VRRP INTERIM REMEDIAL ACTION WORK PLAN - REVISION NO. 1
FREEDOM INDUSTRIES
ETOWAH RIVER TERMINAL
1015 BARLOW DRIVE
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA
VRP #15017

Prepared for:

Freedom Industries, Inc.
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December 2015

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1.0 INTRODUCTION

Freedom Industries, Inc. (Freedom Industries) previously owned and operated the Etowah River Terminal facility located at 1015 Barlow Drive, Charleston, West Virginia 25311 (referred to as the "Site). Figure 1 presents a Site Map. The Site was a former liquid bulk storage and distribution facility providing chemicals, primarily to the mining industry. Site activities included the storage, staging, formulation, and distribution of chemicals and compounds primarily used in the mining industry.

1.1 Purpose

This Interim Remedial Action (IRA) Work Plan identifies the proposed interim remedial actions to achieve the following objectives:

- Excavate and properly dispose of the construction and demolition (C&D) waste (previously referred to as cobble fill) which was identified during previous Site Investigation (SI) and Interim Site Assessment (ISA) activities;
- Excavate and properly dispose of site soils containing 4-methyl-1-cyclohexanemethanol (MCHM) and propylene glycol phenyl ether (PPH) at concentrations above laboratory reporting (quantitation) limits (i.e., detectable concentrations) to eliminate surface water contact with MCHM and PPH- contaminated soil and fill material;
- Backfill and compact the excavation areas with suitable clean, imported backfill;
- Revegetate the backfilled and newly disturbed areas of the site to stabilize soils and prevent erosion;
- Excavation, reinstallation and sampling of the collection trench; and,
- Discontinue surface water collection, management and disposal after the excavation is completed, since surface water contact with MCHM and PPH- contaminated media will be eliminated.

The IRA activities described in this Work Plan are designed to facilitate issuance of a Certificate of Completion in accordance with the Voluntary Remediation Agreement (VRA) executed on March 27, 2015 and achieve compliance with the Bankruptcy Court Order and the November 2014 Consent Order between Freedom Industries and the West Virginia Department of Environmental Protection (WVDEP).

This IRA Work Plan reflects the WVDEP Office of Environmental Remediation (OER) comments addressing the May 19, 2015, VRRP Interim Remediation Work Plan prepared by Arcadis U.S, Inc. (Arcadis), as well as the CORE Environmental Services, Inc. (CORE) Interim Remedial Action (IRA) Report submitted in November 2015 and CORE's recent meetings with WVDEP personnel.

2.0 BACKGROUND

On January 9, 2014, a release was reported from former aboveground storage tank (AST) identified as Tank 396, which contained a blend of 85.5% MCHM, 7.3% PPH, and 4% water by weight. The released material flowed onto the ground surface and into the adjacent Elk River. The material then entered the water supply intake of West Virginia American Water Company (WVAWC), which serves approximately 300,000 customers in Kanawha and surrounding counties. Immediate spill response measures and initial remediation have been completed by various contractors since the January 9, 2014 release.

On January 10, 2014, the WVDEP issued Order No. 8027 to Etowah River Terminal. The Order required that Etowah River Terminal immediately cease and desist any further receipt of material to be stored within the area of the faulty secondary containment. In addition, the Order required Etowah River Terminal to immediately take all necessary measures to contain, recover and remediate the material that escaped from the breached AST and the secondary containment structure, including installation of interceptor trenches adjacent to the Elk River and installation and maintenance of booms and absorbents in affected waterways. The Order also required Etowah River Terminal to immediately conduct an integrity test of all ASTs and secondary containment structures for the entire facility. Prior to resuming receipt of material to be stored, Etowah River Terminal was required to provide a report for approval which documented that the integrity of all storage and containment structures were sound.

On January 10, 2014, WVDEP issued Order No. 8028 to Freedom Industries. The Order required Freedom Industries to, within twenty-four (24) hours, begin removal of all material from all ASTs and store the material in an off-site area which provided adequate secondary containment. The initial emergency response, as well as remedial and sampling activities, were performed by Civil and Environmental Consultants, Inc. (CEC). The initial incident response activities included installation of sumps. Shallow soil samples were collected and analyzed for MCHM and PPH after removal of ASTs in 2014. A Remediation Delineation and Investigation Work Plan was submitted by Arcadis to the WVDEP on September 16, 2014. Contaminated soils were subsequently excavated and disposed of off-site, contaminated surface water has been collected and transported off-site for treatment, and all ASTs have been removed from the facility. Site investigation activities performed by Arcadis included soil borings, and collection of surface soil, subsurface soil, groundwater, sub-tank soil, sump, diversion trench, and surface water samples.

A Site Investigation Report prepared by Arcadis, dated April 30, 2015, presents the site investigation procedures, findings, and the soil remediation procedures. CORE was contracted to resume the site investigation and remediation activities in July 2015. CORE submitted an ISA Work Plan on August 25, 2015, to further assess the geophysical conditions beneath the site in order to address preferential pathways and to characterize the extent of the cobble fill area previously identified by Arcadis. This work has since been completed and serves as the basis for the proposed activities outlined in this IRA Work Plan.

3.0 PREVIOUS SOIL SAMPLING RESULTS

Site soil samples were collected and submitted for analysis of MCHM and PPH by Arcadis during the period from January 2014 through February 2015, and by CORE as part of the Interim Site Assessment (ISA) in August and September 2015.

Arcadis collected a total of 163 soil samples for analysis of MCHM and PPH. Some of the samples were also analyzed for other parameters. The sampling results are presented in the Site Investigation Report dated April 30, 2015. Soil boring samples were identified by Arcadis using a “SB” sample identification prefix, surface soil samples were identified by a “SS” prefix, and post-excavation confirmation soil samples were identified by a “CS”. Ninety-five of the samples contained detectable concentrations of one or more of these target analytes at sample depths ranging from 0.0 to 16.0 feet below ground surface (bgs). Excluding the sub-tank soil samples, which were collected at former AST 395, 396, and 397, a total of 24 soil samples contained MCHM and/or PPH at detectable concentrations (concentrations above the laboratory reporting limit, including estimated values) at sample depths ranging from 0.0 to 14.0 feet bgs, based on the surface, subsurface, and confirmatory soil sample results. Figure 1 identifies the sample locations.

A soil sample collected at Arcadis soil boring SB-10 during the Arcadis SI contained an estimated (based on laboratory precision and quality assurance protocol) 100 micrograms per kilogram (ug/kg) of PPH at a depth of 10.0 to 12.0 feet bgs; however, this estimated concentration is not considered to be valid based on the distance of SB-10 from the failed AST, and other soil sampling results.

During ISA test pit excavation activities performed in September 2015, CORE collected a total of 44 soil samples at depths ranging from 0.0 to 18.0 feet bgs and all were submitted for MCHM and PPH analysis. A total of seven samples collected from four test pit locations (TP-2, TP-3, TP-9, and TP-16) contained MCHM and/or PPH at detectable concentrations. Figure 1 identifies the test pit locations.

The CORE sample depths with detectable concentrations of MCHM and/or PPH ranged from 0.0 to 10.0 feet bgs.

Figures 2 and 3 present subsurface geologic cross-sections depicting surface topography, Arcadis SI soil boring and soil sample locations, the extent of previous soil excavation, and CORE ISA test pit and sample locations.

Figure 4 presents the estimated extent of C&D waste and soil with detectable concentrations of MCHM and PPH, including the lower collection trench which is presumed to contain MCHM and/or PPH at detectable concentrations.

4.0 REMEDIAL ACTION PLAN

This section addresses the proposed IRAs that will be performed to achieve the objectives identified in Section 1.0.

4.1 Site Preparation and Erosion Control

As an initial step to the IRA proposed in this Work Plan, a Site-Specific Health and Safety Plan (SSHASP) with an Air Monitoring Plan and Erosion and Sediment (E&S) Control Plan have been developed and are included as Appendices A and B, respectively.

After this IRA Work Plan, and the accompanying documents have been approved by the WVDEP, CORE will initiate construction activities with the installation of erosion control measures as specified in the E&S Control Plan, temporary construction fencing with danger signage to limit site access, and site clearing and grubbing activities in and around the proposed excavation area as shown on Figure 4. The goal of the E&S control measures is to direct surface water away from and around the excavation site or toward the downgradient collection trench. Due to the limited size of the disturbed area (less than one acre), the WVDEP has determined that no general stormwater permit is deemed necessary.

Stormwater runoff will be controlled and collected within the target excavation areas as specified in this IRA Work Plan. Personnel will be deployed during anticipated significant rain events to maintain control and contain all surface water runoff in, or migrating from, the excavation and site areas until the excavation and backfilling activities are completed. The existing collection trench, temporary E&S controls, pumps and hoses, and the existing frac tanks will be utilized as necessary for this purpose.

Surface water that accumulates in open excavations following a rainfall event will be pumped into the on-site frac tanks before additional excavation takes place.

4.2 Target Excavation Areas

A cobble fill area was previously identified by Arcadis during the site characterization phase and is shown on Figure 4 as Area 4. During the ISA in August and September 2015, 17 test pits were excavated to estimate the extent of this cobble fill area. The test pit locations are identified in Figure 1.

The total depth of the test pits ranged from 2 feet bgs to 18 feet bgs. The cobble fill material was found to be more appropriately characterized as C&D waste since the cobble fill material contained C&D debris, and was not homogenous cobbles. The test pits that contained C&D waste were excavated until the vertical extent was delineated or to refusal, whichever occurred first. If no C&D waste was encountered, the test pit was advanced to a maximum depth of 18 feet bgs or to refusal, whichever occurred first. The C&D waste was encountered at a total of 4 of the 17 test pits.

CORE's ISA Report summarized these activities and identified the lateral extent of the C&D waste. CORE recommended excavation of the C&D waste and MCHM/PPH contaminated soil in the ISA Report.

The following soil and waste will be excavated as part of the implementation of this IRA Work Plan:

- C&D waste;
- soil with MCHM/PPH concentrations above laboratory reporting limits ("impacted soil"); and,
- the lower collection trench fill and liner material, and the upper one foot of the underlying native soil.

The proposed excavation area is shown on Figure 4. The excavation area has been segregated into six areas. The excavation will generally proceed from south to north, beginning with Area 1A and concluding with Area 5. Areas 1A, 1B, 2, and 3 comprise the higher elevation portion of the Site, and the former AST locations. Area 4 constitutes an approximate 1:1 slope. Area 5 represents the lower collection trench.

Excavation specifications are as follows:

Area	Depth of Impacted Soil and/or C&D Waste	Estimated Surface Area	Estimated Volume of Impacted Soil and C&D Waste to be Disposed of Off-Site	Estimated Weight of Impacted Soil and C& D Waste to be Disposed of Off-Site
	Feet	**Square feet**	**Cubic yards**	**Tons**
1A	0 to 1.0	10,900	400	600
1B	0 to 10.0	4,950	1,800	2,700
2	0 to 14.0	1,390	720	1,100
3	0 to 14.0	3,660	1,900	2,800
4	0 to 9.0	2,900	970	1,500
5	0 to 7.0	2,200	570	860
TOTAL		**26,000**	**6,360**	**9,560**

The actual volume and weight of soil and C&D waste will be determined by field conditions, as described below.

Excavated materials will be stockpiled to provide an adequate amount of soil for loading into trucks for transport to the Waste Management's Charleston Landfill for disposal as non-hazardous waste. The completed stockpiles will be covered with plastic unless they are being sampled or loaded from. If necessary, excavated material will be stockpiled on-site on plastic to prevent contact with clean soil, prior to loading into trucks. Direct (live) loading into trucks will be performed when feasible. This waste material has already been accepted at this facility. All waste will be manifested into the facility and disposal records maintained for documentation purposes of total weight shipped and disposed. These efforts will be summarized in an IRA Report documenting the activities in this IRA Work Plan. Details on the content of this report are further specified in Section 7.0 of this Work Plan.

The excavation specifications presented previously provide a general framework for the IRA, and will be supplemented with field screening. Field screening will be performed on site soil using the headspace

method and a photoionization detector (PID) calibrated to isobutylene, since previous site data indicates PID response to MCHM and PPH. A flame ionization detector (FID) will also be used to confirm PID results, as necessary. Olfactory methods cannot be used to field screen soil while personnel are wearing level C PPE which includes an air purifying respirator. The field screening results will be used to segregate soil as either "presumed clean" or "obviously impacted". The former will be stockpiled pending sampling and expedited analysis for MCHM and PPH, and the latter will be loaded to trucks for off-site disposal. A representative number of soil samples will be used to characterize the presumed clean soil stockpile (e.g., one per 300 tons). PID calibration and results will be documented in a field notebook.

Odor and emission control measures to be implemented during the excavation and transportation activities are as follows:

- Excavated areas will be partially or fully backfilled as soon as practicable after excavation (e.g., daily) to control potential odors; excavated soil will be live loaded or removed from the site as quickly as practicable and a layer of lime will be applied to soil in the trucks leaving the site to minimize odor generation; and,
- If necessary, lime will also be utilized in any open excavation which cannot be backfilled on the day of excavation.

Lime weight is not included in the excavation specifications table presented previously.

If lime proves to be unfeasible due to site conditions or odor/emissions results (based on the air monitoring plan implementation), inert and non-toxic detergent-based aqueous odor and emission control foam (Rusmar AC-645 or similar) will be applied to the exposed soil in the excavation and/or loaded trucks using foam application equipment (Rusmar NTC/8 or PFU400/25 or similar), in lieu of lime.

Should buried piping be encountered during the excavation process, work will stop until the status and utility of the pipe is determined. Any active piping such as a gas line, water line, or similar, will not be undermined and the respective utility will be contacted to assist in piping protection and decisions regarding further excavation, support and cover placement in relation to this pipe. Should the pipe be deemed inactive, it will be removed from the excavation at least to the limits of the excavation and disposed of accordingly. If the pipe has a limited areal extent, the pipe will be removed from beyond the excavation area limits. Plastic sheeting will be maintained near all excavations in the event of pipe and free liquids discovery. If free liquids are encountered, the liquids will be containerized to prevent contact with clean site soil. Excavated piping will be live loaded to trucks or staged on plastic sheeting prior to removal from the site for proper disposal.

Piping that extends beyond the immediate area of the excavation will be located utilizing a Trimble unit and Global Positioning System (GPS) coordinates collected, so these pipes can be further evaluated at a later date as part of additional site assessment activities.

Soil or C&D waste within 5-15 feet of fire hydrants, retaining walls, and utility poles (e.g., Areas 1A, 1B 2) and the concrete surface water intake structure (located to the north of Area 4) will not be excavated, to avoid compromising structural integrity.

Monitoring wells MW-3, MW-3A, and MW-13 are located proximate to the lower collection trench. Monitoring well MW-13 will be reinstalled after the excavation area is backfilled. If the C&D waste is found to extend to the monitoring well MW-3 and MW-3A locations, the wells will be properly abandoned and reinstalled, and the top of casing and ground surface elevations will be determined by a professional licensed surveyor. The replacement monitoring wells will be constructed using the same construction details as the existing monitoring wells.

A detailed discussion of the proposed excavation activities in each area is presented below:

Area 1A

The first area that will be excavated is located in the southernmost portion of the Site. Sampling results indicated MCHM/PPH and encompasses test pit 15 soil borings/sample locations SS-6 and SS-7, SB-10, and SB-25, as noted on Figure 4. The sample locations and borings contained concentrations of MCHM/PPH at a depth of 0 to 1.0 feet bgs. The results for soil sample SB-10 were previously addressed in Section 3.0.

Prior to excavation of this area, CORE will collect a surface water sample from the Elk River up-stream and downstream of the on-site collection trench. Following excavation of this area, confirmatory (verification) soil samples will be obtained from the base and sidewalls of the excavation and analyzed as discussed in Section 6.0 of this IRA Work Plan to document the concentrations of MCHM/PPH contamination, if any, remaining in this area.

Area 1B

As a result of the test pit excavation and characterization activities conducted in late August and September 2015, MCHM/PPH contaminated soil was identified at test pits 9, 16, and 17,as well as Arcadis soil samples and borings SS-3, SS-4, SS-5, SS-11, SB-23, and SB-43, as shown on Figure 4.

Following excavation of the contaminated soil in this area, confirmatory soil samples will be obtained from the base and sidewalls of the excavation as discussed in Section 6.0 of this IRA Work Plan to document the concentrations of MCHM/PPH contamination, if any, remaining in this area.

Area 2

MCHM/PPH contaminated soil was identified at Arcadis soil boring SB-38 at a depth of 12.0 to 14.0 feet bgs and the soil throughout Area 2 is presumed to be impacted.

Following excavation of the contaminated soil in this area, confirmatory soil samples will be obtained from the base and sidewalls of the excavation as discussed in Section 6.0 of this IRA Work Plan to document the concentrations of MCHM/PPH contamination, if any, remaining in this area.

Area 3

C&D waste and MCHM/PPH contaminated soil were detected in test pits 1 and 10 at depths to 8 feet below grade. MCHM/PPH contaminated soils were also identified in these two test pits as well as Arcadis surface soil and soil borings SB-20, SB-24, SB-26, and SB-45 at depths ranging from 1 to 14 feet below grade.

Following excavation of the C&D waste and contaminated soil in this area, confirmatory soil samples will be obtained from the base and sidewalls of the excavation and analyzed as discussed in Section 6.0 of this work plan to document the concentrations of MCHM/PPH contamination, if any, present in this area.

Area 4

After the first day of excavation in this area, CORE will collect a surface water sample from the Elk River up-stream and downstream of the on-site collection trench. The C&D waste and contaminated soil in the area with steep grades will be excavated and backfilled using a terrace design approach to minimize potential slope instability. A bench will be established along the slope, approximately 10 feet in width. C&D waste was detected in test pits 2 and 3 on the slope at depths to 8 feet below grade. MCHM/PPH contaminated soils was identified in these two test pits, as well as Arcadis soil sample CS-3.

Following excavation of the C&D waste and contaminated soil in this area, confirmatory soil samples will be obtained from the base and sidewalls of the excavation and analyzed as discussed in Section 6.0 of this work plan to document the concentrations of MCHM/PPH contamination, if any, present in this area.

Confirmatory soil samples will not be collected from Area 4 and will not be backfilled until after Area 5 is excavated. This will allow for access to and excavation of Area 5 via Area 4.

Area 5

This area is defined as the existing collection trench area. This area will be excavated last to maximize the use of this trench during excavation of the other areas for surface water management. Both existing collection sumps will be removed and this area excavated to an approximate depth of 7 feet below grade, removing all contaminated gravel fill and the liner materials. After the first day of excavation in this area, CORE will collect a surface water sample from the Elk River up-stream and downstream of the on-site collection trench.

A dewatering area will be constructed up-gradient of Area 5 within Area 4. The dewatering area will consist of a plastic-lined depressed area with perimeter berms (6 inches height, minimum) and a plastic-lined sump for free liquid containment and collection. Soil containing free liquids (water or other liquids) will be placed in the dewatering area to allow the soil to drain. Free liquids collected in the dewatering area and sump will be pumped to a frac tank dedicated to free liquid collection. The soil will be staged at the dewatering area until no further free liquid is observed in the material or the sump. As necessary, a representative grab sample of the soil containing potential free liquids will be collected and submitted for free liquid analysis using the Paint Filter Test (EPA SW-846 Method 9095B). After excavation completion, all plastic and other materials in contact with potential MCHM/PPH containing soil will be properly disposed of. All free liquids and material in contact with MCHM/PPH containing soil will be manifested and disposal documentation will be included in the IRA report.

Following excavation of the contaminated soil, trench fill and liner materials in this area, confirmatory soil samples will be obtained from the base and sidewalls of the excavation and analyzed as discussed in Section 6.0 of this IRA Work Plan to document the concentrations of MCHM/PPH contamination, if any, present in this area.

All excavation area boundary locations will be documented using GPS to identify mapping coordinates.

4.3 Backfill and Site Grading

Each area that is excavated as specified in Section 4.2 of this IRA Work Plan will be backfilled, if confirmatory results indicate the area has no MCHM and/or PPH detections. If a confirmatory soil sample result indicates an MCHM and/or PPH detection, the sample location will be over-excavated and resampled. Backfilling of each area will be completed near the excavation limits of the subsequent excavation area but

not to the point of allowing contact with contaminated materials. Liner material may be used to limit contact if deemed necessary.

Clean backfill material and topsoil will be obtained from a borrow source located in Mt. Hope, West Virginia, or an alternate location (identified to WVDEP and approved by the WVDEP prior to or during the excavation). An estimated 12,000 tons of backfill and 2,000 tons of topsoil will be required.

General backfill material will be utilized to fill in the excavation areas within 6 inches of final grade. The material will consist of soils in the United States Department of Agriculture (USDA) classification of loams, sandy or silty loams or similar, free of debris, roots, sticks or rocks or stones in excess of 3 inches in diameter. At least 95% of the material will pass through a 1 inch sieve. Physical testing of the backfill will include Standard Proctor, sieve analysis, USDA and Unified Soil Classification System (USCS) classification, and organic content. Chemical analysis will be performed to document that the backfill is clean and uncontaminated.

The backfill will be placed in 12 inch lifts and compacted to 85 to 90% Standard Proctor using test method ASTM-D-698. Material placement and grading will take place utilizing bulldozers and/or a smooth drum roller to achieve these compaction goals. To promote drainage, the final lift of material will be placed with a minimum 3% grade toward the perimeter of the excavation areas above the slope. Compaction testing and some limited surveying will be conducted during material placement to confirm lift thickness and compaction efforts.

To blend in with the surrounding topography of the undisturbed areas, backfill materials in Area 4 will be placed in a similar manner as the bench and terrace as noted in Sections 4.2 of this IRA Work Plan.

Once the backfilling is complete and satisfies the specifications identified above, the final 6 inches of vegetative cover (topsoil) will be placed. This material will consist of soils in the USDA classification of loams, sandy or silty loams or similar, free of debris, roots, sticks, rocks or stones in excess of 1 inch in diameter, that is suitable for establishing a good stand of vegetation that will minimize erosion of the final cover system. The proposed material will also be tested by a laboratory for organic content and for optimum nutrient and seed mixture evaluation.

4.4 Collection Trench Reconstruction

Following collection trench removal and confirmatory soil sample collection, the collection trench will be reconstructed and the existing sumps will be reinstalled to provide a means for surface water sampling to evaluate post-excavation water quality. The sumps will be removed after two consecutive sampling events (minimum of four weeks apart) indicating no detectable MCHM and/or PPH above laboratory

reporting limits, and WVDEP notification. The collection trench will remain in case future surface collection and/or sampling is needed. The trench construction details are identified in Appendix C.

The areal extent and construction will conform to the as-built construction details for the existing trench, with the exception that the trench will be installed to a depth of approximately 5' below grade.

4.5 Revegetation

Once the topsoil layer has been placed, a final survey of the cover system completed and verified as satisfying the 3% slope criteria and surface conditions are suitable for vegetation, the area will be revegetated. Since IRA activities are expected to occur in the fourth quarter of 2015, the backfilled excavation will be temporarily seeded with fast growing, hardy grasses, such as winter wheat, oats, rye or similar mixture to establish a quick stand of grass before the winter months. A local nursery or Penn State University agricultural department will perform and/or be provided with the soil quality test data to derive a suitable mixture for application. Lime and fertilizer will be applied as recommended by the local nursery or Penn State University upon review of the soil test data.

The lime, fertilizer and seed will be applied to the disturbed areas of the site using manual spreaders. Straw mulch will be applied following the application of lime, fertilizer and seed. An erosion control mat (woven straw mesh) will be placed on all slopes exceeding 3% following application of lime, fertilizer, and seed.

A final application of seed and soil amendments will be applied after completion of final site assessment and any final remedial activities. The final seeding specifications will be identified in a future work plan provided to the WVDEP.

4.6 Site Drainage

The goal of the backfilling and regrading of the site is to promote drainage away from the backfilled area and at the same time, minimize erosion from future rain events. Various temporary and permanent site drainage features, including: drainage channels; grass lined swales; diversion ditches; check dams; erosion control matting; silt and super silt fencing; small retention areas; and, the existing collection trench will be utilized as shown in the E&S Control Plan in Appendix B.

Temporary control measures will remain until completion of the final site assessment. These control measures will be removed upon WVDEP approval.

4.7 Perimeter Fencing

Temporary construction fencing (6-foot height) will be positioned around the perimeter of the excavation areas, in conjunction with existing permanent fencing, for public safety and to prevent access to the excavations. A locking gate will be secured during non-working hours. The construction fencing will be removed following backfill completion.

5.0 SITE-SPECIFIC AIR MONITORING

A Site-Specific Air Monitoring Plan will be implemented during the IRA. The Plan is presented as an attachment to the HASP located in Appendix A, and provides for personnel and perimeter ambient monitoring activities, both real time using a PID calibrated to isobutylene, and also time weighted averages using sampling pumps and laboratory (ALS Environmental) analysis of sample media. The analytical results will be compared against existing Occupational Safety and Health Administration (OSHA) and National Institute for Occupational Safety and Health (NIOSH) established standards and exposure limits for benzene and Risk-Based Screening Levels (RBSLs) for MCHM and PPH approved by the WVDEP.

6.0 POST-EXCAVATION SOIL SAMPLING PLAN

Verification soil sampling will be performed on the sidewalls and base after the excavation is completed, and in the collector trench excavation. One grab soil sample will be collected for each 300 square feet of sidewall and base. Also, a minimum of four side wall and three base samples will be collected at the collector trench excavation. For all excavation areas other than the trench, a grid-based systematic sampling design will be implemented, with random sample locations within each grid. All sampling and analysis will be performed in accordance with EPA and WVDEP protocols. Accelerated laboratory turnaround time (24 to 48 hours) will be requested in order to determine if all impacted soil has been excavated.

All soil samples will be analyzed for MCHM and PPH by gas chromatography/mass spectrometry methods in accordance with USEPA SW-846 Method 8270D. Samples will be placed in containers with minimal headspace and Teflon lined lids.

Sample containers will be labeled, and a chain of custody form will accompany samples. Clean sampling tools will be used to avoid cross-contamination, and samples will be placed in one 4-ounce pre-cleaned unpreserved container with a Teflon lined lid, immediately placed in a cooler with ice, and submitted to ALS Environmental for analysis. A GPS will be used to determine all sample location and final lateral excavation boundary coordinates.

Quality control samples will be collected and submitted as follows:

- One duplicate sample for every ten samples submitted for analysis; and
- One matrix spike and matrix spike duplicate sample for every twenty samples submitted for analysis.

All analysis will be performed with Level IV deliverables. CORE will coordinate sampling with the WVDEP to all for collection of split soil sampling.

The soil sample locations will be documented using GPS to identify mapping coordinates. Sample depths will be recorded in a field notebook.

7.0 REPORT PREPARATION

Following completion of the IRAs outlined in this Work Plan, an Interim Remedial Actions Report will be prepared summarizing the activities and outcomes. The report will provide a summary of excavation activities, tables and figures detailing site activities and laboratory analytical results, air monitoring data during construction activities, confirmatory soil sample results, disposal documentation, quantities of backfill and topsoil utilized, final details from revegetation efforts, a site drawing showing the final surveyed grading plan and E&S control measures employed.

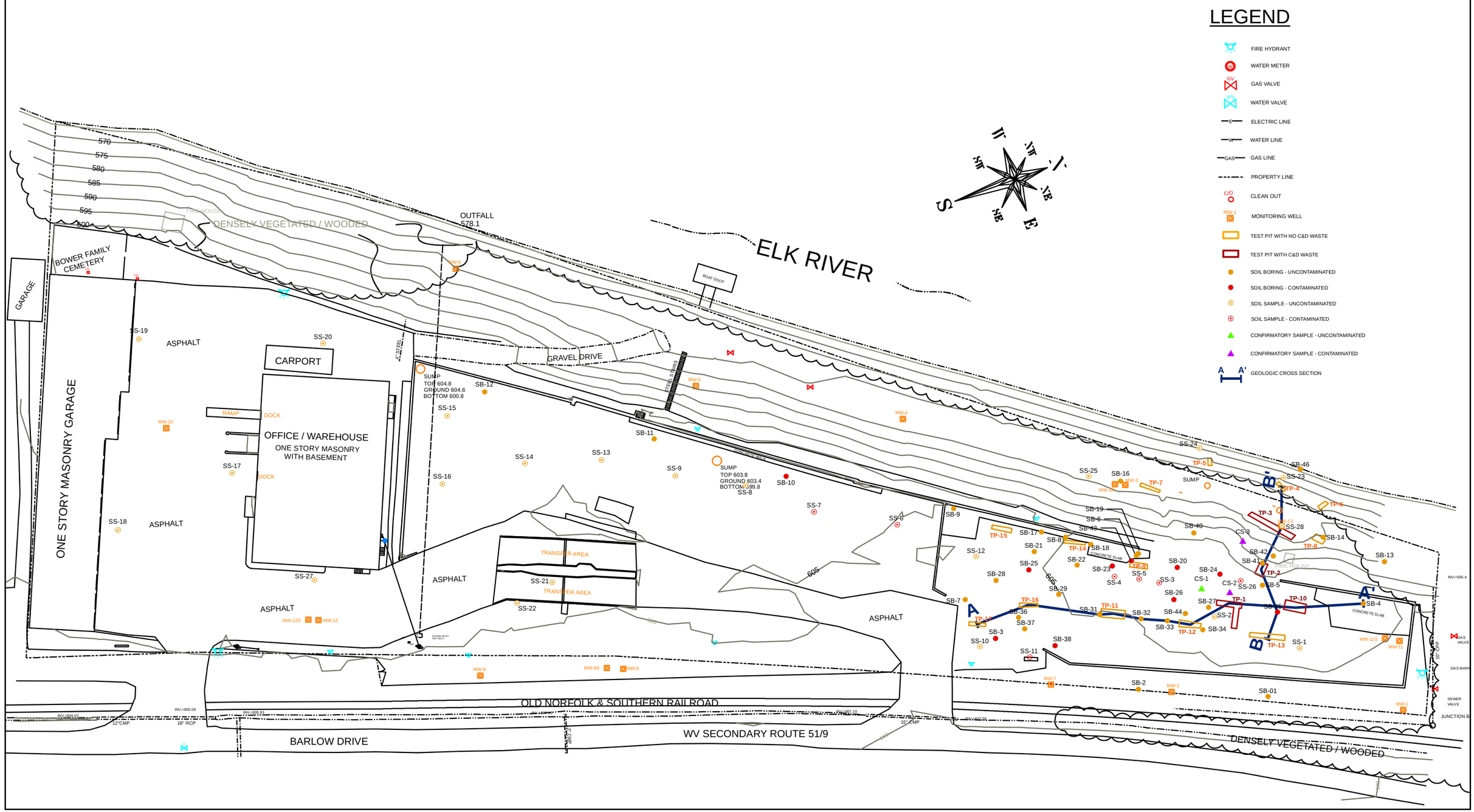
This report will be submitted to the WVDEP within ninety days after completion of the IRA.

8.0 REMEDIAL ACTION SCHEDULE

The following presents a proposed project time line addressing the key steps specified in this work plan and associated completion dates, assuming WVDEP approval of this IRA Work Plan within five business days after receipt.

	Activity	Completion Date
1)	Site Preparation	5 days after WVDEP IRA Work Plan approval
2)	Excavation and Backfilling	60 days after WVDEP IRA Work Plan approval
3)	Installation of New Collection Trench	75 days after WVDEP IRA Work Plan approval
4)	Submittal of IRA Report	First Quarter 2016

FIGURES



CORE ENVIRONMENTAL SERVICES, INC.
533 North Jefferson Street
Suite 3
Lewisburg, WV 24901
T: 304-520-4260
F: 304-520-4265
WWW.CORE-ENV.COM

N

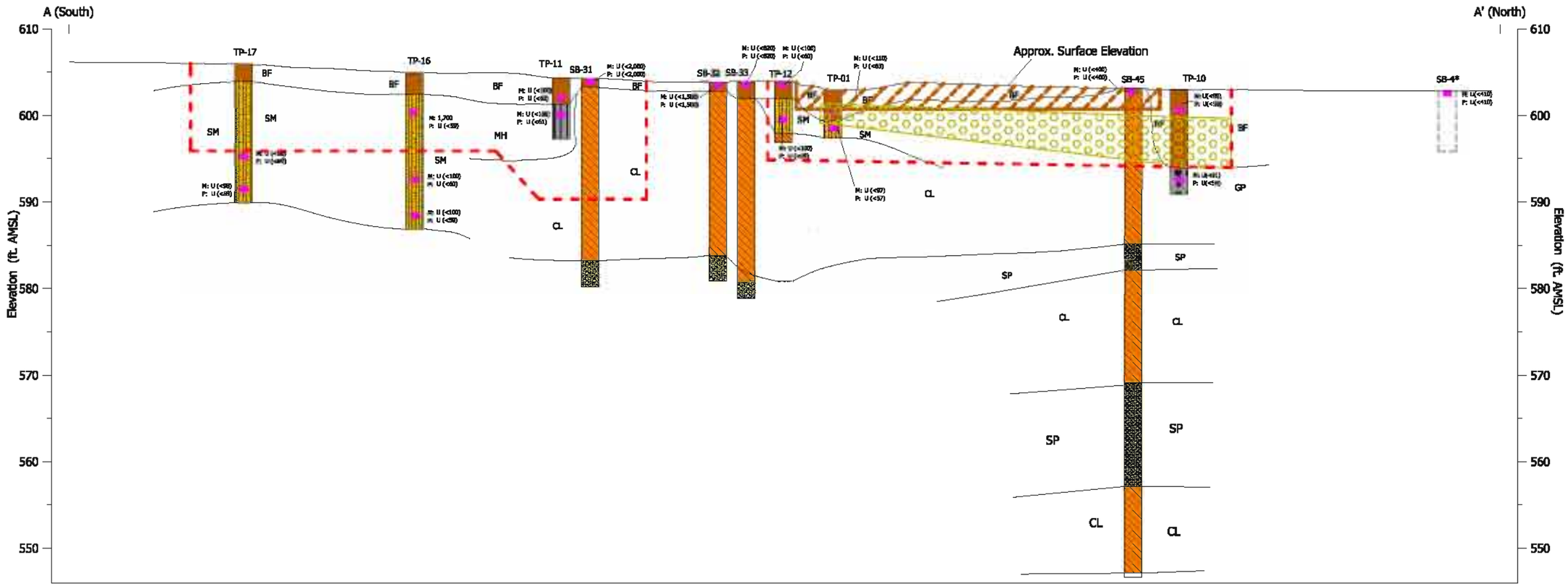
1 inch = 60 feet

0 60 120 Feet

SITE MAP

FREEDOM INDUSTRIES - ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DRAWN BY: DJ	DES.:	PROJECT NUMBER: FRE-2015-364
CHECKED BY:	APPROVED:	
DATE: 11/5/2015	REVISED:	FIGURE NUMBER: 1



- Approximate Extent of C&D Waste
- Soil Sample Location and Result:
  M - MCHM Result
  P - PPH Result

All sample results reported in ug/kg
J- Laboratory Estimated Value
U- Undetected Value

* Soil boring log not provided in the Arcadis Site Investigation Report

- BF: Backfill
- SM: Silty Sand
- MH: Silt / Clayey Silt
- CL: Gravelly Clay/Sandy Clay/Silty Clay
- GP: Gravel / Sandy Gravel
- SP: Gravelly Sand / Sand
- BR: Bedrock

Approximate Soil Excavation Performed by Arcadis

Approximate Extent of C & D Waste

Proposed Soil and C & D Waste Excavation Extent

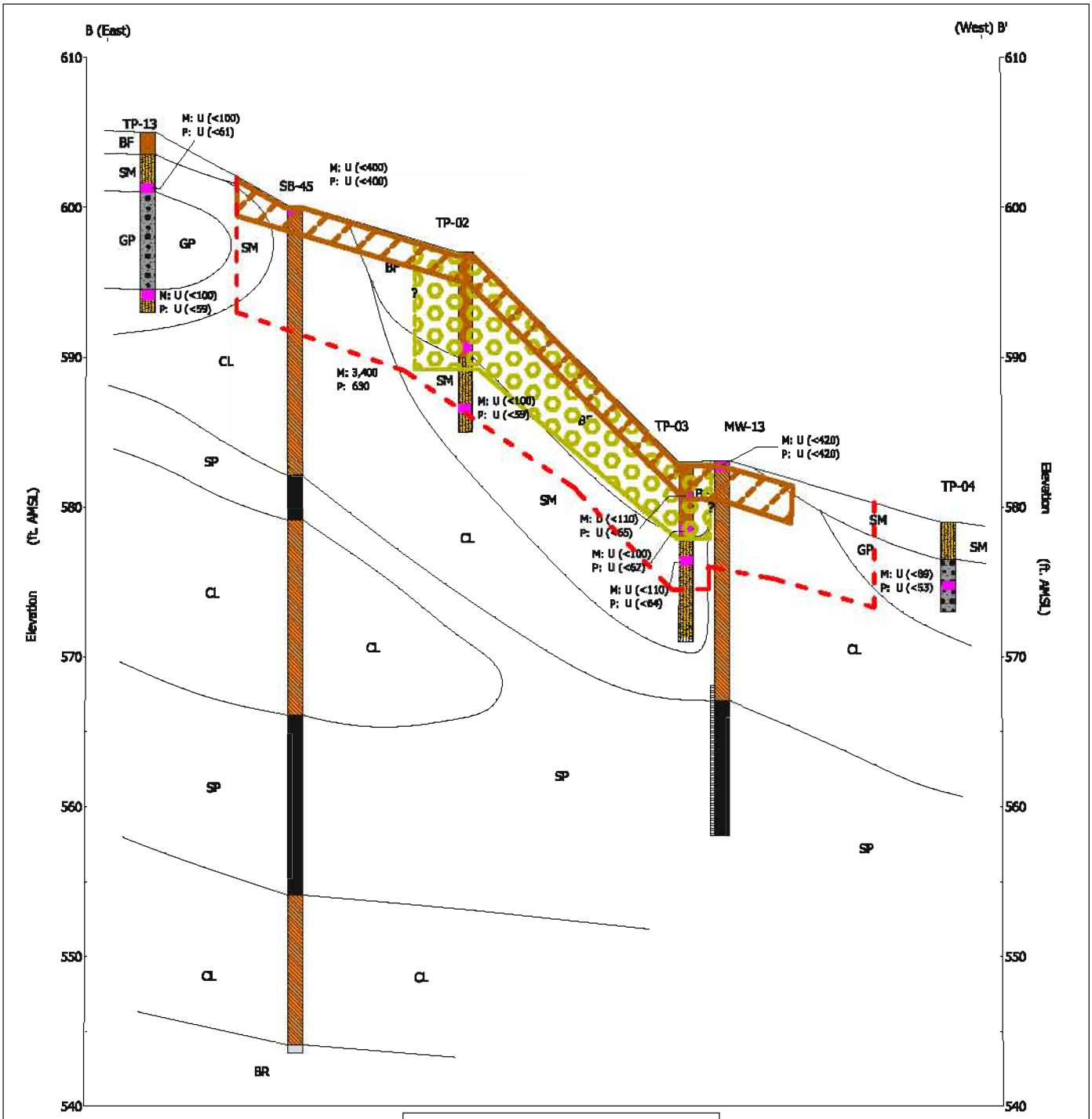
0 12.5 25
FEET

2x Vertical Exaggeration

CORE ENVIRONMENTAL SERVICES, INC.

TITLE:
GEOLOGIC CROSS SECTION A – A'
FREEDOM INDUSTRIES – ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DWN: NZ	DES.:	PROJECT NO.: FRE–2015–364
CHKD:	APPD:	FIGURE NO.: 2
DATE: 10/9/15	REV.: DF	



- Soil Sample Location and Result:
  M - MCHM Result
  P - PPH Result

All sample results reported in ug/kg
J- Laboratory Estimated Value
U- Undetected Value

- SP: Gravelly Sand / Sand
- SM: Silty Sand
- GP: Gravel / Sandy Gravel
- CL: Gravelly Clay/Sandy Clay/Silty Clay
- BR: Bedrock
- BF: Back Fill

Approximate Soil Excavation Performed by Arcadis

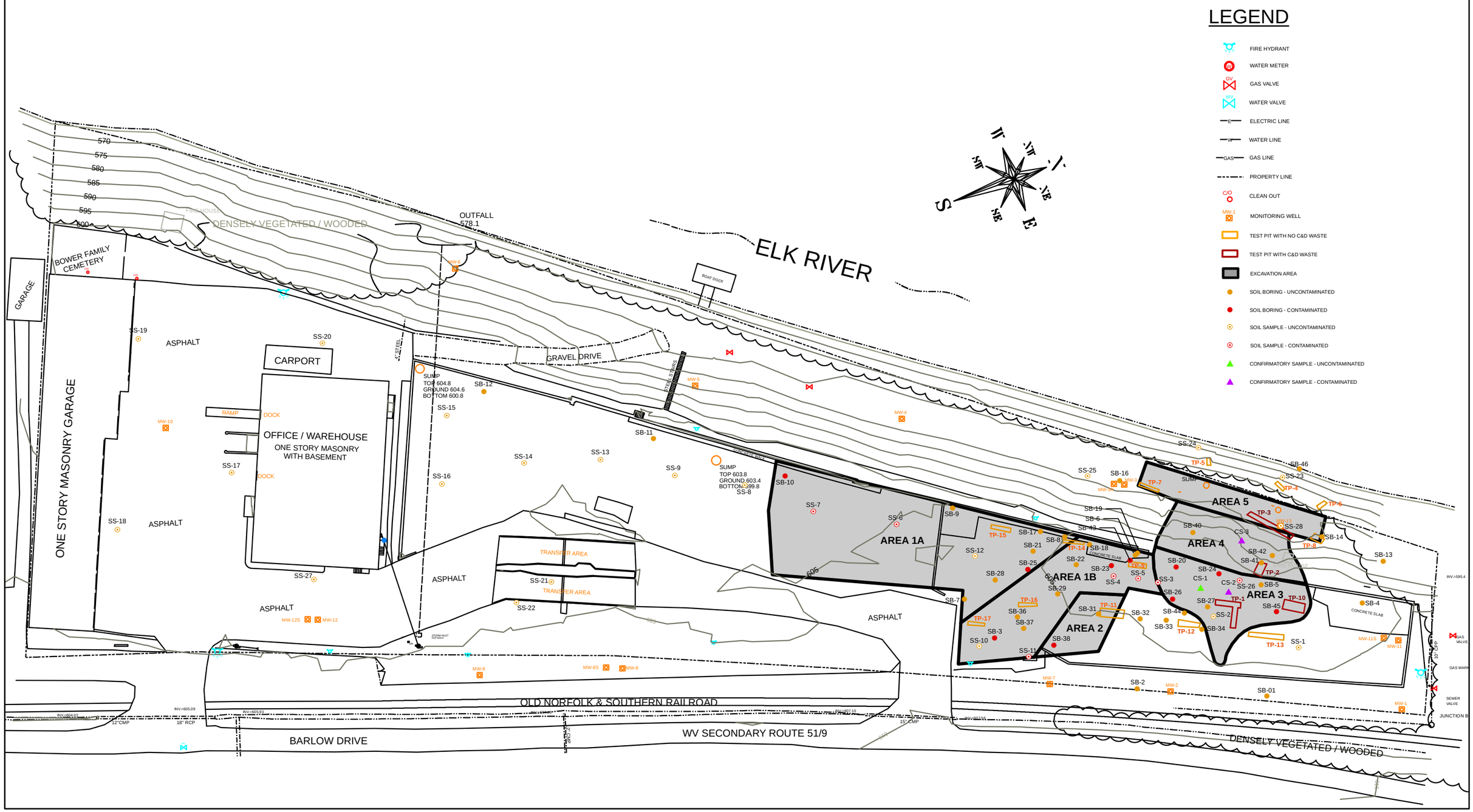
Approximate Extent of C & D Waste

Proposed Soil and C & D Waste Excavation Extent

0 12.5 25
FEET
Vertical Exaggeration 2X

CORE ENVIRONMENTAL SERVICES, INC.

TITLE:	DWN:	DES.:	PROJECT NO.:
GEOLOGIC CROSS SECTION B – B' FREEDOM INDUSTRIES ETOWHA RIVER TERMINAL CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA	DF		FRE-2015-364
	CHKD:	APPD:	FIGURE NO.:
	DATE: 10/19/15	REV.:	3



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1 inch = 60 feet

0 60 120 Feet

SOIL AND C&D WASTE EXCAVATION PLAN

FREEDOM INDUSTRIES - ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DRAWN BY: DJ	DES.:	PROJECT NUMBER: FRE-2015-364
CHECKED BY:	APPROVED:	
DATE: 11/5/2015	REVISED:	FIGURE NUMBER: 4

APPENDIX A

SITE-SPECIFIC HEALTH AND SAFETY PLAN

CORE
ENVIRONMENTAL SERVICES, INC.

SITE-SPECIFIC HEALTH & SAFETY PLAN

Project #: FRE-2015-364

Project Name: Freedom Industries Interim Remedial Action

<u>USE</u>: THIS PLAN MUST BE ON SITE AT ALL TIMES - REVIEWED AND SIGNED BY EVERYONE WHO ENTERS THE WORK AREA. NO CHANGES ARE TO BE MADE TO THIS PLAN WITHOUT THE APPROVAL OF THE PROJECT MANAGER AND/OR THE HEALTH, SAFETY, AND ENVIRONMENTAL (HSE) MANAGER.

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APPENDIX B JOB SAFETY ANALYSIS FORMS
APPENDIX C AIR MONITORING PLAN
APPENDIX D SITE MAPS
APPENDIX E SAFETY DATA SHEETS

A. SITE INFORMATION

1. **Client: Freedom Industries, Inc.**
2. **Site Name: Freedom Industries**
3. **Address/Location: 1015 Barlow Drive, Charleston, WV**

Access Entrance: Latitude: 38° 22' 6.48" North

Longitude: 81° 36' 24.18" West

4. **Date Plan Prepared: 11/5/15**

   Expires:
5. **Prepared by: Matthew Ford, LRS**

   Title: Senior Consultant
6. **Major Hazards(s): Exposure to potentially contaminated soil and groundwater, and heavy machinery.**
7. **Weather Conditions: To be determined daily in Job Safety Analysis**
8. **Topography: Benched area with steep incline.**

B. ON-SITE ORGANIZATION

The following personnel are assigned to carry out the job and the functions of that job. No changes are to be made without the approval of the Project Manager and noted by the HSE Manager on this plan.

TITLE	PRINT NAME	SIGNATURE	DATE
PROJECT MANAGER	Matthew A. Ford		
HSE MANAGER	Steve Zbur		
SITE SUPERVISOR	Sotero Svingos		
ALT SITE SUPERVISOR	Jared Sommers		
ALT SITE SUPERVISOR	Lafe Kunkel		
ALT SITE SUPERVISOR	Larry Emerson		

CORE ENVIRONMENTAL SERVICES, INC.

CREW MEMBERS

	PRINT NAME	SIGNATURE	DATE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
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16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			

C. ON-SITE CONTROL

1. **CORE Environmental Services, Inc.** has the responsibility of providing right-of-entries. All questions or concerns will be directed to **CORE Environmental Services, Inc.**

2. No unauthorized person or persons are allowed on-site. Security is the responsibility of all personnel. Report any security violations or suspicious activity immediately to the Site Supervisor.

3. The local law enforcement agency can be called for additional security needs.
   a. Name of agency: Kanawha County Sheriff
   b. Non-emergency phone number: 304-357-0200
   c. Emergency phone number: **Local 9-1-1**

D. SITE CONTINGENCY/ EMERGENCY MEDICAL CARE

1. All injuries will be reported immediately to the **HSE Manager and Project Manager**. Injuries will be assessed and the nature of the injury will determine the course of action to be taken.

2. First aid equipment and supplies for minor injuries are on-site in **company vehicles or with Crew Members and the Site Supervisor.**

3. The closest minor emergency facility or doctor's office is located at:
   Name: Saint Francis Hospital (1.6 miles/ 5 minutes)
   Street: 333 Laidley Street
   City, State, Zip: Charleston, WV 25322
   Phone number: (304) 347-6500
   Website:

   Name:
   Street:
   City, State, Zip:
   Phone number:
   Website:

   Name:
   Street:
   City, State, Zip:
   Phone number:
   Website:

4. The closest Level II Trauma Center is located at:
    a. Name: CAMC General Hospital
    b. Street: 501 Morris Street
    c. City, State, Zip: Charleston, WV 25301
    d. This facility is **1.8** miles from the work site.
    e. Ground transportation is **5** minutes.
    f. Is air transportation available in this area: Yes ☒ No ☐
    g. Flight time to this facility from time of notification is **?** minutes.

5. Emergency Medical Services (EMS) are provided by:
    a. Name: Kanawha County Emergency Ambulance Authority (KCEAA)
    b. Emergency Phone Number: 304-342-1107 **9-1-1 or local**
    c. Services provided:
        a. Advanced life support (ALS): Yes ☐ No ☒
        b. Basic life support (BLS): Yes ☒ No ☐
    d. EMT first aid by emergency medical technicians: Yes ☒ No ☐
    e. Emergency ground transportation will ☒ / will not ☐ be provided by this organization.

6. Information for emergency transport if not available by EMS (listed in item 4 above)
    a. Name:

Maps with directions are provided in **Appendix A, Medical Care Directions**.

NOTES

Air Transportation shall be dispatched and initiated by ground EMS depending on the patient assessment and/or the severity of the incident.

E. ENTRY OBJECTIVES

1. The purpose of entering this worksite is to oversee implementation of the Interim Remedial Action Work Plan that includes soil excavation, backfilling/compaction; oversee the transportation and disposal of the impacted soil; and collect confirmatory soil and water samples.
2. Perform ambient and personal air monitoring.
3. Daily goals and tasks will be set at the morning meeting during the Job Safety Analysis (JSA) and provided in **Appendix B, Job Safety Analysis Forms** for review. JSAs will

be completed during the initial start of the project, at the beginning of each new job task, and reviewed and signed daily depending on the job task.

4. The work day will close with a debriefing and critique of the day's activities.

F. SAFETY HAZARDS

CORE personnel could be potentially exposed to the following hazards during each task of the project. The JSA forms provided in **Appendix B, Job Safety Analysis Forms** will be completed during the initial start of the project, at the beginning of each new job task, and reviewed and signed daily depending on the job task. Any new safety hazards observed in the field will be added, as needed, to the JSA.

HAZARDS	PREVENTATIVE MEASURES
Contaminated soil, water, and air	**Wear proper PPE as recommended during the daily safety meetings.** **Implement Air Monitoring Plan, which is included as Appendix C.** **Only properly trained personnel with 40-hour HAZWOPER training are permitted on the site.**
Etiological	**First Aid and CPR Training** **-Be alert, stay clear, advise crew members of allergies to stings/bites, etc.**
Weather **(Driving Conditions and Heat/Cold Stress)**	**Defensive Driving and Vehicles Safety Training** **-Journey management by determining weather/road conditions prior to driving to site** **-Vehicle inspections prior to use** **Heat/Cold Stress Training** **-Dress accordingly, hydrate & breaks**
Heavy Equipment and traffic	**Personal Protective Equipment Training** **-Communication with operator** **-Operator always has right-of-way** **-Set up traffic controls**
Slips, Trips, and Falls	**-Wear proper PPE as recommended during the daily safety meetings.** **- Avoid wet and muddy areas at the site.** **-Use good housekeeping practices.** **-Mark site obstacles and protect open excavations.**

Training programs and records are available upon request from the HSE Manager.

During inclement weather all warnings by the national weather service will be monitored until the warnings have expired.

G. PERSONAL PROTECTIVE EQUIPMENT (PPE)

1.	Level- A ☐	Fully encapsulated suit/ supplied air SCBA
2.	Level-B ☐	Coveralls (Tyvek)/ supplied air/ gloves/ safety boots
3.	**Level-C ☒**	**Tyvek overalls and boot covers/ half-mask respirator with organic vapor cartridge and particulate filter/ gloves(nitrile (inner) / nitrile/neoprene (outer)/ safety boots/ hard hat/safety-glasses/hearing protection (Full-face respirator can be substituted for half-mask respirator/safety glasses combination).**
4.	**Level-D ☒**	**Work uniforms/ hard hat/ safety boots/ gloves/ safety glasses/hearing protection**

Note:

- NO FRC Clothing should be required due to No Flash Fire Exposure Potential.
- This should be verified by your Client Representative and Approved.
- High-Visibility Clothing must be utilized.
- Respirator cartridges must be changed daily and respirators must be worn in accordance with CORE's Respirator Protection Program, which will be available on-site.

Level C PPE will be required initially for all on-site personnel working near each excavation area (within the exclusion zone). An exclusion zone will be identified. Air monitoring will be performed to determine the exposure concentrations in ambient air. Following consultation with the Certified Industrial Hygienist, the CORE Project Manager will notify on-site personnel whether PPE should be upgraded to Level B or downgraded to Level D based on air monitoring results. Level C PPE will be donned during initial work in each excavation area. The number of air monitoring samples and the collection frequency is detailed in Appendix C - Air Monitoring Plan.

H. COMMUNICATION PROCEDURES

1. Radios will ☐ / will not ☒ be used.
2. Cell phone may be used if operational at site.
3. The following standard hand signals will be used in the event other forms of communications fail.

Hand gripping throat	Out of air
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	Ok, I am alright, I understand
Thumbs down	No, negative

I. DECONTAMINATION

1. A drum will be placed at the perimeter of each exclusion zone for collection of PPE and disposable sampling equipment.
2. All heavy equipment including dump trucks must be decontaminated prior to leaving the site. An equipment decontamination area will be set up at the former loading rack. Gross soil contamination will be removed from all equipment in this area prior to leaving the site. The area is concrete lined and all water leaving this area is collected in an oil/water separator, which is emptied into one of the on-site frac tanks for off-site disposal.

J. EVACUATION PLAN

1. A safe area will be considered **OUTSIDE** of the work area at a minimum of **50** feet away from the hazard.
2. The assembly point will be the on-site office.
3. A head count will be performed at each assembly area and will be reported to staff.

K. SITE MAP

1. A site-specific map of the work area will be provided in **Appendix D, Site Maps** and updated as needed.
2. Features to be shown but not limited to:
   a. Work area
   b. Break area
   c. Exclusion area/hot zone
   d. Contamination reduction zone/warm zone

e. Assembly points/safe haven

The project location is primarily commercial/industrial area of Kanawha County, West Virginia located off of Barlow Drive. The site is located on Barlow Drive – 1.5 miles north of the juncture of Barlow Drive and Keystone Drive. Freedom Industries is located on the left side of the road.

L. HEALTH HAZARD EVALUATION

Safety Date Sheets shall be collected and maintained in **Appendix E, Safety Data Sheets** for all chemicals that CORE personnel will be working near. Potential chemicals include petroleum products for maintenance of heavy equipment and fueling operations. The following table lists chemicals that have been added to Appendix D.

Number	Chemical
1.	Methanol
2.	Sodium Bisulfate
3.	Hydrochloric Acid
4.	Ethylene glycol
5.	Propylene glycol
6.	4-methylcyclohexanemethanol (MCHM)
7.	Propylene glycol phenyl ether (PPH)
8.	Alcohols
9.	Volatile Fatty Acids
10.	Formaldehyde
11.	Acetaldehyde
12.	Benzene
13.	Nitric Acid

Number	Chemical
14.	Sulfuric Acid
15.	RusFoam – Vapor Sealant Foam

M. JOURNEY MANAGEMENT (to/from site)

Hazard Mitigation:

1. Complete a Pre-Trip Inspection of the vehicle.
2. Familiarize yourself with the vehicle.
3. Wear your seatbelt at all times.
4. Focus on driving ONLY.
5. Review maps and directions before getting on the road, have maps and directions close, and pull over if you have to review them.
6. Remove all distractions, cell phones etc.
7. Heavy traffic areas and construction zones should be avoided. Consider time of day when journey will take place.
8. Adjust speed as road conditions vary.
9. Avoid left turns across traffic.
10. Use familiar routes.
11. When parking, park away from high traffic areas, make sure to avoid tight parking spaces.
12. Always plan before your journey, give extra time to reach your destination.
13. Don't speed if you are running late, take your time.
14. Try to make the journey during the day; night driving is three times more dangerous than driving during the day.
15. Get plenty of rest before beginning your journey, fatigue slows reaction time, and can be very dangerous.

Mobile Equipment:

1. Only use mobile equipment if you have been authorized by management and have been trained on the piece of equipment.
2. Complete the Mobile Equipment Pre-Operational Checklist.
3. Secure all loads.
4. No passengers shall ride on mobile equipment unless equipped to accommodate.
5. Don the proper PPE.

6. Wear your seat belt at all times, if available.
7. Mobile equipment shall be driven off-road only – Public roads shall only be used if allowed by State, County, or Local laws.
8. Focus on driving ONLY.
9. Review maps and directions before getting on the road, have maps and directions close, and pull over if you have to review them.
10. Remove all distractions, cell phones etc.

N. EMERGENCY PHONE NUMBERS AND CHAIN OF COMMAND

The following emergency contacts are in order by the chain-of-command.

Name	Organization	Title	Phone Number
Matt Ford	CORE Environmental Services, Inc.	Project Manager	304-646-7616
Sotero Svingos	CORE Environmental Services, Inc.	Geologist	304-634-2416
Jared Sommers	CORE Environmental Services, Inc.	Field Technician	304-290-3280
Steve Zbur	CORE Environmental Services, Inc.	HSE Manager	412-977-2737

Contact information for all on-site personnel, project management personnel, and other emergency contacts will be posted in the on-site office. A copy will also be distributed to all on-site personnel. The location will be discussed during the daily safety meetings.

O. ADDITIONAL COMMENTS

- This Site Specific Health and Safety Plan is intended as a contingency in the event of an emergency during the scope of work.

- It shall remain in place on the location until the completion of the work scope. The information contained within this shall be addressed with all employees at the location, as well as where the plan can be found.

- This plan shall also be accompanied by daily JSA, where mitigation techniques are identified for relevant site hazards.

All employees have the right and are encouraged to stop work for any unsafe acts or conditions during the scope of work.

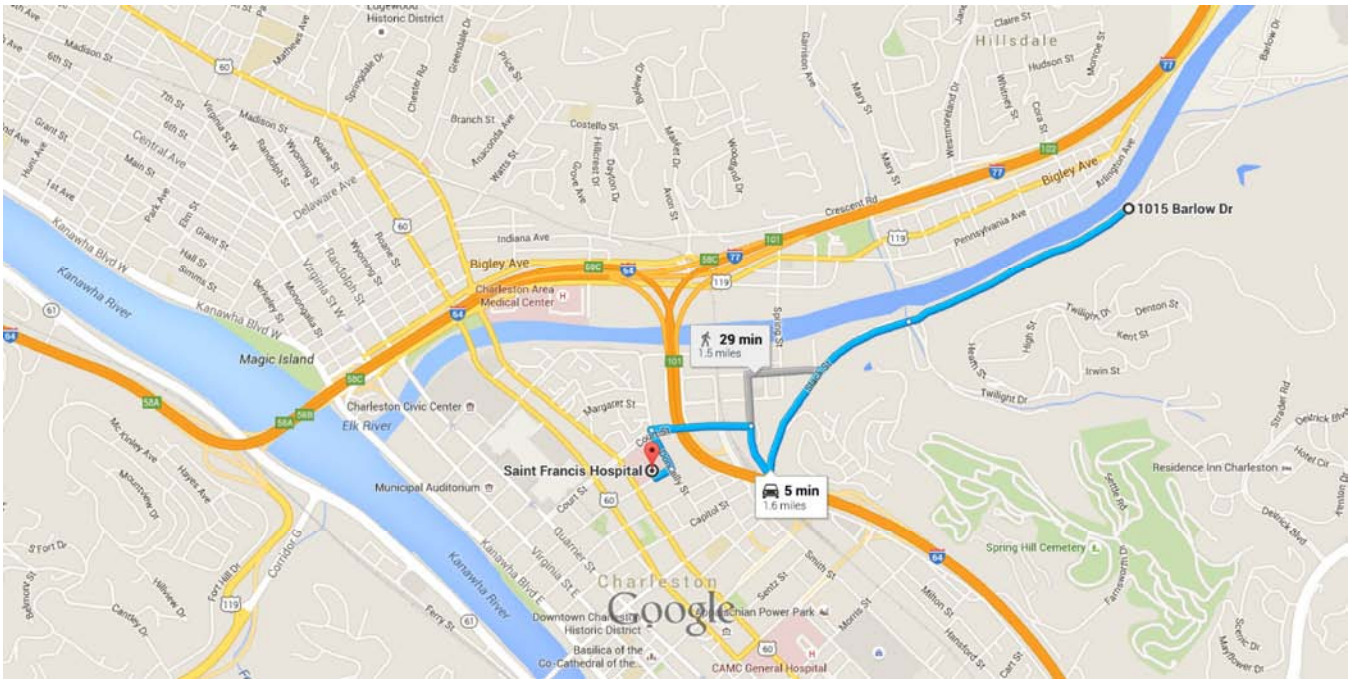
APPENDIX A

MEDICAL CARE DIRECTIONS

Google

1015 Barlow Dr, Charleston, WV 25311 to Saint Francis Hospital

Drive 1.6 miles, 5 min



1015 Barlow Dr

Charleston, WV 25311

1. Head **southwest** on **Barlow Dr** toward **Twilight Dr**

0.6 mi

2. Continue onto **Slack St**

0.5 mi

3. Turn **right** onto **Piedmont Rd**

0.1 mi

4. Turn **left** onto **Court St**

0.2 mi

5. Turn **left** onto **Donnally St**

0.1 mi

6. Turn **right** onto **Laidley St**

Destination will be on the right

213 ft

Saint Francis Hospital

333 Laidley Street, Charleston, WV 25322

APPENDIX B

JOB SAFETY ANALYSIS FORMS

CORE ENVIRONMENTAL SERVICES, INC.

JOB SAFETY ANALYSIS

COMPANY: Freedom Industries, Inc.	**DATE:**
LOCATION: Freedom Industries	**PROJECT#: FRE-2015-364**

Work Activity:
Project Manager:
JSA Completed By:

SECTION 1 Identify Work Activities	SECTION 2 Identify Potential Hazards	SECTION 3 Precautions to Reduce Hazards

CORE ENVIRONMENTAL SERVICES, INC.

List any hazardous materials likely to be involved in this job:
Was MSDS reviewed on each?
Project Manager Signature:

JSA PREPARATION CHECKLIST

IDENTIFY below all HAZARDS associated with the activity. LIST selected hazards in SECTION 2 of the chart on page 1.

Driving or vehicle hazards

○ Weather	○ Road Surface	○ Construction
○ Traffic	○ Trailers	○ Wildlife
○ Abnormal Loads	○ Communication	○ Lighting

Lifting, pulling, prying, or bending

○ Body Positioning	○ Tightening/Loosening	○ Pinch Points
○ Slips/Falls	○ Rigging/Sling/Chain Use	○ Line of Fire

What hazards related to climbing up, over, down, or through piping, skids, packages, vessels, coolers, etc. will be present?

○ Stepping On/Off	○ Uneven Surfaces	○ Slippery Surfaces
○ Hot/Cold Surfaces	○ Heights	○ Body Positioning
○ Use of Ladders		

Stored/Residual energy hazards

○ Rotating Equipment	○ Electrical	○ Pressurized Gas
○ Hot/Cold Surfaces	○ Mechanical Forces	○ Gravitational Forces

CORE ENVIRONMENTAL SERVICES, INC.

Hazards associated with the work area

○ Confined Space	○ Overhead Operations	○ Hot/Cold Surfaces
○ Noise	○ Hazardous Gases	○ Flammable Gases
○ Trapped Pressure	○ Rotating Equipment	○ Operating Equipment
○ Construction	○ Hazardous Material	○ Weather
○ Special Tooling		

Hazards associated with the procedure, process, or tooling

○ Equipment Change	○ Rotating Equipment	○ Electrical
○ Gas Pressure	○ Hot/Cold Surfaces	○ Operating Equipment
○ Special Tooling		

Environmental or flammable hazards

○ Vapors from Fueling Ops	○ Chemicals	○ Fluids
○ Gases	○ Solids	○ Hazardous Waste
○ Emissions Release	○ Spill Potential	

Work Permits

○ Confined Space	○ Hot Work	○ Safe Work
○ Lockout/Tagout	○ Management of Change	○ Ground Disturbance
○ Pre-Lift		

IDENTIFY below ways to CONTROL HAZARDS. LIST selected controls in SECTION 3 of the chart on page 1.

○ Body Positioning	○ Designate Parking	○ Housekeeping	○ Protection/Barrier
○ Capacities Known	○ Disconnect Power	○ Inspections	○ Release Trapped Pressure
○ Dry/Clean Surfaces	○ Drip/Catch Pans	○ Journey Management	○ Restrict Access
○ Communications Process	○ Eliminate Ignition Source	○ Lockout/Tagout	○ Sampling/Monitoring
○ Constant Monitoring	○ Eliminate Noise	○ MSDS	○ Secure Equipment/Process
○ Contact Customer	○ Equipment Cool Down	○ PPE	○ Stabilize Equipment
○ Contact PWR HSE	○ Fire Extinguisher	○ Observation	○ Tag Lines
○ Contact PWR Manager	○ Fire Watch	○ Proper Lifting Devices	○ Ventilation
○ Drink Fluids/ Rest	○ Foot Placement	○ Proper Lifting Technique	○ Work Permit
○ Delay Job	○ Guarding	○ Proper Tools/Quality	○ Other (List Below)
○	○	○	○

CORE ENVIRONMENTAL SERVICES, INC.

PPE: SAFETY EQUIPMENT REQUIRED (Check all that apply and make notes where appropriate)

O BREATHING APPARATUS:	O LOCK OUT / TAG OUT:
O COMMUNICATIONS:	O PROTECTIVE CLOTHING:
O FALL PROTECTION:	O RESPIRATORY PROTECTION:
O FIRE EXTINGUISHER:	O SAFETY GLASSES:
O GLOVES:	O SPECIAL EYE / FACE PROTECTION:
O HARD HAT:	O WORK VEST:
O HEARING PROTECTION:	O OTHER:
O LEL METER:	O OTHER:

SIGN IN: PERSONNEL INVOLVED IN THIS JOB MUST SIGN BELOW INDICATING THEY ARE COMFORTABLE WITH THE WORK CONDITIONS AND THIS JSA WILL BE FOLLOWED:

1.	9.
2.	10.
3.	11.
4.	12.
5.	13.
6.	14.
7.	15.
8.	16.

APPENDIX C

AIR MONITORING PLAN

AIR MONITORING PLAN

FREEDOM INDUSTRIES
ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA
VRP ID #15017

Prepared by:

CORE Environmental Services, Inc.
533 N. Jefferson St. Suite 3
Lewisburg, West Virginia 24901

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FIGURES

Figure 1 – Site Location Map
Figure 2 - Site Layout

APPENDICIES

Appendix A – Derivation Memos for MCHM and PPH Risk Based Screening Levels

AIR MONITORING PLAN
FREEDOM INDUSTRIES
ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA
VRP ID #15017

1.0 Frequency and Types of Air Monitoring/Sampling

Air monitoring will detect and quantify potential Contaminants of Potential Concern (COPC) in and around the on-site excavation areas for the duration that the excavation is open. Air monitoring will consist of both ambient air monitoring (site and perimeter) and personal air monitoring. Ambient air monitoring will be performed using direct reading instruments which read in real time, as well as sampling pumps to collect time-weighted average samples. Perimeter air monitoring for the COPC will also take place. Air measurements will be collected over a time duration that represents the air quality at each monitoring location for the extent that a given task and/or job is performed as well as to monitor for public health concerns should they arise.

Equipment utilized for air monitoring or sampling will be calibrated before each use, if applicable, and the calibration checked immediately after sampling. Equipment and sampling media will be handled and maintained per specified methods, manufacturer's recommendations, and good industrial hygiene practices. All test instruments used in the calibration of air sampling equipment will be traceable to the National Institute of Standard Testing (NIST) standards. The regular calibration of each instrument used will be documented in the site files. All monitoring and sampling equipment will be used exclusively by authorized/trained and/or certified individuals.

2.0 Contaminants of Potential Concern Summary

COPC were chosen based on the specific chemicals released into the environment in January 2014, as well as contaminants which were found to be present during earlier site assessment activities in 2001 through the completion of test pit sampling in August and September of 2015. The COPCs identified which pose an inhalation risk may include:

- 4-Methyl-1-cyclohexanemethanol (MCHM);
- Propylene glycol phenyl ether (PPH);
- Benzene; and,
- Other volatile organic compounds (VOC's).

3.0 Monitoring Locations and Data Tracking

A monitoring control point (predominantly upwind location) will be established at the start of the project and be utilized as a background location to provide concentrations of the COPCs. This monitoring point will preferably be a known benchmark with coordinates established using an immobile, readily definable landmark and located in a predominantly upwind location. An initial walk through of the excavation area will be done with an initial real-time ambient monitor (photoionization unit-PID) and/or flame ionization detector (FID). This walk through will focus on delineating the work area, including: the boundary of the proposed work area, the locations of the monitoring points to be used for the duration of the project. Additionally, ambient air samples will be collected prior to beginning intrusive work at the site to determine pre-excavation concentrations of MCHM, PPH, and benzene.

The ambient air monitoring specified for the on-site excavation activities will produce continual readings for VOC's. It will also provide laboratory data associated with time weighted average sampling points for MCHM, PPH, and benzene. The time-weighted average samples will be collected over a 8-9 hour period (shift) via two pumps per location. Air sampling pumps will be set to a flow rate of approximately 200 milliliters/minute. One pump will collect samples to be analyzed for MCHM and benzene; the second pump will collect samples to be analyzed for PPH. Samples will be submitted to ALS Environmental laboratory in Cincinnati, Ohio for analysis. All real-time air monitoring data collected will be logged along with accompanying spatial features and/or GPS coordinate information, if available. Walking should be done at an approximate rate of 30 meters per minute (approximately 1 mile per hour), with the PID/FID held approximately four-five feet above the ground (breathing zone) and moved slowly in a serpentine fashion.

Two ambient air monitoring locations will also be set up in predominantly downwind areas to monitor for potential public health concerns. Two time-weighted average samples per location will be collected for the duration of the site activities each day. If it is found that excavation activities cause elevated levels in the downwind perimeter monitoring points, additional air controls will need to be considered, such as suppressant foam, lime, and/or limiting the excavation area.

Personal air monitoring will also be completed using two time-weighted average sampling pumps (8-9 hours). One pump will be located on a heavy equipment operator during excavation activities and the other on another site worker that is in close proximity to the excavation area, such as a sampling technician. One pump will be used to sample for PPH and the other will be utilized to sample for both MCHM and benzene. ALS Environmental analytical reports will be produced for each days sampling activities. All personnel monitoring will be performed under the supervision of a Certified Industrial Hygienist (CIH).

CORE in coordination with the CIH will determine the need to continue air monitoring and change PPE requirements based on previous air monitoring data within each excavation area. The laboratory requires a minimum of three business days to return analytical data, so a minimum of three days of air monitoring in each excavation area will be required.

4.0 Direct Reading/Real-Time Air Monitoring

The direct reading/real-time air monitoring will be completed with a PID and/or FID for VOCs. The rationale for setting Action Levels for the real-time monitoring measurements is based on the following two scenarios:

- Soil contamination is present at levels of potential concern - If any direct measurement is above one third of the established action levels, it can be assumed that the COPC may present exposure issues.

- Soil contamination is present at levels that require continued monitoring and respective corrective action - If direct measurements representative of the area give an average result above an established action level, then a corrective action (i.e., placement of additional lime and/or foam, elevation of PPE level) will need to be taken along with additional continuous monitoring.

5.0 Dusts/Particulates

Dust/particulates will be kept to a minimum using best management practices (dust control). If it is deemed that dust or particulates are becoming an addressable issue then some or all of the following site emission controls will be used to mitigate exposure:

- Adding moisture to the soil;
- Using a misting system;
- Reducing the speed of the equipment that disturbs the soil;
- Installing barriers to reduce wind speed;
- Limiting the rate of excavation or the area of exposed work;
- Ceasing excavation;
- Enclosing the excavation in a temporary structure; and/or,
- Covering stockpiles and/or excavations with plastic, lime or suppressant foam.

6.0 Time-Weighted Average Ambient Air Monitoring (Perimeter)

Perimeter monitoring for the three COPCs will take place with the use of two sampling pumps per sampling location. One pump will be utilized to sample for PPH and the other will sample both MCHM and benzene.

Each of the three COPCs is discussed in more detail in the sections below.

6.1 Volatile Organic Compounds- Benzene

VOC's will be directly monitored with the use of a PID. In a PID, sample gas is pumped through a small chamber illuminated by an ultraviolet lamp. Substances in the sample gas with ionization potentials less than or equal to the energy of the ultraviolet light are ionized. When a compound is ionized by a PID, it yields a current characteristic of the specific compound influenced by its molecular structure. There is a relationship between the detector current and concentration. By plotting the detector response to reference gases of known concentration, the instrument generates a curve where the slope of that curve represents the calibrated response per unit concentration. The response factor is the ratio of the detector response for isobutylene or methanol to the detector response for the sample gas. Response factors to a wide range of substances have been determined experimentally and are programmed into the instrument.

The primary purpose of using a direct-reading ambient air PID is to check for the potential presence of volatiles in ambient air. The PID selected will be configured so that it is optimized for benzene and operated consistent with manufacturer recommendations. PID readings will be logged and recorded in a field notebook. Minimum quality control requirements for the PID will include at least two calibration checks each day with a known source, once at the start of the day and once at the end of data collection.

Benzene will also be monitored utilizing sampling pumps during the excavation activities to provide time weighted average concentrations. Each sample will be collected over a 7-8 hour period (shift) and submitted each day to ALS Environmental laboratory for analysis. There will be a total of five (5) time-weighted average ambient air samples collected for benzene time weighted average concentrations during each day's activities. One will be located in the pre-determined upwind monitoring location and two will be located in the pre-determined downwind monitoring locations. Two additional personal monitoring locations will also be sampled daily. One will be located on the main heavy equipment operator working in close proximity to the excavations areas and the other on another site worker nearest the excavation activities for that sampling day, most likely a sampling technician.

Adjustments to the frequency of VOC sampling and benzene monitoring may be made if laboratory results dictate such a change is warranted.

6.2 4-Methyl-1-Cyclohexanemethanol

MCHM will be monitored utilizing sampling pumps to provide time weighted average concentrations. Each sample will be collected over a 8-9 hour period and submitted each day to ALS Environmental laboratory for analysis. There will be a total of five (5) ambient air samples collected for MCHM time weighted average concentrations during each day's activities plus one duplicate. One will be located in the pre-determined upwind monitoring location and two will be located in the pre-determined downwind monitoring locations. Two additional personal monitoring locations will also be sampled daily. One will be located on the main heavy equipment operator working in close proximity to the excavations areas and the other on another site worker nearest the excavation activities for that sampling day, most likely a sampling technician.

Adjustments to the frequency of MCHM sampling may be made if laboratory results dictate that such a change is warranted.

6.3 Propylene Glycol Phenyl Ether

PPH will be monitored utilizing sampling pumps to provide time weighted average concentrations. Each sample will be collected over a 8-9 hour period and submitted each day to ALS Environmental laboratory for analysis. There will be a total of five (5) time-weighted average ambient air samples collected for PPH time weighted average concentrations during each day's activities plus one duplicate. One will be located in the pre-determined upwind monitoring location and two will be located in the pre-determined downwind monitoring locations. Two additional personal monitoring locations will also be sampled daily. One will be located on the main heavy equipment operator working in close proximity to the excavations areas and the other on another site worker nearest the excavation activities for that sampling day, most likely a sampling technician.

Adjustments to the frequency of PPH sampling may be made if laboratory results dictate that such a change is warranted.

7.0 Summary of Direct Reading and Ambient Air Sampling Action Levels

VOC's via PID Readings

1 to 10 units/ppm	Remain in Level D PPE. Use colorimetric tubes or other chemical specific device to verify low PEL contaminant levels (benzene) where applicable. Cease work and consult with Project Management if levels exceed 10 units/ppm on a sustained basis.
10 to 50 units/ppm	Withdraw from work area and contact Project Management. Institute appropriate

	vapor control measures. If necessary, upgrade to Level C protection for re-entry and/or initiate control measures discussed earlier in this plan.
> 50 units/ppm	Secure operations, withdraw from work area, and discontinue work at that location until contaminants can be controlled and site HASP amended/updated if warranted.

MCHM via Time-Weighted Average Samples

Worker: 200 ppb (1 mg/m³)	If personal air monitoring analytical results show levels in excess of the 200 ppb work shall halt and excavation activities will need to be re-evaluated/controlled and/or site workers shall remain in Level C protection. Note that all personnel working in the exclusion zone will be required to wear Level C PPE until air monitoring results indicate that personnel can downgrade to Level D.
Child: 11 ppb (0.06 mg/m³)	If downwind air monitoring analytical reports show levels in excess of the 11 ppb limit work shall halt and excavation activities will need to be re-evaluated/controlled.

PPH via Time-Weighted Average Samples

Worker: 3,050 ppb (19 mg/m³)	If personal air monitoring analytical results show levels in excess of the 3,050 ppb limit work shall halt and excavation activities will need to be re-evaluated/controlled and/or site workers shall remain in Level C protection. Note that all personnel working in the exclusion zone will be required to wear Level C PPE until air monitoring results indicate that personnel can downgrade to Level D.
Child: 1,000 ppb (6.2 mg/m³)	If downwind air monitoring analytical reports show levels in excess of the 1,000 ppb limit work shall halt and excavation activities will need to be re-evaluated/controlled.

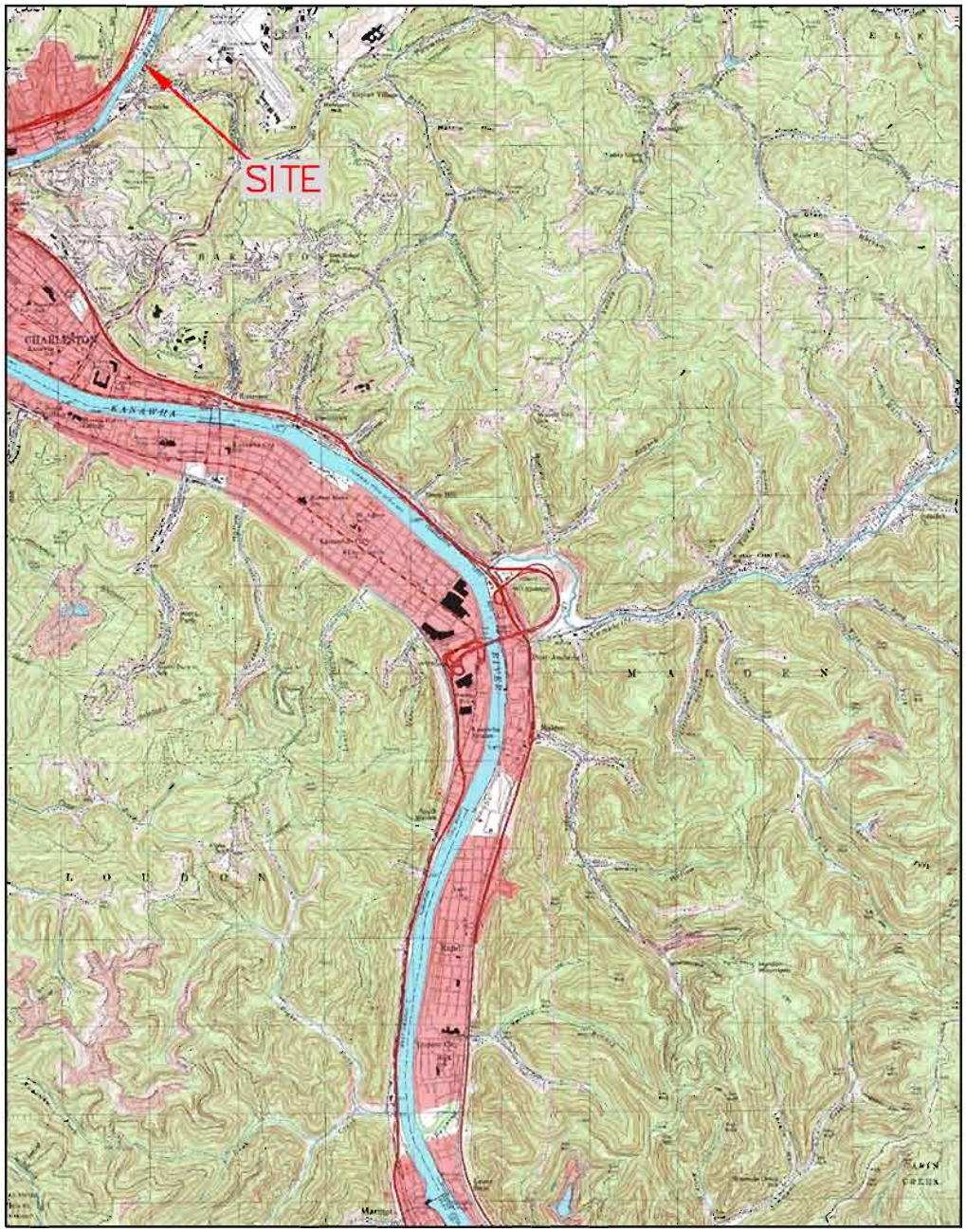
Benzene via Time-Weighted Average Samples

OSHA PEL: 1 ppm (3.19 mg/m³) (TWA)	If personal air monitoring analytical results show levels in excess of the 1 ppm limit**,** work shall halt and excavation activities will need to be re-evaluated/controlled and/or site

	workers shall remain in Level C protection. Note that all personnel working in the exclusion zone will be required to wear Level C PPE until air monitoring results indicate that personnel can downgrade to Level D.

Note: The action levels for MCHM and PPH presented above are Risk Based Screening Levels (RBSLs) developed by RBR Consulting, Inc. and approved by the WVDEP. Refer to Appendix 1 for a copy of the memos provided by RBR Consulting, Inc. that detail the derivation of each RBSL.

FIGURES



SCALE 1:24000

1 0 1 MILE

0 1000 2000 3000 4000 5000 6000 7000

FEET

USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE:

Charleston East

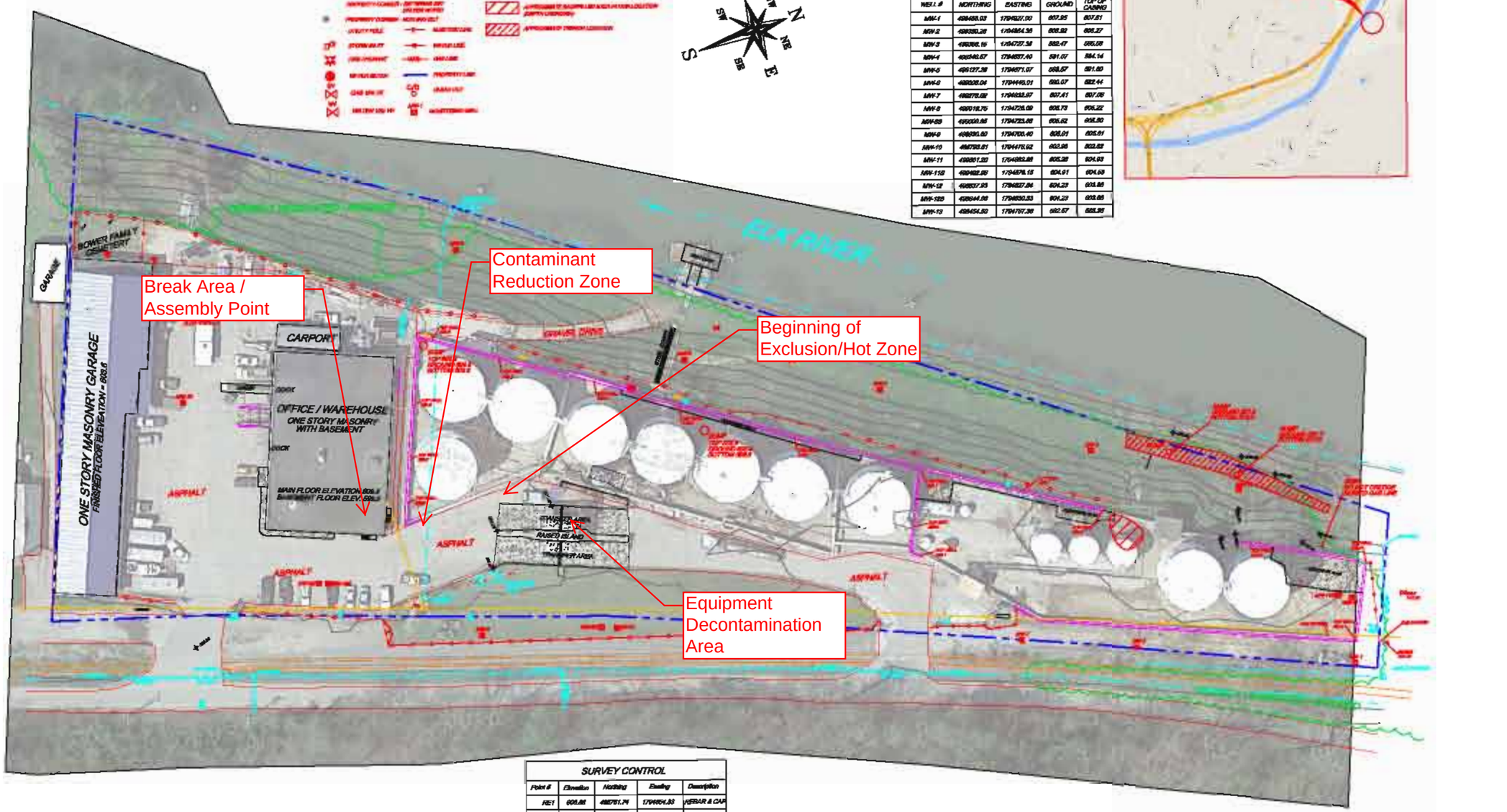
SITE COORDINATES:

38.368978° N

-81.506414° W

CORE ENVIRONMENTAL SERVICES, INC.

FIGURE NO.	CLIENT/LOCATION:	
1	FREEDOM INDUSTRIES CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA	
DRAWN BY: A.SAMPSON	DESCRIPTION: SITE LOCATION MAP	
REVIEWED BY:	DATE: 9/28/15	PROJECT NO. FRE-2015-364



MONITORING WELLS				
WELL #	NORTHING	EASTING	GROUND	TOP OF CASING
MW-1	498469.03	1794027.00	607.95	607.61
MW-2	498350.26	1794064.36	608.92	608.27
MW-3	498268.16	1794727.38	592.47	595.08
MW-4	498140.67	1794637.40	591.07	594.14
MW-5	498127.38	1794571.97	588.57	591.80
MW-6	498308.04	1794449.01	590.07	592.44
MW-7	498278.08	1794052.97	607.41	607.09
MW-8	498019.75	1794726.09	608.73	608.22
MW-8B	498000.85	1794723.68	608.62	608.30
MW-9	498090.60	1794700.40	608.01	605.61
MW-10	498793.81	1794479.02	602.96	602.82
MW-11	498861.20	1794093.86	605.28	604.93
MW-11B	498862.86	1794076.15	604.61	604.69
MW-12	498837.95	1794027.84	604.23	603.86
MW-12B	498844.08	1794030.33	604.23	603.86
MW-13	498454.50	1794797.38	592.57	595.35

SURVEY CONTROL				
Point #	Elevation	Northing	Easting	Description
RE1	608.86	498791.74	1794604.33	REBAR & CAP
RE2	608.21	498866.63	1794528.31	REBAR
RE3	608.77	498179.91	1794808.99	MAGNAIL
RE5	603.41	498362.84	1794474.18	MAGNAIL

COORDINATES ARE WEST VIRGINIA STATE PLANE / SOUTH ZONE (4702)
NORTH AMERICA VERTICAL DATUM OF 1988

Source - Randolph Engineering - 9/29/2015

CORE ENVIRONMENTAL SERVICES, INC.

TITLE:
SITE MAP
FREEDOM INDUSTRIES - ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DWN: AS	DES.:	PROJECT NO.: FRE-2015-364
CHKD:	APPD:	FIGURE NO.: 2
DATE: 9/30/15	REV.:	

APPENDIX A

DERIVATION MEMOS FOR MCHM AND PPH RISK BASED SCREENING LEVELS

Risk-Based Remedies

RBR Consulting, Inc.

650 Shady Drive
Beaver Falls, PA 15010

MEMORANDUM

TO: Matt Ford
CORE Environmental Services, Inc.

FROM: Bruce Fishman

DATE: October 29, 2015

SUBJECT: Derivation of Risk-Based Screening Levels for MCHM in Ambient Air

---

The derivation of risk-based screening levels (RBSLs) for 4-Methylcyclohexanemethanol (MCHM) in ambient air is based on an approach developed by the USEPA's National Center for Environmental Assessment (NCEA). Because inhalation toxicity studies are not available for developing toxicity values for MCHM, oral studies are used and inhalation values are calculated based on route-to-route extrapolation.

The selected toxicity study is a short-term repeated-dose oral study conducted in rats. In this study, male and female CD(SD)BR rats (5/sex/dose group) were administered MCHM (purity >96%) via gavage at doses of 0, 25, 100, and 400 mg/kg-day, 5 days per week, for 28 days (Eastman Kodak Company, 1990). The lowest-observed-adverse-effect level (LOAEL) for this study is 400 mg/kg-day based on erythropoietic, kidney (increased tubular degeneration), and liver (increased weight and inflammation) effects. The associated no-observed-adverse-effect level (NOAEL) is 100 mg/kg-day.

To convert the NOAEL dose of 100 mg/kg-day to an RBSL, several steps were completed. First, uncertainty factors (UFs) were applied to the NOAEL dose. Default UFs of 10 each are used to account for (1) uncertainty in extrapolating from laboratory animals to humans (i.e., interspecies variability); (2) human- to-human variability in susceptibility and consideration of possible effects on vulnerable populations, including pregnant women and children; and (3) the limited availability of data and database deficiencies. The resulting oral reference dose is 0.1 mg/kg-day.

In converting the oral dose to an air concentration, it is assumed that the efficiency of MCHM absorption is the same between an oral dose and inhalation. The route-to-route conversion factors incorporate body weights for an adult (70 kg) and a child (10 kg), as well as inhalation rates. For an adult worker, an inhalation rate of 0.83 m^3/hour for an 8 hour work day was assumed. For a child, a daily inhalation rate of 17.3 m^3/day was assumed.

The reference concentrations (in units of mg/m^3) may be converted to units of ppb (using a molecular weight of 128.21 g/mol). Derivation of the final RBSLs for a worker and a child are presented below.

NOAEL Dose =	100 mg/kg-day
Total UF =	1000 (10 for interspecies adjustment; 10 for intraspecies adjustment; 10 for database deficiencies)
Oral RfD =	0.1 mg/kg-day

Worker

Route to Route Factors =	70 kg BW; 8 hrs/day x 0.83 m^3/hr
Final RBSL =	1 mg/m^3 (200 ppb)

Child

Route to Route Factors =	10 kg BW; 17.3 m^3/day
Final RBSL =	0.06 mg/m^3 (11 ppb)

References

Eastman Kodak Company (1990) Four-week oral toxicity study of 4-methylcyclohexane methanol in the rat. Toxicological Sciences Laboratory, Health and Environment Laboratories. April 3, 1990. http://www.eastman.com/Literature_Center/Misc/Pure_Distilled_MCHM-28-day_Oral_Feeding_Study.pdf

Risk-Based Remedies

RBR Consulting, Inc.

650 Shady Drive
Beaver Falls, PA 15010

MEMORANDUM

TO: Matt Ford
CORE Environmental Services, Inc.

FROM: Bruce Fishman

DATE: November 3, 2015

SUBJECT: Derivation of Risk-Based Screening Levels for PPH in Ambient Air

---

The derivation of risk-based screening levels (RBSLs) for Propylene Glycol Phenol Ether (PPH) in ambient air is based on the approach presented in the USEPA's (2009) "Risk Assessment Guidance For Superfund (RAGS) Part F: Supplemental Guidance for Inhalation Risk Assessment." Because inhalation toxicity studies are inadequate for developing toxicity values for PPH, oral studies are used and inhalation values are calculated based on route-to-route extrapolation.

The toxicity study determined to be most appropriate for developing a short-term RBSL was conducted by ECHA (2014). In this study, Wistar rats were continuously administered PPH in drinking water for 90 days at concentrations of 0, 500, 2000, and 6000 ppm (0, 35/46, 146/177, and 429/486 mg/kg-day BW in males/females). The no-observed-adverse-effect level (NOAEL) in this study was 146 mg/kg-day (2000 ppm group), based on body weight changes in males and discoloration of urine in both males and females seen in the next highest dose group of 6000 ppm (429/486 mg/kg-day bw in males/females), which was the highest dose tested.

To convert the NOAEL dose of 146 mg/kg-day to an RBSL, several steps were completed. First, uncertainty factors (UFs) were applied to the NOAEL dose to calculate an oral reference dose (RfD). Default UFs of 10 each are used to account for (1) uncertainty in extrapolating from laboratory animals to humans (i.e., interspecies variability); (2) human- to-human variability in susceptibility and consideration of possible effects on vulnerable populations, including pregnant women and children; and (3) the limited availability of data and database deficiencies. The resulting oral RfD for PPH is 0.146 mg/kg-day.

Next, the oral RfD is converted to an inhalation reference concentration (RfC). It is assumed that the efficiency of PPH absorption is the same between an oral dose and inhalation. In accordance with USEPA (2009), the RfC is calculated by multiplying the RfD by a default adult body weight of 70 kg, and dividing by a default adult inhalation rate of 20 m^3/day. The resulting RfC for PPH is 0.51 mg/m^3.

RBSLs for ambient air may be calculated using the RfC and the following equation from USEPA (2009):

$$RBSL\ (mg/m^3) = [AT \times THQ \times RfC] \ / \ [ET \times EF \times ED]$$

where:

AT	=	Averaging time (hours)
THQ	=	Target hazard quotient
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)

The scenario being addressed in this memorandum is a short-term construction scenario that is assumed to occur over 30 days. Because this is considered to be a one-time project, the exposure duration (ED) is set to 1 year, and the averaging time (AT) is 8,760 hours (365 days x 24 hours/day). The exposure frequency is 30 days per year. These factors apply to both a project worker and a nearby resident (child). The worker is assumed to have an exposure time (ET) of 8 hours per day, while the residential child is assumed to have an ET of 24 hours per day. The target hazard quotient (THQ) for PPH is 1.

The resulting calculated RBSLs for the worker and the child are presented below. These RBSLs (in units of mg/m^3) may be converted to units of ppb (using a molecular weight of 152.19 g/mol).

NOAEL Dose =	146 mg/kg-day
Total UF =	1000 (10 for interspecies adjustment; 10 for intraspecies adjustment; 10 for database deficiencies)
Oral RfD =	0.146 mg/kg-day
Route to Route =	70 kg BW; 20 m^3/day inhalation rate
Inhalation RfC =	0.51 mg/m^3
Worker RBSL =	19 mg/m^3 (3,050 ppb)
Child RBSL =	6.2 mg/m^3 (1,000 ppb)

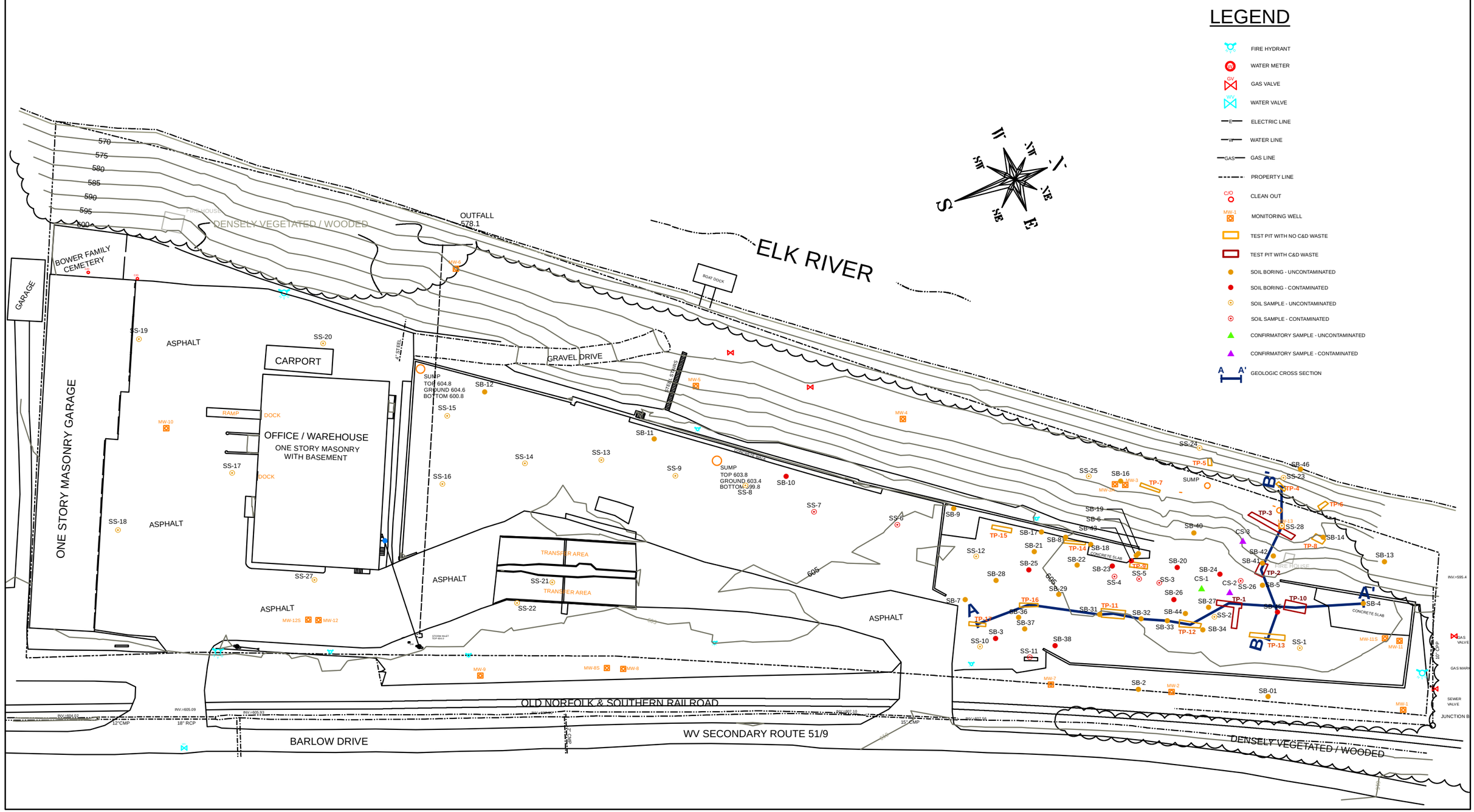
References

European Chemicals Agency (ECHA; 2014) Registration Dossier for 1-phenoxypropan-2-ol (PPH). Exp Key Toxicity to Reproduction. 001; DOW Product Safety Report: BASF 2000; Last modified 3-11-14. Available at http://apps.echa.europa.eu/registered/data/dossiers/DISS-a212e0a8-c808-5392-e044-00144f67d031/DISS-a212e0a8-c808-5392-e044 00144f67d031_DISS-a212e0a8-c808- 5392-e044-00144f67d031.html

Unites States Environmental Protection Agency (USEPA; 2009) Risk Assessment Guidance For Superfund (RAGS) Volume I: Human Health Evaluation Manual**;** Part F: Supplemental Guidance for Inhalation Risk Assessment. EPA-540-R-070-002. January.

APPENDIX D

SITE MAPS



CORE ENVIRONMENTAL SERVICES, INC.
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Lewisburg, WV 24901
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F: 304-520-4265
WWW.CORE-ENV.COM

N

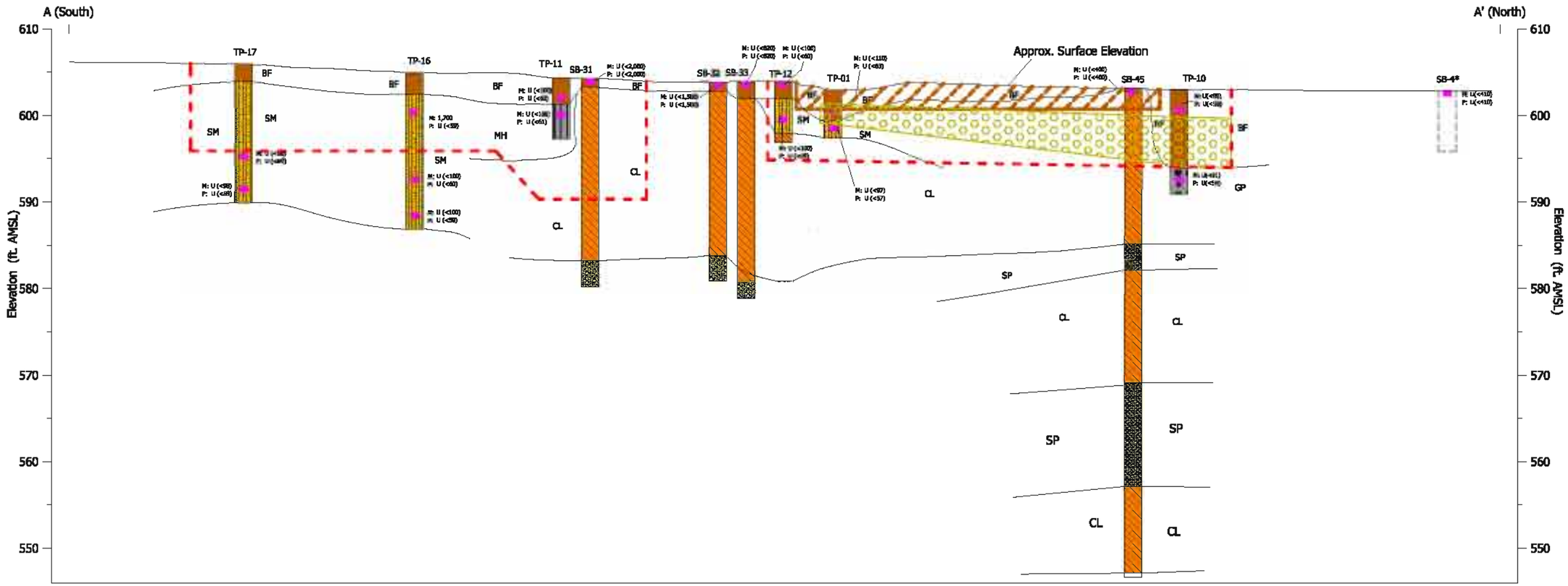
1 inch = 60 feet

0 60 120 Feet

SITE MAP

FREEDOM INDUSTRIES - ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DRAWN BY: DJ	DES.:	PROJECT NUMBER: FRE-2015-364
CHECKED BY:	APPROVED:	
DATE: 11/5/2015	REVISED:	FIGURE NUMBER: 1



- Approximate Extent of C&D Waste
- Soil Sample Location and Result:
  M - MCHM Result
  P - PPH Result

All sample results reported in ug/kg
J- Laboratory Estimated Value
U- Undetected Value

* Soil boring log not provided in the Arcadis Site Investigation Report

- BF: Backfill
- SM: Silty Sand
- MH: Silt / Clayey Silt
- CL: Gravelly Clay/Sandy Clay/Silty Clay
- GP: Gravel / Sandy Gravel
- SP: Gravelly Sand / Sand
- BR: Bedrock

Approximate Soil Excavation Performed by Arcadis

Approximate Extent of C & D Waste

Proposed Soil and C & D Waste Excavation Extent

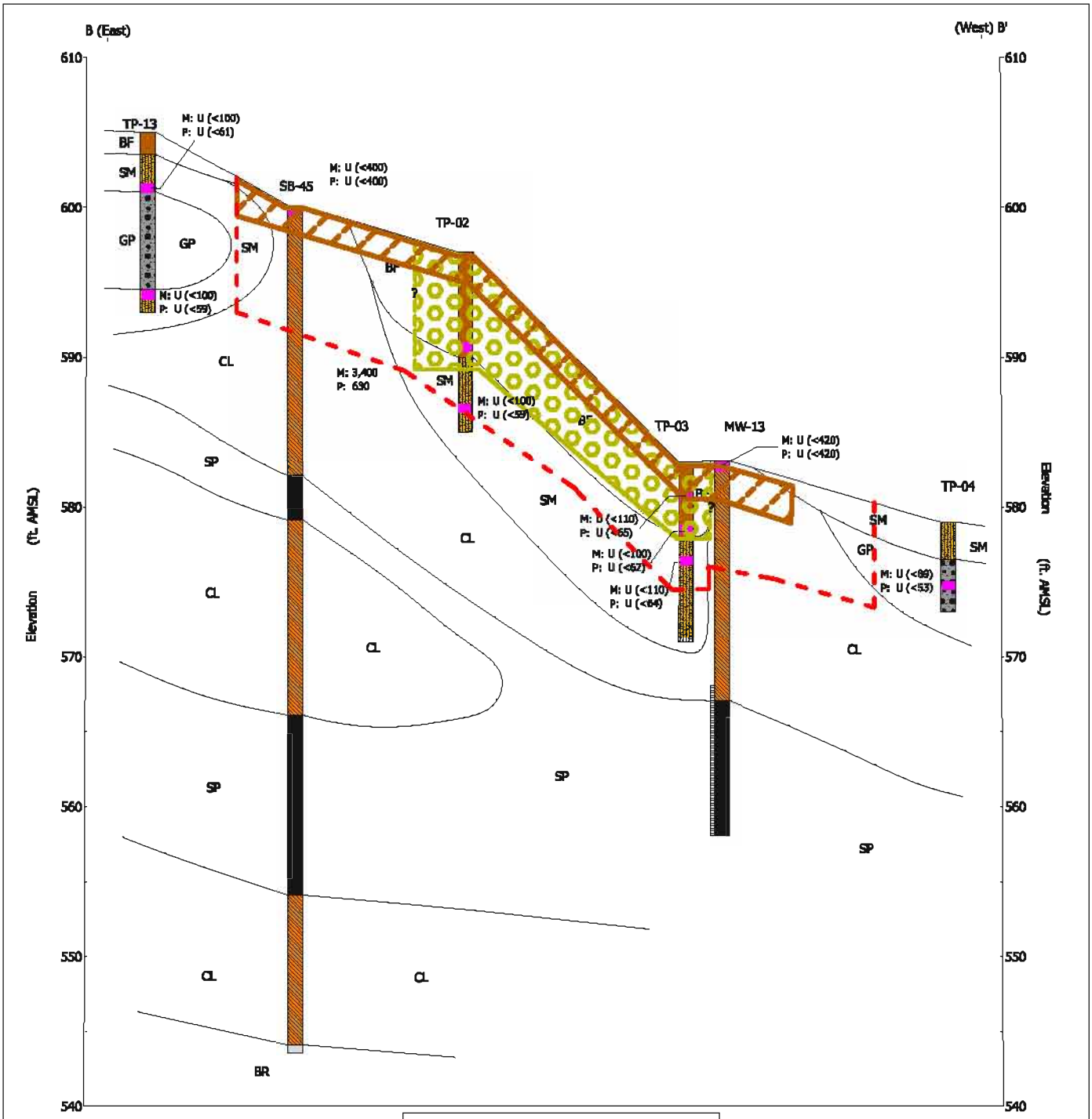
0 12.5 25
FEET

2x Vertical Exaggeration

CORE ENVIRONMENTAL SERVICES, INC.

TITLE:
GEOLOGIC CROSS SECTION A – A'
FREEDOM INDUSTRIES – ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DWN: NZ	DES.:	PROJECT NO.: FRE–2015–364
CHKD:	APPD:	FIGURE NO.: 2
DATE: 10/9/15	REV.: DF	



- Soil Sample Location and Result:
  M - MCHM Result
  P - PPH Result

All sample results reported in ug/kg
J- Laboratory Estimated Value
U- Undetected Value

- SP: Gravelly Sand / Sand
- SM: Silty Sand
- GP: Gravel / Sandy Gravel
- CL: Gravelly Clay/Sandy Clay/Silty Clay
- BR: Bedrock
- BF: Back Fill

Approximate Soil Excavation Performed by Arcadis

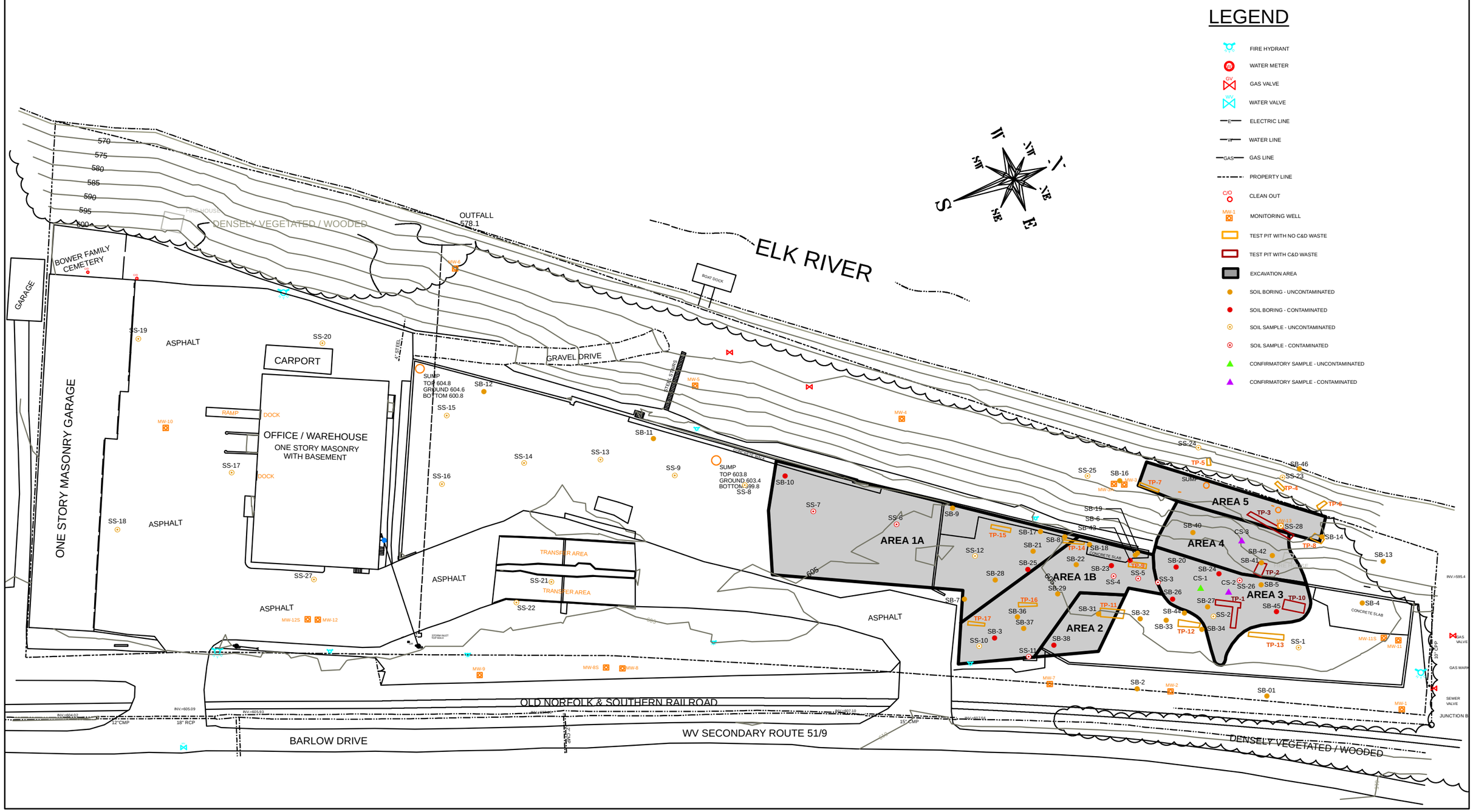
Approximate Extent of C & D Waste

Proposed Soil and C & D Waste Excavation Extent

0 12.5 25
FEET
Vertical Exaggeration 2X

CORE ENVIRONMENTAL SERVICES, INC.

TITLE:	DWN:	DES.:	PROJECT NO.:
GEOLOGIC CROSS SECTION B – B' FREEDOM INDUSTRIES ETOWHA RIVER TERMINAL CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA	DF		FRE-2015-364
	CHKD:	APPD:	FIGURE NO.:
	DATE: 10/19/15	REV.:	3



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1 inch = 60 feet

0 60 120 Feet

SOIL AND C&D WASTE EXCAVATION PLAN

FREEDOM INDUSTRIES - ETOWAH RIVER TERMINAL
CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

DRAWN BY: DJ	DES.:	PROJECT NUMBER: FRE-2015-364
CHECKED BY:	APPROVED:	
DATE: 11/5/2015	REVISED:	FIGURE NUMBER: 4

APPENDIX E

SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

ALCONOX®

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Union REACH Regulations

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME:	**ALCONOX®**
CHEMICAL FAMILY NAME:	Detergent.
PRODUCT USE:	Critical-cleaning detergent for laboratory, healthcare and industrial applications
U.N. NUMBER:	Not Applicable
U.N. DANGEROUS GOODS CLASS:	Non-Regulated Material
SUPPLIER/MANUFACTURER'S NAME:	Alconox, Inc.
ADDRESS:	30 Glenn St., Suite 309, White Plains, NY 10603. USA
EMERGENCY PHONE:	**TOLL-FREE in USA/Canada** 800-255-3924
	International calls 813-248-0585
BUSINESS PHONE:	914-948-4040
DATE OF PREPARATION:	May 2011
DATE OF LAST REVISION:	February 2008

SECTION 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: This product is a white granular powder with little or no odor. Exposure can be irritating to eyes, respiratory system and skin. It is a non-flammable solid. The Environmental effects of this product have not been investigated.

US DOT SYMBOLS

Non-Regulated

CANADA (WHMIS) SYMBOLS

EUROPEAN and (GHS) Hazard Symbols

Signal Word: **Warning!**

EU LABELING AND CLASSIFICATION:

Classification of the substance or mixture according to Regulation (EC) No1272/2008 Annex 1
EC# 205-633-8 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 268-356-1 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 231-838-7 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 231-767-1 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 207-638-8 Index# 011-005-00-2
EC# 205-788-1 This substance is not classified in the Annex I of Directive 67/548/EEC

GHS Hazard Classification(s):

Eye Irritant Category 2A

Hazard Statement(s):

H319: Causes serious eye irritation

Precautionary Statement(s):

P260: Do not breath dust/fume/gas/mist/vapors/spray
P264: Wash hands thoroughly after handling
P271: Use only in well ventilated area.
P280: Wear protective gloves/protective clothing/eye protection/face protection/

Hazard Symbol(s):

[Xi] Irritant

Risk Phrases:
R20: Harmful by inhalation
R36/37/38: Irritating to eyes, respiratory system and skin

Safety Phrases:
S8: Keep container dry
S22: Do not breath dust
S24/25: Avoid contact with skin and eyes

HEALTH HAZARDS OR RISKS FROM EXPOSURE:

ACUTE: Exposure to this product may cause irritation of the eyes, respiratory system and skin. Ingestion may cause gastrointestinal irritation including pain, vomiting or diarrhea.

CHRONIC: This product contains an ingredient which may be corrosive.

TARGET ORGANS: ACUTE: Eye, respiratory System, Skin CHRONIC: None Known

SECTION 3 - COMPOSITION and INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS:	CAS #	EINECS #	ICSC #	WT %	HAZARD CLASSIFICATION; RISK PHRASES
Sodium Bicarbonate	144-55-8	205-633-8	1044	33 - 43%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	268-356-1	Not Listed	10 – 20%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Tripolyphosphate	7758-29-4	231-838-7	1469	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Tetrasodium Pyrophosphate	7722-88-5	231-767-1	1140	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Carbonate	497-19-8	207-638-8	1135	1 - 10%	HAZARD CLASSIFICATION: [Xi] Irritant RISK PHRASES: R36
Sodium Alcohol Sulfate	151-21-3	205-788-1	0502	1 – 5%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Balance of other ingredients are non-hazardous or less than 1% in concentration (or 0.1% for carcinogens, reproductive toxins, or respiratory sensitizers).					

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard *JIS Z 7250: 2000*.

SECTION 4 - FIRST-AID MEASURES

Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with contaminated individual.

EYE CONTACT: If product enters the eyes, open eyes while under gentle running water for at least 15 minutes. Seek medical attention if irritation persists.

SKIN CONTACT: Wash skin thoroughly after handling. Seek medical attention if irritation develops and persists. Remove contaminated clothing. Launder before re-use.

INHALATION: If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if breathing dificulty continues.

INGESTION: If product is swallowed, call physician or poison control center for most current information. If professional advice is not available, do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or MSDS with the victim to the health professional.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing skin, or eye problems may be aggravated by prolonged contact.

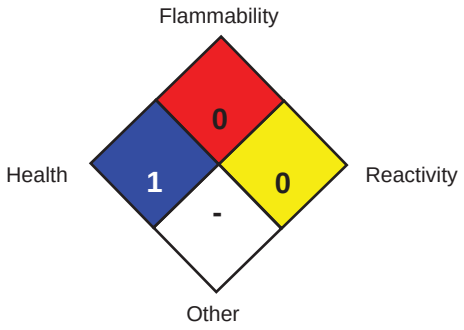
RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

SECTION 5 - FIRE-FIGHTING MEASURES

FLASH POINT: Not Flammable
AUTOIGNITION TEMPERATURE: Not Applicable
FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): NA Upper (UEL): NA
FIRE EXTINGUISHING MATERIALS: As appropriate for surrounding fire. Carbon dioxide, foam, dry chemical, halon, or water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This product is non-flammable and has no known explosion hazards.
Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive
SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

NFPA RATING SYSTEM



HMIS RATING SYSTEM

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD (BLUE)	**1**
FLAMMABILITY HAZARD (RED)	**0**
PHYSICAL HAZARD (YELLOW)	**0**

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	See Sect 8		See Sect 8

For Routine Industrial Use and Handling Applications

Hazard Scale: 0 = Minimal **1** = Slight **2** = Moderate **3** = Serious **4** = Severe * = Chronic hazard

SECTION 6 - ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Personnel should be trained for spill response operations.
SPILLS: Contain spill if safe to do so. Prevent entry into drains, sewers, and other waterways. Sweep, shovel or vacuum spilled material and place in an appropriate container for re-use or disposal. Avoid dust generation if possible. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations).

SECTION 7 - HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: Containers of this product must be properly labeled. Store containers in a cool, dry location. Keep container tightly closed when not in use. Store away from strong acids or oxidizers.

SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/GUIDELINES:

Chemical Name	CAS#	ACGIH TWA	OSHA TWA	SWA
Sodium Bicarbonate	144-55-8	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium Tripolyphosphate	7758-29-4	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Tetrasodium Pyrophosphate	7722-88-5	5 mg/m³	5 mg/m³	5 mg/m³
Sodium Carbonate	497-19-8	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium Alcohol Sulfate	151-21-3	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust

Currently, International exposure limits are not established for the components of this product. Please check with competent authority in each country for the most recent limits in place.

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Use local exhaust ventilation to control airborne dust. Ensure eyewash/safety shower stations are available near areas where this product is used.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.

RESPIRATORY PROTECTION: Based on test data, exposure limits should not be exceeded under normal use conditions when using Alconox Detergent. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Use chemical resistant gloves to prevent skin contact.. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate to prevent contact (e.g. lab coat, overalls). If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards.

SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

PHYSICAL STATE:	Solid
APPEARANCE & ODOR:	White granular powder with little or no odor.
ODOR THRESHOLD (PPM):	Not Available
VAPOR PRESSURE (mmHg):	Not Applicable
VAPOR DENSITY (AIR=1):	Not Applicable.
BY WEIGHT:	Not Available
EVAPORATION RATE (nBuAc = 1):	Not Applicable.
BOILING POINT (C°):	Not Applicable.
FREEZING POINT (C°):	Not Applicable.
pH:	9.5 (1% aqueous solution)
SPECIFIC GRAVITY 20°C: (WATER =1)	0.85 – 1.1
SOLUBILITY IN WATER (%)	>10% w/w
COEFFICIENT OF WATER/OIL DIST.:	Not Available
VOC:	None
CHEMICAL FAMILY:	Detergent

SECTION 10 - STABILITY and REACTIVITY

STABILITY: Product is stable
DECOMPOSITION PRODUCTS: When heated to decomposition this product produces Oxides of carbon (COx)
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids and strong oxidizing agents.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Contact with incompatible materials and dust generation.

SECTION 11 - TOXICOLOGICAL INFORMATION

TOXICITY DATA: Toxicity data is available for mixture:

CAS# 497-19-8 LD50 Oral (Rat)	4090 mg/kg
CAS# 497-19-8 LD50 Oral (Mouse)	6600 mg/kg
CAS# 497-19-8 LC50 Inhalation (Rat)	2300 mg/m³ 2H
CAS# 497-19-8 LC50 Inhalation (Mouse)	1200 mg/m³ 2H
CAS# 7758-29-4 LD50 Oral (Rat)	3120 mg/kg
CAS# 7758-29-4 LD50 Oral (Mouse)	3100 mg/kg
CAS# 7722-88-5 LD50 Oral (Rat)	4000 mg/kg

SUSPECTED CANCER AGENT: None of the ingredients are found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.
IRRITANCY OF PRODUCT: Contact with this product can be irritating to exposed skin, eyes and respiratory system.
SENSITIZATION OF PRODUCT: This product is not considered a sensitizer.
REPRODUCTIVE TOXICITY INFORMATION: No information concerning the effects of this product and its components on the human reproductive system.

SECTION 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.
ENVIRONMENTAL STABILITY: No Data available at this time.
EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plants or animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

SECTION 13 - DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.

SECTION 14 - TRANSPORTATION INFORMATION

US DOT; IATA; IMO; ADR:
THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.
PROPER SHIPPING NAME: Non-Regulated Material
HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable
UN IDENTIFICATION NUMBER: Not Applicable
PACKING GROUP: Not Applicable.
DOT LABEL(S) REQUIRED: Not Applicable
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): Not Applicable
MARINE POLLUTANT: None of the ingredients are classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION (DOT) SHIPPING REGULATIONS:
This product is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:
This product is not classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA):
This product is not classified as Dangerous Goods, by rules of IATA:

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION:
This product is not classified as Dangerous Goods by the International Maritime Organization.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

This product is not classified by the United Nations Economic Commission for Europe to be dangerous goods.

SECTION 15 - REGULATORY INFORMATION

UNITED STATES REGULATIONS

SARA REPORTING REQUIREMENTS: This product is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows: None

TSCA: All components in this product are listed on the US Toxic Substances Control Act (TSCA) inventory of chemicals.

SARA 311/312:

Acute Health: Yes Chronic Health: No Fire: No Reactivity: No

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): None

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): None of the ingredients are on the California Proposition 65 lists.

CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: All of the components of this product are on the DSL Inventory

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: No component of this product is on the CEPA First Priorities Substance Lists.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: This product is categorized as a Controlled Product, Hazard Class D2B as per the Controlled Product Regulations

EUROPEAN ECONOMIC COMMUNITY INFORMATION:

EU LABELING AND CLASSIFICATION:

Classification of the mixture according to Regulation (EC) No1272/2008. See section 2 for details.

AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: All components of this product are listed on the AICS.

STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS: Not applicable.

JAPANESE INFORMATION FOR PRODUCT:

JAPANESE MINISTER OF INTERNATIONAL TRADE AND INDUSTRY (MITI) STATUS: The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

INTERNATIONAL CHEMICAL INVENTORIES:

Listing of the components on individual country Chemical Inventories is as follows:

Asia-Pac:	Listed
Australian Inventory of Chemical Substances (AICS):	Listed
Korean Existing Chemicals List (ECL):	Listed
Japanese Existing National Inventory of Chemical Substances (ENCS):	Listed
Philippines Inventory if Chemicals and Chemical Substances (PICCS):	Listed
Swiss Giftliste List of Toxic Substances:	Listed
U.S. TSCA:	Listed

SECTION 16 - OTHER INFORMATION

PREPARED BY: Paul Eigbrett Global Safety Management, 10006 Cross Creek Blvd. Suite 440, Tampa, FL 33647

Disclaimer: To the best of Alconox, Inc. knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness is not guaranteed and no warranties of any type either express or implied are provided. The information contained herein relates only to this specific product.

ANNEX:

IDENTIFIED USES OF ALCONOX® AND DIRECTIONS FOR USE

Used to clean: Healthcare instruments, laboratory ware, vacuum equipment, tissue culture ware, personal protective equipment, sampling apparatus, catheters, tubing, pipes, radioactive contaminated articles, optical parts, electronic components, pharmaceutical apparatus, cosmetics manufacturing equipment, metal castings, forgings and stampings, industrial parts, tanks and reactors. Authorized by USDA for use in federally inspected meat and poultry plants. Passes inhibitory residue test for water analysis. FDA certified.

Used to remove: Soil, grit, grime, buffing compound, slime, grease, oils, blood, tissue, salts, deposits, particulates, solvents, chemicals, radioisotopes, radioactive contaminations, silicon oils, mold release agents.

Surfaces cleaned: Corrosion inhibited formulation recommended for glass, metal, stainless steel, porcelain, ceramic, plastic, rubber and fiberglass. Can be used on soft metals such as copper, aluminum, zinc and magnesium if rinsed promptly. Corrosion testing may be advisable.

Cleaning method: Soak, brush, sponge, cloth, ultrasonic, flow through clean-inplace. Will foam—not for spray or machine use.

Directions: Make a fresh 1% solution (2 1/2 Tbsp. per gal., 1 1/4 oz. per gal. or 10 grams per liter) in cold, warm, or hot water. If available use warm water. Use cold water for blood stains. For difficult soils, raise water temperature and use more detergent. Clean by soak, circulate, wipe, or ultrasonic method. Not for spray machines, will foam. For nonabrasive scouring, make paste. Use 2% solution to soak frozen stopcocks. To remove silver tarnish, soak in 1% solution in aluminum container. RINSE THOROUGHLY—preferably with running water. For critical cleaning, do final or all rinsing in distilled, deionized, or purified water. For food contact surfaces, rinse with potable water. Used on a wide range of glass, ceramic, plastic, and metal surfaces. Corrosion testing may be advisable.

Section 1 - Chemical Product and Company Identification 61

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
EINECS Number: 200-753-7
ACX Number: X1001488-9
Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; STEL: 5 ppm.

NIOSH REL
TWA: 0.1 ppm; STEL: 1 ppm.

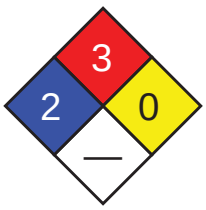
DFG (Germany) MAK
Skin.

ACGIH TLV
TWA: 0.5 ppm; STEL: 2.5 ppm; skin.

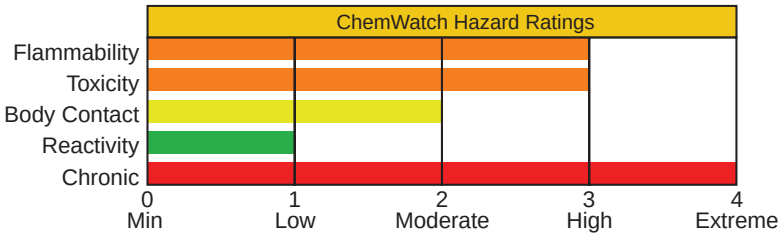
IDLH Level
500 ppm.

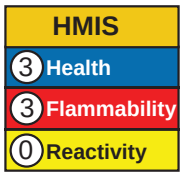
EU OEL
TWA: 1 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: headache, dizziness, drowsiness. Absorbed through skin. Chronic Effects: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.

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If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

See DOT ERG

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

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Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

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

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.

3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

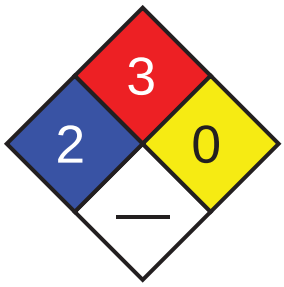
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients. Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v

See DOT ERG



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

See DOT ERG

Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.

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May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:
PE/EVAL/PE ..... Best selection
PVA ..... Best selection
TEFLON ..... Best selection

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VITON ..... Best selection
VITON/NEOPRENE ..... Best selection
NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
BUTYL ..... Poor to dangerous choice for other than short-term immersion
NITRILE ..... Poor to dangerous choice for other than short-term immersion
NEOPRENE..... Poor to dangerous choice for other than short-term immersion
PVC..... Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER..... Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Odor Threshold: 4.68 ppm
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 80.1 °C (176 °F)
Freezing/Melting Point: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.18 g/100 g of water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

Irritation
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

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Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.13

Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Benzene
ID: UN1114
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

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SAFETY DATA SHEET

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

1.1 Product identifier

Product name: Crude MCHM

Product No.: EAN 972790. 18717-00, P1871700, P18717EA, P18717ET, P18717YZ

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Industrial chemical. gasoline blending
Uses advised against: None known.

1.3 Details of the supplier of the safety data sheet

Manufacturer / Supplier

Eastman Chemical Company
200 South Wilcox Drive
Kingsport, TN 37660-5280 US
+14232292000

Visit our website at www.EASTMAN.com or email emnmsds@eastman.com

1.4 Emergency telephone number:

For emergency health, safety, and environmental information, call 1-423-229-4511 or 1-423-229-2000.

For emergency transportation information, in the United States: call CHEMTREC at 800-424-9300 or call 423-229-2000.

SECTION 2: Hazards identification

WARNING!
HARMFUL IF SWALLOWED
CAUSES SKIN AND EYE IRRITATION
AT ELEVATED TEMPERATURES, VAPOR MAY CAUSE IRRITATION OF EYES AND RESPIRATORY TRACT

SECTION 3: Composition/information on ingredients

3.1 / 3.2 Substances / Mixtures

General information:

Chemical name	Concentration	Additional identification	Notes
4-methylcyclohexanemethanol	68 - 89%	CAS-No.: 34885-03-5 EC No.: 609-038-8	
4-(methoxymethyl)cyclohexanemethanol	4 - 22%	CAS-No.: 98955-27-2	

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water	4 - 10%	CAS-No.: 7732-18-5 EC No.: 231-791-2	
methyl 4-methylcyclohexanecarboxylate	5%	CAS-No.: 51181-40-9	
dimethyl 1,4-cyclohexanedicarboxylate	1%	CAS-No.: 94-60-0 EC No.: 202-347-5	
methanol	1%	CAS-No.: 67-56-1 EC No.: 200-659-6 INDEX No.: 603-001-00-X	#
1,4-cyclohexanedimethanol	1 - 2%	CAS-No.: 105-08-8 REACH Registration No.: 01-2119448337-34-0000 01-2119448337-34-0002	#

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.
# This substance has workplace exposure limit(s).
PBT: persistent, bioaccumulative and toxic substance.
vPvB: very persistent and very bioaccumulative substance.

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation: Treat symptomatically. Move to fresh air. Get medical attention if symptoms persist.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention. In case of irritation from airborne exposure, move to fresh air. Get medical attention if symptoms persist.

Skin contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Ingestion: Call a physician or poison control center immediately. Only induce vomiting at the instruction of medical personnel. Never give anything by mouth to an unconscious person. Not relevant, due to the form of the product.

4.2 Most important symptoms and effects, both acute and delayed: No data available.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: No data available.

Treatment: Treat symptomatically.

SECTION 5: Firefighting measures

General fire hazards: None known.

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5.1 Extinguishing media

Suitable extingishing media: Water spray. Dry chemical. Carbon Dioxide. Alcohol foam.

Unsuitable extinguishing media: None known.

5.2 Special hazards arising from the substance or mixture: None known.

5.3 Advice for firefighters

Special Fire Fighting Procedures: Fight fire from a protected location.

Special protective equipment for fire-fighters: Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures: Wear appropriate personal protective equipment.

6.2 Environmental precautions: Avoid release to the environment.

6.3 Methods and material for containment and cleaning up: Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Large Spillages: Flush spill area with water spray. Prevent runoff from entering drains, sewers, or streams. Dike for later disposal.

Notification Procedures: In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

SECTION 7: Handling and storage:

7.1 Precautions for safe handling: Avoid breathing vapor from heated material. Avoid contact with eyes, skin, and clothing. Do not taste or swallow. Use only with adequate ventilation. Wash thoroughly after handling.

7.2 Conditions for safe storage, including any incompatibilities: Keep container closed. Keep away from food, drink and animal feedingstuffs.

7.3 Specific end use(s): Industrial chemical. gasoline blending

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limits

If exposure limits have not been established, maintain airborne levels to an acceptable level.

Chemical name	Type	Exposure Limit values	Source
methanol	TWA	200 ppm	US. ACGIH Threshold Limit Values (01 2010)
	STEL	250 ppm	US. ACGIH Threshold Limit Values (01 2010)
	PEL	200 ppm 260 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)

Biological limit values

Chemical name	Exposure Limit values	Source
methanol (methanol: Sampling time: End of shift.)	15 mg/l (Urine)	ACGIH BEL (01 2010)

8.2 Exposure controls

Appropriate engineering controls: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

General information: Eye bath. Safety shower. Washing facilities.

Eye/face protection: Wear safety glasses with side shields (or goggles). Wear a full-face respirator, if needed.

Skin protection

Hand protection: Wear chemical-resistant gloves, footwear, and protective clothing appropriate for the risk of exposure. Contact health and safety professional or manufacturer for specific information.

Other: No data available.

Respiratory Protection: If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA Standard 63 FR 1152, January 8, 1998. Respirator type: Air-purifying respirator with an appropriate, government approved (where applicable), air-purifying filter, cartridge or canister. Contact health and safety professional or manufacturer for specific information.

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Hygiene measures: Observe good industrial hygiene practices.

Environmental Controls: No data available.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	
Physical State:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Alcohol
Odor Threshold:	No data available.
pH:	No data available.
Freezing Point:	0 °C
Boiling Point:	180 °C
Flash Point:	112.8 °C (Setaflash Closed Cup)
Evaporation Rate:	No data available.
Flammability (solid, gas):	No data available.
Flammability Limit - Upper (%)–:	No data available.
Flammability Limit - Lower (%)–:	No data available.
Vapor pressure:	No data available.
Vapor density (air=1):	No data available.
Relative density:	< 1 (estimated)
Solubility(ies)	
Solubility in Water:	Appreciable
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Autoignition Temperature:	No data available.
Decomposition Temperature:	Thermal stability not tested. Low stability hazard expected at normal operating temperatures.
Viscosity:	No data available.
Explosive properties:	No data available.
Oxidizing properties:	No data available.

SECTION 10: Stability and reactivity

10.1 Reactivity: Materials containing similar structural groups are normally stable.

10.2 Chemical stability: Not fully evaluated.

10.3 Possibility of hazardous reactions: None known.

10.4 Conditions to avoid: Excessive heat.

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10.5 Incompatible materials: Strong oxidizing agents.

10.6 Hazardous decomposition products: Carbon Dioxide. Carbon Monoxide.

SECTION 11: Toxicological information

Information on likely routes of exposure

Inhalation: At elevated temperatures, vapor may cause irritation of eyes and respiratory tract.

Ingestion: Harmful if swallowed.

Skin contact: Causes skin irritation.

Eye contact: Causes serious eye irritation.

11.1 Information on toxicological effects

Acute Toxicity

Oral

Product: Oral LD-50: (Rat): 825 mg/kg

Dermal

Product: Dermal LD-50: (Rat): > 2,000 mg/kg

Inhalation

Product: No data available.

Specified substance(s)

4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	LC50 (Rat, 6 h): > 3 mg/l (highest concentration tested)

Repeated dose toxicity

Product: No data available.

Specified substance(s)

4-methylcyclohexanemethanol	No data available.
4-	No data available.

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(methoxymethyl)cyclohexanemethanol	
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	NOEL - No Observable Effect Level (Rat, in drinking water, 90 d): 8000 mg/l

Skin corrosion/irritation:

Product: (Rabbit, 24 h): strong

Serious eye damage/eye irritation:

Product: (Rabbit): moderate

Respiratory or skin sensitization:

Product: Skin Sensitization:, (Guinea Pig) - Not a skin sensitizer.

Germ cell mutagenicity

In vitro

Product: No data available.

Specified substance(s)

4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	Mutagenicity - Bacterial, : negative +/- activation Mutagenicity - Mammalian, : negative +/- activation Chromosomal abberation, : negative +/- activation

In vivo

Product: No data available.

Specified substance(s)

4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.

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methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Carcinogenicity

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Reproductive toxicity

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Specific target organ toxicity - single exposure

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.

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water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Specific target organ toxicity - repeated exposure

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Aspiration hazard

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Other adverse effects: No data available.

SECTION 12: Ecological information

12.1 Toxicity

Acute toxicity

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Fish

Product:	LC-50 (Fathead Minnow, 96 h): 57.4 mg/l NOEC: (Fathead Minnow, 96 h): 25 mg/l

Aquatic invertebrates

Product:	EC-50 (daphnid, 48 h): 98.1 mg/l NOEC: (daphnid, 48 h): 40 mg/l

Chronic Toxicity

Fish

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Aquatic invertebrates

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

Toxicity to Aquatic Plants

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexan	No data available.

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emethanol	
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	EC-50 (Alga, 72 h): > 122.9 mg/l (only concentration tested) NOEC: (Alga, 72 h): >= 122.9 mg/l (only concentration tested)

12.2 Persistence and degradability

Biodegradation

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	99.2 % (28 d, Ready Biodegradability: DOC Die Away Test) Readily biodegradable

Biological Oxygen Demand:

Product	BOD-5: 70 mg/g BOD-20: 1,300 mg/g

Chemical Oxygen Demand:

Product	2,450 mg/g

BOD/COD ratio

Product	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.

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1,4-cyclohexanedimethanol	No data available.

12.3 Bioaccumulative potential

Product:	No data available.
Specified substance(s)	
4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	No data available.

12.4 Mobility in soil: No data available.

Known or predicted distribution to environmental compartments

4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	0.499 - 1.6 (QSAR model)

12.5 Results of PBT and vPvB assessment: No data available.

4-methylcyclohexanemethanol	No data available.
4-(methoxymethyl)cyclohexanemethanol	No data available.
water	No data available.
methyl 4-methylcyclohexanecarboxylate	No data available.
dimethyl 1,4-cyclohexanedicarboxylate	No data available.
methanol	No data available.
1,4-cyclohexanedimethanol	Not fulfilling PBT (persistent/bioaccumulative/toxic) criteria

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12.6 Other adverse effects: No data available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

General information: No data available.

Disposal Methods: Dispose of waste and residues in accordance with local authority requirements. Mix with compatible chemical which is less flammable and incinerate. Since emptied containers retain product residue, follow label warnings even after container is emptied. Residual vapors may explode on ignition; do not cut, drill, grind, or weld on or near this container.

SECTION 14: Transport information

Important Note: Shipping descriptions may vary based on mode of transport, quantities, package size, and/or origin and destination. Consult your company's Hazardous Materials/Dangerous Goods expert for information specific to your situation.

DOT

Class not regulated

IMDG - International Maritime Dangerous Goods Code

Class not regulated

IATA

Class not regulated

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.
WHMIS (Canada) Status: controlled
WHMIS (Canada) Hazard Classification: D/2/B

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SARA 311-312 Hazard Classification(s):
immediate (acute) health hazard

US EPCRA (SARA Title III) Section 313 - Toxic Chemical List
METHANOL

OSHA: hazardous

TSCA (US Toxic Substances Control Act): All components of this product are listed on the TSCA inventory. Any impurities present in this product are exempt from listing.

DSL (Canadian Domestic Substances List) and CEPA (Canadian Environmental Protection Act): One or more components of this product are not listed on the DSL. In Canada, its use is restricted to research and development purposes only.

MITI (Japanese Handbook of Existing and New Chemical Substances): One or more components or reactants of this product are not listed in the Handbook. In Japan, its use is restricted to research and development purposes only.

ECL (Korean Toxic Substances Control Act): One or more components of this product are not listed on the Korean inventory. In Korea, its use is restricted to research and development purposes only.

SECTION 16: Other information

HMIS® Hazard Ratings: Health - 2, Flammability - 1, Chemical Reactivity - 0

HMIS® rating involves data interpretations that may vary from company to company. They are intended only for rapid, general identification of the magnitude of the specific hazard. To deal adequately with the safe handling of this material, all the information contained in this MSDS must be considered.

Revision Information:	Not relevant.
Key literature references and sources for data:	No data available.
Training information:	No data available.
Issue Date:	08/18/2011
SDS No:	
Disclaimer:	This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

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Section 1 - Chemical Product and Company Identification 61

Material Name: Hydrochloric Acid **CAS Number:** 7647-01-0
Chemical Formula: ClH
Structural Chemical Formula: HCl
EINECS Number: 231-595-7
ACX Number: X1002202-3
Synonyms: 4-D BOWL SANITIZER; ACIDE CHLORHYDRIQUE; ACIDO CLORHIDRICO; ACIDO CLORIDRICO; ANHYDROUS HYDROCHLORIC ACID; ANHYDROUS HYDROGEN CHLORIDE; AQUEOUS HYDROGEN CHLORIDE; BOWL CLEANER; CHLOORWATERSTOF; CHLOROHYDRIC ACID; CHLOROWODOR; CHLORURE D'HYDROGENE; CHLORURE D'HYDROGENE ANHYDRE; CHLORURO DE HIDROGENO; CHLORWASSERSTOFF; CLORURO DE HIDROGENO ANHIDRO; EMULSION BOWL CLEANER; EPA PESTICIDE CHEMICAL CODE 045901; HYDROCHLORIC ACID; HYDROCHLORIC ACID GAS; HYDROCHLORIDE; HYDROGEN CHLORIDE; HYDROGEN CHLORIDE (HCL); HYGEIA CREME MAGIC BOWL CLEANER; MURIATIC ACID; MURIATIC ACID); NOW SOUTH SAFTI-SOL BRAND CONCENTRATED BOWL CLEANSE WITHMAGIC ACTIO; PERCLEEN BOWL AND URINAL CLEANER; SPIRITS OF SALT; VARLEY'S OCEAN BLUE SCENTED TOILET BOWL CLEANER; VARLEY POLY-PAK BOWL CREME; WHITE EMULSION BOWL CLEANER; WUEST BOWL CLEANER SUPER CONCENTRATED
General Use: Hydrogen chloride is used to produce pharmaceutical hydrochlorides; vinyl chloride from acetylene; alkyl chlorides from olefins and arsenious chloride from arsenious oxide; electronic grade for etching semiconductor crystals. Used in the chlorination of rubber; in organic reactions involving isomerization, polymerization and alkylation; as a catalyst and condensing agent; for making chlorine where economical; in the separation of cotton from wool and cotton de-linting; as flux in the babbitt type of metal alloy; etching semi-conductor crystals.
Hydrochloric acid is used for pickling and heavy duty cleaning of metal parts; rust and scale removal. The production of chlorides; neutralizing bases; a laboratory reagent. For hydrolyzing starch and proteins in preparations for food. As a catalyst and solvent in organic synthesis. As "spirits of salts" for cleaning of lime and masonry from new brickwork. As flux or flux component for soldering; manufacture of "killed spirits".

Section 2 - Composition / Information on Ingredients

Name	CAS	%
hydrogen chloride	7647-01-0	> 99.0

OSHA PEL
Ceiling: 5 ppm, 7 mg/m^3.

NIOSH REL
Ceiling: 5 ppm (7 mg/m^3).

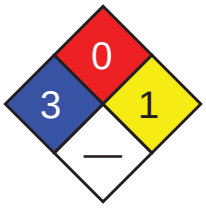
DFG (Germany) MAK
TWA: 5 ppm; PEAK: 5 ppm.

ACGIH TLV
Ceiling: 2 ppm.

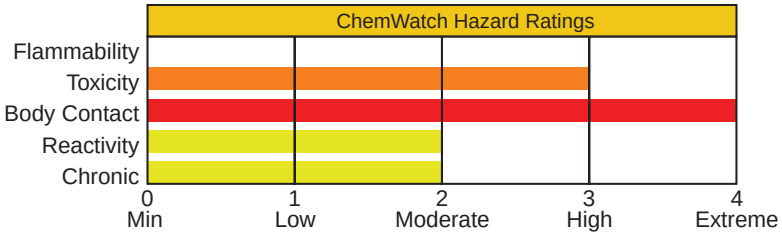
IDLH Level
50 ppm.

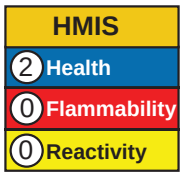
EU OEL
TWA: 5 ppm; STEL: 10 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!

Corrosive Compressed Gas

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; characteristic suffocating, pungent odor. Corrosive. Stored as compressed gas which may cause frostbite. Chronic Effects: erosion of teeth.

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Potential Health Effects

Target Organs: eyes, skin, respiratory system, liver (in animals)
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects

Inhalation: The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.
Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.
A single severe exposure may cause coughing and choking; bleeding of nose, inflammation and occasionally ulceration of the nose, throat and larynx. Fluid on the lungs followed by generalized lung damage may follow.
Breathing of vapor may aggravate asthma and inflammatory or fibrotic pulmonary disease.
High concentrations cause necrosis of the tracheal and bronchial epithelium, pulmonary edema, atelectasis and emphysema and damage to the pulmonary blood vessels and liver.
Inhalation hazard is increased at higher temperatures.
The vapor from heated material is extremely discomforting to the upper respiratory tract and lungs if inhaled.
Continued severe exposure can result in pulmonary edema and corrosion of tissues in the nose and throat.

Eye: Hydrogen Chloride: The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Hydrochloric Acid: Eye contact is extremely painful and may cause rapid corneal damage. The liquid is extremely corrosive to the eyes and is capable of causing severe damage with loss of sight.
The vapor is highly discomforting and may be corrosive to the eyes. The vapor from heated material is extremely discomforting to the eyes.

Skin: The material is corrosive to the skin and may cause chemical burns.
Toxic effects may result from skin absorption. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.
The vapor is discomforting to the skin.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal if swallowed in quantity. Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic exposure may cause discoloration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.
Repeated exposures of animals to concentrations of about 34 ppm produced no immediate toxic effects.
Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.
Repeated or prolonged exposure to dilute solutions may cause dermatitis. Repeated exposure to low vapor concentrations can cause skin tenderness, bleeding of the nose and gums, chronic bronchitis, gastritis.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. Rinse mouth out with plenty of water. Do NOT induce vomiting. Give a glass of water.

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

Note to Physicians: For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

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3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

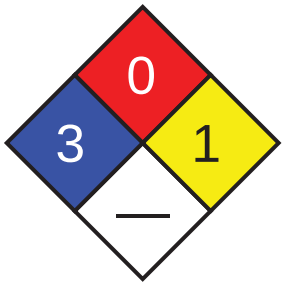
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Water spray or fog; foam; Bromochlorodifluoromethane (BCF) (where regulations permit); Dry agent; Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Noncombustible liquid. Will not burn, but heat produces highly toxic fumes/vapors.
Heating may cause expansion or decomposition leading to violent rupture of containers. Decomposes on heating and produces toxic fumes of hydrogen chloride. Decomposition may produce toxic fumes of chlorine.
Reacts with metals producing flammable/explosive hydrogen gas. Contact with moisture or water may generate heat causing ignition. Reacts vigorously with alkalis. Moderate fire hazard when in contact with reducing agents.
Fire Incompatibility: Reacts with metals producing flammable/explosive hydrogen gas.
Avoid reactions with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate, unsaturated organics, metal acetylides, sulphuric acid.
Note: Compatibility with plastics should be confirmed prior to use.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Cool fire-exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire. Equipment should be thoroughly decontaminated after use. Water spray or fog may be used to disperse vapor. Do not approach cylinders suspected to be hot. If safe to do so, stop flow of gas.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: DO NOT touch the spill material. Clean up all spills immediately. Wear fully protective PVC clothing and breathing apparatus. Contain and absorb spill with sand, earth, inert material or vermiculite. Use soda ash or slaked lime to neutralize. Collect residues and place in labeled plastic containers with vented lids. Clear area of personnel and move upwind. Avoid breathing vapors and contact with skin and eyes. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Water spray or fog may be used to disperse vapor.
Large Spills: Contact fire department and tell them location and nature of hazard. Clear area of personnel and move upwind. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Stop leak if safe to do so. Remove leaking cylinders to a safe place if possible. Release pressure under safe, controlled conditions by opening the valve. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Shut off all possible sources of ignition and increase ventilation. Water spray or fog may be used to disperse vapor. Use soda ash or slaked lime to neutralize.
Collect and seal in labeled drums for disposal. Wash spill area with large quantities of water. If contamination of

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drains or waterways occurs, advise emergency services. After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing. DO NOT touch the spill material. Contain and absorb spill with sand, earth, inert material or vermiculite.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist and vapor, breathing vapors and contact with skin and eyes.
Avoid physical damage to containers. Use in a well-ventilated area. Wear protective clothing and gloves when handling containers. Handle and open container with care.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Local exhaust ventilation may be required for safe working, i.e. to keep exposures below required standards; otherwise, PPE is required.
Keep dry. Reacts violently with water.
Transport containers on a trolley. Avoid sources of heat. DO NOT transfer gas from one cylinder to another.

Recommended Storage Methods: Packaging as recommended by manufacturer. Check that containers are clearly labeled.
Cylinder. Ensure the use of equipment rated for cylinder pressure. Ensure the use of compatible materials of construction. Valve protection cap to be in place until cylinder is secured, connected. Cylinder must be properly secured either in use or in storage. Cylinder valve must be closed when not in use or when empty. Segregate full from empty cylinders. WARNING: Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.
Hydrochloric acid: Packs of 2.5 litres or less require a child-resistant closure. Glass container or Plastic carboy or Polylined drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: If risk of overexposure exists, wear air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
If risk of inhalation or overexposure exists, wear NIOSH-approved respirator or work in fume hood. Hydrogen chloride vapors will not be adequately absorbed by organic vapor respirators.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Neoprene gloves; rubber gloves. Nitrile gloves.
Safety footwear. Rubber boots.
Hydrochloric acid: Barrier cream and Neoprene gloves or Elbow length PVC gloves. Nitrile gloves.
PVC boots or PVC safety gumboots.

Respiratory Protection:
Exposure Range >5 to <50 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 50 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: white

Other: Ensure there is ready access to a safety shower; Eyewash unit.
Acid-resistant overalls. Full protective suit. Operators should be trained in procedures for safe use of this material.

Glove Selection Index:
BUTYL ..... Best selection
BUTYL/NEOPRENE ..... Best selection
HYPALON ..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
NITRILE+PVC ..... Best selection
PE/EVAL/PE ..... Best selection
SARANEX-23 ..... Best selection
VITON/NEOPRENE ..... Best selection
PVC..... Best selection

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NITRILE ..... Best selection
NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
NAT+NEOPR+NITRILE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Hydrogen chloride: Colorless, corrosive gas. Pungent suffocating odor. White fumes in moist air. Soluble in methanol, ethanol, ether and benzene.
Hydrochloric acid: Clear to light yellow (orange tint for inhibited grades) fuming corrosive liquid with sharp, suffocating odor.

Physical State: Hydrogen chloride: Compressed gas; Hydrochloric acid: Liquid
Odor Threshold: 0.26 to 0.3 ppm
Vapor Pressure (kPa): < 24.8 at 25 °C
Vapor Density (Air=1): 1.268 at 20 °C
Formula Weight: 36.461
Specific Gravity (H_2O=1, at 4 °C): < 1.19 at 20 °C
Evaporation Rate: Slow

pH: Hydrochloric acid: < 1
Boiling Point: -85 °C (-121 °F)
Freezing/Melting Point: -114.44 °C (-173.992 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not applicable
Water Solubility: 56.1 g/100 cc hot water at 60 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Decomposes in the presence of moisture to produce corrosive acid. May generate sufficient heat to ignite combustible materials. Presence of heat source and direct sunlight (ultra-violet radiation). Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.
Storage Incompatibilities: Hydrogen chloride: Segregate from most common metals and their alloys, alkalis, unsaturated organics, fluorine, metal carbides, metal acetylides, potassium permanganate and sulfuric acid. Compatibility with plastics should be confirmed prior to use.
Hydrochloric acid: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates. Avoid storage with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate. Reacts with zinc, brass, galvanized iron, aluminum, copper and copper alloys.

Section 11 - Toxicological Information

Toxicity
Inhalation (human) LC_{Lo}: 1300 ppm/30 m
Inhalation (human) LC_{Lo}: 3000 ppm/5 m
Inhalation (rat) LC_{50}: 3124 ppm/60 m
Inhalation (rat) LC_{50}: 4701 ppm/30 m
Oral (rat) LD_{50}: 900 mg/kg

Irritation
Eye (rabbit): 5 mg/30 s - mild

See *RTECS* MW 4025000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: TL_m Gambusia affinis (mosquito fish) 282 ppm/96 hr (fresh water) /Conditions of bioassay not specified; Lethal Lepomis macrochirus (bluegill sunfish) 3.6 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Cockle 330 to 1,000 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Carassius auratus (goldfish) 178 mg/l (1 to 2 hr survival time) /Conditions of bioassay not specified; LC_{50} Shore crab 240 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Shrimp 100 to 330 ppm/48 hr (salt water) /Conditions of bioassay not specified; LC_{100} Trout 10 mg/l 24 hr /Conditions of bioassay not specified
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Treat and neutralize at an effluent treatment plant. Bury residue in an authorized landfill. Decontaminate empty containers with a lime slurry. Return empty containers to supplier or bury empty containers at an authorized landfill.
Return empty cylinders to supplier.

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Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Hydrogen chloride, anhydrous
ID: UN1050
Hazard Class: 2.3 - Poisonous gas
Packing Group:
Symbols:
Label Codes: 2.3 - Poison Gas, 8 - Corrosive
Special Provisions: 3
Packaging: **Exceptions:** None **Non-bulk:** 304 **Bulk:** None
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
Vessel Stowage: **Location:** D **Other:** 40

Shipping Name and Description: Hydrochloric acid
ID: UN1789
Hazard Class: 8 - Corrosive material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: A3, A6, B3, B15, IB2, N41, T8, TP2, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** C **Other:**

Shipping Name and Description: Hydrochloric acid
ID: UN1789
Hazard Class: 8 - Corrosive material
Packing Group: III - Minor Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: IB3, T4, TP1, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 203 **Bulk:** 241
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** C **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 5000 lb
TPQ: 500 lb
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 61

Material Name: Isobutene **CAS Number:** 115-11-7
Chemical Formula: C_4H_8
Structural Chemical Formula: $(CH_3)_2C{=}CH_2$
EINECS Number: 204-066-3
ACX Number: X1003822-9
Synonyms: Isobutene; ISOBUTYLENE; ASYM-DIMETHYLETHYLENE; GAMMA-BUTYLENE; 1,1-DIMETHYLETHYLENE; ISO-BUTENE; ISOBUTENE; ISOPROPYLIDENEMETHYLENE; LIQUEFIED PETROLEUM GAS; 2-METHYL-1-PROPENE; 2-METHYLPROPENE; 2-METHYLPROPYLENE; 1-PROPENE,2-METHYL-; PROPENE,2-METHYL-; UNSYM. DIMETHYLETHYLENE
General Use: Production of butene polymers used as adhesives, tackifiers, oil additives.
Butyl rubbers, copolymer resins with butadiene, acrylates and methacrylates.
Also to produce anti-oxidants for foods, food supplements, plastics and in production of isooctane and high-octane aviation gasoline.
Used in closed pressurized systems, fitted with safety relief valve.
Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.

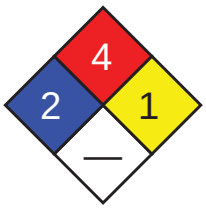
Section 2 - Composition / Information on Ingredients

Name	CAS	%
isobutene	115-11-7	>99

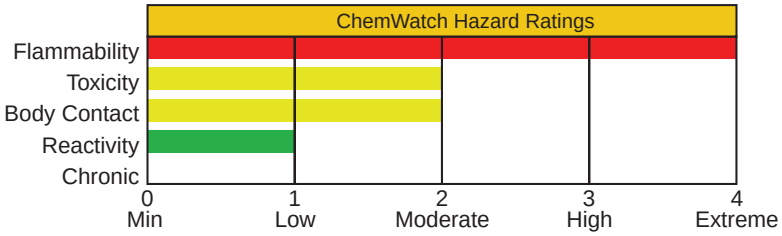
OSHA PEL **NIOSH REL**

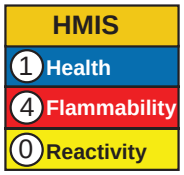
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas. Acute Effects: Simple asphyxiant which can displace available oxygen; initial symptoms: rapid respiration, air hunger, diminished mental alertness, impaired muscular coordination. Can form explosive mixtures in air. Flammable.

Potential Health Effects

Target Organs: None reported
Primary Entry Routes: inhalation
Acute Effects
Inhalation: The gas is a simple asphyxiant (precludes access to oxygen) and is harmful if exposure is prolonged and inhalation may cause loss of consciousness.

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Acute effects from inhalation of high concentrations of gas / vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated atmosphere of gas is prolonged this may lead to narcosis, unconsciousness, even coma, and unless resuscitated, death.
Iso-butene is a simple asphyxiant and may have a narcotic action.
Material is highly volatile and may quickly form concentrated atmosphere in confined or unventilated area. Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.
Hydrocarbons may sensitize the heart to adrenalin and other circulatory catecholamines; as a result cardiac arrhythmias and ventricular fibrillation may occur. Abrupt collapse may produce traumatic injury.
Central nervous system (CNS) depression may be evident early. Symptoms of moderate poisoning may include giddiness, headache, dizziness and nausea.
Serious poisonings may result in respiratory depression and may be fatal.
The paraffin gases C1-4 are practically non-toxic below their lower flammability limits (18000-50000 ppm). Above this level, incidental effects include CNS depression and irritation but these are reversible upon cessation of the exposure. The C3 and iso-C5 hydrocarbons show increasing narcotic properties; branching of the chain also enhances the effect.
The C4 hydrocarbons appear to be more highly neurotoxic than the C3 and C5 members. Several fatalities due to voluntary inhalation of butane have been reported, possibly due to central, respiratory and circulatory effects resulting from anesthesia, laryngeal edema, chemical pneumonia or the combined effects of cardiac toxicity and increased sympathomimetic effects.
Inhalation of petroleum gases may produce narcosis, due in part to olefinic impurities. Displacement of oxygen in the air may cyanosis.
If present in sufficient quantity these gases may reduce the oxygen level to below 18% producing asphyxiation. Symptoms include rapid respiration, mental dullness, lack of coordination, poor judgement, nausea and vomiting. The onset of cyanosis may lead to unconsciousness and death.

Eye: The liquid is highly discomforting and may cause severe cold burns and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The gas is regarded as non-irritating to the eyes.

Skin: Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.The liquid is discomforting to the skin and may rapidly cause severe cold burns.
Bare unprotected skin should not be exposed to this material.
There is no evidence of skin absorption but contact may cause frostbite,

Ingestion: Overexposure is unlikely in this form.
Considered an unlikely route of entry in commercial/industrial environments.
The liquid is highly discomforting if swallowed and may cause severe cold burns.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic overexposure may produce dermatitis.

Section 4 - First Aid Measures

Inhalation: Avoid becoming a casualty and remove to fresh air.
Lay patient down. If breathing is shallow or has stopped, ensure clear airway and apply resuscitation.
If available, medical oxygen should be administered by trained personnel.
Transport to hospital or doctor, without delay.

See DOT ERG

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: In case of cold burns (frost-bite): Bathe the affected area immediately in cold water for 10 to 15 minutes, immersing if possible and without rubbing.
Do not apply hot water or radiant heat. Apply a clean, dry dressing.
Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.

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

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:
1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

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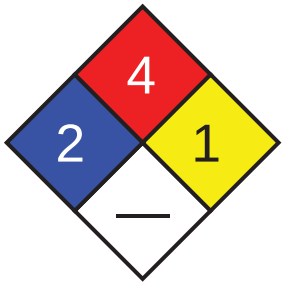
2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: -76.111 °C
Autoignition Temperature: 465 °C
LEL: 1.8% v/v
UEL: 9.6% v/v
Extinguishing Media: Water spray or fog; dry chemical powder.
Carbon dioxide.
Foam.

See DOT ERG



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Flammable gas. Liquid and vapor are highly flammable.
Dangerous hazard when exposed to heat, flame and oxidizers.
Gas may form explosive mixtures with air over a wide area.
Decomposes on heating and produces toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Do not extinguish burning gas. If safe to do so, stop flow of gas.
If flow of gas cannot be stopped, leave gas to burn.
Cool fire-exposed containers with water spray from a protected location.
Do not approach cylinders suspected to be hot.
If safe to do so, remove containers from path of fire.
Fight fire from a safe distance, with adequate cover.

Section 6 - Accidental Release Measures

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

See DOT ERG

Large Spills: DO NOT touch the spill material. Shut off all possible sources of ignition and increase ventilation. Restrict access to area. Clear area of personnel and move upwind.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Avoid spraying water onto liquid pools.
Use extreme caution to avoid a violent reaction.
Stop leak if safe to do so.
DO NOT enter confined places where gas may have collected. Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.
Keep area clear of personnel until gas has dispersed
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices. Use in a well-ventilated area.

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Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.
Atmospheres must be tested and O.K. before work resumes after leakage.
Wear protective clothing and gloves when handling containers.
No smoking, bare lights, heat or ignition sources.
Use spark-free tools when handling. Ground all lines and equipment.
Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
Gas may travel a considerable distance to source of ignition.
Vapor may ignite on pumping or pouring due to static electricity.
Avoid physical damage to containers.
DO NOT transfer gas from one cylinder to another.
Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquified petroleum streams and in product streams having similar boiling points.
Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon enriched stream or containing internal deposits of radioactive material. Field studies, however, have not shown that conditions exist that expose the worker to cumulative exposures in excess of general population limits. Equipment containing gamma-emitting decay products should be presumed to be internally contaminated with alpha- emitting decay products which may be hazardous if inhaled or ingested.
During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma-radiation to drop to background levels. Protective equipment (including high efficiency particulate respirators (P3) suitable for radionucleotides or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination or inhalation of any residue containing alpha-radiation.
Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Cylinder fitted with valve protector cap.
Ensure the use of equipment rated for cylinder pressure.
Ensure the use of compatible materials of construction.
Cylinder valve must be closed when not in use or when empty.
Cylinder must be properly secured either in use or in storage.
WARNING: Suckback into cylinder may result in rupture.
Use back-flow preventive device in piping.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated areaIf gas concentrations are high: or If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Used in closed pressurized systems; fitted with temperature and pressure safety relief valves which are vented to allow safe dispersal.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Protective gloves eg. leather gloves or gloves with leather facing. Neoprene rubber gloves.
Safety footwear.

Other: Operators should be trained in correct use & maintenance of respirators Ensure that there is ready access to breathing apparatus.
Protective overalls, closely fitted at neck and wrist. Eye-wash unit.
IN CONFINED SPACES:
1. Non-sparking protective boots.
2. Static-free clothing.
3. Ensure availability of lifeline.
Staff should be trained in all aspects of rescue work.
Ensure there is ready access to an emergency shower.

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Section 9 - Physical and Chemical Properties

Appearance/General Info: Easily liquified flammable gas or colorless highly volatile liquid. Packed as liquid under pressure and remains liquid only under pressure. Sudden release of pressure or leakage may result in rapid vaporization with generation of large volume of highly flammable / explosive gas. Strong gasoline odor. Floats and boils on water giving a flammable / explosive, visible cloud. Soluble in alcohol, ether, benzene and sulphuric acid.

Physical State: Liquefied gas
Odor Threshold: 1.3 to 3.0 mg/m^3
Vapor Pressure (kPa): 182 kPa at 10 °C
Vapor Density (Air=1): 2.01
Formula Weight: 56.11
Specific Gravity (H_2O=1, at 4 °C): 0.59
Evaporation Rate: Very rapid
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: -6.9 °C (20 °F)
Freezing/Melting Point: -140.35 °C (-220.63 °F)
Volatile Component (% Vol): 100
Water Solubility: Practically insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid contact with oxidizing agents.

The interaction of alkenes and alkynes with nitrogen oxides and oxygen may produce explosive addition products; these may form at very low temperatures and explode on heating to higher temperatures (the addition products from 1,3-butadiene and cyclopentadiene form rapidly at -150 °C and ignite or explode on warming to -35 to -15 C). These derivatives ("pseudo- nitrosites") were formerly used to characterize terpene hydrocarbons.

Exposure to air must be kept to a minimum so as to limit the build-up of peroxides which will concentrate in bottoms if the product is distilled.

The product must not be distilled to dryness if the peroxide concentration is substantially above 10 ppm (as active oxygen) since explosive decomposition may occur. Distillate must be immediately inhibited to prevent peroxide formation. The effectiveness of the antioxidant is limited once the peroxide levels exceed 10 ppm as active oxygen. Addition of more inhibitor at this point is generally ineffective.

Prior to distillation it is recommended that the product should be washed with aqueous ferrous ammonium sulfate to destroy peroxides; the washed product should be immediately re-inhibited.

A range of exothermic decomposition energies for double bonds is given as 40-90 kJ/mol. The relationship between energy of decomposition and processing hazards has been the subject of discussion; it is suggested that values of energy released per unit of mass, rather than on a molar basis (J/g) be used in the assessment. For example, in "open vessel processes" (with man-hole size openings, in an industrial setting), substances with exothermic decomposition energies below 500 J/g are unlikely to present a danger, whilst those in "closed vessel processes" (opening is a safety valve or bursting disk) present some danger where the decomposition energy exceeds 150 J/g.

Avoid reactions with oxidizing agents, organic acids, inorganic acids halogenated compounds, polymerizable esters, oxygen, cyanohydrins and molten sulphur.

Section 11 - Toxicological Information

Toxicity
Inhalation (rat) LC_{50}: 620000 mg/m^3/4h

Irritation
Nil reported

See *RTECS* UD 0890000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options.
Discharge to burning flare. Return empty cylinders to supplier.

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Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Isobutylene *see also* Petroleum gases, liquefied
ID: UN1055
Hazard Class: 2.1 - Flammable gas
Packing Group:
Symbols:
Label Codes: 2.1 - Flammable Gas
Special Provisions: 19, T50
Packaging: **Exceptions:** 306 **Non-bulk:** 304 **Bulk:** 314, 315
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 150 kg
Vessel Stowage: **Location:** E **Other:** 40

Shipping Name and Description: Petroleum gases, liquefied *or* Liquefied petroleum gas
ID: UN1075
Hazard Class: 2.1 - Flammable gas
Packing Group:
Symbols:
Label Codes: 2.1 - Flammable Gas
Special Provisions: T50
Packaging: **Exceptions:** 306 **Non-bulk:** 304 **Bulk:** 314, 315
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 150 kg
Vessel Stowage: **Location:** E **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification 61

Material Name: Nitric Acid **CAS Number:** 7697-37-2
Chemical Formula: HNO_3
Structural Chemical Formula: HNO_3
EINECS Number: 231-714-2
ACX Number: X1002177-5
Synonyms: ACIDE NITRIQUE; ACIDO NITRICO; AQUA FORTIS; AZOTIC ACID; AZOTOWY KWAS; ENGRAVER'S ACID; ENGRAVERS ACID; HYDROGEN NITRATE; KYSELINA DUSICNE; NITAL; NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH >70% NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH NOT >70% NITRICACID; NITROUS FUMES; NITRYL HYDROXIDE; RED FUMING NITRIC ACID (RFNA); SALPETERSAURE; SALPETERZUUROPLOSSINGEN; WHITE FUMING NITRIC ACID (WFNA)
General Use: Manufacture of organic and inorganic nitrates and nitro compounds for fertilizers, dye intermediates and many organic chemicals.
Used for etching and cleaning metals.
Operators should be trained in procedures for safe use of this material.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
nitric acid	7697-37-2	>95

OSHA PEL
TWA: 2 ppm; 5 mg/m^3.

ACGIH TLV
TWA: 2 ppm; STEL: 4 ppm.

EU OEL
STEL: 2.6 mg/m^3 (1 ppm).

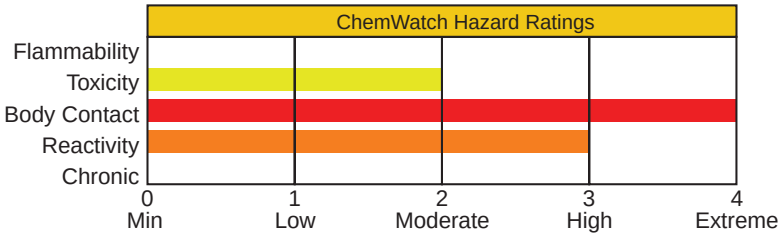
NIOSH REL
TWA: 2 ppm (5 mg/m^3); STEL: 4 ppm (10 mg/m^3).

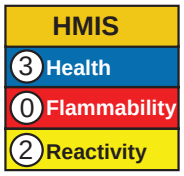
IDLH Level
25 ppm.

DFG (Germany) MAK
TWA: 2 ppm; PEAK: 2 ppm.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word

Danger!

Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear to yellow fuming liquid; acrid, suffocating odor. Corrosive. Other Acute Effects: lung damage. Chronic Effects: tooth erosion, bronchitis. Strong oxidizer.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, teeth
Primary Entry Routes: inhalation, ingestion, skin contact, eye contact
Acute Effects
Inhalation: The vapor is extremely discomforting and corrosive to the upper respiratory tract and lungs and the material presents a hazard from a single acute exposure or from repeated exposures over long periods.
Inhalation hazard is increased at higher temperatures.
Reactions may occur following a single acute exposure or may only appear after repeated exposures.

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Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later.
The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.
Inhalation of nitric acid mist or fumes at 2 to 25 ppm over an 8 hour period may cause pulmonary irritation and symptoms of lung damage.
Only several minutes of exposure to concentrated atmosphere i.e. 200 ppm may cause severe pulmonary damage and even fatality. Death may be delayed for several days.
Exposure to nitric acid fumes (with concurrent inhalation of nitrogen dioxide and nitric oxide) may elicit prompt irritation of the upper respiratory tract leading to coughing, gagging, chest pain, dyspnea, cyanosis if concentrations are sufficiently high and duration of exposure sufficiently long, pulmonary edema.

Eye: The liquid is extremely corrosive to the eyes and contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.
The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may produce moderate eye irritation leading to inflammation.
Repeated or prolonged exposure to irritants may produce conjunctivitis.
Eye contact with concentrated acid may give no pain, whilst diluted solution causes intense pain and both can cause permanent eye damage or blindness. Burns may result in shrinkage of the eyeball, symblepharon (adhesions between tarsal and bulbar conjunctivae), permanent corneal opacification, and visual impairment leading to blindness.

Skin: The liquid is extremely corrosive to the skin and contact may cause tissue destruction with severe burns.
Bare unprotected skin should not be exposed to this material.
The vapor is highly discomforting to the skin.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.
Skin contact causes yellow discoloration of the skin, blisters and scars that may not heal. The skin may be stained bright-yellow or yellowish brown due to the formation of xanthoproteic acid. Dilute solutions may harden the epithelium without producing overt corrosion.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The material is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal.
Even a small amount causes severe corrosion of the stomach, burning pain, vomiting and shock, possibly causing non-healing scarring of the gastrointestinal tract and stomach. Death may be delayed 12 hours to 14 days or to several months. Such late fatalities are attributed to a chemical lobular pneumonitis secondary to aspiration. Survivors show stricture of the gastric mucosa and subsequent pernicious anemia.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Prolonged or repeated overexposure to low concentrations of vapor may cause chronic bronchitis, corrosion of teeth, even chemical pneumonitis.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Immediately transport to hospital or doctor. DO NOT delay.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor. DO NOT delay.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.
Immediately transport to hospital or doctor. DO NOT delay.

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

Note to Physicians: For acute or short-term repeated exposures to strong acids:

1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.

See DOT ERG

Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Will not burn but increases intensity of fire.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Heat affected containers remain hazardous.
Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.
May emit irritating, poisonous or corrosive fumes.
Decomposes on heating and produces toxic fumes of nitrogen oxides (NO_x) and nitric acid.

Fire Incompatibility: Oxidizing agents as a class are not necessarily combustible themselves, but can increase the risk and intensity of fire in many other substances.
Reacts vigorously with water and alkali.
Avoid reaction with organic materials/compounds, powdered metals, reducing agents and hydrogen sulfide (H_2S) as ignition may result.
Reacts with metals producing flammable/explosive hydrogen gas.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
Extinguishers should be used only by trained personnel.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
If fire gets out of control withdraw personnel and warn against entry.
Equipment should be thoroughly decontaminated after use.

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Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Dangerous levels of nitrogen oxides may form during spills of nitric acid.
Wear fully protective PVC clothing and breathing apparatus.
Clean up all spills immediately. No smoking, bare lights, ignition sources.
Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials, as ignition may result.
Avoid breathing dust or vapors and all contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with dry sand, earth, inert material or vermiculite. DO NOT use sawdust as fire may result.
Scoop up solid residues and seal in labeled drums for disposal.
Neutralize/decontaminate area.
Use soda ash or slaked lime to neutralize.

Large Spills: DO NOT touch the spill material. Restrict access to area.
Clear area of personnel and move upwind. Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, flames or ignition sources. Increase ventilation.
Contain spill with sand, earth or other clean, inert materials.
NEVER use organic absorbents such as sawdust, paper, cloth; as fire may result. Avoid any contamination by organic matter.
Use spark-free and explosion-proof equipment.
Collect any recoverable product into labeled containers for possible recycling. DO NOT mix fresh with recovered material.
Collect residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains. Decontaminate equipment and launder all protective clothing before storage and reuse.
If contamination of drains or waterways occurs advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Do not allow clothing wet with material to stay in contact with skin.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Stainless steel drum. Check that containers are clearly labeled.
Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Bare unprotected skin should not be exposed to this material. Impervious, gauntlet length gloves i.e., butyl rubber gloves or Neoprene rubber gloves or wear chemical protective gloves, e.g. PVC.

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Wear safety footwear or safety gumboots, e.g. Rubber.

Respiratory Protection:

Exposure Range >2 to <25 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 25 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Other: Operators should be trained in procedures for safe use of this material.

Acid-resistant overalls or Rubber apron or PVC apron.

Ensure there is ready access to an emergency shower.

Ensure that there is ready access to eye wash unit.

Ensure that there is ready access to breathing apparatus.

Glove Selection Index:

BUTYL ..... Best selection
HYPALON ..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
PE/EVAL/PE ..... Best selection
SARANEX-23 ..... Best selection
NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
PVC..... Poor to dangerous choice for other than short-term immersion
NITRILE+PVC..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to slightly yellow liquid. Sharp strong odor.
CAUTION: exothermic dilution hazard.
HIGHLY CORROSIVE. Corrosive to most metals. Powerful oxidizing agent.
Darkens to brownish color on aging and exposure to light.

Physical State: Liquid
Odor Threshold: 0.75 to 2.50 mg/m^3
Vapor Pressure (kPa): 8.26
Vapor Density (Air=1): 1.5
Formula Weight: 63.02
Specific Gravity (H_2O=1, at 4 °C): 1.3-1.42
pH: < 1
pH (1% Solution): 1
Boiling Point: 83 °C (181 °F) at 760 mm Hg
Freezing/Melting Point: -42 °C (-43.6 °F)
Volatile Component (% Vol): 100 (nominal)
Decomposition Temperature (°C): Not applicable
Water Solubility: Soluble in all proportions

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and direct sunlight. Storage in unsealed containers. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from reducing agents, finely divided combustible materials, combustible materials, sawdust, metals and powdered metals.

Avoid contamination of water, foodstuffs, feed or seed.

Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD_{Lo}: 430 mg/kg
Inhalation (rat) LC_{50}: 2500 ppm/1 hr
Unreported (man) LD_{Lo}: 110 mg/kg

Irritation

Nil reported

See *RTECS* QU 5775000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: LC_{50} Starfish 100-300 mg/l/48 hr /Aerated water conditions; LC_{50} Shore crab 180 mg/l/48 hr /Static, aerated water conditions; LC_{50} Cockle 330-1000 mg/l/48 hr /Aerated water conditions

BCF: no food chain concentration potential

Biochemical Oxygen Demand (BOD): none

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Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Special hazards may exist - specialist advice may be required.
Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an approved treatment plant.
Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
Puncture containers to prevent reuse and bury at an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Nitric acid *other than red fuming, with more than 70 percent nitric acid*
ID: UN2031
Hazard Class: 8 - Corrosive material
Packing Group: I - Great Danger
Symbols:
Label Codes: 8 - Corrosive, 5.1 - Oxidizer
Special Provisions: B47, B53, T10, TP2, TP12, TP13
Packaging: **Exceptions:** None **Non-bulk:** 158 **Bulk:** 243
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 2.5 L
Vessel Stowage: **Location:** D **Other:** 44, 66, 89, 90, 110, 111

Shipping Name and Description: Nitric acid *other than red fuming, with not more than 70 percent nitric acid*
ID: UN2031
Hazard Class: 8 - Corrosive material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: B2, B47, B53, IB2, T8, TP2, TP12
Packaging: **Exceptions:** None **Non-bulk:** 158 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** D **Other:**

Shipping Name and Description: Nitric acid, red fuming
ID: UN2032
Hazard Class: 8 - Corrosive material
Packing Group: I - Great Danger
Symbols: + - Override definitions
Label Codes: 8 - Corrosive, 5.1 - Oxidizer, 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: 2, B9, B32, B74, T20, TP2, TP12, TP13, TP38, TP45
Packaging: **Exceptions:** None **Non-bulk:** 227 **Bulk:** 244
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
Vessel Stowage: **Location:** D **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 1000 lb
TPQ: 1000 lb
TSCA: Listed

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Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

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Material Safety Data Sheet
The Dow Chemical Company

Product Name: DOWANOL™ PPH Glycol Ether

Issue Date: 02/11/2013
Print Date: 12 Feb 2013

The Dow Chemical Company encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
DOWANOL™ PPH Glycol Ether

COMPANY IDENTIFICATION
The Dow Chemical Company
2030 Willard H. Dow Center
Midland, MI 48674
United States

Customer Information Number: 800-258-2436

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 989-636-4400
Local Emergency Contact: 989-636-4400

2. Hazards Identification

Emergency Overview
Color: colourless
Physical State: Liquid.
Odor: Very slight
Hazards of product:

WARNING! Causes eye irritation. Isolate area.

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects
Eye Contact: May cause severe eye irritation. May cause slight corneal injury.
Skin Contact: Prolonged contact may cause slight skin irritation with local redness.
Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts.
Inhalation: At room temperature, vapors are minimal due to low volatility. Vapor from heated material or mist may be hazardous on single exposure. For respiratory irritation and narcotic effects: No relevant data found.

®(TM)*Trademark

Ingestion: Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.
Aspiration hazard: Based on physical properties, not likely to be an aspiration hazard.
Birth Defects/Developmental Effects: Has caused birth defects in laboratory animals only at doses toxic to the mother.

3. Composition Information

Component	CAS #	Amount
Propylene glycol phenyl ether	770-35-4	> 99.5 %

4. First-aid measures

Description of first aid measures

General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Inhalation: Move person to fresh air; if effects occur, consult a physician.
Skin Contact: Wash skin with plenty of water.
Eye Contact: Immediately flush eyes with water; remove contact lenses, if present, after the first 5 minutes, then continue flushing eyes for at least 15 minutes. Obtain medical attention without delay, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.
Ingestion: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.

Most important symptoms and effects, both acute and delayed

Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), no additional symptoms and effects are anticipated.

Indication of immediate medical attention and special treatment needed

No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. Fire Fighting Measures

Suitable extinguishing media

Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective. Water fog, applied gently may be used as a blanket for fire extinguishment.
Extinguishing Media to Avoid: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture

Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.
Unusual Fire and Explosion Hazards: Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Do not use direct water stream. May spread fire. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Water fog, applied gently may be used as a blanket for fire extinguishment.
Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection. Refer to Section 7, Handling, for additional precautionary measures.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Small spills: Absorb with materials such as: Sand. Vermiculite. Collect in suitable and properly labeled containers. Large spills: Contain spilled material if possible. Pump into suitable and properly labeled containers. See Section 13, Disposal Considerations, for additional information.

7. Handling and Storage

Handling
General Handling: Do not get in eyes. Avoid contact with skin and clothing. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.
Other Precautions: Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

Storage
Store in the following material(s): Carbon steel. Stainless steel. Phenolic lined steel drums. Do not store in: Aluminum. Copper. Galvanized iron. Galvanized steel.
Shelf life: Use within, Metal drums. 24 Months
Bulk 6 Months

8. Exposure Controls / Personal Protection

Exposure Limits

None established

Personal Protection
Eye/Face Protection: Use chemical goggles.
Skin Protection: Wear clean, body-covering clothing.
Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Examples of preferred glove barrier materials

include: Butyl rubber. Ethyl vinyl alcohol laminate ("EVAL"). Examples of acceptable glove barrier materials include: Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyvinyl chloride ("PVC" or "vinyl"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. Use an approved air-purifying respirator when vapors are generated at increased temperatures or when dust or mist is present. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

9. Physical and Chemical Properties

Appearance	
Physical State	Liquid.
Color	colourless
Odor	Very slight
Odor Threshold	No test data available
pH	No test data available
Melting Point	11 °C (52 °F) *Literature*
Freezing Point	11 °C (52 °F) *Literature*
Boiling Point (760 mmHg)	241.2 °C (466.2 °F) *Literature* .
Flash Point - Closed Cup	115 °C (239 °F) *Literature*
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammability (solid, gas)	No
Flammable Limits In Air	**Lower**: 0.8 %(V) *Literature* **Upper**: Not determined
Vapor Pressure	0.01 hPa @ 20 °C *Literature*
Vapor Density (air = 1)	5.27 *Literature*
Specific Gravity (H2O = 1)	1.060 20 °C/20 °C *ASTM D4052*
Solubility in water (by weight)	15.1 g/l @ 20 °C *Literature*
Partition coefficient, n-octanol/water (log Pow)	1.41 *Measured*
Autoignition Temperature	1,013 hPa 480 °C (896 °F) *Literature*
Decomposition Temperature	No test data available
Dynamic Viscosity	22.7 mPa.s @ 25 °C *Literature*
Kinematic Viscosity	21.4 mm2/s *Literature*
Explosive properties	Not explosive
Oxidizing properties	No
Liquid Density	8.83 lb/gal @ 25 °C *Literature*
Molecular Weight	No test data available
Surface tension	67.8 mN/m @ 20 °C *Literature*
Henry's Law Constant (H)	4.41E-07 atm*m3/mole; 25 °C Estimated.

10. Stability and Reactivity

Reactivity
No dangerous reaction known under conditions of normal use.

Chemical stability
Thermally stable at typical use temperatures.

Possibility of hazardous reactions
Polymerization will not occur.

Conditions to Avoid: Do not distill to dryness. Product can oxidize at elevated temperatures.

Incompatible Materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous decomposition products
Decomposition products depend upon temperature, air supply and the presence of other materials.
Decomposition products can include and are not limited to: Aldehydes. Ketones. Organic acids.

11. Toxicological Information

Acute Toxicity
Ingestion
LD50, rat > 2,000 mg/kg
Dermal
LD50, rat > 2,000 mg/kg
Inhalation
No deaths occurred following exposure to a saturated atmosphere. , 4 h, Aerosol, rat 5.4 mg/l
Eye damage/eye irritation
May cause severe eye irritation. May cause slight corneal injury.
Skin corrosion/irritation
Prolonged contact may cause slight skin irritation with local redness.
Sensitization
Skin
Did not cause allergic skin reactions when tested in guinea pigs.
Respiratory
No relevant data found.
Repeated Dose Toxicity
Based on available data, repeated exposures are not anticipated to cause additional significant adverse effects.
Chronic Toxicity and Carcinogenicity
No relevant data found.
Developmental Toxicity
Has caused birth defects in laboratory animals only at doses toxic to the mother.
Reproductive Toxicity
In animal studies, did not interfere with reproduction.
Genetic Toxicology
In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were predominantly negative.

12. Ecological Information

Toxicity

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

Fish Acute & Prolonged Toxicity
LC50, Pimephales promelas (fathead minnow), static test, 96 h: 280 mg/l
Aquatic Invertebrate Acute Toxicity
LC50, Daphnia magna (Water flea), static test, 48 h, survival: 370 mg/l
Aquatic Plant Toxicity
EC50, Desmodesmus subspicatus (green algae), static test, Growth rate inhibition, 72 h: > 100 mg/l

Persistence and Degradability

Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation rate may increase in soil and/or water with acclimation.
OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method	10 Day Window
72 %	28 d	OECD 301F Test	fail

Indirect Photodegradation with OH Radicals

Rate Constant	Atmospheric Half-life	Method
3.72E-11 cm3/s	3.5 h	Estimated.

Theoretical Oxygen Demand: 2.31 mg/mg

Bioaccumulative potential
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient, n-octanol/water (log Pow): 1.41 Measured

Mobility in soil
Mobility in soil: Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient, soil organic carbon/water (Koc): 19 - 21 Estimated.
Henry's Law Constant (H): 4.41E-07 atm*m3/mole; 25 °C Estimated.

13. Disposal Considerations

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device.

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
NOT REGULATED

IMDG
NOT REGULATED

ICAO/IATA
NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

US. Toxic Substances Control Act
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

CEPA - Domestic Substances List (DSL)
All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

16. Other Information

Product Literature

Additional information on this product may be obtained by calling your sales or customer service contact. Ask for a product brochure.

Hazard Rating System

NFPA	Health	Fire	Reactivity
	1	1	0

Recommended Uses and Restrictions

Identified uses

Solvent for consumer and industrial applications.

Revision

Identification Number: 82587 / 0000 / Issue Date 02/11/2013 / Version: 3.0

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight
OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ_DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

The Dow Chemical Company urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

Section 1 - Chemical Product and Company Identification 61

Material Name: Sulfuric Acid **CAS Number:** 7664-93-9
Chemical Formula: H_2O_4S
Structural Chemical Formula: H_2SO_4
EINECS Number: 231-639-5
ACX Number: X1002217-4
Synonyms: ACIDE SULFURIQUE; ACIDO SOLFORICO; ACIDO SULFURICO; BATTERY ACID; BOV; DIHYDROGEN SULFATE; DIPPING ACID; ELECTROLYTE ACID; EPA PESTICIDE CHEMICAL CODE 078001; HYDROGEN SULFATE; MATTLING ACID; OIL OF VITRIOL; SCHWEFELSAEURELOESUNGEN; SULFURIC ACID; SULFURIC ACID (AQUEOUS); SULFURIC ACID,SPENT; SULPHURIC ACID; VITRIOL BROWN OIL; ZWAVELZUUROPLOSSINGEN
General Use: The manufacture of superphosphate fertilizer, inorganic and petro-chemicals, explosives and pigments.
Component of heavy duty metal cleaners, pickles.
In manufacture of rayon, cellulose film.
As battery electrolyte and also in electroplating processes.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
sulfuric acid	7664-93-9	>51
water	7732-18-5	remainder

OSHA PEL
TWA: 1 mg/m^3.

NIOSH REL
TWA: 1 mg/m^3.

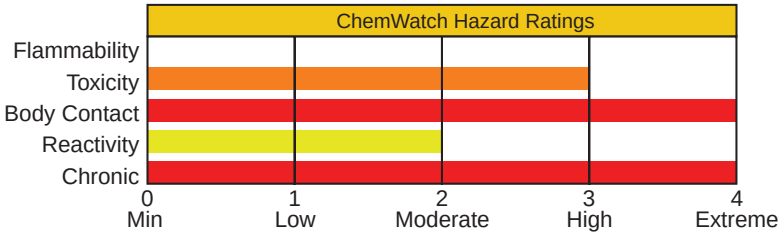
DFG (Germany) MAK
TWA: 0.1 mg/m^3; PEAK: 0.1 mg/m^3; Ceiling: 0.2 mg/m^3; measured as inhalable fraction of the aerosol.

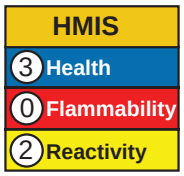
ACGIH TLV
TWA: 1 mg/m^3; STEL: 3 mg/m^3; A2 = as contained in strong inorganic acid mists.

IDLH Level
15 mg/m^3.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word
Danger!

Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless to dark-brown, oily, odorless liquid. Corrosive. Other Acute Effects: blindness. Chronic Effects: tooth erosion, GI disturbances, dermatitis. Reaction with water produces excessive heat.

Potential Health Effects

Target Organs: respiratory system, eyes, skin, teeth
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects
Inhalation: The vapor is extremely discomforting to the upper respiratory tract and is capable of causing severe mucous membrane irritation, upper respiratory tract inflammation.
Exposure to high concentrations causes bronchitis and is characterized by the onset of hemorrhagic pulmonary edema.

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Mists are highly irritating to eyes, mucous membranes and respiratory tract and high mist concentrations may lead to pulmonary edema.

Eye: HIGHLY CORROSIVE The liquid is extremely corrosive to the eyes and any contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.
The mist is highly corrosive and contact may cause rapid tissue destruction.
The vapor is extremely discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: HIGHLY CORROSIVE. The liquid is extremely corrosive to the skin and any contact may cause rapid tissue destruction with severe burns.
The mist is highly discomforting to the skin and may cause deep ulceration to body tissue.
Topical application of a 10% solution to skin on the scapula or waist produces only negligible evidence of irritation.

Ingestion: HIGHLY CORROSIVE and Considered toxic by all exposure routes.
The liquid is extremely corrosive and may rapidly cause severe burns to the gastrointestinal tract and may be fatal if swallowed in quantity.
Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Group 1, Carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Repeated minor exposure to mists can cause erosion of teeth and inflammation of the upper respiratory tract leading to chronic bronchitis.
Repeated skin contact with dilute solutions may cause dermatitis.
Lungs of sulfuric acid plant workers appear to be less affected than the lungs of workers exposed to "dust".
There is evidence that the corrosion of tooth enamel occurs at 1 mg/m^3 but that acclimatized workers could tolerate three to four times that level. Forming room workers in a battery factory exposed to 3 to 16 mg/m^3 sulfuric acid mist concentrations exhibited the most serious signs of erosion whilst charging room workers exposed to 0.08 to 2.5 mg/m^3 were affected to a lesser degree.
Workers chronically exposed to sulfuric acid mists may show various skin lesions, tracheobronchitis, stomatitis, conjunctivitis and gastritis.
Increased risk of laryngeal cancer is associted with chronic exposures.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.
DO NOT attempt to neutralize burns with alkaline solutions.

Ingestion: Rinse mouth out with plenty of water.
Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

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

Note to Physicians: For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

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SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.
EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

See DOT ERG

Fire Diamond

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Use extinguishing media suitable for surrounding area. Water spray or fog, from a safe distance only.
General Fire Hazards/Hazardous Combustion Products: HIGHLY CORROSIVE.
Noncombustible liquid. Reacts vigorously with water.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Contact with readily oxidizable organic material may cause ignition /fire.
Reacts with metals producing flammable/explosive hydrogen gas.
Decomposes on heating and produces acrid and toxic fumes of sulfur oxides (SO_x).
Fire Incompatibility: Reacts with mild steel, galvanized steel/zinc producing hydrogen gas which may form an explosive mixture with air.
Contact with readily oxidizable organic material may cause ignition /fire.
Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Wipe up. Place in a suitable labeled container for waste disposal.
Use soda ash or slaked lime to neutralize.
Large Spills: DO NOT touch the spill material. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Stop leak if safe to do so.
Contain spill with sand, earth or vermiculite.
Collect recoverable product into labeled containers for recycling.
Neutralize/decontaminate residue.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If contamination of drains or waterways occurs, advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Recommended Storage Methods: Glass carboy. Glass container is suitable for laboratory quantities.
Plastic carboy. Polylined drum.
Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
DO NOT use mild steel or galvanized containers.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.
Personal Protective Clothing/Equipment:
Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.
Respiratory Protection:
Exposure Range >1 to 10 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to <15 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range 15 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: white with dust/mist prefilter (use P100 or consult supervisor for appropriate dust/mist prefilter)
Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.
Glove Selection Index:
NATURAL RUBBER..... Best selection
NATURAL+NEOPRENE..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
NITRILE..... Best selection
PE..... Best selection
PVC..... Best selection
SARANEX-23 ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, oily, dense, HIGHLY CORROSIVE liquid. Faint acid odor.
Material is a powerful oxidizing and dehydrating agent causing rapid human tissue destruction on contact.
Concentrated acid is very exothermic (generates heat) when mixed with water.
DANGER: Adding water to acid will cause violent steam explosion, scattering corrosive acid. Always add acid slowly to water.
Mixes with alcohol in all proportions. Available in technical, pure and analytical grades

Physical State: Liquid
Odor Threshold: 1.0 mg/m^3
Vapor Pressure (kPa): 0.133 at 146 °C
Vapor Density (Air=1): 3.40
Formula Weight: 98.07
Specific Gravity (H_2O=1, at 4 °C): 1.6-1.84 at 15 °C
Evaporation Rate: Non Vol. at 38 °C
pH: < 1
pH (1% Solution): 1
Boiling Point: About 290 °C (554 °F)
Freezing/Melting Point: 10.36 °C (50.648 °F)
Decomposition Temperature (°C): 340

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Water Solubility: Soluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.
Reacts vigorously with water and alkali.
Contact with readily oxidizable organic material may cause ignition /fire.
Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 2140 mg/kg
Inhalation (rat) LC_{50}: 510 mg/m^3/2h
Inhalation (human) TC_{Lo}: 3 mg/m^3/24w

Irritation
Eye (rabbit): 1.38 mg SEVERE
Eye (rabbit): 5 mg/30sec SEVERE

See *RTECS* WS 5600000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: TL_m Lepomis macrochirus (bluegill) 24.5 ppm/24 hr fresh water /Conditions of bioassay not specified; LC_{50} Flounder 100 to 330 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC_{50} Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC_{50} Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible or consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an effluent treatment plant.
Use soda ash or slaked lime to neutralize.
Recycle containers, otherwise dispose of in an authorized landfill.
Bury residue in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Sulfuric acid *with more than 51 percent acid*
ID: UN1830
Hazard Class: 8 - Corrosive material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: A3, A7, B3, B83, B84, IB2, N34, T8, TP2, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** C **Other:** 14

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 1000 lb
TPQ: 1000 lb

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TSCA: Listed

Section 16 - Other Information

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SAFETY DATA SHEET

LONG DURATION FOAM AC-900 SERIES

Section 1. Identification

GHS product identifier : LONG DURATION FOAM AC-900 SERIES

Other means of identification : Aqueous anionic surfactant, polymer latex mixture.

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Product use : Aqueous Surfactant. Spray application for VOC and Odor control.

Area of application : Industrial applications.

Supplier/Manufacturer : Rusmar, Inc.
216 Garfield Avenue
West Chester, PA 19380
Phone: 610-436-4314
Fax: 610-436-8436

e-mail address of person responsible for this SDS : info@rusmarinc.com
Website: www.rusmarinc.com

Emergency telephone number (with hours of operation) : 888 488 8044 or 212 682 1200
CHEMTREC 800 424 9300

Section 2. Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Other means of identification : Aqueous anionic surfactant, polymer latex mixture.

CAS number/other identifiers

CAS number : Not available.

Product code : Not available.

Ingredient name	Other names	%	CAS number
Proprietary Surfactant.	-	100	-

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health and hence require reporting in this section.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

Section 4. First aid measures

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls/personal protection

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Viscous liquid.]

Color : Opaque. Gray.

Odor : Not available.

Odor threshold : Not available.

pH : Not available.

Melting point : Not available.

Boiling point : 99°C (210.2°F)

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Not applicable.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : 3.3 kPa (25 mm Hg) [room temperature]

Vapor density : Not available.

Relative density : 1.01 to 1.06

Solubility : Easily soluble in the following materials: cold water and hot water.

Solubility in water : Easily soluble.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : Keep from freezing.

Incompatible materials : No specific data.

Section 10. Stability and reactivity

Hazardous decomposition products : Low levels of sulfur oxides on combustion.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Conclusion/Summary : Not expected.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Section 11. Toxicological information

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-
Transport hazard class(es)	-	-	-
Packing group	-	-	-
Environmental hazards	No.	No.	No.
Additional information	-	-	-

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: Not determined.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

Section 15. Regulatory information

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

SARA 313

Not applicable.

State regulations

Massachusetts : None of the components are listed.

New York : None of the components are listed.

New Jersey : None of the components are listed.

Pennsylvania : None of the components are listed.

California Prop. 65

WARNING: This product contains less than 0.1% of a chemical known to the State of California to cause cancer. This product contains trace amounts of 1,4 Dioxane, a condition which creates the potential for human exposure. If this product is handled according to the recommendations in the MSDS, the presence of these trace amounts of 1,4 Dioxane is not expected to result in any short term or long term hazard.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
1,4-dioxane	Yes.	No.	Yes.	No.

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health	0
Flammability	0
Physical hazards	0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
Not classified.	

History

Date of issue/Date of revision	:	05/28/2015
Date of previous issue	:	No previous validation
Version	:	1
Prepared by	:	IHS
Key to abbreviations	:	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations

Section 16. Other information

References : HCS (U.S.A.)- Hazard Communication Standard
International transport regulations

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

LONG DURATION FOAM AC-645

Section 1. Identification

GHS product identifier : LONG DURATION FOAM AC-645

Chemical name : Proprietary Surfactant.

Other means of identification : Aqueous anionic surfactant mixture.

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Product use : Aqueous Surfactant. Spray application for VOC and Odor control.

Area of application : Industrial applications.

Supplier/Manufacturer : Rusmar, Inc.
216 Garfield Avenue
West Chester, PA 19380
Phone: 610-436-4314
Fax: 610-436-8436

e-mail address of person responsible for this SDS : info@rusmarinc.com
Website: www.rusmarinc.com

Emergency telephone number (with hours of operation) : 888 488 8044 or 212 682 1200
CHEMTREC 800 424 9300

Section 2. Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : Proprietary Surfactant.

Other means of identification : Aqueous anionic surfactant mixture.

CAS number/other identifiers

CAS number : Not available.

Product code : Not available.

Ingredient name	Other names	%	CAS number
Proprietary Surfactant.	-	100	-

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health and hence require reporting in this section.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Section 6. Accidental release measures

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Clear viscous liquid.]

Color : Translucent. White.

Odor : Odorless.

Odor threshold : Not available.

pH : Not available.

Melting point : Not available.

Boiling point : 99°C (210.2°F)

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Not applicable.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : 3.3 kPa (25 mm Hg) [room temperature]

Vapor density : Not available.

Relative density : 1.01 to 1.06

Solubility : Easily soluble in the following materials: cold water and hot water.

Solubility in water : Easily soluble.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : Keep away from heat.

Incompatible materials : No specific data.

Hazardous decomposition products : Low levels of sulfur oxides on exposure to high temperatures (concentrate).

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Conclusion/Summary : Not expected.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Section 11. Toxicological information

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Section 12. Ecological information

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-
Transport hazard class(es)	-	-	-
Packing group	-	-	-
Environmental hazards	No.	No.	No.
Additional information	-	-	-

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: Not determined.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

SARA 313

Not applicable.

State regulations

Massachusetts : This material is not listed.

New York : This material is not listed.

New Jersey : This material is not listed.

Pennsylvania : This material is not listed.

California Prop. 65

None of the components are listed.

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health	0
Flammability	0
Physical hazards	0

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Procedure used to derive the classification

Classification	Justification
Not classified.	

History

Date of issue/Date of revision	:	05/28/2015
Date of previous issue	:	No previous validation
Version	:	1
Prepared by	:	IHS
Key to abbreviations	:	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations

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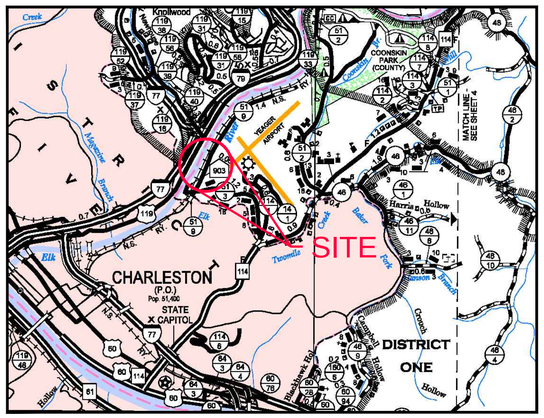
APPENDIX B

EROSION AND SEDIMENT CONTROL PLAN

CORE ENVIRONMENTAL SERVICES, INC.

LEWISBURG, WEST VIRGINIA



SITE LOCATION

DRAWING NUMBER	DESCRIPTION
C-1	PHASE 1 SEDIMENT AND EROSION CONTROL PLAN
C-2	PHASE 2 SEDIMENT AND EROSION CONTROL PLAN
C-3	PHASE 3 SEDIMENT AND EROSION CONTROL PLAN
C-4	PHASE 4 SEDIMENT AND EROSION CONTROL PLAN
C-5	PHASE 5 SEDIMENT AND EROSION CONTROL PLAN
C6 - C7	SEDIMENT AND EROSION CONTROL DETAILS

EROSION AND SEDIMENT CONTROL PLANS

FREEDOM INDUSTRIES SITE
ETOWAH RIVER TERMINAL
KANAWHA COUNTY, WEST VIRGINIA

OCTOBER 2015

JACOB C. WHITE, P.E. #15083

PLANS PREPARED BY:

RANDOLPH ENGINEERING
6767 TEAYS VALLEY ROAD SCOTT DEPOT, WV 25560-0346
OFFICE 304-757-9217 FAX 304-757-1029

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PROFESSIONAL ENGINEER REGISTERED IN THE FOLLOWING STATES: INDIANA, ILLINOIS, KENTUCKY, OHIO, WEST VIRGINIA. SURVEYOR REGISTERED IN OHIO, WEST VIRGINIA.

NOTES:

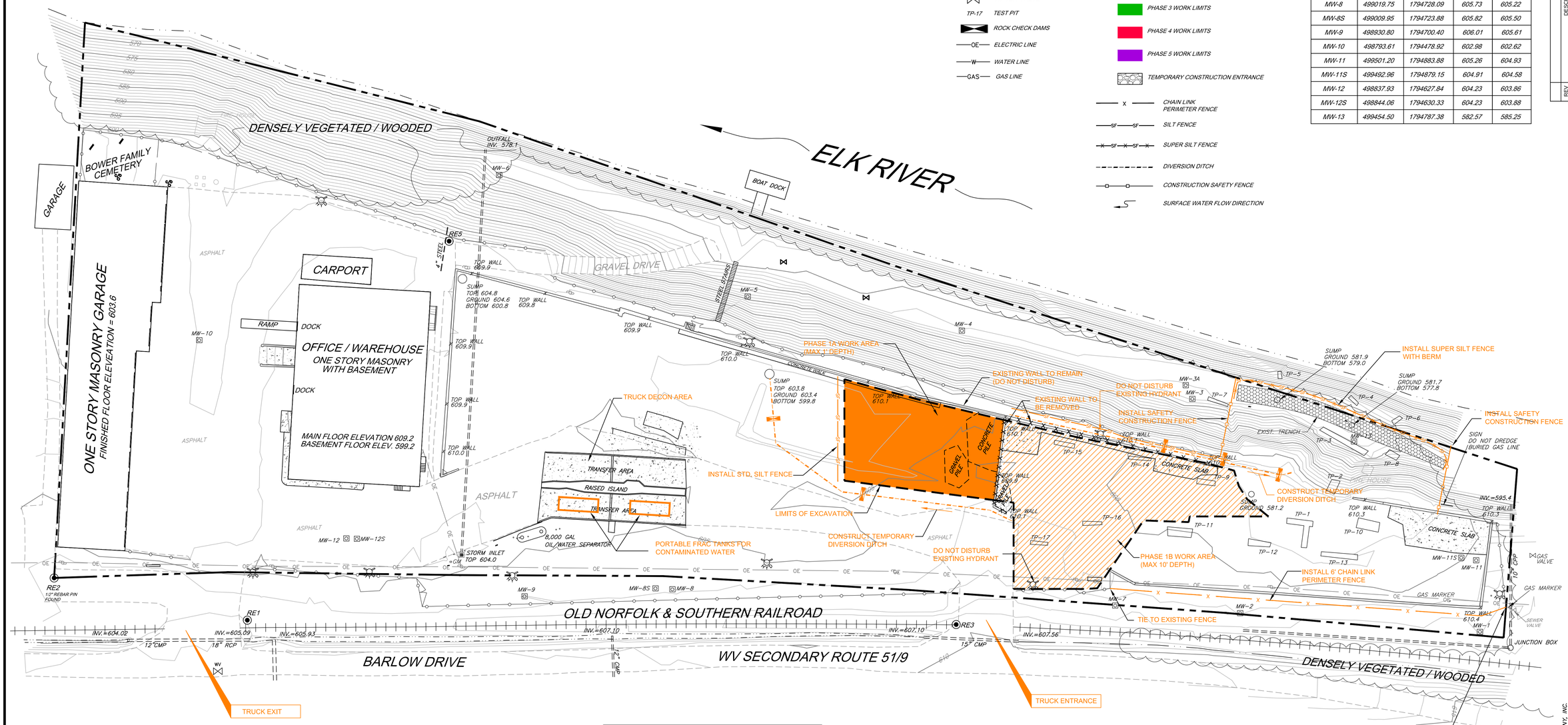
1. DURING PHASE 1A & 1B, INSTALL THE SUPER SILT FENCE AND BERM AS SHOWN ADJACENT TO THE EXISTING TRENCH ON THE BENCH ABOVE THE RIVER. CONSTRUCT TEMPORARY DIVERSION DITCH & SILT FENCE WEST O PHASE 1B WORK AREA. INSTALL CHAIN LINK PERIMETER FENCE AS SHOWN.
2. REFER TO THE WORK PLAN FOR SEQUENCING DETAILS.
3. GRADE BACKFILL PLACED IN PHASE 1A & 1B WORK LIMITS SUCH THAT IT SLOPES TO THE SOUTH & WEST AWAY FROM PHASE 2 WORK AREA.
4. SEED AND STRAW PHASE 1A & 1B WORK LIMITS UPON COMPLETION OF BACKFILL OPERATIONS.

LEGEND

- PROPERTY CORNER - 5/8" REBAR SET UNLESS NOTED
- PROPERTY CORNER - NOTHING SET
- UTILITY POLE
- DI STORM INLET
- FIRE HYDRANT
- WATER METER
- GV GAS VALVE
- WV WATER VALVE
- TP-17 TEST PIT
- ROCK CHECK DAMS
- OE ELECTRIC LINE
- W WATER LINE
- GAS GAS LINE
- PROPERTY LINE
- C/O CLEAN OUT
- MW-1 MONITORING WELL
- PHASE 1A WORK LIMITS
- PHASE 1B WORK LIMITS
- PHASE 2 WORK LIMITS
- PHASE 3 WORK LIMITS
- PHASE 4 WORK LIMITS
- PHASE 5 WORK LIMITS
- TEMPORARY CONSTRUCTION ENTRANCE
- X CHAIN LINK PERIMETER FENCE
- SF SILT FENCE
- SF X SF X SUPER SILT FENCE
- DIVERSION DITCH
- CONSTRUCTION SAFETY FENCE
- SURFACE WATER FLOW DIRECTION

MONITORING WELLS

WELL #	NORTHING	EASTING	GROUND	TOP OF CASING
MW-1	499488.03	1794927.00	607.95	607.61
MW-2	499350.28	1794864.36	606.92	606.27
MW-3	499368.15	1794727.38	582.47	585.58
MW-3A	499367.16	1794717.85	581.17	584.14
MW-4	499246.57	1794637.40	581.07	584.14
MW-5	499127.28	1794571.07	588.57	591.80
MW-6	499006.04	1794446.01	580.07	582.44
MW-7	499278.02	1794832.97	607.41	607.06
MW-8	499019.75	1794728.09	605.73	605.22
MW-8S	499009.95	1794723.88	605.82	605.50
MW-9	498930.80	1794700.40	606.01	605.61
MW-10	498793.61	1794478.92	602.98	602.62
MW-11	499501.20	1794883.88	605.26	604.93
MW-11S	499492.96	1794879.15	604.91	604.58
MW-12	498837.93	1794627.84	604.23	603.86
MW-12S	498844.06	1794630.33	604.23	603.88
MW-13	499454.50	1794787.38	582.57	585.25



SURVEY CONTROL

Point #	Elevation	Northing	Easting	Description
RE1	606.88	498761.74	1794654.83	REBAR & CAP
RE2	606.21	498656.63	1794588.31	REBAR
RE3	609.77	499179.91	1794809.99	MAGNAIL
RE5	603.41	498962.64	1794474.18	MAGNAIL

COORDINATES ARE WEST VIRGINIA STATE PLANE / SOUTH ZONE (4702)
NORTH AMERICA VERTICAL DATUM OF 1988

30' 15' 0 30'

PHASE 1A & 1B PLAN

SCALE: 1" = 30'

REV	DESCRIPTION OF REVISION	DATE	BY

SEAL

JACOB C. WHITE REGISTERED 15080 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Civil Engineering
Structural Engineering
Land/Site Development
Land Surveying
Environmental Engineering
Transportation Engineering
Demolition Planning
Shoring Design
Structural Inspections
Process Piping Design

Partnering to Make Your Vision a Reality

EROSION AND SEDIMENT CONTROL PLANS
FOR
FREEDOM INDUSTRY SITE
SITUATE IN ELK DISTRICT
KANAWHA COUNTY, WEST VIRGINIA

RANDOLPH ENGINEERING
4414 TEAYS VALLEY ROAD SCOTT DEPOT, WV 25560-0346
OFFICE 304-757-9217 FAX 304-757-1029

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DWG TYPE.	SHEET NO.
C	1 OF
DATE 10/16/15	
PROJECT NO. 2015149	SHEETS

NOTES:

1. CONSTRUCT TEMPORARY CONSTRUCTION ENTRANCE, TEMPORARY 8" STEEL PIPE AND ALL DIVERSION DITCHES AND SILT FENCE PRIOR TO BEGINNING CONSTRUCTION IN PHASE 2 WORK AREA.
2. REFER TO THE WORK PLAN FOR SEQUENCING DETAILS.
3. AFTER EXCAVATION AND BACKFILL OPERATIONS, GRADE PHASE 2 WORK LIMITS SUCH THAT IT SLOPES TO THE WEST TOWARD THE RIVER. REMOVE TEMPORARY DIVERSION DITCH ALONG THE WESTERN EDGE OF PHASE 1B BUT LEAVE THE SILT FENCE IN THIS AREA.
4. SEED AND STRAW PHASE 2 WORK LIMITS UPON COMPLETION OF BACKFILL OPERATIONS..

LEGEND

- PROPERTY CORNER - 5/8" REBAR SET UNLESS NOTED
- PROPERTY CORNER - NOTHING SET
- UTILITY POLE
- DI STORM INLET
- FIRE HYDRANT
- W WATER METER
- GV GAS VALVE
- WV WATER VALVE
- TP-17 TEST PIT
- ROCK CHECK DAMS
- OE ELECTRIC LINE
- W WATER LINE
- GAS GAS LINE
- PROPERTY LINE
- C/O CLEAN OUT
- MW-1 MONITORING WELL
- PHASE 1A WORK LIMITS
- PHASE 1B WORK LIMITS
- PHASE 2 WORK LIMITS
- PHASE 3 WORK LIMITS
- PHASE 4 WORK LIMITS
- PHASE 5 WORK LIMITS
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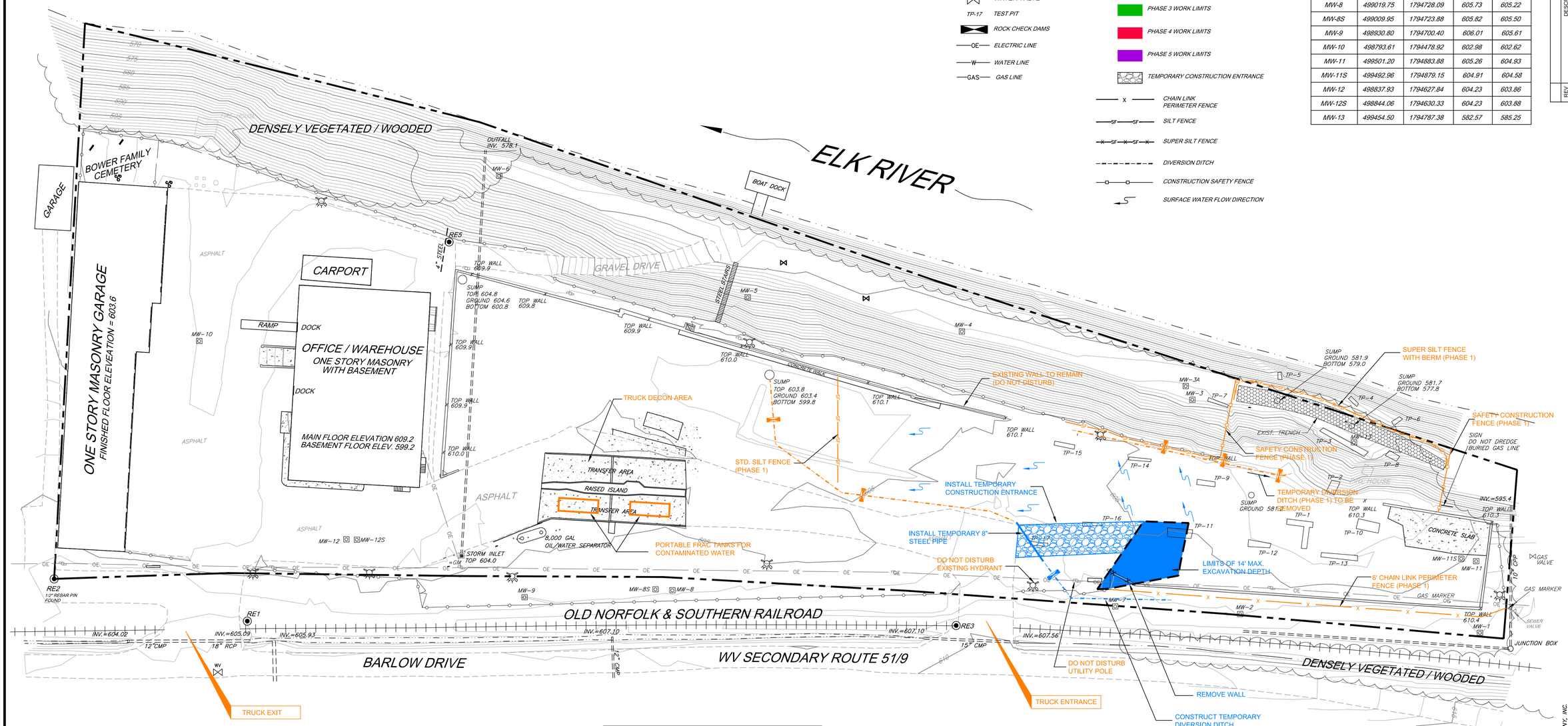
- SF SILT FENCE
- SF X SF X SUPER SILT FENCE
- DIVERSION DITCH
- CONSTRUCTION SAFETY FENCE
- SURFACE WATER FLOW DIRECTION



SURVEY CONTROL				
Point #	Elevation	Northing	Easting	Description
RE1	606.88	498761.74	1794654.83	REBAR & CAP
RE2	606.21	498656.63	1794588.31	REBAR
RE3	609.77	499179.91	1794809.99	MAGNAIL
RE5	603.41	498962.64	1794474.18	MAGNAIL

COORDINATES ARE WEST VIRGINIA STATE PLANE / SOUTH ZONE (4702)
NORTH AMERICA VERTICAL DATUM OF 1988

MONITORING WELLS				
WELL #	NORTHING	EASTING	GROUND	TOP OF CASING
MW-1	499488.03	1794927.00	607.95	607.61
MW-2	499350.28	1794864.36	606.92	606.27
MW-3	499368.15	1794727.38	582.47	585.58
MW-3A	499367.16	1794717.85	581.17	584.14
MW-4	499246.57	1794637.40	581.07	584.14
MW-5	499127.28	1794571.07	588.57	591.80
MW-6	499006.04	1794446.01	580.07	582.44
MW-7	499278.02	1794832.97	607.41	607.06
MW-8	499019.75	1794728.09	605.73	605.22
MW-8S	499009.95	1794723.88	605.82	605.50
MW-9	498930.80	1794700.40	606.01	605.61
MW-10	498793.61	1794478.92	602.98	602.62
MW-11	499501.20	1794883.88	605.26	604.93
MW-11S	499492.96	1794879.15	604.91	604.58
MW-12	498837.93	1794627.84	604.23	603.86
MW-12S	498844.06	1794630.33	604.23	603.88
MW-13	499454.50	1794787.38	582.57	585.25

30' 15' 0 30'

PHASE 2 PLAN

SCALE: 1" = 30'

REV	DESCRIPTION OF REVISION	DATE	BY

SEAL

SEAL JACOB C. WHITE REGISTERED 15089 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

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Structural Engineering
Land/Site Development
Land Surveying
Environmental Engineering
Transportation Engineering
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EROSION AND SEDIMENT CONTROL PLANS
FOR
FREEDOM INDUSTRY SITE
SITUATE IN ELK DISTRICT
KANAWHA COUNTY, WEST VIRGINIA

RANDOLPH ENGINEERING
4414 TEAYS VALLEY ROAD SCOTT DEPOT, WV 25560-0346
OFFICE 304-757-9217 FAX 304-757-1029

DWG TYPE.	SHEET NO.
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DATE 10/16/15	
PROJECT NO. 2015149	SHEETS

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NOTES:

1. EXTEND TEMPORARY CONSTRUCTION ENTRANCE TO PHASE 3 WORK AREA, INSTALL TEMPORARY 8" STEEL PIPE AND ALL DIVERSION DITCHES PRIOR TO BEGINNING CONSTRUCTION IN PHASE 3 WORK AREA.
2. REFER TO THE WORK PLAN FOR SEQUENCING DETAILS.
3. AFTER EXCAVATION AND BACKFILL OPERATIONS, GRADE PHASE 3 TO THE APPROXIMATE ORIGINAL CONTOUR.
4. SEED AND STRAW ENTIRE DISTURBED AREA, EXCLUDING PHASE 4 TEMPORARY CONSTRUCTION ACCESS. USE EROSION MATTING ON ALL SLOPED AREAS.

LEGEND

- PROPERTY CORNER - 5/8" REBAR SET UNLESS NOTED
- PROPERTY CORNER - NOTHING SET
- UTILITY POLE
- DI STORM INLET
- FIRE HYDRANT
- WATER METER
- GV GAS VALVE
- WV WATER VALVE
- TP-17 TEST PIT
- ROCK CHECK DAMS
- OE ELECTRIC LINE
- W WATER LINE
- GAS GAS LINE
- PROPERTY LINE
- C/O CLEAN OUT
- MW-1 MONITORING WELL
- PHASE 1A WORK LIMITS
- PHASE 1B WORK LIMITS
- PHASE 2 WORK LIMITS
- PHASE 3 WORK LIMITS
- PHASE 4 WORK LIMITS
- PHASE 5 WORK LIMITS
- TEMPORARY CONSTRUCTION ENTRANCE
- X CHAIN LINK PERIMETER FENCE
- SF SILT FENCE
- SF X SF X SUPER SILT FENCE
- DIVERSION DITCH
- CONSTRUCTION SAFETY FENCE
- SURFACE WATER FLOW DIRECTION

MONITORING WELLS

WELL #	NORTHING	EASTING	GROUND	TOP OF CASING
MW-1	499488.03	1794927.00	607.95	607.61
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MW-9	498930.80	1794700.40	606.01	605.61
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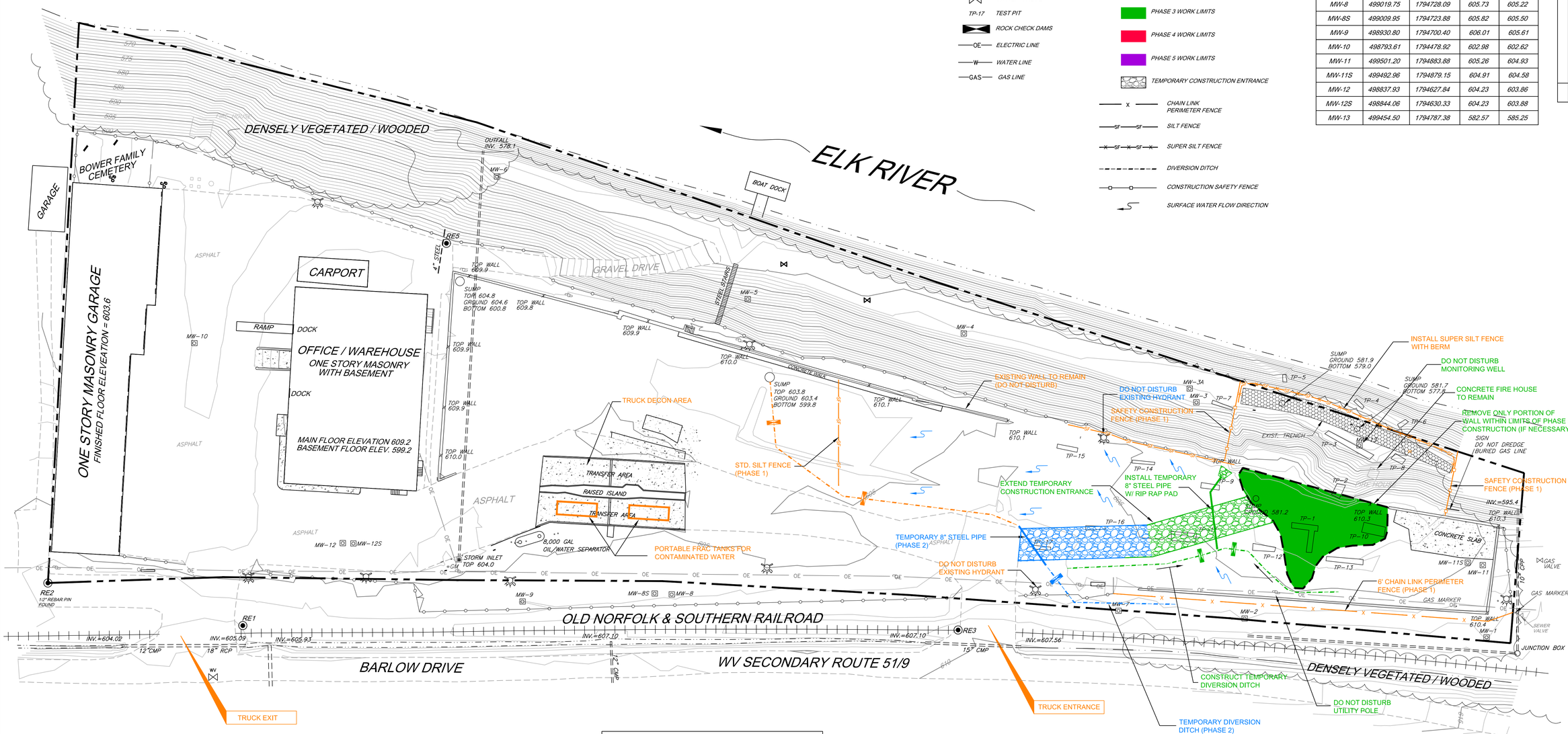
MW-12S	498844.06	1794630.33	604.23	603.88
MW-13	499454.50	1794787.38	582.57	585.25



SURVEY CONTROL

Point #	Elevation	Northing	Easting	Description
RE1	606.88	498761.74	1794654.83	REBAR & CAP
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COORDINATES ARE WEST VIRGINIA STATE PLANE / SOUTH ZONE (4702)
NORTH AMERICA VERTICAL DATUM OF 1988

30' 15' 0 30'

PHASE 3 PLAN

SCALE: 1" = 30'

REV	DESCRIPTION OF REVISION	DATE	BY

SEAL

Seal: NICOS C. WHITE, REGISTERED PROFESSIONAL ENGINEER, 15083, STATE OF WEST VIRGINIA

Civil Engineering
Structural Engineering
Land/Site Development
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NOTES:

1. EXTEND TEMPORARY CONSTRUCTION ENTRANCE TO TOP OF SLOPE ABOVE PHASE 4 WORK AREA.
2. REFER TO THE WORK PLAN FOR SEQUENCING DETAILS.
3. AFTER BACKFILLING PHASE 4 WORK AREA, CONSTRUCT ACCESS BENCH ON SLOPE FOR PHASE 5 WORK AREA.
4. SEED AND STRAW PHASE 4 WORK AREA OUTSIDE OF ACCESS BENCH AREA. USE EROSION MATTING ON ALL SLOPED AREAS.

LEGEND

- PROPERTY CORNER - 5/8" REBAR SET UNLESS NOTED
- PROPERTY CORNER - NOTHING SET
- UTILITY POLE
- DI STORM INLET
- FIRE HYDRANT
- W WATER METER
- GV GAS VALVE
- WV WATER VALVE
- TP-17 TEST PIT
- ROCK CHECK DAMS
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- C/O CLEAN OUT
- MW-1 MONITORING WELL
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- TEMPORARY CONSTRUCTION ENTRANCE
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- SF SILT FENCE
- SF SUPER SILT FENCE
- DIVERSION DITCH
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MONITORING WELLS				
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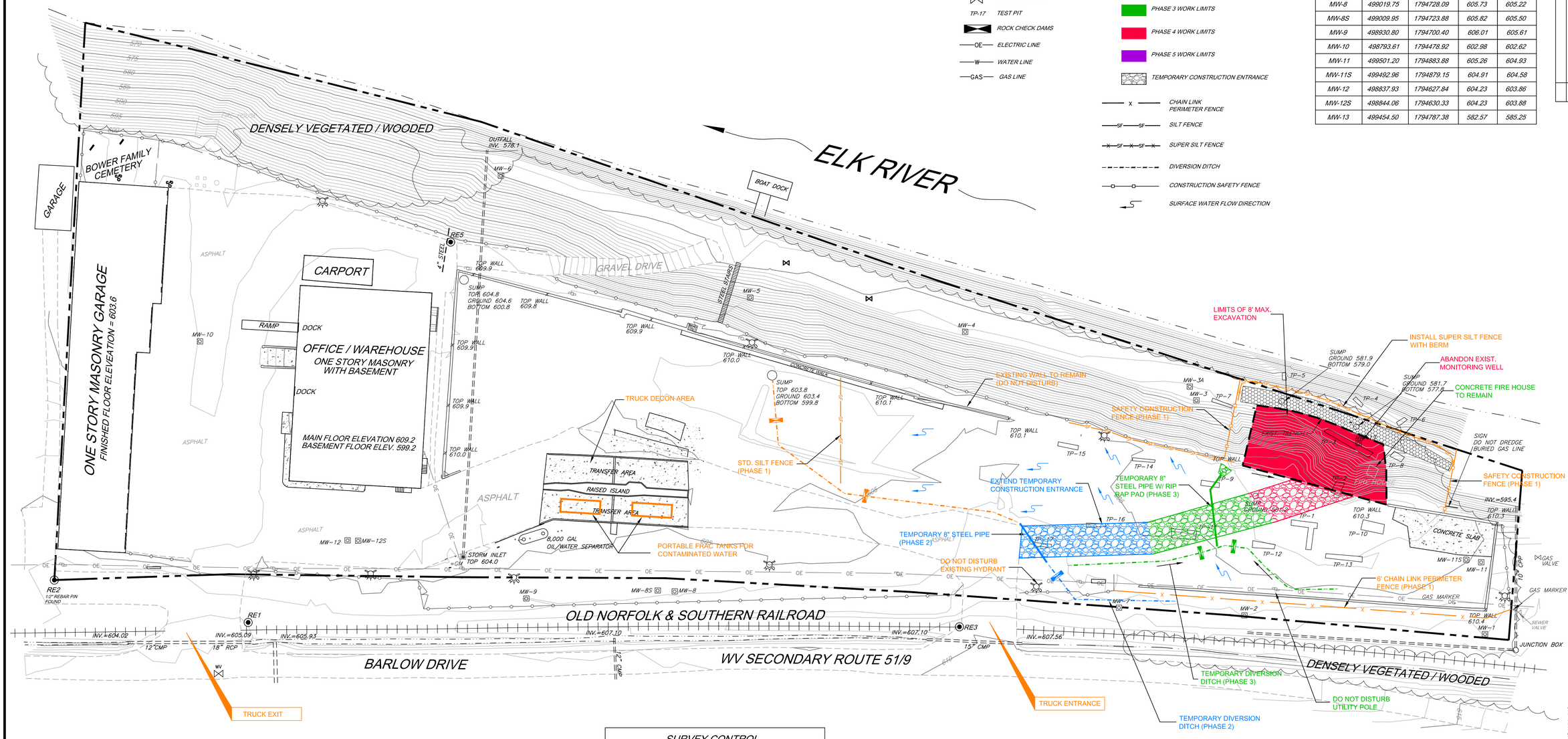

SURVEY CONTROL				
Point #	Elevation	Northing	Easting	Description
RE1	606.88	498761.74	1794654.83	REBAR & CAP
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COORDINATES ARE WEST VIRGINIA STATE PLANE / SOUTH ZONE (4702)
NORTH AMERICA VERTICAL DATUM OF 1988

30' 15' 0 30'

PHASE 4 PLAN

SCALE: 1" = 30'

REV	DESCRIPTION OF REVISION	DATE	BY

SEAL

JACOB C. WHITNEY REGISTERED 15083 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Civil Engineering
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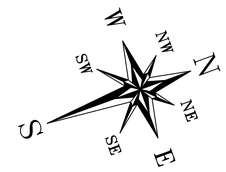
NOTES:

1. INSTALL HDPE PLASTIC LINER AT THE TOP OF THE PHASE 4 WORK AREA TO CONTAIN MATERIAL EXCAVATED FROM EXISTING TRENCH.
2. REFER TO THE WORK PLAN FOR SEQUENCING DETAILS.
3. EXCAVATE TRENCH, REPLACE WITH CLEAN MATERIAL, IN KIND, AND RE-ESTABLISH CONTAINMENT BERM.
4. AFTER TRENCH MATERIAL IS REMOVED AND HAULED OFF SITE, REMOVE HDPE LINER AND 6" OF ADDITIONAL SOIL IN THIS AREA.
5. RE-INSTALL THE TWO SUMPS, PUMPS AND PIPING IN THE TRENCH.
6. REMOVE CONSTRUCTION ACCESS, TEMPORARY PIPES AND DIVERSION DITCHES.
7. REGRADE AND SLOPE THE PHASE 4 & 5 WORK AREAS.
8. SEED AND STRAW ENTIRE DISTURBED AREA. USE EROSION MATTING ON ALL SLOPED AREAS.
9. THE SILT FENCE AND SUPER SILT FENCE SHALL REMAIN AND MAY BE REMOVED AFTER VEGETATIVE COVER EXCEEDS 70% COVERAGE.



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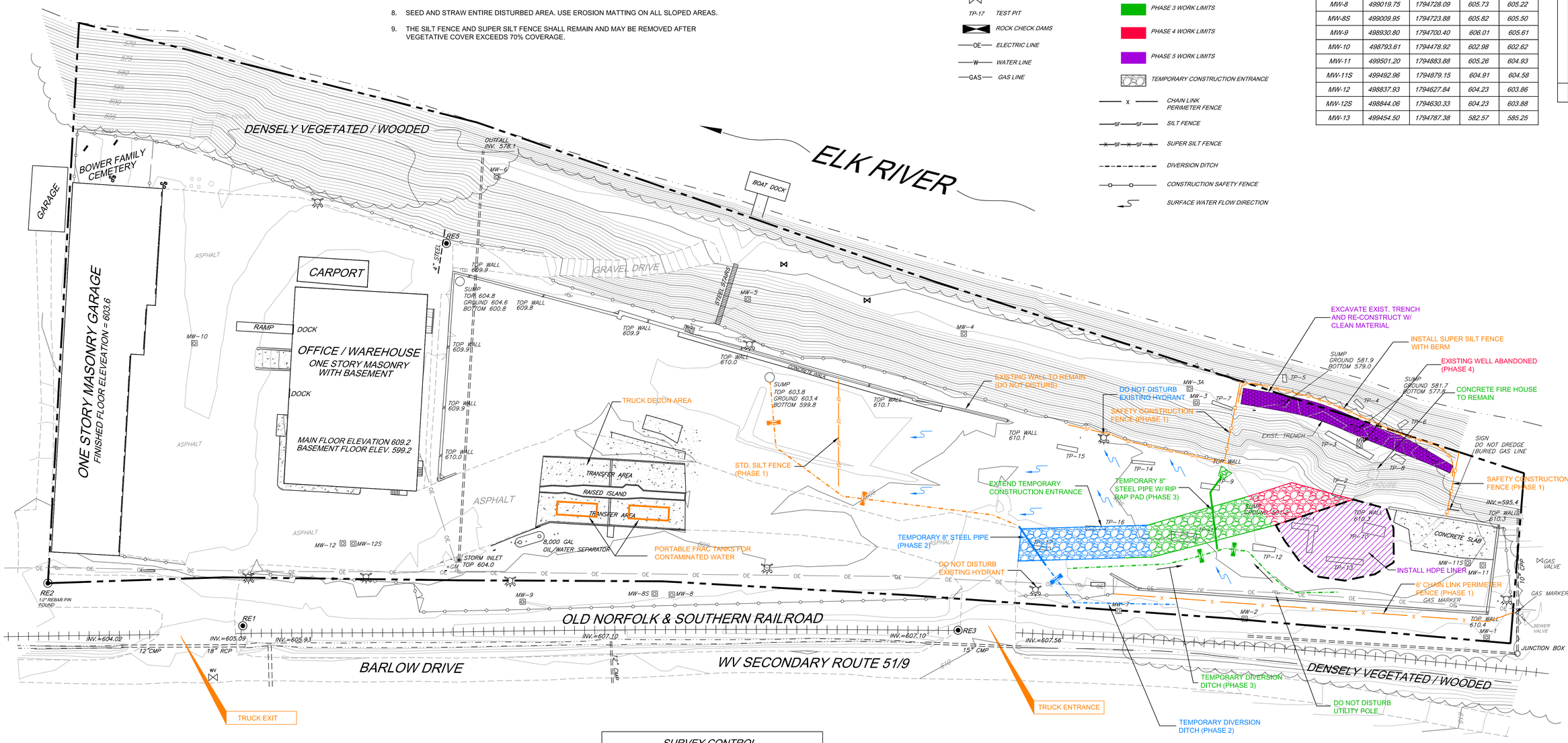

SURVEY CONTROL

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NORTH AMERICA VERTICAL DATUM OF 1988

30' 15' 0 30'

PHASE 5 PLAN

SCALE: 1" = 30'

REV	DESCRIPTION OF REVISION	DATE	BY

SEAL

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EROSION & SEDIMENT CONTROL GENERAL NOTES:

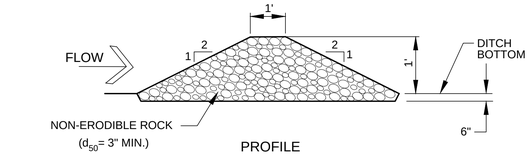
1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. ADDITIONAL SILT FENCE MAY BE REQUIRED AS DIRECTED.
3. SILTATION CONTROL DEVICES TO REMAIN IN PLACE UNTIL 70% VEGETATION COVERAGE HAS BEEN ESTABLISHED.
4. SILTATION FENCES SHALL BE INSPECTED DAILY, AND AS NECESSARY ON WEEKENDS FOR DAMAGE AND FOR AMOUNT OF SEDIMENTATION WHICH HAS ACCUMULATED. REMOVAL OF SEDIMENT WILL BE REQUIRED WHEN IT REACHES 1/4 OF THE HEIGHT OF THE SILTATION FENCE.
5. SILT FENCE SHALL BE INSTALLED PERPENDICULAR TO FLOW.
6. CONTRACTOR SHALL DOCUMENT & RECORD ALL INSPECTION AND MAINTENANCE ACTIVITIES SUCH AS CLEANING SEDIMENT BASINS OR TRAPS AND OTHER SEDIMENT TRAPPING STRUCTURES OR CATCH BASINS AS WELL AS ALL RE-SEEDING & MULCHING.
7. CONTRACTOR SHALL DEVELOP IN ACCORDANCE WITH THESE PLANS A DETAILED PLAN AND SCHEDULE FOR MAINTENANCE OF ALL PERMANENT AND TEMPORARY SEDIMENT CONTROL STRUCTURES. THIS PLAN SHALL INCLUDE A DESCRIPTION OF PROCEDURES TO MAINTAIN IN GOOD AND EFFECTIVE CONDITION AND PROMPTLY REPAIR OR RESTORE ALL GRADE SURFACES, WALLS, DAMS AND STRUCTURES, VEGETATION, EROSION AND SEDIMENT CONTROL MEASURES AND OTHER PROTECTIVE DEVICES. AT A MINIMUM, PROCEDURES IN THE PLAN SHALL PROVIDE THAT ALL EROSION CONTROLS ON THE SITE BE INSPECTED AT LEAST ONCE EVERY DAY AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.5 INCHES OF RAIN PER 24 HOURS.
8. EROSION AND SEDIMENT CONTROL INSPECTION SHALL BE PERFORMED DURING WEEKENDS WHEN STORMWATER MANAGEMENT IS NECESSARY. COORDINATE INSPECTIONS WITH WVDEP.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR TRAINING EMPLOYEES IN PROPER USE OF SEDIMENT AND EROSION CONTROL DEVICES.
10. AS CONSTRUCTION ACTIVITIES PROGRESS IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO ADJUST THE EROSION & SEDIMENT PLAN ACCORDINGLY, WITH APPROVAL OF ENGINEER.
11. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED IMMEDIATELY UPON REACHING FINAL GRADE. IN THE EVENT THE CONSTRUCTION ACTIVITY STOPS FOR (1) ONE WEEK OR MORE IN AN AREA, THAT AREA SHALL BE IMMEDIATELY SEEDED AND MULCHED WITH A TEMPORARY VEGETATIVE COVER.

SEEDING NOTE:

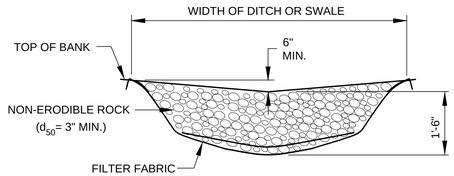
THE DISTURBED AREA SHALL BE SEEDED AND MULCHED WITH A TEMPORARY VEGETATIVE COVER USING THE FOLLOWING RATES:

- 10 LB/AC OF ANNUAL RYE GRASS AND 50LB/AC OF CEREAL RYE
- 2 TONS/AC OF STRAW OR HAY MULCH
- 1000 LB/AC OF LIME
- 800 LB/AC OF 10-20-10 FERTILIZER

VERIFY LIME AND FERTILIZER RATES THROUGH SOIL ANALYSIS.



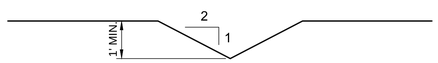
PROFILE



CROSS SECTION

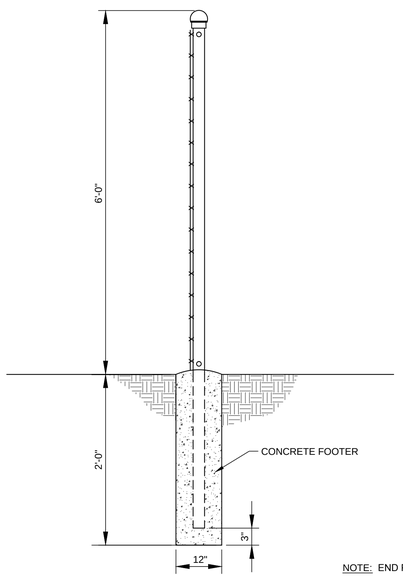
DETAIL

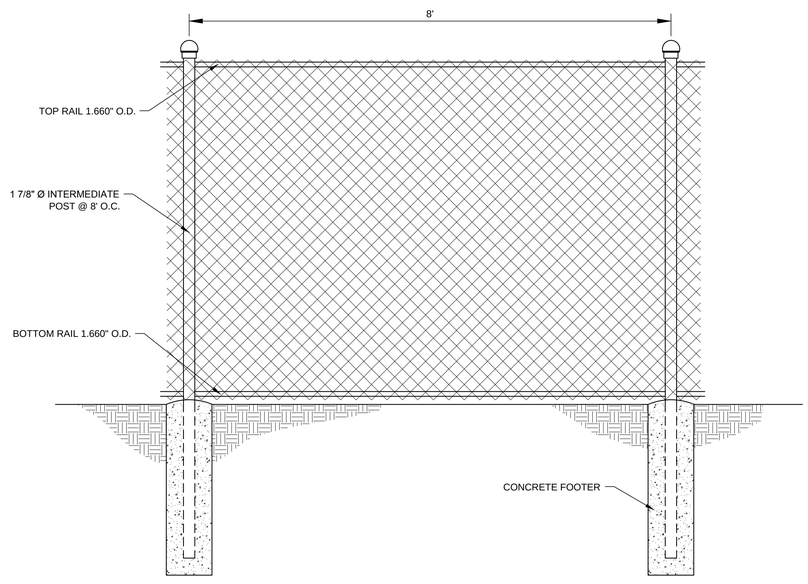
TYPICAL ROCK CHECK DAM — NOT TO SCALE



SECTION

TYPICAL TEMPORARY DIVERSION DITCH — NOT TO SCALE

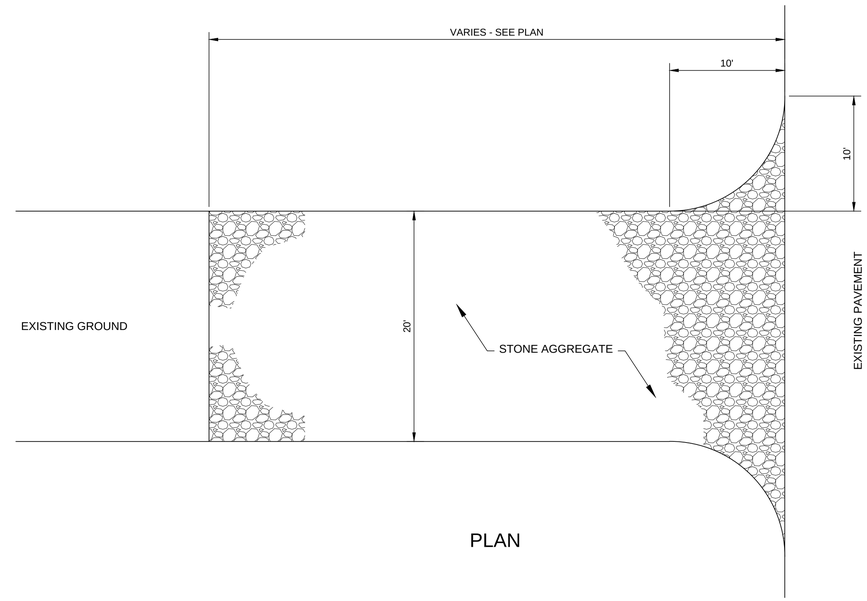




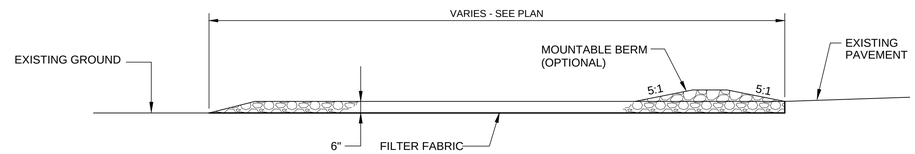
NOTE: END POST SHALL BE 2 1/2" Ø

DETAIL

PERIMETER FENCE — NOT TO SCALE



PLAN



PROFILE

NOTES:
1. STONE SIZE - USE 2" MIN. STONE SIZE OR CRUSHED CONCRETE EQUIVALENT.
2. LENGTH - AS REQUIRED, BUT NOT LESS THAN 50'.
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWENTY (20') FEET MINIMUM, BUT NOT LESS THAN THE FULL WIDTH OF PROPOSED ENTRANCE.
5. FILTER FABRIC SHALL BE PLACED OVER ENTIRE AREA PRIOR TO PLACING STONE.
6. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING ONTO RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY SHALL BE REMOVED IMMEDIATELY.
7. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH SIGNIFICANT STORM EVENTS.

DETAIL

CONSTRUCTION ENTRANCE — NOT TO SCALE

QUANTITIES

SILT FENCE	215 LF
SUPER SILT FENCE	170 LF
SAFETY CONSTRUCTION FENCE	110 LF
PERIMETER FENCE	255 LF
ROCK CHECK DAMS	8 EA
ROCK TRENCH	50 CY
ROCK RIP-RAP	3 CY
CONSTRUCTION ENTRANCE	75 CY
8" STEEL PIPE	85 LF
HDPE LINER	2700 SF

EROSION & SEDIMENT CONTROL DETAILS

SCALE: N.T.S.

REV	DESCRIPTION OF REVISION	DATE	BY

SEAL

SEAL — JACOB C. WHITE, REGISTERED, 15083, STATE OF WEST VIRGINIA, PROFESSIONAL ENGINEER

Civil Engineering
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Land/Site Development
Land Surveying
Environmental Engineering
Transportation Engineering
Demolition Planning
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Structural Inspections
Process Piping Design
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EROSION AND SEDIMENT CONTROL PLANS FOR FREEDOM INDUSTRIES SITE
SITUATE IN ELK DISTRICT
KANAWHA COUNTY, WEST VIRGINIA

RANDOLPH ENGINEERING
4414 TEAYS VALLEY ROAD SCOTT DEPOT, WV 25560-0346
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DWG TYPE.	SHEET NO.
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PROJECT NO. 2015149	SHEETS

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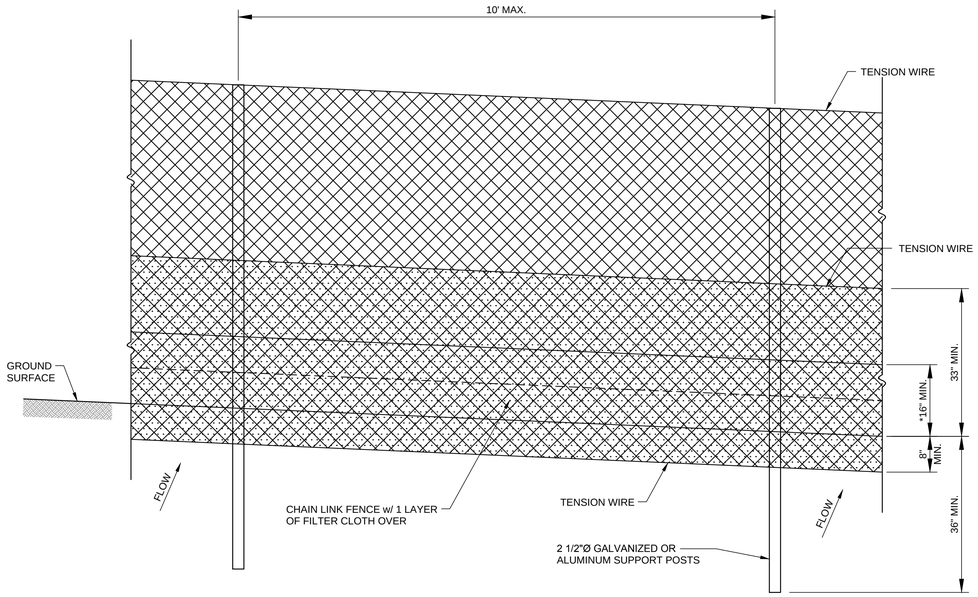
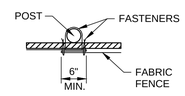
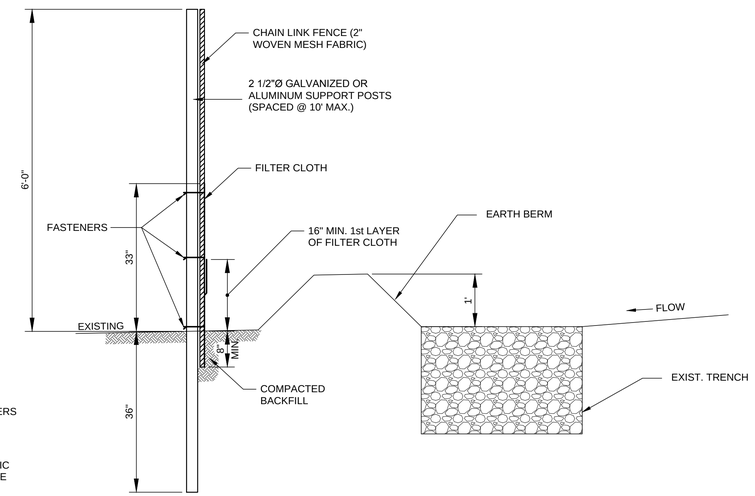


* FIRST LAYER OF FILTER CLOTH

ELEVATION



JOINING FENCE SECTIONS



END VIEW

NOTES:

1) CHAIN LINK TO POST FASTENERS SPACED @ 14" MAX. USE NO. 6 GA. ALUMINUM WIRE OR NO. 9 GALVANIZED STEEL PRE-FORMED CLIPS. CHAIN LINK TO TENSION WIRE FASTENERS SPACED @ 60" MAX. USE NO. 10 GA. GALVANIZED STEEL WIRE. FABRIC TO CHAIN FASTENERS SPACED @24" MAX. c/c.

2) INSTALL NO. 7 GA. TENSION WIRE HORIZONTALLY AT TOP AND BOTTOM OF CHAIN-LINK FENCE.

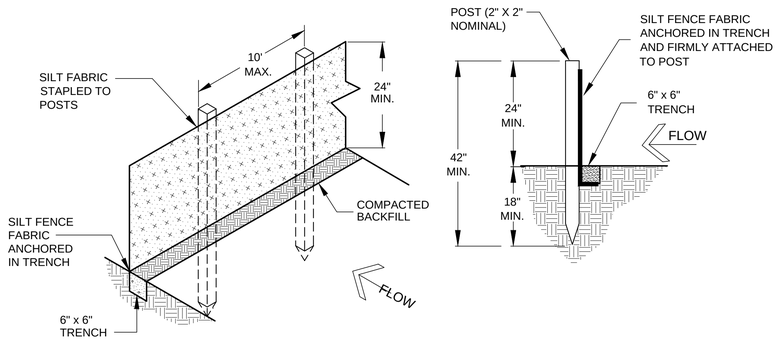
3) FILTER FABRIC FENCE MUST BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER MUST BE EXTENDED AT LEAST 8 FEET UPSLOPE AT 45 DEGREES TO MAIN BARRIER ALIGNMENT.

4) SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH 1/4 THE ABOVE GROUND HEIGHT OF THE FENCE.

5) FENCE POST SPACING SHALL NOT EXCEED 10' c/c.

DETAIL

SUPER SILT FENCE — NOT TO SCALE



DETAIL

STANDARD SILT FENCE — NOT TO SCALE

EROSION & SEDIMENT CONTROL DETAILS

SCALE: N.T.S.

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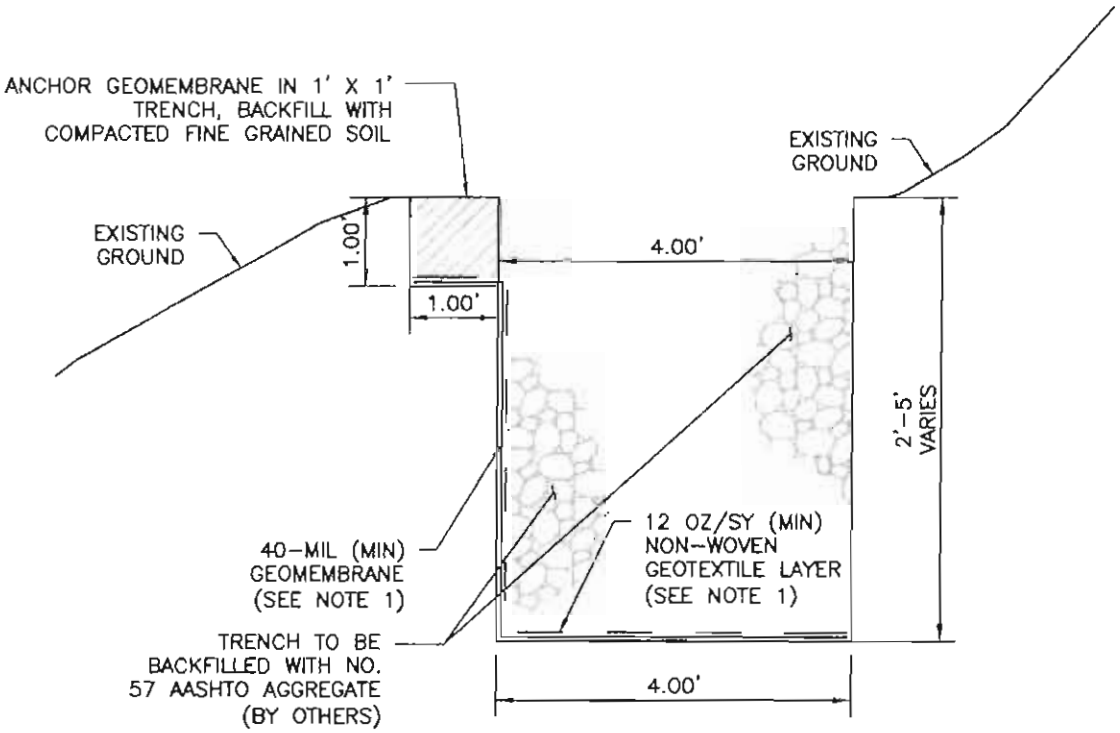
0	7 OF
DATE 8/21/15	
PROJECT NO. 2015149	SHEETS

APPENDIX C

COLLECTION TRENCH CONSTRUCTION DETAILS



1
FIG.1

COLLECTION TRENCH

N.T.S.

NOTES:

1. GEOMEMBRANE AND GEOTEXTILE TO BE INSTALLED AT BOTTOM AND DOWNHILL SIDE OF CUTOFF TRENCH

* HAND SIGNATURE ON FILE

Civil & Environmental Consultants, Inc.
333 Baldwin Road · Pittsburgh, PA 15205
412-429-2324 · 800-365-2324
www.cecinc.com

FREEDOM INDUSTRIES
CHARLESTON, WEST VIRGINIA

COLLECTION TRENCH DETAIL

DRAWN BY:	JMB	CHECKED BY:	RCD	APPROVED BY:	*RCD	FIGURE NO.:	3
DATE:	2/04/2014	DWG SCALE:	N.T.S.	PROJECT NO:	140-256		

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APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

QUALITY ASSURANCE PROJECT PLAN

FREEDOM INDUSTRIES

WEST VIRGINIA VOLUNTARY REMEDIATION PROGRAM

VRA # 15017

DECEMBER 17, 2015
REVISION 3

Prepared for:

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ACRONYM GLOSSARY

ALS-C	ALS Environmental's Cincinnati, Ohio Laboratory
ALS-H	ALS Environmental's Holland, Michigan Laboratory
CAS	Chemical Abstract Number
CCV	Continuing Calibration Verification
CORE	CORE Environmental Services, Inc.
DL	Detection Limit
DQO	Data Quality Objectives
FOM	Field Operations Manager
GPS	Global Positioning System
ICP	Inductively Coupled Plasma
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IS	Internal Standard
LCS	Laboratory Control Samples
LOQ	Limit of Quantitation
LRS	Licensed Remediation Specialist
MB	Method Blank
MCHM	4-methyl-1-cyclohexanemethanol
MD	Matrix Duplicate
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
OER	Office of Environmental Remediation
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PPH	Propylene glycol phenyl ether
PQL	Practical Quantitation Limit
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QAO	Quality Assurance Officer
QC	Quality Control
RBC	Risk-Based Concentration
RL	Reporting Limit
RPD	Relative Percent Deviation
RSD	Relative Standard Deviation
SQL	Sample Quantitation Limit
VOC	Volatile Organic Compound
VRP	Voluntary Remediation Program
WVDEP	West Virginia Department of Environmental Protection

1.0 Introduction

The objective of the site assessment activities, to which this quality assurance project plan (QAPP) applies, is to facilitate a Certificate of Completion in accordance with the Voluntary Remediation Agreement (VRA) and achieve compliance with the Bankruptcy Court Order and the November 2014 Consent Order between Freedom Industries and the West Virginia Department of Environmental Protection (WVDEP).

2.0 Data Quality Objectives (DQOs)

In accordance with the requirements of the Voluntary Remediation Program (VRP), field samples will be analyzed for 4-methyl-1-cyclohexanemethanol (MCHM) and propylene glycol phenyl ether (PPH) by a WVDEP certified laboratory. Soil and aqueous samples will be analyzed using promulgated US EPA methodology such as those listed in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition* (SW-846). Air samples will be analyzed using the National Institute for Occupational Safety and Health (NIOSH) guidelines for air sampling and analytical method development and evaluation. These methodologies specify Quality Assurance and Quality Control (QA/QC) procedures that are to be implemented by the approved laboratory performing the analyses.

MCHM and PPH are not listed method analytes in SW-846 or NIOSH, and as such, project laboratories must demonstrate proficiency prior to sample analysis. QA/QC method validation documentation applicable to MCHM and PPH analytical proficiency, data usability, and defensibility will be verified and validated independently. This documentation may include, but not be limited to: laboratory quality manuals, standard operating procedures (SOPs), method detection limit studies, analyst demonstration of proficiency, and control charts. Findings of major insufficiencies that impact data usability and defensibility will be provided to the laboratory. The laboratory must initiate corrective action prior to sample analysis.

A minimum of 10% of the project data generated will be verified and validated independently prior to use.

Based on CORE Environmental Services' (CORE) Interim Remedial Action Work Plan, soil, surface water, and air monitoring samples will be collected. See Table 1 for details regarding sample quantity and required analyses.

ALS Environmental has been chosen to perform analytical services. ALS Environmental's Cincinnati, Ohio, laboratory (ALS-C) will perform the air sample analysis. ALS Environmental's Holland, Michigan laboratory (ALS-H) will perform the soil and aqueous sample analysis. ALS-C and ALS-H are WVDEP-certified laboratories. However, the WVDEP does not certify laboratories for air analysis. West Virginia Rule 47 CSR 32 "Environmental Laboratories Certification and Standards of Performance" governs the certification of laboratories conducting environmental analysis of waste and wastewater only.

Due to the data collected during the field sampling activities being screened and compared to *de minimis* risk-based environmental standards and criteria, each individual solid sample must be corrected for percent moisture content.

3.0 Data Usability Objectives

In order to meet the data usability requirements of the project, practical quantitation limits (PQLs) for each compound in each media have been established. A summary of the established PQLs is presented on Table 2. The PQLs will be provided to the laboratory at least 10 days prior to sample receipt, and will be provided with each Chain-of-Custody to the laboratory. If the PQLs cannot be met for any reason, CORE must be notified immediately.

Data collected during the field sampling activities will be screened and compared to the following *de minimis* environmental standards and criteria:

- *WV de minimis Levels, Table 60-3B* (Revised June 2014) industrial soil and groundwater risk-based concentrations (RBCs).
- MCHM/PPH PQLs.

4.0 Laboratory Quality Control Samples

4.1 Detection Limit (DL)

A DL is a measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte, instrument, and matrix specific and may be laboratory dependent. Some of the more commonly used definitions are described below.

Instrument Detection Limit (IDL) - The lowest concentration or mass an instrument can detect above background instrument noise under ideal conditions. IDLs are typically applied to the analysis of metals. Sample preparation is not considered in the determination of an IDL.

Method Detection Limit (MDL) - A statistically derived estimate of the lowest concentration or mass detectable under method conditions at the concentration evaluated. A series of standards at an estimated limit of detection is analyzed multiple times (usually seven). Then a standard deviation of these seven replicate analyses is determined and the standard deviation is multiplied by the Student's t-distribution statistic at 6 degrees of freedom. Sample preparation is considered in the determination of an MDL.

Practical Quantitation Limit (PQL) - A measure of the lowest limit of detection under the conditions of a particular method. The PQL is often determined by multiplying the MDL by a factor between 3 and 10. The acceptable PQLs for the parameters in this study are provided on Table 2.

Reporting Limit (RL), Limit of Quantitation (LOQ), or Sample Quantitation Limit (SQL) - For a target analyte, the RL, LOQ, or SQL (these acronyms are synonymous) is instrument dependent and based on the lowest concentration point of the instrument's current calibration curve. It is also sample specific, as percent moisture, dilution factor, and sample preparation variables are to be included in the calculation of the final RL, LOQ, or SQL.

For this project, each compound of interest will be reported at its appropriate MDL <u>and</u> RL, LOQ, or SQL.

Where technologically feasible, the MDLs must meet the *de minimis* environmental standards and criteria listed in section 3.0 of this QAPP. If the MDLs are not technologically feasible by the laboratory, the laboratory must communicate this prior to sample receipt and reporting.

4.2 Instrument Calibrations

A calibration is a comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments. Laboratory instrument calibrations typically consist of two types: initial calibration verification (ICV) and continuing calibration verification (CCV).

Initial Calibration Verification – ICV procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, a minimum of three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is commonly expressed as a correlation coefficient or response factor. Any detected compound whose response is below the calibration range of the instrument must be considered quantitatively estimated, qualified with a "J," and reported as such to the data user.

Dilution - Any detected compound whose response is above the calibration range of the instrument must be considered quantitatively estimated and re-analyzed at an appropriate dilution to achieve a response within the calibration range of the instrument. If a dilution is not possible, the result is to be reported and qualified with an "E." If multiple dilutions result in multiple compounds of interest falling within the calibration range of the instrument, all dilutions will be reported by the laboratory to the user of the data.

Continuing Calibration Verification - a CCV usually includes measurement of one or more calibration standards. The response is compared to the initial measured instrument response. Continuing calibration is performed at least once per operating shift for laboratory analyses. Where required, the CCV standard must be a separate source (*i.e*. a different vendor, or if same vendor, a different lot number) from the ICV standard.

Instrument calibration procedures, both ICV and CCV, are to be analyzed according to the requirements of the US EPA-approved methodologies performed. Any deviations from the above must be documented and reported to the user of the data.

4.3 Laboratory Control Samples

Laboratory control samples (LCS) are used to evaluate the accuracy of the laboratory's procedures. A LCS, or blank spike, is prepared and analyzed every one per 20 samples of the same media within the same preparation or analytical batch. Any LCS that does not meet the laboratory-established recovery criteria must be prepared and analyzed again, along with any associated samples until acceptable recovery is achieved. Procedures for the preparation and analysis of the LCS are according to the requirements of the US EPA-approved methods and must be the same as the samples to which the LCS is compared. Any deviations from the above must be documented by the laboratory and reported to the data user.

4.4 Method Blank

Method blank (MB) samples are used to evaluate the presence and/or effect of laboratory

contamination. A MB must be analyzed every one per 20 samples of the same media within the same preparation or analytical batch. A MB is prepared to represent the sample matrix as closely as possible and analyzed exactly like the samples for which it is associated. Any MB that demonstrates contamination (*i.e*. any positive response of compounds of interest) must be prepared and analyzed again, along with any associated samples that demonstrated the same compounds of interest detected. The only acceptable deviation from this is if the compound sample concentration is greater than ten times the concentration detected in the MB. Procedures for the MB are analyzed according to the requirements of the US EPA-approved methods performed. Any deviations from the above must be documented and reported by the laboratory to the data user, with impacted results qualified with a "B."

4.5 Internal Standard

An internal standard (IS) is a standard unlikely to be found in environmental samples but has similar properties to the compounds of interest. The IS is added to the sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method. Any sample for which an IS did not meet the US EPA-approved method established recovery and retention time criteria, must be analyzed again. If the IS failure is duplicated, matrix interference is assumed and both results are to be reported by the laboratory to the data user.

4.6 Surrogate Standard

A surrogate standard of known concentration is added to environmental samples for QC purposes. A surrogate standard is unlikely to be found in environmental samples but has similar properties to the compounds of interest. Surrogate standards are intended to monitor recovery differences, problems during the extraction phase of the analysis, and for any potential matrix interferences. Any sample that a surrogate standard did not meet the laboratory-established recovery criteria must be prepared and analyzed again. If the surrogate standard failure is duplicated, matrix interference is assumed and both results are to be reported by the laboratory to the data user.

4.7 Matrix Quality Control Samples

Matrix spike (MS) and matrix spike duplicate (MSD) samples, performed by the laboratory, are used to evaluate the accuracy and precision of the sample matrix for the organic analyses. MS and matrix duplicate (MD) samples are used to evaluate the accuracy and precision of the matrix for the inorganic analyses. A MS, MSD, or MD that did not meet the laboratory-established accuracy or precision criteria is indicative of possible matrix interference. Only matrix QC samples selected from media specific to this project are to be reported. Procedures for the MS, MSD, and MD are performed according to the same requirements of the US EPA approved methods. One MS/MSD per 20 samples will be submitted for analysis during the interim remedial sampling activities. See Tables 3 and 4 for details.

4.8 Technical Holding Times

A sample's technical holding time is the period of time a sample may be stored prior to its required preparation and analysis by the laboratory. While exceeding the holding time does not necessarily negate the usability of the analytical results, it causes the qualifying of any data as not meeting the specified acceptance criteria. If the technical holding time of any sample is exceeded it is to be reported by the laboratory to the data user immediately. A summary of the

technical holding times is presented on Table 5, Field Sample Container Requirements.

4.9 Sample Preservation

A sample's preservation requirements are media and analysis specific. Preservation is required at sample collection in order to preserve the contaminants in their original state prior to analysis by the laboratory. The laboratory is required to maintain the preservation of the samples once they are in the custody of the laboratory. If the sample is found to be outside the preservation required, it is to be reported by the laboratory to the data user immediately. A summary of the preservation requirements is presented on Table 5, Field Sample Container Requirements.

5.0 Field Quality Control Samples

5.1 Blanks

A blank is a sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. It is sometimes used to adjust or correct routine analytical results. It is a sample that is intended to contain none of the analytes or compounds of interest. A blank can be used to detect contamination during sample collection, handling, or shipment. There are many types of blanks, each with a specific purpose but only a trip blank will be collected for the interim remedial action sampling.

Trip Blank - A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures. One trip blank per day per cooler that contains volatile organic compounds (VOC) is required for this sampling. See Tables 3 and 4 for details.

Field Blank - A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. See Tables 3 and 4 for details.

Equipment Rinsate - A blank used to provide information about contaminants that may be introduced during sample collection. A sample collected after completion of equipment decontamination and prior to sampling using blank water, returned to the laboratory, and treated as an environmental sample. See Tables 3 and 4 for details.

Temperature Blank - An aqueous sample, typically submitted as water in a 40 mL VOC vial, is transported to the laboratory for temperature verification of the samples. One temperature blank is required with each sample shipment container. See Table 4 for details.

5.2 Duplicate Samples

Duplicate samples are two samples taken from, and representative of, the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. There are several different types of duplicate samples that provide information on the precision of specific types of environmental data operations:

Field Duplicates - Independent samples that are collected as close as possible to the same

point in time and space. They are two separate samples taken from the same source, stored in separate containers and analyzed independently. These types of duplicates are useful in characterizing the precision of the sampling process. One field duplicate for every 10 samples will be submitted for analysis during the interim remedial action sampling. See Tables 3 and 4 for details.

5.3 Field Documentation and Records

Field documentation is a crucial element of field activities. Therefore, Field Team members should strictly adhere to logbook entry protocol. Field logbook entries shall include the information requested in the project control documents and shall be recorded in a manner consistent with this procedure.

Each Field Team conducting sampling activities should maintain a field logbook to document the activities performed by the Field Team each day that field work is conducted. At a minimum, the following information shall be recorded daily in the field logbook:

- Name and location of the site.
- Date(s) of sample collection event or field activity.
- Names of Field Team members and responsibilities.
- Time of arrival to the site.
- Weather conditions.
- All on-site personnel, visitors, and activities.
- Pertinent field observations. **Note**: Only objective field observations shall be recorded in the field logbook. Subjective observations such as opinions and speculations shall not be recorded in the field logbook.
- Daily summary of equipment preparation and calibration procedures, if appropriate (See Table 6 for calibration details).
- Time of collection of each sample.
- Numbers and types of samples collected and sample identification numbers.
- A description of sampling methodology by reference to the project control documents.
- A description of the analytical methods that are being requested and the laboratory where the samples are being sent.
- Record of project-related phone calls and/or contact with individuals at the site.
- Management or disposal of investigation-derived waste.
- Photo logs (if applicable) shall include:
    - Photo number
    - Location of photo
    - Brief description of photo
- Global Positioning System (GPS) coordinates, if applicable.
- Any required maintenance of field equipment (see Table 7 for details).

6.0 Assessments and Oversight

6.1 Performance and System Audits

6.1.1 Technical Performance Audits

Qualified Field personnel will perform technical performance monitoring on an ongoing basis during the project, as field data are generated, reduced, and analyzed. These monitoring activities serve as a performance audit and are essentially ongoing due to the length of the project schedule. All numerical analyses such as manual calculations, mapping, and computer modeling, are documented and will be the subject of performance audits in the form of quality control review, numerical analysis, and peer review.

6.1.2 Laboratory System Audits

The WVDEP commercial laboratory certification program performs external system audits of the laboratory on a pre-defined basis. The system audit may consist of review of the following:

- Laboratory QA manual
- Instrumentation and/or analytical systems for the analyses of interest
- Sample preparation methodologies
- Laboratory sample handling
- Sample receiving and custody procedures
- Data reduction and reporting procedures
- Data validation procedures
- Instrument calibration procedures
- QC program
- Other laboratory procedures that may impact laboratory analyses

6.1.3 Method Validation

Environmental Standards, Inc. (Environmental Standards), was contracted by CORE to review the procedures used by ALS-H and ALS-C to analyze for the compounds MCHM and PPH by SW 846 Method 8270D, and for MCHM in air by NIOSH Method 1405. Aqueous and non-aqueous sample procedures, both sample preparation and sample analysis, were reviewed for ALS-H. Air sample procedures were reviewed for ALS-C.

QA/QC documents were also reviewed for major insufficiencies, but not subjected to an in-depth assessment intended to provide a comprehensive analysis of all potential issues. Major insufficiencies have the potential to impact data quality, usability, and defensibility and should be corrected prior to sample analysis. The QA/QC documents reviewed included the laboratory QA manual, SOPs, MDL studies, control charting, and each analysts' demonstration of capability.

Comments, findings, and recommendations based on the review were presented to CORE, ALS-C, and ALS-H. Corrective action was recommended prior to sample analysis. These corrective actions will be verified during the data validation.

6.2 Corrective Action

6.2.1 Field Corrective Action

The initial responsibility for monitoring the quality of field measurements and observation lies with the field personnel. The Field Operations Manager (FOM) is responsible for verifying that all QC procedures are being followed. This requires that the FOM assess the correctness of field methods and their ability to meet the QA objectives. If a problem occurs that may jeopardize the integrity of the project or cause some specific QA objective to not be met, the field project personnel will report it to the FOM. The FOM will then report all such suspect problems to the Project Manager (PM). The PM documents the problem, consults with the Quality Assurance Officer (QAO), licensed remediation specialist (LRS), and/or WVDEP, Office of Environmental Remediation Project Manager (OER PM) as applicable, develops a corrective action, and documents the results. The FOM will initiate the corrective action and identify and direct the appropriate personnel to implement the corrective action.

6.2.2 Laboratory Corrective Action

The initial responsibility for monitoring the quality of an analytical system lies with the analyst. In this pursuit, the analyst must verify that all standard operating procedures and QC procedures are followed and that the results of analysis of instrument calibration and QC samples are within acceptance criteria.

If his or her assessment reveals that any of the QC acceptance criteria were not met, he or she immediately assesses the analytical system to correct the problem. The deficiency is reported to the appropriate supervisor, who notifies the laboratory QC Officer. Specific corrective actions to exceed acceptance criteria for the laboratory QC checks are defined in the laboratory QA program.

The laboratory corrective action process has already been implemented for this project during Environmental Standards' method validation activities. Refer to section 6.1.3 of this QAPP.

6.2.3 Reports to Management

Reports to management encompass both routine reports and special reports, including written reports and memoranda documenting data assessment activities, results of data validations, audits, nonconformance, and corrective actions. The management hierarchy receiving some or all of the reports includes appropriate personnel such as the LRS, QAO, and PM and the WVDEP, OER PM.

7.0 Data Usability

The following sections describe the processes used to generate and check data and produce reports for both field sampling and laboratory analysis data.

7.1 Data Reduction

Data will be reduced either manually on calculation sheets or by computer on formatted printouts. The methodology and procedures implemented by Freedom Industries to determine

the accuracy of data reduction are described in this section. The following responsibilities are delegated in the data reduction process:

- Technical personnel document and review their own work and are accountable for its correctness.
- Major calculations receive both a method and an arithmetic check by an independent checker. The checker is accountable for the correctness of the checking process.
- The QAO is responsible for ensuring that data reduction is performed in a manner that produced quality data through review and approval of calculations.

Hand calculations are to be legibly recorded on calculation sheets and in logical progression with sufficient descriptions. Major calculations are checked by an engineer or scientist of professional level equal to or higher than that of the originator. After completing the check, the checker will initial and date the calculation sheet immediately below the originator. Both the originator and checker are responsible for the correctness of calculations. A calculation sheet will contain the following, at a minimum:

- Project title and brief description of the task
- Date performed
- Initials of person who performed the calculation
- Basis for calculation
- Assumptions made or inherent in the calculation
- Complete reference for each source of input data
- Methods used for calculations
- Results of calculations, clearly annotated

Computer analyses include the use of models, programs, and data management systems. For published software with existing documentation, test case runs are performed periodically to verify that the software is performing correctly. Both systematic and random-error analyses are investigated and appropriate corrective action measures are taken.

7.2 Data Validation and Verification

The process through which data is accepted, qualified, or rejected is based on specific data verification and validation criteria. These criteria are discussed below for both field and laboratory data. Personnel experienced with sampling and analytical protocols and procedures will perform the data validation in accordance with the established criteria and the intended use of the data.

Field data verification and validation are used to eliminate or limit the use of field data that are not collected or documented in accordance with specified protocols outlined here. In some instances, the field data are used only for approximation purposes. In all cases, evaluations of field data are performed on two separate levels. First, all field data will be verified at the time of collection by following the QC checks outlined within this QAPP. Second, field data will be validated by the PM, or designee, who will review the field data documentation to identify discrepancies or unclear entries. Field data documentation will be validated against the following criteria, as appropriate:

- Sample location and adherence to the work plan
- Adherence to procedures and protocols

- Field instrumentation and calibration
- Sample collection protocol
- Sample volume
- Sample preservation
- Equipment QC samples collected and submitted
- Field duplicate QC samples collected and submitted
- Sample labels protocols
- Sample documentation protocols
- Chain-of-Custody protocol
- Sample shipment

The laboratory analytical data validation will be performed by an independent third party in accordance with the general guidance provided in "US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (SOM02.2)," OSWER No. 9355.0-132, US EPA 540-R-014-002, August 2014 and "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," OSWER No. 9200.1-85, US EPA 540-R-08-005, 13 January 2009, Stage 4 Verification and Validation Checks, as applicable.

Ten percent (10%) of the total data generated will be validated. The 10% will be selected at random from sample results to be used in the risk assessment. The laboratories will report the results to be validated in a Stage 4 data package (US EPA Contract Laboratory Program equivalent, including raw data).

7.3 Requested Analyses

Under the review procedures, the following data validation criteria for the requested analyses are to be prepared by the laboratory for potential validation in an organized, legible, and tabulated manner:

- Sample paperwork, both preparatory and analysis
- PQLs
- Chromatograms
- Retention times
- Peak integration and labels
- Mass spectral library comparisons
- ICV
- CCV
- LCS
- Method Blank/Instrument Blank
- MS/MSD/MD
- Holding time
- Surrogate recovery
- Internal standards recovery and retention time
- Dilution factor
- Moisture content
- Confirmation Data

7.4 Data Quality Assessment

Data quality assessments are prepared to document the overall quality of data collected in terms of the established DQOs and the effectiveness of the data collected and generation processes. The data assessment parameters calculated from the results of the field measurements and laboratory analyses will be reviewed to ensure that all data used in subsequent evaluations were scientifically valid, of known and documented quality, and, where appropriate, legally defensible. In addition, the performance of the overall measurement system will be evaluated in terms of the completeness of the project plans, effectiveness of field measurement and data collection procedures, and relevance of laboratory analytical methods used to generate data as planned. Finally, the goal of the data quality assessment is to present the findings in terms of data usability.

Generally, to achieve an acceptable level of confidence in the decisions that were made from the data, the degree to which the total error in the results derived from data collected and generated will be controlled. The methods and procedures used to implement and accomplish these QC objectives are as follows:

- Assess the quality of data values measured and generated to ensure that all were scientifically valid, of known and documented quality, and, where appropriate, legally defensible. This is accomplished by assessing actual data values generated or measured against the established DQOs for parameters such as precision, accuracy, completeness, representativeness, and comparability, and by testing generated data against acceptance criteria established for these parameters.

- Achieve an acceptable level of confidence in the decisions that were to be made from measurements and data by controlling the degree of total error permitted in the data through QC checks. Data that failed the QC checks or did not fall within the acceptance criteria established will be rejected from further use or qualified for limited use.

The major components of a data quality assessment are presented below and show the logical progression of the assessment leading to determination of data usability:

- *Data Validation Summary*: Summarizes the individual data validation reports for all sample delivery groups by analytical method. Systematic problems, data generation trends, general conditions of the data, and reasons for data qualification are presented.
- *Data Evaluation Procedures*: Describes the procedures used to further qualify data caused by such factors as dilution, reanalysis, matrix effect and duplicate analysis of samples. Examples of the decision logic are provided to illustrate the methods by which qualifiers are applied.
- *QC Sample Evaluation*: Evaluates QC samples such as field blanks, trip blanks, equipment rinsates, field replicates, and laboratory control samples to assess the quality of the field activities and laboratory procedures.
- *Assessment of Data Quality Objectives*: Assesses the quality of data measured and generated in terms of accuracy, precision, representativeness, and completeness through the examination of laboratory and field control samples in relation to objectives established.
- *Summary of Data Usability*: Summarizes the usability of data, based on the assessment of data conducted during the previous four steps. Sample results for

each analytical method will be qualified as acceptable, rejected, estimated, biased high, or biased low.

7.5 Data Reporting

Field measurements and observations will be recorded in the field logbook maintained by the FOM. Laboratory data is reported in standard formats that identify the specific sample, date, parameter, parameter value, detection limit, and various analytical parameters. Both field and laboratory data will be combined and summarized as appropriate in tables, graphs, and other formats that are appropriate to the type of data and conveyed information, to support the findings of the data collection program. In all cases, data will be clearly tabulated and presented in a consistent manner to support comparison of common sets of data. Finally, data will be presented so as to logically lead to and substantiate the conclusions and recommendations provided by the final report.

CORE will compare each analytical result to its established PQL. A non-detect result above an established PQL has limited usability and may require re-sampling and/or re-analysis. The WVDEP PM should be consulted for corrective action when there are limitations on the usability of the data.

8.0 Reconciliation with Data Quality Objectives

All data generated for the project will be assessed for accuracy, precision, completeness, representativeness, and comparability. The methods for calculating accuracy, precision, and completeness, and for evaluating representativeness and comparability are summarized in US EPA guidance documents (EPA 1990a). Generally, data that do not meet the established acceptance criteria may be probable cause for re-sampling and re-analysis. However, in some cases, data that did not meet acceptance criteria are usable with specified limitations. Data that are marked as usable with limitations are included in the project reports, but will be clearly marked as having limited usability.

The WVDEP PM should be consulted for corrective action when there are limitations on the usability of the data.

8.1 Qualitative Quality Assurance Objectives

8.1.1 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that pertains to the proper design of the sampling program. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected.

This parameter is addressed in the project-specific Work Plans by collecting samples at locations specified in such Work Plans, and by following the procedures for sample collection/analyses that are described in the Work Plan. Additionally, analytical programs utilize procedures that are consistent with US EPA approved analytical methodology. QA/QC parameters that are utilized to aid representativeness of environmental samples are technical

holding time and sample preservation. The technical holding time and sample preservation requirements, presented in Table 5, are used in accordance with this QAPP to ensure that the environmental samples submitted to the laboratories remain representative of site conditions.

8.1.2 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This goal is achieved through the use of the standardized techniques for sample collection and analysis presented in the Work Plan. The US EPA *Methods of Chemical Analysis for Water and Waste* or *Test Methods for Evaluating Solid Waste (SW846)* analytical methods are updated on occasion by the US EPA to benefit from recent technological advancements in analytical chemistry and instrumentation. In most cases, the method upgrades include the incorporation of new technology that improves the sensitivity and stability of the instrumentation or allows the laboratory to increase throughput without hindering accuracy and precision.

The overall goal for analytical programs conducted in accordance with this QAPP is to provide comparable analytical data over time through the use of approved analytical techniques that remain consistent in their general approach and continued use of the basic analytical techniques (*i.e*., sample extraction/ preparation, instrument calibration, QA/QC procedures, *etc*.). Through this use of consistent base analytical procedures and by requiring that updated procedures meet the QA/QC criteria specified in this QAPP, the analytical data from past, present, and future sampling events are comparable to allow for qualitative and quantitative assessment of site conditions.

8.2 Quantitative Quality Assurance Objectives

8.2.1 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event or investigation compared to the total data planned. Completeness of laboratory tests is expected to be 90 percent (90%) or better for investigations conducted in accordance with this QAPP. The reasons for any variances from 100% completeness will be identified and addressed, as required, in the appropriate data validation report. This quantity is calculated as follows:

$$\textbf{Completeness (\%)} = \frac{V}{P} \times 100$$

Where **V = number of valid measurements**
P = number of planned measurements

8.2.2 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. For investigations conducted in accordance with this QAPP, precision was defined as the relative percent difference (RPD) or the relative standard deviation (RSD) between duplicate sample results. The lower these values are, the more precise the data are. These quantities are calculated as follows:

$$\text{RPD (\%)} = 100 \times \frac{(S - D)}{(S + D)/2}$$

$$\text{RSD (\%)} = \frac{100}{\sqrt{2}} \times \frac{2\,(S - D)}{(S + D)}$$

Where **S = Analyte or compound concentration in a sample**
D = Analyte or compound concentration in a duplicate sample

Or when there are more than two measurements:

$$\text{RSD (\%)} = 100 \frac{(s)}{0}$$

Where ***s* = Standard deviation of replicate measurements**
0 = Mean of replicate measurements

The duplicate samples utilized to evaluate precision include laboratory MD, MS, MSD, and field duplicates samples. The goal is to maintain a level of analytical precision consistent with the objectives of the sampling event. To maximize precision, consistent sampling and analytical procedures are followed as presented in the Work Plan. Control limits for field duplicate sample analyses are 40%. Control limits for laboratory MS, MSD, and MD sample analyses are determined by the laboratory's internal QA plan.

8.2.3 Accuracy

Accuracy measures the bias in an analytical system, or the degree of agreement of a measurement with a known reference value. This measure is defined as the difference between the reported values and the actual value. Accuracy is expressed as the percent bias for standard reference samples. The closer this value is to zero, the more accurate the data are. This quantity is calculated as follows:

$$\text{Bias (\%)} = \frac{(MC - SC)}{SC} \times 100$$

Where **SC = Known analyte or compound (*i.e.* spike) concentration**
MC = Measured analyte or compound concentration

In cases where accuracy is determined from spiked samples, such as the LCS, accuracy is expressed as the percent recovery. The closer these values are to 100, the more accurate the data are. The percent recovery value is calculated as follows:

$$\text{Recovery (\%)} = \frac{(MC)}{SC} \times 100$$

Where **SC = Known analyte or compound (*i.e.* spike) concentration**
MC = Measured analyte or compound concentration

Matrix spike percent recovery is calculated as follows:

$$\textbf{Recovery (\%)} = \frac{(MC - USC)}{SC} \times 100$$

Where **MC = Measured analyte or compound concentration**
USC = Unspiked sample concentration
SC = Known analyte or compound (*i.e.* spike) concentration

For investigations conducted in accordance with this QAPP, accuracy is defined as the percent recovery of QA/QC samples that were spiked with a known concentration of an analyte of interest. The QA/QC samples used to evaluate analytical accuracy included instrument calibration, internal standards, inductively coupled plasma (ICP) serial dilution analysis, laboratory control samples, MS/MSD samples, and surrogate compound recoveries. Control limits for instrument calibration, internal standards, ICP serial dilution analysis, laboratory control samples, MS/MSD samples, and surrogate compound recoveries are provided in the applicable US EPA approved methods or determined by the laboratory's internal QA plan.

8.2.4 Sensitivity

The sensitivity is defined by the MDLs. Unless otherwise specified in the project-specific Work Plan, the analytical results were reported against the laboratory MDLs.

The achievement of MDLs depends on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrument sensitivity to ensure data quality through constant checks on instrument performance. The MDL is defined as the minimum concentration of a substance that can be measured with 99% confidence that the concentration is above zero.

MDL is calculated as follows:

$$\textbf{MDL} = s * t_{(n-1,\ 1-a=0.99)}$$

Where: **s = standard deviation of replicate analyses**
$t_{(n-1,\ 1-a=0.99)}$ = t-value for a one-sided 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

TABLES

Table 1. SAMPLING AND ANALYTICAL SUMMARY
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

Excavation Area of Concern	Estimated Square Footage	Number of Samples*
Area 1a	10,900	37
Area 1b	4,950	17
Area 2	1,390	5
Area 3	3,660	13
Area 4	2,900	10
Area 5	2,200	8

Environmental Media and Area of Concern	Analytical Testing		Sample Summary	
	MCHM / PPH SW 846 Method 8270D	Free Liquid SW 846 Method 9095B	Total Analyses	Type
Post Excavation Soil Samples				
Area 1a	37	0	37	Grab
Area 1b	17	0	17	Grab
Area 2	5	0	5	Grab
Area 3	13	0	13	Grab
Area 4	10	0	10	Grab
Area 5	8	1	9	Grab
Soil Sample Total	90	1	**91**	
Surface Water Samples				
Elk River, upstream background	3	0	3	Grab
Elk River, near source	3	0	3	Grab
Collection Sumps (2) in Collector Trench	4	0	4	Grab
Surface Water Total	4	0	**10**	
Air Monitoring Samples				
Perimeter Samples	10**	0	10	Composite
Air Samples Total	10	0	**10**	

Notes:
*1 grab per 300 sq ft of sidewall and base
**Air samples are collected and analyzed via NIOSH Method 1405 for MCHM/PPH and benzene
Refer to Table 3 for number of Quality Control Samples
MCHM - 4-methyl-1-cyclohexanemethanol
PPH - propylene glycol phenyl ether
SW 846 - US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

Table 2. Maximum Allowed PQLs
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

		Aqueous	Soil	Air
COMPOUND	**CAS Number**	**SW 846 Method 8270D (µg/L)**	**SW 846 Method 8270D (µg/kg)**	**NIOSH Method 1405 (mg/m^3)**
4-methyl-1-cyclohexanemethanol (MCHM)	34885-03-5	5.0	170	0.06 (11 ppb)
propylene glycol phenyl ether (PPH)	770-35-4*	5.0	170	6.2 (1000 ppb)
Benzene	71-43-2	N/A	N/A	3.2 (1000 ppb)

Notes:
PQL - Practical Quantitation Limit
SW 846 - US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
NIOSH = The National Institute of Occupational Safety and Health
N/A = not applicable
* PPH is an isomer mix. CAS Number 770-35-4 represents the major isomer, secondary alcohol 1-Phenoxy-2-propanol. The minor isomer, primary alcohol 2-Phenoxypropanol, CAS Number is 4169-04-4 and the commercial mixed isomer product CAS Number is 41593-38-8.

Table 3. QC SAMPLES PER MATRIX
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

QC Sample Type	Number of Samples QC Samples		
	Aqueous	Soil	Air
Field Duplicate[1]			
- MCHM/PPH	3	15	N/A
- MCHM/Benzene	N/A	N/A	1
- PPH	N/A	N/A	1
- Free Liquid	1	N/A	N/A
Matrix Spike/Matrix Spike Duplicate[1]			
- MCHM/PPH	3	8	N/A
Trip Blank[2]			
- MCHM/PPH	N/A	N/A	N/A
Background[3]			
- MCHM/Benzene	N/A	N/A	10
- PPH	N/A	N/A	10
Field Blank[3]			
- MCHM/Benzene	N/A	N/A	10
- PPH	N/A	N/A	10
Equipment Rinsate[4]			
- MCHM/PPH	N/A	N/A	N/A
TOTAL	**7**	**23**	**42**

Notes:

[1] - One QC sample per 20 field samples.

[2] - One QC sample per cooler when samples collected for Volatile Organic Compounds are being shipped.

[3] - One QC sample per day

[4] - One QC sample per 20 field samples or per week, whichever is greater. Only applies if sample equipment used is not clean/disposable and must be decontaminated between each use.

N/A - Not Applicable

Table 4. QC SAMPLE DETAILS
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

QC Sample Type	Purpose	Collection	Sample Numbering
Field Duplicate	To check reproducibility of laboratory and field procedures. To indicate matrix non-homogeneity.	Collect from areas that are known or suspected to be contaminated. Collect one per 20 field samples per matrix.	Assign two separate (unique) sample numbers (*i.e* .,one number to the primary sample and one to the duplicate). Submit blind to the laboratory.
Trip Blank	To check contamination during sample handling and shipment from field to laboratory.	Collect one sample (water demonstrated to be free of the contaminants of concern) per day per sample cooler. Trip blank samples are prepared before sampling begins by the laboratory. Place in the cooler used to ship samples.	Assign separate sample numbers to the trip blanks. Submit blind to the laboratory.
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	Required to check accuracy and precision of analyses and matrix effect.	**Aqueous:** Collect triplicate volume **Solid:** No extra volume required. **Air**: Not applicable Collect one MS/MSD per 20 field samples per matrix.	Not applicable; however, the sample designated for Matrix QC must be documented as
Temperature Blank	To check temperature of the cooler during shipping upon arrival at the laboratory.	Collect 1 sample per cooler shipped to the lab. Use blank water (water demonstrated to be organic-free, dionized, or distilled for inorganics).	Do not assign separate sample number. Note as "Temperature Blank" on label.
Background	To check for background or ambient air concentration.	Collect one sample per each day of air sampling. Background samples are placed upwind of air sample location to collect ambient or background air concentrations of suspect compounds.	Assign separate sample numbers to the background sample. Submit blind to the laboratory.
Field Blank	To provide information about contaminants introduced during sampling event.	Collect one sample per each day of air sampling. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.	Assign separate sample numbers to the field blank. Submit blind to the laboratory.
Equipment Rinsate	To provide information about contaminants introduced during sampling event.	Collect after completion of equipment decontamination and prior to sampling using blank water (water demonstrated to be organic-free, dionized, or distilled for inorganics). Collect one per week or 1 per 20 field samples per matrix, whichever is greater.	Assign separate sample numbers to the equipment rinsate. Submit blind to the laboratory.

Notes:
QC - quality control

Table 5. FIELD SAMPLE CONTAINER REQUIREMENTS
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

Sample Matrix	Fraction	Minimum Sample Volume	Sample Size/ Container Type*	Preservative	Technical Holding Time
Aqueous	**MCHM/PPH**	2 each	1000 mL glass amber jar	Cool, 0-6°C, no freezing	7 days to prepare/ 40 days to analyze
	Free Liquid	1 each	100 mL glass or plastic jar	none	none
Solid	**MCHM/PPH**	1 each	4 oz. glass jar	Cool, 0-6°C, no freezing	14 days to prepare/ 40 days to analyze
Air	**MCHM/PPH/ Benzene**	1 each	Sorbent Tube: coconut shell charcoal, 100 mg/50 mg	Cool, 0-6°C, no freezing	48 hours to prepare/ 7 days to analyze

Notes:
MCHM - 4-methyl-1-cyclohexanemethanol
PPH - propylene glycol phenyl ether
* sample containers must be pre-cleaned, certified, and traceable to the supplier.

Table 6. Calibration and Corrective Action - Field Equipment
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

Instrument	Calibration Standard(s)	Frequency Initial Calibration	Frequency Continuing Calibration	Acceptance Criteria	Corrective Action
Photo Ionization Detector	Isobutylene (100 ppm)	Daily	N/A	determined by supplier	Return to supplier for maintenance if unable to meet acceptance criteria.
Air Pump	0.01-0.2L/minute*	Daily	N/A	determined by supplier	Return to supplier for maintenance if unable to meet acceptance criteria.

Notes:
* total air sample volume is not to exceed 10 liters, unless it can be demonstrated by the laboratory breakthrough is not occurring.
Identify all tools, gauges, instruments, and other equipment used for data collection activities that must be calibrated to maintain performance within specified limits.
N/A - Not Applicable

Table 7. Preventative Maintenance - Field Equipment
Freedom Industries VRP Site
1015 Barlow Drive, Charleston, West Virginia
VRA 15017

Instrument	Activity	Frequency
Digital Camera	Battery check	at the beginning of each day
GPS	Battery check	at the beginning of each day
Photo Ionization Detector	Battery check	at the beginning of each day
Air Pump	Power check	at the beginning of each day

Note:
Identify field equipment and/or systems requiring periodic preventative maintenance. Describe the activity (*e.g.,* check the battery, *etc.*)