM SAMPLING AND IDW MANAGEMENT		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilize to work site	Traffic accident	Compliance with Leidos Corporate EH&S Procedure 32.0, *Vehicle Operation* (valid driver's license, seat belt use, routine vehicle inspections, no cell phone use while driving).
	Unauthorized personnel	Posted exclusion zone around work area.
IDW drum sampling and management	Temperature extremes	If temperature is above 80°F or below 40°F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or tornado warning issued, and do not return to work for 30 minutes after the last evidence of same.
	Lifting (musculoskeletal injuries)	Compliance with Leidos Corporate EH&S Procedure 50.0, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning. Filled drums will not be handled by hand.
	Electrical shock	Compliance with Leidos Corporate EH&S Procedure 26.0, *Electrical Safety*. Portable electrical tools, and all portable electrical equipment that poses a shock hazard, shall be connected through GFCIs and inspected prior to use.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all work areas.
	Pinch	Keep hands from between IDW containers (e.g., drums). Keep fingers out of all openings.
	Chemical exposure	Handle carefully to avoid visible dust generation. Current medical clearance for hazardous waste work. Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Wash hands before eating or drinking. Nitrile gloves and safety glasses for chemical/contaminant contact. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling. A 15-minute eyewash shall be located within 20 feet if pouring corrosives. Eyewash bottle shall be within 10 feet if adding water samples to pre-preserved containers.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure storage area provides adequate protection against physical damage or disturbance.

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ACTIVITY HAZARD ANALYSIS		
WORK ACTIVITY: EQUIPMENT DECONTAMINATION		
Personal Protective Equipment (PPE)	**Selected**	**Comments**
Safety Shoes	X	
Hard Hat	X	If near operating equipment, or overhead hazards present.
Safety Glasses With Side Shields	X	
Faceshield		
Goggles		
Lifeline/Body Harness		
Hearing Protection		
Air-Purifying Respirator		
Supplied Air Respirator – SCBA		
Personal Floatation Device		
Gloves	X	Nitrile or similar for potentially contaminated material. Heavy-duty work gloves for material handling.
Other		
Safety Cones/Barricades	X	As necessary, to control/alert traffic and exclude unauthorized personnel.
High-Visibility Vest/Clothing		As necessary for traffic safety.
Knee Pads		
Caution Tape	X	As needed, to exclude unauthorized personnel.
Competent Person	Rich Sprinzl, Leidos	
Subcontractor	TTL Associates Inc.	

WORK ACTIVITY: EQUIPMENT DECONTAMINATION		
Job Steps	**Potential Hazard**	**Critical Actions to Control Hazard**
Mobilize to work site	Traffic accident	Compliance with Leidos Corporate EHS Procedure 32.0, *Vehicle Operation* (valid driver's license, seat belt use, routine vehicle inspections, and no cell phone use while driving).
	Unauthorized personnel	Posted exclusion zone around work area.
Equipment decontamination by hand washing	Lifting (musculoskeletal injury)	Compliance with Leidos Corporate EH&S Procedure 50.0, *Manual Lifting*. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain shall be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help shall be obtained by workers or mechanical assistance used onsite if equipment to be moved is unwieldy, has a weight > 50 pounds, or has to be moved by maneuvering through awkward positioning.
	Temperature extremes	If temperature is above 80°F or below 40°F, administrative controls shall be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
	Severe weather	FM shall check weather report prior to each day and alter schedule to prevent severe weather exposure. Locate nearest severe weather shelter/strong structure before beginning field work. Avoid water, high ground, open spaces, and metal objects. Suspend field work when lightning is first seen, thunder is first heard, or tornado warning issued, and do not return to work for 30 minutes after the last evidence of same.
	Pinch	Keep hands and fingers from between fittings. Keep fingers out of all openings.
	Fire	Fire extinguishers rated 2A and 5B (serviced annually and inspected monthly) available in all fuel/flammable liquid use areas.
	Chemical exposure	Complete 40-hour HAZWOPER and current refresher training for workers. Complete 8-hour additional supervisor training for FM, SSHO, and all other onsite supervisors. Current medical clearance for hazardous waste work. Nitrile gloves and safety glasses for chemical/contaminant contact. Wash hands before eating or drinking. Chemical containers labeled with identity and hazard. SDSs onsite for all chemicals in use. Site-specific training shall address chemicals, hazards, and proper handling.
	IDW control	Label or mark IDW containers to indicate container number, contents (including physical state), investigation location, date of collection, and client name. Ensure storage area provides adequate protection against physical damage or disturbance.

APPENDIX C
SAFETY DATA SHEETS

ALCONOX® (DECONTAMINATION) [OR LIQUINOX®]
BENTONITE
BUG SPRAY (DEET BASED)
COMBUSTIBLE GAS INDICATOR CALIBRATION GAS
CONCRETE MIX
GASOLINE, UNLEADED
DIESEL
DRY CHEMICAL FIRE EXTINGUISHER
HYDRAULIC FLUID
HYDROCHLORIC ACID (SAMPLE PRESERVATIVE)
ISOBUTYLENE CALIBRATION GAS
ISOPROPYL ALCOHOL (DECONTAMINATION)
MOTOR OIL
NITRIC ACID (SAMPLE PRESERVATIVE, DECONTAMINATION)
PH CALIBRATION BUFFER SOLUTIONS
SPRAY PAINT, AEROSOL
SULFURIC ACID (SAMPLE PRESERVATIVE)
WELL SAND

[*NOTE: SSHO will assemble applicable SDSs and attach to SSHP prior to field mobilization. A copy of the SDSs shall be provided to NASA GRC Waste Management and PBS Construction Manager during field mobilization.*]
SDS sheets are not included in this review.

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APPENDIX D
SUBCONTRACTOR HEALTH AND SAFETY PLANS (HASPs)

TTL ASSOCIATES INC. – DRILLING AND WELL INSTALLATION AND ABANDONMENT

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GRC SITE-SPECIFIC HEALTH AND SAFETY PLAN

Prime Contractor: **Leidos, Inc.**

Field Contractor: **TTL Associates, Inc.**

Project Name: **E117: Firing Ranges 3 and 4 Removal Action**

Work Location: **NASA Plum Brook Station, Sandusky, OH**

Projected Start Date: **May 1, 2020**

Prepared By: **Rich Sprinzl/ Rick Mielcarek** **Phone: (330) 405-5808**

Date Submitted: **February 28, 2020**

INTRODUCTION: The purpose of this Health and Safety Plan (HASP) is to set forth, in an orderly and logical fashion, appropriate health and safety procedures to be followed during onsite construction activities at the Glenn Research Center (GRC). During the performance of the task to be performed, this HASP identifies potential hazards which TTL Associates, Inc. (TTL) personnel may be exposed to. TTL personnel shall not participate in this Task without having read this plan in its entirety. This plan has been developed to be as complete as possible; however, should conditions dictate revisions or additions to this plan, amendments shall be drafted, added, and distributed to all persons involved with this plan. This plan works in concert with the TTL Corporate "Safety and Health Plan," the GRC Safety Manual, the GRC Occupational Health Manual, the GRC Environmental Programs Manual, (OSHA) standard *Code of Federal Regulations* 1926, United States Environmental Protection Agency regulations, National Fire Protection Association Codes, and any other applicable codes stated in the NASA contract. It shall be the prime contractor's responsibility to ensure that all of its subcontractors comply with the provisions set forth in this plan.

A. DESCRIPTION OF WORK
Brief description of project
TTL will provide drilling services for installation and abandonment of one groundwater monitoring well within the restored blast wall footprint.
All solid and liquid materials created from drilling activities will be containerized in drums and coordinated for disposal with GRC Waste Management.

IN CASE OF EMERGENCY CALL 419-621-3222

***Dialing 911 from the NASA GRC phone system will connect to NASA emergency assistance. From a cellular phone or non-NASA landline, you must dial (419) 621-3222.**

EMERGENCY CONTACTS

Emergency	Responder	Location	NASA Phone	Mobile/ Other Phone
Fire	NASA PBS Fire Department	Building 7233	911	(419) 621-3222
Police	NASA PBS Security	Building 7233	911	(419) 621-3222
Ambulance	NASA PBS Security	Building 7233	911	(419) 621-3222
Hospital	Firelands Regional Medical Ctr.	1111 Hayes Ave.	(419) 557-7455	(419) 557-7455

Directions to Hospital: 1111 Hayes Ave., Sandusky, OH, (419) 557-7455
After leaving the site Main Gate on Scheid Rd., turn left onto Route 250. Turn left onto Bogart Rd. Turn right onto County Rd. 120/Columbus Ave. Turn left onto Townsend St. Turn left onto Hayes Ave. Firelands Regional Medical Center is on the right.
Map to Firelands Medical Center is located on next page (page 3).

NASA NON-EMERGENCY CONTACTS

	Plum Brook Station
NASA Dispatch	(419) 621-3326 or (419) 621-3221
Environmental, Health, and Safety (EHS) Helpline (for reporting non-emergencies)	(216) 433-8848
NASA Health and Safety Division Point of Contact (POC): Joyce Jordan	(216) 433-3873

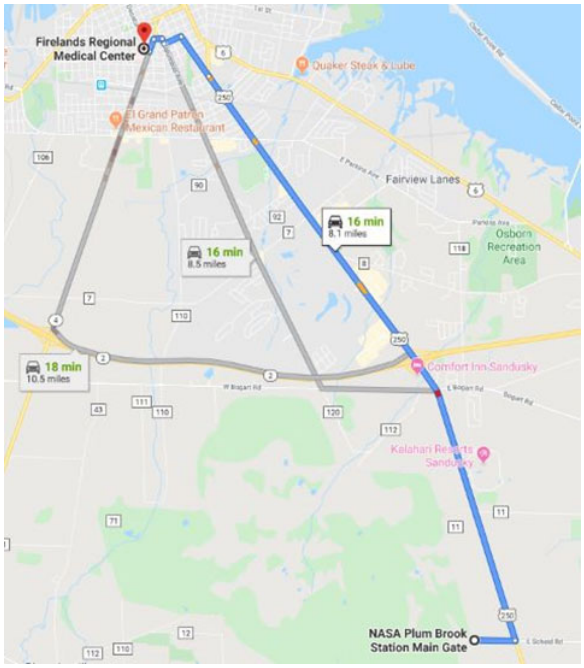
On Site phone, dial "8" to obtain an outside line

PROJECT CONTACT NUMBERS

Leidos COMETS Environmental Program Manager Jen Thomas	Work: (216) 433-3184 Cell: (216) 854-6219
Leidos Project Manager Heather Adams, Professional Geologist	Work: (330) 405-5822 Cell: (614) 330-9857
Leidos Field Manager/Site Safety and Health Officer Rich Sprinzl, PE	Work: (330) 405-5808 Cell: (330) 348-1378
Leidos Geologist/Competent Person Jasmine Stefansky, Geologist Alternate: Charles Spurr, Geologist	Work: (865) 481-8565 Cell: (865) 228-1367 Work: (330) 405-5809 Cell: (216) 317-5726
Leidos FE&E Health and Safety Manager Stephen Lowery, Certified Industrial Hygienist, Certified Safety Professional	Work: (571) 526-6659 Cell: (405) 919-4176
NASA GRC Technical Representative(s): John Brodt Christie Myers	Work: (216) 433-6028 Cell: (216) 299-8628 Work: (216) 433-8874 Cell: (216) 315-0390
Drilling Subcontractor Field Manager (Driller) TBD (prior to mobilization) TTL Associates Inc.	TBD (prior to mobilization)

MAP FOR HOSPITAL

Firelands Regional Medical Center, 1111 Hayes Ave., Sandusky, OH, (419) 557-7455
After leaving the site Main Gate on Scheid Rd., turn left onto Route 250. Turn left onto Bogart Rd. Turn right onto County Rd. 120/Columbus Ave. Turn left onto Townsend St. Turn left onto Hayes Ave. Firelands Regional Medical Center is on the right.



B. SUBCONTRACTOR(S)	
List all subcontractors working on this task and the activities they will perform	
Subcontractor Company Name	**Activities Performing in Task**
No subcontractors will be utilized by TTL	

C. SAFETY PLAN ACKNOWLEDGMENT		
I acknowledge that I have read and understand the attached safety and health plan and I agree to perform work on this task in accordance with this plan, safe work practices and OSHA regulations. I acknowledge that I have received a Glenn Research Center safety orientation.		
Employee Signature	**Company**	**Date**

FIELD CONTRACTOR ASSUMPTION OF RESPONSIBILITY

Contractor POC: Rick Mielcarek, Drilling Manager Date: February 26, 2020

D. WORK ACTIVITIES

General description of tasks to be performed.

Hollow-Stem Auger and/or Air Rotary Drilling services; installation of groundwater monitoring well; equipment decontamination; and investigation-derived waste (IDW) management.

E. POTENTIAL HAZARDS

Identify those hazards that relate to the work activities noted above. ***Use numbers next to the hazard and correspond with the* PROPOSED CONTROLS *table below.***

1 Chemicals or flammables	3 Eye, face, or Head Hazards (PPE)	__Egress
__Scaffolding	4 Power Tools	__Road Blockage
__Traffic Control	__Falls (Heights > 4')	__Utility Service Interruption (Area Clearance Req'd)
2 Spills or Leaks	5 Respiratory Hazards	__High Pressure Systems
__Ladders	6 Excavation (Permit Req'd)	__Hot Work (Permit Req'd)
__Barricading	__Radiation (Contact Health Physics @3173)	__Cryogenic Spills, Burns
__Hazardous Energy (LO/TO Req'd)	7 Noise	__Confined Space Entry (Permit Req'd)
__ Demolition	8 Biological	__Special Hazards – ACM, LCM, Cadmium, Mercury
__Cranes/Aerial	__Sanitation	__Other

F. PROPOSED CONTROLS

Work practices, personal protective equipment, training, and/or emergency procedures that will be used to ensure the safety of workers, and onsite personnel, against the hazards identified above.

General	TTL personnel have current OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and 8-hour HAZWOPER refresher training (as applicable).
General	TTL employees will follow all facility safety requirements as per site-specific training. TTL employees will follow procedures outlined in the attached Job Safety Analysis (JSA) and HASP in the event of an emergency.
1	Chemicals – Safety Data Sheets (SDSs) for Diesel and Gasoline fuels will be reviewed and available onsite. Equipment will be fueled prior to coming to the site to minimize onsite fueling needs. SDS for drilling materials (bentonite, concrete, sand, and hydraulic fluid) will be reviewed and available onsite.
2	Spills/Leaks – Portable spill kit will be available at the drilling site in case of fuel or oil leaks from equipment. All equipment will be inspected prior to first use each day to verify it is in first class working condition with no visually observed leaks. Equipment identified with leaks will be tagged out of service and removed from the site.
3	Eye, Face, or Head Hazards (Personal Protective Equipment [PPE]) – Level D PPE consisting of Hard Hat, Safety Toe Boots, hearing protection, Safety Glasses, and task appropriate gloves will be required during site activities.
4	Power Tools – Only employees trained in the safe operation of drilling equipment and authorized to operate the drilling rig will be used to complete this project. Equipment will be equipped with dead man controls.

F. PROPOSED CONTROLS (Continued)	
Work practices, personal protective equipment, training, and/or emergency procedures that will be used to ensure the safety of workers, and onsite personnel, against the hazards identified above.	
5	Respiratory Hazards – All concrete work is to be performed in accordance with OSHA 1926.1153, "Respirable Silica Standard." Concrete sawing/cutting is not anticipated, only concrete mixing. Task is to be performed outside in less than 4 hours and requires no Assigned Protection Factor (APF).
6	Excavation – Verify that Dig/Excavation permit has been obtained by NASA representative before work commences.
7	Noise – It is anticipated that noise will exceed the permissible noise exposure levels so hearing protection will be required. Ear Plugs must be worn by personnel working within proximity to the drilling rig.
8	Utilize permethrin on clothing to minimize ticks. Perform frequent tick inspections throughout the day.

G. COMPETENT PERSONS

Identify the Field Contractor's Competent Person(s) responsible for oversight of the particular hazards identified above. The Competent Person is required to conduct daily, documented site inspections.

Field Contractor Company Name	Competent Person Name	Field Contact Number
TTL Associates, Inc.	Rick Mielcarek, Drilling Manager	(419) 214-5138

H. SUPPORT DOCUMENTATION

Provide as needed. Ensure all checked items below are signed, approved, and placed on jobsite. To check a box, Double Click the box and select "Checked" under Default Value on the popup window.

Check all that apply and attach to approved HASP:

☒ ATTACH SDS to final, approved HASP **(Not old MSDS forms) – included as Appendix C to Leidos (Prime) SSHP**
☐ C-787 LO/TO Form

☐ C-199 Confined Space Permit
☐ C-7 Hot Work Permit
☐ C-260a Waste Removal Form

☐ Support Drawings
☒ Other: JSA

TTL ASSOCIATES, INC.
Job Hazard Analysis

Subcontractor: TTL Associates, Inc.	**Date:** February 19, 2020 **Project:** E123 Multi Site Characterization – NASA Glenn Research **(Review for latest use before the job is performed)**

Description of the work: Performance of hollow stem augering, monitor well installation, abandonment & vapor point borings with installation at the NASA Plum Brook Site (Sandusky, OH) using a Geo-Probe direct push rig. The work site includes Fox, Snake River & Taylor Road Burning Grounds and surrounding areas in Erie County, Ohio.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)
Mobilization/demobilization to borehole locations	Pedestrians, utilities, moving in tight areas, road conditions & steep grades.	Use caution, drive slowly, pay attention to surroundings, use a spotter, scout area for utilities and other obstacles that may create a hazardous situation, obey all traffic signs and signals, drive on grades safe to operate on, scout areas for hidden obstacles such as rocks brush piles or large holes. Never exceed recommended grades posted by the manufacturer of equipment.
Setting up the equipment for drilling.	Pinch points, striking over head utilities, physical and biological hazards, slips trips and falls, uneven drilling surface, and being struck by other vehicles.	Stay away from moving parts, only the operator shall run the machine, scout area for poisonous plants, animals and insects (Wear and use proper clothing and sprays to protect against ticks, mosquitoes, poison ivy, and other biological hazards), remove any debris that may cause any tripping or entanglement hazards, mark hazards with tape or pant, wear high visibility clothing, use traffic control, and use safety cones, signs and caution tape.

Tripping tools in and out of the ground. Direct push tooling as well as soil gas probe materials.	Pinch points, loud noise, flying particles, underground utilities, exposure to hazardous materials in the soil or ground water (dermal or airborne), weather, fire, asphyxiation due to engine exhaust, being hit by other equipment or vehicles, potential for overhead utilities and suspended loads.	Stay away from moving parts / do not wear loose clothing, use hearing protection and eye protection, hand protection, steel toe boots, use utility locators, , call OUPS (Ohio utilities), and hand clear to depth if unsure of utility markings (Do not drill closer than 5ft. to identified utilities unless daylighted), use the proper PPE as specified in HSP that relates to the specific hazards associated with the site, consult the MSDS for the site history of chemicals and contaminants, use air monitoring techniques, do not operate machine in inclement weather, lower the mast while bad weather is occurring, utilize 30-30 rule at minimum for lightning, know location of nearest tornado shelter, take frequent water breaks in cool environments during times of very hot conditions, keep fire extinguishers at an available position, no smoking around the work area, make sure drilling is done in well ventilated areas, use barricades and signs, and wear high visible clothing such as a vest. Maintain safe distance (20ft. minimum from drill mast) from overhead utilities and suspended loads, stop work when there is any over head work being performed that may have a potential for anything being dropped from above. Know where the kill switches are located on the rig in case an emergency shut-down is necessary and test daily as part of equipment inspection. Make sure hands are away from any point of impact e.g. using hammer on auger while holding.

Extracting samples from sample tubes.	Use a wrench &/or proper Geo-Probe liner cutting tool – wear hand protection to avoid cuts and from sharp edge, be aware of sample being pressurized, and contamination on skin and in eyes, and exposure to airborne contaminants, broken or cracked soil liners.	Use proper (cut resistant) gloves, point sample in a safe direction, and use recommended PPE by consulting the MSDS for known contaminants, if contaminants are unknown, use the maximum level of PPE according to site history, know where safety showers and eyewash stations are, keep eye wash bottles in close proximity to drilling location and easily accessible, use ventilation, use respiratory protection when ventilation does not exist, use only approved liner cutting device, do not run fingers along cut surface of liners.
Decontaminating tools between boreholes.	Chemical splash, high pressure steam, water slip hazard, noise hazards.	Use proper PPE, gloves, eye protection, ear plugs and Poly Tyvek suits as needed to prevent splash on work clothes, use face shield when using pressure washers, safety cone off area from other people, spray in a safe direction, and keep area from accumulating large quantities of water on the walking surface. Do not point wand at another person or use to decon boots, gloves, etc.
Entire direct push procedure and operation.	Site emergencies.	Know how to identify on-site emergencies by listening for warning alarms or sirens, identify wind direction throughout the day, know were the closest shelter in place is located, in case of emergency shut down the equipment, yield to all emergency vehicles, follow emergency response plan and go to safe place. Identify all key switches and safety stops on equipment in case it needs to be turned off in an emergency.

Containment of IDW	Exposure to chemicals, opening drums, opening pressurized drums, liquid splash, sharp edges on soil liners, slips trips falls.	Properly contain small quantities of IDW for transport to drum storage area, use proper lifting techniques, use the buddy system, open drums with heavy duty protective gloves, purge air from drums through bungs slowly to make sure there is no pressure, wear proper PPE, gloves, keep drum storage area clean from debris for slip, trip, and fall hazards.
Use of hand auger to clear boreholes for utilities.	Hazards involved are: back and arm fatigue, use of spud bar, and pinch points.	Use of safety cones and signs for working area to warn pedestrians. Use of spud bar is limited to only prying rocks and large debris from the borehole, never use a spud bar to throw into the borehole to break rocks or other construction debris. When using a hand auger, have proper posture and never strain to bust debris in the borehole. Use air monitoring techniques to test the breathing zone at all times. If the breathing zone becomes contaminated, all work will be stopped until a review of what can be done to eliminate the hazardous atmosphere. When opening a drum, always use hand protection such as leather gloves to avoid pinch points.

Use of hand tool such as drill, angle grinder, and thread tap and use of a generator	Electric shock, hand puncture, sparks, cuts, sparks, flying debris, exhaust from generator	Use approved electric cords, GFCI, leather or Kevlar gloves, face shield, spark arrestor, use a fire watch with fire extinguisher, keep generator away from flammable materials, make sure exhaust is aimed away from work area and plenty of ventilation
Travel by vehicle on and off sites up to and including area roadways.	Collisions with other vehicles, buildings, utilities, people, animals, etc. Falling out of or being ejected from vehicle.	Follow all traffic signs and signals. Adjust speed to weather conditions. If too bad pull over and wait for better conditions. Never talk, text or e-mail while driving. Drive defensively and look out for the other person and pedestrians. Learn to recognize actions of other drivers that are being aggressive, and stay away. When backing, use a spotter and or do a 360 walk around. Always wear a seat belt. Never haul a passenger unless there is a seat and belt provided for them. Never operate a vehicle under the influence of alcohol, drugs or medicine. Perform daily inspections as required by the DOT of motor vehicles before you driving.

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SITE SPECIFIC HEALTH AND SAFETY PLAN
FIRING RANGE 5 AND CDP EXCAVATION ACTIVITIES
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Submitted to:

NASA Glenn Research Center
Cleveland, Ohio

Submitted by:

Arrowhead Contracting, Inc.

Revision 0c

April 2020

Table of Contents

List of Tables

List of Figures

List of Appendices

Appendix	*Title*
A	Health and Safety Forms

- HASP Acknowledgment Form
- HASP Amendment Form
- Site Entry Log
- Daily Tailgate Safety Meeting Log
- Heavy Equipment Initial Inspection Checklist
- Heavy Equipment Daily Inspection Checklist
- Safety Equipment Daily Inspection Checklist
- Intrusive Activities Permit
- Incident Investigation Report
- Supervisor's Employee Injury Report

B Activity Hazard Analyses (AHAs)

- AHA 01 General Site Work and Oversight Activities
- AHA 03 Excavation of Contaminated Soil
- AHA 04 Decontamination
- AHA 06 Treatment of Contaminated Material
- AHA 07 Loading Contaminated Material
- AHA 08 Backfilling and Site Restoration
- AHA 09 Asbestos Abatement
- AHA 10 Surveying

C Safety Data Sheets (SDSs)

D Asbestos Abatement Plan

List of Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos Containing Material
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CDP	Construction Debris Pile
CFR	Code of Federal Regulation
CHSO	Corporate Health and Safety Officer
COC	contaminant of concern
CPR	Cardio Pulmonary Resuscitation
CY	Cubic yard
DOT	Department of Transportation
ECCL	Erie County Conservation League
EMS	Emergency Medical Services
FANS	Firelake-Arrowhead NASA Services
FR5&CDP	Firing Range 5 and Construction Debris Piles
FMCSR	Federal Motor Carrier Safety Regulations
GCR	NASA Glenn Research Center
GFCI	Ground Fault Circuit Interrupter
H&S	health and safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B virus
HEPA	High-efficiency Particulate Absorption
HIV	human immunodeficiency virus
LEL	lower explosive limit
NASA	National Aeronautics and Space Administration
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PBS	Plum Brook Station
PPE	Personal Protective Equipment
PM	Project Manager
SDS	Safety Data Sheet
SSO	Site Safety Officer
USEPA	United States Environmental Protection Agency

1.0 Introduction

This document constitutes the Health and Safety Plan (HASP) for field activities associated with the Firing Range 5 and the Construction Debris Pile (FR5&CDP) located in the southeast area of the NASA's Plum Brook Station (PBS), Sandusky, Ohio.

This document was prepared for the National Aeronautics and Space Administration (NASA), Plum Brook Station (PBS), Sandusky, Ohio by Arrowhead Contracting, Inc (Arrowhead). This HASP is specific to the excavation work at the FR5&CDP and incorporates by reference the previously approved Site-Specific Health and Safety Plan for NASA Glenn Research Center (GRC) facilities submitted by Firelake-Arrowhead NASA Services dated May 2018.

This HASP covers excavation and associated activities conducted by Arrowhead in accordance with the subcontract scope of work (SOW). Additional HASPs have been or will be developed, as needed, for other on-site construction activities. The purpose of the HASP is to present the health and safety procedures and guidelines for protecting on-site personnel, visitors, and the public from physical harm and potential hazardous exposures during excavation and related activities, which include the following:

- Excavating contaminated soil and construction debris materials
- Stabilizing contaminated sand blast grit with Calciment™, or similar
- Loading contaminated material into trucks for transport to the disposal facility
- Backfilling and site restoration of the disturbed areas
- Asbestos abatement in Construction Debris Pile 1
- Surveying
- Confirmation and waste characterization sampling (*performed by Leidos*)
- Decontamination of equipment

This HASP is intended to ensure compliance with standards established by the Occupational Safety and Health Administration (OSHA) in 29 Code of Federal Regulations (CFR) Parts 1910 and 1926, including the Hazardous Waste Operations and Emergency Response (HAZWOPER) standards (29 CFR 1910.120 and 29 CFR 1926.65.

This document is intended for use by Arrowhead personnel, including Arrowhead subcontractors. The health and safety measures presented herein are in effect for the duration of the excavation activities. All project personnel are required to abide by these measures. Where not specifically mentioned, all project personnel are required to comply with applicable OSHA standards while conducting the work. The procedures and guidelines contained herein are based on best available information at the time of preparation of the HASP. Specific requirements may be revised as new information is received or site conditions change.

1.1 Site Description

FR5&CDP is located in the southeast area of the PBS near the Space Environments Complex. The bullet backstop is an earthen berm. The CDP is comprised of concrete with reinforcing steel and includes asbestos containing material (ACM), sand blasting grit, paint chips, asphalt, and metal debris. The chemicals of concern are lead and benzo(a)pyrene in soil, ACM in the CDP (Debris Pile 1), and lead in the sand blast grit (Debris Piles 2 and 3). The removal action includes about 1,820 tons of construction debris and 602 tons of soil. The removal objective is to attain soil concentrations below residential objectives that will allow unrestricted reuse of the area.

1.2 Field Activities

The objective of the work is to mitigate public exposure risk to hazardous substances due to past activities at the FR5&CDP and is being conducted in a two-phased approach:

Phase 1

- Task 1 – Assist in Response to Public Comments (ongoing)
- Task 2 – Develop an Action Memorandum (planned for 2020)

Phase 2 (Option 1)

- Task 3 – Develop Removal Action (RA) Work Plan (planned for 2020)
- Task 4 – Develop Health and Safety Plans (HASPs) and Quality Control Plans (QCPs) (planned for 2020)
- Task 5 – Implement Removal Action (planned for 2020)
- Task 6 – Produce a Removal Action Completion Report (planned for 2020)

This HASP covers only excavation and related activities. Other HASPs have been or will be developed, as necessary, to cover the other on-site activities. Leidos will have a separate HASP that covers confirmation sampling and QC oversight.

For purposes of developing Activity Hazard Analyses (AHAs) (refer to Appendix B), the excavation activities work has been broken down into seven distinct tasks with similar H&S requirements and hazards:

- AHA 01 General Site Work and Oversight Activities
- AHA 03 Excavation of Contaminated Soil
- AHA 04 Decontamination
- AHA 06 Treatment of Contaminated Material
- AHA 07 Loading Contaminated Material
- AHA 08 Backfilling and Site Restoration
- AHA 09 Asbestos Abatement
- AHA 10 Surveying

1.3 Arrowhead Policy Statement

It is the policy of Arrowhead to provide a safe and healthful work place for all employees, subcontractors, and clients in compliance with governmental requirements. Every associate will receive the appropriate training, equipment, and other resources necessary to complete assigned tasks in a safe and efficient manner. Subcontractors shall also be appropriately trained, participate in the necessary medical surveillance programs, and comply with the required policies, procedures, and regulations. Safety, industrial hygiene, and loss prevention are the direct responsibility of all members of management, who must create an environment in which everyone shares a concern for their own safety and the safety of other associates. Safety will take precedence over expediency or short cuts. It is a condition of employment that all employees work safely and follow established safety rules and procedures.

1.4 Field Crew Safety Summary

Workers in the field should be mindful of the following health and safety issues while completing excavation activities at the site:

- The primary contaminants of concern (COC) at the site are lead in the sand blasting grit that comprises Debris Piles 2 and 3, and asbestos in the construction debris found in Debris Pile 1. The following control measures will be employed to mitigate the dust/lead and asbestos issues on the site:
  1. Using real-time perimeter air monitoring (DustTrak™ or similar) and perimeter air sampling (variable airflow sampling pumps and laboratory analysis) to monitor

dust/lead and asbestos conditions at the site perimeter

2. Using personal air monitoring to collect samples in the worker breathing zone for laboratory analysis to gauge the concentrations of dust/lead and asbestos and adjust the level of PPE, if needed
3. Starting the excavation phase using half-face air purifying respirators while dust sampling data is collected to determine the appropriate level of respiratory protection
4. Minimizing dust by avoiding traveling through the impacted areas of the site and instead travel along the perimeter areas of the site
5. Equipping the cab of the equipment that works with impacted materials with a HEPA filtration system.
6. Keeping workers away from the excavation and other equipment operations unless required to be there. Workers required to be in the general area of equipment operations (grade checker, Site Supervisor, Site Safety Officer, etc.) will stay upwind of the work and inside a support vehicle when possible
7. Washing hands and face before eating, smoking, or drinking

- Personal protective equipment (PPE) to be used by field crews while completing excavation and associated activities include the following standard level D work clothing:
  1. Hard hat
  2. Steel toed boots
  3. Safety glasses
  4. Work gloves
  5. Shirt and long pants
  6. High visibility vest

- Personal protective equipment (PPE) to be used by field crews while completing excavation and stabilization activities at Debris Piles 2 and 3 and excavation and asbestos abatement at Debris Pile 1 include the following standard level C work clothing. The Level C ensemble will be worn during the first few days of the excavation work at Debris Piles 2 and 3 and asbestos abatement work at Debris Pile 1 while air monitoring is performed to collect data needed to change the level of protection, if warranted.
  1. Hard hat

2. Safety glasses
3. Work gloves
4. Vinyl or nitrile gloves
5. Shirt and long pants
6. High visibility vest
7. Disposable Tyvek™ coverall or pants, if determined to be needed by the SSO based on wipe sample or air monitoring results
8. Steel-toed boots with disposable over boots or washable steel toed boots, if determined to be needed by the SSO based on wipe sample or air monitoring results
9. 1/2-face air-purifying respirator with HEPA filter, if determined to be needed by the SSO based on air monitoring results

- Because dust can be generated during excavation and related activities, personal and perimeter dust monitoring will be required. Visual dust monitoring will also be employed and if dust is observed, the Site Safety Officer will determine the best course of action to mitigate the dust issue. Likely, the mitigation efforts will involve stopping operations until the dust has abated or increasing dust control measures such as wetting the dusty area with water or covering the area with a tarp or poly sheeting.

2.0 Organization and Responsibilities

This section describes Arrowhead personnel responsibilities for health and safety. Table 2-1 identifies Key Health and Safety (H&S) personnel from Arrowhead.

2.1 On-Site Personnel

All on-site personnel are responsible for continuous adherence to H&S procedures during the performance of assigned work. In no case may work be performed in a manner that conflicts with the inherent safety and environmental precautions outlined in this plan. After due warning, personnel violating safety procedures will be dismissed from the site and possibly terminated from further work. Any person who observes unsafe acts or conditions or other safety problems should immediately report them to supervisory personnel.

2.2 Corporate Health and Safety Officer

The Corporate Health and Safety Officer (CHSO) has ultimate authority and responsibility for establishing, implementing and enforcing Arrowhead's H&S program. Accordingly, the CHSO develops and/or approves site-specific HASPs, ensures that Arrowhead personnel meet applicable training and medical monitoring requirements, and develops company policies and procedures for H&S in accordance with OSHA and other applicable standards.

2.3 Project Manager

The Project Manager (PM) is responsible for coordinating the development, implementation, and enforcement of this HASP. The PM is responsible for ensuring that the necessary resources are available for the project to be completed safely and in compliance with HASP requirements, OSHA regulations, and other applicable standards.

2.4 Site Safety Officer

The Site Safety Officer (SSO) will conduct inspections to ensure that operations are conducted in accordance with the HASP, OSHA regulations, and the subcontract specifications. The SSO reports directly to the PM. An open dialogue between the SSO and the PM will be maintained in order to quickly address safety issues and implement corrective actions as necessary. The SSO has the authority to suspend operations at the site due to the ineffectiveness of or non-conformance to this HASP. The most senior associate will be assigned the duties of the SSO (Alternate SSO) when the SSO is not on-site. The SSO has an independent reporting line

of authority to the Corporate Health and Safety Officer. This reporting authority provides for suitable checks and balances for production and safety related decisions.

2.5 Site Supervisor

The Site Supervisor is primarily charged with production at the site and coordinating all on-site aspects of the project. The Site Supervisor is responsible for implementing the scope of work, schedule, and budget in the field. The Site Supervisor maintains contact with the Arrowhead PM and also reports to the PM.

2.6 Asbestos Personnel

Asbestos abatement work at Debris Pile 1 will have the certifications and will perform the duties described in the Asbestos Abatement Plan in Appendix D.

2.7 Subcontractors

Subcontractors, if used at the site, are responsible for the H&S of their employees and for complying with the standards established in this HASP and all other project requirements. The following are some of the requirements that apply to subcontractors:

- All subcontractors under the direction of Arrowhead will report to the PM.
- Subcontractors shall submit all training and medical surveillance documents to Arrowhead prior to mobilization, as applicable.
- Planned operations for the day shall be verbally conveyed to the Site Supervisor at the beginning of each day. Any changes in scopes of work or specified quantities shall also be conveyed to the Site Supervisor on a regular basis.
- The Site Entry Log shall be signed at the beginning and end of each workday by all subcontractor employees working on-site.
- All subcontractor personnel shall attend a project safety orientation (refer to Section 11.3) prior to beginning work on-site.
- All subcontractor personnel shall attend the morning tailgate safety meeting (refer to Section 11.2). If scheduling precludes attendance, then subcontractors shall hold and document their own safety meeting. Safety meeting documentation is to be submitted to the SSO.
- All accidents, fires, injuries, illnesses, and spills shall be immediately reported to the SSO.
- Heavy equipment is to be inspected daily by the equipment operator. Inspection documentation shall be submitted to the SSO.

- Subcontractors are required to frequently inspect work sites for safety deficiencies and correct all deficiencies.

2.8 Visitors

All visitors shall check in with on-site personnel to verify that all appropriate entry requirements are met. Visitors will also require clearance by the Site Supervisor. Visitors will only be allowed in support areas unless they are properly trained and equipped to enter exclusion zones / restricted areas. All visitors will be given a safety briefing upon arriving at the site. Visitors will be escorted by on-site personnel at all times.

3.0 General Health and Safety Requirements

This section addresses general safety issues, rules, and miscellaneous topics.

3.1 Project Safety Goal

Safety is Arrowhead's highest priority. Arrowhead has established a goal of zero accidents for this project. The process of planning the project work is performed to identify, evaluate, and control the site hazards and to help realize the goal of zero accidents. All activities shall be conducted in a manner that minimizes the probability of incidents, accidents, injuries, or illnesses.

3.2 Compliance Agreements

All field personnel will receive a copy of the HASP and read the plan prior to commencement of fieldwork. The HASP Acknowledgment Form presented in Appendix A will be signed by field personnel after reviewing the plan and acknowledging the plan's provisions. This agreement will be retained as part of the project files.

3.3 Safety Meetings

A project-specific safety orientation meeting will be conducted by the SSO prior to work on-site. During the meeting, an overview of the objectives of the project and the HASP will be discussed. Once discussions conclude, field personnel will be required to sign an acknowledgment of the HASP (Appendix A).

A daily "tailgate" safety meeting will also occur each morning prior to starting the day's field activities. All field and construction personnel will be required to attend the daily tailgate safety meeting. All safety meetings will be documented and kept on file in the field office.

3.4 General Safety Provisions

The following general provisions will be in effect during all site activities:

- There will be no activities conducted on-site without sufficient backup personnel. At a minimum, two persons or some means of communication must be present during site activities.
- No loose jewelry, clothing, or long hair shall be permitted on or near equipment with moving parts.

- Except as necessary to perform the required field assignments, personnel shall avoid contact with contamination (pooled liquids, discolored areas, etc.) or any area that shows obvious evidence of contamination.
- Personnel shall not enter contaminated areas (i.e., exclusion zones) unless it is necessary.
- Field personnel must observe one another for signs of chemical exposure and or physical stress (changes in skin color, coordination, speech, breathing, etc.) and inform co-workers and management of other signs and/or symptoms (headaches, nausea, dizziness, etc.).
- Damaged personal protective equipment (PPE) or clothing will be immediately repaired or replaced.
- Smoking, eating, drinking, or any other activity involving hand-to-mouth contact while in the exclusion zone is prohibited.
- Personnel must thoroughly wash their hands and face before eating, smoking, or drinking.
- All regulated work zones, as established on the site, shall be observed. Entry into a restricted area or exclusion zone shall be by prior notification and authorization of the Site Supervisor or SSO. All required PPE shall be worn prior to entering these zones.

3.5 Fire Prevention and Protection

Fire prevention and protection procedures/resources at the site include:

- Fire extinguishers will be made available at the site. A minimum of one ABC-rated fire extinguisher will be maintained at each active work area.
- Flammable materials will be stored in marked ("No Smoking") areas with fire extinguishers available.
- Smoking will only be permitted in designated areas.
- Project personnel are only permitted to extinguish fires in their incipient stages. Fighting large fires beyond the incipient stage is prohibited by project personnel and shall only be performed by the local fire department.
- As necessary, hot work permits will be obtained.
- All equipment will be turned off at the end of each workday.

3.6 Housekeeping

The following provisions are specified to maintain a high standard of housekeeping:

- The importance of housekeeping and the expectations that good housekeeping shall be maintained will be regular topics of the daily safety meetings.
- The site shall be cleaned on a daily basis.
- Subcontractors shall be informed of their responsibilities to maintain their housekeeping.

Housekeeping is an operational/safety item, which is regularly considered during routine inspections.

3.7 Heavy Equipment Inspections

All heavy mechanical equipment shall be inspected by the SSO and Site Supervisor upon arrival at the site, and will be inspected by operator(s) on a daily basis thereafter. Daily inspections shall be documented on inspection checklists as presented in Appendix A. Deficiencies in the equipment shall be noted on the form. All inspection documentation shall be submitted to the SSO so that repairs can be initiated. Prior to the demobilization of equipment, all equipment will be inspected by the SSO or the Site Supervisor prior to the equipment leaving the site.

3.8 First-Aid and Medical Facilities

The following provisions apply to first aid and medical facilities:

- A first-aid kit(s) will be provided and maintained on-site.
- A blood borne pathogen exposure control kit will be provided and maintained on-site.
- Eye wash bottles will be provided to individual construction crews.
- Emergency phone numbers will be posted on-site.
- The route to the hospital will be posted on-site.
- At a minimum, two on-site employees shall be certified in first aid and cardio pulmonary resuscitation (CPR).

3.9 Sanitation

The following provisions will be made to address sanitation:

- A portable lavatory unit will be set up in the support area when four or more workers are routinely working at the site. Additional lavatory units will be set up (as needed) where the work is being performed.
- A portable hand-wash station will be set up adjacent to the lavatory units. Additional hand-wash units will be set up (as needed) where the work is being performed.
- Safe drinking water will be made available as necessary to provide drinking water at individual work locations.

3.10 Security

To provide general security during field operations, the following facilities or measures will be provided:

- Existing fence gates at the PBS will remain closed at all times unless authorized by PBS personnel.
- There will not be an office trailer at FR5&CDP site. At the conclusion of each workday, the office trailer at the ECCL will be locked. Keys to the office trailer at the ECCL will only be provided to authorized personnel from Arrowhead.
- The keys to heavy construction equipment will be removed from the equipment and placed inside the office trailer at the ECCL at the end of each workday.
- All personnel and visitors to the site will be required to sign in and sign out. Site visitors will not be allowed to enter restricted areas or exclusion zones unless approved by the Site Supervisor or SSO.

3.11 Illumination

Most project operations will occur during daylight hours, between sunrise and sunset. Supplemental illumination at the excavation areas is not anticipated. Additional lights may be installed on existing poles at the site or on the security trailer. All yard lighting will be directed from residential areas.

3.12 Communication and Buddy System

The "buddy system" will be used at all times while working in restricted areas and exclusion zones. Generally, the "buddy system" requires that personnel must maintain visual and voice communication with other personnel in the same general work area. However, cell phones and two-way radios can be used to maintain contact and meet the "buddy system" requirement in some instances and if approved on a case-by-case basis by the SSO.

4.0 Activity Hazard Assessment

A hazard assessment is performed to identify the potential safety, health, and environmental hazards associated with specific field activities. It is used to determine the control measures necessary for protecting personnel, the community, and the environment. The SSO, with input from the Site Supervisor and CHSO, will perform a hazard assessment for each major field activity to be performed during the project. Once developed, the hazard assessment may be revised when new tasks/activities are added, job situations change, or when it becomes necessary to alter safety requirements. Additions and changes to the HASP, such as revisions to the hazard assessment, must be documented on the HASP Amendment Form (Appendix A). Based on the field activities anticipated during excavation activities, the following H&S hazards are anticipated:

- Chemical exposure (minor concern for lead and benzo(a)pyrene in soil)
- Chemical exposure (lead in sand blast grit)
- Asbestos exposure (asbestos containing material in acoustic tiles within the CDP) (see Asbestos Abatement Plan in Appendix D)
- Chemical exposure (operational chemicals)
- Dust
- Noise
- Fire/flammables
- Eye hazards
- Slip, trip, falls
- Operation of heavy construction equipment
- Operation of small equipment and power tools
- Electrical hazards
- Hazardous energy
- Intrusive activities
- Material handling
- Contact with hot items
- Motor vehicle / traffic control hazards
- Heat stress
- Cold stress
- Blood borne pathogens
- Environmental hazards

Table 4-1 presents a summary of these hazards as they apply to the project construction. Appendix B presents the Activity Hazard Analysis (AHA) for the tasks included in this scope of work – a breakdown of the H&S hazards associated with the primary field activities and the control measures that will be implemented to eliminate or minimize theses hazards.

5.0 Hazard Control Measures

There are numerous chemical, physical, environmental and industrial hazards associated with the excavation activities at the Plum Brook Station. These hazards, if not properly controlled, can cause harm to project personnel, visitors, and the public. This section, combined with the remaining sections of this HASP, address the recommended measures for controlling or minimizing the hazards. These control measures are summarized in Table 5-1.

5.1 Chemical Exposure

This phase of the project entails mechanical excavation of contaminated soil and construction debris materials, stabilization of the sand blasting grit, and loading the contaminated material for transportation and disposal. The chemicals of concern in the FR5&CDP are Asbestos Containing Material (ACM) in acoustic tiles found among the construction debris in the CDP and sand blasting residue that is hazardous (TCLP analysis) due to the presence of lead from lead-based paint. There is also a potential for exposure to operational chemicals such as diesel fuel, lubricants, and soil stabilization agents.

Site work will potentially expose construction crews and public receptors to the following environmental hazards and exposure pathways:

- Inhalation exposure to asbestos originating from Construction Debris Pile 1
- Inhalation exposure to lead dust in the sand blasting grit in Construction Debris Piles 2 and 3
- Inhalation exposure to nuisance dust from non-contaminated soils
- Inhalation and dermal contact exposure to operational chemicals

Sand Blasting Residue

Sand blasting grit that includes lead based paint is found in Construction Debris Piles 2 and 3 located in the west and north areas of FR5&CDP. The material is considered hazardous based on TCLP analysis.

Arrowhead plans to stabilize the material with Calciment™ to render the material non-hazardous by lowering the TCLP result in the stabilized material. The Calciment™ will be applied by sprinkling it onto the top of the sand blasting girt piles and then using equipment such as a skid steer loader, wheel loader, or excavator to accumulate the stabilized material into larger piles

ready for sampling and loading (approximately 250 CY). Each pile will be mixed as necessary to evenly distribute the Calciment™ throughout the pile. The piles will be sampled to ensure that each passes the TCLP hazardous waste threshold. Piles that do not pass will undergo additional stabilization by adding additional Calciment™ and remixing the pile. Once a pile has passed the TCLP test and has been accepted for disposal by the disposal facility the pile will be loaded onto trucks for transport to the landfill.

Inhalation exposure hazards will be controlled through the implementation of the following control measures:

- Minimizing dust by avoiding traveling through the impacted areas of the site and instead travel along the perimeter areas of the site when possible
- Equipping on-site equipment (e.g., excavator, skid steer, wheel loader, etc.) with a cab that has a HEPA filtration system.
- Keeping workers away from the excavation operations unless required to be there. Workers required to be in the general area of the excavation activities (Site Supervisor, Site Safety Officer, etc.) will stay upwind of the work and inside a support vehicle when possible
- Washing hands and face before eating, smoking, or drinking
- Complying with site-specific action levels (see below)
- Perimeter air monitoring
- Personal air sampling
- Engineering and administrative controls for dust suppression
- PPE and respiratory protection

Operational Chemicals

There is also a potential for exposure to operational chemicals used during the project. Chemicals such as diesel fuel and lubricants will be brought on-site for use during the project. In addition, stabilization chemicals such as Calciment™ will be used to stabilize the sand blasting grit to decrease the TCLP lead analysis result to a level that can be accepted by the disposal facility.

The use of operational chemicals is regulated by OSHA under the Hazard Communication Standard (29 CFR 1910.1200). Arrowhead's *Hazard Communication Program* provides requirements for the safe use of operational chemicals, including the requirement to maintain SDSs on-site for each chemical product. Exposure to operational chemicals will be controlled by using the products in the manner recommended by the manufacturer, donning PPE

recommended by the manufacturer, ensuring that chemical containers are properly labeled, and storing the products in approved containers and cabinets.

Based on a review of the SDS for Calciment™, the stabilization agent is a caustic powder and exposure can cause skin, eye, and respiratory irritation. Engineering controls include ventilation and dust control. PPE includes dust mask, safety glasses, dry gloves, level D work clothes, and caustic resistant footware. Treatments for exposure include moving the exposed person to fresh air, flushing eyes for 15 minutes, and flushing exposed skin with large amounts of water.

5.2 Asbestos

Asbestos abatement will be conducted at CDP 1 by hand-picking acoustic ceiling tiles from the construction debris. Hazard control measures are discussed in the Asbestos Abatement Plan in Appendix D.

5.2 Nuisance Dust

During excavation, stabilization, and loading operations involving material that is not deemed hazardous to health, there is still the potential to generate nuisance dust, and the nuisance dust will need to be managed. Both operational and administrative controls will be implemented to ensure that ambient dust levels remain below action level that, in the case of non-hazardous materials, is visible dust. Operational controls will include:

- Applying water to dry areas to minimize dust
- Minimizing creating dust while operating equipment and trucks
- Following proper decontamination protocols for equipment entering and leaving the site

Administrative controls will include the following:

- Maintaining speed limits on site access roads
- Stopping or restricting work activities when dust levels become elevated or when the wind speed is excessive
- Positioning personnel upwind

5.3 Noise

The primary sources of noise at the site will be the operation of heavy construction equipment. Sound pressure levels during construction operations may exceed the NASA action level of 82 decibels TWA, particularly in the immediate vicinity of construction equipment.

With respect to construction crews, hearing protection will be required when working in the vicinity of construction equipment. It is Arrowhead policy to don hearing protection whenever operating construction equipment. Using a sound level meter (Spark Super Duty or equivalent), the SSO will conduct real-time noise monitoring to ensure compliance with OSHA's *Hearing Conservation Standard* (29 CFR 1910.95) and Chapter 3—*Hearing Conservation Program* of the NASA Glenn Research Center Occupational Health Programs Manual. The SSO will also perform real-time monitoring to ensure that decibel levels remain below permissible limits at site boundaries and at select locations indicative of public exposure. Noise monitoring will be documented and records will be maintained, controlled, and retrievable at all times.

5.4 Eye Hazards

The potential for eye injuries is high for most construction activities. Eye hazards include projectiles, fumes, dust, heat, and glare. The specific eyewear that will be used to protect workers form these hazards will include:

- Safety glasses with side-shields – all operations except office administration
- Goggles – upgrade for high levels of dust or for splash hazards, as deemed necessary by the SSO
- Face shields (used with safety glasses) – upgrade for splash hazards, as deemed necessary by the SSO

All protective eyewear will meet American National Standards Institute (ANSI) Z87.1 standards. Furthermore, at least one eyewash station will be available near the primary work area.

5.5 Slips, Trips, and Falls

During the project, conditions such as uneven ground surface and other obstructions will create a general slip, trip, and fall hazard for field personnel. The following general provisions shall apply to the prevention of slips, trips, and falls:

- Personnel shall keep working areas clean and orderly. Tools, equipment, and materials shall be used and stored in a fashion to minimize tripping hazards
- Small, loose items such as tools and other small objects shall not be left on the ground surface
- Spills shall be cleaned up immediately
- Personnel using hand and mechanical tools shall position themselves properly and consider the events if a tool slips or suddenly moves

- Personnel shall not walk or climb on equipment not designed as walking surfaces
- Electrical extension cords and electrical wiring shall be kept clear of walking and working areas and/or covered or otherwise secured
- Walking and working surfaces shall be kept clean
- Running is prohibited

5.6 Fire Hazards

The potential for fire explosion hazards at the site is associated with the storage and use of flammable liquids (e.g. diesel fuel). The following provisions shall apply to the storage and use of flammable liquids:

- Flammable liquids shall be kept away from ignition sources
- Flammable liquids shall be used and stored only in areas with good ventilation.
- Containers shall be stored in approved, metal containers.
- Containers shall be grounded and bonded when transferring liquids to safely discharge static electricity.
- Spills shall be immediately cleaned up and reported to the SSO and Site Supervisor

5.7 Operation of Heavy Construction Equipment

Equipment will be used/operated during excavation activities, including:

- Excavators
- Skid-steer loaders
- Wheel loaders
- Off-road dump trucks
- Pickup trucks and trailers

All operators of heavy equipment shall be familiar with the requirements for inspection and operation of the equipment. Before equipment is placed into use and on a daily basis, the operator is to inspect and verify that it is in safe operating condition. The heavy equipment inspections shall be documented on the inspection checklists provided in Appendix A. The following general safety guidelines shall be followed while operating heavy equipment:

- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded
- Getting on or off any equipment while it is in motion is prohibited

- Equipment will be operated in accordance with the manufacturer's instructions and recommendations
- All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to be serviced while running are exempt from this requirement
- Buckets, blades, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise
- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on
- Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut-off which prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running
- Each piece of heavy equipment and other similar equipment will be equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 5-pound ABC
- Personnel will not work, pass under, or ride in the buckets or booms of loaders in operation
- All self-propelled construction equipment, whether moving alone or in combination, shall be equipped with a reverse signal alarm
- Seat belt use is required while operating equipment

Spotters for the operator will be the only personnel allowed in the vicinity of the heavy equipment. Spotters shall stay out of the boom radius area. Personnel needing to approach heavy equipment while operating shall observe the following protocols:

- Make eye contact with the operator (and spotter)
- Signal the operator to cease heavy equipment activity
- Approach the equipment only after the operator has given signal to do so

5.8 Operation of Small Equipment and Power Tools

Hand and power tools shall be used, inspected, and maintained in accordance with the manufacturer's instructions and recommendations and will be used only for the purpose for which designed. The following requirements shall be followed:

- The tool housing will be checked to be sure it is in good condition (i.e., free of cracks and defects)
- If provided, trigger locks (to prevent accidental activation) will be checked for proper function prior to using the tool
- Tools designed to accommodate guards will be equipped with the guards when in use
- Reciprocating, rotating, and moving parts of equipment shall be guarded whenever possible if exposed to contact by workers
- Moveable guards shall operate freely
- Tools shall be inspected to ascertain safe operating condition and are to be kept clean and free of accumulated dirt
- Electric power tools and extension cords shall be used with ground fault circuit interrupter (GFCI)
- If the tool is not three-wire ground protected, it will be double-insulated
- Portable power cords will be designated as hard usage or extra hard usage and shall not be used if damaged, patched, oil-soaked, worn, or frayed
- For pneumatic power tools, compressed air hoses will be in good condition (no visible cracks, bubbles, or kinks) and hose connections shall be secured such that there are no noticeable air leaks
- Hydraulic tools will be checked to be sure there is no fluid leakage, hydraulic lines are in good condition (no visible cracks, bubbles, or kinks), and connections are secure
- The motor, muffler, spark plugs, and other components of gasoline-powered tools will be checked to be sure they are in good condition. The tools will also be checked for signs of fuel leakage around the gasoline tank or fuel line

5.9 Electrical Hazards

In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by four inches for every 10 kV over 50 kV. If it is necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard:

- The line will be will be de-energized and grounded
- An insulating barrier will be erected to prevent contact with the line. The barrier must be rated for the voltage of the line to be guarded

Arrowhead ***will maintain the minimum clearance distances (at least 10 feet) from overhead power lines.*** During operations near overhead power or communication lines, one person involved in the operation (or the SSO) will be assigned the duty of spotter to visually monitor the

operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the spotter will be positioned "so as to be able to visually monitor the clearance between the equipment and power lines." The observer cannot be assigned other duties that would interfere with the ability to provide safety oversight and timely warnings.

Signs and/or barricades will be place below power lines to alert truck drivers and equipment operators that there are overhead lines above. Typically, this will be accomplished using Type II plastic barriers with signs noting the overhead power lines. In addition, if there are power poles that are near traffic areas, parking areas, or equipment operations, the poles will be protected from moving equipment using concrete barriers such as Jersey Barriers or similar.

Applicable standards for electrical power 29 include CFR 1926 Subpart K. The following general electrical safety provisions shall apply during construction:

- All portable electrical equipment and extension cords shall be protected with a GFCI as part of the circuit
- Use only three-wire ground protected or double insulated power tools
- If a tool is not three-wire ground protected, it will be double-insulated
- Wear rubber-soled shoes/boots and rubber gloves when using tools in wet locations
- To the extent practical, suspend cords above head height when it is necessary to have them across aisles or traffic areas. If cords are placed across aisles or traffic areas for prolonged periods of time, place protective strips over the cord(s)
- Do not hang cords over nails, bolts, or sharp edges
- Replace damaged or frayed power cords immediately
- Immediately discontinue the use of tools that shock, smoke, smell or spark

5.10 Hazardous Energy

The potential for releasing hazardous energy is a significant concern due to the following conditions:

- Utility lines that could become breached during site work
- Release of hazardous energy during maintenance or service of equipment and tools

To minimize the potential for releasing hazardous energy from live utility lines, the following site-specific procedures will be implemented:

- Lockout/tag out procedures – de-energize, depressurize, or isolate energized lines and equipment, as necessary
- Safe excavation methods
- Maintaining safe distances from energized utility lines and appurtenances

Lockout/tag out procedures (referencing 29 CFR 1926.417) will also be implemented during servicing or maintenance of equipment to preclude the unexpected start-up and/or release of stored energy. To prevent the accidental start-up of equipment while a person's hands are near a hazardous location (i.e., point-of-operation, rotating belts, gears), the operator must turn off the power to the machine and apply a lock or otherwise control the power source to ensure that the equipment cannot be inadvertently energized.

5.11 Intrusive Activities

Before any intrusive activity (excavation) begins, positive steps shall be taken to determine the locations of underground utilities. Excavation personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines. The following procedure shall be followed to identify the locations of buried utilities prior to commencing intrusive activities. Intrusive activities shall not begin until the Arrowhead designee has signed off on the Intrusive Activities Form, provided in Appendix A.

Note: The process of clearing underground utilities will be on-going throughout the project. If more than two weeks elapse from the date of the initial utility clearance, or if the original markings are faded or obscured, the utility clearance will be repeated before excavation work commences. Construction crews will ensure that underground utility markings are clear and visible prior to excavating.

- The Arrowhead designee will submit the Excavation Permit to PBS Construction Manager at least 2 weeks prior to beginning site preparation and excavation activities. The PBS Utility Surveyor will verify NASA underground drawing records within PBS
- The Arrowhead designee shall contact the utility locating hot line (Ohio One-Call [Ohio811], 1-800-362-2764 or 811) to notify them of intent to initiate intrusive activity at the given property location. This notification will be made a minimum of two working days prior to the initiation of intrusive activity
- A subcontracted private utility locating service will be used to locate utilities on private property and confirm the marking provided by Ohio One-Call

- The utility clearance task will include marking (with spray paint or pin flags) the locations of any underground utilities on pavement and soil surfaces within the site limits and excavation boundaries
- As necessary, local utility providers will be notified and responsible authorities will confirm the presence/absence of utilities on the property. Those service providers with service in the proximity to any work area will visit to the site and mark the locations of the underground utilities
- The Arrowhead designee will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint).
- Once the clearance process is completed, the Arrowhead designee will sign the Intrusive Activities Form (Appendix A)

5.12 Excavation Hazards

All project personnel shall participate in the site-specific training session and be instructed on the following general safety requirements:

- Before commencing excavation, the existence and location of underground pipes, electrical equipment, telephone, gas lines, etc. shall be determined and documented.
- Operations shall be suspended and ignition sources eliminated if a hazardous atmosphere is encountered or suspected
- If excavating equipment is being operated in the vicinity of overhead power lines, minimum clearance distances from energized overhead electric lines will be maintained or the lines will be grounded or guarded

5.13 Material Handling

Various materials and equipment may be handled manually during project operations. Care should be taken when lifting and handling heavy or bulky items to avoid back injuries. Additionally, workers may be exposed to injury from handling materials with sharp edges and from inadvertently dropping materials with slippery surfaces.

The following fundamentals address the proper lifting techniques that are essential in preventing back injuries:

- The size, shape, and weight of the object to be lifted shall first be considered. No individual employee is permitted to lift any object that weighs over 40 pounds. Multiple employees or the use of mechanical lifting devices are required for objects over the 40-pound limit
- The anticipated path to be taken by the lifter should be inspected for the presence of slip, trip, and fall hazards

- The feet shall be placed far enough apart for good balance and stability (typically shoulder width)
- The worker shall get as close to the load as possible. The legs shall be bent at the knees
- The back shall be kept as straight as possible and abdominal muscles should be tightened
- Twisting motions should be avoided when performing manual lifts, i.e., auger flights
- To lift the object, the legs are straightened from their bending position
- A worker shall never carry a load that cannot be seen over or around
- When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered
- For high loads, position the body as close as possible to the load, slide the load towards you, and lift with the arms and legs (not the back)

When two or more workers are required to handle the same object, coordination is essential to equally divide the weight between the individuals carrying the load and to make a uniform lift. When carrying the object, each worker, if possible, shall face the direction in which the object is being carried. Additionally, each worker shall lift, walk, and lower the load together. When carrying loads on the shoulder, each worker shall carry the load on the same shoulder, walk in step, and put the load down together.

To protect the feet and hands from injury, field personnel will be required to wear steel-toed boots and leather gloves, respectively, while performing construction operations.

5.14 Contact with Hot Items

Contact with hot equipment, such as exhaust pipes of gas-powered equipment, hot water from steam sprayer, generators, and equipment tooling, may subject field personnel to burns. Field work will be monitored by the SSO to ensure that workers are either avoiding hot equipment or are using safe work practices to prevent contact with hot equipment. Safe work practices will include the use of PPE (i.e., leather gloves, face shields, protective suits), as necessary, and allowing equipment to cool off before making contact with affected components. In the event a worker is burned, the following procedure will be followed:

- Cool the burned area with cool water and cool, wet cloths
- Expose the area, but do not remove clothing that sticks
- Cover with dry, sterile dressings or clean cloth
- Do not break blisters, apply ointments, or try to clean third degree burns

5.15 Motor Vehicle / Traffic Control Hazards

It is anticipated that excavation activities will be completed within the Plum Brook Station footprint and will not require working on any of the adjacent roads (Fox Road, Milan Road, or Patrol Road). Typical equipment operating on public roads will involve mobilizing a skid steer loader, excavator, and associated equipment on trailers pulled by semis or pickup trucks.

Transport of equipment from the support area to work areas

Travel of construction equipment and support vehicles transporting personnel and material about the site will be on existing site roads and trails, to the extent possible, to minimize disturbing vegetation and soil. This will minimize generating dust.

Parking

Site personnel will park in designated locations within the designated support area at the facility.

Personnel Travel

All personnel shall drive defensively and wear seat belts while vehicles are in motion. Since backing accidents at these types of projects are frequent, the following guidelines shall be observed:

- Backing of vehicles shall be avoided when possible. Extra care shall be taken to back vehicles when unavoidable
- When parking vehicles, vehicles shall be backed into the space whenever possible
- Before backing a vehicle which has been parked, the driver shall physically walk to the back of the vehicle to observe the area before entering the vehicle
- Spotters shall be used to back vehicles whenever possible

5.16 Heat Stress

Heat stress is a significant concern for summertime work in the Midwest. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, PPE, workload, and individual characteristics. Heat stress can cause physical discomfort, loss of efficiency, or personal illness/injury. Reduced work tolerance and the increased risk of heat stress are directly influenced by the amount and type of PPE worn. PPE adds weight, bulk, reduces the body's capability for thermoregulation (i.e., evaporation, convection, and radiation), and increases energy expenditure.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur - ranging from mild to fatal. These physical reactions to excessive heat include:

- Heat rash is caused by continuous exposure to heat and humidity and aggravated by chafing clothes. Heat rash decreases the body's ability to tolerate heat in addition to being a nuisance
- Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. Heat cramps cause painful muscle spasms and pain in the extremities and abdomen
- Heat exhaustion is caused by increased stress on various organs to meet increased demand to cool the body. Heat exhaustion causes shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness
- Heat stroke is the most severe form of heat stress. Heat stroke symptoms include hot, dry skin; no perspiration; nausea; dizziness; confusion; strong, rapid pulse; coma; and sometimes death. Heat stroke is a serious medical emergency. The affected person shall be cooled down rapidly and medical attention must be given immediately

The following practices will help prevent heat stress:

- Acclimatize workers to hot working conditions
- Provide plenty of liquids to replace the body fluids lost by perspiration. Fluid intake should be forced because, under conditions of heat stress, the normal thirst mechanism is not adequate to bring about a voluntary replacement of lost fluids
- Provide personal cooling devices
- Conduct strenuous field operations in the early morning
- Rotate personnel to various job duties
- Establish adequate work/rest cycles

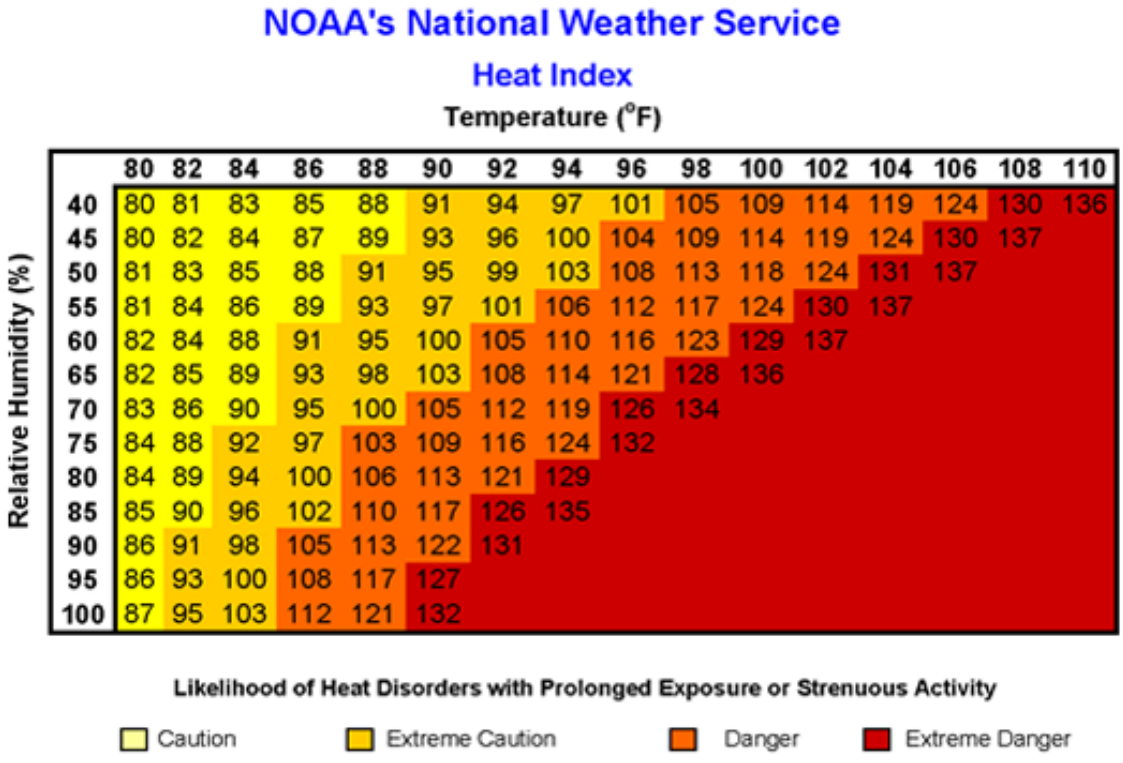
Individuals or coworkers expressing the symptoms of heat stress shall notify the SSO or Site Supervisor immediately. **At the onset of heat related illness, activities must be halted and treatment initiated**. Early detection and treatment of heat stress helps to prevent further serious illness or injury. Individuals that have experienced heat related illness can become more sensitive and predisposed to additional heat stress related problems.

Heat exhaustion can be alleviated by having the affected person rest in a cool, shaded location and have them drink cool water. **In a heat stroke situation, the body must be cooled**

immediately to prevent severe injury or death - medical attention must be immediately obtained. To cool down the affected person's body:

- Remove impermeable PPE
- Remove worker from the hot environment
- Apply copious amounts of cool (not cold) water to the body
- Have the person drink cool water, not cold, if conscious

Adequate work/rest periods shall be implemented as necessary to prevent heat stress on personnel. However, since individuals vary in their susceptibility to heat stress, field personnel will be reminded to perform physiological monitoring to aid in measuring individual response to heat stress. Physiological monitoring will become applicable when ambient temperatures exceed 70 ºF.



Heat Index	Risk Level Category	Work/Rest Regimen	Mandatory Break Duration
< 91°F	Category 1	Continuous Work, Self-paced rest periods	N/A
91 - 103°F	Category 2	Light Work: Take self-paced breaks Heavy Work: Take a break every 45 minutes	10 - 15 minutes

104 - 114°F	Category 3	Light Work: Take a break every 60 minutes Heavy Work: Take a break every 30 minutes	15 - 20 minutes
115 - 124°F	Category 4	Light Work: Take a break every 45 minutes Heavy Work: Take a break every 15 minutes	30 minutes
> 124°F	Category 5	Break frequency should be reviewed and discussed between project management and safety managers.	

** Workers wearing polypropylene coveralls or pants, increase to the next higher Risk Level Category* (https://www.osha.gov/SLTC/heatillness/heat_index/pdfs/all_in_one.pdf)

Work Type Examples (not all inclusive and meant as a guide):

Light Work:

- Operating Equipment (Excavators, Skid Steers, Haul Trucks, etc.)
- Carrying light objects or tools (under 10 lbs.)
- Sweeping or cleaning up job site/shop area

Heavy Work:

- Hand digging
- Carrying/moving heavy objects or tools (35+lbs)

5.17 Cold Stress

The adverse effects of cold weather are a concern during the winter months. While hypothermia should be recognized as a potential hazard, the highest probability of worker injury is though frost-bite. Workplace monitoring shall begin where the environmental temperatures fall below 60.8°F so that the ACGIH Cold Stress standard (TLV) can be applied. Control measures to prevent adverse physiological affects from cold weather should be implemented prior to the exhibition of any signs or symptoms.

Frostbite occurs when the extremities do not get sufficient heat from the central body stores. The fluids around the cells of the body tissues can freeze from exposure to low temperatures. This freezing can result in damage and loss of tissue. The most vulnerable areas for frostbite are the nose, cheeks, ears, fingers, and toes. Skin and tissue damage from frostbite can result in scarring, tissue death, permanent loss of movement, or amputation. There are three degrees of frostbite:

- First Degree - Freezing without blistering or peeling
- Second Degree - Freezing with blistering or peeling
- Third Degree - Freezing with skin tissue death and possible deeper tissue damage.

Symptoms of frostbite include:

- Skin color changes to white or grayish-yellow, to reddish-violet, and finally black as the tissue dies
- Coldness or numbness of the affected part
- Pain may be felt at first, but subsides.

Hypothermia, or a drop in body core temperature, is a dangerous condition resulting from cold stress. Employees should be protected from exposure to cold so that their deep-core body temperature does not fall below 97.6° F. A lower body temperature can result in reduced mental alertness, reduction in rational decision-making, or loss of consciousness with the threat of fatal consequences. The symptoms of hypothermia are:

- First, uncontrollable shivering and the sensation of cold
- Heartbeat slows and may become irregular
- Pulse weakens and the blood pressure changes
- As the body's core temperature drops, other signs may include cool skin, slow irregular breathing, slurred speech, loss of coordination, and apparent exhaustion
- The victim may become listless, confused, exhibit severe shivering, or develop severe pain in the extremities
- The advanced/final signs of hypothermia are a significant drop in blood pressure, fatigue, shallow respiration, coma, and death.

When the ambient air temperature falls below 36° F (inside or outside the building), the following requirements shall apply:

- If wind chill is a factor, the cooling effect of the wind shall be reduced by shielding the work area or providing employees an outer wind breaking layer of clothing
- Extremities (i.e., fingers, ears, toes, and nose) shall be protected from extreme cold by protective clothing
- Employees performing light work and whose clothing may become wet shall wear an outer layer of clothing that is impermeable to water
- Employees performing moderate to heavy work and whose clothing may become wet shall wear an outer layer of clothing that is water repellent
- Outer garments shall provide for ventilation to prevent wetting of inner clothing by sweat
- If clothing is wet, the employee shall change into dry clothes before entering a cold environment

- Workers shall change socks and removable felt insoles at regular daily intervals or use vapor barrier boots
- Workers who become immersed in water or whose clothing becomes wet shall immediately be provided a change of clothing and be treated for hypothermia if necessary. If the clothing becomes wet from sweating, the employee may finish the task that caused the sweating before changing into dry clothes
- Metal handles of tools and control bars will be covered by thermal insulating materials when temperatures fall below 30° F

Individuals or coworkers expressing the symptoms of hypothermia or frostbite shall notify the SSHO or Field Supervisor immediately. At the onset of cold related illness, activities must be halted and treatment initiated. Early detection and treatment of hypothermia or frostbite will prevent further serious illness or injury.

Frostbite can be alleviated by having the affected body parts gently warmed with room temperature water. Never rub frostbitten skin. Seek medical attention for all but the mildest cases of frostbite. In a hypothermic situation, the body must be warmed immediately to prevent severe injury or death - medical attention must be immediately obtained. To warm up the affected person's body:

- Bring affected person to a warm room
- Remove impermeable PPE and wet clothing
- Wrap person in warm coats
- Have them drink warm liquids, if conscious

5.18 Blood Borne Pathogens

Exposure to blood borne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

- Hepatitis B vaccine (HBV) is offered to employees who may be exposed to PIM when they complete training and within 10 working days of assignment. (Note: Employees whose exposure stems only from rendering first aid as a collateral duty receives the vaccine after exposure.)
- Employees who decline the HBV vaccine must sign the declination form (contact regional Safety Program Assistant [SPA]) indicating they declined the vaccination. Anyone who declines the vaccination and chooses to receive the vaccination at a later time may still receive the vaccination by contacting the SPA.

- Hepatitis B and tetanus vaccinations can be requested by completing the medical portion of the enrollment form, located under Tools & Forms at the HS&E web page, or by contacting the regional SPA.

Work Controls

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials
- Consider all sharps encountered at industrial, medical, dental, or biological waste facilities or sampling locations to be contaminated and PIMs
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes. These must be provided for employees who have been exposed to PIMs. When antiseptic cleansers or towelettes are used, always rewash your hands and face with soap and running water as soon as available. Do not consume food or beverages until after thoroughly washing your hands and face
- Decontaminate all potentially contaminated equipment and environmental surfaces with chlorine bleach as soon as possible. Clean and decontaminate on a regular basis (and immediately upon visible contamination) all bins, pails, cans, and other receptacles intended for reuse that have the potential for becoming contaminated
- Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area
- Place regulated waste in containers that are closable and are constructed to contain all contents and prevent leakage of fluids during handling, storage, transport or shipping, are labeled with a biological warning label or color-coded, and are tightly closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping. These activities are typically coordinated through NASA Waste Management.

Employees who participate in waste characterization studies, sort or sample refuse, or contact medical, dental, or biological waste streams should follow these procedures:

- If exposure is anticipated, this group of employees should wear safety goggles or glasses, puncture-resistant utility gloves with inner latex glove liners, Tyvek coveralls or cotton coveralls with a rubber apron, and puncture-resistant shoes or boots
- If splash potential is present, employees should wear a full-face shield
- If a respiratory hazard is present, a full-face respirator with HEPA filters should be worn

Post Exposure

A confidential medical examination will be provided should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure
- Testing the exposed employee's and the source individual's blood (with consent)
- Administering post-exposure prophylaxis

5.19 Environmental Hazards

Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; contact 911 immediately if a severe reaction occurs.

Mosquito Bites

Due to the possibility of the West Nile Virus being present at the site, it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.
- Note: Vitamin B and ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death. The West Nile Virus incubation period is from 3-15 days.

Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in Spring and Summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in Fall, but plants lose its (yellowed, then brown) leaves in Winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol (you-ROO-shee-ol), a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around, there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. DO NOT apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size.

In some geographic areas, exposure is not easily avoided. The threat can be minimized by wearing tightly woven light-colored clothing with long sleeves, tucking pant legs into boots, spraying only outside of clothing with permethrin or permanone, spraying skin with only DEET, wearing permethrin-treated tick/chigger gaiters, and checking frequently for ticks. Where site conditions warrant (vegetation above knee height, tick endemic area) or when tasks warrant (e.g., having to sit/kneel in vegetation) that diminish the effectiveness of the other controls mentioned above, bug-out suits /Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Use preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

Be aware of the symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop.

6.0 Personal Protective Equipment

When engineering and administrative controls are not feasible or adequate to protect personnel from the hazards associated with project activities, PPE use will be required. This section discusses the anticipated PPE requirements for the project. However, PPE requirements may be adjusted (upgraded or downgraded) in the field based on actual field conditions and/or results of air monitoring activities. The site-specific PPE requirements are discussed below and are summarized in Table 6-1.

6.1 Respiratory Protection

Arrowhead's approach for respiratory protection involves aggressive dust control measures for maintaining dust / COC at safe levels. If dust levels become elevated, work will be stopped and suppression measures increased until dust levels diminish. If dust suppression cannot bring the dust levels below the action level, PPE will be increased to Level C with respiratory protection.

The Arrowhead SSO is not restricted from requiring respiratory protection at other times when site conditions become hazardous to personnel. If respiratory protection becomes necessary, personnel will don respirator style appropriate for the task with filters appropriate for the hazard. Respiratory protection equipment shall be NIOSH-approved, and respirator use will conform to ANSI Z88.2 and OSHA 29 CFR 1910.134 requirements. All personnel using APRs shall have successfully passed a respirator fit test within the last 12 months. Fit testing and any training related to respiratory protection for site personnel will be documented. Respirators shall be inspected before each use for damage, missing parts, and proper function.

6.2 Levels of Protection

Excavation activities will be conducted in Level C protection at the start of the project while air sampling is conducted to determine the appropriate level of protection. It is anticipated that about 3 weeks will be needed to collect enough information to make the determination. If appropriate, the level of protection can be decreased to Level D-Modified or Level D. Note that samples will continue to be collected throughout the project and that the level of protection can be changed at any time the SSO deems it appropriate. Levels of PPE shall not be downgraded without prior approval from the Arrowhead SSO.

Level D protection represents the minimum requirements for PPE and shall, at a minimum, consist of:

- High-visibility vests
- Shirt, long pants
- Steel-toed work boots
- Safety glasses with side-shields
- Hearing protection (as required)
- Vinyl or nitrile gloves when handling fluids
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary) – i.e. leather gloves when utilizing hand and power tools
- Hard hat

Level D-Modified and Level C PPE shall, at a minimum, consist of:

- High-visibility vests
- Long pants
- Steel-toed boots
- Safety glasses with side-shields
- Uncoated disposable pants or uncoated disposable coveralls, such as Tyvek™ or Kleenguard™, with short sleeve shirt
- Vinyl or nitrile gloves
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary) - i.e. leather gloves when utilizing hand and power tools
- Hearing protection
- Hard-hat
- 1/2-face APR with HEPA filters (Level C only)

In general, levels of PPE are subject to change or modification based on sampling results and changing conditions. PPE can be upgraded or downgraded based on changing site conditions. A change in PPE may occur based on real-time air monitoring, time integrated air sampling results, weather conditions (e.g., dry/windy, rainy/calm), site activities, or any other factor that might impact worker safety. It is the responsibility of all site workers to raise concerns about the level of PPE to the SSO for discussion. However, only the SSO can make the decision to downgrade the level of PPE.

7.0 Site Control and Work Zones

The primary purposes of site control are to protect personnel and public from chemical and physical hazards associated with site activities and to prevent the spread of contamination to clean areas. The work areas that pose physical hazards to personnel will be regarded as regulated or restricted. If significant exposure to site contaminants within a given work area is known or suspected, the area will be designated an exclusion zone. These areas will be established in general accordance with *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH, et al. 1985).

7.1 Staging Area

The main staging area for all of the excavation activities will be located at the southeast area of the ECCL (former clubhouse area) north of Fox Road. Arrowhead will procure an office trailer for use by on-site personnel. The NASA on-site support contractor (TFOME) will provide a power drop and electrical panel that will be used to provide electrical power to the office trailer. The office will be furnished with desks, drafting table, storage, and meeting area. The office will be equipped with cellular telephones, Hot Spot internet access, portable computers, printer/scanner/fax/copier machine, and potable water.

A small parking area will be designated for private vehicles. A Conex box or enclosed trailer will be set up in the staging area for storage of supplies. Areas will be designated for equipment, tool trailers, and trucks. Lavatory units and hand wash stations will be set up in the staging area as needed.

A temporary equipment decontamination pad will also be constructed in the footprint of FR5&CDP with a polyethylene liner and hay bales. The solid material will be added to the contaminated soil pile for transportation and disposal with the soil. The water will be allowed to evaporate, if possible, or will be contained, sampled, and disposed with approval of NASA Waste Management.

7.2 Exclusion Zones / Restricted Areas

Due to the presence of physical and chemical hazards (COCs), all areas where construction activities are in progress will be considered restricted. Until such time that contaminated media is covered with clean fill, the entire limits of excavation will be treated as an exclusion zone,

where only certified (HAZWOPER) personnel will be allowed to enter. Access to excavations will be controlled using orange construction fencing and/or other appropriate barricades.

Where formal work zones are necessary, they will be established as discussed below.

Support Zone

A Support Zone will be established for workers to take breaks, eat lunch, etc. Worker personal items will be left in the Support Zone. The Support Zone will be near the Exclusion Zone but will not interfere with work activities. Emergency equipment and supplies such as first aid kits, eye wash bottles, fire extinguishers, etc. will be staged in the Support Zone. Workers will don PPE in the Support Zone before moving through the Contaminant Reduction Zone into the Exclusion Zone.

Contaminant Reduction Zone

A Contaminant Reduction Zone (CRZ) will be established between the Exclusion Zone and the Support Zone. When exiting the Exclusion Zone, workers will remove PPE in the CRZ prior to entering the Support Zone. In addition, workers can drink water in the CRZ provided that they have removed coveralls to the waist, removed gloves, and cleaned hands using hand wipes or soap and water. Tyvek pants and boots do not need to be removed prior to drinking water.

Exclusion Zone

The Exclusion Zone will be clearly identified and marked as restricted with construction fencing, traffic cones, warning tape or other appropriate barriers placed at the boundary of each restricted area. Restricted area boundaries will be established and modified by the SSO or Site Supervisor as construction activities progress. Personnel working within exclusion zones will be required to employ PPE, conventional sanitation practices, and personnel / equipment decontamination procedures to minimize the spread of contamination.

7.3 Site Entry Requirements

Project personnel will monitor the site for entry by unauthorized personnel. Visitors will be required to sign an entry/visitor log located inside the site trailer. Visitors not directly involved in onsite project activities will not be permitted to enter restricted areas or exclusion zones without first checking with the Site Supervisor or SSO. In order to allow an individual into a restricted area or exclusion zone, he/she must meet the following requirements:

- Documentation of training requirements
- Obtain authorization from Site Supervisor or SSO
- Attend an orientation meeting with the SSO
- Don the appropriate PPE
- Sign the site entry log

Visitors will be escorted at all times.

8.0 Decontamination

8.1 Personnel Decontamination

In general, field personnel will not make direct contact with contaminated media at the site, or contact will be minimal and incidental. The majority of contaminated media will be moved, placed, and covered using heavy construction equipment. Accordingly, personnel decontamination will consist of using "best management" sanitation practices, including:

- Brush / rinse / wash soiled work boots as needed
- Remove and dispose soiled coveralls as needed (Modified D)
- Remove and dispose soiled gloves as needed
- Wash and rinse hands and face on a regular basis
- Shower regularly
- Launder work clothing regularly
- Avoid distributing / transporting contaminated media to clean areas

8.2 Equipment Decontamination

Equipment used to excavate contaminated soil will be dry decontaminated using shovels and brooms prior to moving the equipment from a contaminated area to a clean area.

Prior to demobilizing equipment from the site, all equipment making contact with contaminated soil (including the excavator bucket) will be properly decontaminated to remove all contamination that may be adhering to the equipment surfaces. Decontamination will generally consist of spraying with a low volume, high pressure (or steam) washer. A "decontamination pad" will be constructed (using plastic sheeting, lumber, hay bales, etc.) at the support area to promote the collection / recovery of rinse water. At the conclusion the field work, all equipment will be thoroughly decontaminated prior to being returned to vendors. The SSO or Site Supervisor will inspect all equipment leaving the site for adequacy of decontamination.

The SSO will establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified accordingly.

9.0 Air Monitoring

9.1 Perimeter Air Monitoring

Arrowhead will perform perimeter air monitoring and air sampling during excavation and associated activities, including the following:

- Perimeter air monitoring stations at four locations along the perimeter of the site. The perimeter air monitoring stations will be established between the primary work areas and the location of potential receptors
- Real-time air monitoring of particulate dust using DustTrak™ monitors for the analysis of total dust
- Collection of air monitoring samples for analysis of lead. Samples will be collected using variable airflow sampling pumps and drawn through filter cassettes for laboratory analysis
- Evaluation of air sample data to determine if action levels have been exceeded
- Provide air monitoring data to site personnel and others as necessary to manage site work activities to meet air quality action levels at the site perimeter
- Perimeter air monitoring for asbestos abatement is discussed in the Asbestos Abatement Plan in Appendix D.

9.2 Personal Air Sampling

Personal air monitoring for asbestos abatement is discussed in the Asbestos Abatement Plan in Appendix D.

Personal air sampling will be conducted to verify that administrative controls, engineering controls, and PPE are effectively preventing harmful exposures to project personnel. Time-integrated air sampling will be conducted as directed by the SSO to quantify lead in comparison to permissible exposure limits (PELs) and risk-based inhalation levels. Air sampling to assess worker exposure will be conducted in accordance with the NIOSH Method 7300. Personal air samples will be collected from the breathing zone using low-volume sampling pumps. The pump and appropriate filter cassette (37 mm, 2.0 micron, pre-weighed Teflon filter) will be attached to a field crew member performing the operation being evaluated. Personal air samples will be collected at the following general frequencies:

- Two samples per day for the first week, worn by personnel representing worst-case soil and dust exposure, including mechanical excavation crews
- One to two samples per week thereafter based on the results from the first week
- Possible reduction as construction activities near completion, based on historic results

The general procedure for collecting air samples is as follows:

- Components of the air sampling system shall include the sample media (cassette or cartridge), and sampling pumps (low-volume sampling pump for personal samples and perimeter samples)
- The sampler/cassette will be attached to the sampling pump via vinyl tubing
- The sampling pump will be turned on, and the initial flow rate will be checked (with the sampler in line) using a rotameter or other approved air flow measurement device
- The flow rate will then be adjusted to the required flow rate for sampling
- After noting the specific start time, the air sampling system will be operated continuously over a time period sufficient for collecting the required air volume
- Once the sample is completed, the specific finish time will be noted, and the sampling pump will be turned off. The final flow rate will be checked using a rotameter or other air flow measurement device
- The sampler/cassette will then be detached from the tubing and capped at both ends (inlet and outlet) or placed in appropriate vials
- The sample will be labeled with the sample ID and packaged for shipment to the laboratory
- The following parameters will be documented: sample ID, total sample time (in minutes, based on start and finish times), average flow rate (in liters per minute, based on initial and final flow rates), and total volume (flow rate x total time)

10.0 Emergency Response Plan

An emergency situation is defined as a sudden, generally unexpected occurrence demanding immediate action. Emergencies may include accidents, injuries requiring medical care, fires, explosions, spills and other significant releases hazardous substances, and extreme weather events.

10.1 Emergency Responsibilities and Authority

The Site Supervisor/SSO will be responsible for implementing and directing emergency response procedures and determining appropriate response actions, including the decision whether or not to evacuate or take shelter. Local authorities (including NASA Plum Brook Station Dispatch [419-621-3222]) will decide if the emergency requires evacuation of the surrounding community. Responsibility for community evacuations will be with the local authority in charge of the emergency

10.2 Emergency Contacts and Notification

Telephone numbers for emergency contacts will be maintained and posted at the site. The PM, and Site Supervisor/SSO will be notified immediately in the event of an emergency. The Site Supervisor/SSO will immediately evaluate the incident and, if necessary, notify emergency response personnel by calling NASA Plum Brook Station Dispatch (419-621-3222).

DO NOT CALL 911 from a cell phone, dial 419-621-3222. CALL 911 from a NASA phone

The utility owner will be contacted in the event that a gas or electrical utility is struck during excavation. NASA Plum Brook Station Dispatch will be notified in the event of fire, significant hazardous material spill, or other emergency beyond the capabilities of project personnel. Emergency Medical Services (EMS) will be contacted by calling NASA Plum Brook Station Dispatch (419-621-3222) in the event of personal injury or medical emergency (beyond minor first-aid). The information provided to the emergency contact should include the nature of the incident and the exact location. Specifically, the information shall include:

- Name and telephone number of the individual reporting the incident
- Location and type of incident
- Nature of the incident (i.e., fire, explosion, spill, or release) and substances involved (if any)
- Number and nature of medical injuries

- Potential for additional risks or dangers
- Potential off-site risks or dangers
- Movement or direction of spill/vapor/smoke
- Response actions currently in progress
- Estimate of quantity of any released materials
- Status of incident
- Other pertinent information.

10.3 Medical/Personal Injury Response

Minor injuries will be treated on-site by qualified first-aid/CPR responders. In the event of moderate to severe physical injury, NASA Plum Brook Station Dispatch (419-621-3222) shall be contacted to arrange EMS transport. A map to the nearest local medical facility is presented in Figure 3-1. The following procedure will be implemented in the event of an emergency:

1) Assess and Stabilize the Victim (Conscious or Unconscious, severity of injury, life threatening or superficial injury, body temperature) using First Aid
2) Immediately notify Site Manager of incident
3) Call NASA Plum Brook Station Dispatch (419-621-3222)
4) If practical, identify the nature of the injury and vital statistics—this will help the dispatcher identify the type of response equipment needed—i.e., man-basket for head or neck injury or EMT burn unit for burn related injury
5) Describe to the dispatcher the nature and extent of the incident or injury

However, injured personnel who require medical treatment beyond minor first-aid, shall be transported to the hospital by EMS. First-aid and emergency eyewash equipment shall be available at the site. Personnel will be notified as to the locations of first-aid equipment and eyewash stations during the initial safety briefing session. The following procedures will be implemented in the event of a personal injury (other than first-aid only):

- Administer first-aid and contact the Site Supervisor/SSO to arrange for dispatch of the EMS.
- When the situation has been stabilized, decontaminate the injured person. Do not perform decontamination if it interferes with emergency treatment, such as in a life-threatening situation.
- Move the person to the support area if there is no risk of further injury.
- Wait for emergency care, and maintain radio contact with the Site Supervisor/SSO.

If the injury or illness occurs from exposure to a hazardous substance, rapid identification of that substance should be attempted. This information shall be provided to the medical personnel,

which may include SDS for operational chemicals. In the event of a chemical exposure, the following procedures shall be followed:

- **Skin Contact.** Flush with water; remove clothing, flush skin with water; obtain medical attention.
- **Inhalation.** Remove the person from the area; administer first-aid/CPR, as needed; obtain medical attention.
- **Ingestion.** Contact the Poison Control Center (800-222-1222) for immediate treatment, then obtain medical attention. Inducing vomiting may cause further injury to the victim; follow instructions from the SDS and/or Poison Control Center.
- **Eye Contact.** Flush eyes immediately with water. Corrosive materials require flushing with water for a minimum of 15 minutes. Obtain medical attention.

10.4 Fire Response

In the event of a fire or explosion at the site, the following actions shall be implemented:

- Evacuate all personnel to a safe location upwind or crosswind of the incident. Contact the PM and Site Supervisor/SSO.
- Concurrently with the above, contact NASA Plum Brook Station Dispatch (419-621-3222).
- If personnel are present who have had training in the use of fire extinguishers, use available fire extinguishers to extinguish fires in their incipient stages.
- Alert the local hospital of the possibility of fire victims, as appropriate.

Following the incident, details shall be documented in the field logbook or on an Incident Investigation Report form (Appendix A).

10.5 Spill Prevention and Response

The following measures shall be taken to minimize the possibility of spills/discharges:

- Site security and controls are to be maintained so that only authorized personnel have access to work areas.
- Site personnel will be advised of appropriate spill/discharge control measures.
- Containers (drums) will remain closed except when adding/dispensing product.
- Containers will be stored upright and in an orderly fashion.
- Appropriate secondary containment structures will be used for storage of fluids on-site.
- Storage containment will be examined daily.

- Small containers of chemical product will be stored inside the job box when not in use. Flammable products will be stored inside approved cabinets.

If a spill or other release of a hazardous material occurs, the Site Supervisor/SSO will be immediately notified. The Site Supervisor/SSO will immediately notify spill response personnel by calling NASA Plum Brook Station Dispatch (419-621-3222). An assessment will be made of the magnitude and potential impact of the release. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

- The spill or release area will be approached from upwind (if outside).
- Hazards will be identified based on available information from witnesses or material identification documents (i.e., placards, SDS). The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.
- If necessary, the spill area will be evacuated, isolated, and secured.
- The spill area will be sealed off using caution tape or other appropriate means.
- Entry to the spill area will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Hazardous spill containment and collection will be performed as follows:
  - Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes. Cover or dike floor drains, storm drains, and other conduits for off-site migration of the spilled material.
  - Control the spill at the source by plugging leaks, up-righting containers, over packing containers, or transferring contents of a leaking container.
  - Collect the spilled material with shovels and other equipment as necessary.
  - Store the spilled material in drums for further treatment or disposal by NASA Waste Management.
  - Decontaminate personnel and equipment after the response is complete.

If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. Upon arrival at the site, the Site Supervisor/SSO will brief emergency responders of the current status and potential hazards. Following a spill incident, details shall be documented in the field logbook and on an Incident Investigation Report form (Appendix A).

10.6 Evacuation Procedures

In the event that site evacuation is required, an announcement will be made to field crews using verbal communication, cellular phones, or two-way radios. **Personnel working in the**

restricted area will immediately proceed to the designated safe area (selected by the SSO at the start of the project) for a "head count".

10.7 Severe Weather Procedure

Personnel should be aware of the possibility for severe weather. Necessary precautions or response, directed by the SSO, will be taken in the event of severe weather. Local weather broadcasts will be monitored by the Site Supervisor / SSO when severe weather is imminent. For severe weather associated with lightning, advanced warning notices will be used as a basis for temporarily discontinuing fieldwork. In the event lightning is viewed in the project area the SSO will notify project personnel to stop work and seek shelter. Project personnel shall seek shelter in vehicles or the closest structure available if required. When fieldwork is discontinued due to lightning, field crew members remaining out at the project properties should wait 30 minutes prior to returning to work. For severe weather events, direct announcements will be used to alert crews of threatening weather and recommendations to take shelter. **Accordingly, personnel should take refuge in a nearby building as selected by the SSO at the start of the project**. Pending on-site verification, the Plum Brook Station main gate/security building 7235 will be considered the nearest shelter from severe weather.

10.8 Emergency Equipment

At a minimum, the following emergency equipment shall be maintained at the site:

- Fire extinguishers
- First-aid kits
- Blood-borne pathogen control kit
- Emergency eyewash
- Communication devices (cellular phones and/or two-way radios)

This equipment will be inspected by the SSO on a regular basis during the project to verify that they are in good condition, ready to use, and easily accessible.

11.0 Training and Medical Monitoring Requirements

The SSO is responsible for informing all site personnel and all visitors of the contents of this HASP and ensuring that each person accepts the provisions of the HASP (by signing the HASP Acknowledgment Form in Appendix A) prior to working on the site. Documentation of training certification(s) for project personnel will be reviewed by the SSO and filed on-site.

Supervisors must complete HSE training that covers, at minimum, record keeping, incident investigation, regulatory agency inspections, HSE documentation requirements, and OSHA 10-hour course for construction, unless otherwise specified by local legislation (e.g., by the State OSHA 30-hour course for construction supervisors).

11.1 HAZWOPER Training

Full-time construction personnel will be required to meet the HAZWOPER training requirements per 29 CFR 1926.65 and 29 CFR 1910.120, including an initial 40-hour training course and an 8-hour refresher class within the past 12 months. One or more Arrowhead personnel will have HAZWOPER 8-Hour Supervisor training.

11.2 Daily Tailgate Safety Meetings

The Site Supervisor/SSO (or designee) shall conduct a safety meeting at the beginning of each shift. The topics discussed at this daily "tailgate" safety meeting shall include:

- H&S considerations for the day's activities
- Hazard assessments
- Engineering controls to be implemented
- Required PPE
- H&S supply inventory
- Problems encountered and lesson's learned
- Areas/activities requiring special warning or caution
- Related safety topics

Attendance records and meeting notes will be recorded on the Daily Tailgate Safety Meeting Log (Appendix A). Daily Tailgate Safety Meeting Log will be maintained with the project files.

11.3 Site-Specific Orientation Meetings

All personnel, including subcontractors, working at the site shall attend a site-specific orientation covering the following topics:

- Purpose and review of the HASP
- Names and responsibilities of personnel responsible for site safety
- The provisions for medical care and facilities and the names of CPR and first-aid trained personnel assigned to the project
- H&S hazards on-site and the means to control/eliminate those hazards
- Procedures for reporting and correcting unsafe conditions or practices
- Responsibilities for reporting all accidents and illnesses
- PPE requirements, use, and care
- Location of safety equipment (i.e., fire extinguishers, first-aid kits, eye wash stations)
- Standard operating procedures, safety rules, and safe work practices for the project
- Hazard Communication Program (includes discussion of applicable SDS)
- Fire protection and prevention
- Housekeeping
- Other pertinent aspects of project-specific hazard assessments

The content of the training will be derived from information contained within this HASP.

11.4 Hazard Communication

All personnel performing field activities will receive basic hazard communication and right-to-know training, including a review of Arrowhead's Hazard Communication Program, applicable SDS, container labeling requirements, chemical hazard warnings, and general chemical health hazards. Personnel shall be trained on the hazards of operational chemicals by reviewing SDS. SDS for additional materials brought on-site will be reviewed with personnel prior to the use.

Arrowhead will maintain all SDSs at the Project site in a notebook readily available for inspection with an index arranged by "Brand Name". If such materials or substances are part of any item requiring a shop drawing or other submittal, the SDS will accompany the submittal.

11.5 Asbestos Training

Training requirements for workers engaged in asbestos abatement are discussed in the Asbestos Abatement Plan in Appendix D.

11.6 First-Aid/CPR

At least two members of Arrowhead's on-site staff will be trained and certified in American Red Cross first-aid and CPR. The certification and recertification requirements for first-aid (three

years) and CPR (one year) are applicable. First-aid and CPR training/certification must be made by a reputable provider, such as the American Red Cross or American Heart Association.

11.7 Additional Training, Certification, and Licenses

In addition to the training and certification discussed previously, commercial drivers must meet applicable certification and licensing requirements as mandated by the DOT. Truck drivers must possess a valid commercial driver's license.

11.8 Medical Monitoring

Medical surveillance requirements will apply to personnel covered under HAZWOPER requirements. Arrowhead and subcontractors will utilize the services of an Occupational Medicine physician for the medical surveillance requirements of this project.

Medical Examination

All affected personnel will have successfully completed a pre-placement or periodic/updated physical examination that complies with HAZWOPER (29 CFR 1926.65 and 29 CFR 1910.120). Pre-placement (baseline) medical examinations shall consist of a standard battery of tests and blood lead testing.

The medical surveillance provided to the employee includes a written opinion by the medical examiner of the employee's ability to use the necessary respiratory protective equipment. Any employee found to have a medical condition, which could directly or indirectly be aggravated by exposure to any chemical substance present at the site, or by the use of respiratory equipment, will not be employed for the project. A copy of the medical examination shall be provided at the employee's request. The employee will be informed of any medical conditions that would result in work restriction or that would prevent him/her from working at hazardous waste sites.

Site personnel may be required to receive an annual update exam in accordance with 29 CFR 1926.65(f)(2) and 29 CFR 1910.120(f)(2). The results of these exams are compared to previous results and the baseline physical to determine if any medical effects due to exposure have occurred. Appropriate actions shall be taken as recommended by the physician should the results indicate an exposure; otherwise, employees are cleared for continued work.

Periodically, the need arises to conduct medical examinations at times other than those previously discussed. These times include reassignment in accordance with 29 CFR 1910.120 (f)(3)(i)(C) and 29 CFR 1926.65 (f)(3)(i)(C), if an employee develops signs or symptoms of

illness relating to work place exposure, if the physician determines examinations need to be conducted more often than once a year, and whenever an employee sustains a lost time injury or develops a lost time illness.

Subcontractor Requirements

Subcontractor personnel that are performing work activities involving contact with contaminated material shall certify that their employees have successfully completed a physical examination by a qualified physician or provide the medical clearance form provide by the physician. The physical examinations shall meet the requirements of 29 CFR 1926.65 and 29 CFR 1910.120.

Medical Records

Medical and personal exposure monitoring records will be maintained according to the requirements of 29 CFR 1926.65 and 29 CFR 1910.120 and will be retained for a minimum of 30 years. The confidentiality of employee medical records shall be maintained. The written medical opinion from the occupational physician will be kept in site files.

Medical Restrictions

When a medical care provider identifies a need to restrict work activity, the terms of the restriction will be discussed by the employee and the SSO. Every attempt will be made to keep the employee working, while not violating the terms of the medical restriction.

12.0 Record Keeping and Reporting

Proper record keeping and data management are essential in the implementation of this HASP. The forms associated with the record keeping and data management requirements shall be completed in an accurate, timely fashion and appropriately filed. The proper completion of H&S forms is the responsibility of the Site Supervisor/SSO. Subcontractors will also be responsible for keeping a copy of the forms pertaining to their activities. A copy of all pertinent H&S forms and logs are provided in Appendix A.

12.1 Daily Safety Forms and Logs

The SSO will maintain and complete a daily log for each day's work. The daily log will document each day's H&S activities in sufficient detail for future reference as needed. The following forms and logs (Appendix A) will be completed daily as applicable:

- Site Entry Log
- Daily Tailgate Safety Meeting Log
- Heavy Equipment Daily Inspection
- Intrusive Activities Permit

12.2 Daily Safety Report

The SSO will record H&S activities and data, not otherwise captured in daily logs or forms, in a field log book. A brief summary of safety issues, along with H&S logs and forms completed during the day, will be included as part of the Daily Quality Control Report (DQCR).

12.3 Safety Inspections

The SSO will inspect the site daily and identify areas of concern or ideas for safety improvement. The Site Supervisor will also inspect site conditions and activities daily to identify changing conditions or potential hazards. Identified safety and occupational health deficiencies and suggested corrective measures will be brought to the attention of the Site Supervisor, PM, and/or SSO. Corrective actions will be documented as described in the CQCP, including the corrective action taken/proposed, responsible person, and the date the corrective action is to be completed. Follow-up inspections will be performed to verify that corrective actions or measures have been implemented. Significant findings during safety inspections will be included in the DQCR. Applicable inspection checklists are provided in Appendix A, including:

- Safety Equipment Daily Inspection Checklist
- Heavy Equipment Initial Inspection Checklist
- Heavy Equipment Daily Inspection Checklist

12.4 Accident Investigation and Reporting

Project personnel are required to **immediately** report all near misses, injuries, illnesses, and accidents to the Site Supervisor and SSO. The SSO shall immediately arrange appropriate medical care as required. Once medical care for the injured personnel has been assured, the SSO shall complete and submit the appropriate reports as soon as possible or with in 72 Hours. The reports that may be applicable include:

- Incident Investigation Report
- Supervisor's Employee Injury Report

All near misses, injuries, illnesses, and accidents shall be immediately investigated by on-site management personnel. The Site Supervisor/SSO will investigate the conditions contributing to the accident. They will document how the accident occurred and identify unsafe acts or conditions that occurred or existed at the time of the accident. Corrective actions will be determined and implemented to prevent the recurrence of the accident, and responsibility for implementation of corrective actions will be assigned. An Incident Investigation Report (Appendix A) will be prepared within two working days of the incident/accident. The report shall specify:

- Company name
- Name of person reporting
- Date and time of incident/accident
- Location of incident/accident
- Summary of incident/accident giving pertinent details, including the field activity in progress at the time of the incident/accident
- Cause of the incident/accident
- Casualties
- Details of chemical hazards or contamination
- Estimated property damage, if applicable
- Nature of damage, effect on schedule
- Action taken to ensure safety/security

The final report and required forms will be completed within five days of the incident. In the event that an accident results in an employee being sent to a doctor, a release will be obtained on the date of treatment indicating one of the following conditions:

- Employee not fit for duty
- Employee fit for light duty
- Employee fit for duty.

A copy of this release shall accompany the accident report.

13.0 References

Final Erie County Conservation League (ECCL) Firing Range Site Investigation Report, National Aeronautics and Space Administration, Plum Brook Station, Sandusky, Ohio, by Leidos, dated March 29, 2018

National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Coast Guard, and U.S. Environmental Protection Agency (USACE et al.), 1985 *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH Publication No. 85-115, October 1985.

Site-Specific Health & Safety Plan, Construction, Maintenance, Environmental, and Testing Services (COMETS), Contract No. 80GRC018C0022, Submitted by Firelake-Arrowhead NASA Services, Submitted to NASA Glenn Research Center, May 2018.

Title 29 Code of Federal Regulations (CFR) Part 1910, *Safety and Health Regulations for General Industry*.

Title 29 Code of Federal Regulations (CFR) Part 1926, *Safety and Health Regulations for Construction*.

U.S. Army Corps of Engineers (USACE), *Safety & Health Requirements Manual*, EM 385-1-1, November 2014.

U.S. Army Corps of Engineers, *Safety and Occupational Health Document Requirements for Hazardous, Toxic and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OWE) Activities,* Appendix A, ER 385-1-92, May 2007.

TABLES

Table 2-1
Safety and Health Responsibilities

Name	Telephone Number(s)	S&H Responsibility
Mr. Scott Siegwald, CIH, CSP	(913) 814-9994 office (913) 461-3804 cell	Arrowhead Health and Safety Officer
Mr. Josh Phillips	(515) 961-8000 Office (515) 577-8503 Cell	Arrowhead Program Manager
Mr. Jeremy Soenen	(515) 961-8000 office (515) 664-7308 cell	Arrowhead Project Manager
Michael Britsch, CIH, CSP	(515) 961-8000 Office (515) 664-7537 Cell	Arrowhead Site Safety Officer
Mr. Dirk Doege	(515) 961-8000 Office (567) 274-1557 Cell	Arrowhead Alternate Site Safety Officer
Michael Britsch, CIH, CSP	(515) 961-8000 Office (515) 664-7537 Cell	Asbestos Hazard Evaluation Specialist and Air-Monitoring Technician
Mr. Dirk Doege	(515) 961-8000 Office (567) 274-1557 Cell	Asbestos Hazard Abatement Specialist
Mr. Jaime Gutierrez	(515) 961-8000 Office	Asbestos Hazard Abatement Specialist
Ms. Mercedes Dahler	330-677-0785 Office	Asbestos Project Designer

Table 4-1
Summary of Site Hazards

Hazard	Description
Chemical exposure (site contaminants)	Potential for exposure to COCs present in the piles of sand blasting grit (primarily lead) during activities that generate COC-laden dust (excavation, stabilization, and loading). Primary routes of entry include inhalation and dermal contact.
Chemical exposure (operational chemicals)	Potential for exposure to operational chemicals (including fuels, lubricants, and stabilization agents) during use and storage. Primary routes of entry include inhalation, ingestion, and dermal contact.
Asbestos fiber exposure	Potential for inhalation of asbestos fibers and dispersing asbestos fibers beyond the current extent or off site.
Dust	Potential for inhaling nuisance dust during field activities, including excavation work, miscellaneous construction work, soil load-out, hauling, and site restoration.
Noise	High noise levels anticipated during activities involving the operations heavy construction equipment, including mechanical excavation, stabilization, load-out, miscellaneous construction, backfilling, and site restoration.
Eye injury	Hazards to the eye include the potential for: • Projectiles (chips, sparks, and other debris) from construction activities. • Emission of dust, fumes, and exhaust gases. • Liquid splashes from the use of operational chemicals. • Heat and extreme light/glare from welding and cutting.
Slips, trips, falls	Potential for slips, trips, and falls from general site hazards, including: • Slippery surfaces • Obstruction in walkways (i.e. power cords, hoses, small tools) • Uneven surfaces • Poor lighting • Use of ladders
Fire	Potential for fire from the use and storage of flammable liquids and gases, hot work activities (welding and cutting), and generation of sparks.
Operation of small equipment and power tools	Potential for the following hazards associated with the operation of small equipment and tools: • Contact with the point-of-operation (i.e. drill bit, saw blade) • Impact from projectiles (i.e. cuttings, sparks) during use • Damaged or faulty equipment/tools • Accidental activation • Excessive vibrations • Awkward posture during use
Operation of heavy equipment	Major project hazard, due to the operation of numerous pieces of equipment on-site. Potential for hazards from the following conditions: • Contact with moving parts of equipment (i.e. belts, chains, hoist) • Danger zone created by swing radius of equipment • Maneuvering equipment within/around obstructions, tight spaces, and other equipment • Moving equipment near workers, including the “crushing zone” created when workers are positioned between equipment and

Hazard	Description
	fixed/stationary object • Operating equipment near overhead power lines
Electrical	Potential for electrical shock and fires from the following: • Contact with energized appurtenances at the site • Improper grounding • Work near overhead and below-ground power and communication lines
Hazardous energy	Potential for the unexpected release of hazardous energy, such as: • Breaching live utility lines during intrusive activities. • Unexpected startup of equipment during maintenance and/or change out of tooling. • Hazards associated with pressure vessels.
Intrusive activities	Potential for inadvertently breaching underground utility lines during intrusive posthole excavation or post driving work.
Material handling	Potential hazards with regards to lifting and handling of materials, including: • Back injury from improper lifting technique • Contact with sharp or jagged edges • Dropping materials that are slippery from water, oil, or grease
Contact with hot items	Potential for burns due to contact with hot equipment (i.e. exhaust pipes, steam sprayer, and generators).
Operation of motor vehicles / traffic control	Hazards associated with the operation of motor vehicles, including vehicle accidents, injury to pedestrians, damage to property, and lost loads during transport. Also includes traffic control hazards associated with movement of work vehicles through Plum Brook Station; transport of contaminated soil from the excavation area to the landfill; and transport of backfill from the source to the site.
Heat stress	Potential heat-related illnesses from working at high temperatures in an outdoor, summer environment.
Cold stress	Potential cold-related illnesses from working at low temperatures in an outdoor, winter environment.
Bloodborne pathogens	Potential for exposure to blood.
Environmental hazards	Potential for encountering poisonous plants, insects, snakes, spiders, etc.

Table 5-1
Air and Noise Monitoring Action Levels

Parameter	Equipment	Action Level (Engineering Controls)*	Action Level (Upgrade PPE)
Dust in areas disturbed by excavation and associated activities	Visual Observation	Visible Dust	Level D - Modified
Dust from sand blasting grit in breathing zone of on-site workers	Visual Observation	Visible Dust	Level C
Asbestos fibers in breathing zone of on-site workers	DustTrak™	0.1 fibers/cm^3	Level C
Noise	Sound Level Meter	82 dB	82 dB

Table 6-1
Levels of Protection and Air Monitoring Parameters

Field Activity	Initial Level of Protection (PPE)*	Upgrade Level of Protection (PPE)	Special Requirements	Air Monitoring Parameters
Site preparation	Level D	Level D - Modified	Hearing Protection**	Dust
Impacted soil excavation	Level D	Level D - Modified	Hearing Protection**	Dust
Impacted soil loading	Level D	Level D - Modified	Hearing Protection**	Dust
CDP Asbestos abatement	Level C	Level C	Hearing Protection**	Asbestos
Sand blasting grit excavation	Level C	Level C	Hearing Protection**	Lead
Sand blasting grit stabilization	Level C	Level C	Hearing Protection**	Lead
Sand blasting grit loading	Level C	Level C	Hearing Protection**	Lead
Backfilling and site restoration	Level D	Level D - Modified	Hearing Protection**	Dust
Project administration	Level D	Level D - Modified	Hearing Protection**	N/A
Mobilization / demobilization	Level D	Level D - Modified	Hearing Protection**	N/A
Personnel travel to/from site	Level D	Level D - Modified	Hearing Protection**	N/A
Construction oversight	Level D	Level D - Modified	Hearing Protection**	N/A
Equipment cleaning and maintenance (spray washer)	Level D	Level D - Modified	N/A	N/A

* Level D is the minimum level of protection for construction activities. Asbestos abatement activities will be conducted at Level C. Excavation, stabilization, and loading of the sand blasting grit will start at level C and personal air samples will be collected and analyzed to provide data to determine the appropriate level of protection. The level of protection will be adjusted as appropriate based on the personal air sampling results

** As necessary, based on activity or noise levels

Table 7-1
Emergency Response Contacts and Telephone Numbers

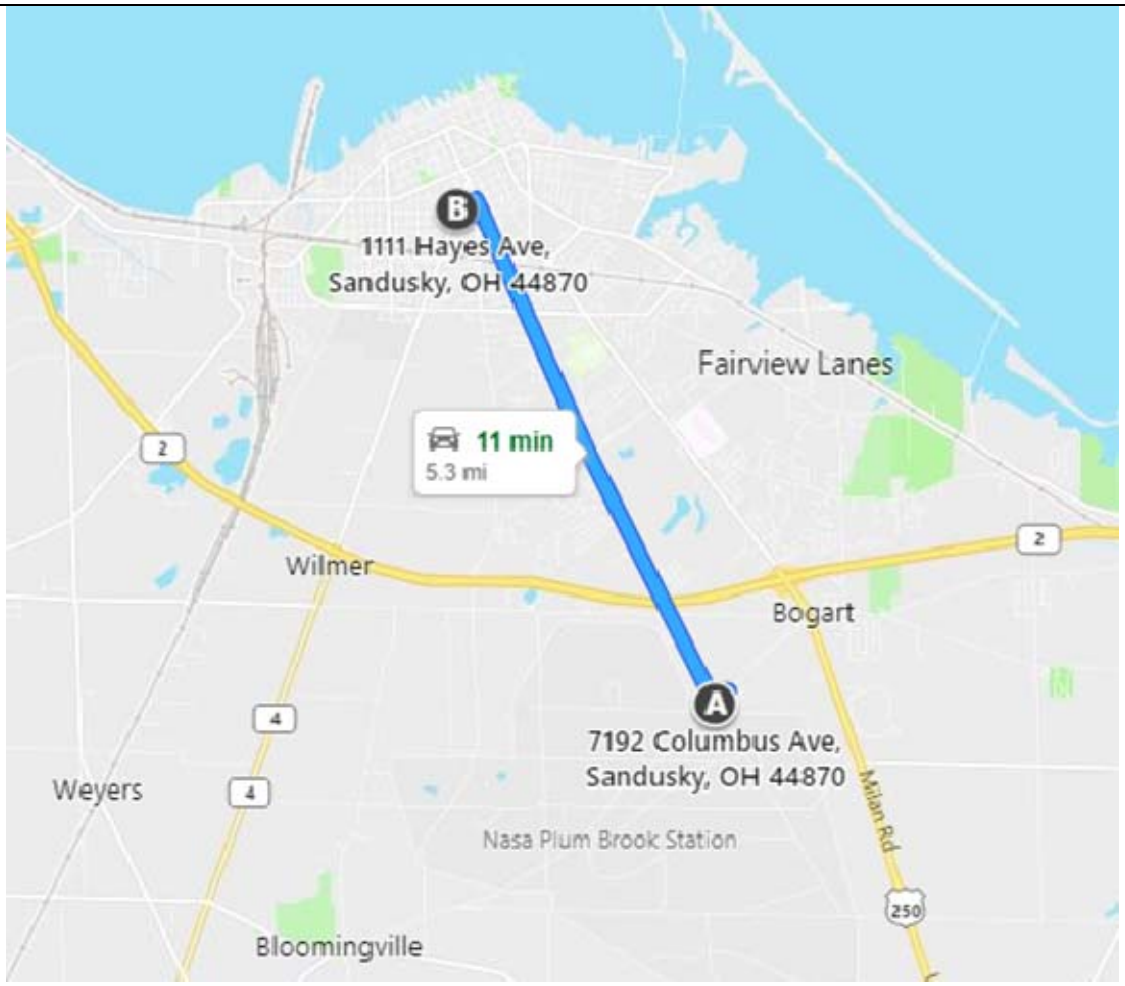
Contact	Telephone Number
Fire Department (NASA PBS Dispatcher)	419-621-3222 (Cell Phone) 911 (NASA Phone)
Police Department (NASA PBS Dispatcher)	419-621-3222 (Cell Phone) 911 (NASA Phone)
EMS, Paramedics (NASA PBS Dispatcher)	419-621-3222 (Cell Phone) 911 (NASA Phone)
Firelands Regional Medical Center 1111 Hayes Avenue Sandusky, OH 44870	419-557-7455
Poison Control	800-366-8888

The PBS Utility Surveyor will verify NASA underground drawing records

Ohio One-Call Service (Ohio811), 1-800-362-2764 or 811

FIGURES

NASA Plum Brook Station FR 5 & CDP Sandusky, Ohio	**1-1 Site Map**



↑	1.	Head **northeast** on **Taylor Rd** toward Clark Rd / CR-120	0.2 mi
↰	2.	Turn **left** onto **Clark Rd / CR-120** Pass BP/BP in 2.4 mi	4.7 mi
↰	3.	Turn **left** onto **Campbell St**	0.1 mi
↱	4.	Turn **right** onto **Tyler St**	0.2 mi
↱	5.	Turn **right** onto **OH-4 / Hayes Ave**	223 ft

NASA FR 5 & CDP **Sandusky, Ohio**	**3-1 Hospital Route Map**

Appendix A

Health and Safety Forms

DAILY TAILGATE SAFETY MEETING

Date: _____ Client: _____

Location: _____ Job No.: _____

Meeting conducted by: _____

Details of safety meeting presented (use back of sheet if necessary):

Level of Protection:

Contaminants:

Physical Hazards:

Other:

Permits/Clearances Required:

ATTENDEES:

Printed Name:	Signature:

Printed Name:	Signature:

HEALTH AND SAFETY PLAN (HASP)
ACKNOWLEDGMENT FORM

I have reviewed, understand, and agree to follow the HASP for:

Project Name: _____ Project Number: _____

Printed Name	Signature	Company	Date

HASP AMENDMENT FORM

Amendment Number: _____ Date Effective: _____

Date: _____ Client: _____

Location: _____ Job No.: _____

Type of amendment:

- ☐ Change of text in SSHP
- ☐ Addition of form
- ☐ Addition of new activity and hazard analysis
- ☐ Deletion of form
- ☐ Other:

Details of amendment (attach appropriate document/documentation):

Approved by: _____ Date: _____
Project Manager

Approved by: _____ Date: _____
Site Safety Officer

HEAVY EQUIPMENT DAILY INSPECTION CHECKLIST

Project Name:	Project Number:	Client:
Project:	Contractor:	Contract No.: Subcontract No.
Equipment Description:	Model No.(s):	Serial No.(s):

CHECKLIST	OK	Not OK	N/A
1. Fuel			
2. Lubrication, engine oil			
3. Brakes			
4. Tires, tracks			
5. Air systems			
6. Horn			
7. Safety guards			
8. Mirrors			
9. Steering mechanism			
10. Cooling water			
11. Operation controls			
12. Lights and reflectors			
13. Windshield wipers, defroster			
14. Backup alarm			
15. Fire extinguisher			
16. Seat belts			
17. Filters (air, oil, fuel, hydraulic)			
18. Lift arm and bucket			
19. Grab handles			
20. Steps (tread, no slip hazards)			
21. Parking brake			
22. General condition			
Remarks:			

Certification

_____ _____

Signature of Certified Operator Date

HEAVY EQUIPMENT INITIAL INSPECTION CHECKLIST

Project Name:	Project Number:	Client:
Project:	Contractor:	Contract No.: Subcontract No.
Type and Make of Equipment	Model	Serial No.

CHECKLIST	Yes	No	N/A
1. Are adequate and serviceable fire extinguishers provided? (09.E.01 through 09.E.03)			
2. Are all wire rope cables in good condition? (15.B.01 and 15.B.02)			
3. Are wire rope, sockets, splices, thimbles, and clips and adequate and properly applied? (15.B.03 through 15.B.08)			
4. Are hooks, safety nooks, shackles, rings, etc., in good condition? (?)			
5. Are necessary platforms, foot-walks, etc., provided? (22.A.01 and 22.A.02)			
6. Are access steps, platforms, etc., provided with non-slip surfaces? (21.A.13)			
7. Is operator protected against the elements, falling or flying objects, swinging loads, and similar hazards? (16.B.10, 16.B.11, and 21.A.11)			
8. Are all glasses in operator's compartment safety glass and in good repair? (16.B.10 and 18.A.07)			
9. Is suitable access provided at lubrication points? (16.B.13)			
10. Do all modifications, extensions, replacement parts, and/or repairs to equipment maintain the same factor of safety as original designed equipment? (16.A.18)			
11. Are drums for load lines equipped with at least one positive holding device, applied directly to the motor shaft or some part of the train gear? (?)			
12. Is there sufficient cable to allow three full wraps of cable on drums at all working positions? (16.C.10)			
13. Are adequate headlights, taillights, and turn signals provided and are they in proper operating condition (16.A.07 and 18.A.02 through 18.A.04)			
14. Are all approved brakes on wheeled equipment and in good operating condition? (16.A.07, 18.A.02, and 18.A.05)			
15. Do windshields have wipers in proper operating condition? (16.A.07, 18.A.02, and 18.A.06)			

CHECKLIST	Yes	No	N/A
16. Are rear view mirrors provided? (18.A.02 and 18.A.06)			
17. Are operating levers equipped with latch and other devices to prevent accidental starting? (18.A.10)			
18. Is engine equipped with power-operated starting device in operative condition? (18.A.06)			
19. Do all pressure vessels have valid inspection certificates? (20.A.03)			
20. Are reverse signal alarms on equipment? (16.B.01)			
21. Are belts, gears, shafts, electrical contacts, etc., adequately guarded? (16.B.03)			
22. Are all hot pipes and surfaces suitably guarded? (16.B.03)			
23. Are fuel tanks located so that spills or overflows will not come in contact with engine or exhaust? (16.B.04)			
24. Are exhausts and discharges so directed as not to endanger workmen or obstruct view of operator? (16.B.05)			
25. Are guards in place on equipment with drop type skip pans? (16.B.03)			
26. Are adequate seats provided for all riders? (16.A.07 and 18.C.01)			
27. Are tires in serviceable condition? Are testing/inspections documented? (18.A.02)			
28. Are steering linkage and tie rod in good operating condition? Are testing/inspections documented? (18.A.02)			
29. Are dump bodies provided with holding device or other suitable device for locking body in raised position? (18.A.10)			
30. Are tailgate dumping devices so arranged that operator will be in the clear while dumping loads? (18.A.10)			
31. Are trip handles provided on tailgates to facilitate handling? (18.A.10)			
32. Is the air hose free from leaks or defects? (? 20.B.03)			
33. Are safety lashing for quick make-up type connections provided? (20.A.16)			
34. Is an acceptable spark arrestor installed and working? (?)			
35. Do heating devices comply with references? (?)			
36. Does welding equipment comply with code requirements? (10.A.10 and 10.E.01)			
37. Is equipment adequately grounded? (10.E.04 and 10.E.07)			
38. Do electrical components comply with code? (10.E.01)			
39. Are required pressure, temperature, or relief gages and valves installed and operable? (20.A.10 through 20.A.13 and 20.B.02)			
40. Are approved seat belts and roll-over protection provided? (16.B.08, 16.B.12, and 18.B.02)			
41. Is recommended preventive maintenance being followed? (16.A.08 and 18.A.02)			

CHECKLIST	Yes	No	N/A
42. Do helicopter cranes meet construction requirements (16.J.01)			
43. Does hydraulic equipment meet special safety conditions (? 11.H.08, 11.H.09, and 13.A.09)			
44. Is concrete equipment fitted with adequate safety devices? (27.A.04)			
45. Are elevating and rotating work platforms in conformance with ANSI A92.2? (22.K.01)			
46. Do conveyors, cableways, and related equipment conform to ANSI 320.01? (?)			
47. Are pile drivers equipped with all appropriate safety devices? (16.L)			
48. Do material hoists conform to ANSI A10.5? (16.K.01)			
49. Do passenger elevators conform to ANSI A10.4? Do temporary hoists conform to ANSI A10.22: (21.H)			
50. Do hand and power tools comply with applicable ANSI standards (13.A through 13.G)			
51. Is high voltage sign posted? (?)			
52. Is equipment fitted with positive stops for rotation when near power lines? (11.E and 16.D.06)			
53. Is there any visible evidence of damage to boom? (16.C.12 and Appendix H)			
54. Is the boom position indicator operating and visible to operator? (16.D.01 and 16.D.04)			
55. Have all operators had a current physical examination? (1.C and 16.C.04)			
56. Is braking equipment capable of effectively braking, lowering, and safely holding a load of at least the full rated load as required? (?)			

Remarks:

Certification: I hereby certify that this item of equipment is in good operating condition and that it meets all above requirements except as noted in the remarks.

_____ _____

Signature of Competent Mechanic Date

_____ _____

Signature of Superintendent/Quality Control Engineer Date

INCIDENT INVESTIGATION REPORT

*** MUST BE COMPLETED WITHIN 72 HOURS ***

Project Name: _____ **Project Number:** _____

Investigation Date: _____ **Date of Incident:** _____

Employee Name: _____

Supervisor Name: _____

Location of Incident: _____

☐ **Incident Classification**

Injury	☐ First Aid	**Vehicle**	☐ Chargeable	**DOT**	☐ DOT Vehicle
	☐ OSHA Recordable		☐ Non-Chargeable		☐ DOT Reportable
	☐ Lost Workday				
	☐ Restricted Workday	**Near Miss**	☐	**General Liability**	☐

☐ **Description (Provide facts, describe how incident occurred, provide diagram (on back) or photos)**

☐ **Analysis 1 (What unsafe acts or conditions contributed to the incident?)**

☐ **Analysis 2 (What systematic or management deficiencies contributed to incident?)**

☐ **Corrective Action(s) (List corrective action items, responsible person, scheduled completion date)**

☐ **Witnesses (Attach statements or indicate why unavailable)**

Investigated By **Print Name:** _____ **Signature:** _____ **Date:** _____

Project Manager **Print Name:** _____ **Signature:** _____ **Date:** _____

(Attach Additional Pages if Needed)

INTRUSIVE ACTIVITIES PERMIT

Permit Number: _____

Project Name: _____ **Project Number:** _____

Clearance is permitted for intrusive activity at: _____

The attached map indicates the limits of the permitted intrusive activity. The area __has __has not been staked or clearly marked.

Utilities Locate Service Reference Number: _____

Limits of Work Permitted		
Description of permitted work:		
Specific location of permitted work:		
Precautions or comments:		
Date Clearance Permitted:	**Date Clearance Terminated:**	
Request Initiated By:	**Phone No.**	**Organization**

Permission to proceed with intrusive activity granted:

_____ _____

Field Supervisor/Project Manager Date

Permission to proceed with intrusive activity granted:

_____ _____

Site Safety and Health Officer Date

I agree to perform work within the limits of this permit:

_____ _____

Supervisor/Foreman/Contractor Date

SAFETY EQUIPMENT DAILY INSPECTION CHECKLIST

Project Name:	Project Number:	Client:
Project:	Contractor:	Contract No.: Subcontract No.

CHECKLIST	Yes	No	N/A
1. Are adequate and serviceable fire extinguishers provided?			
2. Are fire extinguishers present at assigned locations?			
3. Is access to each fire extinguisher clear of obstructions?			
4. Are fire extinguishers fully charged; are locking pins in place?			
5. Are eye wash stations present at assigned locations?			
6. Are eye wash stations filled with water and in sanitary condition?			
7. Is access to each eye wash station clear of obstructions?			
8. Are first aid kits present on site?			
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?			
10. Are emergency spill supplies/kits available on site?			
11. Have air monitoring instruments been properly calibrated?			
12. Is the required PPE available on site?			
13. Has the PPE been inspected for defects or damage?			
14. Are flammable chemicals (not in use) stored in an approved cabinet?			
15. Are Material Safety Data Sheets available on site for operational chemicals?			
16. Is a bloodborne pathogens exposure kit available on site?			
17. Is cold, potable water available to employees?			
18. Are ear plugs or muffs available to personnel?			
Remarks:			

Certification

_____ _____

Signature of Site Safety & Health Officer Date

SITE ENTRY LOG

Date:_____ Client: _____

Location: _____ Job No.: _____

Name	Company	Time In	Time Out

SUPERVISOR'S EMPLOYEE INJURY REPORT

This report is to be initiated by the employee's supervisor. Please answer all questions completely. This report must be forwarded to the appropriate health and safety representative within 24 HOURS of the injury/illness.

EMPLOYEE

Injured Name _____ Sex _____ S.S. No. _____ Birth Date _____

Home Address _____

City _____ State _____ Zip _____ Phone ( ) _____

Job Title _____ Hire Date _____ Hourly Wage _____

SUPERVISOR

Date of Incident _____ Time _____ Time Reported _____ To Whom? _____

Project/Location Name _____ Address _____

Project No. _____ Time Shift Began _____ Did the Employee Leave Work ☐ No ☐ Yes When _____

Has employee returned to work? ☐ No ☐ Yes When _____ Did employee miss a regularly scheduled shift? ☐ No ☐ Yes

Doctor/Hospital Name _____ Address _____

Witness Name(s) _____ Statement Attached? ☐ No ☐ Yes

Nature of Injury _____ Exact Body Part _____

Medial Attention: ☐ None ☐ First Aid On Site ☐ Doctor's Office ☐ Hospital ER ☐ Hospitalized

Job Assignment at Time of Incident _____

Describe Incident _____

What Unsafe Condition and/or Act Contributed to the Incident? _____

What Corrective Action Has Been Taken to Prevent Recurrence? _____

Supervisor _____ (Print) _____ Signature _____ Date

MANAGER

Comments on Incident and Corrective Action _____

Project/Location Mgr. _____ (Print) _____ Signature _____ Date

HEALTH AND SAFETY

Concur With Action Taken ☐ No ☐ Yes Remarks _____

OSHA Classification:

☐ First Aid ☐ Recordable, No Lost/Restricted Workdays ☐ Recordable, Lost Workdays ☐ Recordable, Restricted Activity ☐ Fatality

Days Away From Work _____ Days Restricted Work _____

All injuries/illnesses requiring outside medical treatment must be reported to Corporate Human Resources Office at (913) 814-9994.

Workers' Compensation Claim Number (if applicable) _____

Health and Safety Representative:

_____ (Print) _____ Signature _____ Date

Appendix B

Activity Hazard Analyses (AHAs)

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

Activity/Work Task: **General Site Work and Oversight Activities**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 11/01/18	
Prepared by (Name/Title): Carl Shaw	
Reviewed by (Name/Title): Jeremy Soenen	
Notes: (Field Notes, Review Comments, etc.)	

Call NASA PBS Emergency Dispatch for all emergencies
419-621-3222

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	RAC
General site work, set-up, preparation and administration activities, including, but not limited to: • Equipment delivery, receipt, and inspection • Layout site work zones • Installation temporary facilities • Prepare equipment decontamination area • Decontaminate equipment • Site inspection and oversight activities • Clear utilities • Waste Disposal • Removal of trailers and conex boxes	General	**General:** • Wear protective leather gloves as necessary • Wear safety glasses • Wear hard hats • Wear steel-toed footwear • Wear high-visibility construction vests • Wear hearing protection as necessary when ambient noise levels become elevated • Ensure that fire extinguishers are available to personnel • Provide fire extinguishers (at least 10# ABC) inside site office trailer • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklists contained in HASP) • Smoking shall only be permitted in approved areas • Place signs or barricades to protect overhead power lines • Clear utilities before excavating for rock entrance	**L**
	Heavy lifting	**Heavy Lifting**:	**L**

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

• Office trailer removal • Removal of landscape supplies		• No individual employee is permitted to lift any object that weighs over 40 pounds • Proper lifting techniques shall be used • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit	
	Vehicular traffic	**Vehicular Traffic**: • Personnel working on or near roads shall wear high visibility vests and only remain on road long enough to complete work. • Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic. • Implement traffic control provisions – i.e. barricades, signs, lane closures, flagmen, etc. – as necessary for the given work area • Do not drive or generate dust in areas of the site that are not along the perimeter of the site where the fence is being installed	**L**
	Chemical exposure (general)	**Chemical Exposure (General)**: • Physical contact with contaminated media or hazardous chemicals shall be avoided • Personal protective equipment use is required when contact is possible/probable • Personnel who sustain skin contact shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water using a portable eye wash station) and report the incident to the SSHO	**L**
	Fire	**Fire**: • Smoking shall not be permitted in regulated areas • Fire extinguishers shall be available on-site	**L**
	Slips, trips, falls	**Slips, trips, and falls:** • Implement good housekeeping practices – keep the area free of materials, scrap, and debris • Electrical extension cords and electrical wiring shall be kept clear of walking and working areas and/or covered or otherwise secured	**L**

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

		• Clean up spills immediately • Provide adequate illumination • Do not jump from equipment or elevated surfaces	
	Work from heights (ladders and lifts)	**Work from heights (ladders and lifts):** • Maintain three points of contact when ascending/descending ladders • Face the ladder, and use at least one hand to grasp the ladder when climbing • Don't carry objects while climbing • Don't overreach from a ladder • Straight or extension ladders shall be 1 foot out for every 4 feet up • For extension ladders, provide at least 3 ft of extension above the top point of support • Ensure ladder footings are secure • Inspect ladders prior to each use • Ladders found to be defective shall be taken out of service and tagged accordingly	**L**
	Hand injuries	**Hand Injuries**: • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards.	**L**
	Insect/animal bites	**Insects / Animal Bites**: • Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to limit insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms	**L**
	Contact dermatitis and poison ivy	**Contact Dermatitis**: • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants	**L**

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

		• Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Cover vegetation with plastic (Visqueen) where survey position raises exposure potential • Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions • Identify workers who are known to contract poison ivy	
	Cold stress	**Cold Stress** • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	**L**
	Heat stress	**Heat stress:** • Acclimatize workers to hot working conditions • Provide plenty of liquids to replace the body fluids lost by perspiration • Provide personal cooling devices • Conduct strenuous field operations in the early morning if possible • Rotate personnel to various job duties • Establish adequate work/rest cycles • Monitor heart rate and/or body temperature as appropriate	**L**
	Miscellaneous site activity	**Miscellaneous Site Activity**: • When possible, personnel shall avoid areas that have hazardous activities in progress • When access must be gained in busy areas, the foremen of the activities in the area shall be notified prior to surveying in the area • High visibility vests shall be worn when working in areas with high vehicular or heavy equipment traffic	**L**

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
Personal protective equipment (PPE) as listed below • Leather gloves • Hard hats • Steel-toed footwear • Fire extinguisher • High visibility vests • Hearing protection • Tyvek pants or coverall (Level D-Modified and Level C) • Half-face air purifying respirator (Level C)	• Inspect the job site daily for appropriate PPE and safety equipment • Inspect PPE prior to use	• Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable SDSs. • Heavy equipment operators shall be properly trained

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

General Site Work and Oversight Activities
Activity Hazard Analysis (AHA 01)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

Activity/Work Task: **Excavation of Contaminated Material**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 01-20-2020	
Prepared by (Name/Title):Carl Shaw	
Reviewed by (Name/Title): Jeremy Soenen	

Notes: (Field Notes, Review Comments, etc.)

Call NASA PBS Emergency Dispatch for all emergencies
419-621-3222

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
• Excavating shallow soil, pond and ditch sediment, firing range backstop berms, and construction debris piles • In some cases, direct loading the excavated material into dump trucks for transport and disposal • In other cases, piling the excavated material for on-site treatment to bring TCLP levels below the hazardous threshold	**General Hazards**	**General hazards:** • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear safety-toe footwear. • Wear hearing protection as necessary. • Wear high-visibility construction vests. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas.	
	Excavation hazards (general)	**Excavation hazards (shallow excavations < 4 ft bgs):** • Obtain NASA's GRC Excavation Permit before starting any excavation activity	**L**

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

		• Document the existence of underground pipes, electrical equipment, telephone, gas lines, etc. prior to excavating. • Operations will be suspended and ignition sources eliminated if a hazardous atmosphere is suspected or confirmed.	
	Overhead power lines	**Overhead power lines:** • Place signs or barricades to protect overhead power lines • Equipment operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. • In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by 4 inches for every 10 kV over 50 kV. If it is necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard: (1) the line will be de-energized and grounded, or (2) an insulating barrier will be erected to prevent contact with the line. • During operations near overhead power lines, one person involved in the operation (or the SSHO) will be assigned the duty of "spotter" to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the spotter will be positioned "so as to be able to visually monitor the clearance between the equipment and power lines."	**L**
	Intrusive activities	**Intrusive activities:** • Before any intrusive activity begins, positive steps will be taken to determine the locations of underground utilities. • The Arrowhead designee shall contact Ohio 811 to notify	**L**

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

		them of intent to initiate intrusive activity at the property location. This notification is to be made a minimum of two working days prior to the initiation of intrusive activity. • The Arrowhead designee will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint). • Potholing will be completed to verify the location and depth of marked utilities at appropriate intervals and at locations where known utilities are observed to be running into the ground. • Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines.	
	Heavy construction equipment	**Heavy construction equipment:** • Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment. • Wear safety belts. • Unless the operator gives an "all clear" signal, ground personnel are not permitted to approach heavy construction equipment in operation. • Ground personnel shall not position themselves between heavy construction equipment and a stationary object. • Ground personnel working near heavy construction equipment shall wear high visibility vests. • Inspect equipment when it arrives and daily before starting work. • Equipment found to be defective shall be taken out of service and tagged accordingly. • Keep loose clothing and hair away from moving parts of heavy equipment, and avoid wearing jewelry.	**L**

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

		• Operate equipment in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals. • Shut down and lock out heavy equipment to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed. • No guard or device will be removed from machinery or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of the work and before power is restored.	
	Open excavations	**Open excavations:** • Open trenches will be inspected by the qualified person daily and whenever conditions change • Open trenches (in progress of being excavated) shall be covered, secured, and barricaded when work is not in progress.	**L**
	Dust	**Dust**: • Action level for respirable dust for Firing Range 5 and the CDP is **visible dust** (see Section 5.1 of the HASP) • Personnel shall avoid working in elevated dust environments. • Personnel will stand up-wind of dust-generating activities • Dust monitoring procedures and action levels for dust can be found in the HASP. Level of PPE may be modified by SSO based on site conditions • Minimize contaminated soil free-fall from excavation equipment (e.g., excavators) • Spray water on exposed soil during excavation, taking care to avoid overspraying • Cover stockpiles with plastic sheeting • Spray water on haul roads	**L**

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

		• Suspend or restrict work activities when dust levels become elevated or when the wind speed is excessive	
	General Safety Hazards: • Fire • Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous plants • Weather • Heat stress • Cold stress	**Fire:** • Smoking is not allowed on site • Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB **Heavy Lifting:** • Proper lifting techniques shall be used • No individual employee is permitted to lift any object that weighs over 40 pounds • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit **Slip / Trip / Fall:** • Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials	**L**

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

		• Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:** • Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to limit insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants • Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:** • Weather conditions will be monitored. • Operations will cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool / shaded area **Cold Stress**: • Follow procedures outlined in the SSHP	

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

		• Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
• Excavator • Wheel loader • Skid steer loader • Off-road dump trucks • On-road dump trucks • Personal protective equipment (PPE) • Work gloves • Hard hats • Safety-toe footwear • Safety glasses • High visibility vests • Hearing protection, as needed • Eyewash station • Fire extinguisher • Hand tools • Air monitoring (aerosol monitor) • Tyvek pants or coveralls (Level D-Modified or Level C) • Half-face air purifying respirator (Level C)	• 40-Hour HAZWOPER training and associated annual 8-Hour updates • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Arrowhead Emergency Response Plan, including facility-specific evacuation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable SDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required	• Intrusive activities clearance request form completed • Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect PPE prior to use • Inspect/mark areas of intrusive work for the presence of underground utility lines • Inspect heavy construction equipment upon receipt • Inspect heavy equipment daily • Inspect conditions associated with trenches/excavations daily

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are sanitation facilities (i.e. hand wash) and supplies available on site?
19. Are toilet facilities clean?

Excavation of Contaminated Material
Activity Hazard Analysis (AHA 03)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Decontamination
Hazard Analysis (AHA 04)

Activity/Work Task: **Decontamination**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 05-15-19	
Prepared by (Name/Title):Carl Shaw	
Reviewed by (Name/Title): Jeremy Soenen	
Notes: (Field Notes, Review Comments, etc.) **Call NASA PBS Emergency Dispatch for all emergencies** **419-621-3222**	

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
Decontamination, including: • Decontamination of personnel including doffing and disposal of disposable PPE, washing non-disposable PPE, washing face and hands, and hygiene. • Decontamination of equipment including dry decontamination by removing impacted soil from bucket, tracks, etc. using a shovel and broom/brush; and wet decontamination using water with non-phosphate detergent and a brush.	**General Hazards**	**General hazards:** • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear safety-toe footwear. • Wear hearing protection as necessary. • Wear high-visibility construction vests. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas.	
	Decontamination (personnel)	**Personnel decontamination:** • Establish a contaminant reduction zone (CRZ) between	

Decontamination
Hazard Analysis (AHA 04)

		the exclusion zone and the support zone. Equip the CRZ with decontamination items necessary for the task (e.g., boot wash, garbage bag, hand wipes, etc.) • Remove PPE in the following order: disposable coverall (if used), boots, gloves, and respirator (if used) • Dispose of disposable PPE items • Before removing gloves, wash soiled work boots with water and a brush as needed. A water filled pressurized spray tank can be used to provide water for the boot wash • Remove gloves and use hand wipes on hands and face as needed • Wash and rinse hands and face on a regular basis • Shower regularly • Launder work clothing regularly • Avoid distributing / transporting contaminated media to clean areas • Boot wash and rinse water will be dumped onto the ground and allowed to infiltrate	
	Decontamination (equipment)	**Equipment decontamination:** • Equipment used to excavate contaminated soil will be dry decontaminated using shovels and brooms prior to moving the equipment from a contaminated area to a clean area. • Perform wet decontamination prior to demobilizing equipment from the site • Perform wet decontamination prior to doing repair work to equipment • Wet decontamination will generally consist of spraying with a low volume, high pressure washer. • Control the placement of the power washer hose and lay hose out in a way to minimize obstructions or knots • Wash corner spaces at an angle to minimize back spray • Never aim nozzle towards people or yourself • Be aware of others working around the washing area	**L**

Decontamination
Hazard Analysis (AHA 04)

		• Never change washing tip while machine is running • Never use anything to secure the trigger in the 'ON' position • Do not perform other tasks while holding the pressure washer gun • In the event of a hose tangle, set the wand down while managing the hose • A "decontamination pad" will be constructed (using plastic sheeting, lumber, hay bales, etc.) at the support area to promote the collection / recovery of rise water. • At the conclusion the field work, all equipment will be thoroughly decontaminated prior to being returned to vendors. • The SSO or Site Supervisor will inspect all equipment leaving the site for adequacy of decontamination.	
	Dust	**Dust**: • Personnel will avoid working in elevated dust environments. • When possible, stand up-wing of dust generating operations such as dry decontamination. • Dust monitoring procedures and action levels for dust can be found in the HASP. Level of PPE may be modified by SSO based on site conditions • While performing dry decontamination, minimize material free-fall of contaminated soil from excavation equipment (e.g., excavator bucket) • Drive slowly while on the site to minimize dust generation • Suspend or restrict work activities when dust levels become elevated or when the wind speed is excessive	**L**
	General Safety Hazards: • Fire	**Fire:** • Smoking is not allowed on site	**L**

Decontamination
Hazard Analysis (AHA 04)

	• Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous plants • Weather • Heat stress • Cold stress	• Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB **Heavy Lifting:** • Proper lifting techniques shall be used • No individual employee is permitted to lift any object that weighs over 40 pounds • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit **Slip / Trip / Fall:** • Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:** • Review injury potential with workers	

Decontamination
Hazard Analysis (AHA 04)

		• Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to prevent insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants • Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:** • Weather conditions shall be monitored. • Operations shall cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool, shaded area **Cold Stress**: • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary	

Decontamination
Hazard Analysis (AHA 04)

		• Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
• Pressure washer • Personal protective equipment (PPE) • Rain suit • Waterproof gloves • Hard hats • Waterproof safety-toe footwear • Splash goggles or visor (as necessary) • High visibility vests • Hearing protection (as needed) • Eyewash station • Fire extinguisher • Air monitoring (dust monitor)	• 40-hour HAZWOPER training and 8-hour Refresher • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Arrowhead Emergency Response Plan, including facility-specific evacuation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable SDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required	• Intrusive activities clearance request form completed • Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect PPE prior to use • Inspect/mark areas of intrusive work for the presence of underground utility lines • Inspect heavy construction equipment upon receipt • Inspect heavy equipment daily • Inspect conditions associated with trenches/excavations daily

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?

Decontamination
Hazard Analysis (AHA 04)

12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are sanitation facilities (i.e. hand wash) and supplies available on site?
19. Are toilet facilities clean?

Decontamination
Hazard Analysis (AHA 04)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

Activity/Work Task: **On-site Treatment of Contaminated Material**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 01-20-2020	
Prepared by (Name/Title):Carl Shaw	
Reviewed by (Name/Title): Jeremy Soenen	
Notes: (Field Notes, Review Comments, etc.)	

Call NASA PBS Emergency Dispatch for all emergencies
419-621-3222

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
Treating previously excavated soil, sediment, and berm material that is hazardous, per TCLP analysis, by mixing with a powdered chemical to bring the TCLP level down to non-hazardous range prior to loading and transporting to the landfill for disposal. The mixing will be done using an excavator bucket to add the powdered chemical to the excavated material and then using the excavator bucket to stir the combined material until thoroughly mixed.	**General Hazards**	**General hazards:** • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear safety-toe footwear. • Wear hearing protection as necessary. • Wear high-visibility construction vests. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas.	
	Treatment hazards (general)	**Treatment hazards:** Personnel not need in treatment operations should stay out of the area when equipment is working. If it is necessary for ground	**L**

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

		personnel to enter the area, observe the following safety precautions: • Personnel needed to assist in hooking the bags of treatment chemical should make eye contact with the operator before approaching the area. • Use proper hand signals to communicate with the operator • Stay clear of Supersacks when they are being positioned and when the contents is being dumped onto the stockpile	
	Overhead power lines	**Overhead power lines:** If possible, perform treatment activities in areas of the site that do not have overhead power lines present. If treatment activities are performed in areas with overhead utilities, use the following precautions to protect overhead utilities: • Equipment operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. • In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by 4 inches for every 10 kV over 50 kV. If it is necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard: (1) the line will be de-energized and grounded, or (2) an insulating barrier will be erected to prevent contact with the line. • During operations near overhead power lines, one person involved in the operation (or the SSHO) will be assigned the duty of "spotter" to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the spotter will be positioned "so as to be able to visually monitor the	**L**

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

		clearance between the equipment and power lines."	
	Underground utilities	**Underground utilities:** If possible, conduct treatment activities in areas of the site that do not have underground utilities present. To endure that there are no underground utilities present, or if present, to protect any underground utilities present, conduct the following: • Before any intrusive activity begins, tank positive steps to determine the locations of underground utilities. • The Arrowhead designee shall contact Ohio 811 to notify them of intent to initiate intrusive activity at the property location. This notification is to be made a minimum of two working days prior to the initiation of treatment activity. • The Arrowhead designee will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint). • Potholing will be completed to verify the location and depth of marked utilities at appropriate intervals and at locations where known utilities are observed to be running into the ground. • Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines.	**L**
	Heavy construction equipment	**Heavy construction equipment:** • Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment. • Wear safety belts. • Unless the operator gives an "all clear" signal, ground personnel are not permitted to approach heavy construction equipment in operation. • Ground personnel shall not position themselves between heavy construction equipment and a stationary object.	**L**

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

		• Ground personnel working near heavy construction equipment shall wear high visibility vests. • Inspect equipment when it arrives and daily before starting work. • Equipment found to be defective shall be taken out of service and tagged accordingly. • Keep loose clothing and hair away from moving parts of heavy equipment, and avoid wearing jewelry. • Operate equipment in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals. • Shut down and lock out heavy equipment to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed. • No guard or device will be removed from machinery or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of the work and before power is restored.	
	Stockpiles	**Stockpiles:** • Cover stockpiled treatment chemicals with tarps or poly sheeting when not in use. Secure the tarp or poly sheeting with sandbags or similar • Cover the contaminated/treated material stockpile with tarps or poly sheeting when not in use. Secure the tarp or poly sheeting with sandbags or similar • Wear PPE when tarping the contaminated/treated material stockpile • Place adequate sandbags or similar weights around the perimeter of the tarp/poly sheeting and at any seams to minimize the chance that the tarp/poly sheeting will be blown off the pile during high winds	**L**

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

	Dust	**Dust**: • Action level for respirable dust for Firing Range 5 and the CDP is **visible dust** (see Section 5.1 of the HASP) • Personnel shall avoid working in elevated dust environments. • Personnel will stand up-wind of dust-generating activities • Dust monitoring procedures and action levels for dust can be found in the HASP. Level of PPE may be modified by SSO based on site conditions • Minimize contaminated soil free-fall from excavation equipment (e.g., excavators) • Spray water on exposed soil during excavation, taking care to avoid overspraying • Cover stockpiles with plastic sheeting • Spray water on haul roads • Suspend or restrict work activities when dust levels become elevated or when the wind speed is excessive	**L**
	General Safety Hazards: • Fire • Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous plants • Weather • Heat stress • Cold stress	**Fire:** • Smoking is not allowed on site • Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB **Heavy Lifting:** • Proper lifting techniques shall be used • No individual employee is permitted to lift any object that weighs over 40 pounds • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit	**L**

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

		Slip / Trip / Fall: • Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:** • Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to limit insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants • Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:**	

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

		• Weather conditions will be monitored. • Operations will cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool / shaded area **Cold Stress**: • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
• Excavator • Personal protective equipment (PPE) • Work gloves • Hard hats • Safety-toe footwear • Safety glasses • High visibility vests • Hearing protection, as needed • Eyewash station	• 40-Hour HAZWOPER training and associated annual 8-Hour updates • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Arrowhead Emergency Response Plan, including facility-specific evacuation routes and location of severe weather shelter areas.	• Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect PPE prior to use • Inspect heavy construction equipment upon receipt • Inspect heavy equipment daily

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

• Fire extinguisher • Hand tools • Air monitoring (aerosol monitor) • Tyvek pants or coveralls (Level D-Modified or Level C) • Half-face air purifying respirator (Level C)	• Review hazard communication requirements, including applicable SDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required	

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are sanitation facilities (i.e. hand wash) and supplies available on site?
19. Are toilet facilities clean?

On-site Treatment of Contaminated Material
Activity Hazard Analysis (AHA 06)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

Activity/Work Task: **Loading Contaminated Material**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 01-20-2020	
Prepared by (Name/Title):Carl Shaw	
Reviewed by (Name/Title): Jeremy Soenen	

Notes: (Field Notes, Review Comments, etc.)

Call NASA PBS Emergency Dispatch for all emergencies
419-621-3222

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
Loading soil, sediment, berm material, or construction debris using the following methods: • Directly into on-road dump trucks for transportation to the disposal facility • Into off-road dump trucks for transport to a stockpile • From the stockpile into on-road dump trucks for transport to the disposal facility	**General Hazards**	**General hazards:** • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear safety-toe footwear. • Wear hearing protection as necessary. • Wear high-visibility construction vests. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas.	
	Loading hazards (general)	**Loading hazards:** Ground personnel not needed in loading operations should stay out of the area when equipment is working. If it is necessary for	**L**

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

		ground personnel to enter the area, observe the following safety precautions: • Personnel should make eye contact with the operator before approaching the area • Use proper hand signals to communicate with the operator • Stay clear of the swing radius	
	Overhead power lines	**Overhead power lines:** If possible, perform treatment activities in areas of the site that do not have overhead power lines present. If treatment activities are performed in areas with overhead utilities, use the following precautions to protect overhead utilities: • Equipment operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. • In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by 4 inches for every 10 kV over 50 kV. If it is necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard: (1) the line will be de-energized and grounded, or (2) an insulating barrier will be erected to prevent contact with the line. • During operations near overhead power lines, one person involved in the operation (or the SSHO) will be assigned the duty of "spotter" to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the spotter will be positioned "so as to be able to visually monitor the clearance between the equipment and power lines."	**L**

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

	Underground utilities	**Underground utilities:** If possible, conduct treatment activities in areas of the site that do not have underground utilities present. To endure that there are no underground utilities present, or if present, to protect any underground utilities present, conduct the following: • Before any intrusive activity begins, tank positive steps to determine the locations of underground utilities. • The Arrowhead designee shall contact Ohio 811 to notify them of intent to initiate intrusive activity at the property location. This notification is to be made a minimum of two working days prior to the initiation of treatment activity. • The Arrowhead designee will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint). • Potholing will be completed to verify the location and depth of marked utilities at appropriate intervals and at locations where known utilities are observed to be running into the ground. • Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines.	**L**
	Heavy construction equipment	**Heavy construction equipment:** • Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment. • Wear safety belts. • Unless the operator gives an “all clear” signal, ground personnel are not permitted to approach heavy construction equipment in operation. • Ground personnel shall not position themselves between heavy construction equipment and a stationary object. • Ground personnel working near heavy construction equipment shall wear high visibility vests.	**L**

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

		• Inspect equipment when it arrives and daily before starting work. • Equipment found to be defective shall be taken out of service and tagged accordingly. • Keep loose clothing and hair away from moving parts of heavy equipment, and avoid wearing jewelry. • Operate equipment in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals. • Shut down and lock out heavy equipment to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed. • No guard or device will be removed from machinery or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of the work and before power is restored.	
	Stockpiles (if used)	**Stockpiles:** • Cover stockpiled treatment chemicals with tarps or poly sheeting when not in use. Secure the tarp or poly sheeting with sandbags or similar • Cover the contaminated/treated material stockpile with tarps or poly sheeting when not in use. Secure the tarp or poly sheeting with sandbags or similar • Wear PPE when tarping the contaminated/treated material stockpile • Place adequate sandbags or similar weights around the perimeter of the tarp/poly sheeting and at any seams to minimize the chance that the tarp/poly sheeting will be blown off the pile during high winds	**L**
	Dust	**Dust**:	**L**

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

		• Action level for respirable dust for Firing Range 5 and the CDP is **visible dust** (see Section 5.1 of the HASP) • Personnel shall avoid working in elevated dust environments. • Personnel will stand up-wind of dust-generating activities • Dust monitoring procedures and action levels for dust can be found in the HASP. Level of PPE may be modified by SSO based on site conditions • Minimize contaminated soil free-fall from excavation equipment (e.g., excavators) • Spray water on exposed soil during excavation, taking care to avoid overspraying • Cover stockpiles with plastic sheeting • Spray water on haul roads • Suspend or restrict work activities when dust levels become elevated or when the wind speed is excessive	
	General Safety Hazards: • Fire • Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous plants • Weather • Heat stress • Cold stress	**Fire:** • Smoking is not allowed on site • Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB **Heavy Lifting:** • Proper lifting techniques shall be used • No individual employee is permitted to lift any object that weighs over 40 pounds • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit **Slip / Trip / Fall:**	**L**

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

		• Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:** • Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to limit insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants • Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:** • Weather conditions will be monitored.	

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

		• Operations will cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool / shaded area **Cold Stress**: • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
• Excavator • Personal protective equipment (PPE) • Work gloves • Hard hats • Safety-toe footwear • Safety glasses • High visibility vests • Hearing protection, as needed • Eyewash station • Fire extinguisher	• 40-Hour HAZWOPER training and associated annual 8-Hour updates • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Arrowhead Emergency Response Plan, including facility-specific evacuation routes and location of severe weather shelter areas. • Review hazard communication requirements,	• Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect PPE prior to use • Inspect heavy construction equipment upon receipt • Inspect heavy equipment daily

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

• Hand tools • Air monitoring (aerosol monitor)	including applicable SDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required	

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are sanitation facilities (i.e. hand wash) and supplies available on site?
19. Are toilet facilities clean?

Loading Contaminated Material
Activity Hazard Analysis (AHA 07)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

Activity/Work Task: **Backfill and Site Restoration**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 01-20-2020	
Prepared by (Name/Title): Carl Shaw	
Reviewed by (Name/Title): Michael Britsch	
Notes: (Field Notes, Review Comments, etc.)	

Call NASA PBS Emergency Dispatch for all emergencies
419-621-3222

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
• Placement, compaction, and grading of clean backfill materials (sub-soil and top soil) • Gravel placement, if needed • Removal of temporary orange construction fencing, if needed • Seed and hydromulch	**General Hazards**	**General hazards:** • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear safety-toe footwear. • Wear hearing protection as necessary. • Wear high-visibility construction vests. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking is not allowed on site.	L
	Overhead power lines	**Overhead power lines:** • Equipment operators must remain aware of overhead power lines and maintain safe clearances - use spotters	L

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

		when necessary. • A site layout plan shall be completed prior to mobilizing heavy equipment. The plan shall identify all overhead and underground hazards. • Before drilling equipment is moved, the travel route shall be surveyed for overhead and terrain hazards. The mast must be lowered before transporting equipment. • In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by 4 inches for every 10 kV over 50 kV. If it necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard: (1) the line will be will be de-energized and grounded, or (2) an insulating barrier will be erected to prevent contact with the line. The barrier must be rated for the voltage of the line to be guarded. These options, if needed, will be implemented by the applicable utility company. • During operations near overhead power lines, one person involved in the operation (or the SSHO) will be assigned the duty of "observer" to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the observer will be positioned "so as to be able to visually monitor the clearance between the equipment and power lines." The observer cannot be assigned other duties that would interfere with the ability to provide safety oversight and time warnings.	
	Heavy construction equipment and dump trucks	**Heavy construction equipment:** • Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment.	**L**

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

		• Backup alarms must be operational. • Wear safety belts. • Unless the operator gives an "all clear" signal, ground personnel shall not be permitted to approach heavy construction equipment in operation. • Ground personnel shall not position themselves between heavy construction equipment and a stationary object. • Ground personnel shall not work behind the skid steer while it is operating. • Ground personnel working near heavy construction equipment shall wear high visibility vests. • Spotters shall assist trucks when backing is necessary. • Rigging shall be inspected before each use. • Rigging found to be unsafe shall be taken out of service and tagged accordingly. • Inspect equipment daily (see checklist items below; also, refer to Arrowhead's Heavy Equipment Initial Inspection Checklist and Daily Inspection Checklist). • Equipment found to be defective shall be taken out of service and tagged accordingly. • Keep loose clothing and hair away from moving parts of heavy equipment, and avoid wearing jewelry. • Operate equipment in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals. • Shut down and lock out heavy equipment to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed. • No guard or device will be removed from machinery, or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off; all guards and devices will be replaced immediately after completion of the work and before power is restored.	

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

		• Equipment shall be inspected regularly to check for unusual noises, loose connections, vibrations, misalignment, etc. that may be indicative of malfunction. • All components of heavy equipment that have a direct bearing on the safety of the operation shall be inspected at the beginning of each shift and when possible, observed during operation. • Equipment shall not be used if it is not in a safe operating condition. • A copy of the equipment operating manual shall be available at the job site. **Dump Trucks:** • Dump trucks entering a residential property shall maintain a line of site with a ground person during backing activities. • Ground personnel shall direct trucks with hand gestures and verbal communication. • Ground personnel shall guide trucks backing into properties to prevent property damage, personal injury, and loss of control.	
	General Safety Hazards: • Fire • Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous plants • Weather • Heat stress • Cold stress	**Fire:** • Smoking is not allowed on site • Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB **Heavy Lifting:** • Proper lifting techniques shall be used	**L**

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

		• No individual employee is permitted to lift any object that weighs over 40 pounds • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit **Slip / Trip / Fall:** • Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:** • Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to prevent insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants	

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

		• Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:** • Weather conditions shall be monitored. • Operations shall cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool / shaded area **Cold Stress**: • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
• Skid-steer loader • Compaction equipment, as needed (i.e. walk-behind pad foot roller, walk behind plate compactor)	• Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work.	• Intrusive activities clearance request form completed • Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect hand and power tools prior to use (see checklist

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

• Dump trucks • Trash pump • Personal protective equipment (PPE) • Leather gloves • Hard hats • Safety-toe footwear • Splash goggles (as necessary) • Eyewash station • Fire extinguisher • High visibility vests • Hand tools • Air monitoring (aerosol monitor) • Hearing protection • Tyvek pants or coveralls (Level D-Modified or Level C) • Half-face air purifying respirator (Level C)	• Review Arrowhead Emergency Response Plan, including facility-specific evacuation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable SDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required	items below) • Inspect ladders prior to use • Inspect PPE prior to use • Inspect/mark areas of intrusive work for the presence of underground utility lines; complete Utility Clearance Form) • Inspect heavy construction equipment upon receipt (see Heavy Equipment Initial Inspection Checklist) • Inspect heavy equipment daily (see checklist items below; also, see Heavy Equipment Daily Inspection Checklist) • Inspect conditions associated with trenches/excavations daily (see Trench / Excavation Checklist)

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

Backfill and Site Restoration
Activity Hazard Analysis (AHA 08)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

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Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

Activity/Work Task: **Asbestos Abatement**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 01-20-2020	
Prepared by (Name/Title): Carl Shaw	
Reviewed by (Name/Title): Michael Britsch	
Notes: (Field Notes, Review Comments, etc.) **Call NASA PBS Emergency Dispatch for all emergencies** **419-621-3222**	

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
Asbestos abatement activities to include: • Setup and tear down of containment area • Removal of asbestos containing material • Disposal of asbestos containing material	**General Hazards**	**General hazards:** • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear steel-toed footwear. • Wear hearing protection as necessary. • Wear high-visibility construction vests. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas.	**L**
	Construction equipment	**Construction equipment:**	**L**

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

		• Personnel working near construction equipment shall wear high visibility vests • Avoid pinch points • Ground personnel shall never turn their backs to moving equipment • Establish eye contact with equipment operators when approaching equipment	
	Exposure to asbestos and site contaminants	**Exposure to asbestos and site contaminants:** • All operations, materials, and equipment shall be evaluated to determine the presence of ACM or if ACM could be released into the work environment • Appropriate PPE (i.e., respirators, Tyvek coveralls, etc.) shall be instituted for all ACM work and for support personnel when engineering controls or work practices are not sufficient to limit exposure to ACM outside of the work area • Adequate hygiene facilities shall be provided in the regulated areas for workers that are exposed to ACM.	**L**
	Migration of asbestos outside of work area	**Migration of asbestos outside of work area:** • Engineering and administrative controls shall be used to control the potential for asbestos fibers to migrate outside of the work area • Testing shall be conducted around the perimeter of the work area to monitor asbestos migration.	**L**
	Improper storage of ACM	**Improper storage of ACM:** • Storage prior to transportation will be under the supervision of qualified personnel • All ACM generated at the work areas shall be sealed in double 6-mil bags or two layers of 6-mil poly sheeting • The sealed ACM will be placed into either 55-gallon drums or a roll-off container rated for ACM • All containers will be properly labeled	**L**

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

		• The containers will not be used to hold other materials unless they have been under hazardous waste and DOT requirements.	
	General Safety Hazards: • Fire • Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous plants • Weather • Heat stress • Cold stress	**Fire:** • Smoking shall not be permitted in regulated areas • Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB **Heavy Lifting:** • No individual employee is permitted to lift any object that weighs over 40 pounds • Proper lifting techniques shall be used • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit **Slip / Trip / Fall:** • Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:**	**L**

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

		• Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to prevent insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants • Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:** • Weather conditions shall be monitored. • Operations shall cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool / shaded area **Cold Stress**: • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure	

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

		• Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements
Personal Protective Equipment - Level C (AHAS only): • Full-face Respirator equipped with P100/organic vapor cartridges • Hard Hat (overhead hazards present and/or when working near heavy equipment) • Tyvek Coveralls • Cooling Vest (if necessary) • Cotton Glove Liners • Nitrile Gloves • Safety-Toed Boots • Work Gloves • ANSI Class 2 Reflective Warning Vests (when working near operating heavy equipment or roadways) Equipment: • Fire Extinguishers • Emergency Eyewash • First Aid Kit • Low-pressure Sprayer • Shovel • Respirator Cartridges • Barrier Tape • 6-mil Poly and 6-mil Disposable Bags • 55-gallon Drums and/or Roll-off Containers • “Regulated Area” Signs	Training Requirements: • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable SDSs. • Asbestos Hazard Abatement Supervisor Training (AHAS only) • Asbestos Hazard Evaluation Supervisor Training (AHES only) • 2-hour ACM Awareness Training (other on-site personnel) • HAZWOPER 40-Hour • Heavy equipment operators shall be properly trained	• Vehicle inspection daily • Inspect ACM regulated area (before and after work activities) • Mechanized equipment (prior to use) • Mechanized equipment (daily) • Overhead and underground utilities • Housekeeping (daily) • Fire extinguisher (weekly) • Vehicle inspection (daily) • Equipment and tools inspection (daily and before use)

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
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6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

Asbestos Abatement
Activity Hazard Analysis (AHA 09)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

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Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Surveying
Activity Hazard Analysis (AHA 10)

Activity/Work Task: **Surveying**	Overall Risk Assessment Code (RAC) (of the highest hazard): **L**
Project Location: NASA Plum Brook Station, Sandusky, Ohio	
Contract Number:	
Date Prepared: 01-20-2020	
Prepared by (Name/Title): Carl Shaw	
Reviewed by (Name/Title): Michael Britsch	
Notes: (Field Notes, Review Comments, etc.)	

Call NASA PBS Emergency Dispatch for all emergencies
419-621-3222

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
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Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Determine and enter RAC codes for each **"Hazard"** with safety **"Controls"** (E, H, M, or L)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Use the highest individual RAC of the Hazards + Controls below as the overall RAC for the Activity, and enter at the top of the AHA sheet.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

Job Steps	Hazards	Controls	RAC
Site surveying activities, to include: • Establish horizontal and vertical control • Pre-excavation topographic survey • Post-excavation topographic survey for measurement of excavation volume • Post-common backfill topographic survey for measurement of common backfill volume • Post-topsoil topographic survey for measurement of topsoil volume	**Miscellaneous Site Activity**	**Miscellaneous Site Activity**: • When possible, personnel shall avoid areas that have hazardous activities in progress. • When access must be gained in busy areas, the foremen of the activities in the area shall be notified prior to surveying in the area. • High visibility vests shall be worn when working in areas with high vehicular or heavy equipment traffic. • Avoid contact with contaminated soil	**L**
	Heavy lifting	**Heavy Lifting**:	

Surveying
Activity Hazard Analysis (AHA 10)

		• Proper lifting techniques shall be used. • No individual employee is permitted to lift any object that weighs over 40 pounds. • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit.	
	Intrusive activities	**Intrusive Activities**: • Follow procedure for Intrusive Activities Permit. • Underground utilities shall be located and marked prior to driving stakes, posts, benchmarks, etc.	**L**
	Motor vehicles	**Struck by Vehicles**: • Personnel working on or near roads shall wear high visibility vests and only remain on road long enough to complete work. • Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic.	**L**
	Traffic control	**Traffic Control**: • Personnel shall not control traffic unless the SSHO has been contacted and the necessary safety provisions (barricades, signs, lane closures, flagmen, etc.) are in place.	**L**
	General Safety Hazards: • Fire • Noise • Heavy lifting • Slips, trips, falls • Hand injuries • Insect/animal bites/poisonous	**Fire:** • Smoking is not allowed on site • Fire extinguishers shall be available on-site **Noise:** • Personnel shall wear hearing protection, as necessary, to reduce exposures to below the NASA and OSHA limit of 82dB	**L**

Surveying
Activity Hazard Analysis (AHA 10)

	plants • Weather • Heat stress • Cold stress	**Heavy Lifting:** • Proper lifting techniques shall be used • No individual employee is permitted to lift any object that weighs over 40 pounds • Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit **Slip / Trip / Fall:** • Keep work areas clear and maintain housekeeping • Personnel shall not jump from equipment or elevated surfaces • Personnel shall avoid walking on rough or slippery terrain • Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard) **Hand Injuries:** • Items to be handled shall be inspected for sharp edges prior to being handled • Personnel shall wear leather gloves when handling sharp materials • Personnel shall be aware of and avoid pinch point hazards **Insects / Animal Bites / Poisonous Plants:** • Review injury potential with workers • Wear PPE and tape joints to keep insects away from the skin • Use protective insect repellents containing DEET to prevent insect bites • Treat clothing with permethrin to discourage ticks • Check limbs/body for insects/ insect bites before showering • Notify SSHO of flu-like symptoms • Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants	

Surveying
Activity Hazard Analysis (AHA 10)

		• Identify and review poisonous plants with workers • Avoid unnecessary clearing of plant/vegetation areas • Identify workers who are known to contract poison ivy **Weather:** • Weather conditions shall be monitored. • Operations shall cease during high wind or electrical storms or when electrical storms are imminent. **Heat Stress:** • Follow procedures outlined in the SSHP • Drink ample quantities of water • Wear sunscreen • Protect the head and face from direct sun exposure • Perform self-monitoring of heart rate • Take adequate breaks in a cool / shaded area **Cold Stress**: • Follow procedures outlined in the SSHP • Wear warm clothes and boots • Wear layers of clothing • Avoid sweating by adding or removing layers of clothing, as necessary • Protect the head, face, and hands from cold and wind exposure • Take adequate breaks in a warm area, as needed	

Equipment to be Used	Training Requirements & Competent or Qualified Personnel name(s)	Inspection Requirements

Surveying
Activity Hazard Analysis (AHA 10)

• Personal protective equipment (PPE) as listed below • Nitrile gloves • Leather gloves • Hard hats • Safety-toe footwear • Disposable boot covers • Fire extinguisher • High visibility vests • Hearing protection	• Inspect the job site daily for appropriate PPE and safety equipment • Inspect PPE prior to use	• Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable SDSs. • Heavy equipment operators shall be properly trained,

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

Surveying
Activity Hazard Analysis (AHA 10)

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified persons
EM 385 2008 EDITION

Appendix C

Safety Data Sheets (SDSs)

To be assembled into a binder at the site

Safety Data Sheet

Section 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product identifier

Product Name • **Asbestos, Chrysotile**

Synonyms • Chrysotile Asbestos; Serpentine chrysotile; White asbestos

Product Code • 02107A-AB; 02701-AB; 02740A-AB; 02740-AB

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified use(s) • Laboratory standard in the microscopy laboratory

1.3 Details of the supplier of the safety data sheet

Manufacturer • SPI Supplies Division Structure Probe, Inc.

206 Garfield Ave.
West Chester, PA 19380
United States
http://www.2spi.com
SDS@2spi.com

Telephone (General) • 1-(610)-436-5400

1.4 Emergency telephone number

Manufacturer • 1-(800)-424-9300 - Chemtrec

Manufacturer • 1-(703)-741-5970 - Worldwide

Section 2: Hazards Identification

EU/EEC

According to: Regulation (EC) No 1272/2008 (CLP)/REACH 1907/2006 [amended by 2015/830]

2.1 Classification of the substance or mixture

CLP • Carcinogenicity 1A - H350
Specific Target Organ Toxicity Repeated Exposure 1 - H372

2.2 Label Elements

CLP

DANGER

Hazard statements • H350 - May cause cancer.
H372 - Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention • P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P260 - Do not breathe dust.
P264 - Wash thoroughly after handling.

P270 - Do not eat, drink or smoke when using this product.
P281 - Use personal protective equipment as required.

Response • P308+P313 - IF exposed or concerned: Get medical advice/attention.
P314 - Get medical advice/attention if you feel unwell.

Storage/Disposal • P405 - Store locked up.
P501 - Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

2.3 Other Hazards

CLP • According to Regulation (EC) No. 1272/2008 (CLP) this material is considered hazardous.

United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

2.1 Classification of the substance or mixture

OSHA HCS 2012 • Carcinogenicity 1A
Specific Target Organ Toxicity Repeated Exposure 1

2.2 Label elements

OSHA HCS 2012

DANGER

Hazard statements • May cause cancer.
Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention • Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Wear protective gloves/protective clothing/eye protection/face protection.

Response • IF exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.

Storage/Disposal • Store locked up.
Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

2.3 Other hazards

OSHA HCS 2012 • Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Section 3 - Composition/Information on Ingredients

3.1 Substances

Composition					
Chemical Name	**Identifiers**	**%**	**LD50/LC50**	**Classifications According to Regulation/Directive**	**Comments**
Asbestos, chrysotile	**CAS:**12001-29-5 **EU Index:**650-013-00-6	> 99.99%	NDA	**EU CLP:** Annex VI, Table 3.1: Carc. 1A, H350; STOT RE 1, H372 ** **OSHA HCS 2012:** Carc. 1A; STOT RE 1 (Lungs)	NDA

3.2 Mixtures

- Material does not meet the criteria of a mixture.

Section 4 - First Aid Measures

4.1 Description of first aid measures

Inhalation
- Move victim to fresh air. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. If signs/symptoms continue, get medical attention.

Skin
- Wash skin with soap and water. Flush with copious amounts of water for 15 minutes.

Eye
- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. Get medical attention immediately.

Ingestion
- Obtain medical attention immediately if ingested.

4.2 Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to Physician
- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Section 5 - Firefighting Measures

5.1 Extinguishing media

Suitable Extinguishing Media
- Water, Foam, Dry Chemical.

Unsuitable Extinguishing Media
- No data available

5.2 Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards
- Negligible fire and explosion hazard. Toxic gases and asbestos particulate may be released in a fire.

Hazardous Combustion Products
- No data available

5.3 Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA).
  Structural firefighters' protective clothing will only provide limited protection.

Section 6 - Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal Precautions
- Ventilate enclosed areas. Do not walk through spilled material. Wear appropriate personal protective equipment, avoid direct contact.

Emergency Procedures
- As an immediate precautionary measure, isolate spill or leak area for at least 25 meters (75 feet) in all directions. Keep unauthorized personnel away.

6.2 Environmental precautions

- Avoid run off to waterways and sewers.

6.3 Methods and material for containment and cleaning up

Containment/Clean-up
- Avoid generating dust.

Measures

Use HEPA vacuum wet methods when feasible.
Carefully shovel or sweep up spilled material and place in suitable container.

6.4 Reference to other sections

- Refer to Section 8 - Exposure Controls/Personal Protection and Section 13 - Disposal Considerations.

Section 7 - Handling and Storage

7.1 Precautions for safe handling

Handling

- Use only with adequate ventilation. Minimize dust generation and accumulation. Wear appropriate personal protective equipment, avoid direct contact. Do not breathe dust. Avoid contact with skin, eyes, and clothing. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco.

7.2 Conditions for safe storage, including any incompatibilities

Storage

- Store in well-sealed container in cool, dry area in accordance with all current regulations and standards.

7.3 Specific end use(s)

- This item is not being offered for clinical or diagnostic applications, agricultural uses or for human or animal consumption. Refer to Section 1.2 - Relevant identified uses.

Section 8 - Exposure Controls/Personal Protection

8.1 Control parameters

Exposure Limits/Guidelines		
	Result	**OSHA**
Asbestos, chrysotile (12001-29-5)	TWAs	0.1 fiber/cm3 TWA

8.2 Exposure controls

Engineering Measures/Controls

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment).

Personal Protective Equipment

Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face

- Wear safety goggles.

Skin/Body

- Wear appropriate gloves. Wear long sleeves and/or protective coveralls.

Environmental Exposure Controls

- Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways. Follow best practice for site management and disposal of waste.

Additional Protection Measures

- An eyewash station and emergency shower must be available to the work station.

Key to abbreviations

NIOSH = National Institute of Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	White, gray, greenish, or yellowish, odorless, fibrous solid.
Color	White, gray, greenish, or yellowish.	Odor	Odorless
Odor Threshold	Data lacking		
General Properties			
Boiling Point	Data lacking	Melting Point/Freezing Point	> 500 °C(> 932 °F)
Decomposition Temperature	1000 °C(1832 °F)	pH	Data lacking
Specific Gravity/Relative Density	2.2-2.6 g/cc	Water Solubility	Data lacking
Viscosity	Data lacking	Explosive Properties	Data lacking
Oxidizing Properties:	Data lacking		
Volatility			
Vapor Pressure	Data lacking	Vapor Density	Data lacking
Evaporation Rate	Data lacking		
Flammability			
Flash Point	Data lacking	UEL	Data lacking
LEL	Data lacking	Autoignition	Data lacking
Flammability (solid, gas)	Data lacking		
Environmental			
Octanol/Water Partition coefficient	Data lacking		

9.2 Other Information

- No additional physical and chemical parameters noted.

Section 10: Stability and Reactivity

10.1 Reactivity

- No dangerous reaction known under conditions of normal use.

10.2 Chemical stability

- Stable under normal temperatures and pressures.

10.3 Possibility of hazardous reactions

- Hazardous polymerization will not occur.

10.4 Conditions to avoid

- Avoid generating dust.

10.5 Incompatible materials

- Strong oxidizers, strong acids, and bases.

10.6 Hazardous decomposition products

- None known.

Section 11 - Toxicological Information

11.1 Information on toxicological effects

Components		
Asbestos, chrysotile (> 99.99%)	12001-29-5	**Multi-dose Toxicity:** Inhalation-Hamster TCLo • 30 mg/m³ 6 Hour(s) 78 Week(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Fibrosis (interstitial)**; *Lungs, Thorax, or Respiration*:**Changes in lung weight**; Inhalation-Rat TCLo • 8210 µg/m³ 6 Hour(s) 20 Day(s)-Intermittent; *Lungs, Thorax, or Respiration*:**Fibrosis (interstitial)**; **Tumorigen / Carcinogen:** Ingestion/Oral-Rat TDLo • 7100 mg/kg 39 Week(s)-Continuous; *Tumorigenic*:**Carcinogenic by RTECS criteria**; *Liver*:**Tumors**; *Kidney, Ureter, and Bladder*:**Kidney tumors**; Inhalation-Man TCLo • 400 mppcf 1 Year(s)-Continuous; *Tumorigenic*:**Carcinogenic by RTECS criteria**; *Lungs, Thorax, or Respiration*:**Fibrosis, focal (pneumoconiosis)**; *Lungs, Thorax, or Respiration*:**Tumors**; Inhalation-Rat TCLo • 11 mg/m³ 26 Week(s)-Intermittent; *Tumorigenic*:**Carcinogenic by RTECS criteria**; *Lungs, Thorax, or Respiration*:**Tumors**

GHS Properties	Classification
Acute toxicity	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Skin corrosion/Irritation	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Serious eye damage/Irritation	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Skin sensitization	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Respiratory sensitization	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Aspiration Hazard	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Carcinogenicity	**EU/CLP** • Carcinogenicity 1A; May cause cancer **OSHA HCS 2012** • Carcinogenicity 1A
Germ Cell Mutagenicity	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
Toxicity for Reproduction	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
STOT-SE	**EU/CLP** • Data lacking **OSHA HCS 2012** • Data lacking
STOT-RE	**EU/CLP** • Specific Target Organ Toxicity Repeated Exposure 1 **OSHA HCS 2012** • Specific Target Organ Toxicity Repeated Exposure 1

Potential Health Effects

Inhalation

Acute (Immediate)

- Exposure to dust may cause irritation. Processes such as cutting, grinding, crushing, or impact may result in generation of excessive amounts of airborne dusts in the workplace. Nuisance dust may affect the lungs but reactions are typically reversible.

Chronic (Delayed)

- Overexposure to breathing asbestos may cause asbestosis, pulmonary fibrosis, mesothelioma, other lung disorders or cancer. All types of asbestos are known to cause inflammatory changes in lungs and pleurae. However, there is experimental and epidemiologic evidence that there may be differences in the potential of different asbestos types to produce disease. It has been suggested that crocidolite has greatest potential to produce disease; chrysotile, the smallest; with amosite occupying an intermediate position.

Skin

Acute (Immediate)

- Exposure to dust may cause mechanical irritation.

Chronic (Delayed)
- No data available

Eye

Acute (Immediate)
- Exposure to dust may cause mechanical irritation. Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.

Chronic (Delayed)
- No data available

Ingestion

Acute (Immediate)
- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.

Chronic (Delayed)
- No data available

Carcinogenic Effects
- Repeated and prolonged exposure may cause cancer.

Carcinogenic Effects				
	CAS	OSHA	IARC	NTP
Asbestos, chrysotile	12001-29-5	Specifically Regulated Carcinogen	Group 1-Carcinogenic	Known Human Carcinogen

Key to abbreviations

TC = Toxic Concentration

TD = Toxic Dose

Section 12 - Ecological Information

12.1 Toxicity

- Material data lacking.

12.2 Persistence and degradability

- Material data lacking.

12.3 Bioaccumulative potential

- Material data lacking.

12.4 Mobility in Soil

- Material data lacking.

12.5 Results of PBT and vPvB assessment

- No PBT and vPvB assessment has been conducted.

12.6 Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

13.1 Waste treatment methods

Product waste
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	14.1 UN number	14.2 UN proper shipping name	14.3 Transport hazard class(es)	14.4 Packing group	14.5 Environmental hazards
DOT	UN2590	Asbestos, chrysotile	9	III	NDA
IMO/IMDG	UN2590	ASBESTOS, CHRYSOTILE	9	III	NDA
IATA/ICAO	UN2590	White Asbestos (Chrysotile)	9	III	NDA

14.6 Special precautions for user
- None specified.

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code
- Data lacking.

Section 15 - Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications
- Chronic

Inventory						
Component	**CAS**	**Canada DSL**	**Canada NDSL**	**EU EINECS**	**EU ELNICS**	**TSCA**
Asbestos, chrysotile	12001-29-5	No	No	No	No	No

Canada

Labor

Canada - WHMIS 1988 - Classifications of Substances

• Asbestos, chrysotile	12001-29-5	D2A

Canada - WHMIS 1988 - Ingredient Disclosure List

• Asbestos, chrysotile	12001-29-5	0.1 %

Environment

Canada - CEPA - Priority Substances List

• Asbestos, chrysotile	12001-29-5	Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - OSHA - Specifically Regulated Chemicals

• Asbestos, chrysotile	12001-29-5	1.0 fiber/cm3 Excursion Limit (See 29 CFR 1910.1001, 30 min); 0.1 fiber/cm3 TWA

Environment

U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - CERCLA/SARA - Radionuclides and Their Reportable Quantities

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - CERCLA/SARA - Section 313 - PBT Chemical Listing

• Asbestos, chrysotile	12001-29-5	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - California - Proposition 65 - Developmental Toxicity

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - California - Proposition 65 - Maximum Allowable Dose Levels (MADL)

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Female

• Asbestos, chrysotile	12001-29-5	Not Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Male

• Asbestos, chrysotile	12001-29-5	Not Listed

15.2 Chemical Safety Assessment

- No Chemical Safety Assessment has been carried out.

Section 16 - Other Information

Revision Date
- 19/December/2016

Preparation Date
- 14/January/2016

Disclaimer/Statement of Liability
- Caution! Do not use SPI Supplies products or materials in applications involving implantation within the body; direct or indirect contact with the blood pathway; contact with bone, tissue, tissue fluid, or blood; or prolonged contact with mucous membranes. Products offered by SPI Supplies are not designed or manufactured for use in implantation in the human body or in contact with internal body fluids or tissues. SPI Supplies will not provide to customers making devices for such applications any notice, certification, or information necessary for such medical device use required by US FDA (Food and Drug Administration) regulation or any other statute. SPI Supplies and Structure Probe, Inc. make no representation, promise, express warranty or implied warranty concerning the suitability of these materials for use in implantation in the human body or in contact with internal body tissues of fluids. The information and recommendations set forth above are taken from sources believed to be accurate as of the date hereof, however SPI Supplies and Structure Probe, Inc. make no warranty with respect to the accuracy of the information or the

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Key to abbreviations

NDA = No Data Available

SAFETY DATA SHEET

SDS ID NO.: 0290MAR019
Revision Date: 06/01/2016

1. IDENTIFICATION

Product Name: Marathon Petroleum No. 2 Ultra Low Sulfur Diesel

Synonym: No. 2 Ultra Low Sulfur Diesel 15 ppm Sulfur Max; Ultra Low Sulfur Diesel No. 2 15 ppm Sulfur Max; Ultra Low Sulfur Diesel No. 2 15 ppm Sulfur Max with Polar Plus; No. 2 Diesel, Motor Vehicle Use, Undyed; No. 2 Diesel, Motor Vehicle Use, Undyed, with Polar Plus; ULSD No. 2 Diesel 15 ppm Sulfur Max; ULSD No. 2 Diesel 15 ppm Sulfur Max with Polar Plus; No. 2 MV 15 Diesel; No. 2 MV 15 Diesel with Polar Plus; No. 2 Ultra Low Sulfur Diesel Dyed 15 ppm Sulfur Max; Ultra Low Sulfur Diesel No. 2 Dyed 15 ppm Sulfur Max; Ultra Low Sulfur Diesel No. 2 Dyed 15 ppm Sulfur Max with Polar Plus; No. 2 Diesel, Tax Exempt-Motor Vehicle Use, Dyed; No. 2 Diesel, Tax Exempt-Motor Vehicle Use, Dyed, with Polar Plus; ULSD No. 2 Diesel Dyed 15 ppm Sulfur Max; ULSD No. 2 Diesel Dyed 15 ppm Sulfur Max, with Polar Plus; No. 2 MV 15 Diesel Dyed; No. 2 Low Sulfur Diesel (TxLED); No. 2 MV 15 Diesel Dyed, with Polar Plus; No. 2 NRLM 15 Diesel Dyed; No.2 NRLM Diesel Dyed; No. 2 MV 500 ppm TxLED; No.2 Low Emission Low Sulfur Diesel; No. 2 Low Sulfur Diesel (TxLED) 500 ppm Sulfur Max; No. 2 Heating Oil 5000 NMA Unmarked; NEMA No. 2 Heating Oil; Heating Oil, No. 2 Low Sulfur 5000 ppm; No. 2 Ultra Low Sulfur Diesel Dyed with <6% Renewable Diesel Fuel; Ultra Low Sulfur No. 2 Diesel Dyed with <6% Renewable Diesel Fuel; No. 2 Diesel Dyed with <6% Renewable Diesel Fuel 15 ppm Sulfur Max; No. 2 Ultra Low Sulfur Diesel with <6% Renewable Diesel Fuel; Ultra Low Sulfur No. 2 Diesel with <6% Renewable Diesel Fuel; No. 2 Diesel with <6% Renewable Diesel Fuel 15 ppm Sulfur Max; Garyville Export Diesel; Export Diesel, Garyville; Diesel Fuel, Export Garyville; #2 Motor Vehicle ULSD 15 ppm with 0-5% Renewable Diesel; Marathon No. 2 ULSD with 0-5% Renewable Fuel with R100; Marathon No. 2 ULSD with 0-5% Renewable Fuel with R99; No. 2 Heating Oil 2000 ppm Sulfur Max, Clear (Undyed) Unmarked;Ultra Low Sulfur Heating Oil 15 ppm Sulfur Max, Clear (Undyed) Unmarked; ULS Heating Oil 15 ppm Clear (Undyed) Unmarked; ULS HO 15 ppm CLR; Ultra-Low Sulfur Heating Oil (<= 15ppm, Undyed); No. 2 Heating Oil 2000 ppm Sulfur Max, Dyed Unmarked; No. 2 Heating Oil 2000 ppm Sulfur Max, Dyed Marked; Ultra Low Sulfur Heating Oil 15 ppm Sulfur Max, Dyed Unmarked; Ultra Low Sulfur Heating Oil 15 ppm Sulfur Max, Dyed Marked;15 ppm Sulfur Heating Oil Grade 67; 0291MAR019; 0306MAR019; 0308MAR019; 0334MAR019; 0335MAR019; 0336MAR019; 0337MAR019; 0340MAR019;

Chemical Family: Complex Hydrocarbon Substance

Recommended Use: Fuel.
Restrictions on Use: All others.

Manufacturer, Importer, or Responsible Party Name and Address:

MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 3
Acute toxicity - Inhalation (Dusts/Mists)	Category 4
Skin corrosion/irritation	Category 2
Carcinogenicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Specific target organ toxicity (repeated exposure)	Category 2
Aspiration toxicity	Category 1
Acute aquatic toxicity	Category 2
Chronic aquatic toxicity	Category 2

Hazards Not Otherwise Classified (HNOC)
Static accumulating flammable liquid

Label elements

EMERGENCY OVERVIEW

Danger

FLAMMABLE LIQUID AND VAPOR
May accumulate electrostatic charge and ignite or explode
May be fatal if swallowed and enters airways
Harmful if inhaled
Causes skin irritation
May cause respiratory irritation
May cause drowsiness or dizziness
Suspected of causing cancer
May cause damage to organs (thymus, liver, bone marrow) through prolonged or repeated exposure
Toxic to aquatic life with long lasting effects

Appearance Yellow to Red Liquid **Physical State** Liquid **Odor** Hydrocarbon

Precautionary Statements - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use only non-sparking tools.
Use explosion-proof electrical/ventilating/lighting/equipment
Take precautionary measures against static discharge
Do not breathe mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Wash hands and any possibly exposed skin thoroughly after handling
Avoid release to the environment

Precautionary Statements - Response
IF exposed or concerned: Get medical attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation occurs: Get medical attention
Wash contaminated clothing before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor if you feel unwell
IF SWALLOWED: Immediately call a POISON CENTER or doctor
Do NOT induce vomiting
In case of fire: Use water spray, fog or regular foam for extinction
Collect spillage

Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Keep cool
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container at an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

No. 2 Ultra Low Sulfur Diesel is a complex mixture of paraffins, cycloparaffins, olefins and aromatic hydrocarbon chain lengths predominantly in the range of eleven to twenty carbons. May contain up to 5% Renewable Diesel. May contain small amounts of dye and other additives (<0.15%) which are not considered hazardous at the concentration(s) used. May contain a trace amount of benzene (<0.01%). Contains a trace amount of sulfur (<0.0015%)

Composition Information:

Name	CAS Number	% Concentration
No. 2 Diesel Fuel	68476-34-6	50-100
Kerosine, Petroleum	8008-20-6	0-50
Alkanes, C10-C20 branched and linear	928771-01-1	0-5
Naphthalene	91-20-3	0.3-2.6

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First Aid Measures

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation: Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Skin Contact: Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. May be absorbed through the skin in harmful amounts. Get medical attention if irritation persists. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).

Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties. Destroy contaminated, non-chemical resistant footwear.

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.

Ingestion: Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects: Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking. Prolonged or repeated exposure may cause adverse effects to the thymus, liver, and bone marrow.

Indication of any immediate medical attention and special treatment needed

Notes To Physician: INHALATION: This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

INGESTION: This material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media
Do not use straight water streams to avoid spreading fire.

Specific hazards arising from the chemical
This product has been determined to be a flammable liquid per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the Emergency Response Guidebook 128.

Hazardous combustion products
Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data
Sensitivity to Mechanical Impact No.
Sensitivity to Static Discharge Yes.

Special protective equipment and precautions for firefighters
Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Avoid using straight water streams. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Avoid excessive water spray application. Keep surrounding area cool with water spray from a distance and prevent further ignition of combustible material. Keep run-off water out of sewers and water sources.

Additional firefighting tactics
FIRES INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles: if this is impossible, withdraw from area and let fire burn.

EVACUATION: Consider initial downwind evacuation for at least 1000 feet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 5280 feet (1 mile) in all directions; also, consider initial evacuation of 5280 feet (1 mile) in all directions.

NFPA	Health 1	Flammability 2	Instability 0	Special Hazard -

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:	Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Eliminate all ignition sources. All contaminated surfaces will be slippery.
Protective equipment:	Use personal protection measures as recommended in Section 8.
Emergency procedures:	Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.
Environmental precautions:	Avoid release to the environment. Avoid subsoil penetration.
Methods and materials for containment:	Contain liquid with sand or soil. Prevent spilled material from entering storm drains, sewers, and open waterways.
Methods and materials for cleaning up:	Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers. When recovering free liquids ensure all equipment is grounded and bonded. Use only non-sparking tools.

7. HANDLING AND STORAGE

Safe Handling Precautions:

NEVER SIPHON THIS PRODUCT BY MOUTH. Use appropriate grounding and bonding practices. Static accumulating flammable liquid. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Vapors may travel along the ground or be moved by ventilation. Flashback may occur along vapor trails. No smoking. Use only non-sparking tools. Avoid breathing fumes, gas, or vapors. Use only with adequate ventilation. Avoid repeated and prolonged skin contact. Use personal protection measures as recommended in Section 8. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

Hydrocarbons are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignition of vapors or mists without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.

Portable containers should never be filled while in or on a motor vehicle or marine craft. Containers should be placed on the ground. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers.

A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling.

Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

Storage Conditions:

Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Do not store near an open flame, heat or other sources of ignition.

Incompatible Materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELS:	OSHA - Vacated PELs	NIOSH IDLH
No. 2 Diesel Fuel 68476-34-6	100 mg/m³ TWA Skin - potential significant contribution to overall exposure by the cutaneous route	-	-	-

Kerosine, Petroleum 8008-20-6	200 mg/m³ TWA Skin - potential significant contribution to overall exposure by the cutaneous route	-	-	-
Alkanes, C10-C20 branched and linear 928771-01-1	-	-	-	-
Naphthalene 91-20-3	10 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm TWA: 50 mg/m³	10 ppm TWA 50 mg/m³ TWA 15 ppm STEL 75 mg/m³ STEL	250 ppm

Notes: The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

Engineering measures: Local or general exhaust required in an enclosed area or with inadequate ventilation. Use mechanical ventilation equipment that is explosion-proof.

Personal protective equipment

Eye protection: Use goggles or face-shield if the potential for splashing exists.

Skin and body protection: Wear neoprene, nitrile or PVA gloves to prevent skin contact. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.

Respiratory protection: Use a NIOSH approved organic vapor chemical cartridge or supplied air respirators when there is the potential for airborne exposures to exceed permissible exposure limits or if excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid
Appearance	Yellow to Red Liquid
Color	Yellow to Red
Odor	Hydrocarbon
Odor Threshold	No data available.

Property	**Values (Method)**
Melting Point / Freezing Point	No data available.
Initial Boiling Point / Boiling Range	154-366 °C / 310-691 °F (ASTM D86)
Flash Point	58-76 °C / 136-168 °F (ASTM D93)
Evaporation Rate	No data available.
Flammability (solid, gas)	Not applicable.
Flammability Limit in Air (%):	
Upper Flammability Limit:	No data available.
Lower Flammability Limit:	No data available.
Explosion limits:	No data available.
Vapor Pressure	No data available.
Vapor Density	No data available.
Specific Gravity / Relative Density	0.82-0.86 (ASTM D4052)
Water Solubility	No data available.
Solubility in other solvents	No data available.

Partition Coefficient	No data available.
Decomposition temperature	No data available.
pH:	Not applicable
Autoignition Temperature	No data available.
Kinematic Viscosity	1.90-3.32 cSt @ 40°C (ASTM D445)
Dynamic Viscosity	No data available.
Explosive Properties	No data available.
VOC Content (%)	No data available.
Density	No data available.
Bulk Density	Not applicable.

10. STABILITY AND REACTIVITY

Reactivity The product is non-reactive under normal conditions.

Chemical stability The material is stable at 70°F, 760 mmHg pressure.

Possibility of hazardous reactions None under normal processing.

Hazardous polymerization Will not occur.

Conditions to avoid Excessive heat, sources of ignition, open flame.

Incompatible Materials Strong oxidizing agents.

Hazardous decomposition products None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation Harmful if inhaled. May cause irritation of respiratory tract. May cause drowsiness or dizziness. Breathing high concentrations of this material in a confined space or by intentional abuse can cause irregular heartbeats which can cause death.

Eye contact Exposure to vapor or contact with liquid may cause mild eye irritation, including tearing, stinging, and redness.

Skin contact Causes skin irritation. Effects may become more serious with repeated or prolonged contact. May be absorbed through the skin in harmful amounts.

Ingestion May be fatal if swallowed or vomited and enters airways. May cause irritation of the mouth, throat and gastrointestinal tract.

Acute toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50
No. 2 Diesel Fuel 68476-34-6	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	>1 - <5 mg/L (Rat) 4 h
Kerosine, Petroleum 8008-20-6	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.28 mg/L (Rat) 4 h
Alkanes, C10-C20 branched and linear 928771-01-1	-	-	>1 - <5 mg/l (Rat) 4 h
Naphthalene 91-20-3	490 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 340 mg/m³ (Rat) 1 h

Delayed and immediate effects as well as chronic effects from short and long-term exposure

MIDDLE DISTILLATES, PETROLEUM: Long-term repeated (lifetime) skin exposure to similar materials has been reported to result in an increase in skin tumors in laboratory rodents. The relevance of these findings to humans is not clear at this time. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffer's Encephalopathy), delirium, seizures, and sudden death have been reported from repeated overexposure to some hydrocarbon solvents, naphthas, and gasoline.

MIDDLE DISTILLATES WITH CRACKED STOCKS: Light cracked distillates have been shown to be carcinogenic in animal tests and have tested positive with in vitro genotoxicity tests. Repeated dermal exposures to high concentrations in test animals resulted in reduced litter size and litter weight, and increased fetal resorptions at maternally toxic doses. Dermal exposure to high concentrations resulted in severe skin irritation with weight loss and some mortality. Inhalation exposure to high concentrations resulted in respiratory tract irritation, lung changes/infiltration/accumulation, and reduction in lung function.

ISOPARAFFINS: Studies in laboratory animals have shown that long-term exposure to similar materials (isoparaffins) can cause kidney damage and kidney cancer in male laboratory rats. However, in-depth research indicates that these findings are unique to the male rat, and that these effects are not relevant to humans.

NAPHTHALENE: Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from overexposure to naphthalene. Persons with glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have been reported in persons overexposed to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect. Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) in vitro. Naphthalene has been classified as Possibly Carcinogenic to Humans (2B) by IARC, based on findings from studies in laboratory animals.

DIESEL EXHAUST: The combustion of diesel fuels produces gases including carbon monoxide, carbon dioxide, oxides of nitrogen and/or sulfur, and hydrocarbons that can be irritating and hazardous with overexposure. Long-term occupational overexposure to diesel exhaust and diesel exhaust particulate matter has been associated with an increased risk of respiratory disease, including lung cancer, and is characterized as a “known human carcinogen” by the International Agency for Research on Cancer (IARC), as “a reasonably anticipated human carcinogen” by the National Toxicology Program, and as “likely to be carcinogenic to humans” by the EPA, based upon animal and occupational exposure studies. However, uncertainty exists with these classifications because of deficiencies in the supporting occupational exposure/epidemiology studies, including reliable exposure estimates. Lifetime animal inhalation studies with pulmonary overloading exposure concentrations of diesel exhaust emissions have produced tumors and other adverse health effects. However, in more recent long-term animal inhalation studies of diesel exhaust emissions, no increase in tumor incidence and in fact a substantial reduction in adverse health effects along with significant reductions in the levels of hazardous material emissions were observed and are associated with fuel composition alterations coupled with new technology diesel engines.

Adverse effects related to the physical, chemical and toxicological characteristics

Signs and Symptoms Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking. Prolonged or repeated exposure may cause damage to organs.

Sensitization Not expected to be a skin or respiratory sensitizer.

Mutagenic effects None known.

Carcinogenicity Suspected of causing cancer.

Cancer designations are listed in the table below

Name	ACGIH (Class)	IARC (Class)	NTP	OSHA
No. 2 Diesel Fuel 68476-34-6	Confirmed animal carcinogen (A3)	Not Classifiable (3)	Not Listed	Not Listed
Kerosine, Petroleum 8008-20-6	Confirmed animal carcinogen (A3)	Not Classifiable (3)	Not Listed	Not Listed
Alkanes, C10-C20 branched and linear 928771-01-1	Not Listed	Not Listed	Not Listed	Not Listed
Naphthalene 91-20-3	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Reasonably anticipated to be a human carcinogen	Not Listed

Reproductive toxicity None known.

Specific Target Organ Toxicity (STOT) - single exposure Respiratory system. Central nervous system.

Specific Target Organ Toxicity (STOT) - repeated exposure Thymus. Liver. Bone marrow.

Aspiration hazard May be fatal if swallowed or vomited and enters airways.

12. ECOLOGICAL INFORMATION

Ecotoxicity This product should be considered toxic to aquatic organisms, with the potential to cause long lasting adverse effects in the aquatic environment.

Name	Algae/aquatic plants	Fish	Toxicity to Microorganisms	Crustacea
No. 2 Diesel Fuel 68476-34-6	-	96-hr LC50 = 35 mg/l Fathead minnow (flow-through)	-	48-hr EL50 = 6.4 mg/l Daphnia magna
Kerosine, Petroleum 8008-20-6	72-hr EL50 = 5.0-11 mg/l Algae	96-hr LL50 = 18-25 mg/l Fish	-	48-hr EL50 = 1.4-21 mg/l Invertebrates
Alkanes, C10-C20 branched and linear 928771-01-1	-	-	-	-
Naphthalene 91-20-3	-	96-hr LC50 = 0.91-2.82 mg/l Rainbow trout (static) 96-hr LC50 = 1.99 mg/l Fathead minnow (static)	-	48-hr LC50 = 1.6 mg/l Daphnia magna

Persistence and degradability Expected to be inherently biodegradable.

Bioaccumulation Has the potential to bioaccumulate.

Mobility in soil May partition into air, soil and water.

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues
This material may be a flammable liquid waste.

Safe Handling of Wastes
Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required. Use appropriate grounding and bonding practices. Use only non-sparking tools. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking.

Disposal of Wastes / Methods of Disposal
The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal
Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101):

UN Proper Shipping Name:	Fuel Oil, No. 2
UN/Identification No:	NA 1993
Transport Hazard Class(es):	3
Packing Group:	III

TDG (Canada):

UN Proper Shipping Name:	Diesel Fuel
UN/Identification No:	UN 1202
Transport Hazard Class(es):	3
Packing Group:	III

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b): This product and/or its components are listed on the TSCA Chemical Inventory.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product does not contain any component(s) included on EPA's Extremely Hazardous Substance (EHS) List.

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
No. 2 Diesel Fuel	NA
Kerosine, Petroleum	NA
Alkanes, C10-C20 branched and linear	NA
Naphthalene	NA

SARA Section 304: This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	Hazardous Substances RQs
No. 2 Diesel Fuel	NA
Kerosine, Petroleum	NA

Alkanes, C10-C20 branched and linear	NA
Naphthalene	100 lb final RQ 45.4 kg final RQ

SARA: The following EPA hazard categories apply to this product:

Acute Health Hazard
Fire Hazard
Chronic Health Hazard

SARA Section 313: This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting:
No. 2 Diesel Fuel	None
Kerosine, Petroleum	None
Alkanes, C10-C20 branched and linear	None
Naphthalene	0.1 % de minimis concentration

State and Community Right-To-Know Regulations:
The following component(s) of this material are identified on the regulatory lists below:

No. 2 Diesel Fuel

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 2444
Pennsylvania Right-To-Know:	Not Listed
Massachusetts Right-To Know:	Not Listed
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	SN 2444 TPQ: 10000 lb (Under N.J.A.C. 7:1G, environmental hazardous substances in mixtures such as gasoline or new and used petroleum oil may be reported under these categories)
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Kerosine, Petroleum

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1091
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	SN 1091 TPQ: 10000 lb (Under N.J.A.C. 7:1G, environmental hazardous substances in mixtures such as gasoline or new and used petroleum oil may be reported under these categories)
Illinois - Toxic Air Contaminants:	Not Listed

New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Alkanes, C10-C20 branched and linear

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed
Pennsylvania Right-To-Know:	Not Listed
Massachusetts Right-To Know:	Not Listed
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Naphthalene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Carcinogen, initial date 4/19/02
New Jersey Right-To-Know:	SN 1322 SN 3758
Pennsylvania Right-To-Know:	Environmental hazard Present (particulate)
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Carcinogen
New Jersey - Environmental Hazardous Substances List:	SN 1322 TPQ: 500 lb (Reportable at the de minimis quantity of >0.1%)
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	100 lb RQ (air); 1 lb RQ (land/water)

Canada DSL/NDSL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations.

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
No. 2 Diesel Fuel	B3,D2A,D2B	0.1%
Kerosine, Petroleum	B3,D2B	1%
Alkanes, C10-C20 branched and linear	B3,D2A,D2B	0.1%
Naphthalene	B4,D2A	0.1%

Note: Not applicable.

16. OTHER INFORMATION

Prepared By Toxicology and Product Safety

Revision Date: 06/01/2016

Revision Note:

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Safety Data Sheet

This safety data sheet complies with the requirements of: 2012 OSHA Hazard Communication Standard (29CFR 1910.1200)

Product name PYRO-CHEM ABC Multipurpose Dry Chemical Stored Pressure Extinguisher

1. Identification

1.1. Product Identifier

Product name PYRO-CHEM ABC Multipurpose Dry Chemical Stored Pressure Extinguisher

1.2. Other means of identification

Product code 074011
UN/ID no UN1044
Synonyms None
Chemical Family No information available

1.3. Recommended use of the chemical and restrictions on use

Recommended use No information available
Uses advised against Consumer use

1.4. Details of the Supplier of the Safety Data Sheet

Company Name Tyco Fire Protection Products
One Stanton Street
Marinette, WI 54143-2542
Telephone: 715-735-7411

Contact point Product Stewardship at 1-715-735-7411
E-mail address psra@tycofp.com

1.5. Emergency Telephone Number

Emergency telephone CHEMTREC 800-424-9300 or 703-527-3887

2. Hazards Identification

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Gases Under Pressure - Compressed Gas

2.2. Label Elements

Signal Word
WARNING

hazard statements

Contains gas under pressure; may explode if heated

Precautionary Statements

Storage
Protect from sunlight. Store in a well-ventilated place.

2.3. Hazards Not Otherwise Classified (HNOC)

Not Applicable.

2.4. OTHER INFORMATION

Unknown Acute Toxicity — 5.6208% of the mixture consists of ingredient(s) of unknown toxicity

3. Composition/information on Ingredients

3.1. Mixture

The following component(s) in this product are considered hazardous under applicable OSHA(USA)

Chemical name	CAS No	weight-%
Ammonium sulfate, technical	7783-20-2	7 - 13
Attapulgite	12174-11-7	1 - 5
Calcium carbonate	471-34-1	1 - 5

4. First aid measures

4.1. Description of first aid measures

Eye Contact — Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If eye irritation persists: Get medical advice/attention.

Skin contact — Wash skin with soap and water. Get medical attention if irritation develops and persists.

Inhalation — If experiencing respiratory symptoms: Call a POISON CENTER or doctor.

Ingestion — If swallowed: Call a POISON CENTER or doctor/physician if you feel unwell.

4.2. Most Important Symptoms and Effects, Both Acute and Delayed

Symptoms — None known.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

Note to physicians — Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable Extinguishing Media

Product is extinguishing agent. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Unsuitable Extinguishing Media
None.

5.3. Specific Hazards Arising from the Chemical
Containers may explode when heated. Ruptured cylinders may rocket.

5.4. Explosion Data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

5.5. Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal Precautions	Provide adequate ventilation. Avoid creating dust. Avoid breathing dust/fume/gas/mist/vapors/spray.
For emergency responders	Use personal protection recommended in Section 8.

6.2. Environmental Precautions

Environmental Precautions	See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up

Methods for Containment	Stop leak if you can do it without risk. If sweeping of a contaminated area is necessary use a dust suppressing agent which does not react with product.
Methods for Cleaning Up	Clean up material with vacuum equipped with HEPA filter. Use water as dust suppressant if necessary. Following product recovery, flush area with water.

7. Handling and Storage

7.1. Precautions for Safe Handling

Advice on safe handling	Avoid generation of dust. Do not breathe dust/fume/gas/mist/vapors/spray. Use with local exhaust ventilation. Use personal protective equipment as required. Wash thoroughly after handling. Do not drag, slide or roll extinguishers. Do not drop extinguishers or permit them to strike against each other. Refer to NFPA-10 Standard for Portable Fire Extinguishers and OSHA 1910.157 Portable Extinguishers regarding requirements for inspection, maintenance and training.

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions	Store in a well-ventilated place. Keep cool. Keep container tightly closed. Guard against dust accumulation of material. Use care in handling/storage. Pressurized extinguishers should be properly stored and secured to prevent falling or being knocked over.

Incompatible Materials Strong acids.

8. Exposure Controls/Personal Protection

8.1. Control Parameters

Exposure guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Attapulgite 12174-11-7	TWA: 1 mg/m³ respirable fraction	-	-
Calcium carbonate 471-34-1	-	-	TWA: 10 mg/m³ total dust TWA: 5 mg/m³ respirable dust

ACGIH (American Conference of Governmental Industrial Hygienists) OSHA (Occupational Safety and Health Administration of the US Department of Labor): NIOSH IDLH Immediately Dangerous to Life or Health

8.2. Appropriate Engineering Controls

Engineering controls Showers
Eyewash stations
Ventilation systems.

8.3. Individual protection measures, such as personal protective equipment

Eye/Face Protection Wear safety glasses with side shields (or goggles).

Skin and Body Protection No special precautions are needed in handling this material.

Respiratory Protection In case of insufficient ventilation, wear suitable respiratory equipment.

Ventilation Use local exhaust or general dilution ventilation to control exposure with applicable limits

8.4. General hygiene considerations

Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State powder
Odor odorless
Color Yellow
odor threshold No data available

Property	VALUES	Remarks • Method
pH	No data available	
Melting point/freezing point	No data available	
Boiling point / boiling range	No data available	
Flash Point	No data available	
Evaporation Rate	No data available	
flammability (solid, gas)	No data available	
Flammability limit in air		

Upper flammability limit:	No data available
Lower flammability limit:	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific gravity	No data available
Water Solubility	No data available
Solubility in Other Solvents	No data available
Partition coefficient	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Kinematic viscosity	No data available

10. Stability and Reactivity

10.1. Chemical Stability

Stable under recommended storage conditions.

10.2. Reactivity

No data available

10.3. Possibility of hazardous reactions

Hazardous polymerization does not occur.

hazardous polymerization	Hazardous polymerization does not occur.

10.4. Conditions to Avoid

None known based on information supplied.

10.5. Incompatible Materials

Strong acids.

10.6. Hazardous decomposition products

Carbon oxides. Nitrogen oxides (NOx).

11. Toxicological Information

11.1. Information on Likely Routes of Exposure

Product information

INHALATION	May cause irritation of respiratory tract.
Eye Contact	May cause irritation.
Skin contact	May cause irritation.

INGESTION Ingestion may cause irritation to mucous membranes.

Acute Toxicity

Chemical name	Oral LD50	dermal LD50	Inhalation LC50
Ammonium sulfate, technical 7783-20-2	= 2000 mg/kg (Rat)	-	-
Calcium carbonate 471-34-1	= 6450 mg/kg (Rat)	-	-

11.2. Information on Toxicological Effects

Symptoms No information available.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure

sensitization No information available.

Germ Cell Mutagenicity No information available

carcinogenicity Attapulgite (palygorskite fibers) is a hydrated magnesium aluminum silicate. Long palygorskite (attapulgite) fibers (>5 micrometers) are possibly carcinogenic to humans (Group 2B). Short palygorskite (attapulgite) fibers (<5 micrometers) cannot be classified as to their carcinogenicity to humans (Group 3). The attapulgite present in this product contains fibers 0.5-2.5 um range, so would be considered by IARC as Group 3.

Chemical name	ACGIH	IARC	NTP	OSHA
Attapulgite 12174-11-7	-	Group 3	-	-

IARC (International Agency for Research on Cancer)
Not classifiable as a human carcinogen

Reproductive Toxicity No information available.

STOT - Single Exposure No information available.

STOT - Repeated Exposure No information available.

Target organ effects EYES, Respiratory System, skin.

Aspiration Hazard No information available.

11.4. Numerical Measures of Toxicity - Product information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral) 16260 mg/kg

ATEmix (dermal) 9942 mg/kg

12. Ecological Information

12.1. ecotoxicity

Not classified

0.03348% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical name	Algae/aquatic plants	Fish	Crustacea

Ammonium sulfate, technical 7783-20-2	-	LC50 96 h 460 - 1000 mg/L Leuciscus idus static; LC50 96 h 123 - 128 mg/L Poecilia reticulata semi-static; LC50 96 h = 126 mg/L Poecilia reticulata; LC50 96 h > 100 mg/L Pimephales promelas; LC50 96 h 32.2 - 41.9 mg/L Oncorhynchus mykiss flow-through; LC50 96 h 5.2 - 8.2 mg/L Oncorhynchus mykiss static; LC50 96 h = 18 mg/L Cyprinus carpio; LC50 96 h = 480 mg/L Brachydanio rerio flow-through; LC50 96 h = 420 mg/L Brachydanio rerio semi-static; LC50 96 h = 250 mg/L Brachydanio rerio	LC50 48 h = 14 mg/L Daphnia magna; EC50 24 h = 423 mg/L Daphnia magna
Silicic Acid/silica gel, Amorphous 7631-86-9	EC50 72 h = 440 mg/L Pseudokirchneriella subcapitata	LC50 96 h = 5000 mg/L Brachydanio rerio static	EC50 48 h = 7600 mg/L Ceriodaphnia dubia

12.2. Persistence and Degradability
No information available.

12.3. Bioaccumulation
No information available.

Chemical name	Partition coefficient
Ammonium sulfate, technical 7783-20-2	-5.1

12.4. Other Adverse Effects
No information available

13. Disposal Considerations

13.1. Waste Treatment Methods
Disposal of wastes

This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging

Do not reuse container. Pressurized container: Do not pierce or burn, even after use.

14. Transport Information

DOT
UN/ID no UN1044
Description UN1044, Fire extinguishers, 2.2
Proper Shipping Name Fire extinguishers

Hazard class	2.2
Special Provisions	18, 110
Emergency Response Guide Number	126

TDG

UN/ID no	UN1044
Description	UN1044, Fire extinguishers, 2.2
Proper Shipping Name	Fire extinguishers
Hazard class	2.2

MEX

UN/ID no	UN1044
Description	UN1044, Fire extinguishers, 2.2
Proper Shipping Name	Fire extinguishers
Hazard class	2.2

ICAO (air)

UN/ID no	UN1044
Description	UN1044, Fire extinguishers, 2.2
Proper Shipping Name	Fire extinguishers
Hazard class	2.2
Special Provisions	A19

IATA

UN/ID no	UN1044
Description	UN1044, Fire extinguishers, 2.2
Proper Shipping Name	Fire extinguishers
Hazard class	2.2
ERG Code	2L
Special Provisions	A19

IMDG

UN/ID no	UN1044
Description	UN1044, Fire extinguishers, 2.2
Proper Shipping Name	Fire extinguishers
Hazard class	2.2
EmS-No	F-C, S-V
Special Provisions	225

15. Regulatory Information

15.1. International Inventories

TSCA	Complies
DSL/NDSL	Complies
ENCS	Does not comply
IECSC	Complies
KECL	Does not comply
PICCS	Complies
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

15.2. US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
Ammonium dihydrogen phosphate - 7722-76-1	1.0
Ammonium sulfate, technical - 7783-20-2	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic health hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

15.3. US State Regulations

California Proposition 65

Classification only applies to Attapulgite with fibers >5 um. This product contains Attapulgite with fibers <5 um.

Chemical name	California Proposition 65
Attapulgite - 12174-11-7	Carcinogen
Quartz - 14808-60-7	Carcinogen

U.S. State Right-to-Know Regulations

This product does not contain any substances regulated by state right-to-know regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
Silicic Acid/silica gel, Amorphous 7631-86-9	X	X	X
Magnesium carbonate 546-93-0	X	X	-
Quartz 14808-60-7	X	X	X

16. Other information, including date of preparation of the last revision

NFPA	**Health Hazards** 0	**flammability** 0	**Instability** 0	**Physical and chemical properties** -
HMIS	**Health Hazards** 0	**flammability** 0	**Physical Hazards** 3	**Personal Protection** X

Revision date 25-May-2015

Revision note

No information available

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

SAFETY DATA SHEET

SDS ID NO.: 0127MAR019
Revision Date: 06/01/2016

1. IDENTIFICATION

Product Name: Marathon Petroleum Gasoline - All Grades

Synonym: Gasoline; Regular Unleaded Gasoline; Conventional Regular Unleaded Gasoline; Mid Grade Unleaded Gasoline; Conventional Mid Grade Unleaded Gasoline; Premium Unleaded Gasoline; Conventional Premium Unleaded Gasoline; Sub-Octane Gasoline; Regular RBOB; Super RBOB; Premium RBOB; RBOB; Reformulated Blend Stock For Oxygenated Blending; 84 Octane Gasoline; CBOB; Premium CBOB; Conventional Blend Stock for Oxygenate Blending; Recreational Gasoline; Recreational Gasoline; Recreational Unleaded Gasoline; 89 Recreational Gasoline; Brand 89 Recreational Gasoline; 7.0 Max RVP 89 Recreational Gasoline; BR 7.0 Max RVP 89 Recreational Gasoline; 90 Recreational Gasoline; 90 Marina Gasoline; Brand 91 Recreational Gasoline; 91 Recreational Gasoline; 91 Marina Gasoline; 90 Octane Midgrade Gasoline with No Ethanol; 0125MAR019; 0126MAR019; 0134MAR019; 0313MAR019; 0314MAR019

Chemical Family: Complex Hydrocarbon Substance

Recommended Use: Fuel.
Restrictions on Use: All others.

Manufacturer, Importer, or Responsible Party Name and Address:

MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 1
Skin corrosion/irritation	Category 2
Germ cell mutagenicity	Category 1B
Carcinogenicity	Category 1B
Reproductive toxicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Aspiration toxicity	Category 1
Acute aquatic toxicity	Category 2
Chronic aquatic toxicity	Category 2

Hazards Not Otherwise Classified (HNOC)

Static accumulating flammable liquid

Label elements

EMERGENCY OVERVIEW

Danger

EXTREMELY FLAMMABLE LIQUID AND VAPOR
May accumulate electrostatic charge and ignite or explode
May be fatal if swallowed and enters airways
Causes skin irritation
May cause respiratory irritation
May cause drowsiness or dizziness
May cause genetic defects
May cause cancer
Suspected of damaging fertility or the unborn child
Toxic to aquatic life with long lasting effects

Appearance Clear yellow liquid **Physical State** Liquid **Odor** Hydrocarbon

Precautionary Statements - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools.
Take precautionary measures against static discharge
Avoid breathing mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Wash hands and any possibly exposed skin thoroughly after handling
Avoid release to the environment

Precautionary Statements - Response
IF exposed or concerned: Get medical attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation occurs: Get medical attention
Wash contaminated clothing before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor if you feel unwell
IF SWALLOWED: Immediately call a POISON CENTER or doctor
Do NOT induce vomiting
In case of fire: Use water spray, fog or regular foam for extinction
Collect spillage

Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Keep cool
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container at an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Gasoline is a complex combination of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons having molecular chains ranging in length from four to ten carbons. May contain small amounts of dye and other additives (>0.02%) which are not considered hazardous at the concentrations used.

Composition Information:

Name	CAS Number	% Concentration
Gasoline	86290-81-5	100
Heptane (mixed isomers)	142-82-5	2.5-26
Pentane (mixed isomers)	78-78-4	6.5-19
Butane (mixed isomers)	106-97-8	0.5-14
Hexane Isomers (other than n-Hexane)	107-83-5	2-12
Toluene	108-88-3	3-9.5
Xylene (mixed isomers)	1330-20-7	3.5-9.5
n-Hexane	110-54-3	0.1-4.5
Cumene	98-82-8	0-4
1,2,4 Trimethylbenzene	95-63-6	1-4
Ethylbenzene	100-41-4	0.5-2.5
Benzene	71-43-2	0.1-1.5
Cyclohexane	110-82-7	0-1.5
Octane	111-65-9	0-1.5
1,2,3-trimethylbenzene	526-73-8	0-1
Naphthalene	91-20-3	0.1-0.5

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First Aid Measures

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation: Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. If symptoms occur get medical attention.

Skin Contact: Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. May be absorbed through the skin in harmful amounts. Get medical attention if irritation persists. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).

Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties. Destroy contaminated, non-chemical resistant footwear.

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.

Ingestion: Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects: Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Indication of any immediate medical attention and special treatment needed

Notes To Physician: INHALATION: This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

INGESTION: This material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media
Do not use straight water streams to avoid spreading fire.

Specific hazards arising from the chemical
This product has been determined to be an extremely flammable liquid per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the Emergency Response Guidebook 128.

Hazardous combustion products
Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data
Sensitivity to Mechanical Impact No.
Sensitivity to Static Discharge Yes.

Special protective equipment and precautions for firefighters
Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Avoid using straight water streams. Water may be ineffective in extinguishing low flash point fires, but can be used to cool exposed surfaces. Avoid excessive water spray application. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Keep run-off water out of sewers and water sources.

Additional firefighting tactics
FIRES INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles: if this is impossible, withdraw from area and let fire burn.

EVACUATION: Consider initial downwind evacuation for at least 1000 feet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 5280 feet (1 mile) in all directions; also, consider initial evacuation of 5280 feet (1 mile) in all directions.

NFPA	Health 1	Flammability 3	Instability 0	Special Hazard -

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:	Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Eliminate all ignition sources.
Protective equipment:	Use personal protection measures as recommended in Section 8.
Emergency procedures:	Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.
Environmental precautions:	Avoid release to the environment. Avoid subsoil penetration. Ethanol in gasoline phase seperates in contact with water. Monitor downstream for dissolved ethanol or other appropriate indicators.
Methods and materials for containment:	Contain liquid with sand or soil. Prevent spilled material from entering storm drains, sewers, and open waterways.
Methods and materials for cleaning up:	Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers. When recovering free liquids ensure all equipment is grounded and bonded. Use only non-sparking tools.

7. HANDLING AND STORAGE

Safe Handling Precautions:

NEVER SIPHON THIS PRODUCT BY MOUTH. Use appropriate grounding and bonding practices. Static accumulating flammable liquid. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Vapors may travel along the ground or be moved by ventilation. Flashback may occur along vapor trails. No smoking. Use only non-sparking tools. Avoid contact with skin, eyes and clothing. Avoid breathing fumes, gas, or vapors. Use only with adequate ventilation. Avoid repeated and prolonged skin contact. Use personal protection measures as recommended in Section 8. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

Hydrocarbons are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignition of vapors or mists without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.

Portable containers should never be filled while in or on a motor vehicle or marine craft. Containers should be placed on the ground. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers.

A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling.

Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

Storage Conditions:

Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Do not store near an open flame, heat or other sources of ignition.

Incompatible Materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELS:	OSHA - Vacated PELs	NIOSH IDLH
Gasoline 86290-81-5	300 ppm TWA 500 ppm STEL	-	300 ppm TWA 900 mg/m^3 TWA 500 ppm STEL 1500 mg/m^3 STEL	-

Heptane (mixed isomers) 142-82-5	400 ppm TWA 500 ppm STEL	TWA: 500 ppm TWA: 2000 mg/m³	400 ppm TWA 1600 mg/m³ TWA 500 ppm STEL 2000 mg/m³ STEL	750 ppm
Pentane (mixed isomers) 78-78-4	1000 ppm TWA	-	-	-
Butane (mixed isomers) 106-97-8	1000 ppm STEL	-	800 ppm TWA 1900 mg/m³ TWA	-
Hexane Isomers (other than n-Hexane) 107-83-5	500 ppm TWA 1000 ppm STEL	-	500 ppm TWA 1800 mg/m³ TWA 1000 ppm STEL 3600 mg/m³ STEL	-
Toluene 108-88-3	20 ppm TWA	TWA: 200 ppm Ceiling: 300 ppm	100 ppm TWA 375 mg/m³ TWA 150 ppm STEL 560 mg/m³ STEL	500 ppm
Xylene (mixed isomers) 1330-20-7	100 ppm TWA 150 ppm STEL	TWA: 100 ppm TWA: 435 mg/m³	100 ppm TWA 435 mg/m³ TWA 150 ppm STEL 655 mg/m³ STEL	900 ppm
n-Hexane 110-54-3	50 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 500 ppm TWA: 1800 mg/m³	50 ppm TWA 180 mg/m³ TWA	1100 ppm
Cumene 98-82-8	50 ppm TWA	TWA: 50 ppm TWA: 245 mg/m³ Skin	50 ppm TWA 245 mg/m³ TWA Limit applies to skin	900 ppm
1,2,4 Trimethylbenzene 95-63-6	25 ppm TWA	-	25 ppm TWA 125 mg/m³ TWA	-
Ethylbenzene 100-41-4	20 ppm TWA	TWA: 100 ppm TWA: 435 mg/m³	100 ppm TWA 435 mg/m³ TWA 125 ppm STEL 545 mg/m³ STEL	800 ppm
Benzene 71-43-2	0.5 ppm TWA 2.5 ppm STEL Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm (applies to industry segments exempt from the benzene standard) TWA: 1 ppm STEL: 5 ppm (see 29 CFR 1910.1028)	25 ppm Ceiling 1 ppm TWA 5 ppm STEL	500 ppm
Cyclohexane 110-82-7	100 ppm TWA	TWA: 300 ppm TWA: 1050 mg/m³	300 ppm TWA 1050 mg/m³ TWA	1300 ppm
Octane 111-65-9	300 ppm TWA	TWA: 500 ppm TWA: 2350 mg/m³	300 ppm TWA 1450 mg/m³ TWA 375 ppm STEL 1800 mg/m³ STEL	1000 ppm
1,2,3-trimethylbenzene 526-73-8	25 ppm TWA	-	25 ppm TWA 125 mg/m³ TWA	-
Naphthalene 91-20-3	10 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm TWA: 50 mg/m³	10 ppm TWA 50 mg/m³ TWA 15 ppm STEL 75 mg/m³ STEL	250 ppm

Notes: The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

Engineering measures: Local or general exhaust required in an enclosed area or when there is inadequate ventilation. Use mechanical ventilation equipment that is explosion-proof.

Personal protective equipment

Eye protection:	Use goggles or face-shield if the potential for splashing exists.
Skin and body protection:	Use nitrile rubber, Viton® or PVA gloves for repeated or prolonged skin exposure. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.
Respiratory protection:	Use a NIOSH approved organic vapor chemical cartridge or supplied air respirators when there is the potential for airborne exposures to exceed permissible exposure limits or if excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.
Hygiene measures:	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid
Appearance	Clear yellow liquid
Color	Yellow
Odor	Hydrocarbon
Odor Threshold	No data available.

Property	**Values (Method)**
Melting Point / Freezing Point	No data available.
Initial Boiling Point / Boiling Range	24-210 °C / 75-410 °F (ASTM D86)
Flash Point	-43 °C / -45 °F
Evaporation Rate	No data available.
Flammability (solid, gas)	Not applicable.
Flammability Limit in Air (%):	
Upper Flammability Limit:	7.6
Lower Flammability Limit:	1.4
Explosion limits:	No data available.
Vapor Pressure	5.5-15 psi (ASTM D4814)
Vapor Density	3-4
Specific Gravity / Relative Density	0.70-0.76
Water Solubility	No data available.
Solubility in other solvents	No data available.
Partition Coefficient	2.13-4.5
Decomposition temperature	No data available.
pH:	Not applicable
Autoignition Temperature	280 °C / 536 °F
Kinematic Viscosity	No data available.
Dynamic Viscosity	No data available.
Explosive Properties	No data available.
VOC Content (%)	100%
Density	No data available.
Bulk Density	Not applicable.

10. STABILITY AND REACTIVITY

Reactivity	The product is non-reactive under normal conditions.
Chemical stability	The material is stable at 70°F, 760 mmHg pressure.
Possibility of hazardous reactions	None under normal processing.
Hazardous polymerization	Will not occur.

Conditions to avoid Excessive heat, sources of ignition, open flame.

Incompatible Materials Strong oxidizing agents.

Hazardous decomposition products None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation May cause irritation of respiratory tract. May cause drowsiness or dizziness. Breathing high concentrations of this material in a confined space or by intentional abuse can cause irregular heartbeats which can cause death.

Eye contact Exposure to vapor or contact with liquid may cause mild eye irritation, including tearing, stinging, and redness.

Skin contact Causes skin irritation. Effects may become more serious with repeated or prolonged contact. May be absorbed through the skin in harmful amounts.

Ingestion May be fatal if swallowed or vomited and enters airways. May cause irritation of the mouth, throat and gastrointestinal tract.

Acute toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50
Gasoline 86290-81-5	14000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.2 mg/L (Rat) 4 h
Heptane (mixed isomers) 142-82-5	-	3000 mg/kg (Rabbit)	103 g/m³ (Rat) 4 h
Pentane (mixed isomers) 78-78-4	-	-	450 mg/L (Mouse) 2 h
Butane (mixed isomers) 106-97-8	-	-	658 mg/L (Rat) 4 h
Hexane Isomers (other than n-Hexane) 107-83-5	> 5000 mg/kg (Rat)	-	-
Toluene 108-88-3	> 2000 mg/kg (Rat)	8390 mg/kg (Rabbit)	12.5 mg/L (Rat) 4 h
Xylene (mixed isomers) 1330-20-7	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.04 mg/L (Rat) 4 h
n-Hexane 110-54-3	15000 mg/kg (Rat)	3000 mg/kg (Rabbit)	48000 ppm (Rat) 4 h
Cumene 98-82-8	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 20 mg/L (Rat) 6 h
1,2,4 Trimethylbenzene 95-63-6	3280 mg/kg (Rat)	> 3160 mg/kg (Rabbit)	18,000 mg/m³ (Rat) 4 h
Ethylbenzene 100-41-4	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	17.2 mg/L (Rat) 4 h
Benzene 71-43-2	> 2000 mg/kg (Rat)	> 5000 mg/kg (Rabbit)	> 20 mg/l (Rat) 4 h
Cyclohexane 110-82-7	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	13.9 mg/L (Rat) 4 h
Octane 111-65-9	-	-	118 g/m³ (Rat) 4 h
1,2,3-trimethylbenzene 526-73-8	-	-	-
Naphthalene 91-20-3	490 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 340 mg/m³ (Rat) 1 h

Delayed and immediate effects as well as chronic effects from short and long-term exposure

NAPHTHAS: In a large epidemiological study on over 15,000 employees at several petroleum refineries and amongst residents located near these refineries, no increased risk of kidney cancer was observed in association with gasoline exposures (a similar material). In a similar study, no increased risk of kidney cancer was observed among petroleum refinery workers, but there was a slight trend in the incidence of kidney cancers among service station employees, especially after a 30-year latency period. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffer's Encephalopathy), delirium, seizures, and sudden death have been reported from repeated overexposure to some hydrocarbon solvents, naphthas, and gasoline.

ISOPARAFFINS: Studies in laboratory animals have shown that long-term exposure to similar materials (isoparaffins) can cause kidney damage and kidney cancer in male laboratory rats. However, in-depth research indicates that these findings are unique to the male rat, and that these effects are not relevant to humans.

C9 AROMATIC HYDROCARBONS: A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm.

PENTANES: Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

BUTANES: Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

TOLUENE: Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Abuse of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system, and can cause CNS depression, cardiac arrhythmias, and death. Studies of workers indicate longterm exposure may be related to impaired color vision and hearing. Some studies of workers suggest longterm exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest longterm exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals have been largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Adverse effects on the liver, kidney, thymus and nervous system were observed in animal studies following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

XYLENES, ALL ISOMERS: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, nervous system damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross overexposure. Effects from Prolonged or Repeated Exposure: Impaired neurological function was reported

in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure with evidence of maternal toxicity. The relevance of these observations to humans is not clear at this time. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1,2,4-TRIMETHYLBENZENE: The following information pertains to a mixture of C9 aromatic hydrocarbons, over 40% of which was composed of 1,2,4-trimethylbenzene. A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm. Embryotoxicity has been reported in studies of laboratory animals. Adverse effects included increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate.<n><n>

N-HEXANE: Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Testicular atrophy and partial to full loss of the germ cell line were observed in sub-chronic high-dose inhalation studies of laboratory rodents. These effects appeared irreversible. Rodent reproduction studies have shown evidence of reduced fetal weight but no frank malformations.

CUMENE: Overexposure to cumene may cause upper respiratory tract irritation and CNS depression. Studies in laboratory animals indicate evidence of respiratory tract hyperplasia, and adverse effects on the liver, kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time. Findings from lifetime laboratory rodent inhalation studies were as follows: In F344/N rats: an increased incidence of renal carcinomas and adenomas, respiratory epithelial adenomas, and interstitial cell adenomas of the testes. In B6C3F1 mice: an increased incidence of carcinomas and adenomas of the bronchi and lung, liver neoplasms, hemangiosarcomas of the spleen, and adenomas of the thyroid.

ETHYLBENZENE: Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). The incidence of tumors was also elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure with evidence of maternal toxicity. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals have demonstrated evidence of ototoxicity (hearing loss) following exposure levels as low as 300 ppm for 5 days. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

BENZENE: Studies of workers exposed to benzene show clear evidence that overexposure can cause cancer and other diseases of the blood forming organs including Acute

Myelogenous Leukemia (AML), and Aplastic Anemia (AA), an often fatal disease. Some studies suggest overexposure to benzene may also be associated with Myelodysplastic Syndrome (MDS). Findings from a case control study of workers exposed to benzene was reported during the 2009 Benzene Symposium in Munich included an increase in Acute Myeloid Leukemias and Non-Hodgkins Lymphoid Neoplasms (NHLN) of the subtype follicular lymphoma (FL) in some occupational categories. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of AA have been reported in the offspring of persons severely overexposed to benzene. Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and minor skeletal variations. Benzene has been classified as a proven human carcinogen by OSHA and a Group 1 (Carcinogenic to Humans) material by IARC. The current proposed IARC classification for benzene is summarized as follows: Sufficient evidence for Acute Myeloid Leukemia; limited evidence for Acute Lymphatic Leukemia, Chronic Lymphatic Leukemia, Non-Hodgkin Lymphoma, and Multiple Myeloma.

NAPHTHALENE: Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from overexposure to naphthalene. Persons with glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have been reported in persons overexposed to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect. Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) in vitro. Naphthalene has been classified as Possibly Carcinogenic to Humans (2B) by IARC, based on findings from studies in laboratory animals.

CARBON MONOXIDE: is a chemical asphyxiant with no warning properties (such as odor). At 400-500 ppm for 1 hour headache and dyspnea may occur. If activity is increased, symptoms of overexposure may include nausea, irritability, increased respiration, tinnitus, sweating, chest pain, confusion, impaired judgement, dizziness, weakness, drowsiness, ataxia, irregular heart beat, cyanosis and pallor. Levels in excess of 1000 ppm can result in collapse, loss of conciousness, respiratory failure and death. Extremely high concentrations (12,800 ppm) can cause immediate unconsciousness and death in 1-3 minutes. Repeated anoxia can lead to central nervous system damage and peripheral neuropathy, with loss of sensation in the fingers, amnesia, and mental deterioration and possible congestive heart failure. Damage may also occur to the fetus, lung, liver, kidney, spleen, cardiovascular system and other organs.

WHOLLY-VAPORIZED UNLEADED GASOLINE: Lifetime exposure to wholly vaporized unleaded gasoline produced an increased incidence of liver tumors in female mice exposed to the highest exposure concentration (2056 ppm) and α-2 urinary globulin-mediated kidney tumors in male rats. No exposure-related tumors were observed in male mice or female rats. The male-specific rat kidney tumors are not considered relevant to human health. Mice receiving lifetime repeated skin application of various petroleum naphthas exhibited an irritation-dependent increased incidence of skin tumors. Additional studies suggest that these tumors occur through a mechanism that may not be relevant to human health. Epidemiological data from over 18,000 petroleum marketing and distribution workers

showed no increased risk of leukemia, multiple myeloma, or kidney cancer resulting from gasoline exposure. Unleaded gasoline has been identified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC).

COMBUSTION ENGINE EXHAUST: Chronic inhalation studies of gasoline engine exhaust in mice, rats and hamsters did not produce any carcinogenic effects. Condensates/extracts of gasoline engine exhaust produced an increase in tumors compared to controls when testing by skin painting, subcutaneous injection, intratracheal instillation or implantation into the lungs. Gasoline exhaust has been classified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC).

Adverse effects related to the physical, chemical and toxicological characteristics

Signs and Symptoms Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Sensitization Not expected to be a skin or respiratory sensitizer.

Mutagenic effects May cause genetic defects.

Carcinogenicity May cause cancer.

Cancer designations are listed in the table below

Name	ACGIH (Class)	IARC (Class)	NTP	OSHA
Gasoline 86290-81-5	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Not Listed	Not Listed
Heptane (mixed isomers) 142-82-5	Not Listed	Not Listed	Not Listed	Not Listed
Pentane (mixed isomers) 78-78-4	Not Listed	Not Listed	Not Listed	Not Listed
Butane (mixed isomers) 106-97-8	Not Listed	Not Listed	Not Listed	Not Listed
Hexane Isomers (other than n-Hexane) 107-83-5	Not Listed	Not Listed	Not Listed	Not Listed
Toluene 108-88-3	Not Classifiable (A4)	Not Classifiable (3)	Not Listed	Not Listed
Xylene (mixed isomers) 1330-20-7	Not classifiable (A4)	Not classifiable (3)	Not Listed	Not Listed
n-Hexane 110-54-3	Not Listed	Not Listed	Not Listed	Not Listed
Cumene 98-82-8	Not listed	Possible human carcinogen (2B)	Reasonably anticipated to be a human carcinogen	Not listed
1,2,4 Trimethylbenzene 95-63-6	Not Listed	Not Listed	Not Listed	Not Listed
Ethylbenzene 100-41-4	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Not Listed	Not Listed
Benzene 71-43-2	Confirmed human carcinogen (A1)	Carcinogenic to humans (1)	Known to be human carcinogen	Known carcinogen
Cyclohexane 110-82-7	Not Listed	Not Listed	Not Listed	Not Listed
Octane 111-65-9	Not Listed	Not Listed	Not Listed	Not Listed
1,2,3-trimethylbenzene 526-73-8	Not Listed	Not Listed	Not Listed	Not Listed
Naphthalene 91-20-3	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Reasonably anticipated to be a human carcinogen	Not Listed

Reproductive toxicity Suspected of damaging fertility or the unborn child.

Specific Target Organ Toxicity (STOT) - single exposure Respiratory system. Central nervous system.

Specific Target Organ Toxicity (STOT) - repeated exposure Not classified.

Aspiration hazard May be fatal if swallowed or vomited and enters airways.

12. ECOLOGICAL INFORMATION

Ecotoxicity This product should be considered toxic to aquatic organisms, with the potential to cause long lasting adverse effects in the aquatic environment.

Name	Algae/aquatic plants	Fish	Toxicity to Microorganisms	Crustacea
Gasoline 86290-81-5	72-hr EC50 = 56 mg/l Algae	96-hr LC50 = 11 mg/l Rainbow trout (static)	-	48-hr LC50 = 7.6 mg/l Daphnia magna
Heptane (mixed isomers) 142-82-5	-	96-hr LC50 = 375 mg/L Tilapia	-	-
Pentane (mixed isomers) 78-78-4	-	96-hr LC50 = 3.1 mg/L Rainbow trout	-	48-hr EC50 = >1 - <10 mg/L Daphnia magna
Butane (mixed isomers) 106-97-8	-	-	-	-
Hexane Isomers (other than n-Hexane) 107-83-5	-	-	-	-
Toluene 108-88-3	72-hr EC50 = 12.5 mg/l Algae	96-hr LC50 <= 10 mg/l Rainbow trout	-	48-hr EC50 = 5.46-9.83 mg/l Daphnia magna 48-hr EC50 = 11.5 mg/l Daphnia magna (Static)
Xylene (mixed isomers) 1330-20-7	72-hr EC50 = 11 mg/l Algae	96-hr LC50 = 8 mg/l Rainbow trout	-	48-hr LC50 = 3.82 mg/l Daphnia magna
n-Hexane 110-54-3	-	96-hr LC50 = 2.5 mg/l Fathead minnow	-	-
Cumene 98-82-8	72-hr EC50 = 2.6 mg/l Algae	96-hr LC50 = 6.04-6.61 mg/l Fathead minnow (Flow-through) 96-hr LC50 = 2.7 mg/l Rainbow trout (semi-static)	-	48-hr EC50 = 7.9-14.1 mg/l Daphnia magna (static)
1,2,4 Trimethylbenzene 95-63-6	-	96-hr LC50 = 7.19-8.28 mg/l Fathead minnow (flow-through)	-	48-hr EC50 = 6.14 mg/L Daphnia magna
Ethylbenzene 100-41-4	72-hr EC50 = 1.7-7.6 mg/l Algae	96-hr LC50 = 4 mg/L Rainbow trout	-	48-hr EC50 = 1-4 mg/L Daphnia magna
Benzene 71-43-2	72-hr EC50 = 29 mg/l Algae	96-hr LC50 = 5.3 mg/l Rainbow trout (flow-through)	-	48-hr EC50 = 8.76-15.6 mg/l Daphnia magna (Static)
Cyclohexane 110-82-7	72-hr EC50 = 500 mg/l Algae	96-hr LC50 = 3.96-5.18 mg/l Fathead minnow	-	48-hr EC50 = 1.7-3.5 mg/L Bay shrimp
Octane 111-65-9	-	-	-	48-hr LC50 = 0.38 mg/l Daphnia magna
1,2,3-trimethylbenzene 526-73-8	-	96-hr LC50 = 7.72 mg/l Fathead Minnow (flow-through)	-	-
Naphthalene 91-20-3	-	96-hr LC50 = 0.91-2.82 mg/l Rainbow trout (static) 96-hr LC50 = 1.99 mg/l Fathead minnow (static)	-	48-hr LC50 = 1.6 mg/l Daphnia magna

Persistence and degradability Expected to be inherently biodegradable. The presence of ethanol in this product may impede the biodegradation of benzene, toluene, ethylbenzene and xylene in groundwater, resulting in elongated plumes of these constituents.

Bioaccumulation Has the potential to bioaccumulate.

Mobility in soil May partition into air, soil and water.

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues
This material may be a flammable liquid waste.

Safe Handling of Wastes
Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required. Use appropriate grounding and bonding practices. Use only non-sparking tools. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking.

Disposal of Wastes / Methods of Disposal
The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal
Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101):

UN Proper Shipping Name:	Gasoline
UN/Identification No:	UN 1203
Transport Hazard Class(es):	3
Packing Group:	II

TDG (Canada):

UN Proper Shipping Name:	Gasoline
UN/Identification No:	UN 1203
Transport Hazard Class(es):	3
Packing Group:	II

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b): This product and/or its components are listed on the TSCA Chemical Inventory.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product does not contain any component(s) included on EPA's Extremely Hazardous Substance (EHS) List.

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Gasoline	NA
Heptane (mixed isomers)	NA
Pentane (mixed isomers)	NA
Butane (mixed isomers)	NA
Hexane Isomers (other than n-Hexane)	NA
Toluene	NA
Xylene (mixed isomers)	NA

n-Hexane	NA
Cumene	NA
1,2,4 Trimethylbenzene	NA
Ethylbenzene	NA
Benzene	NA
Cyclohexane	NA
Octane	NA
1,2,3-trimethylbenzene	NA
Naphthalene	NA

SARA Section 304: This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	Hazardous Substances RQs
Gasoline	NA
Heptane (mixed isomers)	NA
Pentane (mixed isomers)	NA
Butane (mixed isomers)	NA
Hexane Isomers (other than n-Hexane)	NA
Toluene	1000 lb final RQ 454 kg final RQ
Xylene (mixed isomers)	100 lb final RQ 45.4 kg final RQ
n-Hexane	5000 lb final RQ 2270 kg final RQ
Cumene	5000 lb final RQ 2270 kg final RQ
1,2,4 Trimethylbenzene	NA
Ethylbenzene	1000 lb final RQ 454 kg final RQ
Benzene	10 lb final RQ 4.54 kg final RQ
Cyclohexane	1000 lb final RQ 454 kg final RQ
Octane	NA
1,2,3-trimethylbenzene	NA
Naphthalene	100 lb final RQ 45.4 kg final RQ

SARA: The following EPA hazard categories apply to this product:

Acute Health Hazard
Chronic Health Hazard
Fire Hazard

SARA Section 313: This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting:
Gasoline	None
Heptane (mixed isomers)	None
Pentane (mixed isomers)	None
Butane (mixed isomers)	None
Hexane Isomers (other than n-Hexane)	None
Toluene	1.0 % de minimis concentration
Xylene (mixed isomers)	1.0 % de minimis concentration
n-Hexane	1.0 % de minimis concentration
Cumene	1.0 % de minimis concentration

1,2,4 Trimethylbenzene	1.0 % de minimis concentration
Ethylbenzene	0.1 % de minimis concentration
Benzene	0.1 % de minimis concentration
Cyclohexane	1.0 % de minimis concentration
Octane	None
1,2,3-trimethylbenzene	None
Naphthalene	0.1 % de minimis concentration

State and Community Right-To-Know Regulations:
The following component(s) of this material are identified on the regulatory lists below:

Gasoline

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 0957
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Carcinogen; Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 0957 TPQ: 10000 lb (Under N.J.A.C. 7:1G, environmental hazardous substances in mixtures such as gasoline or new and used petroleum oil may be reported under these categories)
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Heptane (mixed isomers)

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1339
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Pentane (mixed isomers)

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1064
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed

California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - fourth degree
New Jersey - Environmental Hazardous Substances List:	SN 1064 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Butane (mixed isomers)

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 0273
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - fourth degree
New Jersey - Environmental Hazardous Substances List:	SN 0273 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Hexane Isomers (other than n-Hexane)

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1285
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Toluene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Developmental toxicity, initial date 1/1/91 Female reproductive toxicity, initial date 8/7/09
New Jersey Right-To-Know:	SN 1866
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic (skin); Flammable (skin)
Michigan Critical Materials Register List:	100 lb Annual usage threshold
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed

New Jersey - Special Hazardous Substances:	Flammable - third degree; Teratogen
New Jersey - Environmental Hazardous Substances List:	SN 1866 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	1000 lb RQ (air); 1 lb RQ (land/water)

Xylene (mixed isomers)

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 2014
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic (skin); Flammable (skin)
Michigan Critical Materials Register List:	100 lb Annual usage threshold all isomers
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 2014 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	1000 lb RQ (air); 1 lb RQ (land/water)

n-Hexane

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1340
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 1340 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	1 lb RQ (air); 1 lb RQ (land/water)

Cumene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Carcinogen, initial date 4/6/10
New Jersey Right-To-Know:	SN 0542
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic (skin); Flammable (skin)
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 0542 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Present

New York - Reporting of Releases Part 597 - List of Hazardous Substances:	5000 lb RQ (air); 1 lb RQ (land/water)

1,2,4 Trimethylbenzene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1929
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Ethylbenzene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Carcinogen, initial date 6/11/04
New Jersey Right-To-Know:	SN 0851
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Carcinogen; flammable - Third degree
New Jersey - Environmental Hazardous Substances List:	SN 0851 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	1000 lb RQ (air); 1 lb RQ (land/water)

Benzene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Carcinogen, initial date 2/27/87 Developmental toxicity, initial date 12/26/97 Male reproductive toxicity, initial date 12/26/97
New Jersey Right-To-Know:	SN 0197
Pennsylvania Right-To-Know:	Environmental hazard; Special hazardous substance
Massachusetts Right-To Know:	Carcinogen; Extraordinarily hazardous
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic (skin); Flammable (skin); Carcinogen (skin)
Michigan Critical Materials Register List:	100 lb Annual usage threshold
Massachusetts Extraordinarily Hazardous Substances:	Carcinogen; Extraordinarily hazardous
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Present
New Jersey - Special Hazardous Substances:	Carcinogen; Flammable - third degree; Mutagen
New Jersey - Environmental Hazardous Substances List:	SN 0197 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	10 lb RQ (air); 1 lb RQ (land/water)

Cyclohexane

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 0565
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 0565 TPQ: 500 lb
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	1000 lb RQ (air); 1 lb RQ (land/water)

Octane

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1434
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

1,2,3-trimethylbenzene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1929
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Naphthalene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Carcinogen, initial date 4/19/02
New Jersey Right-To-Know:	SN 1322 SN 3758

Pennsylvania Right-To-Know:	Environmental hazard Present (particulate)
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Carcinogen
New Jersey - Environmental Hazardous Substances List:	SN 1322 TPQ: 500 lb (Reportable at the de minimis quantity of >0.1%)
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	100 lb RQ (air); 1 lb RQ (land/water)

Canada DSL/NDSL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations.

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
Gasoline	B2,D2A,D2B	0.1%
Heptane (mixed isomers)	B2,D2B	1%
Pentane (mixed isomers)	B2	1%
Butane (mixed isomers)	A,B1	1%
Hexane Isomers (other than n-Hexane)	B2	1%
Toluene	B2,D2A,D2B	0.1%
Xylene (mixed isomers)	B2,D2A,D2B	m-, o-isomers 1.0%; p-isomer 0.1%
n-Hexane	B2,D2A,D2B	1%
Cumene	B2,D2A	0.1%
1,2,4 Trimethylbenzene	B3,D2B	1%
Ethylbenzene	B2,D2A,D2B	0.1%
Benzene	B2,D2A,D2B	0.1%
Cyclohexane	B2,D2B	1%
Octane	B2,D2B	1%
1,2,3-trimethylbenzene	B3	1%
Naphthalene	B4,D2A	0.1%

Note: Not applicable.

16. OTHER INFORMATION

Prepared By Toxicology and Product Safety

Revision Date: 06/01/2016

Revision Note:

Revised Sections

The following sections (§) have been updated:
1. IDENTIFICATION
2. HAZARD IDENTIFICATION
3. COMPOSITION/INFORMATION ON INGREDIENTS
4. FIRST AID MEASURES
6. ACCIDENTAL RELEASE MEASURES
7. HANDLING AND STORAGE
8. EXPOSURE CONTROLS/PERSONAL PROTECTION
9. PHYSICAL AND CHEMICAL PROPERTIES
11. TOXICOLOGICAL INFORMATION
12. ECOLOGICAL INFORMATION
15. REGULATORY INFORMATION

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

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

· **1.1 Product identifier**

· **Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)**

· **Article number:** No other identifiers

· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.

· **Application of the substance / the mixture** Lubricant

· **1.3 Details of the supplier of the Safety Data Sheet**

· **Manufacturer/Supplier:**
Synco Chemical Corporation
24 DaVinci Dr., P.O. Box 405
Bohemia, NY 11716
Telephone: 631-567-5300
Email: info@super-lube.com

· **1.4 Emergency telephone number:**
CHEMTREC
1-800-424-9300 (US/Canada)
+01 703-527-3887 (International)

SECTION 2: Hazards identification

· **2.1 Classification of the substance or mixture**

· **Classification according to Regulation (EU) No 2015/830**
The product is not classified as hazardous according to OSHA GHS regulations within the United States.
The product is not classified as hazardous according to the CLP regulation.

· **Information concerning particular hazards for human and environment:**
The product does not have to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.
The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

· **Additional information:**
0 percent of the mixture consists of component(s) of unknown toxicity
There are no other hazards not otherwise classified that have been identified.

· **2.2 Label elements**

· **Labelling according to Regulation (EC) No 1272/2008**
The product is not classified as hazardous according to OSHA GHS regulations within the United States.
This product does not have a classification according to the CLP regulation.

· **Hazard pictograms** Not Regulated

· **Signal word** Not Regulated

(Contd. on page 2)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 1)

· **Hazard-determining components of labelling:** None.
· **Hazard statements** Not Regulated
· **Precautionary statements** Not Regulated
· **Hazard description:**
· **WHMIS-symbols:** Not hazardous under WHMIS.
· **NFPA ratings (scale 0 - 4)**

Health = 0
Fire = 1
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 0
Fire = 1
Reactivity = 0

· **HMIS Long Term Health Hazard Substances**
None of the ingredients are listed.

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

SECTION 3: Composition/information on ingredients

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

· **Dangerous components:** None in reportable quantities.
· **Additional information:**
For the wording of the listed risk phrases refer to section 16.
For the listed ingredients, the identity and exact percentages are being withheld as a trade secret.

SECTION 4: First aid measures

· **4.1 Description of first aid measures**
· **General information:** No special measures required.
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation is experienced, consult a doctor.
· **After eye contact:**
Rinse opened eye for several minutes under running water.
Remove contact lenses if worn.

(Contd. on page 3)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 2)

Seek medical treatment in case of complaints.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed**
May cause gastro-intestinal irritation if ingested.
Acne
· **Hazards** No further relevant information available.
· **4.3 Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

SECTION 5: Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:** Use fire extinguishing methods suitable to surrounding conditions.
· **For safety reasons unsuitable extinguishing agents:** Water with full jet
· **5.2 Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information** No further relevant information available.

SECTION 6: Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures**
Ensure adequate ventilation
Particular danger of slipping on leaked/spilled product.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Pick up mechanically.
Dispose contaminated material as waste according to item 13.
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

SECTION 7: Handling and storage

· **7.1 Precautions for safe handling** Store away from oxidising agents.
· **Information about fire - and explosion protection:** No special measures required.

(Contd. on page 4)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 3)

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:**
Avoid storage near extreme heat, ignition sources or open flame.
· **Information about storage in one common storage facility:**
Store away from foodstuffs.
Do not store together with oxidising and acidic materials.
· **Further information about storage conditions:** None.
· **7.3 Specific end use(s)** No further relevant information available.

SECTION 8: Exposure controls/personal protection

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

· **8.1 Control parameters**
· **Ingredients with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
· **DNELs** No further relevant information available.
· **PNECs** No further relevant information available.
· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
The usual precautionary measures are to be adhered to when handling chemicals.
Keep away from foodstuffs, beverages and feed.
Avoid contact with the eyes and skin.
· **Respiratory protection:** Not required under normal conditions of use.
· **Protection of hands:**
Gloves not required under normal conditions of use.
Wear protective gloves to handle contents of damaged or leaking units.
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**


Safety glasses

(Contd. on page 5)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 4)

· **Body protection:** Not required under normal conditions of use.
· **Limitation and supervision of exposure into the environment** No special requirements.
· **Risk management measures** No special requirements.

SECTION 9: Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Semi-solid
Colour:	Translucent
· **Odour:**	Mild
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Not Determined.
Boiling point/Boiling range:	Undetermined.
· **Flash point:**	>220 °C (>428 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Auto/Self-ignition temperature:**	Not determined.
· **Decomposition temperature:**	Not determined.
· **Self-igniting:**	Product is not self-igniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure:**	Not determined.
· **Density at 20 °C (68 °F):**	0,89 g/cm³ (7,427 lbs/gal)
· **Relative density**	Not determined.
· **Vapour density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with water:**	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.

(Contd. on page 6)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 5)

· **9.2 Other information** No further relevant information available.

SECTION 10: Stability and reactivity

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used and stored according to specifications.
· **10.3 Possibility of hazardous reactions** Reacts with strong acids and oxidising agents.
· **10.4 Conditions to avoid**
Avoid acids.
Excessive heat.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:** Carbon monoxide and carbon dioxide

SECTION 11: Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **LD/LC50 values relevant for classification:** None.
· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** No irritating effect.
· **Sensitisation:** No sensitising effects known.
· **Subacute to chronic toxicity:** No further relevant information available.
· **Additional toxicological information:**
The product is not subject to classification according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version.
When used and handled according to specifications, the product does not have any harmful effects to our experience and the information provided to us.
May cause acne.
· **Repeated dose toxicity:** No further relevant information available.
· **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction):** See Section 15.

SECTION 12: Ecological information

· **12.1 Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **12.2 Persistence and degradability** The product is partially biodegradable. Significant residuals remain.
· **12.3 Bioaccumulative potential** No further relevant information available.
· **12.4 Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

(Contd. on page 7)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 6)

Avoid transfer into the environment.
Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water

· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **12.6 Other adverse effects** No further relevant information available.

SECTION 13: Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Smaller quantities can be disposed of with household waste.
Can be burned with household garbage after consulting with the waste disposal facility operator and the pertinent authorities and adhering to the necessary technical regulations.
The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes.

· **Uncleaned packaging:**
· **Recommendation:** Disposal must be made according to official regulations.

SECTION 14: Transport information

· **14.1 UN-Number**	
· **DOT, ADR, ADN, IMDG, IATA**	Not Regulated
· **14.2 UN proper shipping name**	
· **DOT, ADR, ADN, IMDG, IATA**	Not Regulated
· **14.3 Transport hazard class(es)**	
· **DOT, ADR, ADN, IMDG, IATA**	
· **Class**	Not Regulated
· **14.4 Packing group**	
· **DOT, ADR, IMDG, IATA**	Not Regulated
· **14.5 Environmental hazards:**	
· **Marine pollutant:**	No
· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	-

(Contd. on page 8)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 7)

SECTION 15: Regulatory information

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

· **Section 355 (extremely hazardous substances):**
None of the ingredients are listed.

· **Section 313 (Specific toxic chemical listings):**
None of the ingredients are listed.

· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients are listed.

· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**
None of the ingredients are listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients are listed.

· **IARC (International Agency for Research on Cancer)**

9002-84-0	Polytetrafluoroethylene	3

· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients are listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients are listed.

· **Canada**

· **Canadian Domestic Substances List (DSL)**
All ingredients are listed.

· **Canadian Ingredient Disclosure list (limit 0.1%)**
None of the ingredients are listed.

· **Canadian Ingredient Disclosure list (limit 1%)**
None of the ingredients are listed.

· **Other regulations, limitations and prohibitive regulations**
This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.

(Contd. on page 9)

Safety Data Sheet
according to (EU) 2015 / 830 and OSHA GHS

Revision: February 8, 2016

Trade name: Super Lube® Multi-Purpose Synthetic Grease with Syncolon® (PTFE)

(Contd. of page 8)

· **Substances of very high concern (SVHC) according to REACH, Article 57**

None of the ingredients are listed.

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

SECTION 16: Other information

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

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
WHMIS: Workplace Hazardous Materials Information System (Canada)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent

· **Sources**
SDS Prepared by:
ChemTel Inc.
1305 North Florida Avenue
Tampa, Florida USA 33602-2902
Toll Free North America 1-888-255-3924 Intl. +01 813-248-0573
Website: www.chemtelinc.com

SAFETY DATA SHEET

SDS ID NO.: 0298MAR019
Revision Date: 05/22/2015

1. IDENTIFICATION

Product Name: Marathon Petroleum Premium AW II Hydraulic Oil

Synonym: Premium AW II ISO 32 Hydraulic Oil; Premium AW II ISO 46 Hydraulic Oil; Premium AW II ISO 68 Hydraulic Oil; Premium AW II ISO 100 Hydraulic Oil; ISO 32 Premium AW II Hydraulic Oil; ISO 46 Premium AW II Hydraulic Oil; ISO 68 Premium AW II Hydraulic Oil; ISO 100 Premium AW II Hydraulic Oil

Chemical Family: Hydrocarbon Mixture

Recommended Use: Hydraulic Fluid.
Use Restrictions: All others.

Supplier Name and Address:

MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute aquatic toxicity	Category 3
Chronic aquatic toxicity	Category 3

Hazards Not Otherwise Classified (HNOC)
Not applicable

Label elements

EMERGENCY OVERVIEW

Harmful to aquatic life with long lasting effects

Appearance Clear Liquid **Physical State** Liquid **Odor** Petroleum

Precautionary Statements - Prevention
Avoid release to the environment

Precautionary Statements - Response
Not applicable

Precautionary Statements - Storage
Not applicable

Precautionary Statements - Disposal
Dispose of contents/container at an approved waste disposal plant

Additional Information
Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Lube oil is a complex mixture of highly refined lubricating base stocks and additives.

Composition Information:

Name	CAS Number	Weight %
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	64742-54-7	98-99
2,6-di-tert-butylphenol	128-39-2	0.1-1

4. FIRST AID MEASURES

First Aid Measures

General advice In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation: Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If symptoms occur get medical attention.

Skin Contact: Wash skin with plenty of soap and water. If irritation or other symptoms occur get medical attention. Wash contaminated clothing and clean shoes before reuse. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.

Ingestion: Rinse mouth out with water. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. If symptoms develop, seek medical attention.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects: Preexisting skin conditions and/or respiratory disorders may be aggravated by exposure to this product.

Indication of any immediate medical attention and special treatment needed

NOTES TO PHYSICIAN: SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media
Do not use a solid water stream as it may scatter and spread fire.

Specific hazards arising from the chemical
The product is not combustible per the OSHA Hazard Communication Standard, but will ignite and burn at temperatures exceeding the flash point.

Hazardous combustion products
Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data
Sensitivity to Mechanical Impact No.
Sensitivity to Static Discharge No.

Special protective equipment and precautions for firefighters
Avoid using straight water streams. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Avoid excessive water spray application. Use water spray to cool exposed surfaces from as far a distance as possible. Keep run-off water out of sewers and water sources.

NFPA:	Health 1	Flammability 1	Instability 0	Special Hazards -

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Keep public away. Isolate and evacuate area. Shut off source if safe to do so.

Protective Equipment: Use personal protection measures as recommended in Section 8.

Emergency Procedures: Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.

Environmental precautions: Avoid release to the environment. Avoid subsoil penetration.

Methods and materials for containment: Prevent further leakage or spillage if safe to do so.

Methods and materials for cleaning up: Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers.

7. HANDLING AND STORAGE

Safe Handling Precautions: Avoid contact with skin, eyes and clothing. Do not swallow. Avoid breathing vapors or mists. Use good personal hygiene practices. Wash thoroughly after handling. Use personal protection measures as recommended in Section 8. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

Storage Conditions: Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Store away from incompatible materials.

Incompatible materials Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELS:	OSHA - Vacated PELs	NIOSH IDLH
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	Mineral oil, highly/severely refined, inhalable fraction 5 mg/m³ TWA	-	-	-
2,6-di-tert-butylphenol 128-39-2	-	-	-	-

Notes: The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

Engineering measures: Local or general exhaust required when using at elevated temperatures that generate vapors or mists.

Personal protective equipment

Eye protection: Use goggles or face-shield if the potential for splashing exists.

Skin and body protection: Wear neoprene, nitrile or PVA gloves to prevent skin contact. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times. Wear appropriate protective clothing.

Respiratory protection: Use an approved organic vapor chemical cartridge or supplied air respirators when material produces vapors that exceed permissible exposure limits or excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid
Appearance	Clear Liquid
Color	Clear
Odor	Petroleum
Odor Threshold	No available data.

Property	Values (Method)
Melting Point / Freezing Point	No available data.
Initial Boiling Point / Boiling Range	No available data.
Flash Point	> 220 °C / > 428 °F (Cleveland Open-Cup)
Evaporation Rate	No available data.
Flammability (solid, gas)	Not applicable.
Flammability Limit in Air (%)	
Upper Flammability Limit:	No available data.
Lower Flammability Limit:	No available data.
Vapor Pressure	No available data.
Vapor Density	No available data.
Specific Gravity / Relative Density	0.86-0.88
Water Solubility	No available data.
Solubility in other solvents	No available data.
Partition Coefficient	No available data.
Decomposition temperature:	No available data.
pH:	No available data.
Autoignition Temperature	No available data.
Kinematic Viscosity	≥ 28.8 mm2/s @ 40°C / 104°F (ASTM D445)
Dynamic Viscosity	No available data.
Explosive Properties	No available data.
Softening Point	No available data.
VOC Content (%)	0.12-37.7 (w/w)
Density	No available data.
Bulk Density	Not applicable.

10. STABILITY AND REACTIVITY

Reactivity The product is non-reactive under normal conditions.

Chemical stability Stable under recommended storage conditions.

Possibility of hazardous reactions None under normal processing.

Hazardous polymerization Will not occur.

Conditions to avoid Sources of heat or ignition.

Incompatible materials Strong oxidizing agents.

Hazardous decomposition products None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation Overheating may produce vapors which may cause respiratory irritation, dizziness and nausea.

Eye contact Exposure to vapor or contact with liquid may cause mild eye irritation.

Skin contact Prolonged or repeated exposure may cause dermatitis, folliculitis or oil acne.

Ingestion May cause irritation of the mouth, throat and gastrointestinal tract.

Acute Toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50

Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.5 mg/l (Rat) 4 h
2,6-di-tert-butylphenol 128-39-2	> 5000 mg/kg (Rat)	> 10 g/kg (Rabbit)	-

Delayed and immediate effects as well as chronic effects from short and long-term exposure

This product is considered to have a low order of acute and chronic oral and dermal toxicity.

Adverse effects related to the physical, chemical and toxicological characteristics

Signs & Symptoms Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Sensitization Not expected to be a skin or respiratory sensitizer.

Mutagenic effects None known.

Carcinogenicity Cancer designations are listed in the table below.

Name	ACGIH (Class)	IARC (Class)	NTP	OSHA
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	Mineral oil, poorly/mildly refined Suspected Human Carcinogen (A2) Mineral oil, highly/severely refined, inhalable fraction Not Classifiable (A4)	Mineral oil, untreated or mildly treated Carcinogenic to humans (1) Mineral oil, highly refined Not Classifiable (3)	Mineral oil, poorly/mildly refined Known to be human carcinogen	Not Listed
2,6-di-tert-butylphenol 128-39-2	Not Listed	Not Listed	Not Listed	Not Listed

Reproductive toxicity None known.

Specific Target Organ Toxicity (STOT) - single exposure Not classified.

Specific Target Organ Toxicity (STOT) - repeated exposure Not classified.

Aspiration hazard Not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity Harmful to aquatic life with long lasting effects.

Name	Algae/aquatic plants	Fish	Toxicity to Microorganisms	Crustacea
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	-	96-hr LC50 = 5000 mg/L Rainbow trout	-	48-hr EC50 = 1000 mg/L Daphnia magna
2,6-di-tert-butylphenol 128-39-2	-	-	-	48-hr EC50 = 0.45 mg/l Daphnia magna

Persistence and degradability No information available.

Bioaccummulation Contains component(s) with the potential to bioaccumulate.

Mobility in soil No information available.

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues
No information available.

Safe Handling of Wastes
Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required.

Disposal of Wastes / Methods of Disposal
The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal
Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101):

UN Proper shipping name:	Not Regulated
UN/Identification No:	Not applicable
Transport Hazard Class(es):	Not applicable
Packing group:	Not applicable

TDG (Canada):

UN Proper shipping name:	Not Regulated
UN/Identification No:	Not applicable
Transport Hazard Class(es):	Not applicable
Packing group:	Not applicable

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b): This product and/or its components are listed on the TSCA Chemical Inventory.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product may contain component(s) that have been listed on EPA's Extremely Hazardous Substance (EHS) List:

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	NA
2,6-di-tert-butylphenol	NA

SARA Section 304: This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	CERCLA/SARA - Hazardous Substances and their Reportable Quantities
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	NA
2,6-di-tert-butylphenol	NA

SARA: The following EPA hazard categories apply to this product:

None

SARA Section 313: This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting:
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	None
2,6-di-tert-butylphenol	None

State and Community Right-To-Know Regulations:
The following component(s) of this material are identified on the regulatory lists below:

Solvent Refined, Hydrotreated Heavy Paraffinic Distillate

Louisiana Right-To-Know:	Not Listed.
California Proposition 65:	Not Listed.
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida Substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed.
Michigan Critical Materials Register List:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed.
California - Regulated Carcinogens:	Not Listed.
Pennsylvania RTK - Special Hazardous Substances:	Not Listed.
New Jersey - Special Hazardous Substances:	Carcinogen
New Jersey - Environmental Hazardous Substances List:	Not Listed.
Illinois - Toxic Air Contaminants	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed.

2,6-di-tert-butylphenol

Louisiana Right-To-Know:	Not Listed.
California Proposition 65:	Not Listed.
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida Substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed.
Michigan Critical Materials Register List:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed.
California - Regulated Carcinogens:	Not Listed.
Pennsylvania RTK - Special Hazardous Substances:	Not Listed.
New Jersey - Special Hazardous Substances:	Not Listed.
New Jersey - Environmental Hazardous Substances List:	Not Listed.
Illinois - Toxic Air Contaminants	Not Listed.
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed.

Canada DSL/NDSL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information: "This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations."

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
2,6-di-tert-butylphenol	D2B	1%

NOTE: Uncontrolled product according to WHMIS classification criteria.

16. OTHER INFORMATION

Prepared By Toxicology and Product Safety
Revision Date: 05/22/2015

Revision Note:

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

LEAD METAL
SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Lead Metal

Trade Names and Synonyms: Lead; Pb; Plumbum; Metallic Lead; Inorganic Lead; ASTM B29; TADANAC Lead, Low-Alpha Lead.

Manufacturer:
Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:
In U.S.:
Teck American Metal Sales Incorporated
501 North Riverpoint Blvd, Suite 300
Spokane, WA
USA, 99202

Other than U.S.:
Teck Metals Ltd.
#1700 – 11 King Street West
Toronto, Ontario
M5H 4C7

Preparer:
Teck Metals Ltd.
Suite 3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

Date of Last Review: June 29, 2015.

Date of Last Edit: June 29, 2015.

Product Use: Used as a construction material for tank linings, piping, and equipment used in the manufacture of sulphuric acid and the refining and processing of petroleum; used in x-ray and atomic radiation shielding; used in the manufacture of paint pigments, organic and inorganic lead compounds, lead shot, lead wire for bullets, ballast, and lead solders; used as a bearing metal or alloy; used in the manufacture of storage batteries, ceramics, plastics, and electronic devices; used in the metallurgy of steel and other metals; and used in the form of lead oxide for batteries.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

Health		Physical	Environmental
Acute Toxicity (Oral, Inhalation)	– Does not meet criteria	Does not meet criteria for any Physical Hazard	**Aquatic Toxicity – Short Term (Acute) Category 3**
Skin Corrosion/Irritation	– Does not meet criteria		
Eye Damage/Eye Irritation	– Does not meet criteria		
Respiratory or Skin Sensitization	– Does not meet criteria		
Mutagenicity	– Does not meet criteria		
Carcinogenicity	**– Category 2**		
Reproductive Toxicity	**– Category 1A**		
Specific Target Organ Toxicity Chronic Exposure	**– Category 1**		

LABEL:

Symbols:

Signal Word:

DANGER

Hazard Statements	**Precautionary Statements:**
DANGER! Causes damage to kidneys, blood-forming systems, central nervous system and digestive tract through prolonged or repeated exposure. May damage the unborn child. May cause harm to breast-fed children. Suspected of damaging fertility. Suspected of causing cancer. Harmful to aquatic life.	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection. Do not breathe dust or fumes. Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product. If exposed or concerned or you feel unwell: Get medical advice/attention. Avoid release to the environment.

Emergency Overview: A bluish-white to silvery-grey, heavy, soft metal that does not burn in bulk. Finely-divided lead dust clouds are a moderate fire and explosion hazard, however. When heated strongly in air, highly toxic lead oxide fumes can be generated. Inhalation or ingestion of lead may produce both acute and chronic health effects. Possible cancer and reproductive hazard. SCBA and full protective clothing are required for fire emergency response personnel.

Potential Health Effects: Inhalation or ingestion of lead may result in headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia and leg, arm, and joint pain. Prolonged exposure may also cause central nervous system damage, hypertension, gastrointestinal disturbances, anemia, kidney dysfunction and possible reproductive effects. Pregnant women should be protected from excessive exposure in order to prevent lead crossing the placental barrier and causing infant neurological disorders. Lead and inorganic lead compounds are listed as an *A3 Carcinogen (Confirmed Animal Carcinogen with Unknown Relevance to Humans)* by the ACGIH. IARC has listed lead compounds as *Group 2A Carcinogens (Probably Carcinogenic to Humans)* while lead metal is listed as *Group 2B (Possibly Carcinogenic to Humans)*. The NTP lists lead and lead compounds as *Reasonably Anticipated to be a Human Carcinogen*. OSHA and the EU does not currently list lead as a human carcinogen (see Toxicological Information, Section 11).

Potential Environmental Effects: Lead metal has relatively low bioavailability; however, compounds which it forms with other elements can be toxic to both aquatic and terrestrial organisms at low concentrations. These compounds can be particularly toxic in the aquatic environment. Lead bioaccumulates in plants and animals in both aquatic and terrestrial environments (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENT	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Lead	7439-92-1	99+%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Eye irritation, redness. Gently brush product off face if necessary. Do not rub eye(s). Let the eye(s) water naturally for a few minutes. Look right and left, then up and down. If particle/dust does not dislodge, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, get medical advice/attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Symptoms:* Skin soiling, mild irritation. Gently brush away excess dust. Wash gently and thoroughly with lukewarm, gently flowing water and non-abrasive soap for 5 minutes, or until product is removed. If skin irritation occurs or you feel unwell, get medical advice/attention. *Molten Metal:* Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms:* Respiratory irritation. Remove source of exposure or move person to fresh air and keep comfortable for breathing. Seek medical attention if you feel unwell.

Ingestion: *Symptoms:* Stomach upset. If you feel unwell or are concerned, get medical advice/attention.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not flammable or combustible. Finely-divided lead dust or powder is a moderate fire hazard and moderate explosion hazard when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Explosions may also occur upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: Do not use direct water streams on fires where molten metal is present, due to the risk of a steam explosion that could potentially eject molten metal uncontrollably. Use a fine water mist on the front-running edge of the spill and on the top of the molten metal to cool and solidify it. If possible, move solid material from fire area or cool material exposed to flame to prevent melting of the metal ingots. Highly toxic lead oxide fumes may evolve in fires. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Restrict access to the area until completion of clean-up. Clean up spilled material immediately, observing precautions outlined below. Molten metal should be allowed to solidify before cleanup. If solid metal, wear gloves, pick up and return to process. If dust, wear recommended personal protective equipment (see below) and use methods which will minimize dust generation (e.g., vacuum solids). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, regional, and national requirements.

Personal Precautions: Persons responding to an accidental release should wear protective clothing, gloves and a respirator (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from hot-metal splash as well as a respirator to protect against inhalation of lead fume. Workers should wash and change clothing following cleanup of a lead spill to prevent personal contamination with lead dust.

Environmental Precautions: Lead metal has low bioavailability; however, compounds which it forms with other elements can be toxic to aquatic and terrestrial organisms. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Store in a DRY, covered area, separate from strong acids, other incompatible materials, active metals and food or feedstuffs. Solid metal suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Otherwise, entrained moisture could expand explosively and spatter molten metal out of the bath. No special packaging materials are required. Lead metal, in contact with wood or other surfaces, may leave traces of lead particulate that can accumulate over time. Cleaning or disposal of these surfaces requires review to ensure that any effluent or solid waste disposal meets the requirements of regulations in the applicable jurisdiction.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Lead	0.05 mg/m^3	0.05 mg/m^3	0.05 mg/m^3

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.
ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of lead fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Local exhaust is recommended for melting, casting, welding, grinding, flame cutting or burning, and use of lead powders.

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when lead is processed. Appropriate eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face shield, and clothing to protect from radiant heat and hot metal splash should be worn. Safety type boots are recommended.

Respirators: Where lead dust or fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-100 particulate filter cartridge). When exposure levels are obviously high but the actual concentration is unknown, a self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask should be worn.

General Hygiene Considerations: Do not eat, drink or smoke in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas as well as at the end of the workday. A double locker-shower system with separate clean and dirty sides is usually required for lead handling operations to avoid cross-contamination of street clothes. Contaminated clothing should be changed frequently and laundered before each reuse. Inform laundry personnel of contaminants' hazards. Workers should not take dirty work clothes home and launder them with other personal clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Malleable, bluish-white to silvery-grey solid metal	**Odour:** None	**Odour Threshold:** Not Applicable	**pH:** Not Applicable
Vapour Pressure: (negligible @ 20°C)	**Vapour Density:** Not Applicable	**Melting Point/Range:** 328°C	**Boiling Point/Range:** 1,740°C
Relative Density (Water = 1)**:** 11.34	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Not Applicable	**Solubility:** Insoluble in water
Flash Point: None	**Flammable Limits (LEL/UEL):** Not Flammable	**Auto-ignition Temperature:** None	**Decomposition Temperature:** None

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Freshly cut or cast lead surfaces tarnish rapidly due to the formation of an insoluble protective layer of basic lead carbonate.

Incompatibilities: Lead reacts vigorously with strong acids (e.g., hot concentrated nitric acid, boiling concentrated hydrochloric acid, etc.), strong oxidizers such as peroxides, chlorates, nitrates and halogen or interhalogen compounds such as chlorine trifluoride. Powdered lead metal in contact with disodium acetylide, chlorine trifluoride, sodium carbide or fused ammonium nitrate poses a risk of explosion. Solutions of sodium azide in contact with lead metal can form lead azide, which is a detonating compound. Vigorous reactions can also occur between molten lead and active metals, such as sodium, potassium, lithium and calcium. A lead-zirconium alloy (10-70% Zr) will ignite when struck with a hammer.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting or burning, electric arc welding or overheating a molten bath will generate highly toxic lead oxide fume. Lead oxide is highly soluble in body fluids and the particle size of the metal fumes is largely within the respirable size range, which increases the likelihood of inhalation and deposition of the fume within the body.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Lead accumulates in bone and body organs once it enters the body. Elimination from the body is slow. Initial and periodic medical examinations are advised for persons repeatedly exposed to levels at or above the exposure limits of lead dust or fumes. Once lead enters the body, it can affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal system. The primary routes of exposure to lead are inhalation or ingestion of dust and fumes.

Acute:
Skin/Eye: Contact with dust or fume may cause local irritation but would not cause tissue damage.

Inhalation: Exposure to lead dust or fume may cause headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia, and pain in legs, arms, and joints. An intense, short-term exposure to lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are unlikely in industry today. Kidney damage, as well as anemia, can occur from acute exposure.

Ingestion: Symptoms due to ingestion of lead dust or fume would be similar to those from inhalation. Other health effects such as metallic taste in the mouth and constipation or bloody diarrhea might also occur.

Chronic:
Prolonged exposure to lead dust and fume may produce many of the symptoms of short-term exposure and may also cause central nervous system damage, gastrointestinal disturbances, anemia, and, rarely, wrist drop. Reduced hemoglobin production has been associated with low lead exposures. Symptoms of central nervous system damage due to moderate lead exposure include fatigue, headaches, tremors and hypertension. Very high lead exposure can result in lead encephalopathy with symptoms of hallucinations, convulsions, and delirium. Kidney dysfunction and possible injury has also been associated with chronic lead poisoning. Chronic over-exposure to lead has been implicated as a causative agent for the impairment of male and female reproductive capacity. Pregnant women should be protected from excessive exposure as lead can cross the placental barrier and unborn children may suffer neurological damage or developmental problems due to excessive lead exposure. Teratogenic and mutagenic effects from exposure to lead have been reported in some studies but not in others. The literature is inconsistent and no firm conclusions can be drawn at this time. Lead and lead compounds are listed as an *A3 Carcinogen (Confirmed Animal Carcinogen with Unknown Relevance to Humans)* by the ACGIH. IARC has listed lead compounds as *Group 2A Carcinogens (Probably Carcinogenic to Humans)* while lead metal is listed as *Group 2B (Possibly Carcinogenic to Humans)*. The NTP lists lead and lead compounds as *Reasonably Anticipated to be a Human Carcinogen*. OSHA and the EU do not currently list lead as a human carcinogen.

Animal Toxicity:

Hazardous Ingredient:	Acute Oral Toxicity:	Acute Dermal Toxicity:	Acute Inhalation Toxicity:
Lead	No Data	No Data	No Data

SECTION 12. ECOLOGICAL INFORMATION

While lead metal is relatively insoluble, its processing or extended exposure in aquatic and terrestrial environments may lead to the release of lead compounds in more bioavailable forms. While lead compounds are not particularly mobile in the aquatic environment, they can be toxic to aquatic organisms, especially fish, at low concentrations. Water hardness, pH and dissolved organic carbon content are three major factors which regulate the degree of lead toxicity. Lead in soil is generally neither very mobile nor bioavailable, as it can become strongly sorbed onto soil particles, increasingly so over time, to a degree related to physical properties of the soil. Lead bioaccumulates in plants and animals in both aquatic and terrestrial environments.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME ..... Not a regulated product in ingot form.
TRANSPORT CANADA AND U.S. DOT CLASSIFICATION ..... Not Applicable

TRANSPORT CANADA AND U.S. DOT PIN ..... Not Applicable
MARINE POLLUTANT..... No
IMO CLASSIFICATION ..... Not Regulated

SECTION 15. REGULATORY INFORMATION

U.S.
Ingredient Listed on TSCA Inventory..... Yes

Hazardous Under Hazard Communication Standard ..... Yes

CERCLA Section 103 Hazardous Substances..... ..... Lead ..... RQ: 10 lbs. (4.54 kg.)*
*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

EPCRA Section 302 Extremely Hazardous Substance..... No

EPCRA Section 311/312 Hazard Categories ..... Delayed (chronic) health hazard - Carcinogen
Delayed (chronic) health hazard – Reproductive toxin

EPCRA Section 313 Toxic Release Inventory..... Lead CAS No. 7439-92-1
Percent by Weight - At least 99%

SECTION 16. OTHER INFORMATION

Date of Original Issue: July 23, 1997 **Version:** 01 *(First edition)*

Date of Latest Revision: June 29, 2015 **Version:** 13

The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2015, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, Guide to Occupational Exposure Values – 2015.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben, Ed), 1995.
- Canadian Centre for Occupational Health and Safety, Hamilton, ON, CHEMINFO Record No. 608 - Lead (Rev. 2009-05).
- European Regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 30 January 2015.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – present, (multi-volume work), World Health Organization, Geneva.
- International Chemical Safety Cards (WHO/IPCS/ILO), ICSC:0052 - Lead.
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank (online version).
- Patty's Toxicology, Fifth Edition, 2001: E. Bingham, B. Cohrssen & C.H. Powell, Ed.
- U.S. Dept. of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 13th Report on Carcinogens, October 2014.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards, on-line edition.
- U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Lead, September 2005.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader
Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck American Metal Sales Incorporated and Teck Metals Ltd. extend no warranty and assume no responsibility for the accuracy of the content and expressly disclaim all liability for reliance thereon. This safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.

Safety Data Sheet

RUST-OLEUM CORPORATION
* Trusted Quality Since 1921 *
www.rustoleum.com

1. Identification

Product Name: PRO LSPR 6PK MARK FLUORESCENT ORANGE

Revision Date: 6/5/2015

Product Identifier: 2554838

Supercedes Date: New SDS

Product Use/Class: Marking Paint/Aerosols

Supplier: Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Manufacturer: Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Preparer: Regulatory Department

Emergency Telephone: 24 Hour Hotline: 847-367-7700

2. Hazard Identification

Classification

Symbol(s) of Product

Signal Word
Danger

Possible Hazards
60% of the mixture consists of ingredient(s) of unknown acute toxicity

GHS HAZARD STATEMENTS

Flammable Aerosol, category 1	H222	Extremely flammable aerosol.
Acute Toxicity, Dermal, category 4	H312	Harmful in contact with skin.
Germ Cell Mutagenicity, category 1B	H340	May cause genetic defects . Classified as mutagenic Category 1 if one ingredient is present at or above 0.1% Applies to liquids, Solids (w/w units) and gases (v/v). The substance may also have its own exposure limit. Routes of exposure are dependant on ingredient form.
Carcinogenicity, category 1B	H350	May cause cancer. Classified as carcinogenic Category 1 on the basis of epidemiological and/or animal data. Mixtures are classified as carcinogenic when at least 1 ingredient has been classified as carcinogenic and is present at 0.1% or above Routes of exposure are dependant on ingredient form.

GHS LABEL PRECAUTIONARY STATEMENTS

P201	Obtain special instructions before use.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P281	Use personal protective equipment as required.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P410+P412	Protect from sunlight. Do no expose to temperatures exceeding 50°C/ 122°F.

3. Composition/Information On Ingredients

HAZARDOUS SUBSTANCES

Chemical Name	CAS-No.	Wt.% Range	GHS Symbols	GHS Statements
Aliphatic Hydrocarbon	64742-89-8	10-25	GHS08	H304-340-350
Propane	74-98-6	10-25	No Information	No Information
Limestone	1317-65-3	10-25	No Information	No Information
Hydrous Magnesium Silicate	14807-96-6	2.5-10	No Information	No Information
n-Butane	106-97-8	2.5-10	No Information	No Information
Acetone	67-64-1	2.5-10	GHS02-GHS07	H225-319-336
n-Butyl Acetate	123-86-4	2.5-10	GHS02-GHS07	H226-336
Hydrotreated Light Distillate	64742-47-8	2.5-10	GHS06-GHS08	H304-331
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	1.0-2.5	GHS08	H304-340-350
Organoclay	68911-87-5	1.0-2.5	No Information	No Information
Stoddard Solvent	8052-41-3	0.1-1.0	GHS08	H304-340-350-372
Ethylbenzene	100-41-4	0.1-1.0	GHS02-GHS07	H225-332

The text for GHS Hazard Statements shown above (if any) is given in the "16. Other Information" section.

4. First-aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-fighting Measures

EXTINGUISHING MEDIA: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Dry Sand, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20°F. EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat due to buildup of steam. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can. No unusual fire or explosion hazards noted.

SPECIAL FIREFIGHTING PROCEDURES: Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Full protective equipment including self-contained breathing apparatus should be used. Evacuate area and fight fire from a safe distance. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and launder before reuse. Use only in a well-ventilated area. Use only with adequate ventilation. Follow all MSDS/label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Avoid contact with eyes, skin and clothing.

STORAGE: Store in a dry, well ventilated place. Keep container tightly closed when not in use. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of NFPA Class I flammable liquids. Keep away from heat, sparks, flame and sources of ignition. Contents under pressure. Do not expose to heat or store above 120 ° F. Avoid excess heat. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials.

8. Exposure Controls/Personal Protection

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Aliphatic Hydrocarbon	64742-89-8	20.0	N.E.	N.E.	N.E.	N.E.
Propane	74-98-6	20.0	1000 ppm	N.E.	1000 ppm	N.E.
Limestone	1317-65-3	20.0	N.E.	N.E.	15 mg/m3	N.E.
Hydrous Magnesium Silicate	14807-96-6	10.0	2 mg/m3	N.E.	N.E.	N.E.
n-Butane	106-97-8	10.0	N.E.	1000 ppm	N.E.	N.E.
Acetone	67-64-1	10.0	500 ppm	750 ppm	1000 ppm	N.E.
n-Butyl Acetate	123-86-4	5.0	150 ppm	200 ppm	150 ppm	N.E.
Hydrotreated Light Distillate	64742-47-8	5.0	N.E.	N.E.	N.E.	N.E.
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	5.0	N.E.	N.E.	N.E.	N.E.
Organoclay	68911-87-5	5.0	N.E.	N.E.	N.E.	N.E.
Stoddard Solvent	8052-41-3	1.0	100 ppm	N.E.	500 ppm	N.E.
Ethylbenzene	100-41-4	1.0	20 ppm	N.E.	100 ppm	N.E.

PERSONAL PROTECTION

ENGINEERING CONTROLS: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use gloves to prevent prolonged skin contact. Use impervious gloves to prevent skin contact and absorption of this material through the skin. Nitrile or Neoprene gloves may afford adequate skin protection.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications. Refer to safety supervisor or industrial hygienist for further information regarding personal protective equipment and its application.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

9. Physical and Chemical Properties

Appearance:	Aerosolized Mist	**Physical State:**	Liquid
Odor:	Solvent Like	**Odor Threshold:**	N.E.
Relative Density:	0.871	**pH:**	N.A.
Freeze Point, °C:	N.D.	**Viscosity:**	N.D.
Solubility in Water:	Slight	**Partition Coefficient, n-octanol/ water:**	N.D.
Decompostion Temp., °C:	N.D.		
Boiling Range, °C:	-24 - 537	**Explosive Limits, vol%:**	0.9 - 13.0
Flammability:	Supports Combustion	**Flash Point, °C:**	-96
Evaporation Rate:	Faster than Ether	**Auto-ignition Temp., °C:**	N.D.
Vapor Density:	Heavier than Air	**Vapor Pressure:**	N.D.

(See "Other information" Section for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120 °F (49°C)Avoid contact with strong acid and strong bases. Avoid all possible sources of ignition.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological information

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: Substance may cause slight skin irritation. May cause skin irritation. Allergic reactions are possible. Prolonged or repeated contact may cause skin irritation.

EFFECTS OF OVEREXPOSURE - INHALATION: Harmful if inhaled. High gas, vapor, mist or dust concentrations may be harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Harmful if swallowed. Aspiration hazard if swallowed; can enter lungs and cause damage.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. IARC lists Ethylbenzene as a possible human carcinogen (group 2B).

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

ACUTE TOXICITY VALUES

The acute effects of this product have not been tested. Data on individual components are tabulated below:

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50
64742-89-8	Aliphatic Hydrocarbon	N.I.	3000 mg/kg Rabbit	N.I.
74-98-6	Propane	N.I.	N.I.	658 mg/L Rat
123-86-4	n-Butyl Acetate	N.I.	>17600 mg/kg Rabbit	N.I.
64742-47-8	Hydrotreated Light Distillate	>5000 mg/kg Rat	>2000 mg/kg Rabbit	>5.2 mg/L Rat
64742-49-0	Naphtha, Petroleum, Hydrotreated Light	>5000 mg/kg Rat	>3160 mg/kg Rabbit	N.I.
100-41-4	Ethylbenzene	3500 mg/kg Rat	15354 mg/kg Rabbit	17.2 mg/L Rat

N.I. - No Information

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components. Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Dispose of material in accordance to local, state, and federal regulations and ordinances. Do not allow to enter waterways, wastewater, soil, storm drains or sewer systems.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Paint Products in Limited Quantities	Aerosols	Aerosols	Paint Products in Limited Quantities
Hazard Class:	N.A.	2.1	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Fire Hazard, Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

No TSCA 12(b) components exist in this product.

16. Other Information

HMIS RATINGS

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA RATINGS

Health:	2	**Flammability:**	4	**Instability**	0

VOLATILE ORGANIC COMPOUNDS, g/L: 522

MSDS REVISION DATE: 6/5/2015

REASON FOR REVISION:

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

Text for GHS Hazard Statements shown in Section 3 describing each ingredient:

H225	Highly flammable liquid and vapour.
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H319	Causes serious eye irritation.
H331	Toxic if inhaled.
H332	Harmful if inhaled.
H336	May cause drowsiness or dizziness.
H340	May cause genetic defects.
H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.

Icons for GHS Pictograms shown in Section 3 describing each ingredient:

GHS02

GHS06

GHS07

GHS08

Rust-Oleum Corporation believes, to the best of its knowledge, information and belief, the information contained herein to be accurate and reliable as of the date of this safety data sheet. However, because the conditions of handling, use, and storage of these materials are beyond our control, we assume no responsibility or liability for personal injury or property damage incurred by the use of these materials. Rust-Oleum Corporation makes no warranty, expressed or implied, regarding the accuracy or reliability of the data or results obtained from their use. All materials may present unknown hazards and should be used with caution. The information and recommendations in this material safety data sheet are offered for the users' consideration and examination. It is the responsibility of the user to determine the final suitability of this information and to comply with all applicable international, federal, state, and local laws and regulations.

SAFETY DATA SHEET

SDS ID NO.: 0162MAR019
Revision Date: 05/22/2015

1. IDENTIFICATION

Product Name: Marathon Petroleum Multipower-3 15W-40 Motor Oil

Synonym: Multipower-3 15W-40 Motor Oil; Multipower-3 15W-40 Heavy Duty Motor Oil
Chemical Family: Motor/Lube Oil

Recommended Use: Engine Oil.
Use Restrictions: All others.

Supplier Name and Address:

MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous according to the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious eye damage/eye irritation	Category 2A

Hazards Not Otherwise Classified (HNOC)
Not applicable

Label elements

EMERGENCY OVERVIEW

Warning

Causes serious eye irritation

Appearance Brown Liquid **Physical State** Liquid **Odor** Petroleum

Precautionary Statements - Prevention
Wash hands and any possibly exposed skin thoroughly after handling
Wear eye/face protection

Precautionary Statements - Response
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical attention

Precautionary Statements - Storage
Not applicable

Precautionary Statements - Disposal
Not applicable

Additional Information
Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Motor oil is a complex mixture of highly refined lubricating oil base stocks and additives.

Composition Information:

Name	CAS Number	Weight %
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts	113706-15-3	1-5
Dinonyl diphenylamine	36878-20-3	1-5
Butene, homopolymer	9003-29-6	1-5
Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs.	84605-20-9	1-5

4. FIRST AID MEASURES

First Aid Measures

General advice In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation: Remove to fresh air and keep at rest in a position comfortable for breathing. If symptoms occur get medical attention.

Skin Contact: Wash skin with plenty of soap and water. If irritation or other symptoms occur get medical attention. Wash contaminated clothing and clean shoes before reuse.

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention.

Ingestion: Rinse mouth out with water. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. If symptoms develop, seek medical attention.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects: Causes eye irritation. Symptoms may include redness, itching, and inflammation. May cause skin irritation and/or dermatitis. Preexisting skin conditions and/or respiratory disorders may be aggravated by exposure to this product.

Indication of any immediate medical attention and special treatment needed

NOTES TO PHYSICIAN: Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media
Do not use a solid water stream as it may scatter and spread fire.

Specific hazards arising from the chemical
The product is not combustible per the OSHA Hazard Communication Standard, but will ignite and burn at temperatures exceeding the flash point.

Hazardous combustion products
Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data
Sensitivity to Mechanical Impact No.
Sensitivity to Static Discharge No.

Special protective equipment and precautions for firefighters
Avoid using straight water streams. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Avoid excessive water spray application. Use water spray to cool exposed surfaces from as far a distance as possible. Keep run-off water out of sewers and water sources.

NFPA: Health 1 Flammability 1 Instability 0 Special Hazards -

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Keep public away. Isolate and evacuate area. Shut off source if safe to do so.

Protective Equipment: Use personal protection measures as recommended in Section 8.

Emergency Procedures: Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.

Environmental precautions: Avoid release to the environment. Avoid subsoil penetration.

Methods and materials for containment: Prevent further leakage or spillage if safe to do so.

Methods and materials for cleaning up: Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers.

7. HANDLING AND STORAGE

Safe Handling Precautions: Avoid contact with skin, eyes and clothing. Do not swallow. Avoid breathing vapors or mists. Use good personal hygiene practices. Wash thoroughly after handling. Use personal protection measures as recommended in Section 8. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

Lifetime, continuous skin contact with used motor oils has caused skin cancer in laboratory tests. In testing, thorough washing has been found to prevent the development of skin cancer from used motor oil exposure. Avoid excessive skin contact. Exercise good personal hygiene including the removal and washing of soiled clothing and destroy used motor oil contaminated leather shoes/boots.

Storage Conditions: Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Store away from incompatible materials.

Incompatible materials Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELS:	OSHA - Vacated PELs	NIOSH IDLH
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts 113706-15-3	-	-	-	-
Dinonyl diphenylamine 36878-20-3	-	-	-	-
Butene, homopolymer 9003-29-6	-	-	-	-
Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs. 84605-20-9	-	-	-	-

Notes: The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

Engineering measures: Local or general exhaust required when using at elevated temperatures that generate vapors or mists.

Personal protective equipment

Eye protection: Use goggles or face-shield if the potential for splashing exists.

Skin and body protection: Wear neoprene, nitrile or PVA gloves to prevent skin contact. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times. Wear appropriate protective clothing.

Respiratory protection: Use an approved organic vapor chemical cartridge or supplied air respirators when material produces vapors that exceed permissible exposure limits or excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid
Appearance	Brown Liquid
Color	Brown
Odor	Petroleum
Odor Threshold	No available data.

Property	**Values (Method)**
Melting Point / Freezing Point	No available data.
Initial Boiling Point / Boiling Range	No available data.
Flash Point	> 220 °C / > 428 °F (Cleveland Open-Cup)
Evaporation Rate	No available data.
Flammability (solid, gas)	Not applicable.
Flammability Limit in Air (%)	
Upper Flammability Limit:	No available data.
Lower Flammability Limit:	No available data.
Vapor Pressure	No available data.
Vapor Density	No available data.
Specific Gravity / Relative Density	0.86-0.875
Water Solubility	No available data.
Solubility in other solvents	No available data.
Partition Coefficient	No available data.
Decomposition temperature:	No available data.
pH:	No available data.
Autoignition Temperature	No available data.
Kinematic Viscosity	82 mm2/s @ 40°C / 104°F
Dynamic Viscosity	No available data.
Explosive Properties	No available data.
Softening Point	No available data.
VOC Content (%)	1.7 (w/w)
Density	No available data.
Bulk Density	Not applicable.

10. STABILITY AND REACTIVITY

Reactivity	The product is non-reactive under normal conditions.
Chemical stability	Stable under recommended storage conditions.
Possibility of hazardous reactions	None under normal processing.
Hazardous polymerization	Will not occur.
Conditions to avoid	Sources of heat or ignition.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation	Overheating may produce vapors which may cause respiratory irritation, dizziness and nausea.
Eye contact	Irritating to eyes. May cause reddening and tearing.

Skin contact May cause skin irritation. Prolonged or repeated exposure may cause dermatitis, folliculitis or oil acne.

Ingestion May cause irritation of the mouth, throat and gastrointestinal tract.

Acute Toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts 113706-15-3	-	-	-
Dinonyl diphenylamine 36878-20-3	-	-	-
Butene, homopolymer 9003-29-6	-	-	-
Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs. 84605-20-9	-	-	-

Delayed and immediate effects as well as chronic effects from short and long-term exposure

This product is considered to have a low order of acute and chronic oral and dermal toxicity.

USED MOTOR OIL: Lifetime, continuous skin contact with used motor oils has caused skin cancer in laboratory tests. The combustion process produces compounds (polycyclic aromatic hydrocarbons) in motor oils that increase with use and are responsible for the cancer induction. Thorough washing has been found to prevent the development of skin cancer on animals from used motor oil exposure.

ZDDP: Zinc dialkyldithiophosphate (ZDDP) additives are primarily eye and/or skin irritants or corrosives with low acute toxicity via oral, dermal, and inhalation routes of exposure and are not skin sensitizers. In laboratory repeat dose studies by the dermal and oral routes, ZDDPs cause effects only at high doses, primarily due to irritation, in a manner similar to other irritating materials. The weight-of- evidence of genotoxicity testing indicates that ZDDPs are not mutagenic and do not cause larger chromosomal effects.

Adverse effects related to the physical, chemical and toxicological characteristics

Signs & Symptoms Causes eye irritation. Symptoms may include redness, itching, and inflammation. Contact may cause skin dermatitis and/or irritation. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Sensitization Not expected to be a skin or respiratory sensitizer.

Mutagenic effects None known.

Carcinogenicity Cancer designations are listed in the table below.

Name	ACGIH (Class)	IARC (Class)	NTP	OSHA
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts 113706-15-3	Not Listed	Not Listed	Not Listed	Not Listed
Dinonyl diphenylamine 36878-20-3	Not Listed	Not Listed	Not Listed	Not Listed
Butene, homopolymer 9003-29-6	Not Listed	Not Listed	Not Listed	Not Listed

Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs. 84605-20-9	Not Listed	Not Listed	Not Listed	Not Listed

Reproductive toxicity None known.

Specific Target Organ Toxicity (STOT) - single exposure Not classified.

Specific Target Organ Toxicity (STOT) - repeated exposure Not classified.

Aspiration hazard Not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Used motor and/or lube oils can be toxic to birds and fish.

Name	Algae/aquatic plants	Fish	Toxicity to Microorganisms	Crustacea
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts 113706-15-3	-	-	-	-
Dinonyl diphenylamine 36878-20-3	-	-	-	-
Butene, homopolymer 9003-29-6	-	-	-	-
Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs. 84605-20-9	-	-	-	-

Persistence and degradability Not expected to be readily biodegradable.

Bioaccummulation Contains component(s) with the potential to bioaccumulate.

Mobility in soil No information available.

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues
No information available.

Safe Handling of Wastes
Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required.

Disposal of Wastes / Methods of Disposal
The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal
Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101):

UN Proper shipping name:	Not Regulated
UN/Identification No:	Not applicable
Transport Hazard Class(es):	Not applicable
Packing group:	Not applicable

TDG (Canada):

UN Proper shipping name:	Not Regulated
UN/Identification No:	Not applicable
Transport Hazard Class(es):	Not applicable
Packing group:	Not applicable

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b): This product and/or its components are listed on the TSCA Chemical Inventory.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product may contain component(s) that have been listed on EPA's Extremely Hazardous Substance (EHS) List:

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts	NA
Dinonyl diphenylamine	NA
Butene, homopolymer	NA
Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs.	NA

SARA Section 304: This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	CERCLA/SARA - Hazardous Substances and their Reportable Quantities
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts	NA
Dinonyl diphenylamine	NA
Butene, homopolymer	NA
Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs.	NA

SARA: The following EPA hazard categories apply to this product:

Acute Health Hazard

SARA Section 313: This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting:
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts	None
Dinonyl diphenylamine	None
Butene, homopolymer	None

Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs.	None

State and Community Right-To-Know Regulations:
The following component(s) of this material are identified on the regulatory lists below:

Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts

Louisiana Right-To-Know:	Not Listed.
California Proposition 65:	Not Listed.
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida Substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed.
Michigan Critical Materials Register List:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed.
California - Regulated Carcinogens:	Not Listed.
Pennsylvania RTK - Special Hazardous Substances:	Not Listed.
New Jersey - Special Hazardous Substances:	Not Listed.
New Jersey - Environmental Hazardous Substances List:	Not Listed.
Illinois - Toxic Air Contaminants	Not Listed.
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed.

Dinonyl diphenylamine

Louisiana Right-To-Know:	Not Listed.
California Proposition 65:	Not Listed.
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida Substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed.
Michigan Critical Materials Register List:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed.
California - Regulated Carcinogens:	Not Listed.
Pennsylvania RTK - Special Hazardous Substances:	Not Listed.
New Jersey - Special Hazardous Substances:	Not Listed.
New Jersey - Environmental Hazardous Substances List:	Not Listed.
Illinois - Toxic Air Contaminants	Not Listed.
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed.

Butene, homopolymer

Louisiana Right-To-Know:	Not Listed.
California Proposition 65:	Not Listed.
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida Substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed.
Michigan Critical Materials Register List:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed.
California - Regulated Carcinogens:	Not Listed.
Pennsylvania RTK - Special Hazardous Substances:	Not Listed.
New Jersey - Special Hazardous Substances:	Not Listed.
New Jersey - Environmental Hazardous Substances List:	Not Listed.
Illinois - Toxic Air Contaminants	Not Listed.

New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed.

Amines, polyethylenepoly-, reaction products with succinic anhydride polyisobutenyl derivs.

Louisiana Right-To-Know:	Not Listed.
California Proposition 65:	Not Listed.
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida Substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed.
Michigan Critical Materials Register List:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed.
California - Regulated Carcinogens:	Not Listed.
Pennsylvania RTK - Special Hazardous Substances:	Not Listed.
New Jersey - Special Hazardous Substances:	Not Listed.
New Jersey - Environmental Hazardous Substances List:	Not Listed.
Illinois - Toxic Air Contaminants	Not Listed.
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed.

Canada DSL/NDSL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information: "This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations."

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
Phosphorodithioic acid, mixed O,O-bis(sec-Bu and isooctyl) esters, zinc salts	D2B	1%
Butene, homopolymer	Uncontrolled product according to WHMIS classification criteria	

NOTE: Not Applicable.

16. OTHER INFORMATION

Prepared By Toxicology and Product Safety
Revision Date: 05/22/2015

Revision Note:

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

OIL-DRI
CORPORATION OF AMERICA

SAFETY DATA SHEET
Floor **Absorbent - CN**

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Floor Absorbent - CN

SDS Number: 1006500

Manufacturer:	Oil-Dri Corporation of America 410 North Michigan Avenue Chicago, IL 60611 +1-312-321-1515
TRANSPORTATION EMERGENCY INFORMATION:	Chemtrec +1-800-424-9300 (US and Canada) +1-703-527-3887 (International - Call Collect)

Product Use: Absorbent

Restrictions On Use: Spontaneous combustion can occur when this product is used to high concentrations of chemicals having a high heat of absorption such as olefins, hydrochloric acid, etc.

2. HAZARDS IDENTIFICATION

GHS Classification:

Health: Specific Target Organ Toxicity – Single Exposure Category 3

Environmental: Not Hazardous

Physical: Not Hazardous

GHS Labeling:

Pictogram:

Exclamation mark

WARNING!

H335 May cause respiratory irritation.

Prevention: P261 Avoid breathing dust

P271 Use only outdoors or in a well-ventilated area.

Response: P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.

Storage: Store in a dry area.

Disposal: P501 Dispose of contents/container in accordance with all local and national regulations.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No./ EINECS-No	%
Fullers Earth (Attapulgite-type clay)	8031-18-3	10-100%
Proprietary Ingredient	Proprietary	10-100%

4. FIRST AID MEASURES

Inhalation: Move to fresh air. If irritation or other symptoms occurs, get medical attention.

Skin contact: No first aid should be needed.

Eye contact: Immediately flush eyes with cool running water, lifting upper and lower lids. If irritation persists or for foreign body in the eye, get medical attention.

Ingestion: If used material is ingested, get medical attention due to possibility of chemical contamination. If large amount of unused material is swallowed, get immediate medical attention.

Most Important symptoms and effects, both acute and delayed: Eye contact may cause mechanical irritation and possible eye injury. May cause mechanical skin and respiratory irritation.

Indication of any immediate medical attention and special treatment needed: No immediate medical attention is required.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media: Use media that is appropriate for surrounding fire; unused product is not combustible.

Specific Hazards Arising from the Chemical: None for unused product.

Special Protective Equipment and Precautions for Fire-fighters: Firefighters should always wear self-contained breathing apparatus and full protective clothing for fires involving chemicals or in confined spaces.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: No special equipment is generally required for spill clean-up. For dusty conditions, an approved respiratory may be needed. Refer to Section 8 for additional information.

Environmental Hazards: Report releases as required by local and federal regulations.

Methods and Materials for Containment and Cleaning Up: Sweep up and collect unused material for re-use or disposal. For dusty conditions, an approved respiratory may be needed. Refer to Section 8 for additional information.

7. HANDLING AND STORAGE

Precautions for Safe Handling: Avoid breathing dust. Avoid contact with eyes, skin, and clothing. Wash thoroughly with soap and water after use. If clothing becomes dusty, launder before re-use. Use only with adequate ventilation. Minimize the generation and accumulation of dust. Follow good housekeeping practices to keep surfaces, including areas overhead such as piping, drop ceilings, ductwork, etc. free from settled dust. Dry powders can build static electricity charges when subjected to friction of transfer and in mixing operations.

Conditions for Safe Storage, including any Incompatibilities: Store in a dry area. Keep away from turpentine, hydrofluoric acid, vegetable oil, and other unsaturated organic compounds (such as fish oil), as this may generate heat and/or fire.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limit(s)

Chemical Name	Exposure limit(s)
Fullers Earth (Attapulgite-type clay)	15 mg/m3 (total dust) TWA OSHA PEL 5 mg/m3 (respirable dust) TWA OSHA PEL
Proprietary Ingredient	15 mg/m3 (total dust) TWA OSHA PEL 5 mg/m3 (respirable dust) TWA OSHA PEL

Appropriate Engineering Controls: General ventilation is adequate for normal use. If handling produces airborne dust, local exhaust ventilation may be needed.

Individual Protection Measures, such as Personal Protective Equipment:

Eye Protection: Safety glasses or goggles if needed to prevent eye contact.

Skin Protection: None required for normal use.

Respiratory Protection: None required for normal use. For operations where the dust concentration may be excessive, a dust respirator may be used. Follow OSHA regulations in the selection and use of respiratory protection.

9. PHYSICAL AND CHEMICAL PROPERTIES

Property	Value
Appearance:	White to tan granules
Odor Threshold:	Not applicable.
Boiling point/range	Not applicable.
Melting point/range	Not available
Relative density	2.3-2.37
Vapor pressure	Not applicable.
Vapor density (air=1)	Not applicable.
Solubility	Partially soluble
pH	Not applicable.
Partition coefficient (n-octanol/water):	Not available
Evaporation Rate (Butyl acetate=1)	Not applicable.
Viscosity:	Not applicable.
Volatile Organic Carbon Compounds (VOC) (g/L)	Not available
Flashpoint:	Not applicable.
Flammable Limits in Air % by Volume:	LEL (Lower):Not applicable. UEL (Upper): Not applicable.
Autoignition temperature:	Not available
Decomposition temperature:	Not available
Flammability (solid, gas):	Not flammable

10. STABILITY AND REACTIVITY

Reactivity: Not normally reactive.

Chemical Stability: Stable

Possibility of Hazardous Reactions: Spontaneous combustion can occur when this product is used to high concentrations of chemicals having a high heat of absorption such as olefins, hydrochloric acid, etc.

Conditions to Avoid: None.

Incompatible Materials: Turpentine, hydrofluoric acid, vegetable oil, fish oil, unsaturated organic compounds.

Hazardous Decomposition Products: None.

11. TOXICOLOGICAL INFORMATION

Potential Health Effects:

Acute Hazards:

Inhalation: Inhalation of dust may cause irritation to the eyes, nose, throat and respiratory tract.

Skin contact: No known hazard.

Eye contact: Contact may cause mechanical, abrasive irritation with possible injury.

Ingestion: No known hazard.

Chronic Effects: Inhalation of excessive concentrations of any dust, including this material, may lead to lung irritation and/or injury.

Carcinogenicity Listing: None.

Acute Toxicity Values: None.

12. ECOLOGICAL INFORMATION

Ecotoxicity: No data available for the product. No adverse effects on the environment are expected.

Persistence and Degradability: Fuller's Earth is non-degradable.

Bioaccumulative Potential: Not bioaccumulative.

Mobility in Soil: No data available

Other Adverse Effects: None currently known.

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with local, state and federal environmental Regulations. Unused material is suitable for disposal in sanitary landfill. Used material may be subject to regulation, depending on the nature of the material absorbed. Check with appropriate regulatory authority for used material containing hazardous waste.

14. TRANSPORT INFORMATION

US DOT Shipping Description: Not regulated

IATA Shipping Description (Air): Not regulated

Proper Shipping Name: Not regulated

UN Number: Not applicable.

Packing Group: Not applicable.

Labels Required: None.

15. REGULATORY INFORMATION

US Regulations

SARA 311/312 Hazard Categories: Chronic Health

SARA 313 This Product Contains the Following Chemicals Subject to Annual Release Reporting Requirements Under the SARA Section 313 (40 CFR 372): None.

SARA 302 Listed Chemicals: None.

CERCLA: This product is not subject to CERCLA release reporting. Many states have more stringent reporting requirements. Report releases as required by local and state regulations.

California Proposition 65: None.

EPA Toxic Substances Control Act (TSCA): All of the components of this product are listed on the TSCA Inventory or exempted from TSCA.

International Regulations:

EU REACH: Contact Oil Dri for information on REACH status.

Japan MITI: No data available

AICS: No data available

16. OTHER INFORMATION

Date Prepared: 5/29/2015

Revision Summary: May 29, 2015 - Conversion to Hazcom 2012 classification and labeling and format.

HMIS Rating: Health 0* Fire 0 Reactivity 0

0 = Minimal Hazard, 1 = Slight Hazard, 2 = Moderate Hazard, 3 = Serious Hazard, 4 = Severe Hazard

The information contained herein is true and correct to the best of Oil-Dri Coporation of America's knowledge. However, no warranty, expressed or implied, is made. Nothing herein should be interpreted as a recommendation to infringe existing patents or violate any laws or regulations. Final determination of the suitability of the material is the sole responsibility of the user.

Appendix D

Asbestos Abatement Plan

ASBESTOS ABATEMENT PLAN
FIRING RANGE 5 AND CDP EXCAVATION ACTIVITIES
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Submitted to:

NASA Glenn Research Center
Cleveland, Ohio

Submitted by:

Arrowhead Contracting, Inc.

Revision 0d

April 2020

APPROVALS

ASBESTOS ABATEMENT PLAN
FIRING RANGE 5 AND CDP EXCAVATION ACTIVITIES
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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Asbestos Hazard Project Designer ***PD60894***

4/10/20
Date

Table of Contents

List of Acronyms

ACM	Asbestos Containing Material
ANSI	American National Standards Institute
Arrowhead	Arrowhead Contracting, Inc.
CDP	Construction Debris Pile
CFR	Code of Federal Regulation
CHSO	Corporate Health and Safety Officer
COC	contaminant of concern
DOT	Department of Transportation
ECCL	Erie County Conservation League
FANS	Firelake-Arrowhead NASA Services
FR5&CDP	Firing Range 5 and Construction Debris Piles
FMCSR	Federal Motor Carrier Safety Regulations
GCR	NASA Glenn Research Center
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High-efficiency Particulate Absorption
NASA	National Aeronautics and Space Administration
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PBS	Plum Brook Station
PPE	Personal Protective Equipment
PM	Project Manager
SDS	Safety Data Sheet
SSO	Site Safety Officer
USEPA	United States Environmental Protection Agency

1.0 Introduction

This document constitutes the Asbestos Abatement Plan for field activities associated with the Firing Range 5 and the Construction Debris Pile (FR5&CDP) located in the southeast area of the NASA's Plum Brook Station (PBS), Sandusky, Ohio.

This document was prepared for the National Aeronautics and Space Administration (NASA), Plum Brook Station (PBS), Sandusky, Ohio by Arrowhead Contracting, Inc (Arrowhead). This Plan is provide as an Appendix to the Health and Safety Plan (HASP) and covers only asbestos abatement work associated with Construction Debris Pile 1 at FR5&CDP.

1.1 Site Description

FR5&CDP is located in the southeast area of the PBS near the Space Environments Complex and includes an earthen berm used as a bullet backstop and the CDP area that is comprised of three discrete piles of construction debris. CDP 2 and 3 contain sand blasting grit with lead paint. CDP 1 is demolition debris from a building demolition and includes asbestos containing material (ACM) plus concrete with reinforcing steel, paint chips, asphalt, and metal debris. The ACM in CDP 1 is found in acoustical ceiling tiles that are dispersed throughout the debris and represents only a small fraction of the total volume of the construction debris in CDP 1.

1.2 Field Activities

The objective of the work is to mitigate public exposure risk to hazardous substances due to past activities at FR5&CDP by removing the hazardous substances for proper disposal. The ACM is incorporated into the construction debris in CDP 1. All of the construction debris will be excavated and transported for proper disposal. The ACM is a small percentage of the material in CDP 1. Since the ACM requires special handling, transporting, and disposing procedures, the ACM will be removed from the other construction debris as it is excavated. This will be accomplished by slowly excavating the construction debris and hand picking the acoustical ceiling tiles from the other debris. The construction debris that does not contain ACM will be direct loaded for transportation and disposal. The ACM that is removed from the other debris will be treated as ACM according to the procedures described in this Asbestos Abatement Plan.

2.0 Organization and Responsibilities

This section describes Arrowhead personnel responsibilities for asbestos abatement activities. However, the asbestos abatement work is only a portion of the overall work to be performed at FR5&CDP.

2.1 HASP Management Responsibilities

As discussed in the HASP for FR5&CDP, Arrowhead personnel will perform the following project and safety functions at the FR5&CDP site:

Corporate Health and Safety Officer

The Corporate Health and Safety Officer (CHSO) has ultimate authority and responsibility for establishing, implementing and enforcing Arrowhead's H&S program. Accordingly, the CHSO develops and/or approves site-specific HASPs, ensures that Arrowhead personnel meet applicable training and medical monitoring requirements, and develops company policies and procedures for H&S in accordance with OSHA and other applicable standards.

Project Manager

The Project Manager (PM) is responsible for coordinating the development, implementation, and enforcement of this HASP. The PM is responsible for ensuring that the necessary resources are available for the project to be completed safely and in compliance with HASP requirements, OSHA regulations, and other applicable standards.

Site Safety Officer

The Site Safety Officer (SSO) will conduct inspections to ensure that operations are conducted in accordance with the HASP, OSHA regulations, and NASA Plum Brook Station requirements. The SSO reports directly to the PM and the Corporate Health and Safety Officer. The SSO has the authority to suspend operations at the site due to the ineffectiveness of or non-conformance to this HASP. The most senior associate will be assigned the duties of the SSO (Alternate SSO) when the SSO is not on site.

Site Supervisor

The Site Supervisor is primarily charged with production at the site and coordinating all on-site aspects of the project. The Site Supervisor is responsible for implementing the scope of work,

schedule, and budget in the field. The Site Supervisor maintains contact with the Arrowhead PM and also reports to the PM.

2.2 Asbestos Abatement Management Responsibilities

In addition to the personnel and responsibilities described above, one or more of the Arrowhead personnel doing the asbestos abatement work at Construction Debris Pile 1 will have the following certifications and will perform the duties described.

Asbestos Hazard Evaluation Specialist

The Asbestos Hazard Evaluation Specialist will be responsible for reviewing the site before and after ACM cleanup has taken place. The Asbestos Hazard Evaluation Specialist will identify ACM requiring removal. After the cleanup of all ACM at RQL, the Asbestos Hazard Evaluation Specialist will fill out a "Certification of Visual Inspection" to confirm that all surficial ACM has been removed from the area.

Asbestos Hazard Abatement Specialist

Responsibilities include setting up the regulated area, ensuring work integrity, instituting engineering controls, ensuring adherence to regulatory procedures, approve specified procedures outlined in the AAP adequately protect on-site personnel, ensure that health and safety procedures are modified to meet changing needs, and ensure all on-site personnel strictly adhere to this HASP.

Asbestos Hazard Abatement Air-Monitoring Technician

The Asbestos Hazard Abatement Air-Monitoring Technician is responsible for environmental monitoring or work area clearance air sampling. This also includes air monitoring performed to determine completion of response actions under the rules set forth in 40 C.F.R. 763 Subpart E. This person does not need to be an industrial hygienist, industrial hygienist in training, or certified by the American board of industrial hygiene.

3.0 Training and Medical Monitoring Requirements

All personnel working at the site are required to have training and medical monitoring as outlined in the HASP and in this Asbestos Abatement Plan for the FR5&CDP.

3.1 HASP Training Requirements

The HASP requires that all personnel will have the following training and medical monitoring, as appropriate.

HAZWOPER Training

Full-time construction personnel will be required to meet the HAZWOPER training requirements per 29 CFR 1926.65 and 29 CFR 1910.120, including an initial 40-hour training course and an 8-hour refresher class within the past 12 months. One or more Arrowhead personnel will have HAZWOPER 8-Hour Supervisor training.

Site Specific Orientation Meetings

All personnel, including subcontractors, working at the site shall attend a site specific safety orientation covering the topics in the HASP.

Daily Tailgate Safety Meetings

The Site Supervisor/SSO (or designee) shall conduct a safety meeting at the beginning of each shift. The topics discussed at this daily "tailgate" safety meeting will include H&S considerations for the day's activities, hazard assessments, engineering controls, required PPE, problems encountered and lessons learned, and areas/activities requiring special warning or caution.

Hazard Communication

All personnel performing field activities will receive basic hazard communication and right-to-know training, including a review of Arrowhead's Hazard Communication Program, applicable SDS, container labeling requirements, chemical hazard warnings, and general chemical health hazards.

First-Aid/CPR

At least two members of Arrowhead's on-site staff will be trained and certified in American Red Cross first-aid and CPR. The certification and recertification requirements for first-aid (three years) and CPR (one year) are applicable.

Additional Training, Certification, and Licenses

In addition to the training and certification discussed previously, commercial drivers must meet applicable certification and licensing requirements as mandated by the DOT. Truck drivers must possess a valid commercial driver's license.

3.2 Asbestos Training Requirements

Workers engaged in asbestos abatement will be variously trained to perform the tasks that each individual worker will be doing. Depending on the job description of the worker, the worker will be trained in one or more of the following:

Asbestos Hazard Evaluation Specialist

The Asbestos Hazard Evaluation Specialist will be specially trained in a training course that meets the criteria of supervisor 40-hour AHERA MAP course with an annual refresher and be licensed by the Ohio Department of Health as an Asbestos Hazard Evaluation Specialist.

Asbestos Hazard Abatement Specialist

The Asbestos Hazard Abatement Specialist will be specially trained in a training course that meets the criteria of the 40-hour Asbestos Hazard Emergency Response Act (AHERA) Model Accreditation Plan (MAP) course with an annual refresher and be licensed by the Ohio Department of Health as an Asbestos Hazard Abatement Specialist.

Asbestos Hazard Abatement Air-Monitoring Technician

The Asbestos Hazard Abatement Air-Monitoring Technician will be specially trained in a training course that meets the criteria of the 24-hour Asbestos Hazard Emergency Response Act (AHERA) Model Accreditation Plan (MAP) course with an annual refresher and be licensed by the Ohio Department of Health as an Asbestos Hazard Abatement Air-Monitoring Technician.

3.3 Medical Monitoring

Medical surveillance requirements will apply to personnel covered under HAZWOPER and Asbestos Worker requirements. Arrowhead will utilize the services of an Occupational Medicine physician for the medical surveillance requirements of this project.

Asbestos Worker Medical Surveillance

All affected personnel will have successfully completed a pre placement or periodic/updated physical examination that complies with 29 CFR 1910.1001 App H - Medical Surveillance Guidelines for Asbestos Non-Mandatory. The medical surveillance provided to the employee includes a written opinion by the medical examiner of the employee's ability to perform the assigned work function and to use the necessary respiratory protective equipment.

Site personnel may be required to receive an annual update exam and appropriate actions will be taken as recommended by the physician should the results indicate an exposure. Additional medical examinations may be needed in special cases including reassignment, signs or symptoms of illness relating to work place exposure, determination by the physician that examinations need to be conducted more often than once a year, and whenever an employee sustains a lost time injury or develops a lost time illness.

The annual medical surveillance for Asbestos Workers will include the tests required for the HAZWOPER physical plus the following asbestos-specific tests:

- Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract
- Completion of the respiratory disease questionnaire contained in appendix D of this section
- A physical examination including a chest X-ray and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV1)
- Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

Medical Records

Medical and personal exposure monitoring records will be maintained according to the requirements of 29 CFR 1926.65 and 29 CFR 1910.120 and will be retained for a minimum of

30 years. The confidentiality of employee medical records shall be maintained. The written medical opinion from the Occupational Health physician will be kept in site files.

Medical Restrictions

When a medical care provider identifies a need to restrict work activity, the terms of the restriction will be discussed by the employee and the SSO. Every attempt will be made to keep the employee working, while not violating the terms of the medical restriction.

4.0 Asbestos Cleanup Procedures

Asbestos containing material (ACM) is found in Construction Debris Pile 1 located in the south area of the FR5&CDP site. The ACM is in the form of acoustic ceiling tiles that are part of the demolition debris from a building demolition. Whole and pieces of the acoustic ceiling tiles are mixed into the rubble material that includes concrete, cinder block, metal, roofing, etc. The acoustic ceiling tiles have a metal frame and a paint coating so they generally hold together as either whole tiles or as large pieces. The acoustic tiles are a small percentage of the overall quantity of building demolition debris.

4.1 Acoustic Tile Abatement

Arrowhead personnel will physically separate the acoustic tiles from the remainder of the construction debris and treat the acoustic tile materials as ACM. Arrowhead employees will pick the acoustic tiles from the debris by hand as the debris is excavated and loaded. Any acoustic tiles that are evident on the surface of the pile will be removed prior to starting excavation. As the pile is slowly excavated and loaded, a spotter on the ground will search for additional acoustic tiles that are uncovered by the exaction process and will remove the acoustic tiles from the remainder of the debris. The spotter will also man a hose to keep the material wet as it is excavated.

Sampling performed during the Site Investigation showed that there is no asbestos in the soil beneath the pile. A trench was excavated through the pile and samples collected of the soil below the pile were non-detect for asbestos. Based on this sampling result, no soil sampling for ACM is planned unless the Asbestos Hazard Abatement Evaluation Specialist observes any ACM breaking into small fragments onto the concrete rubble or ground during debris removal. In this case, asbestos samples will be collected from the soil once the pile is excavated to verify that the asbestos has successfully been removed.

Arrowhead personnel will make a good faith effort to remove all of the acoustic ceiling tile material from the debris. This effort will separate the ACM from the remainder of the debris so that the two waste streams – ACM and demolition debris – can be disposed properly. Once the pile has been removed, all of the demolition debris, including ACM, will have been removed leaving clean soil.

The acoustic tile material will be picked by hand from the other demolition debris and double-sealed in two, 6-mil poly bags that are sealed shut. The filled bags will then be placed in roll-off box for transportation to the disposal facility. The bags and roll-off box will be labeled prior to placing ACM into the bag or roll-off box.

The asbestos abatement work will be performed by Arrowhead Contracting personnel. Prior to beginning any asbestos work, all personnel associated with the asbestos work will be properly trained for the task that each will perform.

4.2 Access Controls

Engineering and administrative controls will be used to control the potential for asbestos fibers to migrate outside of the work area. A perimeter exclusion zone will be established around the Construction Debris Pile 1 area while the excavation and loading work is being performed. The exclusion zone will be marked with red plastic tape with DANGER ASBESTOS printed in black on the tape.

A support zone will be located up-wind of the exclusion zone and a contaminant reduction zone will be located between the exclusion zone and the support zone. Adequate decontamination and hygiene facilities will be provided in the contaminant reduction zone. All workers will exit the exclusion zone through the contaminant reduction zone where they will doff their PPE and wash their hands and faces. The respirator will be removed last. Used PPE will be collected in a labeled, 6-mil poly asbestos bag for disposal with the ACM.

Eating, drinking, smoking, and chewing gum will not be permitted within the exclusion zone.

4.3 Dust Control and Monitoring

Water will be sprayed onto the construction debris piles before starting excavation and additional water will be sprayed on the active excavation area during excavation. The construction debris will be kept wet enough to eliminate visible dust throughout the excavation process. If visible dust is observed, excavation activities will be suspended until enough water has been sprayed onto the excavation area to eliminate the visible dust.

Testing will be conducted around the perimeter of the work area to monitor asbestos migration. The testing will include a particulate meter such as a DustTrak™ to provide real-time data on total dust in the air. In addition, a sample pump with a filter cartridge will be used to collect air

samples for laboratory analysis of asbestos fibers using a 25 millimeter (mm) mixed cellulose ester filtered cassette and analyzed by Phase Contrast Microscopy (PCM). Samples will be analyzed by PCM in accordance with the NIOSH 7400 Method, or equivalent, by a laboratory accredited by the American Industrial Hygiene Association (AIHA).

4.4 Personal Protective Equipment and Personal Air Monitoring

Appropriate PPE will be used for all ACM work. The PPE will include Tyvek coveralls, nitrile gloves, work gloves, washable boots or disposable boot covers, safety glasses, and respirator. Seams between the coverall and gloves/boots will be taped to prevent ACM from penetrating the seams of the PPE.

A ½-mask air-purifying respirator with high-efficiency particulate absorption (HEPA) filters will be worn by ground workers inside the work area.

On-site equipment that is used inside the exclusion zone (e.g., excavator, skid steer, wheel loader, etc.) will be equipped with a cab that has a HEPA filtration system, eliminating the need for the operator to wear an air-purifying respirator while operating the equipment. The filtration systems are commonly used in mining, drilling, milling, and construction industries where dust can be a problem for workers. The systems typically have an air pump that draws outside air through a HEPA filter, through the heating/ventilation/air-conditioning unit, and into the cab. In addition, air from inside the cab is also recirculated through a HEPA filter, through the heating/ventilation/air-conditioning unit, and back into the cab. The air that is drawn from outside the cab provides a positive pressure environment within the cab to eliminated dust/asbestos fibers from entering the cab through gaps in doors or windows.

The operator will don a respirator in the support zone before entering the exclusion zone and walking to the equipment. Once inside and with the windows closed and the air system operating, the operator may remove his respirator provided that he keeps the windows closed and continues to operate the HEPA filtration system.

Personnel air monitoring will be conducted each day by collecting an air sample in the breathing zone of a ground level worker. If air sampling shows that employee exposures are below the TWA permissible exposure limit and/or excursion limit, then personal air monitoring for those employees can be discontinued. The sample will be collected using a portable, rechargeable air pump with the cassette assembly draped over the shoulder of the worker to sample the breathing

zone. Personnel samples will be collected and analyzed on an 8-hour time weighted average. The Permissible Exposure Limit (PEL) for asbestos fibers in air is a time weighted average (TWA) of 0.1 fibers per cubic centimeter.

4.5 Waste Containerization and Labeling

All ACM generated at the work areas will be sealed in double 6-mil bags. The bags will be labeled as required by OSHA 29 CFR 1910.1001 and/or 1910.1200 and 1926.1101. The bags will be labeled with a "Regulated Waste" label prior to placing the ACM into the bag.

The sealed ACM will be placed into a roll-off container rated for ACM. The ACM will be packed, labeled, and transported according to U.S. Department of Transportation Regulations 49 CFR 173.216 and 49 CFR 173.240. The roll-off container will be labeled with a "Regulated Waste" label prior to placing the ACM into the container.

ACM storage prior to transportation will be under the supervision of qualified personnel. All ACM will be transported under a waste manifest signed by a representative of Plum Brook WM staff.

4.6 Visual Clearance Inspection

After all of the ACM has been removed and the construction debris pile material has been loaded and transported for disposal, the Construction Debris Pile 1 area will undergo a visual clearance inspection conducted by the Asbestos Hazard Evaluation Specialist. The "Certification of Visual Inspection" will be completed and signed by the Asbestos Hazard Evaluation Specialist who conducted the inspection.

4.7 Decontamination

Construction equipment will be decontaminated prior to being removed from the FR5&CDP area according to the procedures outlined in the HASP.

5.0 Personal Protective Equipment

Level D PPE will be worn at all times while working at the FR5&CDP site and Level C PPE will be worn while doing asbestos abatement at CDP 1. PPE requirements for other tasks at the FR5&CDP area are discussed in the HASP.

Level D protection represents the minimum requirements for PPE and shall, at a minimum, consist of:

- High-visibility vests
- Shirt, long pants
- Steel-toed work boots
- Safety glasses with side-shields
- Vinyl or nitrile gloves when handling fluids
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary) – i.e. leather gloves when utilizing hand and power tools
- Hearing protection, as necessary at noise levels above 82 db
- Hard hat

Level C PPE shall, at a minimum, consist of:

- High-visibility vests
- Shirt, long pants
- Steel-toed boots with disposable boot covers or washable steel-toed boots
- Safety glasses with side-shields
- Uncoated disposable coveralls, such as Tyvek™ or Kleenguard™
- Vinyl or nitrile gloves
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary) - i.e. leather gloves when utilizing hand and power tools
- Hearing protection, as necessary at noise levels above 82 db
- Hard-hat
- 1/2-face APR with HEPA filters (P100)

6.0 Respiratory Protection

Arrowhead's approach for respiratory protection involves wearing 1/2-mask air purifying respirators with HEPA particulate filters and aggressive dust control measures for maintaining dust and asbestos at safe levels. If dust levels become elevated, work will be stopped and dust suppression measures increased until dust levels diminish. Level C PPE, including respiratory protection, will be used by ground personnel while doing asbestos abatement.

All equipment used inside the exclusion zone will have a cab equipped with a HEPA filtration system so that the operator does not need to wear a respirator while operating the equipment. The operator will don a respirator in the support zone before entering the exclusion zone and walking to the equipment. Once inside and with the windows closed and the air system operating, the operator may remove his respirator provided that he keeps the windows closed and continues to operate the HEPA filtration system.

Respiratory protection equipment shall meet the requirements of OSHA 29 CFR 1926.1101 and be approved by the National Institute for Occupational Safety and Health (NIOSH). Respirator use will conform to ANSI Z88.2 and OSHA 29 CFR 1910.134 requirements. All personnel using APRs shall have successfully passed a respirator fit test within the last 12 months. Fit testing and any training related to respiratory protection for site personnel will be documented. Respirators will be inspected before each use for damage, missing parts, and proper function.

TSI

TRAINING SERVICES INTERNATIONAL

Asbestos Project Designer Initial

Certificate

This is to certify

Mercedes Dahler

XXX-XX-9023

has attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Project Designer Initial and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3745-22 Ohio Administrative Code.

Robert Walter	1/31/20	1/29/19 - 1/31/19	1/31/19	Cleveland, OH
Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location

33150 Lakeland Blvd.
Cleveland, OH 44095
www.TSItraining.com

Course Certificate No. **19 TSI 76006 pdi**

TSI Training Services International

Asbestos Project Designer Initial

Mercedes Dahler

XXX-XX-9023

HAS ATTENDED THE COURSE AND SUCCESSFULLY PASSED THE [illegible] EXAMINATION WITH A [illegible] OF 70% OR BETTER IN ACCORDANCE WITH TSCA TITLE II AND [illegible] RULE 326 IAC 18-2 CHAPTER 3745-22 OHIO ADMINISTRATIVE CODE.

Instructor	Exp Date	Class Date(s)	Test Date	Location
Robert Hunter	1/31/20	1/29/19 - 1/31/19	1/31/19	Cleveland , OH

19 TSI 76006 pdi

TSi

TRAINING SERVICES INTERNATIONAL

Asbestos Project Designer Refresher

Certificate

This is to certify

Mercedes Dahler

XXX-XX-9023

has attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Project Designer Refresher and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3745-22 Ohio Administrative Code.

Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location
Doug D. Sehlo	1/16/21	1/16/20	1/16/20	Cleveland, OH

33150 Lakeland Blvd.
Cleveland, OH 44095
www.TSItraining.com

Course Certificate No. **20 TSI 80543 pdr**

Iowa Asbestos Safety

4725 Merle Hay Road Suite 108 – Des Moines - IA - 50322
515-331-1690

Asbestos Safety Training Program

–Certificate of Completion–

This Is to Certify That:

MICHAEL BRITSCH

Has successfully completed the **5-DAY Asbestos Supervisor Initial** training course and has passed the course examination.
Training was in accordance with 40 CFR Part 763, and TSCA Title II.
Program approved by the State of Missouri.

Course Date	Examination Date	Expiration Date
FEBRUARY 3-7, 2020	FEBRUARY 7, 2020	FEBRUARY 7, 2021

CERTIFICATE NUMBER

ASI – 0220-4233

IOWA ASBESTOS SAFETY

Jamie Papian
Principal Instructor
Accredited Training Provider

FEB 2020

TSI TRAINING SERVICES INTERNATIONAL

Asbestos Building Inspector Initial

Certificate

This is to certify

Michael Britsch

XXX-XX-8618

as attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Building Inspector Initial and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3745-22 Ohio Administrative Code.

Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location
	3/11/21	3/9/20 - 3/11/20	3/11/20	Columbus, OH

33150 Lakeland Blvd.
Cleveland, OH 44095
www.TSItraining.com

Course Certificate No. **20 TSI 81594 ii**

TSI TRAINING SERVICES INTERNATIONAL

Asbestos Management Planner Initial

Certificate

This is to certify

Michael Britsch

XXX-XX-8618

has attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Management Planner Initial and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3745-22 Ohio Administrative Code.

Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location
	3/13/21	3/12/20 - 3/13/20	3/13/20	Columbus, OH

33150 Lakeland Blvd.
Cleveland, OH 44095
www.TSItraining.com

Course Certificate No. **20 TSI 81599 mpi**