Norfolk Southern Railway Company

East Palestine, Ohio Derailment

Wastewater Treatment and Contained-In Determination Operational Summary

Milepost PC49 Railroad Tracks Northeast of North Pleasant Drive and Taggart Road Intersect

Columbiana County

East Palestine, Ohio

USEPA ID: OHR000221457

Revision 5

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Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CID	contained-in determination
CWT	centralized water treatment facility
gpd	gallons per day
gpm	gallons per minute
HDPE	high-density polyethylene
lbs/day	pounds per day
LGAC	liquid-phase activated carbon
MCL	maximum contaminant level
mg/L	milligrams per liter
NSRC	Norfolk Southern Railway Company
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSR	Off-Site Rule
OWS	oil water separator
Plan	Wastewater Treatment and Contained-In Determination (CID) Operational Summary Plan
PLC	programmable logic controller
POTW	publicly owned treatment works
ppm	parts per million
ppmw	parts per million by weight
psi	pounds per square inch
QAPP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SVOC	semi-volatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TU	temporary unit
UAO	Unilateral Administrative Order for Removal Actions

USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UTS	universal treatment standards
VGAC	vapor-phase activated carbon
VOC	volatile organic compound
WMP	Waste Management Plan
WVDEP	West Virginia Department of Environmental Protection
WWT	Wastewater Treatment
µg/L	micrograms per liter

1 Introduction

On behalf of Norfolk Southern Railway Company (NSRC), Arcadis U.S., Inc. (Arcadis) has prepared this Wastewater Treatment and Contained-In Determination (CID) Operational Summary Plan (Plan) and is requesting United States Environmental Protection Agency (USEPA) approval for onsite wastewater treatment and offsite disposal of the wastewater. The goal of the onsite treatment is to decrease the vinyl chloride concentrations in wastewater to concentrations below risk-based standards so a CID can be obtained by the Ohio Environmental Protection Agency (OEPA), and the wastewater can be managed as non-hazardous.

Current sampling, characterization and disposal of wastewater is documented in the NSRC East Palestine Waste Management Plan (WMP), which was approved on April 18, 2023 by USEPA. This Plan supplements the WMP and provides details of the onsite collection and treatment of the wastewater, defines sampling and analyses of the treated wastewater, specifies procedures for receiving CID batch approvals from OEPA, and identifies the proposed offsite disposal options for non-hazardous wastewater. For the purpose of this Plan, the term “water” includes surface water, stormwater and groundwater within the Area of Contamination prior to containerization for onsite treatment or offsite disposal. The term “wastewater” will refer to water that has been containerized for onsite treatment or offsite disposal (aka discarded as a waste)[1]. The proposed collection points for the water being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. This Plan complies with criteria for a stand-alone request provided in the OEPA *Application of Contained-In Determination for Media and Debris Contaminated by Hazardous Waste at RCRA Sites* (OEPA 2022) and the USEPA *Contained-In Policy for Soil and Debris Contaminated with Hazardous Waste* (USEPA 1998b).

As described in *Management of Remediation Waste Under RCRA* memorandum (USEPA 1998a) and OEPA *Application of Contained-In Determination for Media and Debris Contaminated by Hazardous Waste at RCRA Sites* (OEPA 2022) the contained-in policy applies only to environmental media (soil, groundwater, surface water and sediments). As such, remedial wastes generated from stormwater infrastructure decontamination activities (e.g., pipe jetting, decontamination wastewater) and non-media wastes will be managed separately. Non-media solid wastes (carbon, filter socks, used bag filters, cleaning fluids) generated as a result of operating the onsite treatment system (OM&M waste) and decontamination wastewater will be characterized as U043 listed hazardous wastes. Management of these waste are addressed in the WMP and are not included in this Plan or in the CID requests.

On March 17, 2023, the USEPA issued an *Alert Regarding Disposal of Hazardous Waste Material from the East Palestine Ohio Train Derailment Site* notifying States that “States cannot unilaterally stop shipments of out-of-state hazardous waste material”. Despite support from the USEPA, political and public pressures throughout the country continues to limit the number of facilities willing to accept waste from the derailment site. Limitations on the volumes that receiving facilities can accept and distances to receiving facilities further restricts the ability to transport and dispose of the wastewater in a timely manner and results in the need for large volumes of U043 listed hazardous wastewater to be stored onsite. Arcadis has identified several nearby facilities that will accept the non-hazardous wastewater if there are no Resource Conservation and Recovery Act (RCRA) codes attached to it. In the interest of decreasing the footprint NSRC has in East Palestine, NSRC would like to pursue options for onsite treatment to facilitate a CID for the non-hazardous wastewater. The proposed process is summarized below:

[1] A list of terms used in the document, OM&M Plan and Quality Assurance Project Plan is provided in Section 8.

- Water that comes in contact with the area of contamination will be collected by pumps or in vacuum trucks and containerized onsite in temporary tanks (referred to as modular tanks) prior to treatment.
- The collected wastewater will be treated through an onsite wastewater treatment (WWT) system capable of removing vinyl chloride to levels below the Maximum Contaminant Level (MCL) of 2 micrograms per liter (µg/L), which is the highest level of a contaminant that is allowed in drinking water (Archived Consumer Factsheet on Vinyl Chloride | USEPA ARCHIVE DOCUMENT).
- The treated wastewater will be containerized and temporarily stored onsite in clean modular tanks, referred to as “CID tanks”. Storage areas and temporary tanks will be managed in accordance with the NSRC East Palestine WMP, which was approved on April 18, 2023 by USEPA.
- Initially six grab samples of the treated wastewater will be collected for each daily batch (one sample every 4 hours). The grab samples will be collected from a sampling port within the WWT system, before discharge to the CID tanks. In addition, one composite sample will be collected from the CID tank for each daily batch. The samples will be submitted for analyses of total vinyl chloride.
- Additional analyses may be completed based on disposal facility requirements (see Section 3.2).
- Following a one-week start-up period, NSRC, USEPA and OEPA will have a meeting to review the analytical results and discuss decreasing the sampling frequency.
- Upon receipt of the analytical data, NSRC will provide documentation that treated wastewater is below the proposed risk-based standard (i.e., the MCL) and request that OEPA approve the CID demonstrating that the treated wastewater no longer contains listed hazardous waste (U043, vinyl chloride). Each daily batch CID request will be submitted via email to OEPA and USEPA and will contain the analytical report and the CID tank identification numbers associated with that sample. Details of the CID submission process are provided in Section 3.3.
- All Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation wastes require disposal at a permitted facility. Prior to offsite disposal of any wastes, the notification requirements in Paragraph 46.b of the Unilateral Administrative Order for Removal Actions (UAO) will be completed in addition to any notifications NS has committed to. Currently CERCLA Off-Site Rule (OSR) notification are being handled by the USEPA. NSRC will provide USEPA with the names, addresses and USEPA IDs, as applicable of any proposed disposal facilities and will not ship wastewater offsite until USEPA approval is received.
- Upon USEPA approval, the treated wastewater will be transported on a non-hazardous waste manifest to a disposal facility permitted to accept non-hazardous wastewater.

As part of the proposed CID, data sets specific to individual batches of treated wastewater will be presented to OEPA (USEPA will be copied on all correspondence). Multiple requests for CID approval will be required (one for each day the WWT system is operating). As additional data are collected to support the CID, the understanding of the WWT system effectiveness increases, and site conditions stabilize, NSRC anticipates that sampling requirements can be re-evaluated and with agency approval, the sample frequency can be revised.

1.1 Site History

On February 3, 2023, a NSRC train derailment and subsequent fire occurred in East Palestine, Ohio. The derailment involved 51 rail cars and resulted in a fire and breaches to tank cars that contained hazardous materials and non-hazardous materials. The releases affected groundwater, the stormwater infrastructure and surface water, including Sulfur Run and Leslie Run. The exact volumes released are not yet available.

On February 21, 2023 Norfolk Southern and the USEPA entered into a UAO (CERCLA Docket No. V-W-23-C-004; USEPA 2023). A List of the Contents of the Rail Cars Which Derailed is provided in Appendix A of the USEPA Unilateral Administrative Order for Removal Actions. Site specific constituents of concern are also identified in the Main Line 1 Track Excavation Plan.

NSRC immediately mobilized response personnel to the incident, however the release of hazardous materials from the damaged cars affected environmental media in the area of the derailment and continues to impact any water that contacts the release area. Response crews continue to recover and contain soil and water impacted by the releases. That work continues and has expanded to include engineering efforts to limit the volume of surface water coming in contact with the release area and efforts to improve the methods for capturing and containing water that has come into contact with the impacted areas of the derailment site.

A site map showing the locations where water is being recovered and stored is provided as Figure 1. Water from the locations shown on Figure 1 is currently being collected in vacuum trucks and transported to the two one million-gallon modular tanks (Tank Farm 1) and the temporary storage tanks in Tank Farms 3, 5, and 6 (main storage area) for consolidation and storage pending offsite disposal. During rain events, surface water may be pumped directly from a recovery location into adjacent temporary storage tanks, with the recovered wastewater then transported via vacuum trucks to the main storage area. There are approximately 155 temporary storage tanks onsite (3.1 million gallons total capacity) for temporary storage of the recovered wastewater pending offsite transport and disposal. To facilitate onsite treatment, NSRC will need to consolidate the collection of the U043 listed hazardous wastewater generated from across the site into one central location. This consolidation will allow much of the collection of U043 listed hazardous water (i.e., impacted surface water, stormwater, and groundwater) to be completed via pumps and direct piped to the tanks. Two one million-gallon modular tanks were installed in the Tank Farm 1 location. It is anticipated that the modular tanks in Tank Farm 1 would store the influent for the WWT system and the treated water would be stored in separate temporary storage tanks in the CID Tank Farm, pending the receipt of sampling data, OEPA approval of the CID, and USEPA approval for offsite disposal.

1.2 Contamination Description and Designation

All containerized wastewater (impacted stormwater, surface water, and groundwater) collected from spill response and remedial activities has been classified as U043 listed hazardous waste based on generator knowledge that impacts to the water are from a release of commercial grade, unused vinyl chloride. Based on a review of Safety Data Sheets for other hazardous materials released, no other listed waste codes apply. AS needed, samples will be collected to evaluate if the wastewater exhibits a characteristics of a hazardous waste. Specific activities and analytical results related to this CID request are discussed below in more detail.

2 The Process Listing

2.1 Actions Generating Contaminated Wastewater

NSRC has undertaken measures to capture impacted water and containerize it in temporary storage tanks pending sampling, analysis, and arrangements for disposal offsite. The water recovery operation is essentially continuous for the short-term, and the volume of water generated is weather-dependent. The volume of captured water has exceeded 500,000 gallons per day (gpd) following rain events of less than 1 inch of precipitation. NSRC continues to employ engineering controls to reroute the water flow around the area of contamination and reduce the volume of water coming in contact with the impacted soils. The bypass system was only recently installed but has bypassed more than 13.5 million gallons non-impacted surface water.

2.2 Management and Disposal of Contaminated Wastewater

Initial response activities included recovery of surface water, fire water, decontamination water, and product from drainage ditches, waterways, interceptor trenches, storm sewer drains, and puddles that formed on the ground. All of the wastewater from the initial response activities that was mixed with non -media water sources has been transported offsite for disposal. Water that is currently collected in the modular tanks is limited to surface water / stormwater from drainage ditches and waterways; and groundwater from monitoring wells and residential wells, springs, and seeps (environmental media). The current collection points for the water are provided in Figure 1. Non-Media wastewater (decontamination water, rinse water) is collected and containerized in temporary storage tanks located in Tanks Farms 5 and 6, Wastewater levels in the temporary tanks are recorded daily. Based on gauging data the collected wastewater does not contain measurable product. The recovered water may have a visible sheen. Water generated from decontamination activities is containerized separately and is clearly marked.

In a two-week period, an average of 126,000 gpd of wastewater impacted with vinyl chloride has been shipped offsite for disposal. As of August 16, 2023, the site has shipped approximately 30,045,104 gallons (6,094 loads)of recovered wastewater for offsite disposal. Below is a summary of the disposal facilities that have accepted the U043 listed hazardous wastewater. The only local disposal option is the Vickery Deep Well in Vickery, Ohio. Due to volume limitations at this facility, only 11% of the wastewater generated has gone to this facility, while 86% of the wastewater generated has been transported to Texas for disposal.

State	Disposal Facility	Address	CERCLA Approved	ID Numbers	Shipped To Date (gallons)
Ohio	Vickery (Deep Well Injection)	3956 State Rte 412 Vickery, OH 43464	Y	OHD020273819	3,696,140
Texas	Texas Molecular Deer Park Services (Deep Well Injection)	2525 Independence Rd, Deer Park, TX 77536	Y	TXD000719518	26,034,837
Michigan	Romulus (Deep Well Injection)	28470 Citrin Drive, Romulus, MI 48174	N (last shipment 2/24)	MIR000016055	313,877

2.3 Description of Listed Waste Codes

Wastewater recovered during the emergency response actions has been characterized as U043 listed hazardous waste due to impacts associated with a release of unused commercial grade vinyl chloride. No other listed codes are applicable to the wastewater associated with this CID request. Based on current laboratory analyses of wastewater samples, there are no characteristic codes associated with the wastewater. OEPA and USEPA have been provided data collected at the site and have concurred that the collected wastewater is listed hazardous waste for vinyl chloride (U043) only and is not characteristically hazardous (see Table 1 - Analytical Summary Table). Additional characterization activities may be necessary for the wastewater and agency approvals when conducting remediation operations in area(s) that have not been currently assessed.

2.4 Volume of Media to be Disposed

Water recovery operations are ongoing. The proposed collection points for the water being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. Remedial activities to achieve the contained-in objectives include a combination of direct water recovery and onsite wastewater treatment. The proposed plan is to perform onsite wastewater treatment, conduct batch testing, submit contained-in requests for the treated wastewater, and dispose of the treated wastewater offsite at a Subtitle D permitted facility after receiving an approved CID.

The volume of water will vary with rainfall amounts. The treatment and CID evaluation was based on an assumption that water recovery operations and wastewater treatment will continue for 6 to 12 months. Based on the current rates of generation, another 30 to 60 million gallons of U043 listed hazardous water could be generated during this time. Soil remediation activities for the area of contamination are underway; as contaminated soil is removed the potential for contamination of water will decrease, and this timeframe may shorten as appropriate.

It is anticipated that the WWT system will operate 24 hours a day/7 days a week at a rate of 100 gallons per minute (gpm), which would generate a maximum daily volume of approximately 140,000 gpd of treated wastewater that would be placed in temporary tanks for onsite storage pending offsite disposal. Operational times and flow rates may be adjusted based on rainfall and the volume of wastewater requiring treatment. Details of the proposed contained-in activities are provided below.

3 Sampling and CID Request

3.1 Current Sampling and Analytical Data

On February 9, 2023, five samples of wastewater were collected from the initial 10 temporary tanks containing a mixture of liquids, including product collected from puddles, firefighting water, and surface water, generated during early response activities. The wastewater was analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, total volatile organic compounds (VOCs), total semi-volatile organic compounds (SVOCs), corrosivity, flashpoint, diesel-range organics, total suspended solids, and total organic carbon. The analytical results for these five wastewater samples were provided in Eurofins lab report 240-180173. The analytical results are presented in Table 1. The basis for the hazardous waste listing is vinyl chloride (U043). Based on the analytical results, the recovered wastewater is not characteristically hazardous. Concentrations of vinyl chloride in the initial samples ranged from 22 to 290 micrograms per liter (µg/L).

On February 26, and March 1, 2023, samples were collected from temporary tanks containing wastewater from discrete pumping stations as identified by the sample name and illustrated on Figure 1. The samples were submitted for analysis of total VOCs, total SVOCs, and TCLP metals. Analytical results from these samples were provided in Eurofins Lab reports 240-180852 and 240-181183 and are presented in Table 1. Vinyl chloride was reported at concentrations ranging from non-detect (< 1 µg/L) to 4.6 µg/L.

On March 6 and 7, 2023, Arcadis randomly selected 15 temporary tanks containing a mixture of wastewater (impacted stormwater, surface water, groundwater) and decontamination water for sampling. This accounted for approximately 15% of the total volume of wastewater stored onsite at the time of sampling. Samples were submitted for analyses of VOCs only. The analytical results in Table 1 indicate that vinyl chloride concentrations ranged from non-detect (less than 1 µg/L) to 81 µg/L.

On March 24, 2023, Arcadis randomly selected five temporary tanks containing water for sampling. This accounted for approximately 15% of the total volume of wastewater stored onsite at the time of sampling. Samples were collected using a bailer; no measurable product was observed. Samples were submitted for analyses of VOCs only. The analytical results in Table 1 indicate that vinyl chloride concentrations ranged from non-detect (less than 1 µg/L) to 34 µg/L.

The wastewater represented by these samples will have been shipped offsite by the time the treatment system is installed and therefore these results are provided only as general information on what the likely influent concentration range will be. These results are not representative of the treated wastewater concentrations and would not be included in a CID request. It is important to note that the analytical results demonstrate a significant decrease in vinyl chloride concentrations from the time of the initial response to present (290 µg/L to 34 µg/L). NSRC anticipates that vinyl chloride concentrations will continue to decline based on the downward trend observed to date, a reduced sheen observed on current wastewater and ongoing flushing of stormwater collections systems.

3.2 Sampling and Analyses to Support CID

The onsite WWT system is anticipated to be operational in June 2023. The proposed collection points for the water being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. The WWT system will treat an estimated 140,000 gpd, which will be collected in six temporary tanks (CID Tanks

T306A through T306F). Each temporary tank will be representative of a 24-hour treatment batch, wastewater samples will be collected at a time agreed to by the OEPA and NSRC. Sampling and Analyses will be performed on the treated wastewater to confirm the concentrations of vinyl chloride are below risk-based standards (i.e. the MCL) and ensure that the wastewater does not exhibit a characteristic of hazardous waste, in particular RCRA metals. Analytical will be reviewed to confirm the wastewater concentrations complies with the acceptance criteria of the receiving non-hazardous disposal facilities. The proposed analyses and sampling frequency are discussed in sections below and may decrease in the future with concurrence from OEPA and USEPA.

A quality assurance project plan (QAPP) for the proposed sampling activities and data quality objectives associated with CID request will be provided as a separate document. The QAPP will document the data quality review process.

3.2.1 Start-Up Period Sampling

During the start-up period one composite sample of the untreated wastewater and one composite sample of the treated wastewater will be collected and analyzed for parameters associated with the disposal facility acceptance criteria. Samples will be collected directly from the temporary tanks. These samples will serve as a baseline check for WWT system operations and will satisfy requirements of the receiving facility for profiling purposes. Based on the acceptance requirements for all of the proposed disposal facilities the following constituents will be analyzed:

- Total metals - arsenic, cadmium, chromium, cobalt, copper, zinc, lead, tin, mercury, selenium, nickel and silver;
- TCLP metals;
- Total and amenable cyanide;
- Reactive cyanide and sulfides;
- SVOCs – to include Bis(2-ethylhexyl)phthalate; carbazol; o-cresol; n-decane; fluoranthene; n-Octadecane; 2,4,6-Trichlorophenol;
- TCLP semi-volatiles;
- Total vinyl chloride (SW 846 Method 8260), laboratory Reporting Limit must be below 1.0 µg/L
- Total VOCs
- TCLP volatiles;
- TCLP herbicides and pesticides;
- Total Oil and Grease;
- Flashpoint – Method 1010 Martin-Pensky closed cup;
- Total PCBs – (must be reported below 1.0 mg/L);
- pH.

During the one-week (6-day) startup operational period, one grab sample of the treated wastewater will be collected every 4 hours (6 samples over a 24-hour period) from the WWT system effluent and one composite sample of the treated wastewater will be collected from the temporary tank for each daily batch. Samples will be analyzed for total vinyl chloride only. The laboratory will be instructed that the analysis must achieve a detection and reporting limit at or below 1 µg/L.

Samples will be collected and preserved in accordance with the current version of SW-846 Method 8260 and the QAPP. The samples will be sent to an offsite laboratory for analysis. As applicable, additional samples of the treated water will be sent directly to the proposed disposal facilities for internal analyses in accordance with the disposal facilities permit. A laboratory turn-around-time of 3 days will be requested for the start-up samples submitted for disposal facility parameters. A 1-day turn-around-time will be requested for the daily batch total vinyl chloride sampling results. The sampling results will be compared to RCRA characteristic criteria, disposal facility acceptance criteria and the MCL for vinyl chloride, which is 2 µg/L.

After the one week start up period, NSRC, USEPA, and OEPA will meet to discuss the analytical results and re-evaluate the sampling frequency. Based on the analytical results, the sampling frequency may decrease in the future with concurrence from OEPA and USEPA.

3.2.2 Remediation Areas not Currently Assessed

Unassessed areas will be defined as areas where no representative soil analytical data has been collected to date. If remedial activities extend beyond the vertical and or horizontal limits of the existing soil data NSRC will collect additional soil samples to evaluate the presence and concentrations of COCs. For unassessed areas NSRC will collect the additional soil samples using an in-situ sampling approach. This approach will allow for an assessment of potential worker exposure and inhalation hazards prior to remediation of the unassessed area.

The WWT system design was based on the types and concentrations of COCs present in the wastewater that has been recovered to date. If based on soil analyses the types and or concentrations of COCs are not consistent with what has been observed to date NSRC will also evaluate water quality within the impacted soil zone. If impacts occur below the water table a representative groundwater sample will be collected via a temporary collection point. If soil impacts are observed above the water table, total and toxicity characteristic leaching procedure (TCLP) data for the soil will be used to assess potential surface water impacts from contact with the soil. All water sampling will be conducted prior to remediation activities. Water samples will be analyzed for the disposal facility parameters listed in Section 3.2.1. Water data will be reviewed to verify the WWT system capabilities to treat the wastewater. Following treatment, effluent sampling for disposal facility parameters listed in 3.2.1 will also be performed to confirm that the treated wastewater concentrations are consistent with the data provided in the waste profile. All samples will be collected and preserved in accordance with the current version of SW-846 Method 8260 and the QAPP.

For areas previously assessed and for areas where soil data is consistent with previous analysis, no additional water sampling is needed.

Additional Car Scrapping Area 4 (CS4) Assessment for Harpoon Tank Emissions

Groundwater sampling and analysis will be performed in the CS4 area to support ongoing emissions evaluations. Groundwater from five piezometers (PZ-11 through PZ-15) located within CS4 will be sampled and analyzed for total VOCs via method 8260 and for total RCRA metals (via SW-846 Methods 6010/7471). The piezometers were installed into the perched aquifer and set at 14 to 15 feet below ground surface (bgs) at the urban fill/ till interface. A map showing locations of the piezometers is provided as Figure 7. The CS4 piezometers have been developed and purged. Current groundwater depth in the piezometers is approximately 7 feet bgs. Sampling from the piezometers is considered representative of the wastewater that will be generated during dewatering of CS4. Water from the sump in the northwest corner of CS4 is currently being collected and consolidated in the modular tanks. As such, the sump water will be accounted for as part of the WWT system influent sampling which is further discussed in the Operation Monitoring and Maintenance Plan.

NSRC/CTEH will use the groundwater analytical data to calculate theoretical tank emissions (pounds per day [lbs/day]) using a weighted average Henry's Law constant reflecting the actual constituent ratios or other acceptable approach. Results will be provided to OEPA prior to excavation of CS4. If the calculated emissions exceed 10 lbs/day, NSRC will discuss options with OEPA and USEPA including additional modeling, submission of a permit exemption request or a substantively compliant permit approval.

3.3 CID Request and Approval Process

Treated wastewater will remain in the CID tanks at the CID Tank Farm until the following is completed:

Step 1 – Review of Analytical

After receiving the analytical result for each daily batch, NSRC will evaluate the result to ensure that it does not exhibit a characteristic of hazardous waste, in particular RCRA metals. If the vinyl chloride concentration is below 2 µg/L and the wastewater is not characteristically hazardous, a CID will be requested (step 2). NSRC believes that the MCL is a conservative and appropriate standard for comparison for the CID. The MCL is defined by USEPA as the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCL Goals as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards. (National Primary Drinking Water Regulations | USEPA; Archived Consumer Factsheet on Vinyl Chloride | USEPA ARCHIVE DOCUMENT)

If the analytical results indicate that the vinyl chloride concentration is greater than or equal to 2 µg/L the water from that treatment batch will be managed as a U043 listed hazardous wastewater and will either be placed back into the H-24 and H-25 so it can be re-treated, or it will be transported offsite for disposal as a U043 listed hazardous wastewater. NSRC will discuss options with USEPA/OEPA and confirm concurrence prior to consolidation or transport and disposal. The CID tank that held the batch of treated wastewater that exceeded MCL will be completely drained, and the liner will be rinsed with clean water before the tank can reused for the treated wastewater. Rinsate from the cleaning of the tank will be consolidated with the other "decontamination water" and managed as a U043 listed hazardous wastewater for offsite disposal.

Step 2 – CID Request

Following NSRC review of batch sample results indicating post-treatment analytical results are below the MCL, NSRC will submit a CID request to OEPA (USEPA will be copied on all communication) for the batch. One CID request will be submitted for each daily batch. The CID request will include the following:

- Generator name and contact information;
- USEPA ID number;
- Batch specific CID number;
- General description of how the wastewater was generated and the treatment process;
- Volume of wastewater requested as part of the CID;
- Corresponding tank location/identification;
- Proposed off-site management facility;
- Comparative risk-based level (e.g., MCL) for the CID determination;
- Sampling information (collection date(s)/time(s));
- Special handling information, if necessary;

- Generator certification statement, contact name and signature; and
- Data summary table, and corresponding analytical report.

An example template of the CID Request letter is provided as Attachment 1. The CID request will be sent via email to the OEPA.

Note: A CID that is granted by OEPA is only applicable to facilities in Ohio. For any out-of-state receiving facility, prior to off-site shipment, NS will provide written documentation to Ohio EPA and U.S. EPA that the receiving facility and the corresponding state's authorized RCRA program concurs with the CID issued by Ohio EPA.

Step 3 – Disposal Facility Approval

Upon receipt of the OEPA CID approval the signed profile, analytical and OEPA CID approval will be provided to disposal facility via email. The disposal facility will issue NSRC a written approval, via email, for the profile and/or the batch ID. For any out-of-state facility NSRC will confirm via email the corresponding state's authorized RCRA program concurrence with the OEPA CID approval prior to requesting USEPA approval to ship (step 4).

Step 4 – USEPA Approval for Offsite Transportation and Disposal

Once the above has been completed, NSRC will request USEPA approval for offsite transportation and disposal of the non-hazardous wastewater.

Step 5 – Offsite Transportation and Disposal

Following approval by USEPA, the wastewater from that batch will be loaded into trucks for transportation to a CERCLA approved offsite disposal facility.

3.4 Storage Capacity and Schedule

The modular tanks in Tank Farm 1 have a capacity of one million gallons each. If the volume of untreated wastewater generated exceeds the capacity of the modular tanks, then the excess untreated wastewater will be loaded into trucks and transported offsite for disposal as U043 listed hazardous wastewater in accordance with current wastewater management practices.

The CID Tank Farm can provide approximately 6 days of treated wastewater storage capacity. If the volume of treated wastewater exceeds the storage capacity of the CID tanks, NSRC will secure additional clean temporary tanks. Per the approved WMP, NSRC will notify Unified Command prior to establishment of any new waste management units (temporary tanks) or areas. The excess treated wastewater will be placed into clean temporary tanks pending CID approval and offsite disposal as non-hazardous wastewater.

NSRC will work with the laboratory to coordinate daily sample pick-ups and will confirm that the lab can provide expedited turn-around time for the requested analyses (24 hours for the daily batch samples and 4 days for the samples submitted for disposal facility acceptance criteria). NSRC requests that OEPA and USEPA also commit to expediting review of the CID and offsite Transport and Disposal requests. It is NSRC understanding that OEPA may want to see more than one days' worth of treated wastewater analytical results before issuing the initial CID approval, but OEPA is committed to performing a timely review of the CID requests and will make a concerted effort to act on the CID request on a daily basis.

4 Onsite Treatment

To address the rapid accumulation rate of water (surface water, stormwater, and groundwater) that must be collected and managed as U043 listed hazardous wastewater, NSRC has requested approval from USEPA to arrange for onsite treatment of the wastewater.

Arcadis contacted several vendors to explore available rental wastewater treatment system options to treat water collected from the site, and identified a proposed configuration that can be readily provided. The onsite WWT system will reduce the concentration of vinyl chloride to below risk-based standards (i.e., the MCL) so a CID can be approved by OEPA and the wastewater can be managed for offsite disposal as non-hazardous waste.

The proposed collection points for the water being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. The proposed treatment system components and layout are illustrated in the process flow diagram (Figure 4). The system has a treatment capacity of 100 gpm.

The proposed treatment system will reduce the concentration of vinyl chloride to below 2 µg/L in the treated wastewater. This level, in addition to being below the MCL for drinking water, is below the Universal Treatment Standard (UTS) of 0.27 mg/L for vinyl chloride (Ohio Administrative Code 3745-270-48). Following onsite treatment and CID approval, the non-hazardous wastewater would be transported to a centralized water treatment facility (CWT) or deep well injection facility. Wastewater treated onsite that is sent to a CWT for disposal would be treated again by the CWT before being discharged to a publicly owned treatment works (POTW). For disposal at a CWT, NSRC will require confirmation that the CWT has notified the POTW of the facilities plans to accept treated wastewater from the East Palestine derailment. NSRC believes that treatment to below the health based MCL and to well below the UTS demonstrates that the treated wastewater no longer contains U043 listed hazardous waste, and that concentrations in the treated wastewater would be fully protective of human health and the environment.

4.1 Waste Minimization and Community Benefits

Under RCRA Section 1003(b), hazardous waste generators must have a waste minimization program which incorporates the following National Policy:

> "wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment."

Surface water from areas north, east, and south of the site primarily drain to channels alongside the NSRC tracks. As part of NSRC commitment to waste minimization, NSRC has installed a clean water bypass system to reduce the volume of clean surface water that comes in contact with the soil in the area of contamination and must be collected and managed as a U043 listed hazardous wastewater (Arcadis, March 30, 2023, East Palestine Surface Water Bypass System).

In addition to reducing the volume of hazardous waste being generated, NSRC proposes employing onsite WWT to expedite a reduction in the toxicity of the wastewater. While storage of U043 listed hazardous water cannot be eliminated, the onsite WWT system would have the following benefits:

1. Onsite WWT and CID approval will **significantly reduce the amount of U043 listed hazardous waste shipments being transported through the East Palestine community** as well as other communities.

- Currently, water is collected by a minimum of 16 vac trucks and tankers driving and transported throughout the community every day to multiple hazardous waste storage areas (tank farms 3, 5 and 6). To facilitate onsite WWT, NSRC will need to consolidate water across the site into one central location. This consolidation will allow much of the collection of water to be completed via pumps and directly discharged to the modular tanks. It is estimated that collecting water directly will allow NSRC to reduce the fleet of vac trucks driving through the community by 50%.
- Currently, 100% of the wastewater generated is shipped offsite as a U043 listed hazardous waste.. Onsite treatment of the water will reduce the vinyl chloride to concentrations below the drinking water standards. Following wastewater treatment, NSRC will seek CID approval. The CID approved treated wastewater will be transported offsite as non-United States Department of Transportation (USDOT) regulated/ non-RCRA regulated wastewater. In addition to the benefits of reduced toxicity the ability to transport treated wastewater as a non-hazardous material (no USDOT placards) will promote public perception that the removal activities are progressing and the public risks are being reduced. Note: the decontamination water from the truck wash will still be managed as a U043 listed hazardous wastewater.
- Further, the CID will significantly reduce the number of communities and highway miles the tanker trucks containing U043 listed hazardous wastewater must travel through to unload. It is estimated that the interstate truck mileage could reduce by approximately 80% compared to the current distance of transporting U043 listed hazardous wastewater to Texas Molecular in Deer Park, Texas. This reduction alone greatly reduces the risk of incidents involving these vehicles, reduces greenhouse gas emissions, and increases the safety of the entire operation and all the communities (including environmental justice communities) in which these trucks travel through.

2. The installation of this WWT system will reduce the overall operational footprint of the site as temporary tanks are cleaned and taken offsite, and the hazardous waste storage areas are cleaned and turned back over to the community.
   - Currently, there are 155 temporary tanks storing U043 listed hazardous wastewater located in eight different hazardous waste storage areas. The CID operations will reduce the number of storage tanks to approximately eight (2 modular tanks for consolidation and storage of the U043 listed hazardous wastewater and six CID tanks for storage of the treated wastewater) and reduce the number of hazardous wastewater storage areas to approximately two.
   - The consolidation of wastewater operations will reduce the remedial response footprint and impact to the community and local businesses. The estimated footprint for the current wastewater storage areas is 12 acres, consolidating the wastewater operations and being able to manage the treated wastewater at local non-hazardous disposal facilities will facilitate a decrease of the wastewater storage area footprint to 3.0 acres (75% reduction). The footprint reduction will include cleaning and demobilization of temporary tanks in the following order:
     1. Tank Farm 4 - this tank farm is the one closest to residents;
     2. Standby Tank Area 1, Standby Tank Area 2, Standby Tank Area 3, Tank Farm 3 and the East Palestine POTW storage area - the temporary tanks in these areas have individual secondary containment liners instead of the entire storage area being secondary containment;
     3. Tank Farm 6; and
     4. Tank Farm 5.

3. The centralized transfer operations will **reduce the risk of human exposure and spills and releases** that could impact the environment.
   - U043 listed hazardous wastewater is currently stored onsite for several days to weeks prior to offsite transportation and disposal. Onsite wastewater treatment will enable 140,000 gpd of U043 listed hazardous wastewater to be treated to concentrations below the drinking water standards, which significantly reduces human exposure time and potential for contact with hazardous wastewater.
   - U043 listed hazardous wastewater is currently being disposed of via permitted hazardous waste deep well injection sites. With deep well injection there is no treatment performed to reduce the toxicity of the wastewater (concentrations of vinyl chloride) prior to disposal. Onsite treatment to remove the U043 listed hazardous waste source from the wastewater prior to disposal is the preferred management method to disposal without treatment.
   - The current hazardous wastewater handling process involves the U043 listed hazardous wastewater being pumped into a vac truck or tanker, off-loading the u043 listed hazardous wastewater into temporary tank for storage, then off-loading the U043 listed hazardous wastewater from the temporary tanks to over the road vehicles for subsequent disposal at an approved facility. Centralizing transfer operations will allow for the installation of semi-permanent loading and unloading points. These semi-permanent points allow for the pumping of U043 listed hazardous wastewater from vac trucks to the modular tanks via a fixed pump clearing the lines after each load. The loading points would eliminate the need for constant connecting and disconnecting of hoses and would therefore reduce the potential for spills and releases from hose connections and transfer operations.
   - The treated wastewater will be stored for 2 to 3 days pending analytical results and CID approval and then the non-hazardous wastewater will be direct piped to an overhead loading rack again eliminating the need for hose connecting and disconnecting. The WWT system operations would be stand alone and require no connecting or disconnecting of hoses once the U043 listed hazardous wastewater is in the modular tanks.
   - The CID operations plan will benefit site safety by reducing the double handling of U043 listed hazardous wastewater and limit transfers and potential exposure events (i.e., vac truck to temporary tank to trucks instead of direct loading to trucks).
   - All loading and unloading transfers would occur on semi-permanent containment constructed of 9-inch-thick asphalt pavement surrounded by a minimum 12-inch-high asphalt curb. This area will be sloped toward two catch basins to capture any drips, spills, or releases and route them back to the temporary tanks for handling. The CID tank farm would be constructed with a single secondary containment consisting of an impermeable geomembrane liner (60 mil high density polyethylene [HDPE]), temporary barriers (i.e., Jersey Barriers, and/or earthen berms). Surface water collected within the secondary containment area will be managed via temporary sumps and disposed in accordance with the plan.
4. **Increase site safety** due to a reduction in wastewater trucks and vac truck movement on site
   - The WWT operations have required NSRC to consolidate the collection of U043 listed hazardous water across the site into one central location, i.e., the two one million-gallon modular tanks. This consolidation has allowed much of the collection of U043 listed hazardous wastewater to be completed via pumps and direct piped to the temporary tanks versus a minimum of 16 vac trucks and tanker trucks driving throughout the community. While some vac trucks are still required to collect at remote collection points,

this can be completed with less than half of the fleet currently in use. This will all allow for less vehicle traffic, which reduces traffic and exposures to all site workers and the public.

5. The CID approval will authorize the treated wastewater to be disposed at non-hazardous disposal facilities which are much closer to the site. This will allow for **shortened storage times and quicker offsite disposal following rain events** (faster turnaround of trucks & loading operations). The WWT system operations plan will expedite completion of the overall site clean-up and decrease timeline for wastewater disposal.
   - The proposed non-hazardous disposal locations are significantly closer in proximity to the site allowing for significantly faster truck turns equating to more loads of wastewater offsite and subsequent faster recovery from rain events. This will increase the number of loads that can be shipped everyday (faster turnaround time per load) while significantly reducing the number of trucks necessary to dispose of the wastewater thereby reducing the number of trucks traveling through East Palestine (i.e., for loads shipping to Texas, 20 trucks are currently needed to dispose of 100,000 gallons of water; however if the disposal facilities were closer only 6 to 10 trucks would be needed to dispose of 100,000 gallons).
   - The current disposal locations for disposal of hazardous wastewater are Vickery Deep Well in Vickery, Ohio which is limited to 6 to 10 loads per day (30,000 to 50,000 gpd) and Texas Molecular in Deer Park, Texas, which has unlimited capacity but is limited by a 5-day turnaround-time per load for direct trucking and a 2 to 3 week turnaround time for rail car loads. Onsite WWT and CID approval will provide the opportunity to use facilities within 2 to 5 hours of the site that can accept 60,000 to 80,000 gpd.
   - The use of closer disposal facilities will reduce or eliminate the need to transload U043 listed hazardous wastewater at the Lordstown yard for rail shipment, again decreasing the risks associated with double and triple handling of the wastewater and connecting and disconnecting of hoses.
6. **Increases ability to maintain water levels** onsite to limit potential overflow discharges to Sulfur Run
   - The pumps used for collection and consolidation of the wastewater into the modular tanks have a faster pump rate than the vac trucks and, unlike the vac trucks which need to stop pumping and drive to the tank farm to offload, the pumps at the modular tanks never stop running. This will increase NSRC's ability to rapidly collect water during a rain event and will limit the potential overflow into Sulphur Run.
   - With the WWT and CID approval, NSRC could ship up to 150,000 gallons of treated wastewater daily, or over one million gallons a week. The onsite treatment allows NSRC to dispose of wastewater much faster because the turn times for trucks are much faster with the additional options available for disposal.
   - As necessary NSRC could ship untreated wastewater, which remains characterized as a U043 listed hazardous wastewater, to ensure there is never overflow into Sulphur Run.

4.2 Permit Requirements

Because the site is regulated under CERCLA, treatment of the U043 listed hazardous wastewater will be addressed in the applicable or relevant and appropriate requirements (ARARs) and a RCRA treatment permit will not be required (https://semspub.epa.gov/work/HQ/174423.pdf).

Treated off-gas from the water treatment system air stripper will be discharged to the atmosphere under either an air permit from OEPA, or an emergency air permitting exemption letter from the OEPA director.

4.3 Onsite Wastewater Treatment System and CID Operations Overview

The proposed collection points for the wastewater being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. The proposed WWT system components and layout are illustrated in the process flow diagram (Figure 4). Site water is collected and stored within two one million-gallon modular tanks located at Tank Farm 1, which will be pumped to the WWT system located just north of the modular tanks. Treated wastewater will be pumped from the WWT system to the CID tanks in the CID Tank Farm located between East Martin Street and the agricultural field north of Brave Industries, as shown on Figure 2. Treated water will be stored in six temporary tanks, with each tank corresponding to the estimated daily water treatment volume (approximately 140,000 gallons).

The response action is being conducted pursuant to a CERCLA Section 106 UAO (USEPA 2023). The two one million-gallon modular tanks will be managed in accordance with the NSRC East Palestine WMP, which was approved on April 18, 2023 by USEPA. As stated in Section 3.2.2 of the WMP, "regulations applicable to the use of Corrective Action Temporary Units are found in 40 CFR 264.553 and Ohio Administrative Code (OAC) rule 3745-57- 73. The use of temporary units (TUs) is being authorized by USEPA as an ARAR during a CERCLA cleanup under the Section 106 UAO." Recognizing that the two one million-gallon modular tanks meet the factors in 40 CFR 264.553(c), USEPA specifically approved those modular tanks as TUs in the WMP. As stated in the WMP, "EPA or authorized states can modify the design, operating and closure standards that normally apply in order to facilitate the prompt cleanup of a site. Table 2 provides a summary of standards applicable to the TUs and documents compliance with those standards." NSRC continues to comply with the standards in Table 2 of the WMP for all modular tanks approved as TUs in the WMP, including the two one million-gallon modular tanks.

4.3.1 Compliance with ARARs

On May 12, 2023, USEPA requested documentation regarding the substantive requirements that may serve as ARARs for the temporary tanks. Information to document compliance of the modular tanks with 40 CFR Part 264 Subpart J (Tank Systems) and 40 CFR 264.553 (Temporary Units) is provided in RCRA Tank System Substantive Standards – Modular tanks and RCRA Tank System Substantive Standards – CID tanks (Attachment 2).

In subsequent correspondence, USEPA and OEPA requested documentation of the applicability of Organic Air Emission Standards in 40 CFR parts 264 and 265, subparts AA, BB, and CC to the proposed collection and WWT system. A summary of the air emission standards and associated applicability to the WWT system are provided below:

- The standards of subpart AA (40 CFR 264.1030(b)) and OAC 3745-256-30 to 3745-256-35 are applicable to process vents associated with air stripping operations that manage hazardous wastes with organic concentrations of at least 10 parts per million by weight (ppmw), Subpart AA is applicable to the WWT system since the system utilizes an air stripper to remove VOCs. However, based on analyses of the influent wastewater the highest concentration of vinyl chloride reported for the wastewater during the last sampling event was 0.065 parts per million (ppm), and the highest total concentration for VOCs was 0.385 ppm (Attachment 3). Since the organic concentrations are below 10 ppmw the substantive requirements of Subpart AA would not be applicable to the process vents associated with the air stripper. WWT system influent will be monitored to confirm that concentrations do not exceed the 10 ppmw threshold value specified in Subpart AA.

If the total VOC concentration should exceed this value NSRC will notify EPA/OEPA to discuss potential corrective actions. Additional details on this monitoring are provided in the OM&M Plan.

- The standards of subpart BB (40 CFR 264.1050(b)) and OAC 3745-256-50 to 3745-256-64 are applicable to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight (10% = 100,000 ppm). Since the concentrations of the influent wastewater are less than 10 percent by weight the equipment associated with the WWT system would not be subject to the substantive requirements of subpart BB.
- The standards of subpart CC (40 CFR 264.1082(c)) and OAC 3745-256-80 to 3745-256-90 are applicable to all facilities that treat, store, or dispose of hazardous waste in tanks, surface impoundments, or containers except if a waste management unit is used solely for on-site treatment or storage of hazardous waste that is placed in the unit as a result of implementing remedial activities required under CERCLA authorities (see OAC rule 3745-256-80(B)(5) and 40 CFR 264.1080(b)(5)). The modular and CID tanks are being used solely for on-site treatment and storage of hazardous remediation wastewater generated as a result of implementing remedial activities required under CERCLA. Additionally, a tank, surface impoundment, or container is exempt from subpart CC standards if the unit has an average VOC concentration at the point of waste origination of less than 500 ppmw (40 CFR 264.1080(c)(1), and 3745-256-83(C)(1)). Based on analytical results the influent wastewater has an average VOC concentration at the point of waste origination of less than 500 ppmw. Finally, listed hazardous wastes that meet LDR treatment standards for the organics in the waste are not subject to Subpart CC regulations (62 FR 64635, 64643-4; December 8, 1997). The wastewater LDR for U043, Vinyl Chloride is 0.27 ppm the highest concentration of the wastewater during the last sampling event was 0.065 ppm. Based on the criteria listed above the modular and CID tanks are exempt from the substantive requirements of subpart CC.

While the temporary tanks and treatment system are not subject to the requirements of subparts AA, BB, and CC, NSRC recognizes the community and worker safety concerns for fugitive emissions from these units. To address these concerns ambient air monitoring is being conducted 24/7 in the vicinity of the wastewater treatment system and temporary tanks. Monitoring requirements and locations are provided in the Air Sampling and Analysis Plan Version 2.1 (Appendix C). In the event of an exceedance notification procedures identified in the Decision Tree will be implemented. Air modeling was also performed to confirm that fugitive VOC emissions from the two open-top modular tanks do not exceed the OEPA air emissions de minimis threshold of 10 lbs/day and determine the maximum concentration of VOCs in the wastewater that could result in an exceedance of this limit. An evaporation model was run using three emissions scenarios: the first assuming that VOC emissions are entirely vinyl chloride; the second assuming that VOC air emissions are entirely butyl acrylate; and the third assuming average properties for medium volatility VOCs (i.e., dimensionless Henry's Law Constant values between 0.00001 and 0.001). Scenario three, considered to be the most representative of the three, predicts that the de minimis threshold could be exceeded if the concentration of total VOCs in the tanks exceeds 41.72 mg/L. This is very unlikely to occur considering that most of the VOC constituents were non-detect in the most recent water sample collected from the tanks on August 1, 2023. A copy of the air modeling results and the August 1, 2023, laboratory analytical report are provided in Attachment 4. Grab wastewater samples will be collected for VOC analysis from the WWT system influent stream, which is representative of concentrations in the tanks, during system operation to confirm that the total VOC concentration remains below this threshold value. Additional details about this sampling are provided in the OM&M Plan.

Additionally, daily air monitoring will be performed on the air stripper component of the WWT system and associated off-gas treatment equipment, to confirm that the equipment is operating as designed and maintaining the required treatment efficiency of VOCs in the air discharge stream.

4.4 Wastewater Collection and Storage

The WWT system treats water collected from the active soil remediation areas at the site. The proposed collection points for the water being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. All collected water is conveyed to modular tanks in Tank Farm 1 either through manual collection utilizing vacuum trucks or by gravity drainage and pumping from sumps in swales within the remediation areas. The proposed WWT system components and layout are illustrated in the process flow diagram (Figure 2). Information to document compliance of the modular tanks with 40 CFR Part 264 Subpart J (Tank Systems) and 40 CFR 264.553 (Temporary Units) is provided in *RCRA Tank System Substantive Standards – Modular tanks,* which is being submitted under separate cover. All collected wastewater is conveyed to Tank Farm 1 either through manual collection utilizing vacuum trucks or above grade lines collecting from sumps. Details on the wastewater temporary tanks are provided below. An as-built for the wastewater storage tank area is provided as Figure 3.

- Two one million-gallon modular Tanks. (Tank numbers: H-24 and H-25)
- 70-foot diameter by 36-foot tall with an individual capacity of 1,036,350 gallons when completely full with zero freeboard.
- Each modular tank has a maximum usable capacity of 680,000 gallons initially. Following planned modifications to the secondary containment system (e.g., installation of longer sheeting), the maximum usable capacity in each tank will be increased to 950,000 gallons which will reserve 3-feet of freeboard. Prior to increasing the maximum usable capacity, NSRC will obtain agency approval.
- Both modular tanks have been plumbed and valved such that the volume of stored water can equalize between modular tanks under controlled conditions. At each modular tank, a valve was installed on the equalization connection pipe between the modular tanks. Each valve is kept closed and locked/tagged-out to reduce the potential for a release from both modular tanks at one time. Equalization will be conducted periodically by a valve operator manually opening the valves on each modular tank. The modular tanks will be monitored throughout the equalization process by the valve operator and other on-site personnel, staffed 24-hours/7 days a week.
- Modular tanks are equipped with visual and audible alarms that will activate when the modular tank reaches the maximum operational capacity of 600,000 gallons (15.2 feet of freeboard) and maximum usable capacity of 680,000 gallons (12.4 feet of freeboard). Following future modifications to the secondary containment system, the alarm float settings will be adjusted to the maximum operational capacity of 950,000 gallons (3 feet of freeboard) and the manufacturer's maximum recommended water level of 993,600 gallons (1.5 feet of freeboard).

The two one million-gallon modular tanks are installed within a single secondary containment consisting of an impermeable liner, steel sheet piles, and earthen berms, as detailed below.

- The impermeable liner consists of 60- and 120- mil Linear Low-Density Polyethylene.
- The total volume of available secondary containment is: 1,131,353 gallons, which exceeds USEPA requirements (i.e., max. volume of largest tank + 25-year, 24-hour rainfall) by approximately 2%.

- Containment is designed to meet the requirements of 40 Code of Federal Regulations (CFR) Subpart J 265.193(e)(1) whereby the capacity is sufficient to contain precipitation from a 25-year, 24-hour rainfall event, which is 3.96 inches (reference: National Oceanic and Atmospheric Administration Atlas 14, Volume 2, Version 3, East Palestine, Ohio).
- The containment calculation also accounts for the following:
- Displacement of one modular tank and two smaller tanks; and
- Displacement of the pumping equipment.
- Water that accumulates within the secondary containment area is collected by two sumps and will be pumped into the one million-gallon modular tanks.
- The truck unloading/loading area will be paved with 9-inch-thick asphalt pavement and surrounded by an asphalt curb to provide secondary containment. This area will also be sloped toward two catch basins that will be piped to the collection sumps located within the modular tank secondary containment area. Any water that accumulates in the collection sumps will be pumped back into one of the one million-gallon modular tanks.

4.5 Wastewater Treatment

Wastewater collected in the two one million-gallon modular tanks will be conveyed to the WWT system using a transfer pump located adjacent to the modular tanks. The WWT system includes the following process equipment.

- Sediment pretreatment process equipment to decrease sediment loading in the wastewater – installed upstream from the main chemical treatment process equipment, consisting of:
  - Chemical injection and flocculation equipment to promote agglomeration of suspended solids.
  - A clarifier which will enhance settling of suspended solids and allow removal of the settled solids as sludge.
  - A centrifuge which will dewater settled sludge for disposal as a U043 listed hazardous waste.
  - A sand filter system for removal of residual suspended solids that are not removed by the clarifier.
  - A sediment bag filter skid – for additional residual suspended solids removal.
- An oil water separator (OWS) – contingency in case of entrained product in the wastewater.
- Sediment bag filters – to remove particulates from WWT stream and reduce total suspended solids.
- Organoclay vessels – installed upstream from air stripper as a precaution to remove any residual product sheens that bypass OWS.
- An air stripper – primary treatment process for vinyl chloride.
- Liquid-phase activated carbon (LGAC) vessels – installed downstream from air stripper as a secondary contingency VOC treatment process.
- Air stripper off-gas treatment components consisting of:
  - Vapor-phase activated carbon (VGAC) – to remove VOCs and reduce consumption of HS-600 media downstream; and
  - HS-600 potassium permanganate-impregnated media installed downstream from VGAC to remove vinyl chloride from vapor stream, which does not readily adsorb to carbon.

Piping and instrumentation diagrams illustrating the WWT system process are provided as Figures 4a, 4b, 4c, 4d and 4e. The WWT system layout is illustrated in Figure 5. The CID Tank Area layout is provided as Figure 6. As discussed in section 1.0 non-media solid wastes generated as a result of operating the onsite treatment system will be managed as U043 listed hazardous wastes. Management of these non-media U043 listed hazardous waste are addressed in the WMP and are not included the CID Plan.

All WWT system equipment is secondarily contained for spill contingency. The wastewater treatment system building, which houses the air stripper, OWS, and bag filters, is designed with a containment lip surrounding the floor to hold 110% of the capacity of the largest wastewater containing vessel inside the building. The building is equipped with a floor sump with a high-level switch that will trigger a system shutdown alarm if activated. The organoclay vessels, LGAC vessels, and sediment pretreatment process vessels will be placed within an above grade secondary containment barrier constructed on an impermeable 60-mil HDPE liner sized to contain 110% of the volume of the largest vessel in the containment. The containment area is equipped with a high-level switch that will trigger a system shutdown alarm if activated. The remaining WWT system equipment is staged on 9-inch-thick asphalt pavement, which, like the truck unloading area, is surrounded by a 12-inch-tall asphalt curb and sloped so all water that accumulates on the pavement will flow towards two catch basins and pumped bank into the modular tanks for subsequent treatment. All wastewater conveyance piping not located within secondary containment is double-walled, including the piping that will transfer the treated effluent wastewater from the system to the CID Tank Farm. A valve is fitted to the end of the double-wall pipes, which is connected to interstitial space. When opened, if the pumped wastewater discharges from this valve it will indicate the interior wall has failed.

The WWT system is equipped with a control panel that will automatically control system operation. System controls include a telemetry module that will transmit alarm notifications to system operators. A high-level or other system shutdown alarm will deactivate power to the transfer pumps between system components and shut off inflow of wastewater from the modular tanks in Tank Farm 1 by closing a solenoid valve on the influent line.

Modeling data for the estimated vinyl chloride removal efficiency through the air stripper is provided with the air stripper cut sheets in Attachment 5. The model was run assuming a vinyl chloride concentration of 12 μg/L in the wastewater influent stream, which was selected based on the average concentration of vinyl chloride observed in recent wastewater samples collected from the temporary tanks currently used to store wastewater collected from the site. The model predicts a vinyl chloride removal efficiency of approximately 99.95% at this influent concentration, and an estimated vinyl chloride effluent concentration of less than 1 μg/L.

The VGAC is expected to achieve greater than 95% control efficiency for all VOCs in the air stripper off-gas stream other than vinyl chloride. The vinyl chloride is expected to pass through the granulated activated carbon and will be treated by the potassium permanganate impregnated media, which is expected to achieve greater than 95% control efficiency for vinyl chloride and any other VOCs remaining in the effluent upon exiting the VGAC. Both control efficiency assumptions are conservative. The USEPA document “Chapter 1 – Carbon Adsorbers” by John L. Sorrel, published in October 2018 states, “When properly designed, operated, and maintained, carbon adsorbers can achieve high VOC removal efficiencies of 95 to 99 percent at input VOC concentrations of between 500 and 2,000 ppm in air. Removal efficiencies greater than 98 percent can be achieved for dilute waste streams.” Both control efficiency assumptions will be confirmed by vapor sampling during the first two days of operation. Additionally, total VOC emissions from the system vapor treatment process will not exceed the 10 lbs/day deminimis threshold specified in OAC 3745-15-05.

Documentation for estimated VGAC and HS-600 adsorptive media usage rates from air stripper off-gas treatment is provided in Attachment 5. Modeling from carbon vendor TetraSOLV indicates that the VGAC usage rate will be approximately 143 pounds per day. However, the carbon modeling is based on the conservate assumption that 100% of the VOC mass in the water will be removed by the air stripper, and thus the input concentrations in the carbon usage calculations includes several constituents that are considered non-strippable. For example, ethanol, which is not strippable, accounts for 80 pounds of the daily carbon usage. If ethanol is removed from the modeling, the carbon usage rate decreases to 63 pounds per day, which is considered a more accurate estimate of what the usage rate will be under actual system operation. Modeling from the potassium permanganate media vendor HYDROSIL predicts that the HS-600 media usage rate will be approximately 1.2 pounds per day. This estimate is also conservative as it assumes that 100% of the vinyl chloride mass and 5% of the other VOC constituent mass is present in the discharge stream from the VGAC vessels and will be removed by the HS-600 media. Thus, the actual HS-600 media usage rate should be lower as well. Treated off-gas from the air stripper will be discharged to the atmosphere under either an air permit from OEPA, or an emergency air permitting exemption letter from the OEPA director.

Additional specifications for WWT system equipment are provided below. Product sheets for the primary WWT system components are included in Attachment 6.

- Clarifier
  - Lockwood Remediation Technologies 18,000-gallon lamella clarifier
  - 200 gpm maximum flow rate
  - Chemical injection system
  - Flocculation tank
- Centrifuge
  - Alfa Laval Lynx500 decanter centrifuge
  - Hydraulic capacity up to 660 gpm
- Sand Filters
  - Rain for Rent 48-2SSK sand filter skid
  - Automatic backwash
  - 425 gpm maximum flow rate
- Bag Filter skids
  - Rain for Rent BF-400 bag filter skids
  - 400 gpm maximum flow rate
  - Stainless steel construction
  - Bag filter housings are rated for a maximum operating pressure of 150 pounds per square inch (psi)
- Triple Bag Filters
  - Trade Size 2-Triple bag filter housing
  - Three units total with varying filter sizes: 100-micron filter upstream from OWS, 50-micron upstream from air stripper, and 10-micron upstream from LGAC units
  - Bag filter housings are rated for a maximum operating pressure of 150 psi
- Transfer Pumps
  - System influent pump (P100)

    - Godwin CD100S Centrifugal Pump
        - 20 HP, 480V,3 phase TEFC Motor
        - Capable of operating at a range of speeds using a variable frequency drive
        - Pump controls system process flow
        - Oversized to provide flexibility in preparation for changing conditions
- Oil Water Separator (P200) and Air Stripper (P300) Transfer Pumps.
  - Oil Water Separator
    - MK Environmental OWS Model C100
      - Maximum flow capacity of 100 gpm
  - Myers 200M Centrifugal Pump
    - 7.5 HP, 480V, 3 phase TEFC Motor
    - Capable of producing 100 gpm at 130 feet of total dynamic head (TDH) (56 psi)
    - Oversized to overcome backpressure created by fouling in bag filters
    - Pump equipped with variable frequency drive that will adjust flow rate automatically based on influent flow to the system
  - Knock-Out Tank Transfer Pump (P400)
    - Myers CT10 High Pressure Centrifugal Pump
      - 1.5 HP, 480V, 3 phase TEFC Motor
      - Capable of producing 40 gpm at 60 feet of TDH
- Sludge Pump (P600)
  - Gorman Rupp T3A3-B self-priming centrifugal pump
    - 5 HP, 480V, 3 phase TEFC Motor
- Clarifier Effluent Pump (P800)
  - Goulds 3656 Centrifugal Pump
    - Capable of producing 100 gpm at 115 feet of TDH
      - 5 HP, 480V, 3 phase TEFC Motor
- Organo Clay Vessels (T202 and T203)
  - Tetrasolv HPAF-3000 Vessels
    - 120 gpm max flow rating
    - Two 5,000-pound vessels connected in series
- Low Profile Air Stripper
  - NEEP model 2651 6-Tray Air Stripper
    - Stainless steel shallow tray model
    - Estimated 99.95% vinyl chloride removal efficiency for influent vinyl chloride concentration of 12 μg/L at process flow of 100 gpm and air flow rate of 600 cubic feet per minute (cfm)
- Air Stripper Blower
  - Tuthill CP Series Model 5009 Rotary Positive Displacement Lobe Blower

    - 40 HP, 480 V, 3 phase TEFC motor
    - 600 cfm design airflow rate (773 cfm max)
- Air Stripper Blower Knock Out Tank (T400)
  - MK Environmental Model KO200
    - Protects blower by removing moisture from the from the air stripper off-gas stream
    - Maximum capacity of 200 gallons
- Liquid Phase Granular Activated Carbon Vessels (T300 and T301)
  - Tetrasolv HPAF-3000 Vessels
    - 120 gpm max flow rating
    - Two 3,000-pound vessels connected in series
- Vapor Phase Granular Activated Carbon Vessels (T401 and T402)
  - MK Environmental Model VF3000
    - Two 3,000-pound vessels connected in series
    - Two additional spare vessels (T403 and T404) are staged with the system if media changeout required
- HS-600 Potassium Permanganate Impregnated Media Vessels (T405 and T406)
  - US Filter VS3000
    - Two 6,700-pound vessels connected in series.
    - One additional 6,700-pound VS3000 vessel and one additional 4,000-pound HS400 Tetrasolv VF2000 model vessel are staged with the system as spares if media changeout required
    - Three VS3000 vessels are housed on a single equipment skid. The HS400 vessel is stand-alone

Please note that the configuration of the sediment pretreatment equipment is subject to change based on the actual sediment load observed in the influent wastewater to the WWt system and the sediment removal performance/ efficiencies of the equipment. This will be evaluated during system startup. Sediment pretreatment equipment that is included in the current system design may be taken offline and removed from the process if it is determined to be unnecessary. Similarly, certain equipment that is currently included in the system chemical treatment process (e.g., oil water separator, organoclay vessels) may also be taken offline and removed from the treatment process if system performance monitoring data demonstrates that this equipment is not necessary or helpful. Any such proposed modifications to the chemical treatment process equipment will be subject to approval by USEPA. Non-media wastes generated from the WWT System, either from routine maintenance or from modifications to the process equipment, will be managed as U043 listed hazardous waste and will be evaluated for characteristics of a hazardous waste

Finally, a second chemical treatment system with the same process equipment as described above may be installed at the site after the first WWT system is up and running with the goal of maximizing system uptime. A second system would provide additional process redundancy limiting operating downtime during both routine equipment maintenance and unplanned shutdowns. Additional details on this potentially redundant system are provided in the accompanying WWT System OM&M Manual, which will be submitted under separate cover.

4.6 Data Collection to Support Wastewater Treatment System Operations

Sampling and field monitoring will be performed to quantify VOC concentrations along the air stripper vapor effluent stream, confirm attainment of the design vapor treatment removal efficiency, and evaluate the performance of vapor treatment process equipment. Additional details about system air sampling and field monitoring are provided in the WWT System OM&M Manual, which will be provided for review under a separate cover.

Sampling will be performed to confirm vinyl chloride wastewater treatment effectiveness and to evaluate the performance of treatment process equipment. Additional details about system operational sampling are provided in the WWT System OM&M Manual, which will be provided for review under a separate cover.

In addition to the roaming realtime air monitoring using handheld instrumentation in the community and the mobile laboratory route encompassing the work area, an additional AreaRAE has been set up on the work area perimeter and an additional analytical air sampling location has been set up in the community. The AreaRAE continuously monitors for VOCs and takes a reading every 15 seconds. The new AreaRAE location can be seen in Figure 8 as AR20. The analytical station is comprised of an evacuated canister that is analyzed for TO-15 + TICs and a passive dosimeter badge that is analyzed for butyl acrylate. The location of the additional analytical sample is identified as MC20 in Figure 9.

4.7 Treated Effluent Wastewater Storage

The proposed collection points for the wastewater being collected for treatment and management as a non-hazardous wastewater are illustrated in Figure 1. The proposed WWT system components and layout are illustrated in the process flow diagram (Figure 4). Treated effluent wastewater from the WWT system will be collected in temporary tanks placed in CID Tank Farm northeast of the water treatment system area (see Figure 2). Wastewater will be pumped from the WWT system to the CID Tank Farm through an above-grade 6-inch HDPE line housed within a 10-inch HDPE carrier pipe for secondary containment. Treated wastewater will be managed in batches, with one batch corresponding to the daily volume of treated effluent wastewater produced by the WWT system (approximately 150,000 gallons). Each batch of treated effluent wastewater will be housed in a CID tank with enough capacity to accommodate the entire batch volume. There will be a total of six CID tanks, which will provide a total storage capacity for up to six days of WWT system operation (see Figure 6). Information to document compliance of the CID tanks with 40 CFR Part 264 Subpart J (Tank Systems) and 40 CFR 264.553 (Temporary Units) is provided in *RCRA Tank System Substantive Standards – CID tanks,* which is being submitted under separate cover.

The CID tanks are equipped with a high-level switch that will signal the WWT system pumps to shut down to prevent a potential overflow if activated. A level gauge will also be deployed in the CID tank that is actively filling so field personnel can monitor the wastewater level in the CID tanks from the ground.

The CID tanks are located within a 60-mil HDPE lined and bermed, containment area designed to meet the requirements of 40 CFR Subpart J 265.193(e)(1) whereby the capacity is sufficient to contain precipitation from a 25-year, 24-hour rainfall event, which is 3.96 inches (reference: National Oceanic and Atmospheric Administration Atlas 14, Volume 2, Version 3, East Palestine, Ohio). The CID Tank secondary containment area has been sized to hold the volume of the largest tank (i.e., 200,000 gallons). Rainwater that collects within the secondary containment area will be removed by a vacuum truck or pumped back via aboveground pipe and offloaded into one of the modular tanks for subsequent treatment by the WWT system.

4.8 Wastewater Treatment Operations Staffing

The WWT system will operate continuously on a 24-hour/7-day a week basis and have around the clock staff to monitor WWT system operation. The proposed WWT system components and layout are illustrated in the process flow diagram (Figure 4).The WWT system is equipped with shutdown alarms/interlocks and other process safety controls that will allow for semi-automated operation. This will reduce the direct operational oversight responsibilities of system operators and allow staff to move between different WWT system operating areas and perform routine maintenance and monitoring. The general routine WWT system operations, monitoring and maintenance (OM&M) activities are listed in Table 2 below.

Truck loading of non-hazardous effluent wastewater from the CID tanks will be limited to daylight hours. Additional CID Tank Farm staff will be assigned to oversight of loading and manifesting. The CID tanks for treated effluent wastewater from the WWT system will be labelled with a RCRA hazardous waste label and a NFPA diamond. The CID tanks will undergo daily visual inspection until the CID for each batch is approved. Inspections will be documented on the Daily Inspection Form (Attachment 8 of the Waste Management Plan). All truck loading activities will be visually monitored by CID Tank Farm staff on top of the truck to prevent overfilling and at the pumps. Loading and offloading operations for the CID tanks is provided in the Modular Tank Summary Sheet (April 7, 2023, Arcadis).

Table 2. General Operations, Monitoring and Maintenance Activities

Unit	Time	Maintenance
Failsafe Devices	Bi-Weekly	Inspect and test the failsafe devices shown on the P&IDs: • Oil Water Separator Level Switch High • Air Stripper Sump Level Switch High High • Knockout Tank Level Switch High High • Air Stripper Blower Temperature Switch High High • Discharge Tank Field High High • Building Sump High High • LGAC Treatment Area Sump High High • ESTOP
Clarifier	As Needed	Monitor wastewater and sludge levels, pump pressures. Replace chemical drums when depleted
Sand Filters	Weekly	Inspect cam-lock connections for leaks. Tighten loose fittings as necessary.
Centrifuge	As Needed	Monitor dewatered solids for free liquids. Adjust speed as required based on influent flow and solids content.
Air Stripper	Per Batch	Monitor sump pressures, operational flow rates, and effluent VOC concentrations.
	As Needed	Clean stripper trays and demister pad when fouling occurs. Air stripper trays may be removed and cleaned using a pressure washer or may be left in place and cleaned by using the bypass line to recirculate cleaning solution.
Transfer Pumps	Weekly	Monitor and record operation pressure, inspect for leaks, and tighten/repair components as necessary.
	Quarterly	Clean impeller casing and inspect seals
Oil Water Separator	Weekly	Check oil reservoir for product and remove if present.
Sediment Bag Filters	Weekly	Monitor and record operational pressures on each filter.
		Inspect cover gasket, lubricate/replace as necessary.
		Replace sediment bag filters as needed. Assume four bags will require replacement per month.
LGAC/VGAC/HS600	Weekly	Inspect granular activated carbon vessels and cam-lock fittings for leaks. Tighten loose fittings as necessary.
		Monitor and record operational pressures.
		When needed, backwash the vessels per the manufacturer's instructions.
	As Needed	Replace spent LGAC based on laboratory analytical results. Replace spent VGAC/HS-600 based on field monitoring results.

5 Transportation and Disposal

Tracking and manifesting of the treated wastewater will be completed in accordance with the Site Waste Management Plan.

5.1 Truck Loading Operations

Two truck loading arms will be installed to facilitate loading operations. The loading arms will be connected to a mobile staircase with a railing from which the loader can fill and gauge the truck. In addition, the loader will have the ability to control the pump with a switch to avoid overfilling the truck and the loading arm is equipped with emergency shutoff valves. It is anticipated that 28 trucks will be needed to load-out each daily batch of treated wastewater. To maintain traffic flow, trucks will be staged at Tank Farm 5 and then called to the CID Tank Farm when they are ready to be loaded. Portions of East Martin Street, the access road to and from the CID Tank Farm, and the truck loading area will be paved to minimize the generation of dust and to facilitate runoff collection. The closest stationary air monitor is located by the pond approximately 300-400 feet east of the CID tank loading area. It is anticipated that street sweeping and air monitoring for dust will not be necessary since all operations involving the tanker trucks will occur on newly paved asphalt parking lots and transportation routes will be restricted to public roadways. Truck traffic flow in the loading area is illustrated on Figure 2.

Wastewater generated from the decontamination of trucks will be collected and stored in a separate temporary tank. Decontamination water will be disposed of as a U043 listed hazardous waste.

5.2 Disposal Facilities

Two disposal facilities were identified in the Request for Approval of Contained-In Determination for Surface Water, which included Vickery Deepwell located in Vickery, Ohio and Valicor Environmental located in Huntington, West Virginia. Offsite truck routes to these facilities have been included in Attachment 7. Both of these facilities are CERCLA approved, however a formal OSR request will be submitted prior to any offsite wastewater shipment.

NRSC has discussed the proposed sampling approach, the onsite WWT system, and the daily batch submittals with both facilities. All proposed facilities have indicated that they are permitted to receive non-hazardous wastewater and have confirmed that they can accept the wastewater as long as the CID approval is attached to the profile and there are no RCRA waste codes applicable to the wastewater.

NSRC is working on notifications and contracting for four additional non-hazardous wastewater disposal facilities, Buckeye Brine, in Coshocton, Ohio; Clean Harbors Spring Grove, in Cincinnati, Ohio; Clean Harbors in Cleveland, Ohio and VLS Environmental Solutions in Lancaster PA . Upon confirmation that these facilities are willing to accept the CID wastewater, NSRC will provide USEPA and OEPA with truck routes for the new facilities. Additionally, USEPA/OEPA will be notified if additional facilities are identified for disposal of the treated wastewater.

6 Emergency Procedures

Emergency procedures include:

- In the event of a spill, the Operations Section Chief, Deputy Operations Section Chiefs, and Wastewater Transfer Group Supervisor will be notified immediately of discovery by onsite personnel.
- The Operations Section Chief will notify Unified Command within 30 minutes of notification.
- Refer to Incident Action Plan ICS 204 Wastewater Transfer Group and ICS 205a Communication List for contact information.

7 Schedule

7.1 Treatment of Hazardous Wastewater

Upon approval to treat the U043 listed hazardous wastewater, the WWT system will have a six-day start-up operational period. During this period samples will be collected as described in section 3.2.1. NSRC will request a rush turnaround time from the laboratory on all samples. The step-by-step process for submitting the CID and requesting USEPA approval for transport is outlined in section 3.3. It is anticipated that the CID for Batch 001 will be submitted on day 4 of the start-up operational period. There are 6 temporary tanks in the CID Tank Farm (CID tanks), one for each day of treatment. If approvals (OEPA approval on CID, Disposal Facility approval on profile, USEPA approval for offsite disposal) are not received by day 6 the WWT system may be turned off or additional TUs may be brought onsite for storage of the treated wastewater pending approvals.

After the one week start up period, NSRC, USEPA, and OEPA will meet to discuss the analytical results, re-evaluate the sampling frequency and discuss the CID and USEPA approval process. Based on the analytical results, the sampling frequency may decrease in the future with concurrence from OEPA and USEPA.

7.2 Closure of Wastewater Treatment System

A Wastewater Treatment System Decontamination and Closure Memo/Plan will be prepared and submitted to USEPA for review and approval within 30-days of approval of the Wastewater Treatment and Contained-In Operational Summary. The Memo/Plan will include the following, at a minimum:

- A detailed description of the steps needed to remove or decontaminate all hazardous waste residues and contaminated containment system components, equipment, structures, and soils, including, but not limited to, procedures for cleaning equipment and removing contaminated non-media solids;
- A description of decontamination requirements for equipment that will be cleaned and returned to vendor;
- All non-media wastes that cannot meet the decontamination debris standards in 40 CFR 268.45 will be managed as U043 listed hazardous waste. The memo/plan will describe any additional sampling required to determine if the non-media waste is characteristically hazardous.
- Proposed transportation and disposal methods will be provided for waste managed for offsite disposal
- Methods for sampling and testing surrounding soils, and criteria for determining that no contamination is present at concentrations that would require long-term monitoring and maintenance (i.e., post-closure care); and
- A schedule for closure to include the total time required to close the WWT system and remove the temporary units (tanks) and the time required to remove and dispose of all contaminated media.

Tanks and ancillary equipment that will be returned to the vendor will be cleaned to the specifications identified in the Water Treatment System Decontamination and Closure Memo/Plan; tank liners, piping and other materials that will be discarded will be managed as U043 hazardous waste or will be decontaminated in accordance with the debris decontamination standards in 40 CFR 268.45 and managed as a non-hazardous waste. Any wastewater generated from the decontamination of U043 debris or from cleaning equipment will be managed as a U043 listed hazardous waste for offsite disposal.

NSRC will notify the USEPA in writing at least 45 days prior to the date on which final closure of the WWT system and temporary tanks will begin.

8 Glossary of Terms

Water	Surface water, stormwater and groundwater within the Area of Contamination prior to containerization for onsite treatment or offsite disposal
Wastewater	Water that has been containerized for onsite treatment or offsite disposal (a.k.a discarded as a waste)
Decontamination Water	Non-media wastewater that has become impacted as a result of cleaning of impacted areas, tanks, equipment, etc.
Untreated Wastewater	OM&M term for influent to the Wastewater Treatment System
Treated Wastewater	OM&M term for effluent from the Wastewater Treatment system
U043 Listed Hazardous Wastewater	References the RCRA waste determination of a Listed hazardous wastewater, which is listed due to the release of unused, pure commercial grade vinyl chloride
Non-Hazardous Wastewater	Used to document the RCRA waste determination of the treated wastewater, following the OEPA CID approval
Environmental Media	Soil, groundwater, surface water and sediments
Non-media wastes/ Non-Media wastewater	Remedial wastes that do not meet the definition of environmental media, including but not limited to debris, decontamination wastes, carbon, filter socks, used bag filters, cleaning fluids
WWT Media	Non-media waste generated from operations and decommissioning of the WTP, to include spent filter media, treatment media and processing wastes associated with the WWT system operations and decommissioning
Temporary Tanks	General term used for CERCLA Remediation waste storage units, includes 20K gallon temporary tanks, Modular Tanks and CID tanks
Modular Tanks (H24 and H25)	Type of temporary storage tank used for the collection of untreated wastewater. Currently there are two one-million gallon Modular Tanks located in Tank Farm 1 (Tank IDs H24 and H25)
CID Tanks (T306A through T306F)	Type of temporary storage tank used for the collection of treated wastewater
Unassessed areas	Areas where no representative soil analytical data has been collected to date

9 References

OEPA. 2022. Application of Contained-In Determination for Media and Debris Contamination by Hazardous Waste at RCRA Sites. Division of Environmental Response and Revitalization. November.

USEPA. 1998a. Management of Remediation Waste Under RCRA. Office of Solid Waste and Emergency Response. EPA530-F-98-025. October 14.

USEPA. 1998b. Contained-In Policy for Soil and Debris Contaminated with Hazardous Waste. November 30.

USEPA. 2023. Unilateral Administrative Order for Removal Actions (UAO) for the Site pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 United States Code (U.S.C.) Section 9606(a), CERCLA Docket No. V-W-23-C-004

Tables

Table 1 - Wastewater Analytical Summary Table

Sample Name: Date Collected: Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-01/2023-02-09/ 02/09/23 240-180173-1	WC-02/2023-02-09/ 02/09/23 240-180173-2	WC-03/2023-02-09/ 02/09/23 240-180173-3	WC-04/2023-02-09/ 02/09/23 240-180173-4	WC-05/2023-02-09/ 02/09/23 240-180173-5	WC-COMPOSITE-01 TO 05 02/09/23 240-180173-7	WC-251068-BLUE BLDG EAST_20230223 02/23/23 240-180852-2	WC-257225-PLEASANT_20230223 02/23/23 240-180852-1	WC-257516- GAS STATION_20230223 02/23/23 240-180852-3	WC - 251060 - BLUE BLDG EAST_20230301 03/01/23 240-181183-2	WC - 251079 - CLARK_20230301 03/01/23 240-181183-3	WC - 251478 - GAS STATION_20230301 03/01/23 240-181183-5	WC - 251633 - PLEASANT_20230301 03/01/23 240-181183-4	WC - 257204 - BLUE BLDG WEST_20230301 03/01/23 240-181183-1
Volatile Organics																
1,1,1-Trichloroethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-trichloro-1,2,2-trifluoroetha	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-Trichloroethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	0.7	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-chloropropane	- -	mg/L	<0.0040	<0.0040	<0.010	<0.0040	<0.0040	NA	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
1,2-Dibromoethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	0.5	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichlorobenzene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	7.5	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2-Butanone	200	mg/L	**0.052**	**0.0084 J**	<0.050	**0.010 J**	**0.0046 J**	NA	<0.010	**0.0019 J**	<0.010	**0.0025 J**	**0.0019 J**	<0.010	**0.0032 J**	**0.0034 J**
2-Ethylhexyl acrylate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.21 J**	**0.22**	**0.046**	**0.18**	**0.045**
2-Hexanone	- -	mg/L	<0.020	<0.020	<0.050	<0.020	<0.020	NA	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
4-Methyl-2-pentanone	- -	mg/L	**0.015 J**	**0.0055 J**	<0.050	**0.0072 J**	**0.0036 J**	NA	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Acetone	- -	mg/L	**0.85**	**0.020**	<0.050	**0.015 J**	<0.020	NA	**0.0066 J**	**0.011**	<0.010	**0.014**	**0.011**	<0.010	**0.014**	**0.017**
Benzene	0.5	mg/L	**0.0028**	**0.0014 J**	**0.0044 J**	**0.0018 J**	**0.0015 J**	NA	<0.0010	**0.00067 J**	<0.0010	<0.0010	**0.00098 J**	<0.0010	**0.0016**	<0.0010
Bromodichloromethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromoform	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromomethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Butyl Acrylate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	**24**	**0.22**	**0.24**	**0.47**	**9.6**
Carbon Disulfide	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon Tetrachloride	0.5	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chlorobenzene	100	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020 F1F2	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	6	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloromethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,2-Dichloroethene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,3-Dichloropropene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyclohexane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dichlorodifluoromethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethanol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	- -	mg/L	**0.0011 J**	**0.0082**	**0.0033 J**	<0.0020	<0.0020 F1F2	NA	<0.0010	<0.0010	**0.00095 J**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Isopropylbenzene	- -	mg/L	<0.0020	**0.0024**	<0.0050	<0.0020	<0.0020 F1F2	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
m,p-Xylene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	- -	mg/L	<0.020	<0.020	<0.050	<0.020	<0.020	NA	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methyl Acrylate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0020	<0.0020	**0.00097 J**	**0.0014 J**	<0.0020
Methyl tert-butyl ether	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylcyclohexane	- -	mg/L	**0.0018 J**	**0.0020**	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylene Chloride	- -	mg/L	<0.010	<0.010	<0.025	<0.010	<0.010	NA	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
o-Xylene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	- -	mg/L	<0.0020	<0.0020	**0.0044 J**	<0.0020	<0.0020 F1F2	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	0.7	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020 F2	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	- -	mg/L	**0.0028**	**0.020**	**0.0066**	<0.0020	**0.0011 JF2**	NA	**0.00065 J**	<0.0010	**0.0017**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
trans-1,2-Dichloroethene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020 F2	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
trans-1,3-Dichloropropene	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	0.5	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichlorofluoromethane	- -	mg/L	<0.0020	<0.0020	<0.0050	<0.0020	<0.0020	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl Chloride	0.2	mg/L	**0.022**	**0.035**	**0.91**	**0.29**	**0.16**	NA	<0.0010	**0.0037**	<0.0010	<0.0010	**0.0011**	<0.0010	**0.0046**	<0.0010
Xylenes (total)	- -	mg/L	**0.0068**	**0.045**	**0.032**	**0.0030 J**	**0.0067 F1F2**	NA	**0.0035**	<0.0020	**0.0081**	<0.0020	<0.0020	<0.0020	<0.0020	**0.00071 J**

Table 1 - Wastewater Analytical Summary Table

Sample Name: / Date Collected: / Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-01/2023-02-09/ 02/09/23 240-180173-1	WC-02/2023-02-09/ 02/09/23 240-180173-2	WC-03/2023-02-09/ 02/09/23 240-180173-3	WC-04/2023-02-09/ 02/09/23 240-180173-4	WC-05/2023-02-09/ 02/09/23 240-180173-5	WC-COMPOSITE-01 TO 05 02/09/23 240-180173-7	WC-251068-BLUE BLDG EAST_20230223 02/23/23 240-180852-2	WC-257225-PLEASANT_20230223 02/23/23 240-180852-1	WC-257516- GAS STATION_20230223 02/23/23 240-180852-3	WC - 251060 - BLUE BLDG EAST_20230301 03/01/23 240-181183-2	WC - 251079 - CLARK_20230301 03/01/23 240-181183-3	WC - 251478 - GAS STATION_20230301 03/01/23 240-181183-5	WC - 251633 - PLEASANT_20230301 03/01/23 240-181183-4	WC - 257204 - BLUE BLDG WEST_20230301 03/01/23 240-181183-1
Semivolatile Organics																
1,1'-Biphenyl	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
2,2'-Oxybis(1-Chloropropane)	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
2,4,5-Trichlorophenol	400	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
2,4,6-Trichlorophenol	2	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
2,4-Dichlorophenol	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
2,4-Dimethylphenol	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
2,4-Dinitrophenol	- -	mg/L	<0.89	<0.89	<0.45	<0.89	<0.18	NA	<25	<25	<0.20	<1.0	<4.0	<4.0	<2.0	<0.050
2,4-Dinitrotoluene	0.13	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
2,6-Dinitrotoluene	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
2-Butoxyethanol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.6**	**12**	**11**	**5.4**	**0.22**
2-Chloronaphthalene	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
2-Chlorophenol	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
2-Methylnaphthalene	- -	mg/L	**0.021**	<0.018	**0.024**	<0.018	**0.013**	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	**0.0014**
2-Methylphenol	200	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
2-Nitroaniline	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
2-Nitrophenol	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
3,3'-Dichlorobenzidine	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
3-Methylphenol, 4-Methylphenol	200	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
3-Nitroaniline	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
4,6-Dinitro-2-methylphenol	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
4-Bromophenyl-phenylether	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
4-Chloro-3-Methylphenol	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
4-Chloroaniline	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
4-Chlorophenyl-phenylether	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
4-Nitroaniline	- -	mg/L	<0.18 *+	<0.18 *+	<0.089 *+	<0.18 *+	<0.036 *+	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
4-Nitrophenol	- -	mg/L	<0.89	<0.89	<0.45	<0.89	<0.18	NA	<25	<25	<0.20	<1.0	<4.0	<4.0	<2.0	<0.050
Acenaphthene	- -	mg/L	**0.020**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Acenaphthylene	- -	mg/L	**0.019**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Acetophenone	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Anthracene	- -	mg/L	**0.025**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Atrazine	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
Benzaldehyde	- -	mg/L	<0.18 *+	<0.18 *+	<0.089 *+	<0.18 *+	<0.036 *+	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
Benzo(a)anthracene	- -	mg/L	**0.023**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Benzo(a)pyrene	- -	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Benzo(b)fluoranthene	- -	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Benzo(g,h,i)perylene	- -	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Benzo(k)fluoranthene	- -	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
bis(2-Chloroethoxy)methane	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
bis(2-Chloroethyl)ether	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
bis(2-Ethylhexyl)phthalate	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
Butylbenzylphthalate	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
Caprolactam	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
Carbazole	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Chrysene	- -	mg/L	**0.023**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Dibenzo(a,h)anthracene	- -	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Dibenzofuran	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Diethylphthalate	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
Dimethylphthalate	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
Di-n-Butylphthalate	- -	mg/L	<0.45	<0.45	<0.22	<0.45	<0.089	NA	<13	<13	<0.10	<0.50	<2.0	<2.0	<1.0	<0.025
Di-n-Octylphthalate	- -	mg/L	<0.18	<0.18	<0.089	<0.18	<0.036	NA	<5.0	<5.0	<0.040	<0.20	<0.80	<0.80	<0.40	<0.010
Fluoranthene	- -	mg/L	**0.082**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Fluorene	- -	mg/L	**0.023**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Hexachlorobenzene	0.13	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Hexachlorobutadiene	0.5	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Hexachlorocyclopentadiene	- -	mg/L	<0.89	<0.89	<0.45	<0.89	<0.18	NA	<25	<25	<0.20	<1.0	<4.0	<4.0	<2.0	<0.050
Hexachloroethane	3	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Indeno(1,2,3-cd)pyrene	- -	mg/L	<0.018	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Isophorone	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Naphthalene	- -	mg/L	**0.040**	<0.018	**0.014**	<0.018	**0.0063**	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	**0.0092**
Nitrobenzene	2	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
N-Nitroso-di-n-propylamine	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
N-Nitrosodiphenylamine	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050

Table 1 - Wastewater Analytical Summary Table

Sample Name: Date Collected: Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-01/2023-02-09/ 02/09/23 240-180173-1	WC-02/2023-02-09/ 02/09/23 240-180173-2	WC-03/2023-02-09/ 02/09/23 240-180173-3	WC-04/2023-02-09/ 02/09/23 240-180173-4	WC-05/2023-02-09/ 02/09/23 240-180173-5	WC-COMPOSITE-01 TO 05 02/09/23 240-180173-7	WC-251068-BLUE BLDG EAST_20230223 02/23/23 240-180852-2	WC-257225-PLEASANT_20230223 02/23/23 240-180852-1	WC-257516- GAS STATION_20230223 02/23/23 240-180852-3	WC - 251060 - BLUE BLDG EAST_20230301 03/01/23 240-181183-2	WC - 251079 - CLARK_20230301 03/01/23 240-181183-3	WC - 251478 - GAS STATION_20230301 03/01/23 240-181183-5	WC - 251633 - PLEASANT_20230301 03/01/23 240-181183-4	WC - 257204 - BLUE BLDG WEST_20230301 03/01/23 240-181183-1
Pentachlorophenol	100	mg/L	<0.89	<0.89	<0.45	<0.89	<0.18	NA	<25	<25	<0.20	<1.0	<4.0	<4.0	<2.0	<0.050
Phenanthrene	- -	mg/L	**0.10**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Phenol	- -	mg/L	<0.089	<0.089	<0.045	<0.089	<0.018	NA	<2.5	<2.5	<0.020	<0.10	<0.40	<0.40	<0.20	<0.0050
Pyrene	- -	mg/L	**0.084**	<0.018	<0.0089	<0.018	<0.0036	NA	<0.50	<0.50	<0.0040	<0.020	<0.080	<0.080	<0.040	<0.0010
Inorganics																
Arsenic	5	mg/L	**0.024 J**	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Barium	100	mg/L	**0.022 JB**	**0.078 JB**	**0.025 JB**	**0.036 JB**	**0.038 JB**	NA	**0.061 JB**	**0.035 JB**	**0.036 JB**	**0.064 JB**	**0.037 JB**	**0.038 JB**	**0.044 JB**	**0.021 JB**
Cadmium	1	mg/L	<0.050	**0.00021 J**	<0.050	**0.00027 J**	<0.050	NA	<0.050	**0.00024 J**	**0.00020 J**	<0.050	<0.050	<0.050	<0.050	<0.050
Chromium	5	mg/L	**0.058**	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Lead	5	mg/L	**0.0031 J**	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Mercury	0.2	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	NA	**0.00013 J**	**0.00023 J**	**0.00013 J**	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Selenium	1	mg/L	**0.018 J**	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver	5	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	<0.050	**0.00084 J**	<0.050	<0.050	<0.050	<0.050
Miscellaneous																
BTU	- -	btu/lb	6300	6300	7000	7100	6900	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diesel C10-C28	- -	mg/L	**980 B**	**160 B**	**28 B**	**2300 B**	**5.6 B**	NA	NA	NA	NA	**1.4 B**	**1.9 B**	**2 B**	**2 B**	**1.3 B**
Diethylene Glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dipropylene glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylene glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ignitability	- -	F	<200	<200	<200	<200	<200	NA	<200	<200	<200	<200	<200	<200	<200	<200
Perfluorooctane sulfonic acid (PI	- -	ng/L	NA	NA	NA	NA	NA	**8.7**	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctanoic acid (PFOA)	- -	ng/L	NA	NA	NA	NA	NA	**9.4**	NA	NA	NA	NA	NA	NA	NA	NA
pH	- -	pH Units	8.8 HF	8.2 HF	7.8 HF	7.5 HF	7.5 HF	NA	NA	NA	NA	7.9 HF	7.9 HF	7.5 HF	7.9 HF	8.0 HF
Propylene Glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	mg/L	**7000**	**410**	**900**	**540**	**280**	NA	NA	NA	NA	**49**	**49**	**20**	**140**	**26**
Total Suspended Solids	- -	mg/L	**18000**	**200**	**89**	**11000**	**28**	NA	NA	NA	NA	**7.3**	**23**	**13**	**23**	**120**
Triethylene glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1 - Wastewater Analytical Summary Table

Sample Name:			WC-251079_20230306	WC-251091_20230306	WC-251321_20230306	WC-251478_20230306	WC-251633_20230306	WC-251782_20230306	WC-256094_20230306	WC-257204_20230306	WC-538B_20230306	WC-251362_20230307	WC-AL4216_20230307	WC-AL4944_20230307	WC-AL5679_20230307	WC-531A_20230307
Date Collected:	NS-E Palestine		03/06/23	03/06/23	03/06/23	03/06/23	03/06/23	03/06/23	03/06/23	03/06/23	03/06/23	03/07/23	03/07/23	03/07/23	03/07/23	03/07/23
Lab Sample ID:	TCLP Criteria	Units	410-117699-7	410-117699-6	410-117699-3	410-117699-2	410-117699-4	410-117699-8	410-117699-5	410-117699-1	410-117699-9	240-181523-1	240-181523-5	240-181523-4	240-181523-3	240-181523-6
Volatile Organics																
1,1,1-Trichloroethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-trichloro-1,2,2-trifluoroetha	- -	mg/L	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.20	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-Trichloroethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	0.7	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-chloropropane	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
1,2-Dibromoethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	0.5	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichlorobenzene	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	7.5	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2-Butanone	200	mg/L	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.20	**0.0015 J**	**0.0018 J**	**0.0035 J**	<0.010	**0.0025 J**
2-Ethylhexyl acrylate	- -	mg/L	**0.055**	**0.22**	**0.023**	**0.027**	**0.0068**	<0.0050	**0.30**	**0.018**	<0.10	NA	NA	NA	NA	NA
2-Hexanone	- -	mg/L	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.20	<0.010	<0.010	<0.010	<0.010	<0.010
4-Methyl-2-pentanone	- -	mg/L	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.20	<0.010	<0.010	<0.010	<0.010	<0.010
Acetone	- -	mg/L	<0.040	<0.020	<0.020	<0.020	**0.024**	<0.020	<0.020	**0.021**	<0.40	**0.0086 J**	**0.010**	**0.012**	<0.010	**0.014**
Benzene	0.5	mg/L	<0.0020	**0.0037**	<0.0010	<0.0010	<0.0010	<0.0010	**0.0039**	<0.0010	<0.020	**0.00080 J**	**0.00043 J**	<0.0010	<0.0010	**0.0021**
Bromodichloromethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromoform	- -	mg/L	<0.0080	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.080	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromomethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Butyl Acrylate	- -	mg/L	**5.6**	**2.6**	**0.33**	**1.5**	**0.035**	**1.2**	**0.077**	**0.13**	**49**	NA	NA	NA	NA	NA
Carbon Disulfide	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon Tetrachloride	0.5	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chlorobenzene	100	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	6	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloromethane	- -	mg/L	<0.0040	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.040	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,2-Dichloroethene	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,3-Dichloropropene	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyclohexane	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dichlorodifluoromethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethanol	- -	mg/L	**7.2**	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	**1.1**	<15	NA	NA	NA	NA	NA
Ethylbenzene	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Isopropylbenzene	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
m,p-Xylene	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	NA	NA	NA	NA	NA
Methyl acetate	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.010	<0.010	<0.010	<0.010	<0.010
Methyl Acrylate	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	NA	NA	NA	NA	NA
Methyl tert-butyl ether	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylcyclohexane	- -	mg/L	<0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylene Chloride	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
o-Xylene	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0022**	<0.0010	<0.020	NA	NA	NA	NA	NA
Styrene	- -	mg/L	<0.010	<0.0050	<0.0050	**0.010**	<0.0050	<0.0050	<0.0050	<0.0050	<0.10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	0.7	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	**0.0029**
Toluene	- -	mg/L	<0.0020	<0.0010	<0.0010	**0.0015**	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	**0.00074 J**	<0.0010	<0.0010	<0.0010	**0.00067 J**
trans-1,2-Dichloroethene	- -	mg/L	<0.0040	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.040	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
trans-1,3-Dichloropropene	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	0.5	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichlorofluoromethane	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl Chloride	0.2	mg/L	**0.0028**	**0.062**	**0.0081**	**0.0064**	**0.011**	<0.0010	**0.0058**	**0.0062**	<0.020	**0.016**	**0.0037**	**0.015**	**0.0075**	**0.0014**
Xylenes (total)	- -	mg/L	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0022**	<0.0010	<0.020	**0.0024**	<0.0020	**0.0015 J**	<0.0020	**0.0026**

Table 1 - Wastewater Analytical Summary Table

Sample Name: Date Collected: Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-251079_20230306 03/06/23 410-117699-7	WC-251091_20230306 03/06/23 410-117699-6	WC-251321_20230306 03/06/23 410-117699-3	WC-251478_20230306 03/06/23 410-117699-2	WC-251633_20230306 03/06/23 410-117699-4	WC-251782_20230306 03/06/23 410-117699-8	WC-256094_20230306 03/06/23 410-117699-5	WC-257204_20230306 03/06/23 410-117699-1	WC-538B_20230306 03/06/23 410-117699-9	WC-251362_20230307 03/07/23 240-181523-1	WC-AL4216_20230307 03/07/23 240-181523-5	WC-AL4944_20230307 03/07/23 240-181523-4	WC-AL5679_20230307 03/07/23 240-181523-3	WC-531A_20230307 03/07/23 240-181523-6
Semivolatile Organics																
1,1'-Biphenyl	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	400	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.13	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butoxyethanol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	200	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylphenol, 4-Methylphenol	200	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Atrazine	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzaldehyde	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl)ether	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Caprolactam	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethylphthalate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Butylphthalate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-Octylphthalate	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	0.13	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	0.5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	3	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1 - Wastewater Analytical Summary Table

Sample Name: Date Collected: Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-251079_20230306 03/06/23 410-117699-7	WC-251091_20230306 03/06/23 410-117699-6	WC-251321_20230306 03/06/23 410-117699-3	WC-251478_20230306 03/06/23 410-117699-2	WC-251633_20230306 03/06/23 410-117699-4	WC-251782_20230306 03/06/23 410-117699-8	WC-256094_20230306 03/06/23 410-117699-5	WC-257204_20230306 03/06/23 410-117699-1	WC-538B_20230306 03/06/23 410-117699-9	WC-251362_20230307 03/07/23 240-181523-1	WC-AL4216_20230307 03/07/23 240-181523-5	WC-AL4944_20230307 03/07/23 240-181523-4	WC-AL5679_20230307 03/07/23 240-181523-3	WC-531A_20230307 03/07/23 240-181523-6
Pentachlorophenol	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics																
Arsenic	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	100	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous																
BTU	- -	btu/lb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diesel C10-C28	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethylene Glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dipropylene glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylene glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ignitability	- -	F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctane sulfonic acid (PI	- -	ng/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perfluorooctanoic acid (PFOA)	- -	ng/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	- -	pH Units	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propylene Glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Suspended Solids	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Triethylene glycol	- -	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1 - Wastewater Analytical Summary Table

Sample Name: / Date Collected: / Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-537A_20230307 03/07/23 240-181523-2	WC-257761-STORM SEWER 03/16/23 240-182044-1	WC-251060 03/24/23 240-182547-3	WC-251478 03/24/23 240-182547-5	WC-251633 03/24/23 240-182547-1	WC-251688 03/24/23 240-182547-4	WC-AL4771 03/24/23 240-182547-2
Volatile Organics									
1,1,1-Trichloroethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-trichloro-1,2,2-trifluoroetha	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-Trichloroethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	0.7	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-chloropropane	- -	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
1,2-Dibromoethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	0.5	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichlorobenzene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	7.5	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2-Butanone	200	mg/L	**0.0027 J**	**0.0043 J**	**0.0024 J**	**0.0020 J**	**0.0023 J**	**0.0020 J**	**0.0042 J**
2-Ethylhexyl acrylate	- -	mg/L	NA	NA					
2-Hexanone	- -	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
4-Methyl-2-pentanone	- -	mg/L	<0.010	**0.0015 J**	<0.010	<0.010	<0.010	<0.010	<0.010
Acetone	- -	mg/L	**0.036**	**0.050**	**0.028**	**0.015**	**0.032**	**0.019**	**0.033**
Benzene	0.5	mg/L	<0.0010	**0.00088 J**	<0.0010	<0.0010	**0.00058 J**	<0.0010	<0.0010
Bromodichloromethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromoform	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromomethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Butyl Acrylate	- -	mg/L	NA	NA					
Carbon Disulfide	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon Tetrachloride	0.5	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chlorobenzene	100	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	6	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloromethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,2-Dichloroethene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,3-Dichloropropene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyclohexane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.00077 J**	<0.0010
Dibromochloromethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dichlorodifluoromethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethanol	- -	mg/L	NA	NA					
Ethylbenzene	- -	mg/L	<0.0010	**0.00087 J**	<0.0010	<0.0010	<0.0010	**0.0029**	**0.0018**
Isopropylbenzene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0014**	<0.0010
m,p-Xylene	- -	mg/L	NA	NA					
Methyl acetate	- -	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Methyl Acrylate	- -	mg/L	NA	NA					
Methyl tert-butyl ether	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylcyclohexane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0061**	<0.0010
Methylene Chloride	- -	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
o-Xylene	- -	mg/L	NA	NA					
Styrene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	0.7	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	- -	mg/L	<0.0010	**0.0028**	<0.0010	<0.0010	<0.0010	**0.0054**	**0.0025**
trans-1,2-Dichloroethene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
trans-1,3-Dichloropropene	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	0.5	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichlorofluoromethane	- -	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl Chloride	0.2	mg/L	<0.0010	**0.016**	**0.0089**	**0.012**	**0.034**	**0.00066 J**	**0.0019**
Xylenes (total)	- -	mg/L	**0.0014 J**	**0.0054**	**0.00050 J**	<0.0020	**0.00045 J**	**0.038**	**0.013**

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Sample Name: / Date Collected: / Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-537A_20230307 03/07/23 240-181523-2	WC-257761-STORM SEWER 03/16/23 240-182044-1	WC-251060 03/24/23 240-182547-3	WC-251478 03/24/23 240-182547-5	WC-251633 03/24/23 240-182547-1	WC-251688 03/24/23 240-182547-4	WC-AL4771 03/24/23 240-182547-2
Semivolatile Organics									
1,1'-Biphenyl	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
2,2'-Oxybis(1-Chloropropane)	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
2,4,5-Trichlorophenol	400	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
2,4,6-Trichlorophenol	2	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
2,4-Dichlorophenol	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
2,4-Dimethylphenol	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
2,4-Dinitrophenol	- -	mg/L	NA	<0.50	<12	<0.44	<0.10	<0.20	<25
2,4-Dinitrotoluene	0.13	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
2,6-Dinitrotoluene	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
2-Butoxyethanol	- -	mg/L	NA	NA					
2-Chloronaphthalene	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
2-Chlorophenol	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
2-Methylnaphthalene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
2-Methylphenol	200	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
2-Nitroaniline	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
2-Nitrophenol	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
3,3'-Dichlorobenzidine	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
3-Methylphenol, 4-Methylphenol	200	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
3-Nitroaniline	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
4,6-Dinitro-2-methylphenol	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
4-Bromophenyl-phenylether	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
4-Chloro-3-Methylphenol	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
4-Chloroaniline	- -	mg/L	NA	<0.10	<2.5 *-	<0.089 *-	<0.020 *-	<0.040 *-	<5.0 *-
4-Chlorophenyl-phenylether	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
4-Nitroaniline	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
4-Nitrophenol	- -	mg/L	NA	<0.50	<12	<0.44	<0.10	<0.20	<25
Acenaphthene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Acenaphthylene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Acetophenone	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Anthracene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Atrazine	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
Benzaldehyde	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
Benzo(a)anthracene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Benzo(a)pyrene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Benzo(b)fluoranthene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Benzo(g,h,i)perylene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Benzo(k)fluoranthene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
bis(2-Chloroethoxy)methane	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
bis(2-Chloroethyl)ether	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
bis(2-Ethylhexyl)phthalate	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
Butylbenzylphthalate	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
Caprolactam	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
Carbazole	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Chrysene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Dibenzo(a,h)anthracene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Dibenzofuran	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Diethylphthalate	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
Dimethylphthalate	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
Di-n-Butylphthalate	- -	mg/L	NA	<0.25	<6.2	<0.22	<0.050	<0.10	<13
Di-n-Octylphthalate	- -	mg/L	NA	<0.10	<2.5	<0.089	<0.020	<0.040	<5.0
Fluoranthene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Fluorene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Hexachlorobenzene	0.13	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Hexachlorobutadiene	0.5	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Hexachlorocyclopentadiene	- -	mg/L	NA	<0.50	<12	<0.44	<0.10	<0.20	<25
Hexachloroethane	3	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Indeno(1,2,3-cd)pyrene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Isophorone	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Naphthalene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Nitrobenzene	2	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
N-Nitroso-di-n-propylamine	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
N-Nitrosodiphenylamine	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5

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Sample Name: / Date Collected: / Lab Sample ID:	NS-E Palestine TCLP Criteria	Units	WC-537A_20230307 03/07/23 240-181523-2	WC-257761-STORM SEWER 03/16/23 240-182044-1	WC-251060 03/24/23 240-182547-3	WC-251478 03/24/23 240-182547-5	WC-251633 03/24/23 240-182547-1	WC-251688 03/24/23 240-182547-4	WC-AL4771 03/24/23 240-182547-2
Pentachlorophenol	100	mg/L	NA	<0.50	<12	<0.44	<0.10	<0.20	<25
Phenanthrene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Phenol	- -	mg/L	NA	<0.050	<1.2	<0.044	<0.010	<0.020	<2.5
Pyrene	- -	mg/L	NA	<0.010	<0.25	<0.0089	<0.0020	<0.0040	<0.50
Inorganics									
Arsenic	5	mg/L	NA	**0.05**	<0.050	<0.050	<0.050	<0.050	<0.050
Barium	100	mg/L	NA	**0.42**	**0.026 J**	**0.024 J**	**0.019 J**	**0.041 J**	**0.025 J**
Cadmium	1	mg/L	NA	**0.0023 J**	**0.00024 J**	<0.050	<0.050	<0.050	<0.050
Chromium	5	mg/L	NA	**0.065**	<0.050	<0.050	<0.050	<0.050	<0.050
Lead	5	mg/L	NA	**0.13**	<0.050	<0.050	<0.050	<0.050	<0.050
Mercury	0.2	mg/L	NA	**0.00041**	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Selenium	1	mg/L	NA	<0.02	**0.0077 JB**	<0.050	**0.017 JB**	<0.050	<0.050
Silver	5	mg/L	NA	<0.01	<0.050	<0.050	<0.050	<0.050	<0.050
Miscellaneous									
BTU	- -	btu/lb	NA	NA					
Diesel C10-C28	- -	mg/L	NA	**160 B**	**3100 B**	**2100 B**	**4900 B**	**6700 B**	**4200 B**
Diethylene Glycol	- -	mg/L	NA	NA					
Dipropylene glycol	- -	mg/L	NA	NA					
Ethylene glycol	- -	mg/L	NA	NA					
Ignitability	- -	F	NA	NA	<0	<0	<0	<0	<0
Perfluorooctane sulfonic acid (PI	- -	ng/L	NA	NA					
Perfluorooctanoic acid (PFOA)	- -	ng/L	NA	NA					
pH	- -	pH Units	NA	7.7 HF	7.6 HF	7.7 HF	7.4 HF	7.5 HF	7.5 HF
Propylene Glycol	- -	mg/L	NA	NA					
Total Organic Carbon	- -	mg/L	NA	**830**	**150**	**30**	**34**	**28**	**180**
Total Suspended Solids	- -	mg/L	NA	**1200**	**330**	**270**	**240**	**460**	**260**
Triethylene glycol	- -	mg/L	NA	NA					

Table 1 - Wastewater Analytical Summary Table

Notes:
btu/lb - British Thermal Units per pound
mg/L - milligrams per liter
ng/L - nanograms per liter

Lab Qualifiers	Definition
*+	
<	The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
B	Indicates an estimated value between the instrument detection limit and the Reporting Limit (RL).
F1	MS and/or MSD recovery exceeds control limits
F2	
HF	
J	Indicates an estimated value.

Table 3 - Regulatory Requirements for Temporary Unit Tanks and Demonstration of Compliance

Requirements for Temporary Units (TUs)	Regulation	How Requirements Will Be Met
Labelling	40 CFR 262.15(a)(5) OAC rule 3745-52-17(A)(5) Ohio Admin. Code 1301:7-7-50	All waste containers and tanks will be labelled with, at a minimum, the words "hazardous waste" and an indication of the hazard. All Staging piles must be identified by signs. Modular tanks will be equipped with NFPA labels. Containers, tanks and staging piles with missing or damaged labels/sign will be relabeled. All signs and labels will be properly maintained (Section 3.2.3 of Waste Management Plan).
Storage Areas	40 CFR 262.17(a)(1) OAC 3745-55-70 to 55-78	
Condition of containers.		All containers and tanks will be maintained in good condition, with no leaks, corrosion, rust, or bulges. If a container or tank is not in good condition or is leaking, transfer the waste into a container that is in good condition (Section 3.2.3 of Waste Management Plan).
Compatibility of waste with containers.		Each waste stream will be stored in a different container, tank or staging pile that is compatible with the waste contained (Section 3.2.3 of Waste Management Plan).
Management of containers.		Waste containers will be kept closed and staging piles will be covered unless waste is actively being added to the container. All containers will be transported to the storage area, handled, and stored in a manner to prevent them from rupturing and to prevent the waste from leaking or spilling (Section 3.2.3 of Waste Management Plan).
Inspections- containers.		At a minimum, TUs and staging piles will undergo daily visual inspection. Inspections will be documented on the Daily Inspection Form (Section 3.2.3 of Waste Management Plan).
Containment.		TUs (containers and tanks) and staging piles will be placed on secondary containment and the secondary containment will be maintained in accordance with the Secondary Containment Standard Operating Procedures (Section 3.2.3 of Waste Management Plan).
Special requirements for ignitable or reactive waste.		NA - no ignitable or reactive wastes onsite.
Special requirements for incompatible wastes.		NA - no incompatible wastes being generated.
Closure.	40 CFR 262.17(a)(8)	Notification of Closure will be provided upon removal of TUs. Data obtained from the *Characterization and Remediation Work Plan for Derailment - Area Soil* will be used to demonstrate compliance with Closure performance standards Temporary Units (container storage areas and tank systems).
Tank systems	40 CFR 264 (subpart J) OAC rule 3745-55-90 to 55-99	
Assessment of existing tank systems integrity.		Not applicable to this derailment Site, no existing tank systems were in place prior to the derailment.

Table 3 - Regulatory Requirements for Temporary Unit Tanks and Demonstration of Compliance

Requirements for Temporary Units (TUs)	Regulation	How Requirements Will Be Met
Design and installation of new tank systems or components.		Only pre-manufactured temporary storage tanks and modular tanks will be used as TUs to store hazardous waste. All tanks (temporary storage tanks and modular tanks) and containers (roll-off boxes, vacuum boxes, drums, totes) are constructed of high quality steel and are constructed according to recognized engineering standards.
Containment and detection of releases.		Farms 5 and 6 have HDPE liner covering the entire storage area with additional HDPE installed under the temporary storage tanks. Rig mats have been placed over the liner to prevent punctures. A containment berm was created using hay bale berms overlain by HDPE liner. Tank Farms 2 and 3, Stand by Tank Farms 2 and 3 and the waste water treatment plant have individual HDPE liners installed under each temporary tank and container storage area. Both Modular tanks were installed within a single secondary containment consisting of an impermeable liner (120 mil Linear Low-Density Polyethylene (LLDPE) liner manufactured by ATARFIL), steel sheet piles, and earthen berms. Modular tanks are equipped with visual and audible high-level alarms will be installed on each tank. All tank inflow pumps will be programmed to automatically shut down when the tank level reaches the maximum usable capacity as indicated by the first level alarm. Tank Farms are monitored 24/7 by personnel gauging tanks and providing oversight of offloading/loading operations. Release detection for temporary tanks is limited to visual inspection and observation.
General operating requirements.		For modular tanks the loading and offloading procedures and tank system operations is provided in the *Modular Tank Summary Sheet (April7, 2023, Arcadis)* General operating requirements for temporary storage tanks are provided by the manufacturer.
Inspections - tank systems.		All tanks and tank systems will be inspected daily, at a minimum.
Response to leaks or spills and disposition of leaking or unfit for use tank systems.		See section 7 of Waste Management Plan for emergency response procedures and notifications in accordance with UAO.
Closure and post-closure care.		Notification of Closure will be provided upon removal of TUs. Data obtained from the Characterization and Remediation Work Plan for Derailment - Area Soil will be used to demonstrate compliance with Closure performance standards Temporary Units (container storage areas and tank systems).

Table 3 - Regulatory Requirements for Temporary Unit Tanks and Demonstration of Compliance

Requirements for Temporary Units (TUs)	Regulation	How Requirements Will Be Met
Special requirements for ignitable waste or reactive waste - tank systems.		NA - no ignitable or reactive waste have been generated from remedial activities.
Special requirements for incompatible wastes.		NA - no incompatible wastes have been generated.

Figures

Legend

- Piezometer Locations

Wells

Status

- Stantec Sentinel Well
- Conveyance Piping
- Stormwater Catch Basin
- Water Bypass
- Waste Staging Pile 3

Decision Unit Areas/Boundaries

- Category 1
- Category 2
- Category 3
- Category 4
- Water Collection by Gravity Drainage and Pumping
- Water Collection by Gravity Drainage and Pumping
- ArtificialPath
- Stream River / Flow Direction
- County/State Boundary
- Expanded Waste Staging Areas
- Vac Truck Water Collection Points
- Conveyance Piping
- Water Collection by Gravity Drainage and Pumping

Map Date: 8/17/2023

Drone imagery date: 06/29/2023

0 200 400
Feet

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

SITE PLAN WITH WATER RECOVERY FEATURES

ARCADIS

FIGURE 1

Document Path: T:_ENV\NorfolkSouthern\EastPalestine_Feb5_2023\MXD\Misc_One_Off\NS_East Palestine_F2_Water Treatment System Area Layout.mxd

Legend

- Approximate Location of CID Treatment System
- CID Tank Storage Location
- CID Treatment System Location
- CID Effluent Pipe to Tank Manifold (Below Grade at Road Crossing and Above Grade Elsewhrere)
- Untreated Influent Pipe to Treatment System (Below Grade)
- CID Pipe Manifold
- Empty Inbound Truck
- Full Outbound Truck

Map Date: 8/17/2023

Drone image dated: 06/29/2023

0 160 320

Feet

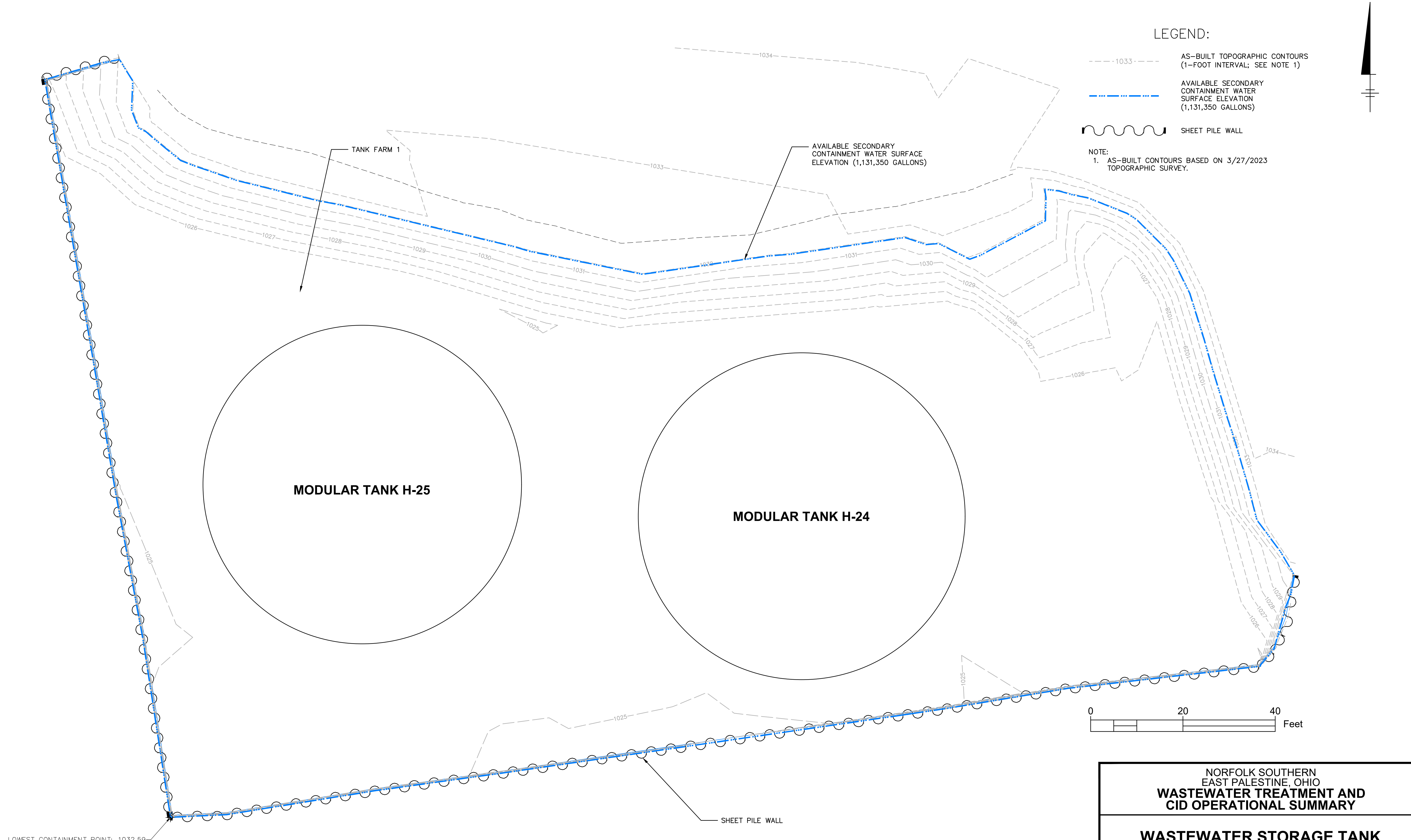
NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER TREATMENT SYSTEM AREA LAYOUT

ARCADIS

FIGURE

2

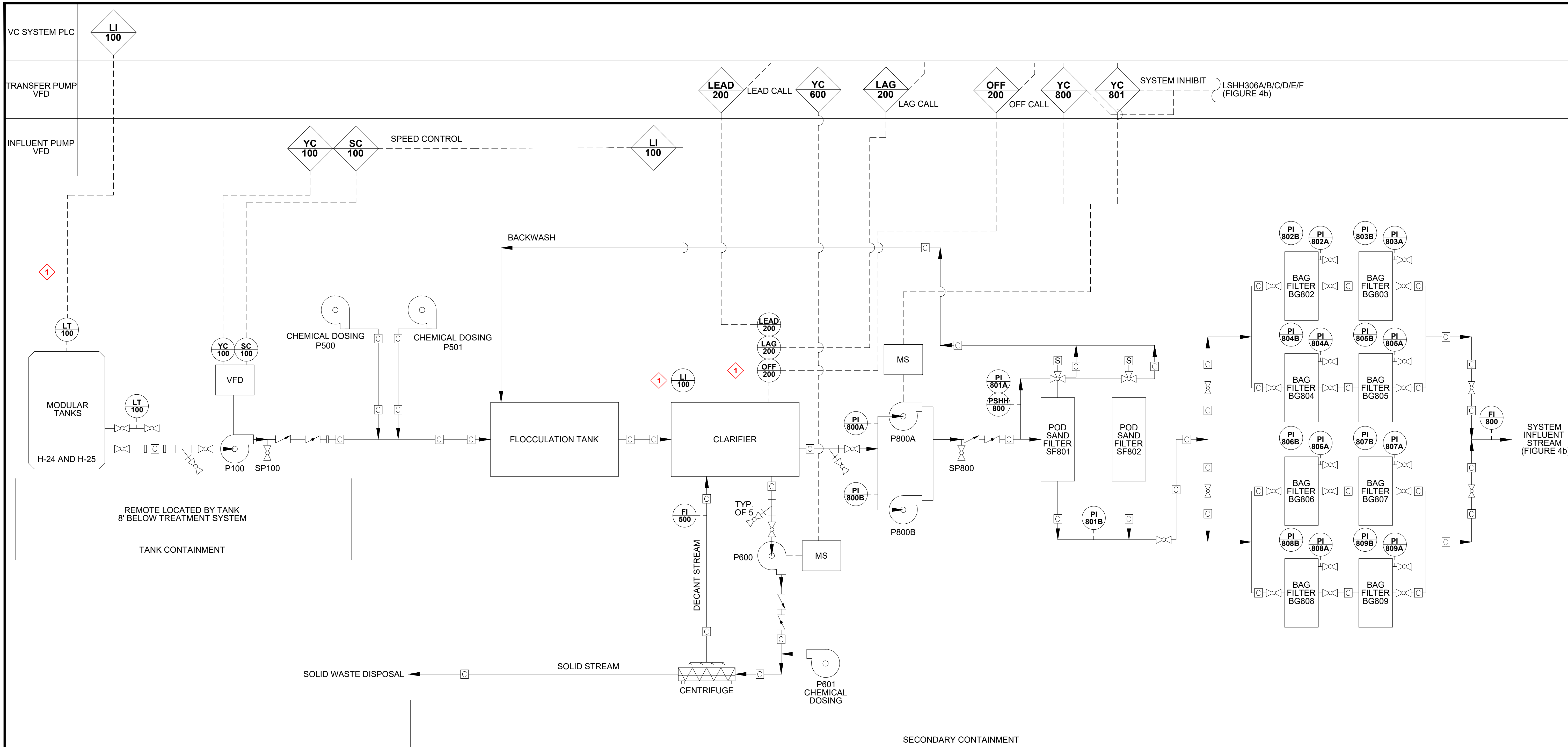


NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER STORAGE TANK CONTAINMENT AREA AS-BUILT

ARCADIS

FIGURE
3



STATE OF OHIO
BRYAN K. BAILEY
E-66658
8/17/23
REGISTERED PROFESSIONAL ENGINEER

Professional Engineer's
BRYAN K. BAILEY

P.E.'s Number	State	Date Signed
E-66658	OH	8/17/2023

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

SEDIMENT PRETREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM

ARCADIS

FIGURE
4a

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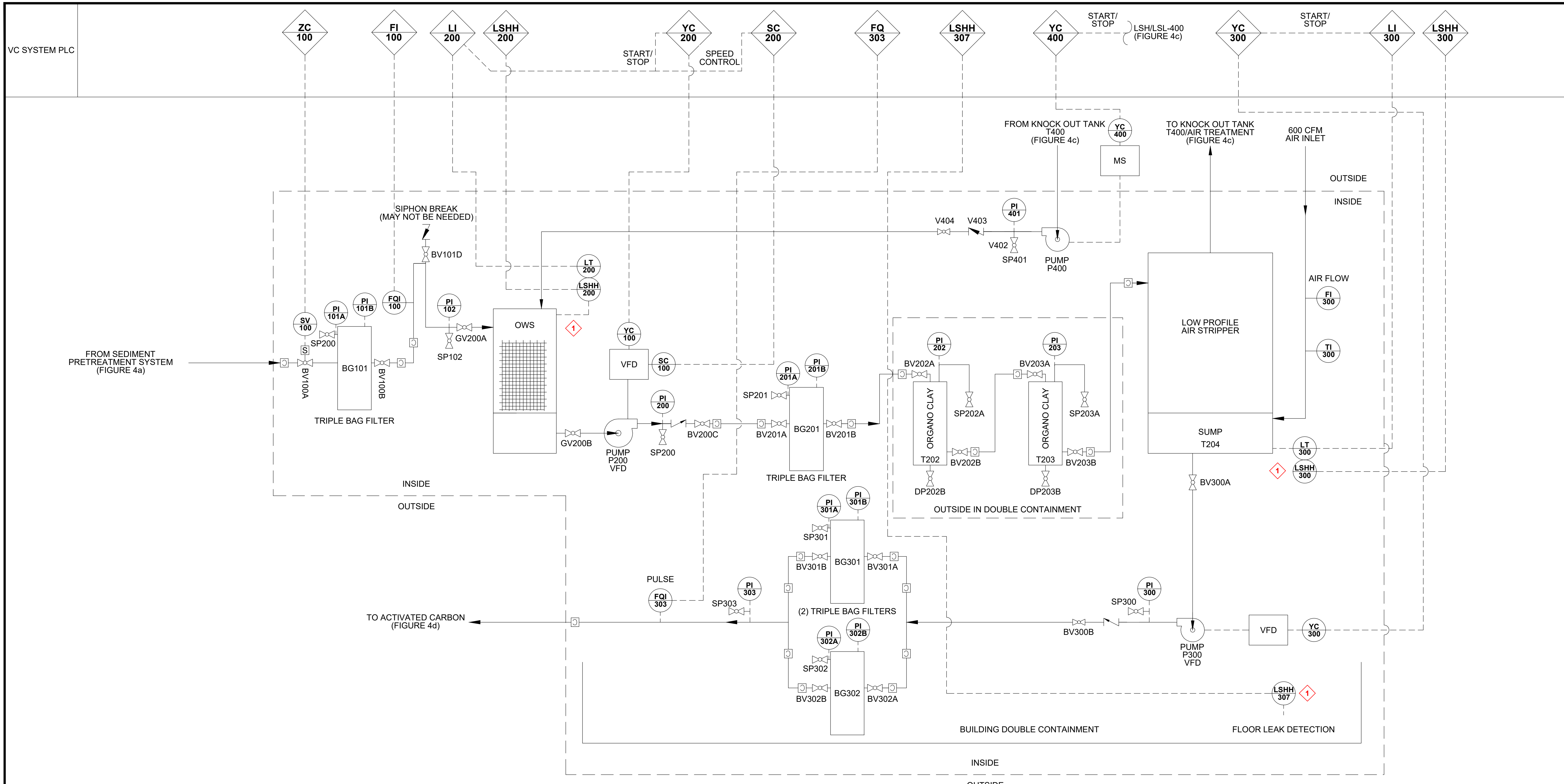

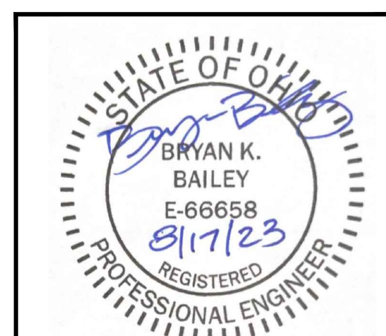

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BRYAN K. BAILEY

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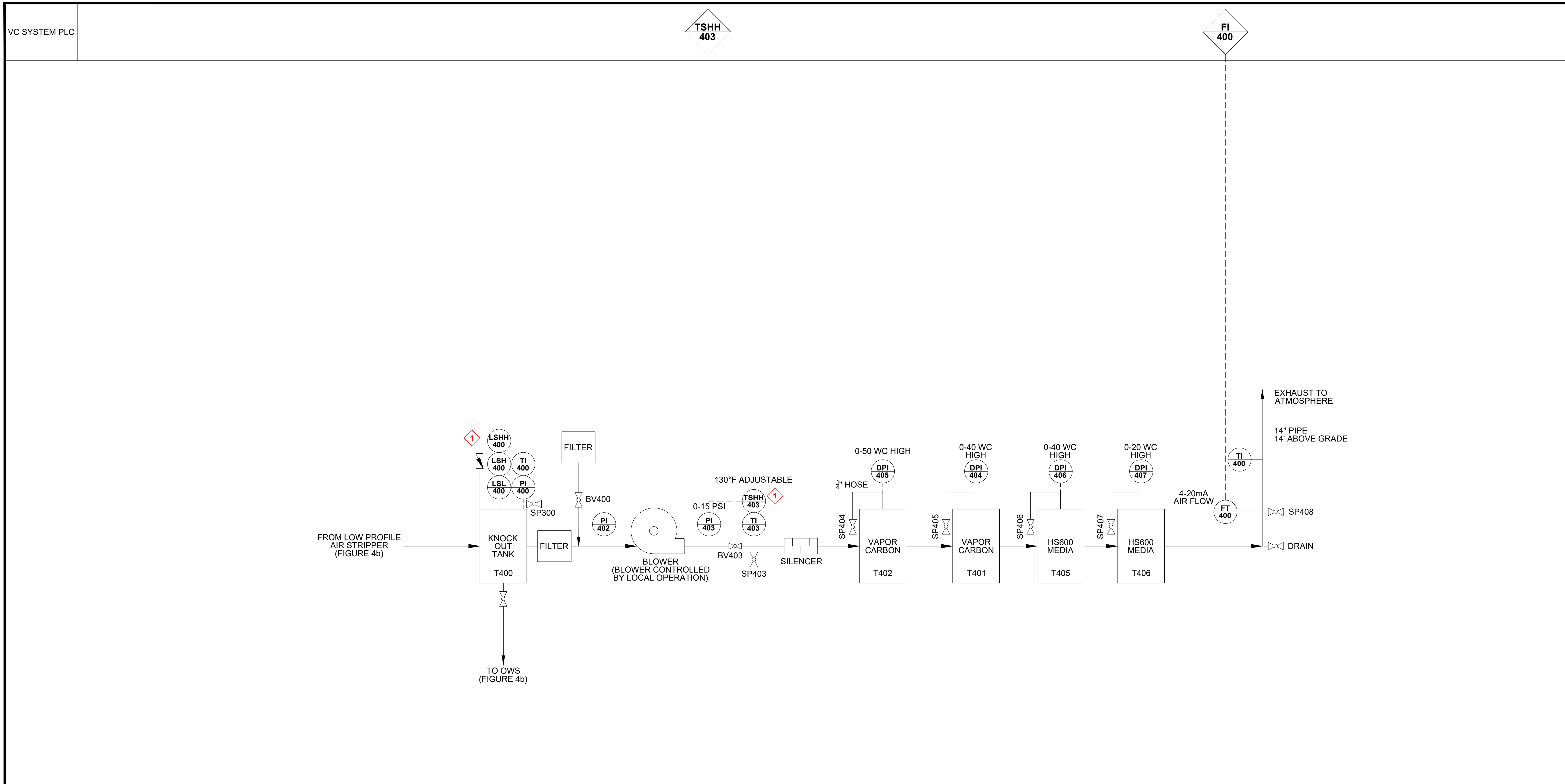
NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM-SYSTEM TREATMENT

ARCADIS

FIGURE
4b



STATE OF OHIO
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Professional Engineer's
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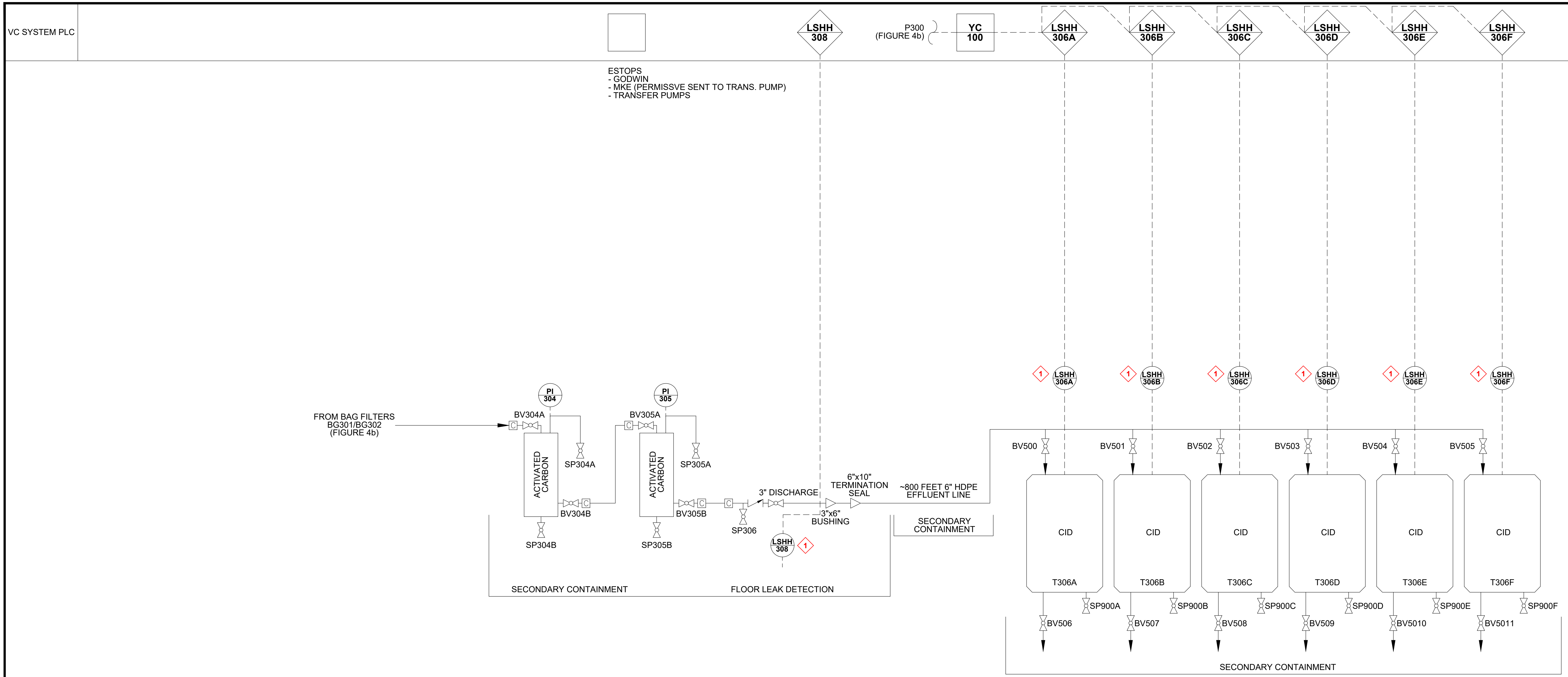
E-66658	OH	8/17/2023

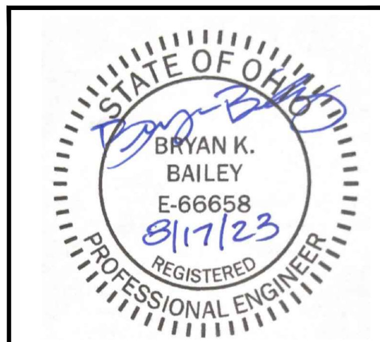
NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM-AIR TREATMENT AND EFFLUENT

ARCADIS

FIGURE
4c





Professional Engineer's
BRYAN K. BAILEY

P.E.'s Number	State	Date Signed
E-66658	OH	8/17/2023

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM-SYSTEM EFFLUENT

ARCADIS

FIGURE
4d

EQUIPMENT LEGEND:

- PRIMARY PROCESS PIPING
- EQUIPMENT ENCLOSURE
- CHECK VALVE
- BUTTERFLY VALVE
- BALL VALVE
- GATE VALVE
- SOLENOID VALVE
- WYE
- CAMLOCK FITTING
- FLANGE FITTING
- PUMP
- BLOWER
- REDUCING BUSHING
- INLINE STATIC MIXER
- CENTRIFUGE

PIPE IDENTIFICATION TAGS:

DIAMETER - SERVICE - SCHEDULE - MATERIAL - OTHER

DIAMETER: NOMINAL DIAMETER (INCHES)

SCHEDULE = US STANDARD UNITS

LOGIC INTERLOCKS:

1 SYSTEM SHUTDOWN AFTER 30 SECOND ALARM DELAY

NOTES:

1. EMERGENCY STOP BUTTON WILL BE LOCATED INSIDE THE EQUIPMENT ROOM OF THE SYSTEM BUILDING, LOCATED NO GREATER THAN 25 FEET FROM AN OPERATING PUMP AND WILL SHUT DOWN ALL PUMPS, MOTORS, AIR STRIPPER, AND OPEN THE SOLENOID VALVE TO THE ATMOSPHERE.
2. ANTI-SIPHON TO BE PLACED ON INVERTED U PIPING TO PREVENT SIPHONING OF REMEDIAL SYSTEM.
3. ALL HOSE CONNECTIONS ARE 3" UNLESS OTHERWISE STATED.

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P.E.'s Number	State	Date Signed
E-66658	OH	8/17/2023

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM-LEGEND

ARCADIS

FIGURE
4e

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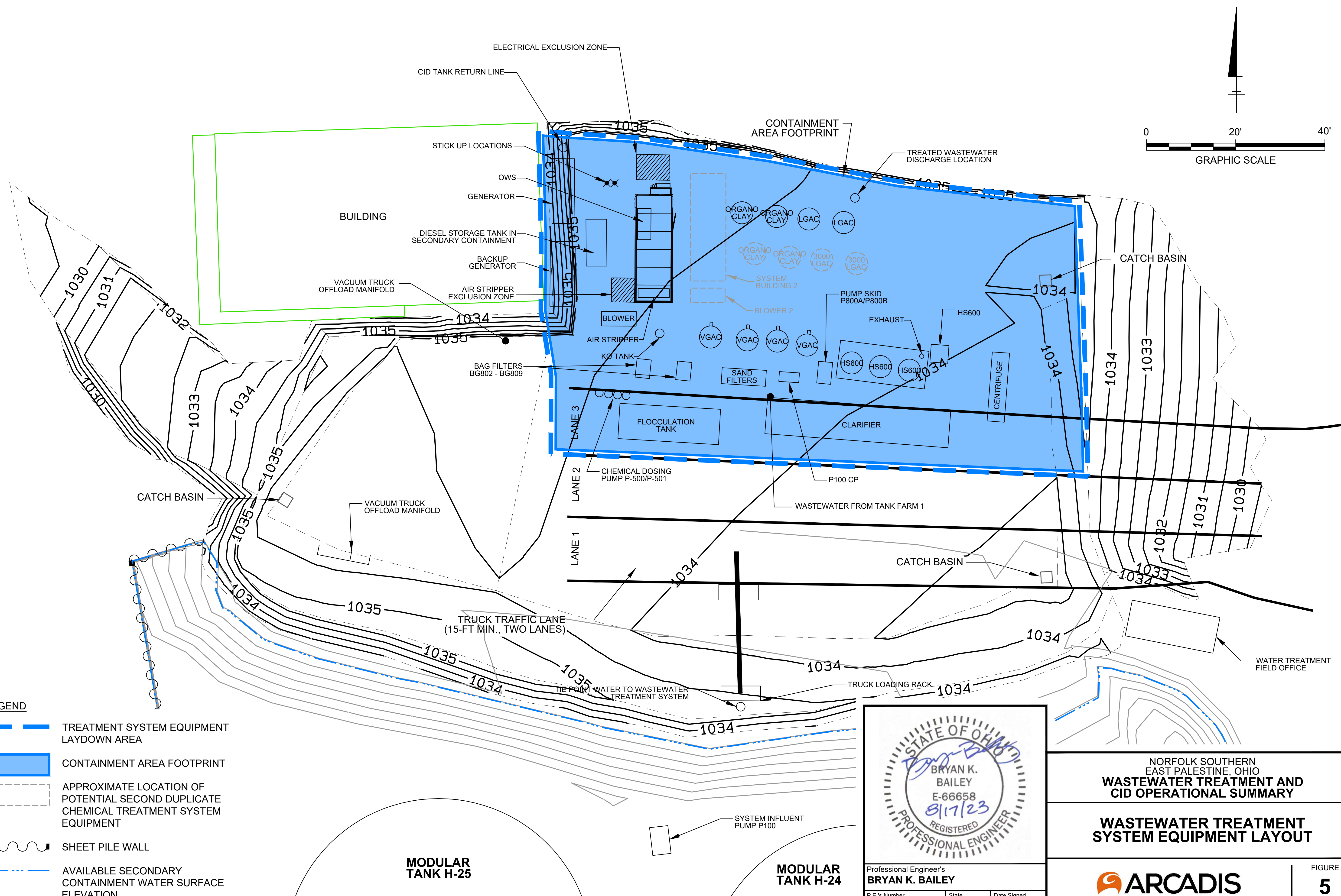

LEGEND

- TREATMENT SYSTEM EQUIPMENT LAYDOWN AREA
- CONTAINMENT AREA FOOTPRINT
- APPROXIMATE LOCATION OF POTENTIAL SECOND DUPLICATE CHEMICAL TREATMENT SYSTEM EQUIPMENT
- SHEET PILE WALL
- AVAILABLE SECONDARY CONTAINMENT WATER SURFACE ELEVATION

STATE OF OHIO
BRYAN K. BAILEY
E-66658
8/17/23
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PROFESSIONAL ENGINEER

Professional Engineer's
BRYAN K. BAILEY

P.E.'s Number	State	Date Signed
E-66658	OH	8/17/2023

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

WASTEWATER TREATMENT SYSTEM EQUIPMENT LAYOUT

ARCADIS

FIGURE
5

C:\Users\ekrahmer\ACCDocs\Arcadis\AUS-NORFOLK SOUTHERN-EAST PALESTINE DERAILMENT-EAST PALESTINE Ohio\Project Files\2023\01-In Progress\01-DWG\CID-FIG_5-WATER TREATMENT SYSTEM EQ LAYOUT.dwg LAYOUT: 5 SAVED: 8/17/2023 1:19 PM ACADVER: 24.2S (LMS TECH)
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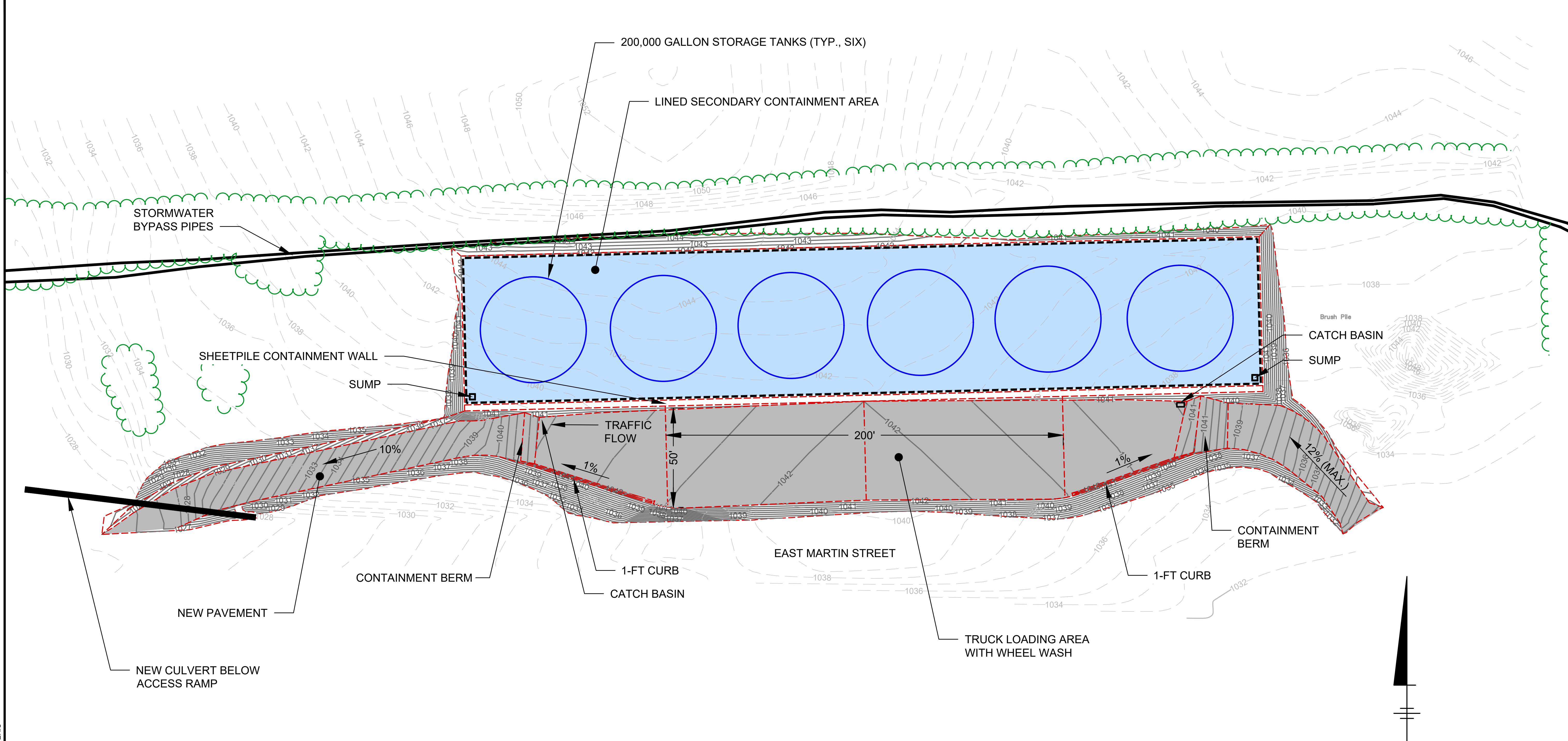


LEGEND:

- 1036 — EXISTING TOPOGRAPHIC CONTOUR (0.5 FT. INTERVAL)
- EXISTING TREELINE
- 1036 — PROPOSED TOPOGRAPHIC CONTOUR (0.5 FT. INTERVAL)
- PROPOSED GRADE BREAK
- LINED SECONDARY CONTAINMENT
- NEW PAVEMENT

STATE OF OHIO
MICHAEL B. HIGGINS JR
E-79115
7-16-23
REGISTERED
PROFESSIONAL ENGINEER

Professional Engineer's
MICHAEL B HIGGINS JR

P.E.'s Number	State	Date Signed
E-79115	OH	7/16/2023

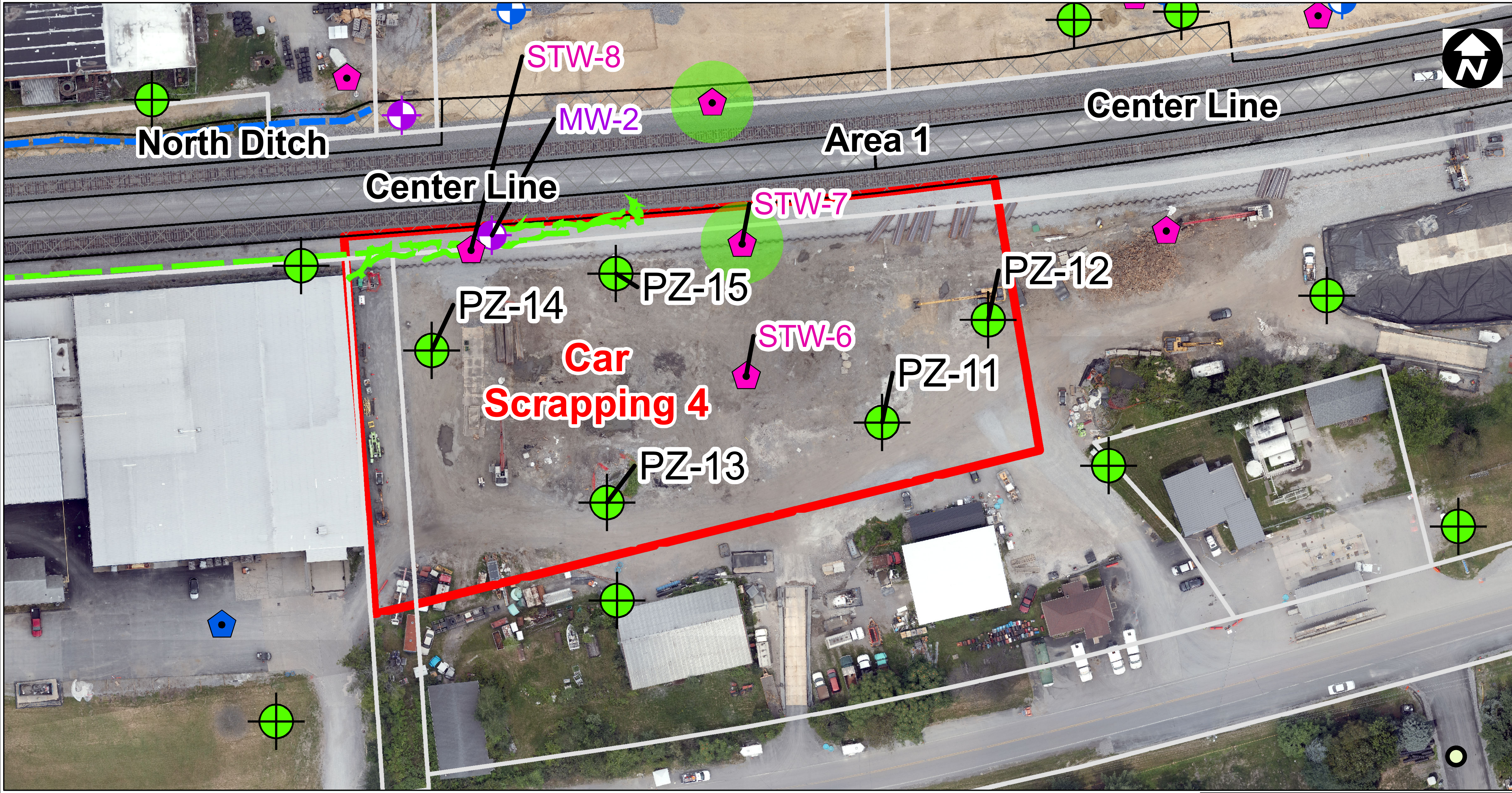
NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT AND CID OPERATIONAL SUMMARY

CID TANK FARM DESIGN LAYOUT

ARCADIS

FIGURE
6

XREFS:
CID-REPORT-X-TITLE
CID-X-BASEMAP-TANK FARM-mod



Legend

- Piezometer Locations
- <Null>
- Completed Deep Monitoring Well
- Proposed Deep Monitoring Well
- Completed Shallow Monitoring Well Locations
- Proposed Shallow Monitoring Well Locations
- Shallow Monitoring Wells Selected for PFAS Analysis
- Fiber Optic Line
- County Boundaries
- Perennial stream

Decision Unit Areas/Boundaries

- Category 1
- Cleared and Restored Under Appendix D

Map Date: 8/10/2023

Drone image dated: 08/07/2023

0 150 300

Feet

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
WASTEWATER TREATMENT & CID OPERATIONAL SUMMARY

**CAR SCRAPPING 4
PIEZOMETER LOCATIONS**

ARCADIS

FIGURE
7

PATH: T:_ENV\NorfolkSouthern\EastPalestine\EastPalestine_Feb5_2023\MXD\GW_Characterization\NS_East Palestine_South_Ditch_PZ.mxd SAVED: 8/10/2023 BY: JOstermann

CTEH

AreaRAE Location Map

East Palestine Train Derailment 02032023 | Updated 7/29/2023

Project: PROJ-024579
Client: Norfolk Southern
City: East Palestine, OH
County: Columbiana

Projection: NAD 1983 2011 StatePlane Ohio North FIPS 3401 Ft US Datum: NAD 1983 2011

Updated At: 6/3/2023 12:22 PM

CTEH®

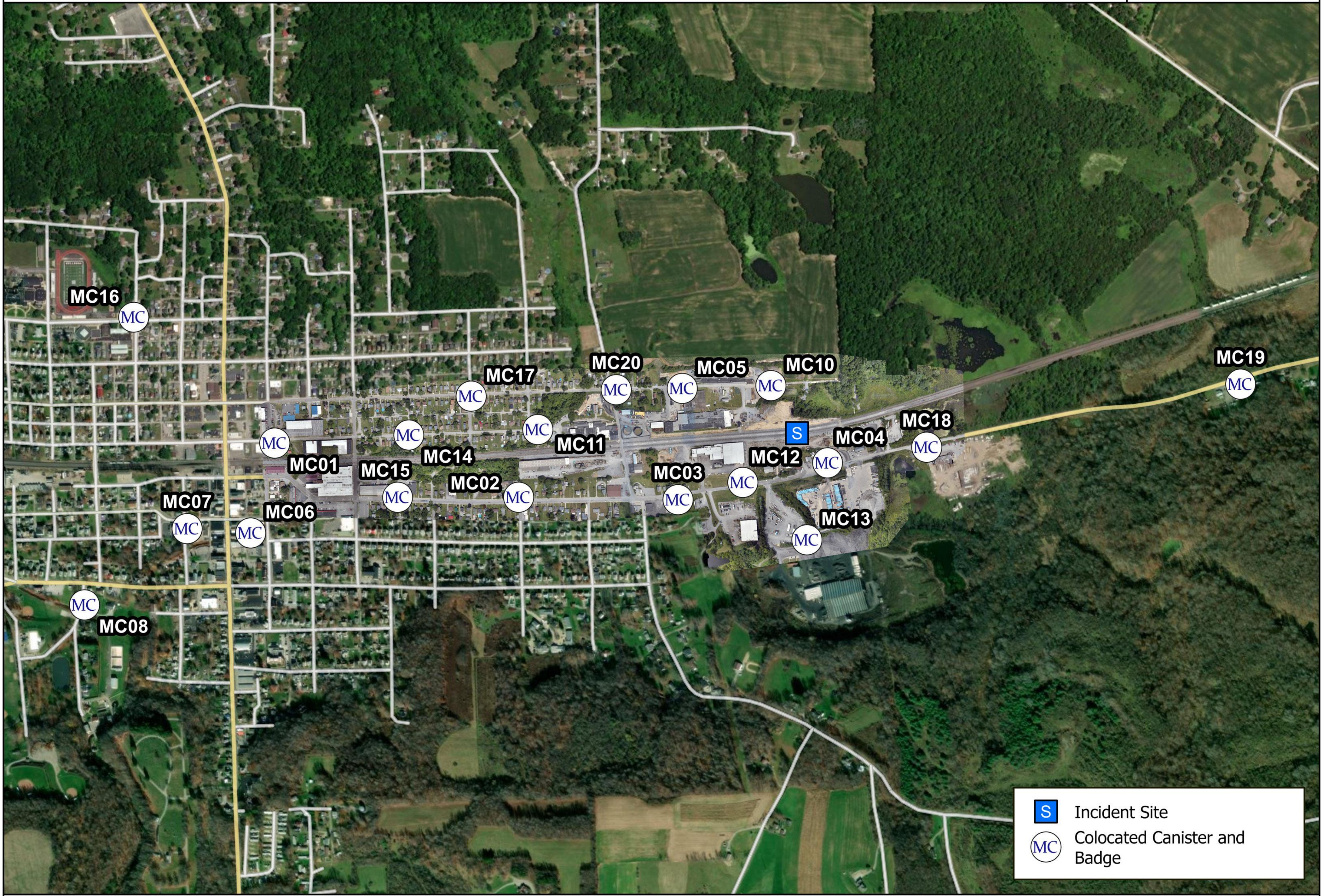
Analytical Air Sampling Locations

East Palestine Train Derailment | Updated 8/10/2023

0 0.25 0.5 Miles

N

Project: PROJ-024579
Client: Norfolk Southern
City: East Palestine, OH
County: Columbiana



Projection: NAD 1983 2011 StatePlane Ohio North FIPS 3401 Ft US Datum: NAD 1983 2011

Attachment 1

CID Request Letter Template

Norfolk Southern Railway Company
650 West Peachtree Street NW
Atlanta, GA 30308
Cell 404-273-4472
Cell (281) 254-9557
Daniel.Hunt@nscorp.com

[DATE], 2023

Melisa Witherspoon, Chief of the Division of Environmental Response and Revitalization
Ohio Environmental Protection Agency, Division of Environmental Response and Revitalization
Northeast District Office
2110 E. Aurora Road
Twinsburg, OH 44087

RE: Request for Approval of Contained-In
East Palestine, OH Derailment

Batch: ______
Temporary Tank ID: _______
Treatment Date: __________

To: Chief of Division of Environmental Response and Revitalization:

Norfolk Southern Railway Company (NSRC) requests Ohio Environmental Protection Agency (OEPA) approval of a contained-in determination (CID) relative to environmental media consisting of remedial action wastewater (impacted stormwater, surface water, groundwater) generated as a result of the February 3, 2023, NSRC East Palestine, Ohio derailment. On February 21, 2023, NSRC and the United States Environmental Protection Agency (USEPA) entered into a Unilateral Administrative Order for Removal Actions (UAO) (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. V-W-23-C-004; USEPA 2023). The remainder of this letter provides information on the site background, the nature of the wastewater, and the regulatory basis behind this request. This request complies with criteria for a stand-alone request provided in the OEPA Application of Contained-In Determination for Media and Debris Contaminated by Hazardous Waste at RCRA Sites and the USEPA Contained-In Policy for Soil and Debris Contaminated with Hazardous Waste.

Site Information

The NSRC - East Palestine Ohio Derailment Site is located at Milepost PC49 Railroad Tracks Northeast of North Pleasant Drive and Taggart Road Intersect, Columbiana County, East Palestine, Ohio 44413 (USEPA ID: OHR000221457). On February 3, 2023, a NSRC train derailment and subsequent fire occurred in East Palestine, Ohio. The derailment involved 51 rail cars and resulted in a fire and breaches to tank cars that contained hazardous materials and non-hazardous materials.

Remedial actions at the site include the recovery of impacted surface water, stormwater and ground water ("water"). A site map showing the locations where water is being recovered and stored is provided as Figure 1 of the Wastewater Treatment and Contained-In Determination Operational Summary (Arcadis 2023). Water from the locations shown on Figure 1 is being pumped directly into the modular tanks and collected in vacuum trucks and transported to the modular tanks (Tank Farm 1).

Contamination Description and Designation

A List of the Contents of the Rail Cars Which Derailed is provided in Appendix A of the USEPA UAO for Removal Actions. Site specific constituents of concern are also identified in the Main Line 1 Track Excavation Plan. One of the chemicals released was commercial grade vinyl chloride, a listed hazardous chemical. No other listed chemicals were released. All water (stormwater, surface water, and groundwater) collected from spill response and remedial activities has been characterized as U043 listed hazardous wastewater based on generator knowledge that impacts to the water are from a release of commercial grade, unused vinyl chloride.

Process Listing

NSRC has undertaken measures to capture impacted water and containerize it in temporary tanks pending sampling, analysis, and arrangements for disposal offsite. Water that is currently collected is limited to surface water/stormwater from drainage ditches and waterways; and groundwater from monitoring wells and residential wells, springs, and seeps (environmental media). The water recovery operation is essentially continuous for the short-term, and the volume of water generated is weather-dependent. The volume of captured water has exceeded 500,000 gallons per day (gpd) following rain events of less than 1 inch of precipitation.

Currently the U043 listed hazardous wastewater is being managed for offsite disposal at Texas Molecular Deer Park Services, Deer Park Texas and Vickery Environmental, Vickery Ohio. Both facilities are Resource Conservation and Recovery Act (RCRA) permitted deep well injection disposal facilities. Due to volume limitations at the Vickery facility, only 11% of the wastewater generated has gone to this facility, while 86% of the wastewater generated has been transported to Texas for disposal.

All water (stormwater, surface water, and groundwater) collected from spill response and remedial activities has been characterized as U043 listed hazardous waste based on generator knowledge that impacts to the water are from a release of commercial grade, unused vinyl chloride. Based on a review of Safety Data Sheets for other hazardous materials released, no other listed waste codes apply. A total of 38 samples have been collected over six separate sampling events to determine if water contained in the temporary storage tanks exhibited any characteristics of hazardous waste. Based on the results of the analyses, the water does not exhibit characteristics of hazardous waste. Specific activities and analytical results related to this CID request are discussed below in more detail.

Water recovery operations are ongoing. In a two-week period, an average of 126,000 gpd of water impacted with vinyl chloride has been shipped offsite for disposal. As of August 16, 2023, the site has shipped 26,034,837 gallons of U043 listed hazardous wastewater has been transported to Texas Molecular and 3,696,140 gallons to Vickery for offsite disposal. The volume of wastewater will vary with rainfall amounts. The wastewater treatment and CID evaluation was based on an assumption that water recovery operations will continue for 6 to 12 months. Based on the current rates of generation, another 30 to 60 million gallons of U043 listed hazardous wastewater could be generated during this time.

Onsite Treatment

To address the rapid accumulation rate of water (surface water, stormwater, and groundwater) that must be collected and managed as U043 listed hazardous wastewater, USEPA has approved NSRC to perform onsite treatment of the wastewater. The wastewater treatment system is a robust multi-component system that includes equipment for removal of particulates, free-phase product or product sheen, and volatile organic compounds from the influent wastewater stream. Air stripping is the primary vinyl chloride treatment process with secondary/backup treatment provided by liquid-phase carbon. The wastewater treatment system has a design operating capacity of 100 gallons per minute. Details of the wastewater treatment system are provided in the CID Operational Summary and in the Wastewater Treatment System Operation and Maintenance Plan. The treated wastewater will be collected in six temporary storage tanks ("CID tanks") located in the CID Tank Farm. Each temporary tank will be representative of a 24-hour treatment batch. The proposed wastewater treatment system will reduce the concentration of vinyl chloride to below 2 micrograms per liter (µg/L) in the treated wastewater with a maximum laboratory reporting limit of 1.0 µg/L.

Sampling and Reporting

Sampling and analysis to support the CID is discussed in detail in section 3.2 of the Wastewater Treatment and Contained-In Determination Operational Summary (Arcadis 2023). The CID Quality Assurance Project Plan (QAPP) addresses the requirements set forth in Section XI (paragraph 40) and Section XII (paragraphs 47 and 48) of the UAO for activities associated with the immediate response. Analytical methods are presented in Worksheet #19 of the CID QAPP. Below is a summary of the proposed sampling plan:

- During the start-up period, one composite sample of the untreated wastewater and one composite sample of the treated wastewater will be collected and analyzed for parameters associated with the disposal facility acceptance criteria. Samples will be collected directly from the modular tanks and the CID tanks.
- During the one-week (6-day) startup operational period, one grab sample of treated wastewater will be collected every 4 hours (6 samples over a 24-hour period) from the wastewater system effluent and one composite sample of the treated wastewater will be collected from the CID tank for each daily batch. Samples will be analyzed for total vinyl chloride only. The laboratory will be instructed that the analysis must achieve a detection and reporting limit at or below 1 µg/L.
- For unassessed areas NSRC will collect the additional soil samples using an in-situ sampling approach. Where soil from the unassessed area indicate similar types and concentrations of COCs found in previously addressed areas, monitoring the influent to the WWTP is sufficient. If, however, soil data in unassessed areas indicate new COCs or COCs at significantly higher concentrations then representative water samples will be collected from the influent to the WWT system (untreated water) and the CID tanks (treated wastewater) and evaluated.

Treated wastewater samples will be collected and preserved in accordance with the current version of SW-846 Method 8260 and the CID QAPP. The samples will be sent to an offsite laboratory for analysis. Samples submitted for disposal facility criteria will be collected as composite samples, per the disposal facility requirements. Samples associated with the CID will be collected as grab samples and daily batch composite samples. Results will compared to the maximum contaminant limit for drinking water, which is below the Universal Treatment Standard of 0.27 milligrams per liter (mg/L) for vinyl chloride (Ohio Administrative Code 3745-270-48). The analytical data summary table that includes all chemicals associated with the U043 listed hazardous waste code is provided at Attachment 1. A copy of the laboratory analytical report is provided as Attachment 2.

Batch Specific Information

Volume of media associated with Batch 001 request: _____________gallons

Collection Date/ Time:

SAMPLE ID	COLLECTION DATE	COLLECTION TIME	SAMPLE TYPE	TOTAL VINYL CHLORIDE (mg/kg)
WC-WTP-B001-T001				

Sample Nomenclature: Waste Characterization (WC) - Water Treatment Plant (WTP) - Batch # (B001) – Tank # (T001)

Proposed Offsite Disposal Facility:

State	Disposal Facility	Address	CERCLA Approved	ID Numbers
Ohio	Vickery Environmental (Deep Well Injection)	3956 State Rte 412 Vickery, OH 43464	Y	OHD020273819
Texas	Texas Molecular Deer Park Services (Deep Well Injection)	2525 Independence Rd, Deer Park, TX 77536	Y	TXD000719518

No special handling requirements apply to the treated wastewater. Tracking and manifesting of the treated wastewater will be completed in accordance with the Site Waste Management Plan and the Wastewater Treatment and Contained-In Determination Operational Summary.

Based on the analytical results the concentration of vinyl chloride for Batch ____ is below the USEPA maximum contaminant limit for drinking water (2.0 micrograms per kilogram [µg/kg]), and below the Universal Treatment Standard of 0.27 mg/L for vinyl chloride. For purposes of this CID request, NSRC seeks concurrence from OEPA that the treated wastewater described in this request qualifies for a contained-out determination and may be managed as non-hazardous wastewater.

Upon written verification of the proposed contained-in determination levels, NSRC will provide OEPA approval to manage the wastewater as non-hazardous to the USEPA and seek approval to transport the wastewater for disposal. NSRC will ensure that all off-site disposal facilities accepting thewater non-RCRA wastewater are in compliance with the CERCLA Off-Site Rule at 40 CFR 300.440. NSRC will not ship waste offsite until NSRC receives confirmation from USEPA that the Off-Site Rule (OSR) approval has been received. CID and OSR approvals will be maintained in the project records.

Conclusion

NSRC appreciates your review and consideration of this information and respectfully requests OEPA's written concurrence. Should you have any questions regarding this information, please contact me at 404-273-4472 at your earliest convenience.

Generator Certification

I certify under penalty of law that this document and all attachments were prepared by me, or under my direction or supervision. The submitted information is to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information. This declaration is made under penalty of perjury.

Daniel Hunt, P.G.
Senior Manager Environmental Remediation
404-273-4472
Daniel.Hunt@nscorp.com

NORFOLK SOUTHERN
650 West Peachtree Street NW
Atlanta, GA 30308

Enclosures:

Attachment 1 – Summary of Analytical Results
Attachment 2 – Analytical Reports

cc: Frank Zingales,
OEPA
Michelle Clayton,
Arcadis

Attachment 2

RCRA Tank System Substantive Standards

Norfolk Southern Railway Company

RCRA Tank System Substantive Standards – Modular Tanks

East Palestine Train Derailment

Columbiana County, Ohio

August 2023

Substantive RCRA Requirements for Hazardous Waste Tank Systems That May Serve as Applicable or Relevant and Appropriate Requirements (ARARs) to the Tanks Used to Accumulate RCRA Hazardous Wastewater (U043) and Treated Wastewater at the East Palestine Response Action

NSR will use two temporary one-million-gallon Modular tanks to accumulate hazardous contaminated wastewater (U043) prior to treating the wastewater to remove vinyl chloride. The two temporary one-million-gallon Modular tanks will be managed in accordance with the NSRC East Palestine Waste Management Plan (the "WMP"), which was approved on April 18, 2023 by USEPA. Recognizing that the two Modular tanks meet the factors in 40 CFR 264.553(c), EPA specifically approved those tanks as TUs in the WMP. However, NSR has provided additional documentation below to demonstrate compliance with substantive requirements under RCRA that are also applicable to new hazardous waste tank systems (40 CFR Part 264 Subpart J) to the extent practicable.

For the purposes of this document, "water" is defined as the following media: surface water, stormwater and/or groundwater. "Wastewater" will be defined as water that has been collected and containerized for offsite disposal.

40 CFR 264.192(a) and OAC Rule 3745-55-92(A) which require a written assessment to show the sufficiency of the tank system's integrity and adequacy of design. Elements of the written assessment must include:

Review Elements	NSR Documentation
Design Standard Used for the Tank (e.g., API, ANSI Standard, AISC, etc.)	Only pre-manufactured temporary storage tanks and modular tanks will be used as TUs. All tanks (temporary storage tanks and modular tanks) are constructed of high-quality steel and are constructed according to recognized engineering standards. The two, 1,000,000-gallon, Modular Tanks were designed in accordance with: • API 650 - Welded Tanks for Oil Storage • ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures • AISC 360-16 - Specification for Structural Steel Buildings https://www.aisc.org/globalassets/aisc/publications/standards/a360-16w-rev-june-2019.pdf • ASCE 7 Online Hazards Tool 2022
Tank drawings showing the design, dimensions, shell thickness	Tank design drawings illustrating the dimensions and shell thickness are included as Attachment A.

Review Elements	NSR Documentation
Description of all the ancillary equipment used in the transfer of waste material to the storage tanks, such as feed systems, safety shut-off, by-pass systems, and pressure controls, if necessary (e.g., vents).	Tanks are loaded via pumping through dual-wall high density polyethylene (HDPE) piping from the North and South Ditches, which is conveyed through a weir tank prior to being pumped to the Modular Tanks. Industrial vacuum trucks also offload into the tanks using a manifold system that gravity feeds to a pump within the secondary containment area before being pumped into the tanks. The truck unloading/loading area has been paved with a 9-inch-thick asphalt pavement section and an asphalt curb to provide secondary containment. This area is sloped to collection sumps that are also plumbed to the Modular Tanks.
Diagram(s) of the piping, instrumentation, and process flow for the tank	See Figure 4a of the *Wastewater Treatment and Contained-In Determination Operational Summary* for a process and instrumentation diagram including the Modular Tanks.
Description of controls and practices to prevent spills and overflows	Staff is monitoring the tanks 24/7. Tanks are also visually inspected daily, and their levels monitored. Visual and audible high-level alarms will be installed on each tank. The high-level alarm will be set to 600,000 gallons (currently approved-level). The high-high level alarm will be set to 680,000 gallons, which represents the maximum usable tank capacity (accounting for precipitation and ancillary equipment). The tanks are currently operated such that pumping into the tanks is suspended prior to reaching the 600,000-gallon level. However, in the event the operational level of 600,000 gallons is exceeded, the high-level sensor will illuminate a visual alarm indicating to onsite staff to turn off all pumps that pump water into the tanks. Wastewater from the tanks will continue to be sent to the WWTP as well as trucked off-site. Once wastewater levels recede below 600,000 gallons, normal operating procedures may commence. If the 600,000-gallon alarm fails to operate, a second high-high level sensor will sound an audible alarm at 680,000 gallons. Following installation of the new sheeting around the secondary containment, the usable capacity of the secondary containment area will increase to that which is presented in Attachment G (approximately 1,131,368 gallons) and the alarms will be set to 3 feet and 1.5 feet below the top of the tank. Truck loading and unloading standard operating procedures (SOPs) are

Review Elements	NSR Documentation
	strictly adhered to and continuously reviewed for improvement. SOPs include a dedicated transfer pump operator for safety purposes. Drip pans are used at truck loading and unloading connection points and the activities are constantly monitored. Spills are immediately cleaned-up with spill kits that are readily available.
Compatibility of the tank liner with the waste	The interior of the tanks are lined with a geomembrane liner. The wastewater has been analyzed and there are no COCs present that would be incompatible with geomembrane liner.
Corrosion protection (e.g., if bottom of tank is in contact with soil)	N/A – The liner, which is securing the contents, is not susceptible to corrosion as it is non-metallic. Refer to Attachment B for the tank liner manufacturer's product information. The structural tank ring will not be in contact with the underlying native soil as it is bedded on gravel. The gravel is drained by two collection sumps.
Hydrostatic analysis/calculations (based on maximum liquid content in tank) on the sidewalls and bottom of the tank	Refer to the calculation brief provided in Attachment C for a hydrostatic analysis.
Evidence of leaks, cracks, corrosion, or erosion in tanks and piping	The tank installer, a qualified installation inspector, certified the tanks installation was performed in accordance with their tank installation procedures. Refer to Attachment D for the tank installation inspection certification and summary reports.
Tank foundation analysis and design, including maintenance of compacted soil tank foundation to prevent edge settlement	The tank foundations consist of a minimum 24-inch-thick layer of compacted gravel. The geosynthetics were laid on the compacted gravel and an additional 10-inch-thick layer of gravel was placed above the liner. 16-ounce non-woven geotextile was installed below and above the liner. Compaction tests were conducted on the gravel layer and are provided in Attachment D. The tank foundation was analyzed for bearing capacity and potential settlement. Bearing capacity met minimum factor of safety requirements and the settlement was within tolerances of the tank and appurtenances. Refer to Attachment E for the tank foundation analysis. Tank foundation surfaces are inspected daily for signs of erosion or deterioration to reduce the potential for edge settlement.
Certification of the assessment by a licensed Professional Engineer	Engineer's certification of this assessment is provided in Attachment J.

40 CFR 264.192(b) and OAC Rule 3745-55-92(B),(D), and (E) which require proper handling procedures are adhered to in order to prevent damage to the system during installation.

Review Elements	NSR Documentation
Tank Installation Procedures	Tanks were delivered and installed in accordance with manufacturer recommendations. Refer to Attachment D for tank installation inspection certification and summary reports. Refer to Attachment F for tank installation procedures.
Inspection/testing or other construction quality assurance measures used to ensure tank was installed properly.	Refer to Attachment D for tank installation inspection certification and summary reports. One June 15th, Hydrera Water Services inspected the Modular Tanks during operation. The inspection report is included in Attachment D, which included a visual inspection of the exterior of the tank's structural components and the interior liner systems. This inspection, which was performed by the tank supplier, concluded that the tanks are properly installed; being operated in accordance with the standard operating procedure; and are fit for continued use.
Tank and ancillary equipment tightness test	The liners installed in the Modular Tanks were lab tested for various characteristics, including break, tear, and adhesion strength. Refer to Attachment B for liner test results. Tanks were initially filled with one foot of potable water to seat the liner, and subsequently filled with collected site water without any indication of leakage. Daily site inspections confirm the tank and ancillary tightness of the Modular Tanks as no leakage has been observed. Based on actual tank data collected since the tank installations, the eastern tank has been filled as high as 650,000-675,000 gallons for approximately 10 hours. The western tank has been filled up to 570,000 gallons which lasted for more than 24 hours.
Evidence of leaks, cracks, corrosion, or erosion in tanks and piping during installation.	The Modular Tanks were new (i.e., not previously used) and did not exhibit evidence of leaks, cracks, corrosion or erosion. The tank installer, a qualified installation inspector, certified the tanks installation in accordance with their tank installation procedures. Refer to

Review Elements	NSR Documentation
	Attachment D for tank installation inspection certification and summary reports.
Repairs to tank system during installation	No repairs were noted by the tank installer during installation.
Ancillary equipment sufficiently supported and protected	Ancillary equipment connecting to the tank was installed in accordance with manufacturer recommendations. Conveyance piping is supported on grade within the secondary containment limits and below grade for protection below paved loadout areas.
Licensed Professional Engineer Certification that tank was properly installed/constructed.	The tank installer, a qualified installation inspector, certified the tank installations. Refer to Attachment D for tank installation inspection certification and summary reports. Although a Professional Engineer was not involved with the installation process and, therefore, cannot certify the installation, the tanks and surrounding infrastructure will continue to be inspected and monitored by a qualified inspector.

40 CFR 264.193 and OAC Rule 3745-55-93 which require secondary containment for new hazardous waste tank systems.

Review Elements	NSR Documentation
Design, capacity, and construction of the secondary containment	Both tanks were installed within a single secondary containment consisting of an impermeable liner, steel sheet piles, and earthen berms. The impermeable liner consists of a 60-mil and 120 mil Linear Low-Density Polyethylene (LLDPE) liner manufactured by ATARFIL (ATARFIL LLD TM). Secondary containment is sized to provide for the tank volume and a minimum of 4 inches of freeboard to account for rainfall from the 25-year, 24-hour rainfall event, which is 3.96 inches (reference: NOAA Atlas 14, Volume 2, Version 3, East Palestine, Ohio). The containment calculation also accounts for the displacement of one Modular Tank, two smaller temporary tanks (i.e., a weir tank and a potable water tank), and the pumping equipment. The current usable capacity of the secondary containment is 800,000 gallons based on the sheet pile calculation for the Existing Condition included in Attachment G. With the need to excavate material adjacent to the existing sheets for remediation purposes and the restoration of the

Review Elements	NSR Documentation
	North Ditch, longer sheets will be installed on the exterior of the existing containment. Refer to the sheet pile calculation for the “Proposed Condition” analysis included in Attachment G. The longer sheets will also provide the additional useable capacity in the secondary containment as described in Attachment G. However, until the new sheeting is installed, the operational tank volume will be limited to 600,000 gallons, with an absolute maximum of 680,000 gallons to not exceed the maximum usable secondary containment volume of 800,000 gallons with consideration for precipitation and ancillary equipment displacement volume (~120,000 gallons).
Compatibility with the waste stored in the tank	The secondary containment system is constructed with a LLDPE liner. The wastewater has been analyzed and there are no COCs present that would be incompatible with LLDPE.
Foundation analysis and design	Arcadis performed an engineering evaluation to determine the maximum volume that could be withheld in the secondary containment under existing conditions (Existing Condition Sheeting Evaluation) based on the known sheet type and length, sheet stick-up, and other site observations (e.g., removal of material from the north ditch). Based on this evaluation, the existing condition is capable of withholding (with a 1.2 factor-of-safety) up to 800,000 gallons or an approximate depth of 6 feet. Arcadis further evaluated what the required sheet length would be to be able to contain the entire secondary containment volume if the tanks were used to their maximum capacity. The result of this Final Condition Sheeting Evaluation requires the installation of longer sheeting. Prior to operating the tanks above their currently approved volume of 600,000 gallons, new sheeting will be installed. The new sheeting will be installed immediately adjacent to the exterior of the existing sheeting to not disturb the existing secondary containment liner system. Refer to Attachment G for the Existing Condition Sheeting Evaluation and the Final Condition Sheeting Evaluation.
Leak detection system (in particular, since tank has a flat bottom)	Leak detection is achieved utilizing daily visual inspections that are documented on daily inspection forms. In addition, unexpected flow to the sump (i.e., dry weather flow) will indicate a potential leak. The system is designed to identify such a leak within 24-hours.

Review Elements	NSR Documentation
Adequate drainage to leak detection system	As indicated above, leak detection is achieved by visual inspection. Water or wastewater that builds-up on the liner, within the stone layer, is collected by the two sumps within the containment.
Capacity to contain 100 percent of the capacity of largest tank (assumption that both tanks are not connected to each other)	The total volume of available secondary containment is 151,240 cubic feet (1,131,353 gallons), which exceeds USEPA requirements (i.e., max. volume of largest tank + 25-year, 24-hour rainfall) by approximately 2%. Refer to Attachment G for an updated secondary containment analysis.
Meets requirements for external liner system specified in 40 CFR 264.193(e)(1) and OAC Rule 3745-55-93(E)(1)	A geomembrane liner system in the secondary containment provides the following in accordance with the referenced requirements: • Containment for 100% of the capacity of the largest tank. • Prevents run-on of precipitation due to the earthen berms and sheet pile wall at the containment perimeter and designed to provide capacity for the 25-year, 24-hour storm. • Barrier free of cracks and gaps since the geomembrane panels were welded. • The secondary containment system completely surrounds the tanks and is capable of preventing lateral and vertical migration of waste due to the perimeter berms and sheet pile wall.
Ancillary equipment associated with tank is provided secondary containment or visually inspected on a daily basis (for qualified equipment)	Ancillary equipment (i.e., conveyance piping) is double-walled HDPE pipe and is inspected on a daily basis.

40 CFR 264.194 and OAC Rule 3745-55-94 which specify general operating requirements.

Review Elements	NSR Documentation
Practices employed to prevent spills and overfilling (this information is also discussed in the written assessment requirements identified above)	High level audible and visual alarms will be installed as noted above. In addition, to ensure the integrity of the tanks and to reduce the potential for spills, the following criteria will be monitored: • All containers and tanks are be maintained in good condition, with no leaks, corrosion, rust, or bulges. • All signs and labels will be properly maintained.

Review Elements	NSR Documentation
	• Tanks are in a secure area and protected from traffic. • At a minimum, the tanks undergo daily visual inspection. Inspections that are documented on the Daily Inspection Form (Attachment H). • All staff performing hazardous waste tasks, including daily inspections of the Temporary Units (includes all tanks and storage areas) are trained in accordance with 40 CFR §262.17(a)(7) and OAC 3745-52-17(a)(7). Training certificates are provided to NSRC and maintained in the project files. • Tank secondary containment is maintained in accordance with the Secondary Containment Standard Operating Procedures from the Waste Management Plan, which is included in Attachment I. • The following Preparedness and Prevention Measures are maintained in the storage area: - A list of emergency contacts, - Personnel working in the storage area carry an emergency radio/cell phone anytime waste is being placed in the storage area or loaded for offsite transport, and during sampling and inspection activities, - Fire extinguishers if flammable liquids are present, - Materials to control spills (i.e., spill absorbents, extra 55-gallon drums to transfer wastes), - PPE supplies (i.e., eyewash, first aid kit).
Required freeboard	The tanks will operate with a typical freeboard of 3 feet and below the manufacturer's minimum freeboard requirement of 1.5 feet. This also exceeds the minimum required freeboard for precipitation from the 25-year, 24-hour storm.

40 CFR 264.195 and OAC Rule 3745-55-95 which requires the tank operator to develop and follow a schedule and procedure for inspecting overfill controls.

Review Elements	NSR Documentation
Inspection procedures and documentation of inspections	At a minimum, all tanks, ancillary equipment and secondary containment systems are inspected daily. Inspections are recorded in the project files and available for review upon request. If a tank is found leaking or unfit for use, the tank will be immediately addressed. If a secondary containment system is found compromised (unable to collect or prevent a release to the environment), the secondary containment will be repaired. If wastewater or water is identified in the secondary containment, accumulated precipitation will be removed from the secondary containment as soon as practicable but not later than 24 hours.
Daily inspection schedule of operating data	
Daily inspection schedule of the tank, ancillary equipment, and secondary containment system	
Procedure to remedy any malfunctions or deterioration of the tank system identified from inspection	

40 CFR 264.196 and OAC Rule 3745-55-96 which require the tank operator to respond to leaks or spills.

Review Elements	NSR Documentation
Procedures to respond to leaks or spills from tanks and/or ancillary equipment	If any tank is observed to be leaking, is in a condition that it is likely to leak or has any damage or corrosion that may compromise the integrity of the containment, the Site Waste Coordinator should be immediately notified and necessary corrective actions will be performed. NS personnel must also be notified immediately. For leaks or threats of leaks, efforts will be made to seal or stop the leak (with caulking foam, other sealant, or other safe measures), contain, and collect leaking material. If leaks cannot be readily stopped, then the container and/or tank will be taken out of service and waste transferred to a non-leaking container. Releases to the secondary containment will be recovered as much as possible using common recovery methods such as vacuum trucks, absorbents and shovels.
Management of waste or materials contaminated by spills or leaks.	Management of waste/impacted materials as a result of a spill or leak from a tank will be completed in accordance with the Derailment Waste Management Plan prepared under separate cover that provides procedures for onsite management, characterization, and offsite disposal of waste associated with the derailment. Emergency Response and notification of releases will be performed in accordance with Section XVII of the UAO (USEPA 2023). A summary of the requirements is provided below: *If any event occurs during performance of the Work that causes or threatens to cause a release of any Waste Material on, at, or from the Site that either constitutes an emergency situation or that may present an immediate threat to public health or welfare or the environment, NS will immediately take all appropriate action to prevent, abate, or minimize such release or threat of release. NS will take these actions in accordance with all applicable provisions of this Order, including, but not limited to, the Health and Safety Plan. NS will immediately notify the OSCs or, in the event of his/her unavailability, the Regional Duty Officer for Region 5 (at 312/353-2318) and Region 3 (at 215/814-3255) of the incident or Site conditions.* *If a release of hazardous waste or hazardous substances occurs where NS is required to report pursuant to Section 103 of*

Review Elements	NSR Documentation
	CERCLA, 42 U.S.C.§ 9603, or Section 304 of the Emergency Planning and Community Right-To-Know Act (EPCRA), 42 U.S.C. § 11004, NS will immediately call the OSC, or, in the event of his/her unavailability, the Regional Duty Officer at Region 5 (at 312/353-2318) and Region 3 (at 215/814-3255) and the National Response Center at (800) 424-8802. This reporting requirement is in addition to, and not in lieu of, the reporting required by CERCLA §§ 103 and 111(g), or EPCRA § 304.
Repair methods for tank and ancillary equipment, including certification for major repairs	Tanks and ancillary equipment will be repaired by qualified personnel and certified by an independent, qualified inspector.
Notification of leaks or spills to USEPA and OEPA	For all Emergencies and releases a written report to EPA within 7 days after the onset of such event, setting forth the action or event that occurred and the measures taken, and to be taken, to mitigate any release or threat of release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release or threat of release.

40 CFR 264.197 and OAC 3745-55-97 which specify closure requirements.

<table>
<tr><th>Review Elements</th><th>NSR Documentation</th></tr>
<tr><td>Decontamination method/procedures for tanks, secondary containment, and ancillary equipment.</td><td rowspan="3">Tank and secondary containment materials will be decontaminated or disposed of offsite in accordance with the Waste Management Plan.

Ancillary equipment that will be returned to the vendor will be cleaned to the vendors specifications (typically rinsed and visually clean); tank liners, piping and other materials that will be discarded will be managed as U043 hazardous waste or will be decontaminated in accordance with the debris decontamination standards in 40 CFR 268.45 and managed as a non-hazardous waste. Any residuals generated from the decontamination of U043 debris or from cleaning equipment that will be returned to the vendor will be managed as a U043 waste for offsite disposal.

Post removal confirmatory sampling will be conducted for material in contact with or surrounding the storage areas to demonstrate contaminants are not present. If contaminants are present, materials will be removed and additional sampling will be conducted until it can be demonstrated that no contamination is present at concentrations that would require long-term monitoring and maintenance (i.e., post-closure care).</td></tr>
<tr><td>Disposition of contaminated materials</td></tr>
<tr><td>Media sampling demonstrating that no contamination is present at concentrations that would require long-term monitoring and maintenance (i.e., post-closure care)</td></tr>
</table>

Attachments

Attachment A - Tank Design Drawings

Attachment B - Tank Liner Product Information

Attachment C - Hydrostatic Analysis

Attachment D - Tank Installation Inspection Reports and Compaction Reports

Attachment E - Tank Foundation Analysis

Attachment F - Tank Installation Procedures

Attachment G - Secondary Containment Analysis

Attachment H - Daily Inspection Form

Attachment I - Secondary Containment Operating Procedures

Attachment J - Assessment Certification

Attachment A

Tank Design Drawings

DRAWING LIST

SHEET	DESCRIPTION
1 of 3	TITLE PAGE
2 of 3	GENERAL ARRANGEMENT
3 of 3	TYPICAL PANEL ASSEMBLY

HYDRERA ENERGY SERVICES

H20P - HARPOON FRAC TANK
SALES DRAWING
RedFox Project No: RF22068
PO: 1011

REVISIONS

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
0	3/12/23	ISSUED FOR INFORMATION PURPOSES	Dan Griffiths		

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REDFOX DESIGN & DRAFTING INC.

Drawn By:	Dan Griffiths
Date:	September-01-2022
Checked By:	-
Approved By:	-
Customer Project No:	1011
RedFox Project No:	RF22068

GENERAL NOTES

1. THE ABOVE GROUND STORAGE TANK HAS BEEN DESIGNED IN ACCORDANCE WITH THE AMERICAN PETROLEUM INSTITUTE STANARD 650.
2. ALL STRUCTURAL STEEL MEMBERS DESIGNED IN ACCORDANCE WITH ANSI/AISC 360-16 SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS.
3. ALL STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING MINIMUM MATERIALS PROPERTIES:

MATERIAL SPECIFICATIONS			Minimum Yield Stress (ksi)	Minimum Rupture Stress (ksi)
SHAPE	CANADA	USA (ASTM)		
HSS	G40.21 50W	A500 Gr. C	50	62
PLATE	G40.21 50W	A572	50	65
PLATE	G40.21 44W	A572	44	65
PLATE	QT-100	A514	100	110
BAR	AISI 1020	A36	36	58

4. FABRICATION SHALL CONFORM TO ANSI/AISC 360-16.
5. ALL WELDING SHALL BE IN ACCORDANCE WITH AWS D1.1 USING E70XX ELECTRODES. WELDING SHALL BE PERFORMED BY WELDERS CERTIFIED FOR THE WELD TYPE AND POSITIONS INVOLVED ACCORDING TO THE CURRENT EDITION OF AWS D1.1.
6. UNLESS OTHERWISE NOTED ALL CONNECTIONS ARE TO BE 3/16" CONTINUOUS FILLET WELDS.
7. MINIMUM FABRICATED THICKNESS OF ALL 10 GAUGE ELEMENTS SHALL BE 0.1345".

ASSEMBLY NOTES

1. ERECTOR SHALL PROVIDE ALL MATERIAL, EQUIPMENT AND LABOR THAT IS REQUIRED FOR TEMPORARY STABILITY OF THE TANK DURING ERECTION.
2. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS COMPLETE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURES AND SEQUENCES TO INSURE SAFETY OF THE BUILDING AND ITS COMPONENTS DURING ERECTION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF NECESSARY SHORING, SHEETING, TEMPORARY BRACING, GUYS, TIE DOWNS, ETC.
3. TANK AND SUMP ARE TO BE SUPPORTED BY LEVEL FOUNDATION, DESIGNED BY OTHERS.
4. TANK IS TO BE USED IN COMPLIANCE WITH LOCAL & FEDERAL JURISDICTION.

SPECIFICATIONS

1. ABOVE GROUND STORAGE TANK IS RATED FOR 20 PANEL ASSEMBLY - SEE DESIGN DATA FOR MORE INFORMATION.
2. TANK VOLUMES (ZERO FREEBOARD):
   - 24,675 US BBL
   - 3,923 m^3
   - 138,540 ft^3

FINISHING DETAILS

1. PANELS : ENDURA EXCEL D2M (SIGNAL BLUE CLR33994)
2. PANEL CONNECTOR: ENDURA EXCEL D2M (GREEN CLR42186)
3. HYDRERA DECAL CENTERED VERTICALLY ON EVERY SECOND PANEL 72" ABOVE GRADE.
4. STENCIL "MADE IN USA" SHALL BE PLACED ON BOTTOM RIGHT OF EACH PANEL. LOCATED 12" FROM BOTTOM OF PANEL TO THE CENTER OF THE STENCIL.

DESIGN DATA

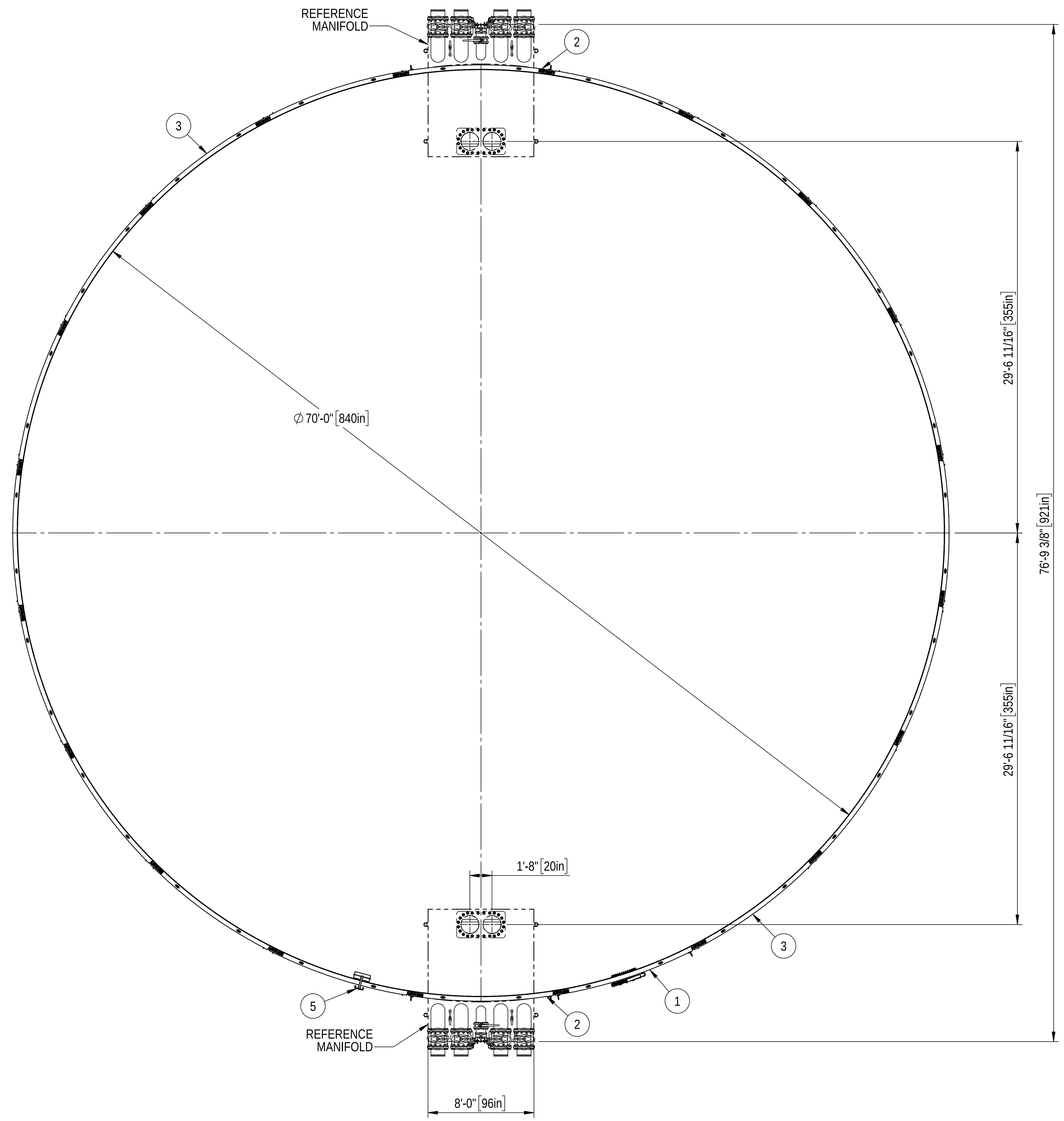
1. DESIGN STANDARDS & REFERENCES:
   a. API 650*
   b. ASCE 7-16
   c. AISC 360-16
   d. ASCE 7 ONLINE HAZARDS TOOL 2022
2. SERVICE LIFE: 25 YEARS
3. GRAVITY LOADS:
   a. SELF WEIGHT OF TANK COMPONENTS
   b. VARIOUS FLUID DEPTHS WITH SPECIFIC GRAVITY (S.G.) = 1.00 - 1.25
4. RISK CATEGORY: I
5. WIND LOAD (MEAN RECURRENCE INTERVAL = 50 YEARS):
   a. BASIC WIND SPEED
      i. NM, WY, OK, ND, WV: 81.3 mph (3-SECOND GUST)
      ii. CO: 86.0 mph (3-SECOND GUST)
      iii. TX, LA: 116.2 mph (3-SECOND GUST)
   b. EXPOSURE CATEGORY: C
   c. DIRECTIONALITY FACTOR: 0.85
   d. TOPOGRAPHIC FACTOR: 1.00
   e. ELEVATION FACTOR: 1.00 (AT SEA LEVEL)
   f. EXPOSURE COEFFICIENT: 1.04
6. SEISMIC LOADS (MEAN RECURRENCE INTERVAL = 50 YEARS)**:
   a. SOIL SITE CLASS: D (DEFAULT)
   b. SEISMIC USE GROUP (SUG): I
   c. SDS
      i. TX, PN, ND, LA, WV: 0.10g
      ii. NM, CO, OK: 0.28g
      iii. WY: 0.30g***
   d. SD1
      i. TX, PN, ND, LA, WV: 0.04g
      ii. NM, CO, OK: 0.13g
      iii. WY: 0.15g***
   e. Rwi (IMPULSIVE RESPONSE MODIFICATION FACTOR): 3.5
   f. Rwc (CONVECTIVE RESPONSE MODIFICATION FACTOR): 2.0

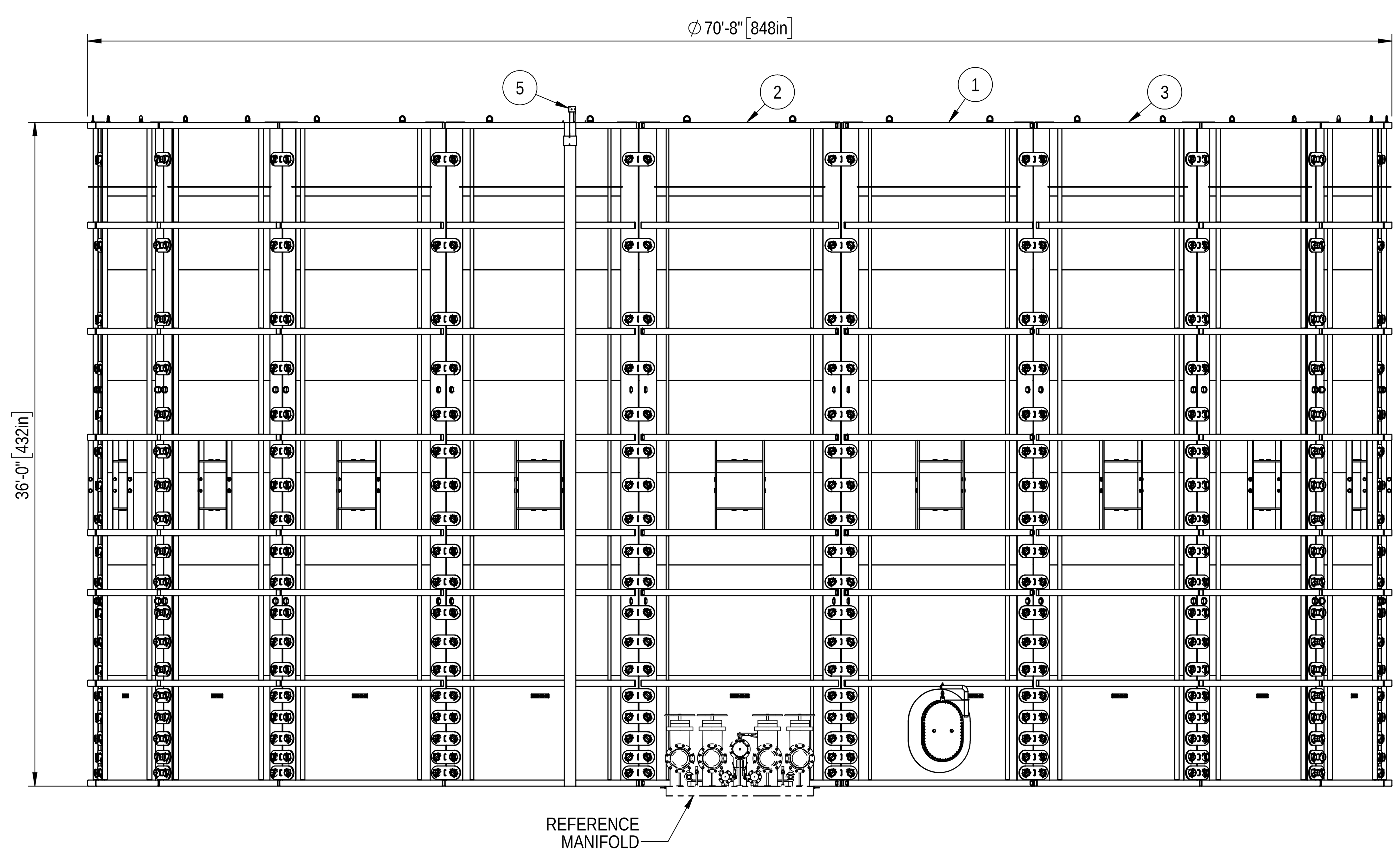
*API 650 REPRESENTS THE RELEVENT INDUSTRY STANDARD FOR TANK CONSTRUCTION.
**SEISMIC DESIGN IS DEFINED AS A PURCHASER'S OPTION PER API 650.
***THE TANK DEPICTED HEREIN IS NOT PERMISSABLE TO BE INSTALLED IN THE FOLLOWING COUNTIES OF WESTERN WYOMING: LINCOLN, PARK, SUBLETTE & TETON

BILL OF MATERIALS

ITEM	PART NUMBER	QTY	DESCRIPTION	WEIGHT (lbs)
1	H20P-1001	1	MANWAY PANEL ASSEMBLY	7837
2	H20P-1002	2	PANEL ASSEMBLY w/ D-RINGS FOR TRANSPORT	7394
3	H20P-1003	17	PANEL ASSEMBLY	7391
4	H20P-1007	1	BLADDER ASSEMBLY	3017
5	H20P-1107	1	TOMCAT GAUGE BOARD ASSEMBLY (36'-0" GUIDED) c/w MAGNETS AND WEIGHTS	169

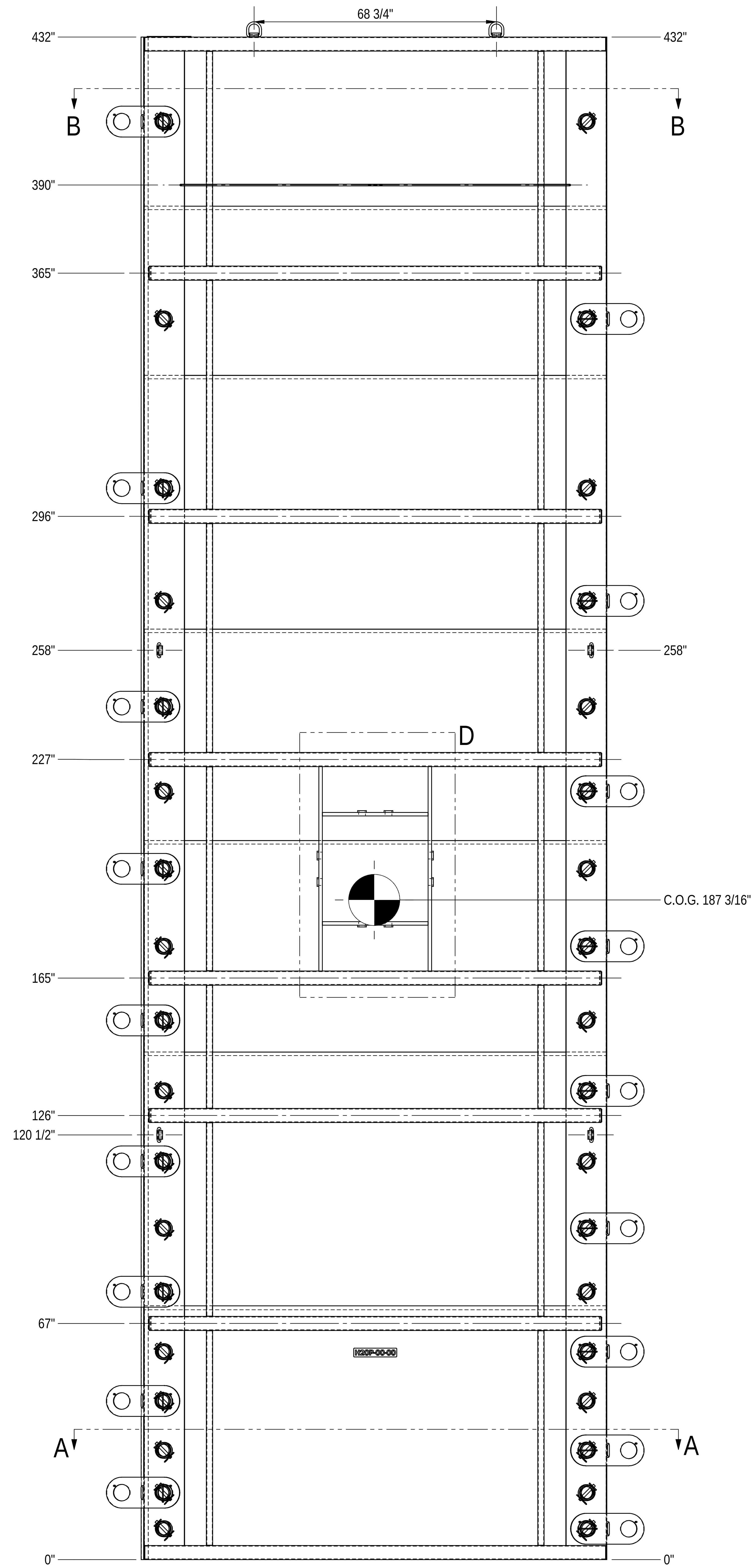
TOTAL WEIGHT: 148445 lbs

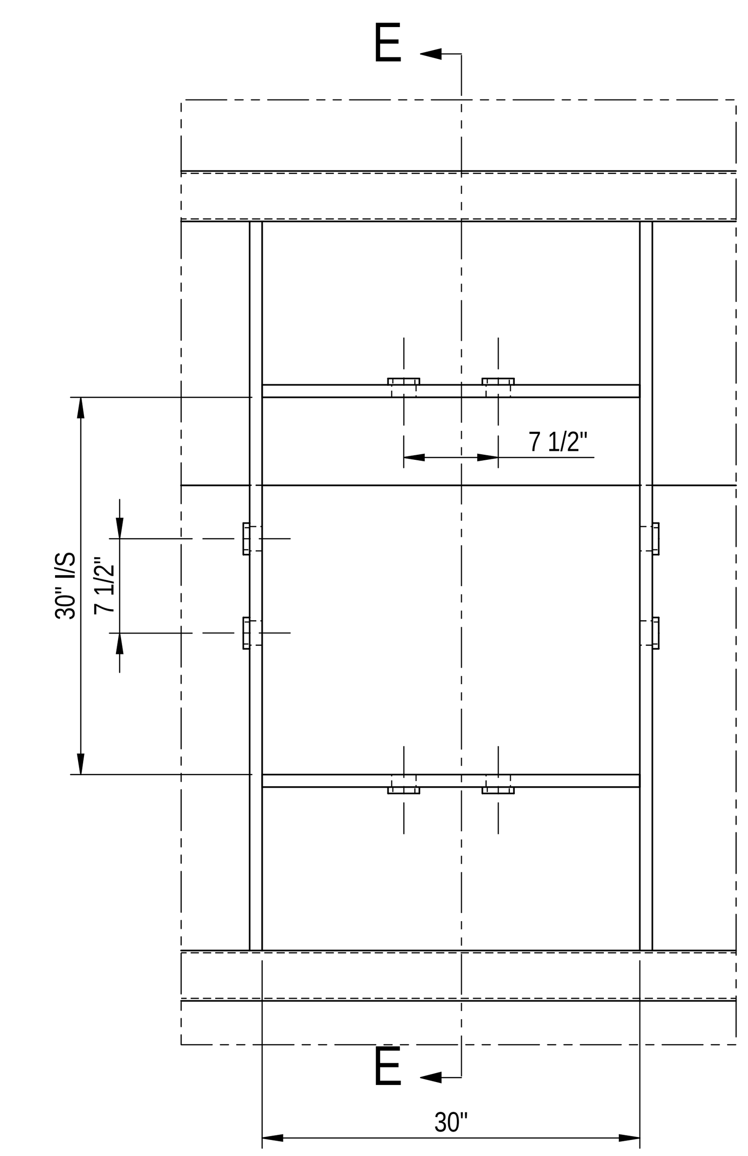




RedFox Design & Drafting Inc
151 Vancouver Crescent
Red Deer, AB T4R 0P2
PH: (403) 877-9859
E: dan@redfox-design.ca
www.redfox-design.ca

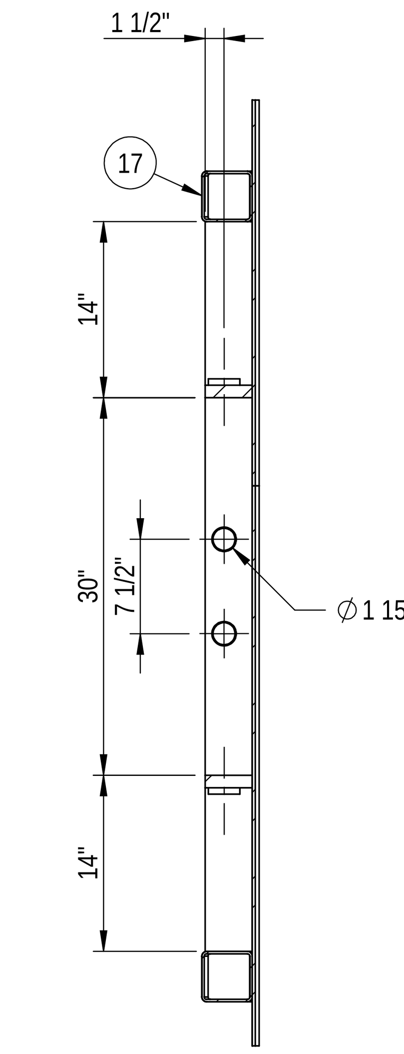
Drawn By: Dan Griffiths	H20P - HARPOON FRAC TANK			
Date: September-01-2022	H20P - HARPOON TANK ASSEMBLY GENERAL ARRANGEMENT			
Checked By: -				
Customer Project No: 1011	RedFox Project No: RF22068	Part Number: H20P-1000	Drawing Number: RF22068-2 Sheet: 2 of 3	Rev: 0



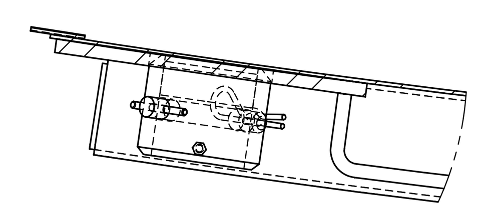


DETAIL D

TELEHANDLER POCKET



SECTION E-E



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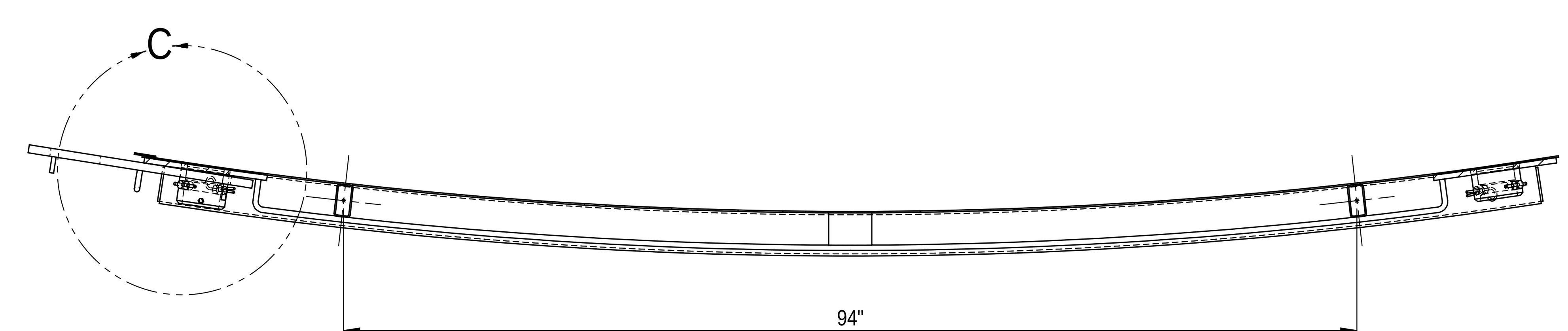
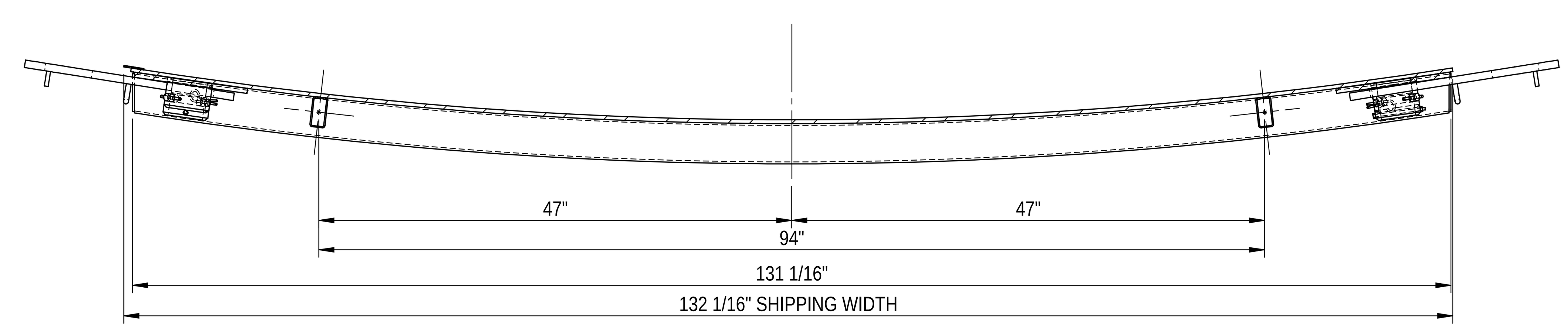


SECTION B-B



SECTION A-A

RedFox Design & Drafting Inc
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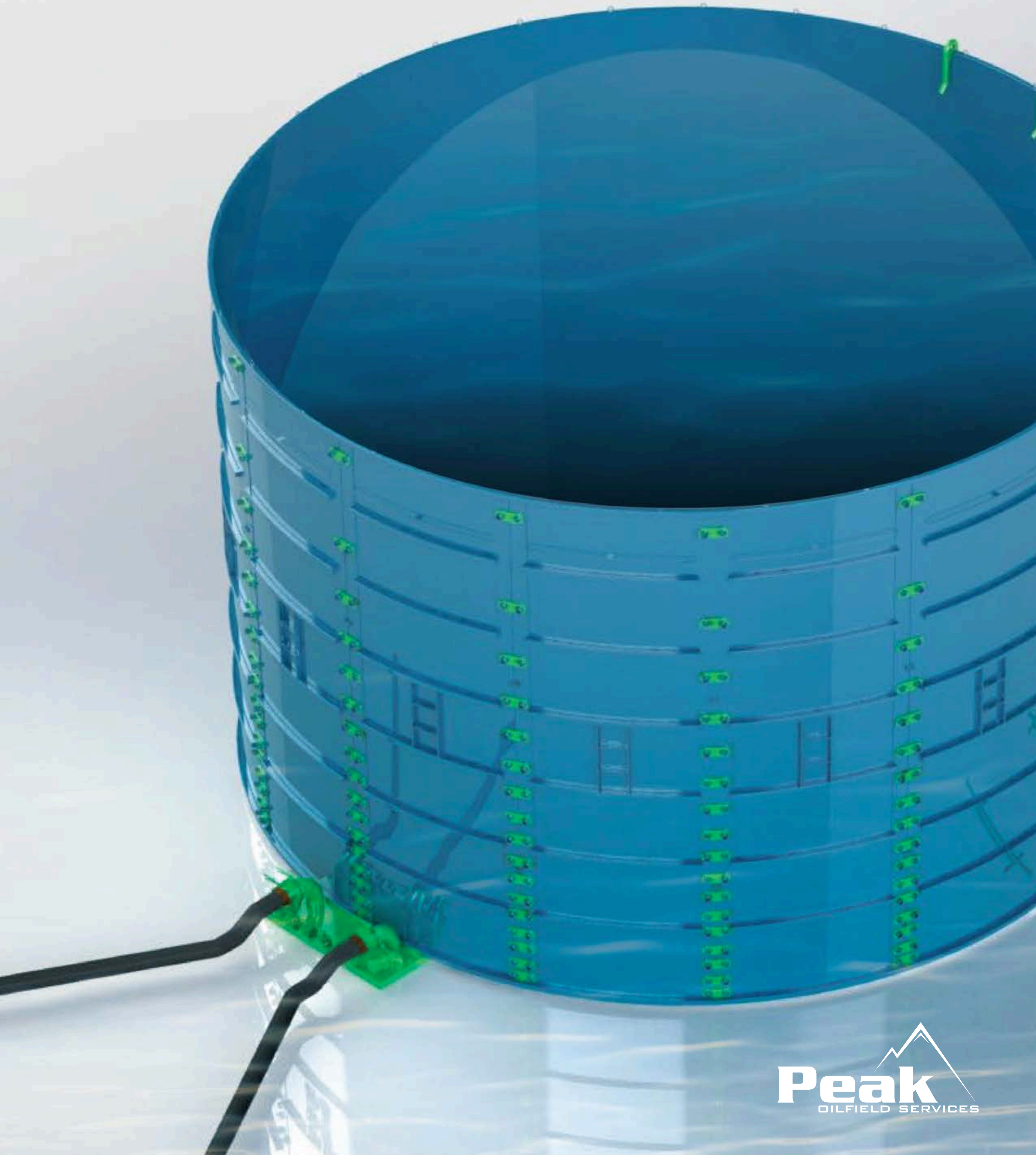
Drawn By: Dan Griffiths	H20P - HARPOON FRAC TANK				
Date: September-01-2022	TYPICAL PANEL ASSEMBLY				
Checked By: -					
Customer Project No: 1011	RedFox Project No: RF22068	Part Number: H20P-1003	Drawing Number: RF22068-3	Sheet: 3 of 3	Rev: 0

Attachment B

Tank Liner Product Information

HARPOON



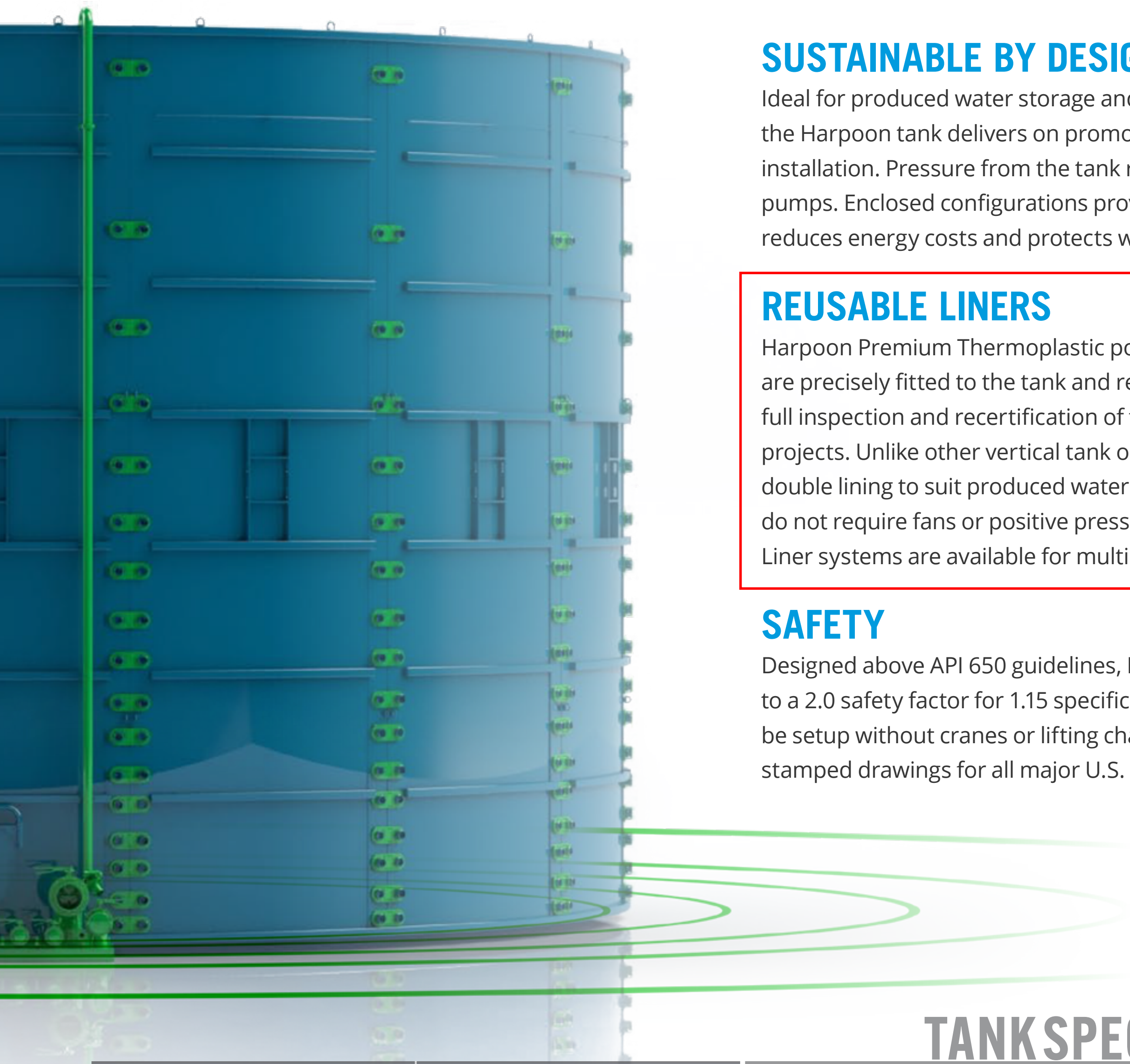
Peak
OILFIELD SERVICES

HARPOON

ABOVE-GROUND
STORAGE SOLUTIONS

A STEP UP IN STORAGE

The Harpoon™ Tank was designed to offer the greatest volume to footprint fluid storage capacity on the market, expanding the possible applications for mobile storage solutions. Current configurations allow 15,000 bbls of usable storage within a 55' diameter—that's half the footprint of a standard AST and one quarter that of standard frac tanks. Built for flexibility and efficiency, the tank can be lined for produced water storage, floating lids, and vapor capture all while delivering 140 bbl/min hydrostatic flow rates.



SUSTAINABLE BY DESIGN

Ideal for produced water storage and ventless operations, the Harpoon tank delivers on promoting ESG goals with each installation. Pressure from the tank reduces the need for transfer pumps. Enclosed configurations provide heat retention that reduces energy costs and protects wildlife.

REUSABLE LINERS

Harpoon Premium Thermoplastic polyurethane (TPU) liners are precisely fitted to the tank and reusable while allowing for full inspection and recertification of the lining system between projects. Unlike other vertical tank options, Harpoon is capable of double lining to suit produced water storage needs. Harpoon tanks do not require fans or positive pressure to force air into the liner. Liner systems are available for multiple fluid types.

SAFETY

Designed above API 650 guidelines, Harpoon tanks are engineered to a 2.0 safety factor for 1.15 specific gravity fluid. The tanks can be setup without cranes or lifting chains and have engineered stamped drawings for all major U.S. basins.

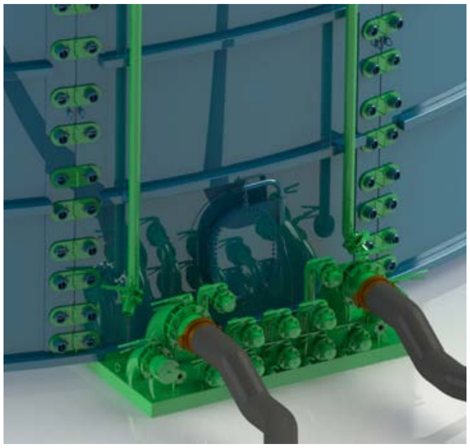
TANK SPECIFICATIONS

Tank Dimensions	55 ft diameter 36 ft height
Number of Panels	15 *(14 typical and 1 manway)*
Hydrostatic Discharge Rate	140 bbl/min
Total Volume	15,000 bbl
Freeboard Volume	14,000 bbl

In addition to these specifications, Harpoon Tanks also feature:

- *Subsurface manifold*
- *2-12 fill and 2-12", 2-8", 13-4" frac manifold*
- *Heating loop for cold weather climates*
- *Return lines to the top of the tank*
- *Dual mechanical level meters, optional remote monitoring*

FEATURES



IMPROVING THE FLOW

Tank height increases the hydrostatic pressure in the tank manifold allowing 140 bbl min flow rates and reducing pump requirements. Fill manifolds are installed opposite the frac manifold to improve site traffic and allows tanks to be daisy-chained with ease.

TELEHANDLER JOINT

The Harpoon Tank is designed for speed and safety during the setup process. Telehandler joints replace chained connections to reduce the potential for incidents. Rig up can be performed with a small crew in as little as a half day.

ENGINEERED FOR STRENGTH

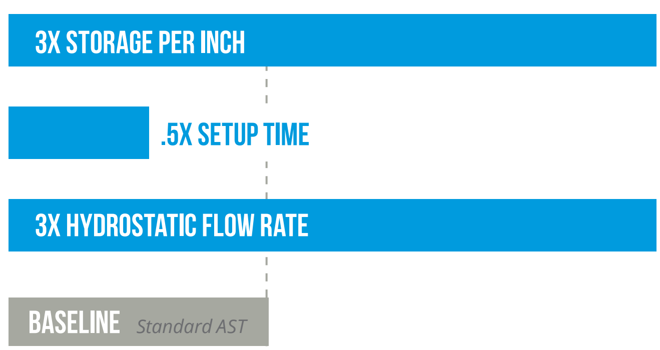
Cold rolled steel construction with third-party mag particle testing make this tank field tough. The Harpoon Tank performs under pressure with 17 plate joints between each panel and a durable enamel finish to prevent corrosion from fluid contact.

SUPPORTED BY THE WATER EXPERTS

Harpoon Tanks are supported by the industry water experts, Select Energy Services. With a broad offering of technical, logistical, and regulatory solutions that encompass the complete water lifecycle, Select's expertise in industrial water solutions is unmatched. Combine your tank installation with solutions from the experts including:

- TANK MONITORING AND AUTOMATED WATER TRANSFER
- WATER SOURCING AND INFRASTRUCTURE
- WATER TREATMENT AND CHEMISTRY
- WATER ANALYSIS AND LAB SUPPORT
- REGULATORY SUPPORT AND LANDOWNER RELATIONS

HOW HARPOON STACKS UP



READY TO SEE WHAT WE CAN DO FOR YOU?

To learn more about our advances in water storage, including Harpoon Tanks contact us at **833.778.PEAK** or visit **peakoilservices.com/harpoon.**

Peak
OILFIELD SERVICES

peakoilservices.com/harpoon

Southplus Inc.

Inspection report

No.	Specification	Standard	Test result
1	Liner #	20P-08	
2	Liner dimension	Ø864" x H484" with flared top of Ø915.36"	Pass
3	TPU resin	BASF	Pass
4	Appearance	Smooth, no bubbles, impurities or holes on the fabric surface	Pass
5	Welding seam	Seamless coverage on HF welding area with 20 mm TPU tape	Pass
6	Welding handles' strength	100 kg min.	Pass
7	Lifting handles' strength	750 kg min.	Pass
8	Hanging handles' strength	1000 kg min.	Pass
9	Breaking Strength, Grab (Warp/Weft)	697/674 lb	Pass, ASTM D751
10	Breaking Strength, Strip (Warp/Weft)	627/570 lb/inch	Pass, ASTM D751
11	Tear Strength, Single Tongue (Warp/Weft)	48/38 lb	Pass, ASTM D751
12	Adhesion (IVK)	28 lb/inch	Pass, ASTM D751

Inspection date: Feb. 21, 2023

QC Manager: C.L. Zhang

Southplus Inc.

Inspection report

No.	Specification	Standard	Test result
1	Liner #	20P-09	
2	Liner dimension	Ø864" x H484" with flared top of Ø915.36"	Pass
3	TPU resin	BASF	Pass
4	Appearance	Smooth, no bubbles, impurities or holes on the fabric surface	Pass
5	Welding seam	Seamless coverage on HF welding area with 20 mm TPU tape	Pass
6	Welding handles' strength	100 kg min.	Pass
7	Lifting handles' strength	750 kg min.	Pass
8	Hanging handles' strength	1000 kg min.	Pass
9	Breaking Strength, Grab (Warp/Weft)	697/674 lb	Pass, ASTM D751
10	Breaking Strength, Strip (Warp/Weft)	627/570 lb/inch	Pass, ASTM D751
11	Tear Strength, Single Tongue (Warp/Weft)	48/38 lb	Pass, ASTM D751
12	Adhesion (IVK)	28 lb/inch	Pass, ASTM D751

Inspection date: Feb. 21, 2023

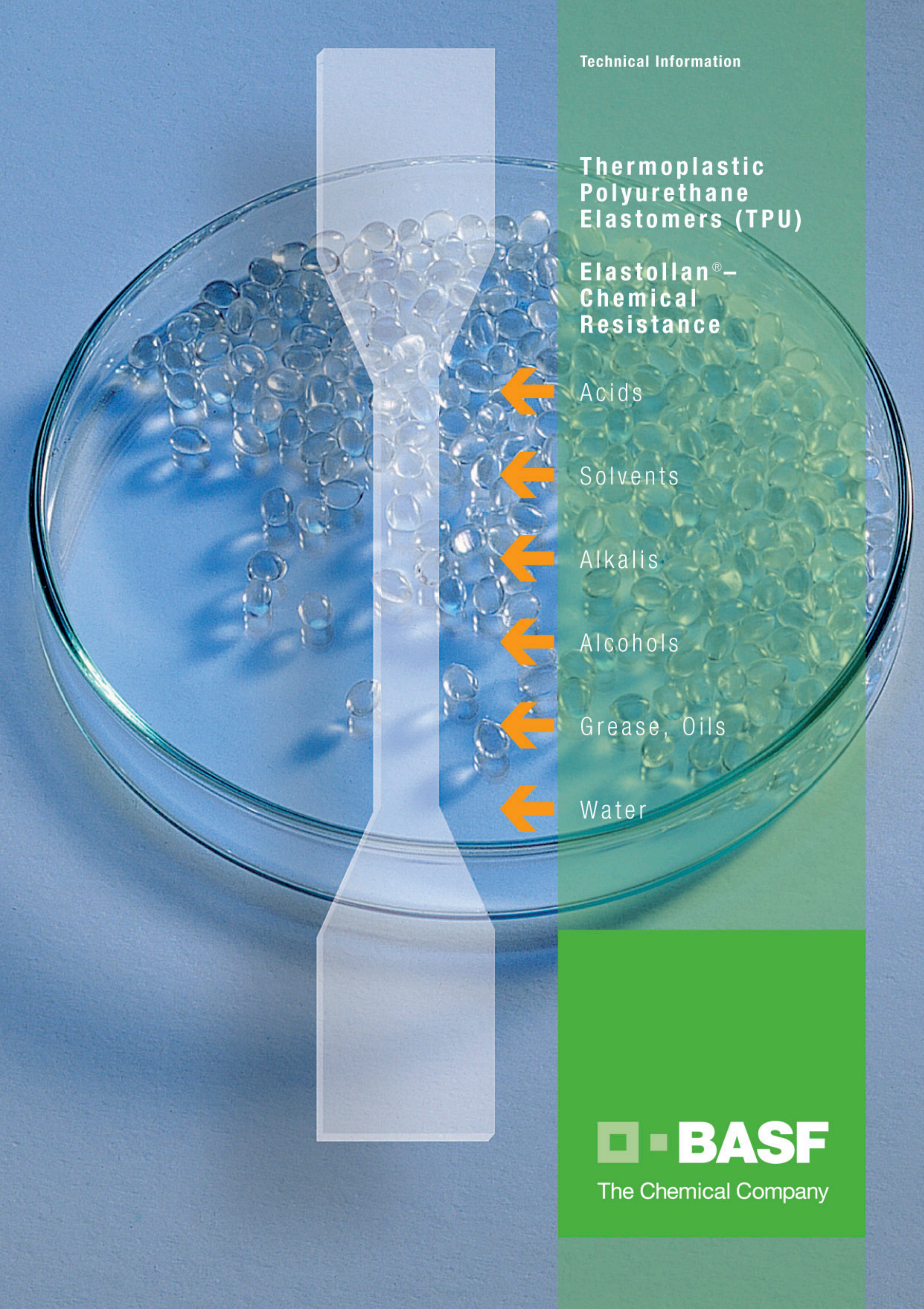
QC Manager: C.L. Zhang

SOUTHPLUS INC. QC

Technical Information

Thermoplastic Polyurethane Elastomers (TPU)

Elastollan®– Chemical Resistance



BASF
The Chemical Company

Introduction

The resistance of plastic materials against chemicals, solvents and other contact substances is an important criterion of selection for many applications.

When contacting such substances, the mechanical properties of plastic materials including Elastollan can be affected.

This Technical Data Sheet provides a survey in tabular form, of the behaviour of selected Elastollan grades towards common contact substances.

The survey is divided into various categories (e. g. weak acids, mineral acids, oxidizing acids, alkaline solutions, solvents). The aim is to simplify the selection of Elastollan types when deciding on their application suitability.

Test Conditions:

Test Specimens
Standard S2 dumb-bells according to DIN 53504. All test pieces pre-tempered for 20 h at 100° C.

Test Temperature
Reagents, 60° C;
Solvents, 20° C

Test Criteria
Reagents: the immersion time to cause a reduction in tensile strength to 20 N/mm^2.
Solvents: reduction in tensile strength due to swelling after three weeks immersion.

The resistance is indicated roughly in terms of days, weeks, months or years.

According to a general rule of thumb, resistance may be extrapolated to double when reducing temperature by 10° C, and when increasing temperature by 10° C, to half.

Tests were performed with the Elastollan grades S 85 A, C 85 A and 1185 A.

Swelling and solution are primarily affected by the number of hydrogen bonds effective between the linear molecular chains, which increases with hardness. From this, it can be derived that harder products suffer less swelling, and their chemical resistance is higher. Highly polar substances may in part or completely break down the molecular interactions, resulting in severe swelling and in extreme cases complete dissolution of Elastollan materials.

Elastollan – Chemical Resistance
Index

Chemical Resistance of Elastollan

Code	Tested	Elastollan S 85 A		Elastollan C 85 A		Elastollan 1185 A	
		20° C	60° C	20° C	60° C	20° C	60° C
0. Water	Tap Water	Years	Months	Years	Months	Years	Years
	Sea Water	Years	Months	Years	Months	Years	Years
1. Weak Acids, Carbonic Acids	3 % Acetic Acid	Weeks	Days	Weeks	Days	Years	Months
	3 % Lactic Acid	Weeks	Days	Weeks	Days	Years	Months
	3 % Boric Acid	Months	Weeks	Months/ Years	Weeks/ Months	Years	Months
	3 % Phenolic Solution	Weeks/ Months	Days	Months/ Years	Weeks	Years However, tensile strength only 50 % due to swelling	Months
	The action of 3 % solutions of formic acid, propionic acid, butyric acid, lauric acid, oleic acid, stearic acid etc., will be comparable.						
2. Chelating Carbon Acids	3 % Citric Acid	Months	Days	Months	Days	Years	Months
3. Weak Mineral Acids	3 % Sodium Bisulphate Solution	Months	Days/ Weeks	Months/ Years	Weeks	Years	Months
	3 % Phosphoric Acid	Months	Days	Months	Weeks	Years	Months
4. Strong Mineral Acids	3 % Hydrochloric Acid	Days	Hours	Days	Hours	Years	Months
	The action of 3 % sulphuric acid will be similar.						
5. Battery Acid	Battery Acid	Days	Hours	Days	Hours	Years	Months
6. Oxidizing Mineral Acids	3 % Nitric Acid	Days	Hours	Days	Hours	Days	Hours
7. Oxidizing Solutions, pH-value around 7	Hydrogen Peroxide 35 %	Weeks/ Months		Months		Months	
	Sodium Nitrate, 3 %	Months/ Years	Weeks	Years	Months	Years	Months
	Sodium Hypochlorite= Bleach (Javelle Water), 3 %	Weeks	Days	Weeks	Days	Months	Weeks
			Surface becomes tacky				
	Bleach (Javelle Water), 0.5 %	Months	Weeks	Months	Weeks	Years	Months
			Surface becomes tacky				

Code	Tested	Elastollan S 85 A 20° C	Elastollan S 85 A 60° C	Elastollan C 85 A 20° C	Elastollan C 85 A 60° C	Elastollan 1185 A 20° C	Elastollan 1185 A 60° C
8. Reducing Solutions	Sodium Sulphite, 3 %	Months/ Years	Weeks/ Months	Years	Months	Years	Months
9. Alkaline Solutions	Saturated Calcium Hydroxide (Slaked Lime)	Months/ Years	Weeks	Years	Months	Years	Months
	3 % Soda Solution	Months/ Years	Weeks	Years	Months	Years	Months
	3 % Soda Lye (Caustic Soda)	Weeks	Days	Months	Weeks	Years	Months
	3 %Triethanolamine Solution	Months	Weeks	Months/ Years	Months	Years	Months
10. Basic Solutions	3 % Urea Solution	Months	Weeks	Months/ Years	Weeks	Years	Months
	3 % Ammonium Solution	Days	Hours	Weeks	Days	Years	Months
	3 % Ammonium Chloride Solution	Months/ Years	Weeks/ Months	Years	Months	Years Reduced tensile strength due to swelling	Months
11. Alcohols	Methanol	Days		Weeks/ Months		Months	
	Ethanol	Months		Months		Years	
	Iso-Propanol	Months		Months		Years	
12. FAM Test Fluids ace. to DIN 51604*	Test Fluid A	Months		Years		Years	
	Test Fluid B	Days		Months		Months severe swelling	
	Test Fluid C	Days		Weeks		Months severe swelling	
13. ASTM-Oils	ASTM-Oil 1	Years	Months	Years	Months	Years	Months
	ASTM-Oil 2	Years	Months	Years	Months	Years	Months
	ASTM-Oil 3	Years	Months	Years	Months	Years	Months

		Elastollan S 85 A		Elastollan C 85 A		Elastollan 1185 A	
Code	Tested	20° C	60° C	20° C	60° C	20° C	60° C
14. Miscellaneous	Anti-freeze (Glysantine/Water 1/1.5)	Months	Weeks	Months/ Years	Weeks	Years	Months
	Silicone Fluid (Dimethyl Polysiloxane)	Years	Months	Years	Months	Years	Months
	Brake Fluid	Hours	Hours	Hours	Hours	Hours	Hours
		Brake fluid/many hydraulic oils attack TPU					
	Trichloroethane volume swelling:	Months 39 %		Months 41 %		Months 52 %	
	Ethyl Acetate	Months		Months		Months Reduced tensile strength due to swelling	
	Volume swelling:	65 %		59 %		76 %	

* DIN 51 604, 03.1984, is the standard, etablished by FAM to assess the resistance of plastic materials to automotive fuels.

(FAM = Fachausschuß Mineral- und Brennstoff-normung-Professional committee for standardization of fuel stuffs)

Test fluid A consists of:
- 50.0 % by volume toluene
- 30.0 % by volume iso-octane
- 15.0 % by volume di-isobutylene
- 5.0 % by volume ethanol

Test fluid B consists of:
- 42.0 % by volume toluene
- 25.5 % by volume iso-octane
- 13.0 % by volume di-isobutylene
- 15.0 % by volume methanol
- 4.0 % by volume ethanol
- 0.5 % by volume water

Test fluid C consists of:
- 20.0 % by volume toluene
- 12.0 % by volume iso-octane
- 6.0 % by volume di-isobutylene
- 58.0 % by volume methanol
- 2.0 % by volume ethanol
- 2.0 % by volume water

Resistance of Elastollan to Solvents

15. Solvents

No degradation of Elastollan products occurs, however, according tothe solvent class a variable degree of swelling and consequent reduction in tensile strength (after evaporation of the solvents, thetensile strength recovers approx.itsoriginal value). Methanol should be considered more asachemicalreagentthanasasolventITPU is soluble in some solvents.
As test procedure, S2 dumb-bells **were immersed inthesolventforthree weeks at 20° C,** and tested for tensile strength and residual swell 15 minutes after withdrawal. The values of volume swelling and reduction of tensilestrenght are quoted as an average guide.

Code	Tested	**Elastollan S 85 A** % Swelling	**Elastollan S 85 A** % Reduction of Tensile Strength	**Elastollan C 85 A** % Swelling	**Elastollan C 85 A** % Reduction of Tensile Strength	**Elastollan 1185 A** % Swelling	**Elastollan 1185 A** % Reduction of Tensile Strength
15.1 Aliphatic Hydrocarbons	Pentane	3	2.0	4.5	10	10	20
	Cyclohexane	4	15	7	10	22	10
	Iso-Octane	2.5	none	2.5	none	7.5	none
	Elastollan types behave similarly in other aliphatic and cyclo-aliphatic hydrocarbons such as methane, ethane, propane, butane, hexane, octane, petroleum ether, paraffin oil, diesel oil and kerosine (although additives can present problems).						
15.2 Aromatic Hydrocarbons	Toluene	52	55	60	45	65	50
	Other aromatic hydrocarbons such as benzene and xylene have a similar affect.						
15.3 Aliphatic Esters	Ethyl Acetate	75	70	70	65	70	75
	Other short-chained esters such as butyl acetate and amyi acetate have a similar affect.						
15.4 Aliphatic Ketones	Methyl Ethyl Ketone	105	80	110	80	130	90
	Other short-chained aliphatic ketones such as acetone and methyl isobutyl ketone = MIBK have a similar affect.						
15.5 Aliphatic Halogenated Hydrocarbons, 1 C-atom	Methylene Chloride	175	75	155	65	190	95
	Chloroform	280	75	260	70		practically dissolved
2C-atoms	Tetrachloroethylene	20	40	28	35	50	45
and higher	Trichloroethane	54	39	65	39	75	54
	Other aliphatic halogenated hydrocarbons with 2 C-atoms and higher have a similar affect.						

Code	Tested	Elastollan S 85 A		Elastollan C 85 A		Elastollan 1185 A	
		% Swelling	% Reduction of Tensile Strength	% Swelling	% Reduction of Tensile Strength	% Swelling	% Reduction of Tensile Strength
15.6 Aromatic Halogenated Hydrocarbons	Chlorobenzene	90	60	100	55	110	60
	Other aromatic halogenated hydrocarbons have a similar affect.						
15.7 ASTM-Oils	ASTM-Oil 1 at 100° C	2	none	none	none	1	none
	IRM-902 at 100° C	1	none	3	none	12	none
	IRM-903 at 100° C	3	none	6	none	18	none
15.8 Agents Dissolving TPU	Tetrahydrofurane	> 450	practically dissolved	> 450	practically dissolved		dissolved
	Dimethyl Formamide (DMF)		dissolved		dissolved		dissolved
	Dimethyl Acetamide		dissolved		dissolved		dissolved
	N-Methyl Pyrrolidone (NMP)		dissolved		dissolved		dissolved
	Dimethyl Sulphoxide (DMSO)		dissolved		dissolved		dissolved
	Pyridine		dissolved		dissolved		dissolved
16. Alcohols and Fuels	Methanol	18	80	18	58	28	60
		poor resistance		limited resistance for sev. weeks			
	Ethanol	16	52	18	52	33	64
	Iso-Propanol	14	44	17	42	30	50
	Benzyl Alcohol	300	95	270	85	not measurable	partly dissolved
		poor resistance		poor resistance		poor resistance	
	Ethylene Glycol	2	none	2	none	4	15
	Glycerine	none	none	none	none	none	none
FAM Test Fluids acc. to DIN 51 604 (ref. also 12.)	Test Fluid A	39	55	45	50	67	60
	Test Fluid B	38	72	38	55	68	74
		poor resistance		limited resistance for sev. weeks			
	Test Fluid C	21	60	24	50	43	70
		poor resistance		limited resistance for sev. weeks			
Diesel Fuel	Diesel Fuel	3.0	15	5.0	none	11	none

Code	Tested	Elastollan S 85 A		Elastollan C 85 A		Elastollan 1185 A	
		% Swelling	% Reduction of Tensile Strength	% Swelling	% Reduction of Tensile Strength	% Swelling	% Reduction of Tensile Strength
Fuel Types ASTM D 471	Fuel A = Iso-Octane	2.5	none	2.5	none	7.5	none
	Fuel B = Iso-Octane/ Toluene 70 %/30 %	13	30	18	32	25	36
	Fuel C = Iso-Octane/ Toluene 50 %/50 %	21	40	27	38	38	44
	Fuel D = Iso-Octane/ Toluene 60 %/40 %	17	37	21	36	31	44

* DIN 51 604, 03.1984, is the standard, etablished by FAM to assess the resistance of plastic materials to automotive fuels.

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- 4.5 % by volume ethanol
- 0.5 % by volume water

Test fluid C consists of:
- 20.0 % by volume toluene
- 12.0 % by volume iso-octane
- 6.0 % by volume di-isobutylene
- 58.0 % by volume methanol
- 2.0 % by volume ethanol
- 2.0 % by volume water

Elastogran is polyurethanes

With top quality products, a reputation for good customer service and continuous progress and development, Elastollan has secured a firm position in numerous markets.

We want to share our know-how and experience to contribute to your own success: The versatile Elastollan is the ideal material to fulfill your requirements.

For further information, the following detailed brochures are available upon request:

- Thermoplastic Polyurethane Elastomers: Elastollan
- Elastollan – Product Range
- Elastollan – Material Properties
- Elastollan – Processing Recommendations
- Elastollan – Electrical Properties

BASF Corporation
Elastollan® TPU
1609 Biddle Avenue
Wyandotte, MI 48192

For inquiries call:
(800) 892-3111
Fax: (734) 324-6467

or visit our internet site at:
www.basf.com/tpu

BASF
The Chemical Company

K/M, 181-07-07/GB

Attachment C

Hydrostatic Analysis

ENGINEERING CALCULATIONS

FROM 2005 TO 2020 15 YEAR ANNIVERSARY

Frost
ENGINEERING & CONSULTING

HydrEra Energy Services
H20P – Harpoon Frac Tank

Engineered Calculations

May 2022

The following individual has overseen development of the attached structural calculations

STATE OF OHIO
TROY A. MADLEM
E-74584
REGISTERED
PROFESSIONAL ENGINEER

Troy A. Madlem, PE
Registration No.: E-74584

All inquiries of the findings within may be directed to:

Frost Engineering & Consulting Company
201 Lincolnway West, Suite 200
Mishawaka, Indiana 46544

Office: (574) 344-5900
Email: Contactus@Frosteng.net

INTENTIONAL APPROACH | INNOVATIVE DESIGN | DRIVEN SOLUTIONS

Design Data – H20P - Harpoon Frac Tank

1. Design Standards & References:
   a. API 650*
   b. ASCE 7-16
   c. AISC 360-16
   d. ASCE 7 Online Hazards Tool, 2022

2. Service Life	25 years
3. Gravity Loads:	
a. Self weight of tank components	
b. Various fluid depths with specific gravity (S.G.) =	1.00 – 1.25
4. Risk Category	I
5. Wind Load (Mean recurrence interval = 50 years):	
a. Basic Wind Speed	
i. NM, WY, OK, ND, WV	81.3 mph (3-second gust)
ii. CO	86.0 mph (3-second gust)
iii. TX, LA	116.2 mph (3-second gust)
b. Exposure Category	C
c. Directionality Factor	0.85
d. Topographic Factor	1.00
e. Elevation Factor	1.00 (At sea level)
f. Exposure Coefficient	1.04
6. Seismic Loads (Mean recurrence interval = 50 years)**:	
a. Soil Site Class	D (Default)
b. Seismic Use Group (SUG)	I
c. S_{DS}	
i. TX, PN, ND, LA, WV	0.10g
ii. NM, CO, OK	0.28g
iii. WY	0.30g***
d. S_{D1}	
i. TX, PN, ND, LA, WV	0.04g
ii. NM, CO, OK	0.13g
iii. WY	0.15g***
e. R_{wi} (Impulsive response modification factor)	3.5
f. R_{wc} (Convective response modification factor)	2.0

*API 650 represents the relevant industry standard for tank construction

**Seismic design is defined as a Purchaser's option per API 650

***The tank assembly is not permissible to be installed in the following counties of Western Wyoming: Lincoln, Park, Sublette & Teton.

Minimum Safety Factor				
Fluid Height (ft)	36	35	34	32.73
Free Board (ft)	0	1	2	3.27
Specific Gravity				
1.00	2.27	2.36	2.45	2.54
1.05	2.17	2.26	2.34	2.43
1.10	2.08	2.16	2.24	2.32
1.15	**2.00**	**2.08**	**2.15**	**2.23**
1.20	1.92	2.00	2.07	2.14
1.25	1.85	1.93	1.99	2.06

Notes:

1. Safety factor represents the nominal capacity to demand ratio for the governing limit state and load scenario
2. The Owner targeted minimum safety factor for in-service conditions is 2.0

Attachment D

Tank Installation Inspection Reports and Field Density Test Results

Tank Installation Reports

5101 Office Park Drive, Suite 100
Bakersfield, CA 93309

Mr. Bryan Martin
VP - Midwest
Hepaco
2647. Hamilton Ln
Hamilton, OH

Rain for Rent has verified with Cody Phillips, owner of C2 Services LLC, and Partner and Field Supervisor for Hydrera Water, he has certified that H20P-05 & H20P-06, located at the East Palestine OH derailment pad site, have been set up in accordance to Hydrera Harpoon Installation SOP, both tanks we set on a 95% compacted and leveled pad per spec. Tanks 05 & 06 were setup consecutively on March 19th & 20th. Both tanks had 1' of fresh water put in to seat liner. Tanks have been inspected since install on 3/29 via aerial manlift after secondary containment was completed. Tanks are in appropriate working order ready for operational use.

We are submitting for your review the install reports from C2 Services based on the set up and conditions of the 2 – 25k Harpoon Tanks that are onsite were installed correctly per manufacturers SOP.

Sincerely,

Steve Bayda
Midwest Regional Vice President
Rain for Rent

Cc: Rich Speidel Midwest Regional Sales Manager

T: (720) 690-6989

HYDRERA WATER SERVICES

DOC #00156

*Harpoon Install Report

H20p-05 & 06 East Palestine OH 2 25k

Sent By

Cody Phillips 005

Sent At

26 March 2023 at 11:11 PM

Submitted By:

Cody

Weather:

Rain/snow

Report #:

J1 H20P-05 Installation 3/19/23

Customer:

Rain For Rent

Field Contact:

Dewey Workman 724-462-9848

Phone #:

(___) ___-____

Supervisor Name:

Cody

Groundwork Supervisor:

Cody

Lease Name:

NS East Palestine Train Derailment

State/Province:

Oh

Directions to Location:

East Palestine OH

Tank Size:

25k

Start Time:

Fluid Composition:

NonPot water/vinyl chloride/fire suppression

Finish Time:

Equipment Type:

Lifting Implements Serial #:

09&12

Lifting Implements Visually Inspected?:

- [x] Yes
- [ ] No

Groundwork Details:

Description:

Flat

Pad Grade Within Spec:

- [x] Yes
- [ ] No

Pad Compaction Sufficient:

- [x] Yes
- [ ] No

Photos of Pad:

Equipment Used:

Tank Panels Serial #:

H20p-05

Tank Panels Visually Inspected?:

(•) Yes ( ) No

Tank Panels Properly Installed?:

(•) Yes ( ) No

Comments:

Liner Type:

TPU

Liner Serial #:

HL25k-008

Liner Visually Inspected?:

(•) Yes ( ) No

Liner Properly Installed?:

(•) Yes ( ) No

Liner Installed By:

C2

Comments:

Groundcloth Visually Inspected?:

- [x] Yes
- [ ] No

Groundcloth Properly Installed?:

- [x] Yes
- [ ] No

Manifold Set Serial #:

28

Manifold Set Visually Inspected?:

- [x] Yes
- [ ] No

Manifold Set Properly Installed?:

- [x] Yes
- [ ] No

Additional Items Installed or Left On Location:

Hydrm24

Additional Items Installed Not Listed:

All Liner Connections Double Checked?

Yes

- [x] Fill Manifold Connection

- [x] Suction Manifold Connection
- [x] Inner Manway Connection
- [x] Outer Manway Connection

Third Party Vendors:

○ Yes ◉ No

General Project Comments:

Tank completed, sone plates were randomly hard to get on

Signed on Corfix

X Cody Phillips

Cody Phillips 005
(cody@hydrera.com)

Signed 11:11:46 PM Sun Mar 26 2023

From IP 76.76.73.224, 172.31.1.95

T: (720) 690-6989

HYDRERA
WATER SERVICES

DOC #00157

*Harpoon Install Report

H20p-05 & 06 East Palestine OH 2 25k

Sent By

Cody Phillips 005

Sent At

26 March 2023 at 11:21 PM

Submitted By:

Cody

Weather:

Nice/sunny

Report #:

J1 H20P-06 Installation 3/20/23

Customer:

Rain For Rent

Field Contact:

Dewey Workman - 724-462-9848

Phone #:

(___) ___-____

Supervisor Name:

Cody

Groundwork Supervisor:

Cody

Lease Name:

East Palestine Train Derailment

State/Province:

Oh

Directions to Location:

Tank Size:

25k

Start Time:

Fluid Composition:

NonPot/Vinyl Chloride/fire suppression

Finish Time:

Equipment Type:

Lifting Implements Serial #:

09 & 12

Lifting Implements Visually Inspected?:

(•) Yes ( ) No

Groundwork Details:

Description:

Flat

Pad Grade Within Spec:

(•) Yes ( ) No

Pad Compaction Sufficient:

(•) Yes ( ) No

Photos of Pad:

Equipment Used:

Tank Panels Serial #:

H20p-06

Tank Panels Visually Inspected?:

(•) Yes ( ) No

Tank Panels Properly Installed?:

(•) Yes ( ) No

Comments:

Liner Type:

TPU

Liner Serial #:

HL25k-09

Liner Visually Inspected?:

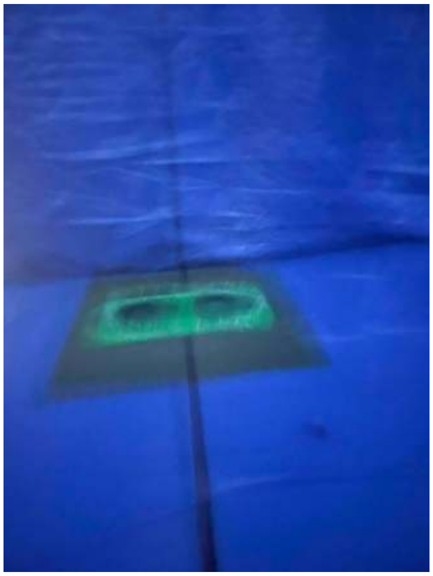
(•) Yes ( ) No

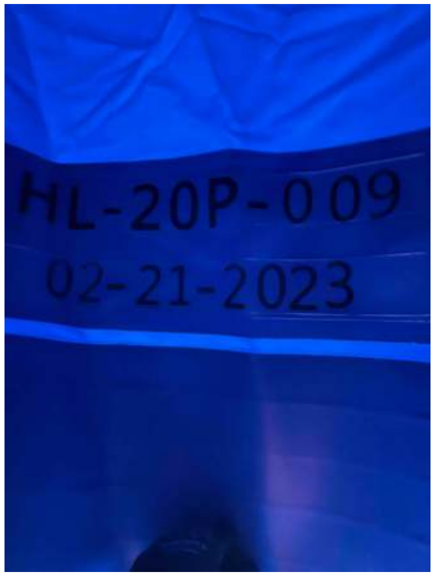
Liner Properly Installed?:

(•) Yes ( ) No

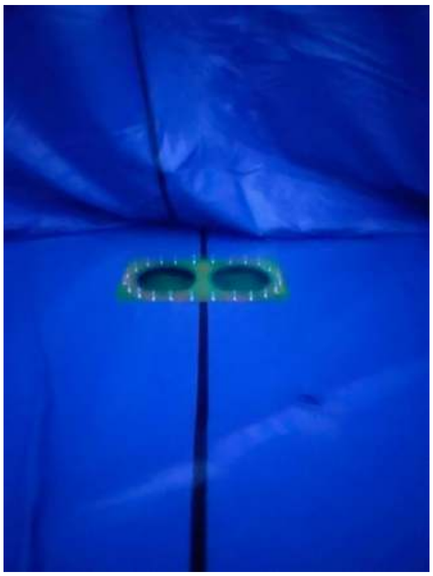
Liner Installed By:

C2





HL-20P-009
02-21-2023



Comments:

Groundcloth Visually Inspected?:

◉ Yes ○ No

Groundcloth Properly Installed?:

◉ Yes ○ No

Manifold Set Serial #:

29

Manifold Set Visually Inspected?:

◉ Yes ○ No

Manifold Set Properly Installed?:

◉ Yes ○ No

Additional Items Installed or Left On Location:

Hydrm23

Additional Items Installed Not Listed:

All Liner Connections Double Checked?

Yes

- [x] Fill Manifold Connection
- [x] Suction Manifold Connection
- [x] Inner Manway Connection

- [x] Outer Manway Connection

Third Party Vendors:

( ) Yes (•) No

General Project Comments:

Tank install complete

X Cody Phillips

Cody Phillips 005
(cody@hydrera.com)

Signed 11:21:52 PM Sun Mar 26 2023
From IP 76.76.73.224, 172.31.20.230

Inspection of 20P Harpoon 05 & 06 6 AST 189,000 gal Tank Farm

Inspection Date: 6/15/23

Performed by:

Cody Phillips, C2 Services/Hydrera Water Services

On June 15th, 2023 A site inspection was completed on the 6 AST tank Farm located on the East Palestine, OH Project.

6 AST Tank Farm:

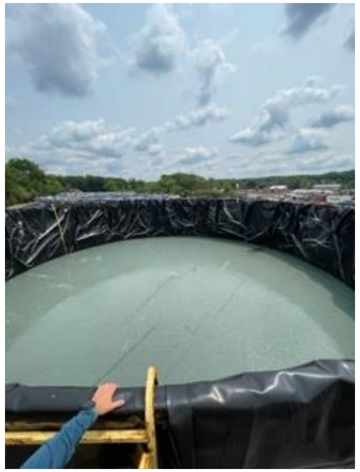
- Tanks 1,2,3,4,6 were sitting with approximately 14" in each tank after undergoing previous hydrotests, Tank 5 was currently undergoing a hydrotest and was sitting with 10' of fluid.
- All 6 Tanks liner looked as they should per SOP
- Pins/Plates/Clamps/Belly Strap was all installed as per SOP
- Pad looked to be compacted
- Crews were installing fill lines on the backside of tanks for filling.
- Continued observations by Arcadis staff to ensure minimum of 1' of fluid remaining in each tank at all times

Conclusion of Inspection: 6 AST Tank Farm has been installed per SOP and is Suitable for continued use

Tank #1

Tank #2

Tank #3



Tank #4

Tank #5

Tank #6

On June 15th, 2023 A site inspection was completed on the (2) 1,000,000 gallon Harpoon Tanks H20P-05 and H20P-06 located on the East Palestine OH project.

Harpoon Tanks:

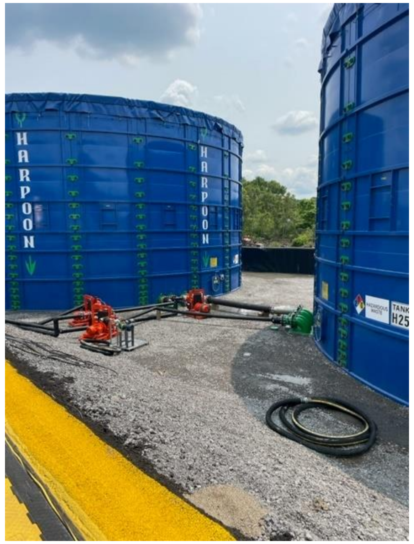
- H20P-05 Tank #1 (east) was holding about 269,304 gallons of fluid
- H20P-06 Tank #2 (west) was holding about 384,342 gallons of fluid
- Plates/Pins/Clips/liner/and external connections were checked visually and installed as per SOP
- H20P-06 Tank #2 had an over the top Fill Line installed by others, fill line was inspected visually with use of a Boom/Manlift to make sure line is clear of all liner. Fill Line stuck out into the tank approximately 2' off the wall and was clear of contact with liner on the wall
- Pumps/manifolding had been setup and connected to both manifolds on the harpoon and looked as they should free of any leaks and was proper supported.

Conclusion of Inspection: Harpoon Tanks are installed and being operated per SOP and suitable for continued use

Tank #1 East

Tank #2 West

Tank #2 West Fill line



Pumps/Manifolding

Manifolding between Tanks

Field Density Test Results

FIELD COMPACTION TEST DATA
R. D. ZANDE ASSOCIATES, INC.

Project: NS East Palestine Derailment
Project Number: 172607922

Density/Moisture Gauge Information

Tested By: Matthew Macielewicz Date: 03/16/2023
Checked By:_______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Standard Density Count: 1716 — % Change: 0
Standard Moisture Count: 635 — % Change: 0

TEST NUMBER	1	2	3	4
LOCATION	Eastern tank pad, Northern half	Eastern tank pad, Southern half	Western tank pad, Northern half	Western tank pad, Southern half
LIFT NUMBER	1	1	1	1
NUMBER OF PASSES	5	5	5	5
LIFT THICKNESS (INCHES)	12	12	12	12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	6	6	6	6
WET DENSITY (PCF)	140.6	136.4	143.3	141.2
DRY DENSITY (PCF)	136.4	132.4	139.3	136.7
MOISTURE (PCF)	4.2	4	4	4.6
MOISTURE (%)	3.1	3	2.9	3.3
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	98.41	95.53	100.51	98.63
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier
Drainage Layer
Test Pad (Recompacted Soil)

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

[3] Pass/Noncompliance Key
P: Passed - test results comply with specs
NC1: Noncompliance - Low Density
NC2: Noncompliance - Low Moisture
NC3: Noncompliance - High Moisture

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 03/16/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Information
Model No.:_______________________
Serial No.:_______________________
Standard Density Count: 1716
Standard Moisture Count: 635

% Change: 0
% Change: 0

TEST NUMBER	5	6	7	8
LOCATION	Eastern tank pad, Southern half	Eastern tank pad, Northern half	Western tank pad, Northern half	Western tank pad, Southern half
LIFT NUMBER	2	2	2	2
NUMBER OF PASSES	4	4	4	4
LIFT THICKNESS (INCHES)	12	12	12	12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	6	6	6	6
WET DENSITY (PCF)	137	139.5	140.6	140.8
DRY DENSITY (PCF)	133.7	135.3	136	135.4
MOISTURE (PCF)	3.3	4.2	4.6	5.4
MOISTURE (%)	2.4	3.1	3.3	4
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	96.46	97.62	98.12	97.69
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier
Drainage Layer
Test Pad (Recompacted Soil)

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

[3] Pass/Noncompliance Key
P: Passed - test results comply with specs
NC1: Noncompliance - Low Density
NC2: Noncompliance - Low Moisture
NC3: Noncompliance - High Moisture

Attachment E

Tank Foundation Analysis

Client: **Norfolk Southern Railway Company (NRSC)**

Project Location: **East Palestine, Ohio**

Project: **East Palestine Derailment** **Project No.:** **3016714**

Calc No: **CB-01** **Subject:** **Modular Tank Design**

Developed By: **ARL** **Date:** **June 29, 2023**

Checked By: **MG** **Date:** **June 30, 2023**

OBJECTIVE:

Evaluate the bearing capacity and settlement due to consolidation under the Modular Tanks at Norfolk Southern (NS) East Palestine derailment site.

REFERENCES:

1. Das, Braja (2011). Principles of Foundation Engineering, SI. Seventh Edition.
2. Coduto, Donald (2016). Foundation Design Principles and Practices. Third Edition.
3. Bowles, J. E., (1977), Foundation Analysis and Design, McGraw-Hill, Inc., New York

ASSUMPTIONS:

1. Two (2) tanks, each tank consisting of a modular interlocking steel framing with the following assumed dimensions:
   - 70 feet (ft) diameter (D)
   - 36 ft framing height (H)
   - For conservatism the max height (36 feet) is assumed for calculation purposes
   - 138,000 pounds (lbs) weight of framing (W)
2. For the purpose of this calculation, it is assumed that no vertical load other than the weight of the framing is transferred to the framing.
3. The interior of the frame is lined with flexible high-density polyethylene (HDPE) liner, which serves as the tank bottom.
4. The foundation consists of 2 feet of compacted crushed gravel. For conservatism, assume the tank is placed directly on subgrade and not buried ($q = 0$). See Attachment 3 for boring logs and laboratory testing.
5. The strength properties of the soil subgrade are as follows:
   - Lowest average N60 in the top 6 ft is 7.7 blows per foot (bpf)
   - Unconfined compressive strength (q_u) of 2,000 pounds per square foot (psf), conservatively selected using a published correlation between unconfined compressive strength and blow counts in cohesive soils (Reference 3).
   - An assumed value of 0 angle of internal friction (phi).

6. Cohesion (c) = 0.5q_u = 0.5(2,000 psf) = 1,000 psf
7. Unit weight (density) of water is 62.4 pcf (γ_w).
8. Minimum required bearing capacity Factor of Safety (FS) of 3.0.
9. The glacial till is over consolidated and the pre-consolidation pressure will not be exceeded.
10. Unit weight (γ) of 110 pcf.

CALCULATIONS:

Bearing Capacity of Modular Tanks

To analyze the bearing capacity factor of safety for the effluent tanks, the bearing pressure P must be calculated using the assumed properties of the tanks:

Area of tank: $A = \pi r^2 = (3.14)\left(\frac{70}{2}\right)^2 = 3{,}846\ sf$

Volume of tank: $V = AH = (3{,}846\ sf)(36\ ft) = 138{,}474\ cf$

Weight of water: $W_w = V\gamma_w = (138{,}474\ cf)(62.4\ pcf) = 8{,}640{,}778\ lbs$

Bearing pressure: $P = \frac{(W_w+W_T)}{A} = \frac{8{,}640{,}778\ lbs+138{,}474\ lbs}{3{,}846\ sf} = 2{,}283\ psf$

Where:

- Radius of tank (r) = 35 ft (D/2, Assumption 1)
- Height of tank (H) = 36 ft (Assumption 1)
- Density of water (γ_w) = 62.4 pcf (Assumption 6)
- Weight of tank framing (W_T) = 138,000 lbs (Assumption 1)

The Terzaghi bearing capacity for a circular foundation, using the given soil properties and assumptions can be evaluated using the equation below.

$$q_u = 1.3cN_c + qN_q + 0.3\gamma BN_\gamma$$

By applying the following Terzaghi's Bearing Capacity Factors for a friction angle (φ) of zero (Table 3.1 in Attachment 1):

- $N_c = 5.70$
- $N_q = 1.00$
- $N_\gamma = 0$

The bearing capacity at the bottom of the foundation (q_u) is as follows:

$$q_u = 1.3(1{,}000\,psf)(5.70) + \cancel{(0psf)(1)} + \cancel{(0.3)(110pcf)(53ft)(0)} = 7{,}410\,psf$$

The bearing capacity of the soil is then compared to the bearing pressure from the tanks found above to determine if the soils on-site can support the weight and pressure from the assumed sized tanks.

$FS = \frac{7{,}410\,psf}{2{,}283\,psf} = 3.2$, which is greater than the minimum required FS of 3.0 (Assumption 7).

With a factor of safety greater than the minimum required, it is determined that the soil subgrade on site can support the weight of the assumed sized tanks.

Modular Tank Consolidation Settlement

The tank consolidation settlement can be determined by the following equations (Reference 2). Refer to Attachment 2 for equations used to define all variables listed above and discussed herein.

$$\delta_c = \sum \frac{C_r}{1+e_0} H_i log\left(\frac{\sigma'_{v0,i} + \Delta\sigma'_{v,i}}{\sigma'_{v0,i}}\right)$$

The methodology below considers the effect of the surcharge load P to a depth equal to one tank diameter (B). The cohesive soils within the zone of influence of thickness B have been subdivided into three layers. The depth of each mid-layer Z_f is computed and used to determine the following parameters for each soil layer:

Effective Stress at mid-layer before Surcharge, σ'_{v0}:

$$\sigma'_{v0,1,mid} = \frac{H_1}{2}\gamma_1 = \frac{(6ft)}{2}(115pcf) = 345psf$$

$$\sigma'_{v0,1,bot} = H_1\gamma_1 = (6ft)(115pcf) = 690psf$$

$$\sigma'_{v0,2,mid} = \sigma'_{v0,1,bot} + \frac{H_2}{2}\gamma_2 = 690psf + \frac{(23ft)}{2}(110pcf) = 1{,}955psf$$

$$\sigma'_{v0,2,bot} = \sigma'_{v0,1,bot} + H_2\gamma_2 = 690psf + (23ft)(110pcf) = 3{,}220psf$$

$$\sigma'_{v0,3,mid} = \sigma'_{v0,2,bot} + \frac{H_3}{2}\gamma_3 = 3220psf + \frac{(23ft)}{2}(110pcf) = 4{,}485psf$$

Change in Effective Stress from Surcharge, $\Delta\sigma_v'$ can be obtained by computing Z_f/B for each layer and obtaining the parameter $\Delta\sigma_v'/q$ from Figure 7.2 (Attachment 2) for each Layer:

$$\frac{Z_{f,1}}{B} = \frac{3}{70} = 0.04.\ Using\ Figure\ 7.2{:}\ \frac{\Delta\sigma'_v}{q} = 0.99.\ It\ follows{:}\ \Delta\sigma'_{v,1} = (0.99)(2283psf) = 2{,}260psf$$

$$\frac{Z_{f,2}}{B} = \frac{17.5}{70} = 0.25.\ Using\ Figure\ 7.2{:}\frac{\Delta\sigma_v'}{q} = 0.9. It\ follows{:}\Delta\sigma_{v,2}' = (0.9)(2283psf) = 2055psf$$

$$\frac{Z_{f,3}}{B} = \frac{40.5}{70} = 0.58.\ Using\ Figure\ 7.2{:}\frac{\Delta\sigma_v'}{q} = 0.5. It\ follows{:}\Delta\sigma_{v,2}' = (0.5)(2283psf) = 1142psf$$

Total Consolidation Settlement δ_c, is expressed as the sum of consolidation settlements of each layer $\delta_{c,i}$:

$$\delta_{c,i} = \frac{C_{r,i}}{1+e_{0,i}} H_i log\left(\frac{\sigma_{v0,i}^{'} + \Delta\sigma_{v,i}^{'}}{\sigma_{v0,i}^{'}}\right)$$

$$\delta_1 = \frac{C_{r,1}}{1+e_{0,1}} H_1 log\left(\frac{\sigma_{v0,1}^{'} + \Delta\sigma_{v,1}^{'}}{\sigma_{v0,1}^{'}}\right) = \frac{0.009}{1+0.6}(6ft)\log\left(\frac{345psf + 2260psf}{345psf}\right) = 0.03ft$$

$$\delta_2 = \frac{C_{r,2}}{1+e_{0,2}} H_2 log\left(\frac{\sigma_{v0,2}^{'} + \Delta\sigma_{v,2}^{'}}{\sigma_{v0,2}^{'}}\right) = \frac{0.009}{1+0.6}(23ft)\log\left(\frac{1955psf + 2055psf}{1955psf}\right) = 0.04ft$$

$$\delta_3 = \frac{C_{r,3}}{1+e_{0,3}} H_3 log\left(\frac{\sigma_{v0,3}^{'} + \Delta\sigma_{v,3}^{'}}{\sigma_{v0,3}^{'}}\right) = \frac{0.009}{1+0.6}(23ft)\log\left(\frac{4485psf + 1142psf}{4485psf}\right) = 0.01ft$$

$$\delta_c = (0.03ft + 0.04ft + 0.01ft) = 0.08ft = 0.99in.$$

The parameters used for each step of the consolidation settlement calculation are summarized below:

Layer	Depth Range (ft)	Height of Layer i Hi (ft)	Depth of Mid-Layer (ft)	Depth below Footing Zf (ft)	Effective Stress at Layer Mid-Depth Before Surcharge σ_{v0}' (psf)	Change in Effective Stress at Depth from Surcharge $\Delta\sigma_v'$ (psf)	e_0	C_r	Settlement (ft.)
1	0-6	6	3	3	345	2260	0.6	0.009	0.03
2	6-29	23	17.5	17.5	1955	2055	0.6	0.009	0.04
3	29-52	23	40.5	40.5	4485	1142	0.6	0.009	0.01

$$\therefore Total\ Settlement = 0.08ft = 0.99in$$

SUMMARY:

Based on the bearing capacity analysis, the chosen tank parameters bearing capacity is acceptable. For the minimum acceptable bearing capacity, there is an expected amount of 0.08 feet of settlement. Note, some very conservative assumptions were made including the tanks will be filled to the absolute top of the tank for the entire lifespan of the tanks. Furthermore, the lifespan of the tanks will likely be shorter than the duration to reach full settlement, which could be several years.

ATTACHMENTS:

1. Reference 1: Principles of Foundation Engineering (Das, 1999)
2. Reference 2: Foundation Design Principles and Practices (Coduto, 1994)
3. Reference 3: SPT vs QU for Cohesive Soil (Bowles, 1977).
4. Boring Logs and Laboratory Testing

Attachment 1:

Reference 1: Principles of Foundation Engineering (Das, 1999, 2011)

For estimating the ultimate bearing capacity of *square* or *circular foundations*, Eq. (3.1) may be modified to

$$\boxed{q_u = 1.3cN_c + qN_q + 0.4\gamma BN_\gamma \qquad \text{(square foundation)}} \tag{3.7}$$

and

$$\boxed{q_u = 1.3cN_c + qN_q + 0.3\gamma BN_\gamma \qquad \text{(circular foundation)}} \tag{3.8}$$

In Eq. (3.7), B equals the dimension of each side of the foundation; in Eq. (3.8), B equals the diameter of the foundation.

For foundations that exhibit the local shear failure mode in soils, Terzaghi suggested modifications to Eqs. (3.3), (3.7), and (3.8) as follows:

$$q_u = \frac{2}{3}cN'_c + qN'_q + \tfrac{1}{2}\gamma BN'_\gamma \qquad \text{(strip foundation)} \tag{3.9}$$

$$q_u = 0.867cN'_c + qN'_q + 0.4\gamma BN'_\gamma \qquad \text{(square foundation)} \tag{3.10}$$

$$q_u = 0.867cN'_c + qN'_q + 0.3\gamma BN'_\gamma \qquad \text{(circular foundation)} \tag{3.11}$$

N'_c, N'_q, and N'_γ are the *modified bearing capacity factors*. They can be calculated by using the bearing capacity factor equations (for N_c, N_q, and N_γ) by replacing ϕ by $\phi' = \tan^{-1}(\frac{2}{3}\tan\phi)$. The variation of N'_c, N'_q, and N'_γ with the soil friction angle, ϕ, is given in Table 3.2.

Terzaghi's bearing capacity equations have now been modified to take into account the effects of the foundation shape (B/L), depth of embedment (D_f), and the load inclination. This is given in Section 3.7. Many design engineers, however, still use Terzaghi's equation, which provides fairly good results considering the uncertainty of the soil conditions at various sites.

MODIFICATION OF BEARING CAPACITY EQUATIONS FOR WATER TABLE

Equations (3.3) and (3.7) to (3.11) have been developed for determining the ultimate bearing capacity based on the assumption that the water table is located well below the foundation. However, if the water table is close to the foundation, some modifications of the bearing capacity equations will be necessary, depending on the location of the water table (see Figure 3.6).

Case I

▼ **TABLE 3.1** Terzaghi's Bearing Capacity Factors — Eqs. (3.4), (3.5), and (3.6)

ϕ	N_c	N_q	N_γ[a]	ϕ	N_c	N_q	N_γ[a]
0	5.70	1.00	0.00	26	27.09	14.21	9.84
1	6.00	1.1	0.01	27	29.24	15.90	11.60
2	6.30	1.22	0.04	28	31.61	17.81	13.70
3	6.62	1.35	0.06	29	34.24	19.98	16.18
4	6.97	1.49	0.10	30	37.16	22.46	19.13
5	7.34	1.64	0.14	31	40.41	25.28	22.65
6	7.73	1.81	0.20	32	44.04	28.52	26.87
7	8.15	2.00	0.27	33	48.09	32.23	31.94
8	8.60	2.21	0.35	34	52.64	36.50	38.04
9	9.09	2.44	0.44	35	57.75	41.44	45.41
10	9.61	2.69	0.56	36	63.53	47.16	54.36
11	10.16	2.98	0.69	37	70.01	53.80	65.27
12	10.76	3.29	0.85	38	77.50	61.55	78.61
13	11.41	3.63	1.04	39	85.97	70.61	95.03
14	12.11	4.02	1.26	40	95.66	81.27	115.31
15	12.86	4.45	1.52	41	106.81	93.85	140.51
16	13.68	4.92	1.82	42	119.67	108.75	171.99
17	14.60	5.45	2.18	43	134.58	126.50	211.56
18	15.12	6.04	2.59	44	151.95	147.74	261.60
19	16.56	6.70	3.07	45	172.28	173.28	325.34
20	17.69	7.44	3.64	46	196.22	204.19	407.11
21	18.92	8.26	4.31	47	224.55	241.80	512.84
22	20.27	9.19	5.09	48	258.28	287.85	650.67
23	21.75	10.23	6.00	49	298.71	344.63	831.99
24	23.36	11.40	7.08	50	347.50	415.14	1072.80
25	25.13	12.72	8.34				

[a] From Kumbhojkar (1993)

where

S_c = primary consolidation settlement
Δe = total change of void ratio caused by the additional load application
e_o = void ratio of the clay before the application of load

For normally consolidated clay (that is, $\sigma'_o = \sigma'_c$)

$$\Delta e = C_c \log \frac{\sigma'_o + \Delta\sigma'}{\sigma'_o} \tag{1.60}$$

where

σ'_o = average effective vertical stress on the clay layer
$\Delta\sigma'$ = $\Delta\sigma$ (that is, added pressure)

Now, combining Eqs. (1.59) and (1.60) yields

$$S_c = \frac{C_c H_c}{1 + e_o} \log \frac{\sigma'_o + \Delta\sigma'}{\sigma'_o} \tag{1.61}$$

For overconsolidated clay with $\sigma'_o + \Delta\sigma' \leq \sigma'_c$,

$$\Delta e = C_s \log \frac{\sigma'_o + \Delta\sigma'}{\sigma'_o} \tag{1.62}$$

Combining Eqs. (1.59) and (1.62) gives

$$S_c = \frac{C_s H_c}{1 + e_o} \log \frac{\sigma'_o + \Delta\sigma'}{\sigma'_o} \tag{1.63}$$

For overconsolidated clay, if $\sigma'_o < \sigma'_c < \sigma'_o + \Delta\sigma'$, then

$$\Delta e = \Delta e_1 + \Delta e_2 = C_s \log \frac{\sigma'_c}{\sigma'_o} + C_c \log \frac{\sigma'_o + \Delta\sigma'}{\sigma'_c} \tag{1.64}$$

Now, combining Eqs. (1.59) and (1.64) yields

$$S_c = \frac{C_s H_c}{1 + e_o} \log \frac{\sigma'_c}{\sigma'_o} + \frac{C_c H_c}{1 + e_o} \log \frac{\sigma'_o + \Delta\sigma'}{\sigma'_c} \tag{1.65}$$

1.15 Time Rate of Consolidation

In Section 1.13 (see Figure 1.14), we showed that consolidation is the result of the gradual dissipation of the excess pore water pressure from a clay layer. The dissipation of pore water pressure, in turn, increases the effective stress, which induces settlement. Hence, to estimate the degree of consolidation of a clay layer at some time *t* after the load is applied, you need to know the rate of dissipation of the excess pore water pressure.

Compression Index

The *compression index,* C_c, is the slope of the straight-line portion (the latter part) of the loading curve, or

$$C_c = \frac{e_1 - e_2}{\log \sigma'_2 - \log \sigma'_1} = \frac{e_1 - e_2}{\log\left(\dfrac{\sigma'_2}{\sigma'_1}\right)} \tag{1.49}$$

where e_1 and e_2 are the void ratios at the end of consolidation under effective stresses σ'_1 and σ'_2, respectively.

The *compression index,* as determined from the laboratory e–log σ' curve, will be somewhat different from that encountered in the field. The primary reason is that the soil remolds itself to some degree during the field exploration. The nature of variation of the e–log σ' curve in the field for a normally consolidated clay is shown in Figure 1.16. The curve, generally referred to as the *virgin compression curve,* approximately intersects the laboratory curve at a void ratio of $0.42e_o$ (Terzaghi and Peck, 1967). Note that e_o is the void ratio of the clay in the field. Knowing the values of e_o and σ'_c, you can easily construct the virgin curve and calculate its compression index by using Eq. (1.49).

The value of C_c can vary widely, depending on the soil. Skempton (1944) gave an empirical correlation for the compression index in which

$$C_c = 0.009(\mathrm{LL} - 10) \tag{1.50}$$

where LL = liquid limit .

Besides Skempton, several other investigators also have proposed correlations for the compression index. Some of those are given here:

Rendon-Herrero (1983):

$$C_c = 0.141 G_s^{1.2}\left(\frac{1 + e_o}{G_s}\right)^{2.38} \tag{1.51}$$

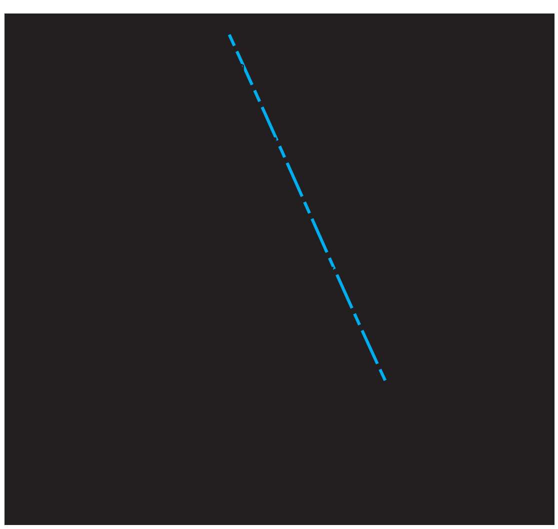
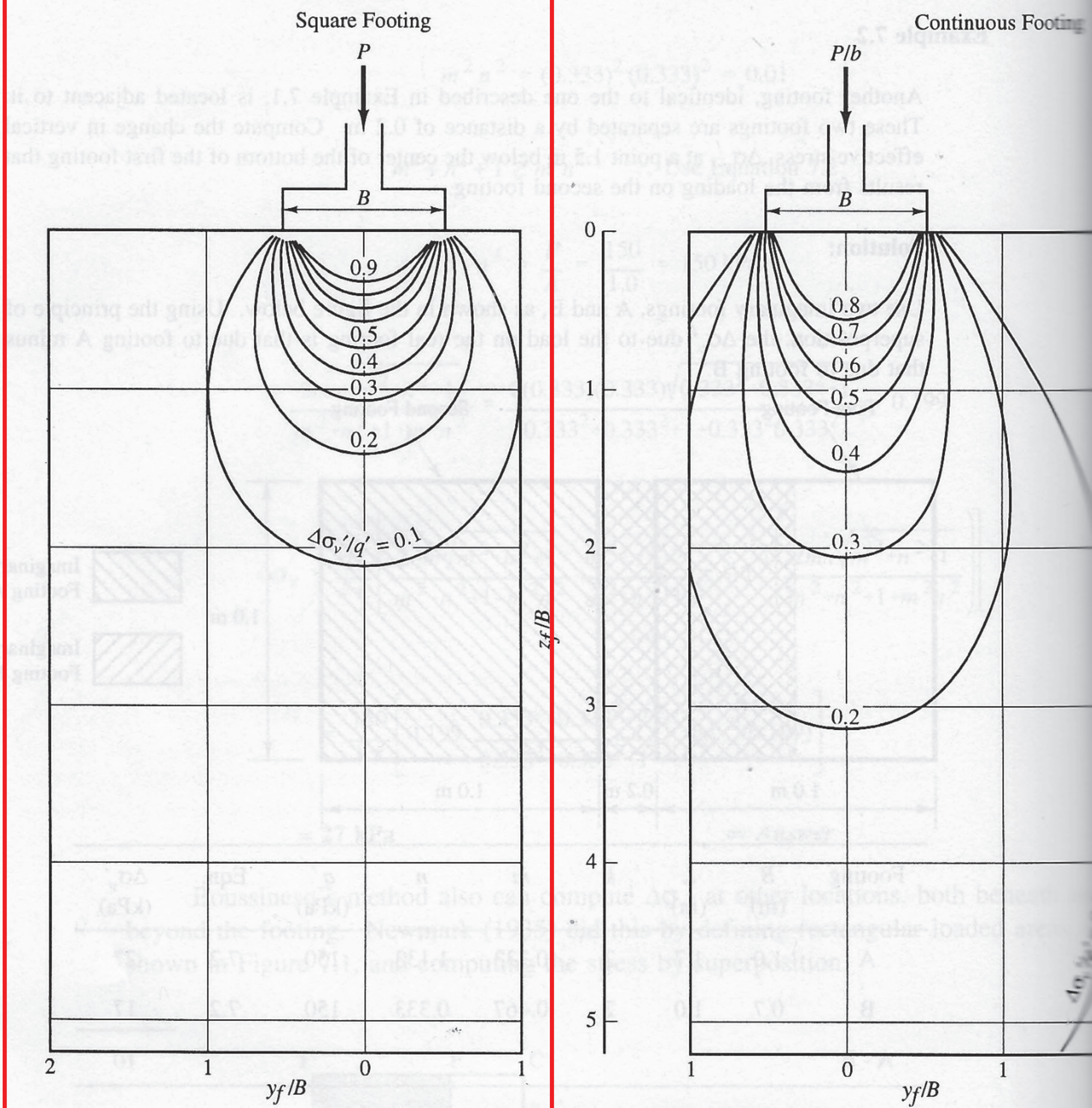


Figure 1.16 Construction of virgin compression curve for normally consolidated clay

Attachment 2:

Reference 2: Foundation Design Principles and Practices (Coduto, 1994)



y_f = horizontal distance from Center line of footing
z_f = depth below bottom of footing
$\Delta\sigma_v'$ = change in vertical effective stress
q' = net bearing pressure

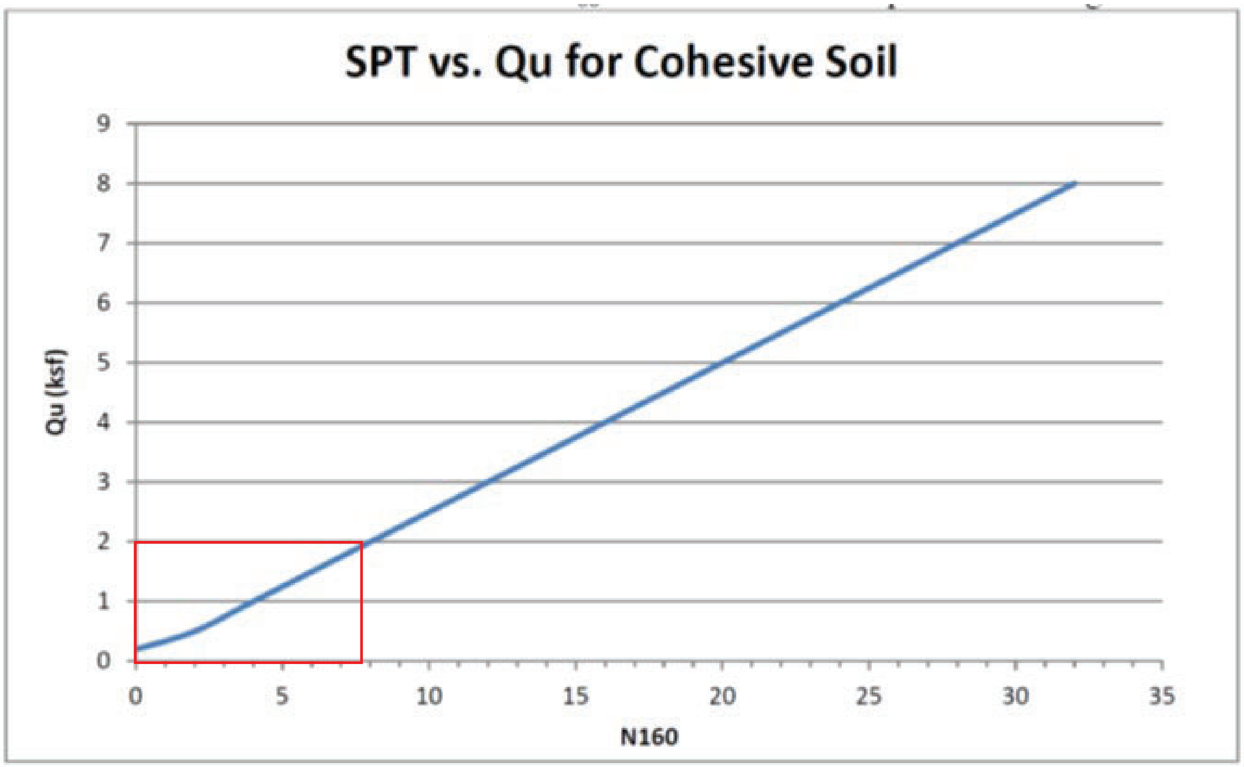
Figure 7.2 Pressure bulbs based on Newmark's solution of Boussinesq's method for square and continuous footings.

stress distribution. Some believe Westergaard's (1938) solution is a more accurate solution. He specifically had soil in mind (Boussinesq's method was a general solution for all materials) and considered it to be a soft elastic material reinforced by closely spaced horizontal flexible but unstretchable sheets. The combined thickness of these

Attachment 3:

Reference 3: Foundation Analysis and Design (Bowles, 1977)

Correlation of SPT $N1_{60}$ to Unconfined Compressive Strength
(after Bowles, 1977)



Attachment 4:

Boring Logs and Laboratory Testing


SPT-6
SPT-5
SPT-4
2023.06.14_m4
Easting (X): 2514581.90
Northing (Y): 432195.50
Elevation (DSM): 1023.77 ft
Zoom to
Pin
Delete
10 m

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: SPT-4 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 3

Site Location: East Palestine Drilling Started 6/13/2023 Drilling Completed 6/13/2023

Total Depth Drilled: 75 feet Hole Diameter: 6"/8" Type of Sample/ Coring Device: Split Spoon/Sonic Core

Length and Diameter of Coring Device: 2' Split Spoon/5' Sonic Core Sampling Interval: 2'

Land-Surface Elev.: 1023.77 feet ☐ Surveyed ☐ Estimated Datum:

Drilling Fluid Used: Water Drilling Method:

Drilling Contractor: Terra Testing Driller: Matt S. Helper: James M.

Prepared By: G. Ferguson Hammer Weight

Sample/Core Depth		Core Recovery	Blows per 6 inches	Hand Penetrometer	Description
From	To	(in.)		(tsf)	
0.0	2.0	6	6-6-6-9	-	6' dk brown clayey sand w/ some silt. Corse 2" cobble angular. Moist. (FILL)
2.0	4.0	8	6-3-3-3	-	8" SAA w/ coal fill (2"), large 1-2" cobble. (FILL)
4.0	6.0	22	1-3-2-2	2.25, 2.75, 1.75, 0.75	20" brown sandy clay. Moist. Low plastic. Soft. Gray mottles. 2" reddish brown sandy clay. ^ clay with depth. GF soft. Gray mottles. PL=14, LL=22, PI=8, MC=18.36%
6.0	8.0	24	4-4-5-9	2.0, 2.5, 4.5+	4" cave in SAA brown sandy, silt. 10" gray lean clay w/ small pebbles and brown mottles. Med-stiff to stiff. (Glacial Till) 10" brown lean clay w/ gray mottles which dissapates w/ depth. sl-moist w/small sandy lenses. (Glacial). PL=18, LL=30, PI=12, MC=20.82%
8.0					
10.0	12.0	24	3-3-3-4	1.5, 1.75, 2.0	2" coal fill cave in. 22" gray lean clay, low plastic. Gray w/ no brown mottling. Some small rounded, angular. Dry. Med-stiff.
12.0					
14.0					

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Boring Log (Cont.d)

Boring SPT-4

Prepared by G. Ferguson

Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Blows per 6 inches	Hand Penetrometer (tsf)	Description
15.0	17.0	16	3-4-3-5	4.5+, 2.5, 2.75	2" cave sandy silt w/ coal fill. 14" SAA gray silty clay. Increase pebbles w/ depth. SL moist in V. then sandy (VF) lenses. Low plastic-med plastic.
16.0					15'-16' organic lenses / seams (1")
18.0					19' organic layer/seam.
20.0	22.0	19	3-3-5-5	2.5, 4.5+, 3.5	3" cave. 2" SAA glacial till. 1" MF sand loose, wet. Some crs sand. 13" glacial till SAA ^ pebbles + sand w/ depth.
24.0					22.5' Sandy seam, wet (1") 22'-24' thing sand lenses (1") 24.5' Gravel Layer (4") wet.
25.0	27.0	22	5-5-7-7	3.0, 4.5, 4.5, 4.0	2" weathered "blue" stone (sand). 22" gray clay w/ silt and pebbles. Some ^ gravel and sand at thin seams. Stiff. Dry interior. Wet exterior from gravel/sand lenses above. Low plastic.
26.0					
28.0					29' sand seam (<1")
30.0	32.0	22	2-5-5-4	3.0 --> 4.5+	16" cave fine to MF sand, trace silt. Coarsens w/ depth. 6" SAA glacial till w/ rounded pebbles.
32.0					32'-33' Gravel /w sand
34.0					
35.0	37.0	15	10-28-29-32	3.5, 3.5, 4.0	2" cave MF-F. Sand wet. 13" gray w/ brown + yellow sands. Angular + rounded pebbles. Some silts.
36.0					
38.0					38' back into glacial till. Dry, gray and brown.
40.0	42.0	5	3-5-8-10	3.5, 4.5	5" gray clay w/ silt, sand and gravel --> Glacial till w/ rounded pebbles. Low plastic, lean clay. Moist.

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Boring Log (Cont.d)

Boring SPT-4

Prepared by G. Ferguson

Sample/Core Depth		Core Recovery	Blows per 6 inches	Hand Penetrometer	
From	To	(in.)		(tsf)	Description
42.0					
44.0					
45.0	47.0	26	4-9-12-48	1.5, 3.5, 4, 4.5	11" cave. Lean clay - gray. 5" gray-brown lean clay w/ rounded pebbles and minor sand, stiff, moist.
48.0					49' Large cobbles
50.0	52.0	15	6-13-25-25	4.5+, 2.5, 3.5, 1	4" SAA sand increases w/ depth. 11" brown to gray sandy gravel w/ trace silt and clay. Rounded pebbles. Poorly graded sands-coarse. Wet.
52.0					
54.0					
55.0	57.0	19	17-16-17-14		5" cave sandy grave w/ rounded pebbles. 14" brown to gray to blakc silty sand w/ gravel. Pebbles increase w/ depth.
56.0					
58.0					
60.0	62.0	15	16-14-17-24	1, 4.5, 3.5, 1	6" gray brown sandy gravel w/ silt and trace clay. 11" gray silty clay w/ trace sand. Stiff, wet. 58'-60' SAA ^ fine sands w/ depth.
62.0					63' sand lense, wet (1")
64.0					64' 6" sandy lense.
65.0	67.0	15	2-3-4-7		7" Well graded sands and gravelly sands w/ little or no fines to silty sands and poorly graded sand-silt w/ round pebbles. Sand is medium grained, portly sorted. 8" SAA. Brown. Wet. PL=NP, LL=NP, PI=NP, MC=11.42%
66.0					
68.0					
70.0	72.0	11	18-18-17-16	1.5, 1, 2.5	11" Well graded sands and gravelly sands w/ little or no fines to silty sands and poorly graded sand-silt w/ silt. Brown-gray. Silt ^ depth. Med to course sand, poorly sorted. PL=NP, LL=NP, PI=NP, MC=8.54%
72.0					
74.0					
75.0					**End of Boring - 75'**

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: SPT-5 | Project/No: East Palestine Emergency Response - 30169714 | Page 1 of 3

Site Location: East Palestine | Drilling Started: 6/12/2023 | Drilling Completed: 6/12/2023

Total Depth Drilled: 50 feet | Hole Diameter: | Type of Sample/ Coring Device: Split Spoon/Sonic Core

Length and Diameter of Coring Device: 2' / 5' | Sampling Interval: 5 feet

Land-Surface Elev.: 1024.39 feet | [X] Surveyed | [ ] Estimated | Datum:

Drilling Fluid Used: Water | Drilling Method:

Drilling Contractor: Terra Testing | Driller: Matt S | Helper: James M

Prepared By: G. Ferguson | Hammer Weight

Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Blows per 6 inches	Hand Penetrometer (tsf)	Description
0.0	1.0				Asphalt + road base
1.0	2.0	12	11-11		12" back fill (coal), angular, loose, wet, trace clays.
2.0			1-8-10-9		6" Same as above black fill. 6" bluish gray clayey silt. Med-stiff. SL Plastic. Moist.
		12			
4.0			1-3-5-6	1.0 -->	12" Same as above bluish gray. 12" orange brown silty clay (glacial till 5' depth). Black angular granuels, some thin sand lenses. Wet at sand lenses. SL plastic.
		24		--> 4.5	
6.0			6-11-12-13		
		18		2 -->4.5	12" Same as above. 6" Same as above with increasring F-MF sand at depth. Wet. Non-plastic.

Boring Log (Cont.d)

Boring SPT-5

Prepared by G. Ferguson

Sample/Core Depth From	To	Core Recovery (in.)	Blows per 6 inches	Hand Penetrometer (tsf)	Description
8.0					
		18	11-10-10-11	1 --> 2.5	12" Cave in. Same as above with sand.
10.0					
12.0					12'-13' clayey gravel. 1/2"-1" gravel with coarse sand. 4" cobble. Wet.
14.0					
			1-5-6-7	2.5 --> 3.75 --> 1.5	
16.0					15'-17': PL=13, LL=20, PI=7, MC=10.84%. Silty sand to silty clay.
18.0					
20					6" cave in.
		20			10" gray stiff silty clay with small pebbles rounded/angular. Some fine silty sand and gravels.
22					2" gray, loose, coarse sand rounded with medium sand angular. Wet.

ARCADIS Design & Consultancy for natural and built assets

Boring Log (Cont.d)

Boring SPT-5

Prepared by G. Ferguson

Sample/Core Depth		Core Recovery	Blows per 6 inches	Hand Penetrometer	Description
From	To	(in.)		(tsf)	
					24' greenish yellow sand lense. Fine sand, dry.
24.0					
25.0	27.0	24	8-9-12-15	bottom 4.0-4.5+	18" Cave. Sands same as above. 6" gray stiff silty clay with small pebbles rounded/angular. Some fine sand + gravels. 26-27.5 coarse sands + gravels, no clays.
26.0					
28.0					
					Cased hole with 6" casings due to cave in. Ran H2O.
30.0					
30.0	32.0	19	4-5-8-12	2.5, 3.5, 4.5, 3.0	Same as above with less sand + pebbles. Thin sand lense at 31.5'. 32-32.5 coarse sand + gravel, some silt + clay.
32.0					
34					
35.0	37.0	22	4-6-9-11	3.5, 3.5, 4.5, 3.0	20" Same as above, silty clay. 2" fine sand loose, wet. PL=13, LL=19, PI=6, MC=12.88%.
36					
38					
40					
40.0	42.0	17	5-8-9-12	3.75 --> 3.0	17" gray lean clay with increasing pebbles with depth. Cobbles up to 3-4". PL=13, LL=21, PI=8, MC=12.22%.
42.0					
44.0					43' coarse sand + gravel, no clays.
45.0	47.0	16	20-12-12-12		Silty sand. 43' coarse + gravel, no clays. PL=NP, LL=NP, PI=NP, MC=10.15%.
50					**End of boring 55'.**

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: SPT-6 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 2

Site Location: East Palestine Drilling Started 6/9/2023 Drilling Completed 6/9/2023

Total Depth Drilled: 60 feet Hole Diameter: Case 8"/ Sample 4" Type of Sample/ Coring Device: Sonic - split spoons

Length and Diameter of Coring Device: 5 ft, 4 ft diameter Sampling Interval: 5 feet

Land-Surface Elev.: 1025.77 feet [X] Surveyed [ ] Estimated Datum:

Drilling Fluid Used: Water Drilling Method Sonic

Drilling Contractor: Terra Testing Driller: Matt S. Helper:

Prepared By: G. Ferguson Hammer Weight

Sample/Core Depth From	To	Core Recovery (in.)	Blows per 6 inches	Hand Penetrometer (tsf)	Description
0.0	2.0	48	Drilled to 2 ft.	1.0-4.0	Asphalt 3", crushed stone 4"., black gravel, angular, wet. Brown Clayey silt with some sand, angular gravel. Some black coal.
2.0	4.0	21	3-5-6-6	1.0-4.0	Brown clayey silt with some sand lenses. Angular sandstone cobbles. Black nodules throughout. SL Moist. Medium dense. Trace black coal.
4.0	6.0	12	5-4-3-4	0.75-3.75	Same as above. Soft as it deepends. 2" coal layers at top of recovery.
6.0	8.0	6	2-5-6-5	2.75-4.25	1" crushed LS out top. Sand clay with silt. Glacial till material. Brown with some gray nodules with small pebbles and gravel. Some MF-F sand lenses. SL moist. PL=14, LL=2-, PI=6, MC=11.64%.
8.0	10.0	15	7-7-9-7	0.75-4.5+	Same as above. Till material. Stiff at depth.
10.0	12.0	10	3-7-7-8	0.75-2.75	Same as above. Color changes to bluish gray/ gray till at 11'. Rounded pebbles. Moist at very fine sand lenses.
15.0	17.0	19	3-5-7-9	1.5-3.5	Same as above with rounded pebles up to 1/2". Some small pebbles angular. Brown mottles at depth. Fine sand lense at 16.5'. Moist.
20.0	22.0	21	2-4-6-9	2.0-4.5+	Silty clay. Increased sand + stiffness with depth. PL=13, LL=19, PI=6, MC=12.30%.

ARCADIS Design & Consultancy for natural and built assets

Boring Log (Cont.d)

Boring SPT-6

Prepared by G. Ferguson

Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Blows per 6 inches	Hand Penetrometer (tsf)	Description
25.0	27.0	14	3-4-5-9	4.5+	Wet, saturdated 2" angular gravel layer dark gray. Some fine sand + silt + clay. Silty clay, dry internally. Some 1: gravel cobble. PL=14, LL=20, PI=6, MC=12.27%.
30.0	32.0	24	6-10-19-13	2.5 at 32'	10" fine sand w/ some fine gravel. Cave in. 5" coarse angular gravel, loose-medium dense. Wet. No fines. 9" dark gray stiff lean clay. Wet in sand lenses. Till material.
35.0	37.0	10	6-7-15-15	2.5-3.5	Same as above fill with reddish brown mottles at depth. 1/2" rounded pebbles and angular coarse gravels throughout. Stiff.
					36' reddish brown mottles, dissipates at 36' depth.
40.0	42.0	15	4-6-10-12	3.5-4.5+	Lean clay. Same as above, no reddish brown. 1/4"-1" angular gravel and subangular gravel. Black nodules throughout. PL=13, LL=21, PI=8, MC=12.33%.
					No Sonic sample recorded.
45.0	47.0	16	8-9-9-12	4.5+	Same as above glacial till, angular gravel 1- pebbles.
50.0	52.0	14	2-6-9-11	3-4.5	
55	57	14	6-8-10-13	NA	
60					**End of Boring 60'.**

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www.jltlabs.com

June 19, 2023
23LS4053

ARCADIS
6041 Wallace Rd Ext
Suite 300
Wexford, PA 15090

Attn: Allen Long

RE: GEOTECHNICAL TEST RESULTS
NS - EAST PALESTINE (30169714 Task 01)

Submitted herein are the results of Moisture Content, Sieve, Atterberg Limits & Classification performed on bag samples, as requested, based on the attached COC forms, for the above referenced project. Where applicable, testing was performed per ASTM Standards while subject to JLT's internal QA / QC and data validation procedures.

We appreciate the opportunity of being of service to you and look forward to working with you again. Should you have any questions, comments or require additional information, please do not hesitate to call. Thank you.

Sincerely,

JLT LABORATORIES, INC.

Martha Lea Boschuk
Office Manager

cc: Accounts Payable
(One PDF include Invoice & Results)

Enclosures
mlb
MSWord\letter\2364
Inv# 8325

GEOTECHNICAL TEST REQUEST AND CHAIN OF CUSTODY

CLIENT: Arcadis U.S., Inc.
PROJECT: 30169714 Task 01 - Emergency Response
JOB NAME: NS - East Palestine

JLT JOB No.: 23LS4053
DATE ASSIGNED: 6-15-23

DATE RECEIVED: 6-15-23
DATE COMPLETED: 6-19-23
RECEIVED BY: AE

BORING & SAMPLE No.	DEPTH (feet)	CLASSIFICATION NOTES	PHYSICAL PROPERTIES								PERMEABILITY	SHELBY TUBES / CYLINDERS		Additional Requests		
			M/C ☐ D2216	SIEVE ☐ D422 ☐ D6913	HYDRO ☐ D422 ☐ D7928	ATTERBERG LIMITS ☐ D4318	SPEC GRAVTY ☐ D854	ORG CONT ☐ D2974	CLASS. ☐ D2487	pH ☐ 4972	PERMEABILITY ☐ D5084	UNCONF TEST ☐ D2166	CIU w/pp TEST ☐ D4767			
SPT-4	4-6'		✓	✓		✓			✓							
SPT-4	6-8'		✓	✓		✓			✓							
SPT-4	45-47'		✓	✓		✓			✓							
SPT-4	65-67'		✓	✓		✓ NP			✓							
SPT-4	70-72'		✓	✓		✓ NP			✓							
SPT-5	15-17"		✓	✓		✓			✓							
SPT-5	35-37'		✓	✓		✓			✓							

COMPLETE THIS SECTION AND INCLUDE WITH SHIPMENT OR EMAIL ATTACHMENT.

SHIPPER: Allen Long
ADDRESS:
CONTACT:
TEL: 724-466-3355 EMAIL: allen.long@arcadis.com

SHIP TO: JLT Laboratories Inc.
938 South Central Avenue
Canonsburg, PA 15317
Tel: (724) 746-4441
e-mail: mboschuk@jltlabs.com

NOTES / INSTRUCTIONS: NP = Non Plastic

JLT GEOTECHNICAL LABORATORY
soilcoc2023.wpd

GEOTECHNICAL TEST REQUEST AND CHAIN OF CUSTODY

CLIENT: Arcadis U.S., Inc.
PROJECT: 30169714 Task 01 - Emergency Response
JOB NAME: NS - East Palestine

JLT JOB No.: 2354053
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BORING & SAMPLE No.	DEPTH (feet)	CLASSIFICATION NOTES	PHYSICAL PROPERTIES								PERMEABILITY	SHELBY TUBES / CYLINDERS		Additional Requests		
			M/C ☐ D2216	SIEVE ☐ D422 ☐ D6913	HYDRO ☐ D422 ☐ D7928	ATTERBERG LIMITS ☐ D4318	SPEC GRAVTY ☐ D854	ORG CONT ☐ D2974	CLASS. ☐ D2487	pH ☐ 4972	PERMEABILITY ☐ D5084	UNCONF TEST ☐ D2166	CIU w/pp TEST ☐ D4767			
SPT-5	40-42'		✔	✔		✔			✔							
SPT-5	45-47'		✔	✔		✔ NP			✔							
SPT-6	6-8'		✔	✔		✔			✔							
SPT-6	20-22'		✔	✔		✔			✔							
SPT-6	25-27'		✔	✔		✔			✔							
SPT-6	40-42'		✔	✔		✔			✔							

COMPLETE THIS SECTION AND INCLUDE WITH SHIPMENT OR EMAIL ATTACHMENT.

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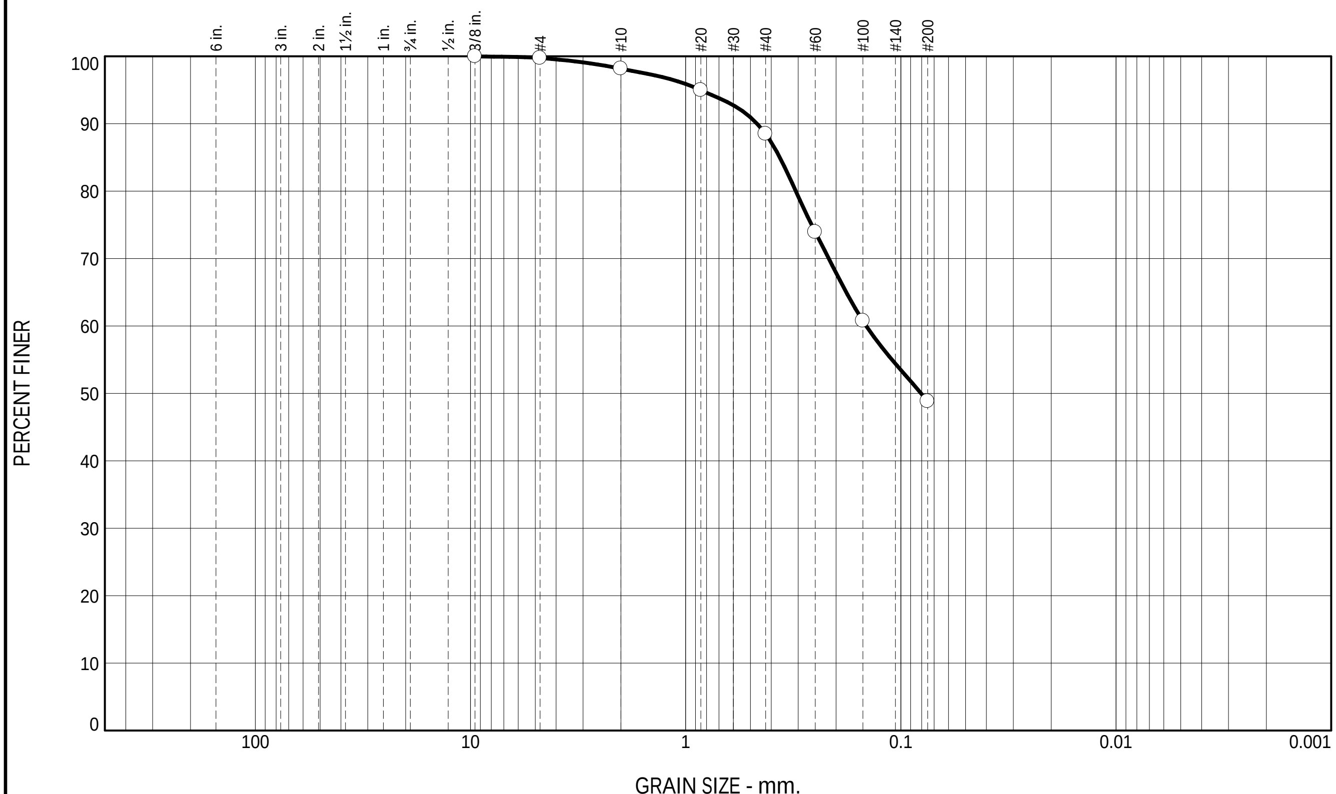
NOTES / INSTRUCTIONS: NP = Non Plastic

JLT GEOTECHNICAL LABORATORY
soilcoc2023.wpd

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	1.5	9.7	39.7	48.8	

Test Results (ASTM D422)				
Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.375	100.0			
#4	99.7			
#10	98.2			
#20	95.0			
#40	88.5			
#60	73.9			
#100	60.8			
#200	48.8			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 14 LL= 22 PI= 8

Coefficients

D_{90}= 0.4657 D_{85}= 0.3651 D_{60}= 0.1447
D_{50}= 0.0804 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Test Remarks

As-Rec'd M/C = 18.36%

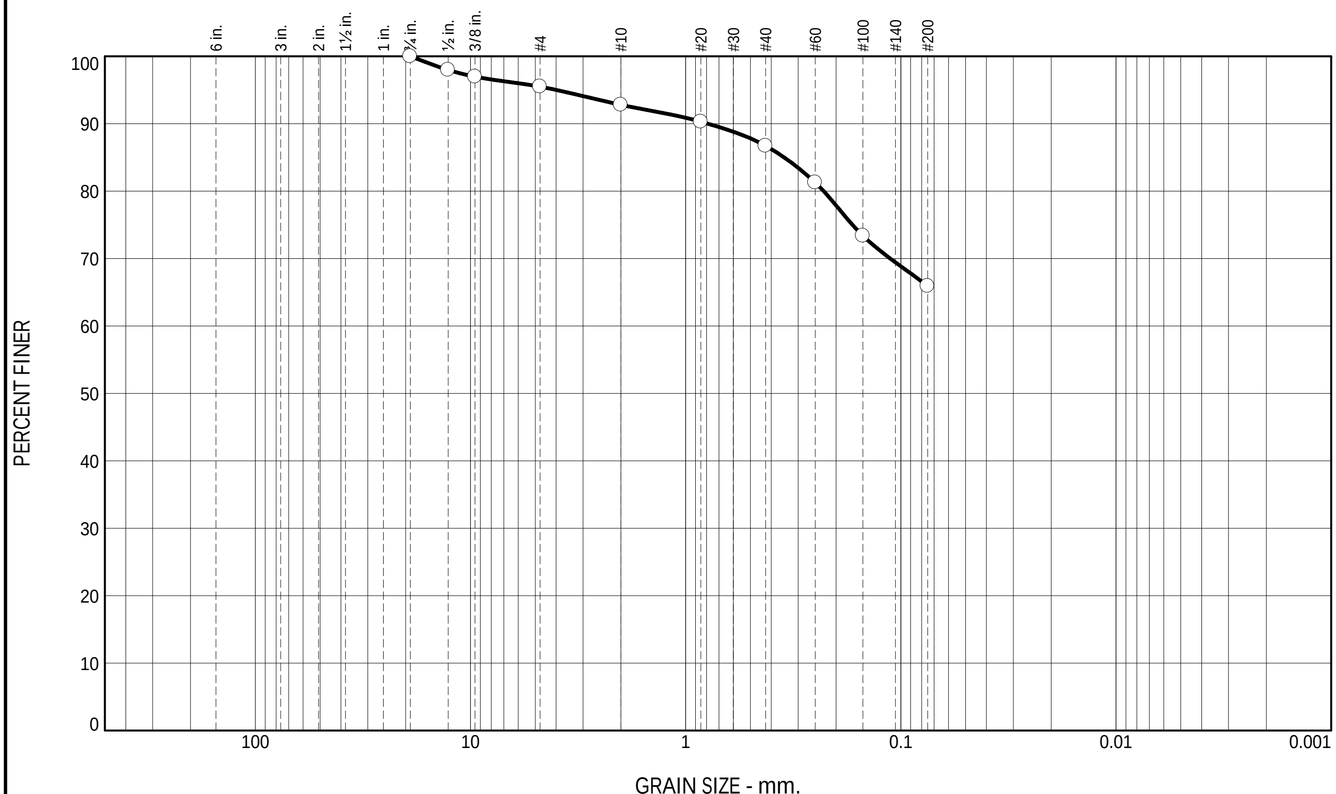
Location: East Palestine
Sample Number: SPT-4 Depth: 4-6' Sample Date:

JLT Laboratories, Inc. Canonsburg, PA	Client: ARCADIS Project: NS - East Palestine ARCADIS Project No: 30169714 Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.5	2.7	6.1	20.8	65.9	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.0			
0.375	97.0			
#4	95.5			
#10	92.8			
#20	90.3			
#40	86.7			
#60	81.3			
#100	73.4			
#200	65.9			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 18 LL= 30 PI= 12

Coefficients

D_{90}= 0.7888 D_{85}= 0.3483 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 20.82%

Location: East Palestine
Sample Number: SPT-4 Depth: 6-8' Sample Date:

JLT Laboratories, Inc.

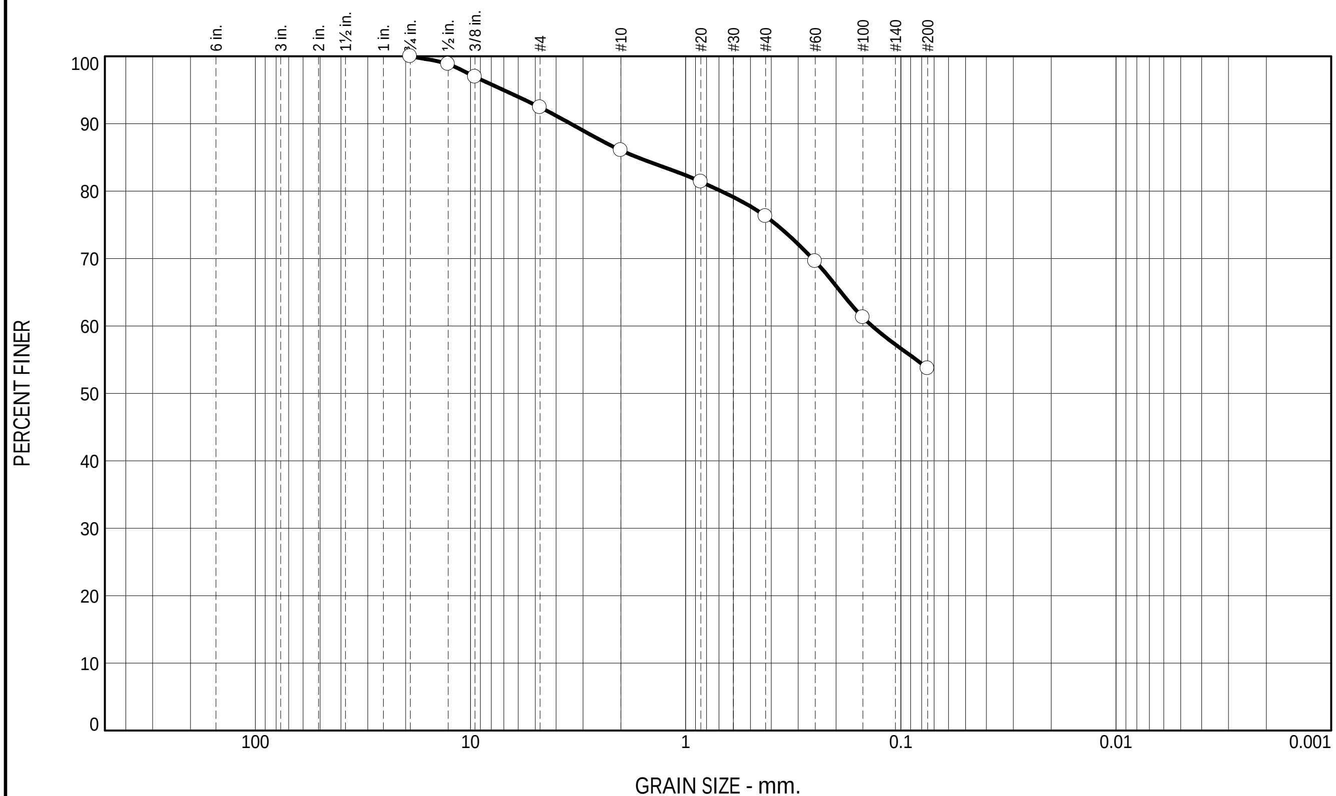
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.6	6.3	9.8	22.6	53.7	

Test Results (ASTM D422)				
Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.9			
0.375	97.0			
#4	92.4			
#10	86.1			
#20	81.4			
#40	76.3			
#60	69.6			
#100	61.3			
#200	53.7			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 12 LL= 21 PI= 9

Coefficients

D_{90}= 3.4196 D_{85}= 1.6678 D_{60}= 0.1358
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 12.68%

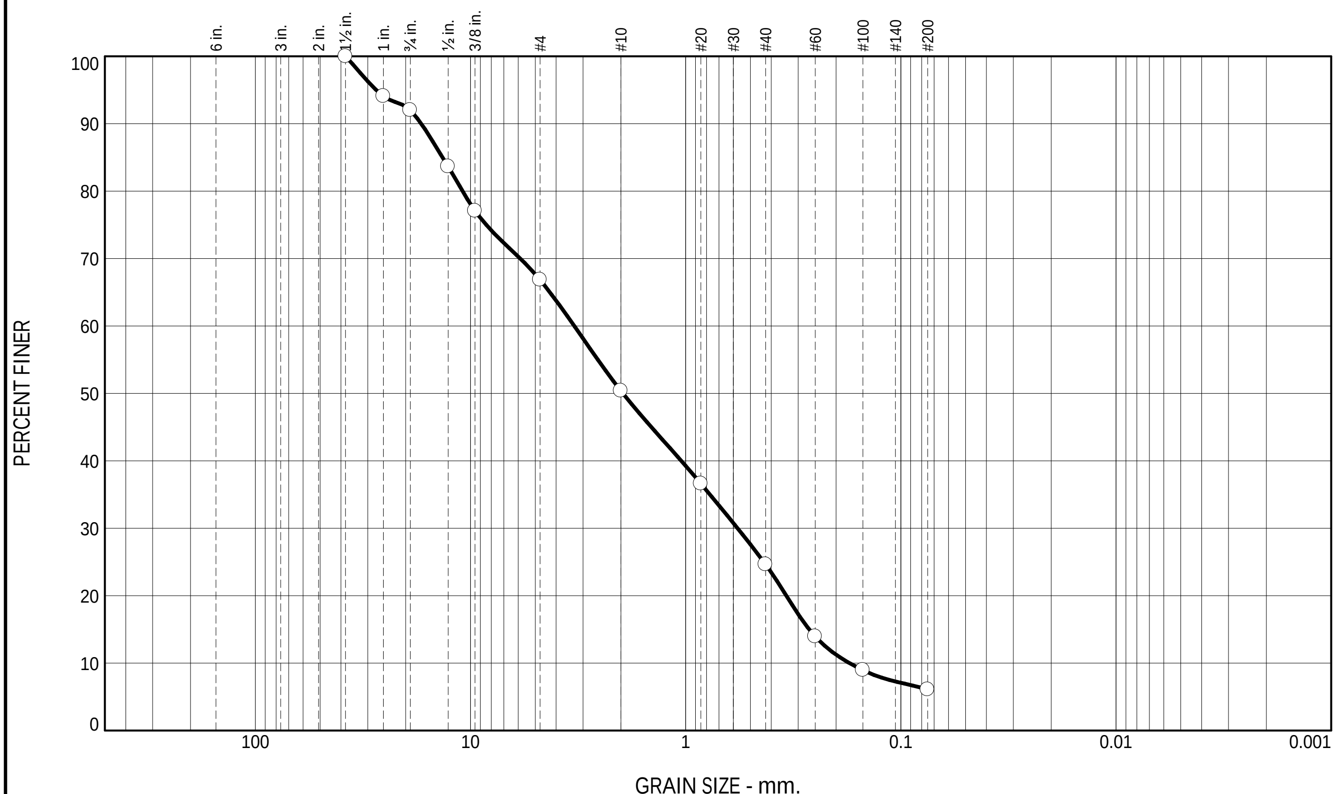
Location: East Palestine
Sample Number: SPT-4 Depth: 45-47' Sample Date:

JLT Laboratories, Inc. Canonsburg, PA	Client: ARCADIS Project: NS - East Palestine ARCADIS Project No: 30169714 Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.0	25.2	16.4	25.8	18.5	6.1	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.50	100.0			
1.00	94.1			
0.75	92.0			
0.50	83.7			
0.375	77.1			
#4	66.8			
#10	50.4			
#20	36.6			
#40	24.6			
#60	13.9			
#100	9.0			
#200	6.1			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 16.9236 D_{85}= 13.4921 D_{60}= 3.2919
D_{50}= 1.9563 D_{30}= 0.5736 D_{15}= 0.2668
D_{10}= 0.1731 C_u= 19.02 C_c= 0.58

Classification

USCS= SW-SM AASHTO=

Test Remarks

As-Rec'd M/C = 11.42%

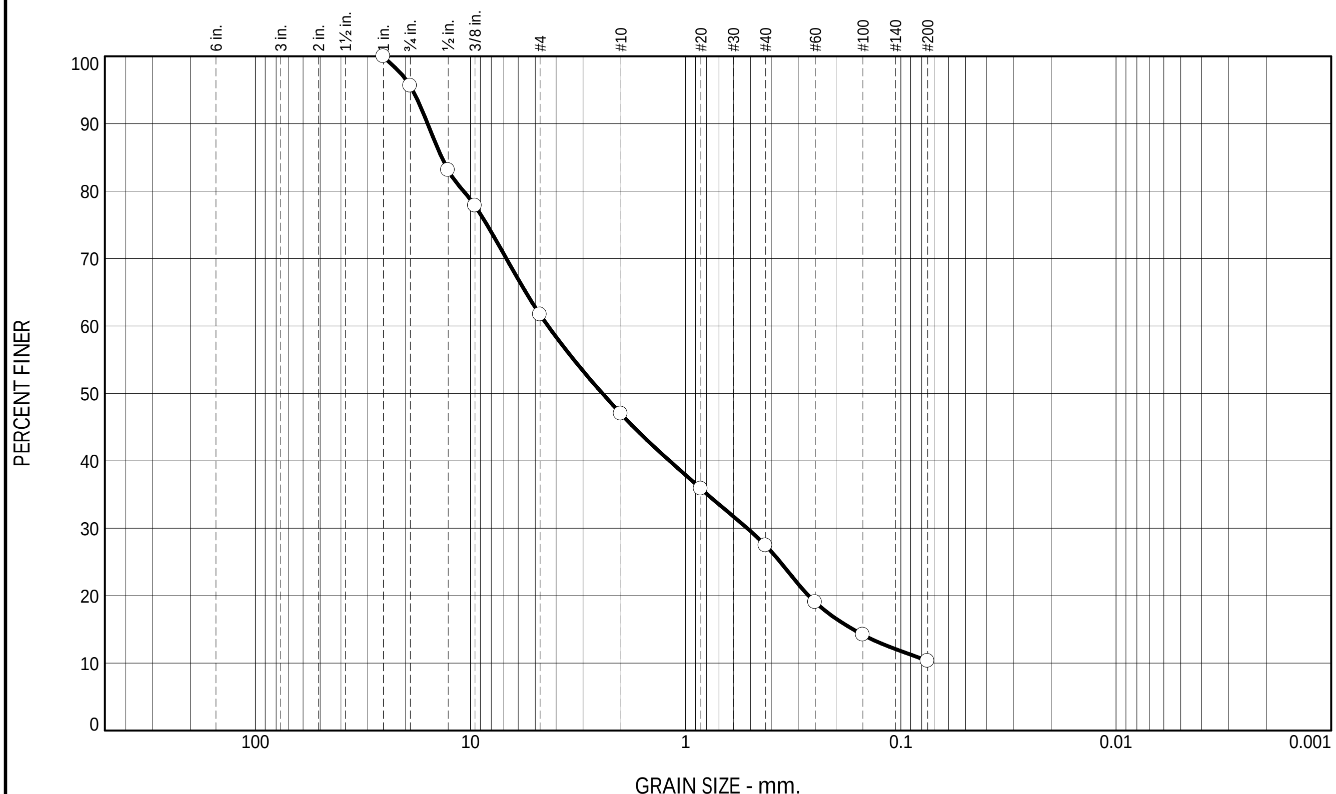
Location: East Palestine
Sample Number: SPT-4 Depth: 65-67' Sample Date:

JLT Laboratories, Inc. Canonsburg, PA	Client: ARCADIS Project: NS - East Palestine ARCADIS Project No: 30169714 Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	33.9	14.7	19.6	17.1	10.3	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	95.6			
0.50	83.1			
0.375	77.8			
#4	61.7			
#10	47.0			
#20	35.9			
#40	27.4			
#60	19.0			
#100	14.2			
#200	10.3			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 15.8063 D_{85}= 13.5962 D_{60}= 4.3570
D_{50}= 2.4360 D_{30}= 0.5174 D_{15}= 0.1664
D_{10}= C_u= C_c=

Classification

USCS= SW-SM AASHTO=

Test Remarks

As-Rec'd M/C = 8.54%

Location: East Palestine
Sample Number: SPT-4 Depth: 70-72' Sample Date:

JLT Laboratories, Inc.

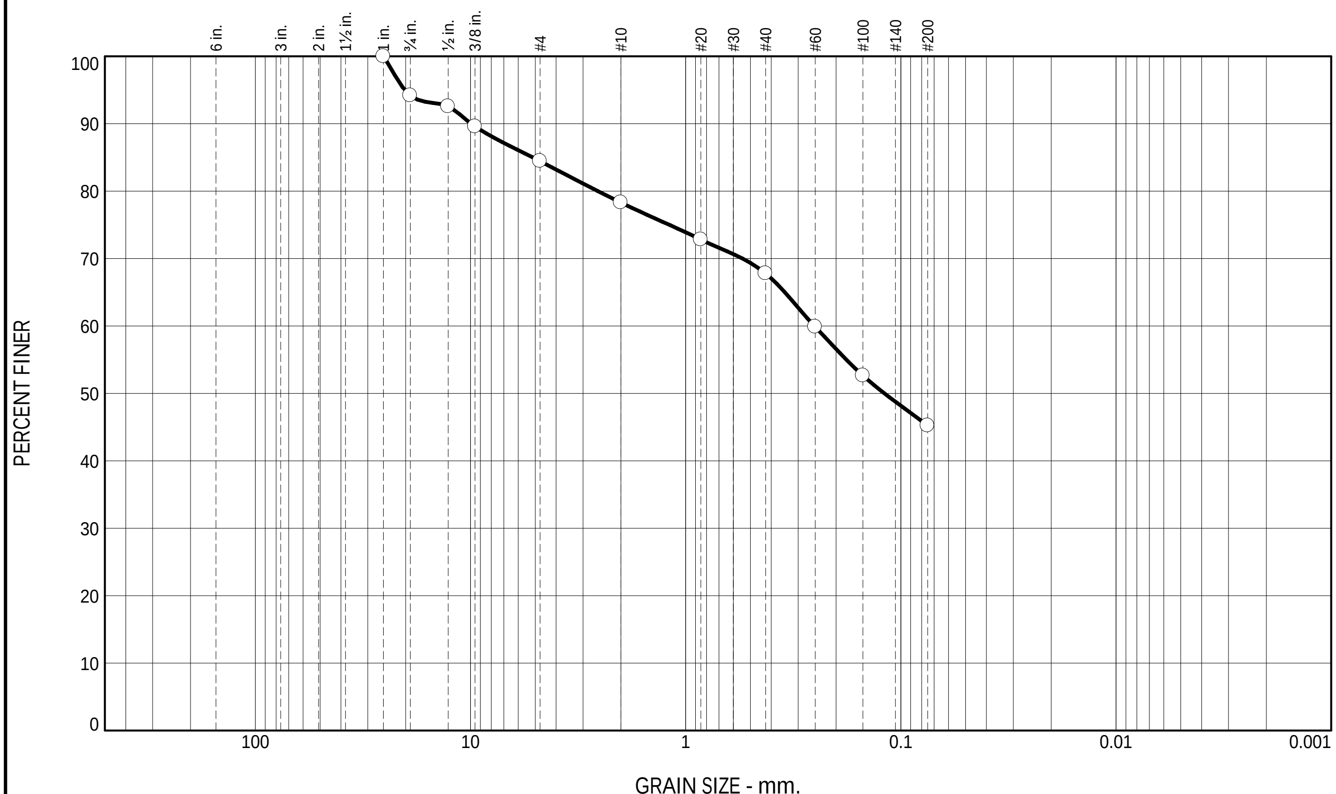
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.8	9.7	6.2	10.5	22.6	45.2	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	94.2			
0.50	92.6			
0.375	89.6			
#4	84.5			
#10	78.3			
#20	72.8			
#40	67.8			
#60	59.9			
#100	52.6			
#200	45.2			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 20 PI= 7

Coefficients

D_{90}= 9.9378 D_{85}= 5.1273 D_{60}= 0.2521
D_{50}= 0.1191 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM-SC AASHTO=

Test Remarks

As-Rec'd M/C = 10.84%

Location: East Palestine
Sample Number: SPT-5 Depth: 15-17' Sample Date:

JLT Laboratories, Inc.

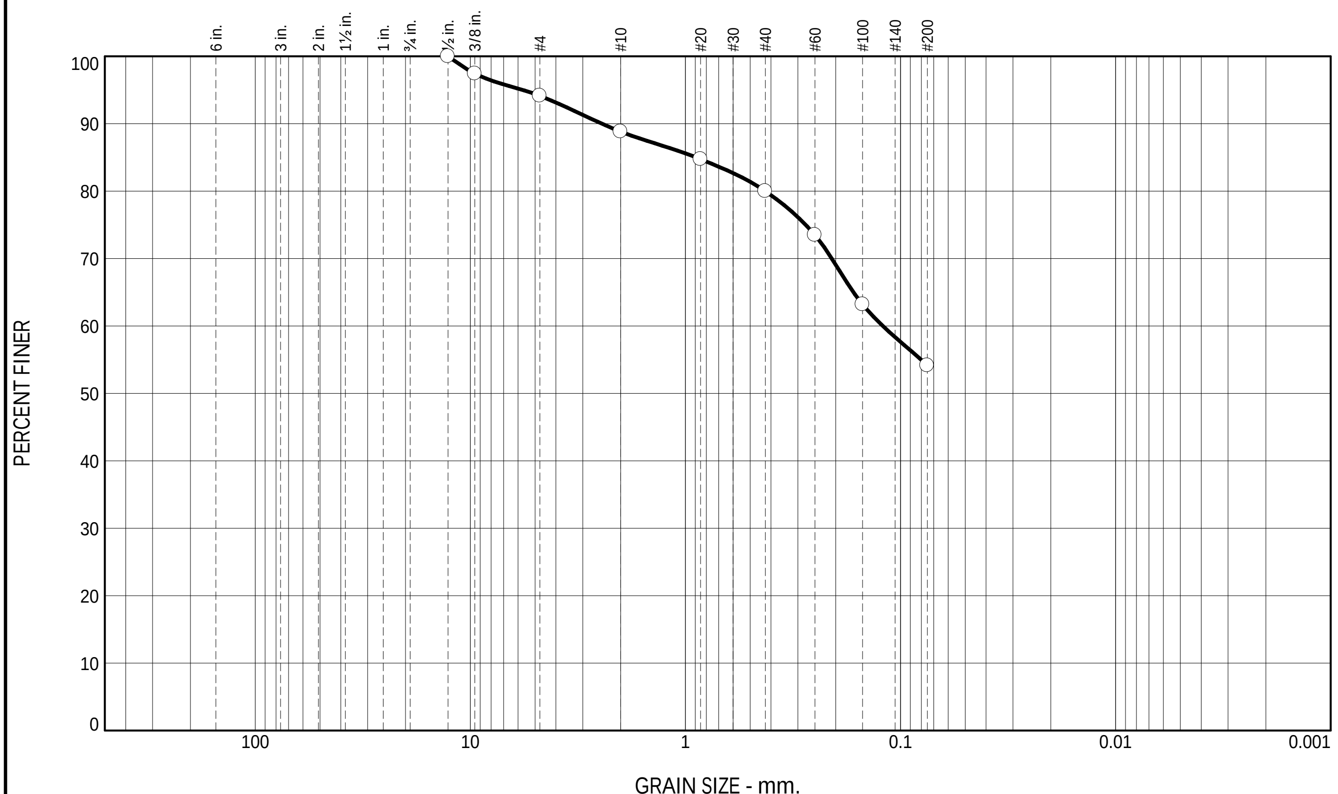
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.9	5.3	8.8	25.9	54.1	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.50	100.0			
0.375	97.4			
#4	94.1			
#10	88.8			
#20	84.7			
#40	80.0			
#60	73.5			
#100	63.2			
#200	54.1			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 19 PI= 6

Coefficients

D_{90}= 2.4392 D_{85}= 0.8889 D_{60}= 0.1208
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML-CL AASHTO=

Test Remarks

As-Rec'd M/C = 12.88%

Location: East Palestine
Sample Number: SPT-5 Depth: 35-37' Sample Date:

JLT Laboratories, Inc.

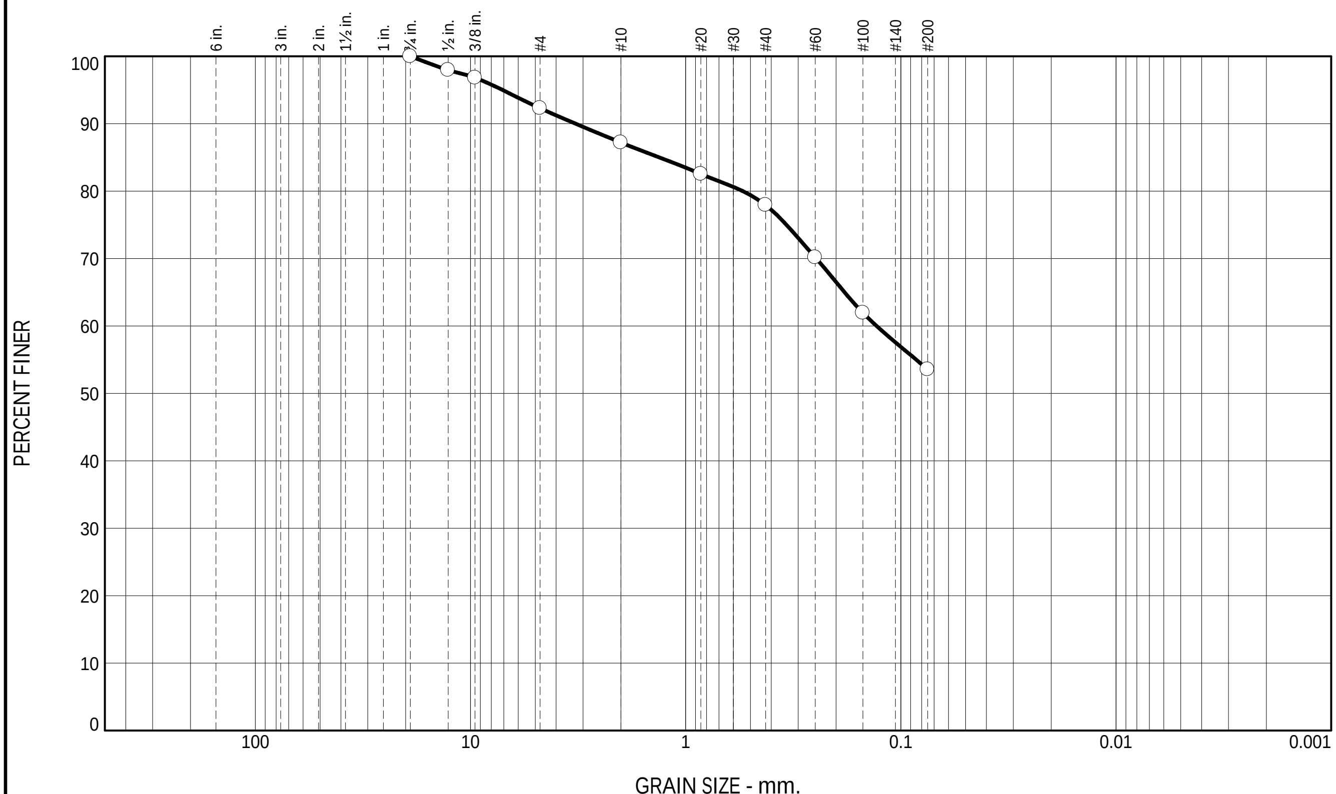
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.7	5.1	9.3	24.3	53.6	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.0			
0.375	96.8			
#4	92.3			
#10	87.2			
#20	82.5			
#40	77.9			
#60	70.2			
#100	62.0			
#200	53.6			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 21 PI= 8

Coefficients

D_{90}= 3.2409 D_{85}= 1.3221 D_{60}= 0.1296
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 12.22%

Location: East Palestine
Sample Number: SPT-5 Depth: 40-42' Sample Date:

JLT Laboratories, Inc.

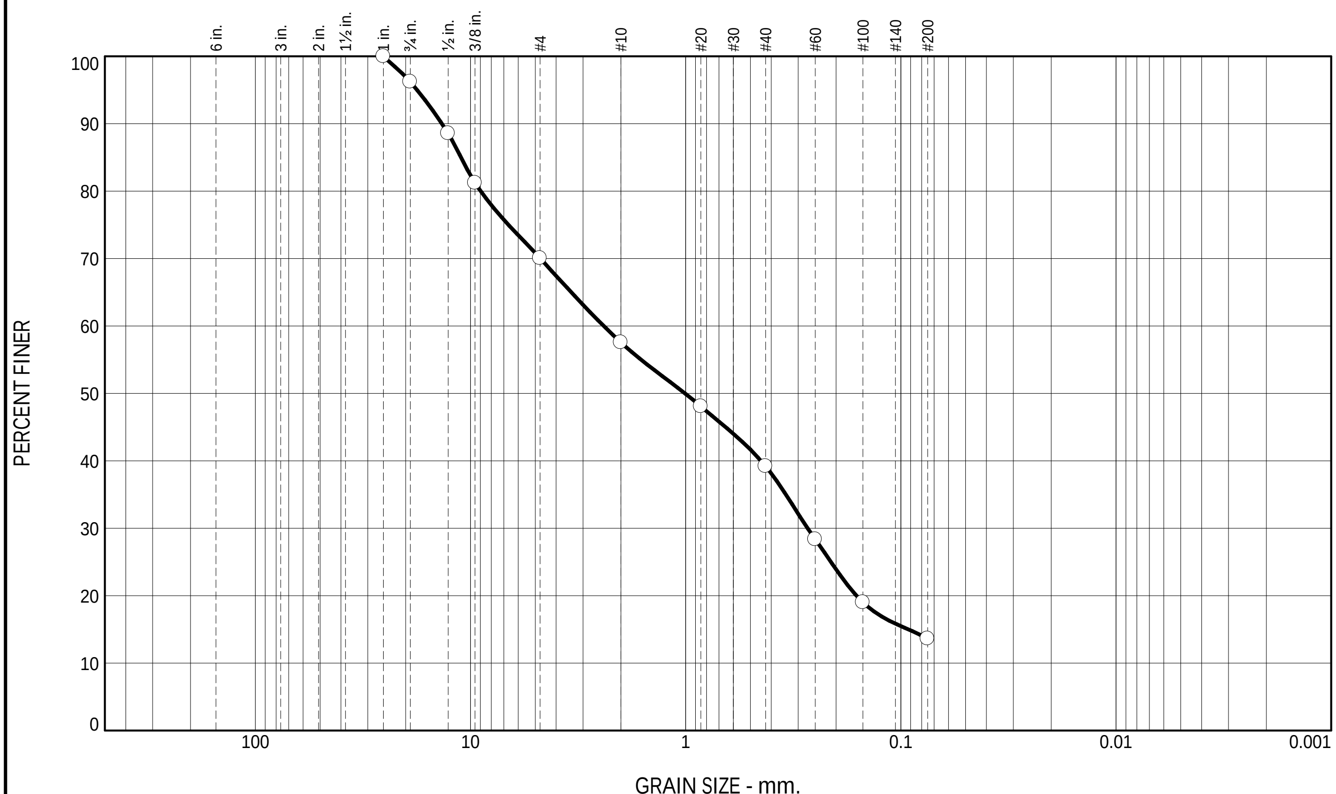
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.8	26.1	12.5	18.4	25.6	13.6	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	96.2			
0.50	88.6			
0.375	81.2			
#4	70.1			
#10	57.6			
#20	48.1			
#40	39.2			
#60	28.4			
#100	19.0			
#200	13.6			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 13.5705 D_{85}= 11.0603 D_{60}= 2.4028
D_{50}= 1.0070 D_{30}= 0.2712 D_{15}= 0.0922
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Test Remarks

As-Rec'd M/C = 10.15%

Location: East Palestine
Sample Number: SPT-5 Depth: 45-47' Sample Date:

JLT Laboratories, Inc.

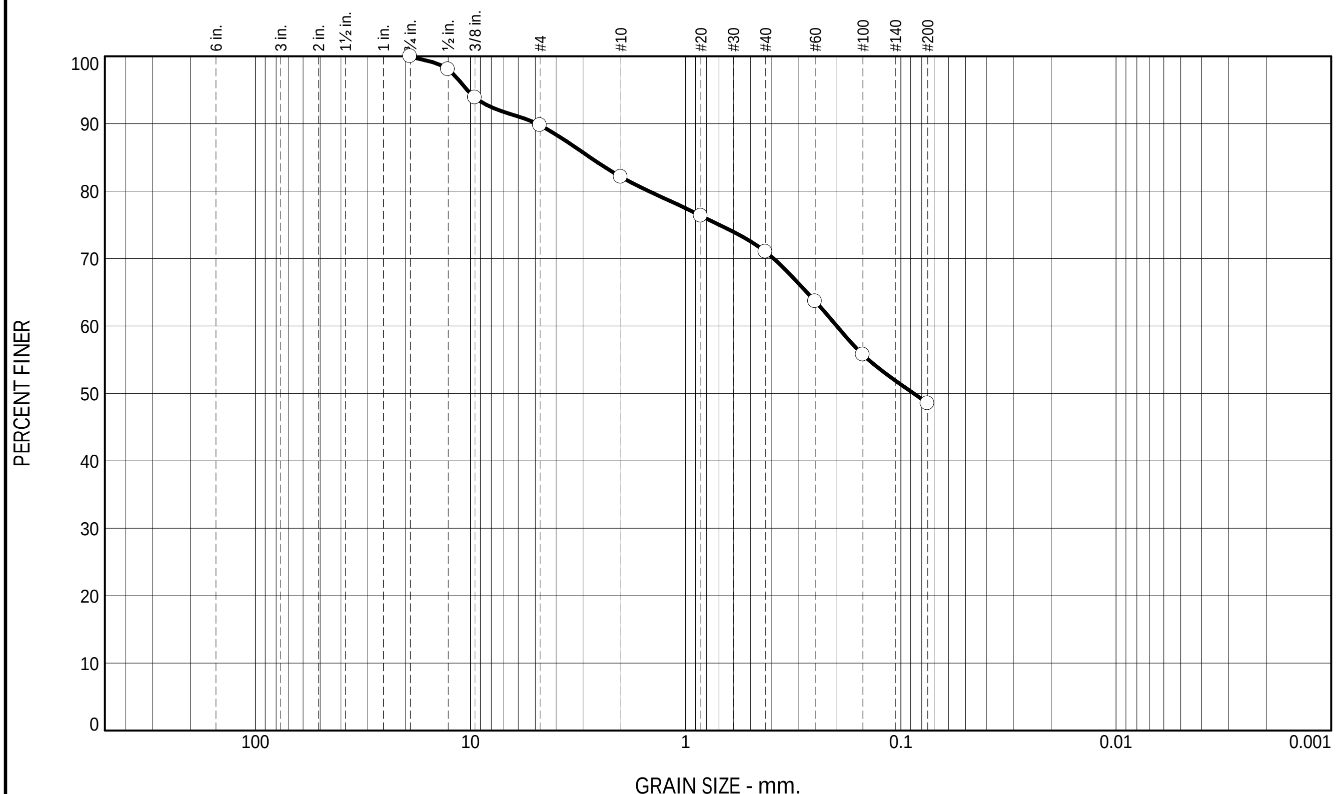
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.2	7.7	11.1	22.5	48.5	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.1			
0.375	93.9			
#4	89.8			
#10	82.1			
#20	76.4			
#40	71.0			
#60	63.7			
#100	55.7			
#200	48.5			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 14 LL= 20 PI= 6

Coefficients

D_{90}= 4.9046 D_{85}= 2.7755 D_{60}= 0.1985
D_{50}= 0.0871 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM-SC AASHTO=

Test Remarks

As-Rec'd M/C = 11.64%

Location: East Palestine
Sample Number: SPT-6 Depth: 6-8' Sample Date:

JLT Laboratories, Inc.

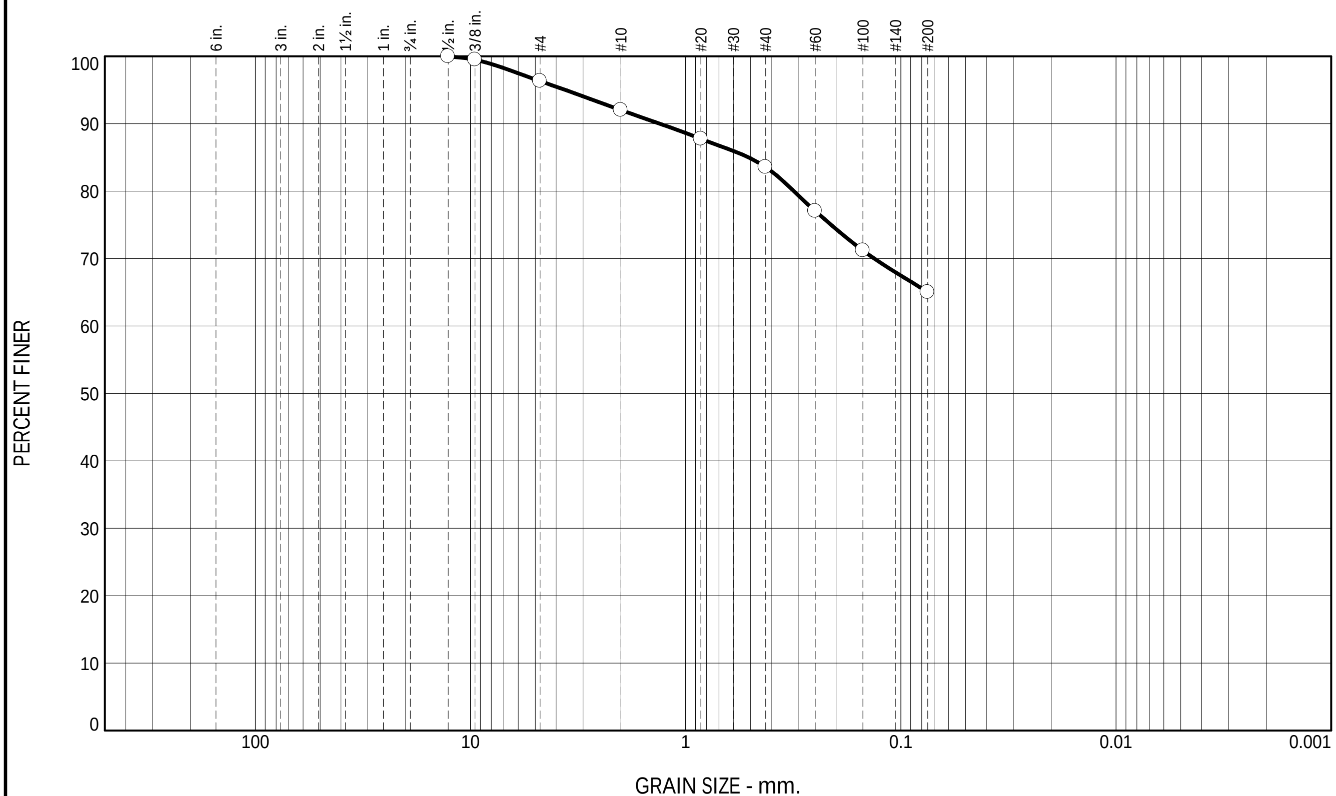
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.7	4.3	8.4	18.6	65.0	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.50	100.0			
0.375	99.5			
#4	96.3			
#10	92.0			
#20	87.8			
#40	83.6			
#60	77.0			
#100	71.2			
#200	65.0			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 19 PI= 6

Coefficients

D_{90}= 1.3165 D_{85}= 0.5098 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML-CL AASHTO=

Test Remarks

As-Rec'd M/C = 12.30%

Location: East Palestine
Sample Number: SPT-6 Depth: 20-22' Sample Date:

JLT Laboratories, Inc.

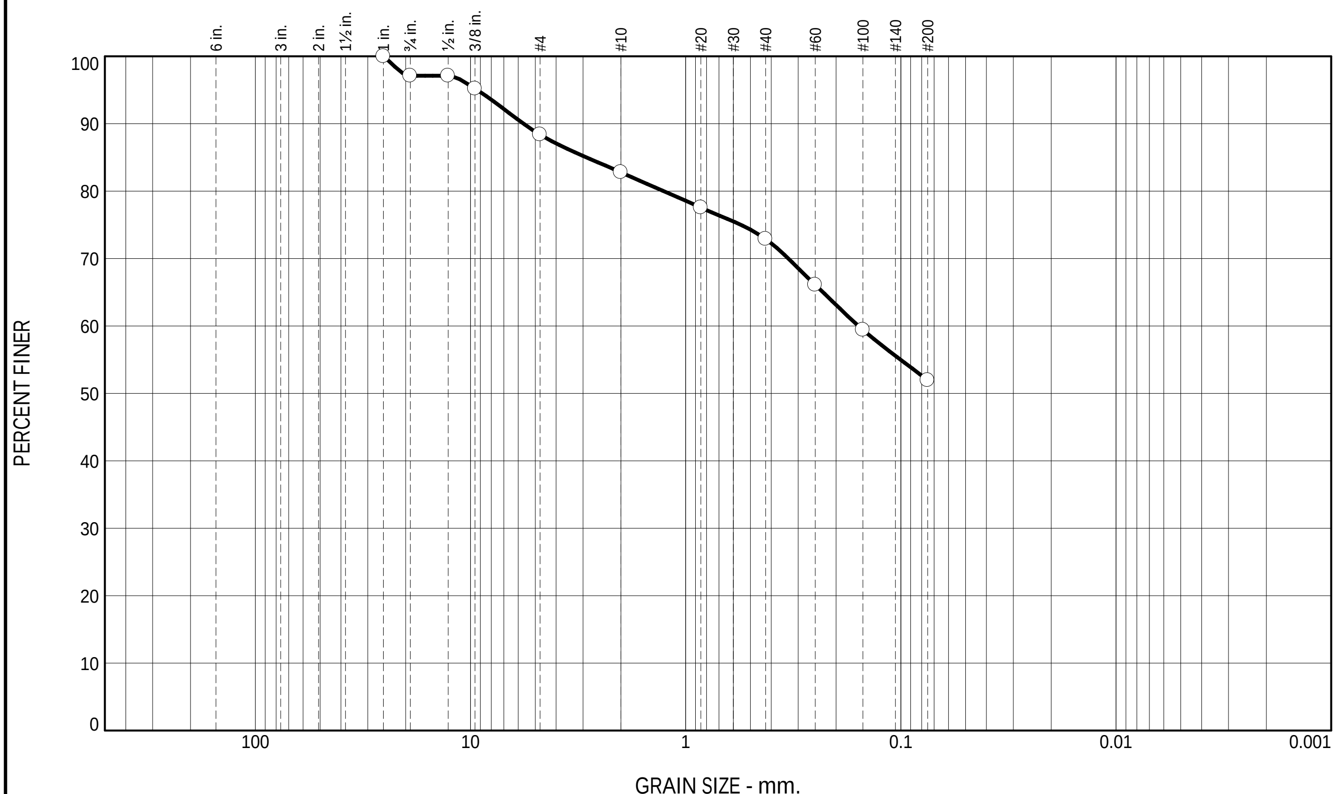
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.9	8.7	5.6	9.9	20.9	52.0	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	97.1			
0.50	97.1			
0.375	95.2			
#4	88.4			
#10	82.8			
#20	77.6			
#40	72.9			
#60	66.1			
#100	59.4			
#200	52.0			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 14 LL= 20 PI= 6

Coefficients

D_{90}= 5.6644 D_{85}= 2.8865 D_{60}= 0.1572
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML-CL AASHTO=

Test Remarks

As-Rec'd M/C = 12.27%

Location: East Palestine
Sample Number: SPT-6 Depth: 25-27' Sample Date:

JLT Laboratories, Inc.

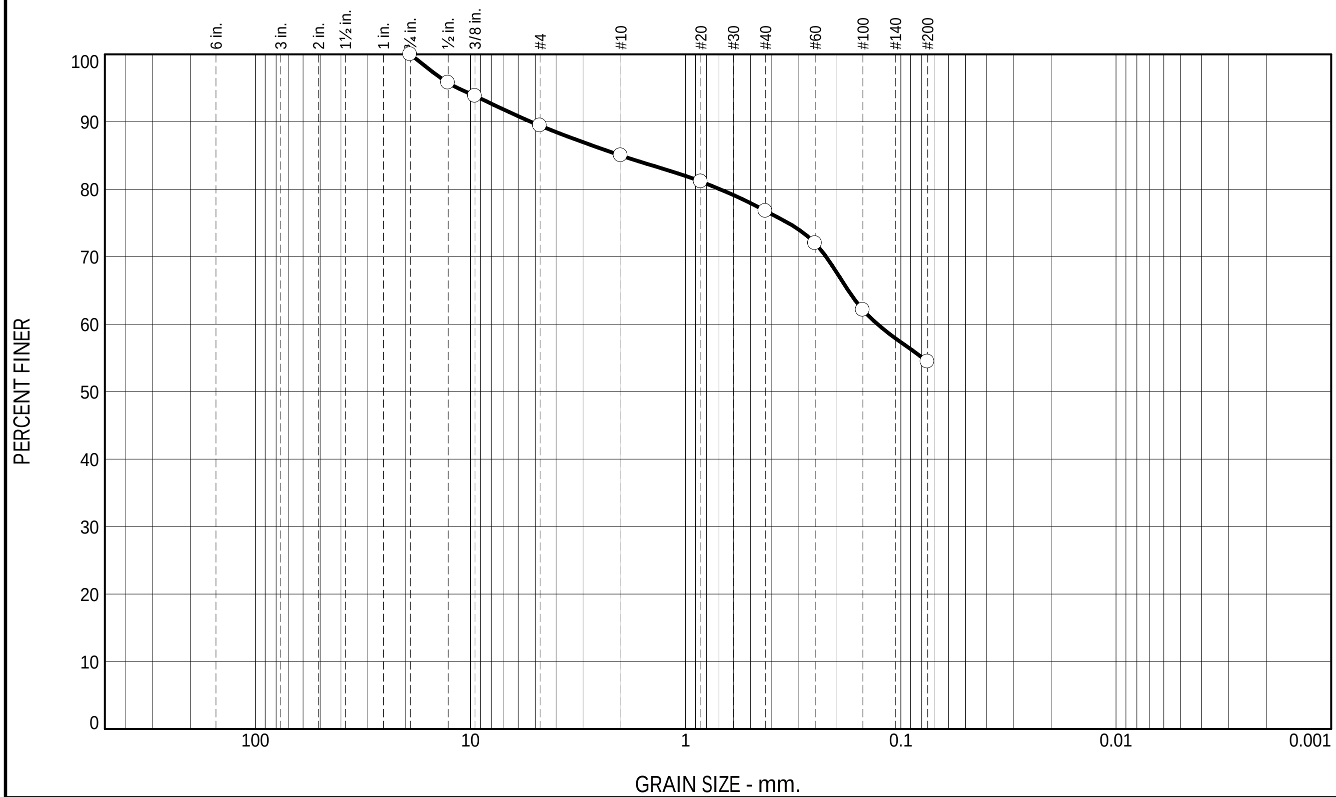
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.6	4.4	8.2	22.4	54.4	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	95.8			
0.375	93.8			
#4	89.4			
#10	85.0			
#20	81.1			
#40	76.8			
#60	72.0			
#100	62.1			
#200	54.4			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 21 PI= 8

Coefficients

D_{90}= 5.2295 D_{85}= 1.9963 D_{60}= 0.1283
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 12.33%

Location: East Palestine
Sample Number: SPT-6 Depth: 40-42' Sample Date:

JLT Laboratories, Inc.

Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 Figure

Tested By: AE Checked By: MLB

Attachment F

Tank Installation Procedures

HYDRERA ENERGY SERVICES (US) CORP.

Standard Operating Procedure
Harpoon Tank Setup

Division: United States

SOP Title: Harpoon Tank Set up

Effective Date:	January 1, 2021
Review Date:	January 1, 2024

Change History:

SOP Number	Effective Date	Significant Changes	Review/Created by:
Harpoon-001	January 1, 2021	Initial version	Kai Magnussen, Dan Kubek
Harpoon-001	May 1, 2021	Revision 1	Kai Magnussen, Dan Kubek
Harpoon-001	July 8, 2021	Revision 2	Kai Magnussen, Dan Kubek
Harpoon-001	October 12, 2021	Revision 3	Kai Magnussen, Dan Kubek
Harpoon-001	October 15, 2022	Revision 4	Kai Magnussen, Billy Logsdon
Harpoon-001	February 21, 2023	Revision 5	Kai Magnussen

1. **Purpose:** The purpose of this Standard Operating Procedure is to provide guidance to a field technician to properly set up HydrEra's Harpoon Tank System.

2. **Introduction:** HydrEra Energy Services (US) Corp (HES) believes that, the Health and Safety of every employee/contractor is of extreme importance. Towards this idea and with a safe workplace as one of our main goals, every employee, contractor, supervisor, and manager

is committed to supporting our HSE Program. Injury prevention and maintaining a safe and healthy working environment for all our employees, benefits HES, and all who work for and with us. Every employee/contractor of the company is responsible for personal safety and the safety of fellow workers. The responsibility begins with the company president and continues through each level of management to reach every employee/contractor, including even the newest personnel. This responsibility cannot be delegated or otherwise set aside. This same corporate attention to safety transcends to the protection of the general public and also to the physical resources belonging to or leased to HES It is the position of HES that the company's safety policies and procedures will, as a minimum, comply with all federal provincial and local regulations applicable to employee/contractor safety. The HSE program calls for the participation of all employees/contractors working toward an environment in which every job or task is performed in the safest practical manner by a well trained workforce using the proper equipment. The benefits of such efforts are numerous and obvious.

3. **Scope:** This SOP precludes that the worker has the required training, tickets and authorization prior to beginning any operations. This SOP is not meant to take the place of or minimize the need for supervision, training and/or client/customer site requirements. It is also in no way comprehensive (as defined by "cannot be added to"). This SOP can be added to as long as the additions further enhance the following: Safety, environmental protection, productivity, (without compromising the first two).

<u>ATTENTION:</u> Use the personal protective equipment (PPE) and safety procedures for all steps at all times. ANSI/CSA approved hard hat, rated safety glasses, harden toe footwear, gloves and fire rated (FR) clothing are required at all times on job service locations. Hoisted loads are required to have a minimum of one tag line. Personnel are required to be properly harnessed and anchored when exceeding a height of 3 meters. Visual inspections are to be done by all workers on tools and equipment before being put into use. This includes but is not limited to hand tools, ladders, AST tanks and auxiliary equipment.

Harpoon Installation Process

Harpoon Tank installation must be performed by trained individuals and overseen by a HydrEra-trained supervisor. No more than two (2) Short Service Employees (SSE) to be present for a Harpoon installation.

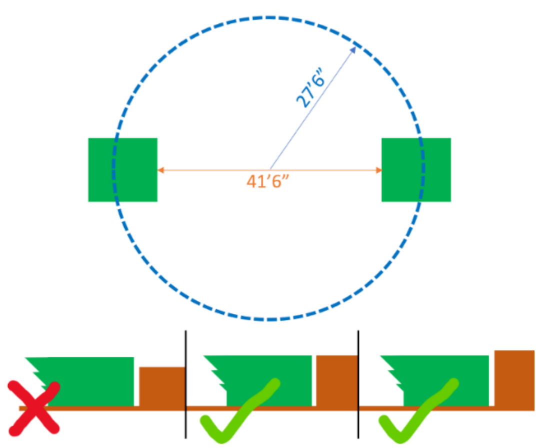
Harpoon Installation Steps:

Required Tool List

4 – 4lbs sledge hammers
4 – Crow bars
4 – Fall arrest harnesses with harnesses
4 – Tool lanyards
1 – Impact driver
1 – Sockets for mayway and suction bolts (3/4”, 1-1/8”, 1-5/16”)
1 – Crescent wrench (or box wrenches in the above sizes)
1 – Shovel
1 – Rake
1 – Push broom
4 – 2x4x8 Blocks for cribbing
1 – Leister heat gun with roller and TPU patches

1. Tank Pad Preparation/Groundwork:

- Approx. 1-2 workers plus operators.
- Work with customer to identify Harpoon location and direction of fill and suction manifolds. Customer should provide level work surface clear of any sharp objects
- Mark the location of the suction manifold, as per customer request, and mark a square with the dimensions 12’ x 12’.
- Using the suction manifold location as a reference, mark another 12’ x 12’ square exactly 39’4” away, ensuring that the two are square. This will account for and extra foot of room around each manifold to allow for adjustments.
- Dig out these boxes to an approximate depth of 8”. The manifold boxes will be placed into the dug out areas, and levelled at approx. 1” below the grade where the panels will be installed. Use a laser level to confirm the height and level of the placement.
- The top plate of the manifolds must be at or below grade, it cannot be set above grade, as this will affect the setting of the panels. (see below)
- Backfill around manifolds once they are in position. Creating a smoot transition from pad material to manifold edge.
- Visually inspect all welds on the manifolds to ensure there is no damage or cracked welds.
- The interior edges of the two manifold boxes should be 41’6” apart, and be square to each other.
- Measure from the front edge of the manifolds to a distance of 20’9” to confirm your center.
- From this center mark, paint a circle with a radius of 27’6” to show where the panels will be placed.
- Use laser level and equipment (skid steer, excavator, etc) to grade pad to within 0.5”+/- off of level. Ensure a safe working distance at all times when working near heavy equipment. Ensure that the operator makes eye contact and shuts down prior to approaching.



- Spacing around the tank must be at least 25 feet when using a telehandler to set panels, and a minimum of 10 feet when setting panels with a crane.
- Check the tank pad area for sharp objects, rocks or any other potential hazards to the liner.

2. Groundcloth Installation:

- Approx. 5 workers.
- Ensure that tank perimeter circle is well marked on the ground.
- Use equipment to place groundcloth roll on edge of perimeter line.
- Groundcloth will be unrolled using equipment and/or manpower. Excessive force must not be used to eliminate damage to ground cloth. The ground cloth is a reusable material for tank installations.
- Once unrolled, check to ensure groundcloth covers tank perimeter line. The groundcloth will have 1’ of material outside the tank wall perimeter
- Unfold both directions and adjust to cover entire tank pad area
- Find center and ensure that the pad center and geo center are lined up
- Ensure suction and fill manifolds are installed properly, with the groundcloth over top the manifolds.
- Locate the inlet ports on both suction and fill manifolds. Cut out holes 3” larger than the rectangular inlet gasket and place over manifold ports. **IMPORTANT:** Ensure there is no overlap of the groundcloth and the inlet gaskets, as this can result in a possible leak.
- Geotextile rolls may be used in place of ground cloth.


3. Setting the Liner(s):

- **NOTE:** This step of the process will be the same whether installing a disposable PVC liner or a reusable TPU liner.
- **NOTE:** All liners have identifying features around the manifold connections to be able to determine the direction of deployment.
- Approx. 5-6 workers.
- **TPU LINERS:** Identifying markers - The reinforced area around the manifold on the manway side is grey, versus blue on the non-manway side.
- Using equipment, place the liner roll on the center point of the tank. The liner will be marked to show which direction the opening for the manway door is situated.
- Flatten/Spread cargo net in all directions to reduce bunches or folds.
- Unroll the liner perpendicular to the manifolds, ensuring the ends of the liner meet the perimeter line.

- PVC LINERS: Identifying markers – There will be a box around the manway-side manifold connection area, and only a line through the center of the non-manway side. These markings will be in the same color as the vertical guide lines.
- Using equipment , place the PVC roll on the non-manway side manifold and unroll towards the manway side manifold.

- For TPU and PVC liners, once unrolled, spread the liner in opposing directions until it is fully deployed towards the perimeter of the tank. The liner does not need to fully meet the wall at this stage.


- Ensure that the engineered liner ports align with the suction and fill manifold ports. Adjust the liner as necessary to ensure perfect placement.
- Ensuring the liner is in the perfect position during this step is not imperative. Adjustment of the positioning of the liner is possible once 2-3 points are lifted up the wall. The liner floor can be adjusted into place at this point.
- Ensure the liner cargo net is present under the liner (TPU only). This will stay in place under the tank floor.
- Fold liner walls back inside the mark on the ground to allow room to place tank walls.

- Fold groundcloth in on top of liner, to protect the liner from the bottom edge of the panels.

- NOTE: when using a PVC liner, or a TPU liner for the first time, it will unroll from the 12 o'clock position to the 6 o'clock position (manifold to manifold) with the manway being in the 5 o'clock position. New liners will be sticky and more difficult to deploy.
- **IMPORTANT**: liners should be constantly inspected inside and out during the deployment of the liner. Any issues will be repaired using the Leister Gun and TPU patches.

4. Placing Tank Panels:

Panel Handling Procedures - Telehandler

- Harpoon panels and attachments are engineered to work safely with 12,000 lb telehandler models including JLG, JCB and Xtreme brands. Panels will connect to HydrEra telehandler attachment for lifting and placement. The telehandler attachment will lock into the center of the panel, with the swing handle engaging the locking mechanism. Once locked in all adjustments can be made using the machine. All personnel must stay back 30 ft during critical lifts (standing the panel) and must keep all body parts clear when making adjustments with the telehandler.
- **IMPORTANT:** When transitioning the panel from horizontal to vertical position, the entire panel must be kept up and off the ground. Panels must only be moved around the work area in the vertical position. Failure to adhere to these guidelines may cause injury or damage to the equipment.
- Harpoon panels can be loaded and offloaded from trucks using the Harpoon attachment or using 4-point lift rigging on the panel d-rings.
- Review Telehandler load chart and SOP. Ensure operators are experienced and licensed to operate specific equipment. One person only should be designated to provide the telehandler operator with signals, however anyone can shut the operator down at any time.

Panel Handling Procedures – Crane

- Harpoon panels are engineered to be safely installed using a crane or picker. Minimum crane sizes to be used are a 30 ton for multiple sets or 100 ton to set the entire Harpoon tank from one position. The crane rigging will attach to the two d-rings on the top rail of the panel.
- **IMPORTANT:** the crane operator must complete a lift plan prior to moving any Harpoon panels.
- Stage panels within the crane's reach. Panels should be stood lifting towards the crane or cross-ways to the cranes position, not away from the crane. Plan for this when offloading panels on location.
- While the crane operator stands the panel, all personnel must remain well outside the panel fall radius, front, rear and on both sides. Panel may shift during this lift.
- Once the panel is standing, with the base on the ground, attach a tag line to each side and guide the panel into place. One person only should be designated to provide signals to the crane operator, however anyone can shut the operator down at any time.

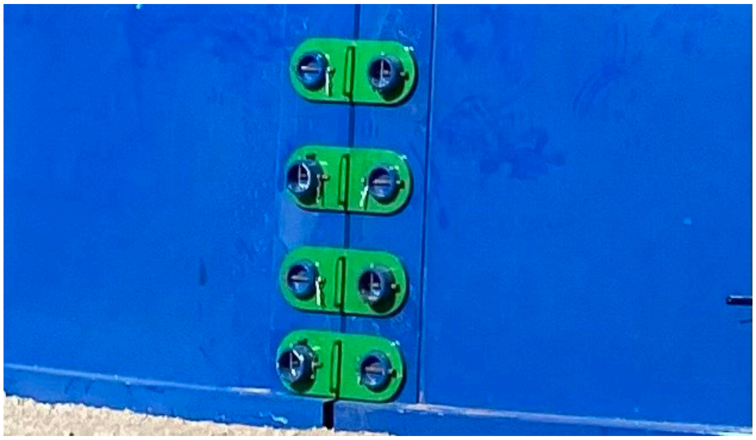
- Approx. 5-6 workers including equipment operators.
- Stage panels near working area.
- Harpoon panels can be safely installed using a 12,000 lb telehandler or a crane (see panel handling section above).

- Attach telehandler #1 to the primary panel. Lift panel vertically and move into position directly on top of the suction manifold. Panel must be centered on the manifold, with end lining up with perimeter circle. Leave a minimum of 3” between the panel and manifold uprights.
- The primary panel will be set centered on the manifold that will be next to the manway panel. The manway panel will be installed second, on the right side of the primary panel. Continue setting panels. Working counterclockwise is simpler when using a crane.

- Telehandler #1 will remain attached to the primary panel, while telehandler #2 or the crane lifts and installs panels 2-8. (shown here using a crane and telehandler)
- The manway panel will always be situated one panel immediately right of the manifold.

- Panels will be placed vertically side by side, while connection plates are rotated and installed over male panel lugs. Install the six (6) bottom connection plates, then work either upwards or downwards with the remaining twelve (12) connectors. Once plates are in place the pressure pin will be installed from the outside-in to lock the connection. Once the pressure pin is installed, a keeper pin will be installed in the pressure pin to prevent any horizontal movement. Continue this for all 18 connection plates, using a man-lift to install the upper connection plates. Ensure that individuals in/operating the man-lift are properly trained and use proper PPE for working at heights. Moving the free end of the panel in and out can help the connection plates be installed efficiently.
- When a panel is set, a small wood block should be placed under the unconnected edge of the panel to allow for easier connection of the next panel. Once the next panel is fully connected, the panel will be lifted and block removed.
- **IMPORTANT:** While personnel are working in the man lift at height, no one may enter the space below the basket. Any falling items could cause serious injury.

HARPOON



- Once the eighth panel is installed, telehandler #1 can release from the primary panel. The two telehandlers (or telehandler and crane) will then work in opposite directions around the tank installing panels. The first telehandler can also be used to begin pulling the liner up and over the walls.
- Measure the panel widths along the perimeter marking as you go to ensure proper placement and spacing.
- Complete the final connection. This may require two pieces of equipment to get into place.

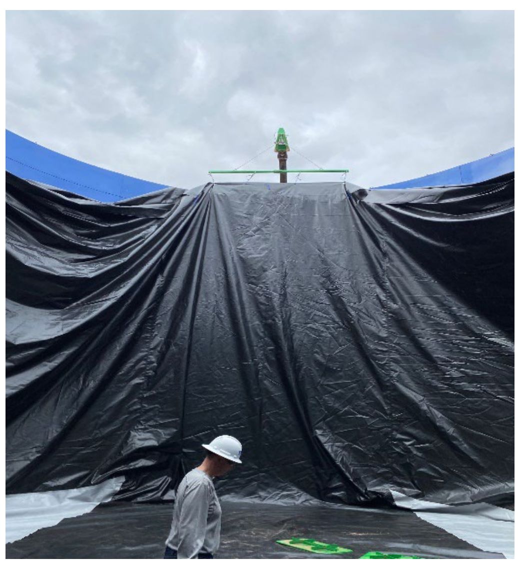
5. Installing the Liner:

- Approx. 5-6 workers.
- Using marking paint draw lines on the ground at the center of each manifold, and 3.75 panels away from each (quarter marks on the tank perimeter)
- Attach the jig winch attachment to the forklift with the spreader bar (add picture). Inspect winch line and hydraulic connections for any damage before using.
- **IMPORTANT:** Proper inspection of winch line should be done by site supervisor. Damaged equipment could cause failure resulting in serious injury or damage to the liner
- Position telehandler or crane in line with the primary panel, directly in front of the suction manifold.
- From the inside of the tank, walk the perimeter and ensure the ground cloth is to the tank wall and goes in the vertical position on the tank wall a minimum of 3".
- Using the jig winch and spreader bar, or crane and spreader bar, lower into tank using a spotter from up above to communicate when the bar is low enough to be hooked to the liner.
- Place the spreader bar centered with the guideline on the liner attaching two slings to the two lifting straps on each side of the guideline
- All personnel in the tank then stand 30' back and inform the spotter above they are clear to lift the liner up and over the walls
- The forklift operator then runs the winch bringing the liner to a height slightly higher than the tank wall.
- Ensuring the liner is square and straight. TPU and PVC liners will have guidelines indicating the center of the four quarters of the liner. These marks must line up with the center of the two manifolds, and perpendicular to the manifolds. The side locations will be found by measuring 3.75 panels away from the center of the manifolds.

- Ensure the ground cloth is properly covering and protecting the liner base.

- Personnel in the manlift will secure liner to the panel using the liner straps and connecting each one to the horizontal securement bar. The liner will be supported by these straps and its own weight on the top edge of the panels until the liner is completely installed, at which point a perimeter strap or cable will be installed to complete the liner installation.
- Proper placement of the liner has the edge of the line at or just above the horizontal securement bar. (This allows for the liner to not be tight or have too much slack. Both can cause damage or failure)
- Use the equipment to keep the liner lifted above the wall. This will allow for the personnel in the man baskets to lift the liner flaps by hand and secure to the horizontal securement bar.
- Once all points have been pulled over the wall, personnel inside will pull liner flat and square with liner running up the wall
- Liner should line up with both manifolds as well as the manway
- Starting at the manway, walk between the liner and the wall to ensure the ground cloth is still in the proper position before installing manway seal
- Install the manway seal, providing an extra egress point. (Line up the manway gasket with the bolt holes on the manway panel, ensure there is no rock or debris between the wall and the gasket, install a bolt at four corners to hold the gasket in place)
- Check for dirt or debris on the backside of the liner as this may cause potential for a leak. The liner will only fit one way.

- Align the liner to fit over the manway gasket on the manway panel. Ensure that the top bolt hole on the liner is in the right position and all other holes line up freely. You should not have to force the liner or create folds. Install over the bolts holding the manway gasket.
- Install the manway seal flange by placing over the liner and onto the bolts holding the manway gasket and the liner. Install remaining bolts and secure tightly.

- While adding water to the Harpoon, the perimeter of the interior MUST be walked and checked by the supervisor ensuring the liner is fully seated to the base of the panels.

- Once the liner is fully pulled up around the tank, install the perimeter strap to cinch the liner tight against the tank walls to prevent wind from entering underneath the liner.

*Double Liner Installation:

- For double lined applications, the primary liner will be lifted into the tank once the secondary liner is installed.
- Repeat the same steps as above to install the primary liner overtop the secondary
- Secure both liners together using their perimeter straps
- Ensure the secondary liner is not pinned by the primary liner around the wall edge. This may require physical inspection between the primary and secondary liners

6. Installing the Manifold Connections:

- Install upper and lower black gasket and the top plate on each of the two manifold boxes. Ensure liner is flat and sealed properly at connection point, and there is no interference with the groundcloth or any pebbles impeding the seal. Install the 24 bolts with washers and nuts, tightening in a lug nut style pattern, using an impact driver and 1-5/16” socket.
- For double lined applications a third gasket will be used so that the top and bottom of each liner is touching a gasket.

7. Installing the Manway Door Connections:

- Install the inner manway connection using the steel ring, then liner, then red rubber gasket against the panel wall.
- Ensure liner is lined up properly and has no folds.
- Ensure there are no tight areas inside the tank where the liner is stressed.
- For double lined applications a second red rubber gasket will be used.
- Install the outer manway connection using the steel door bolted directly to the panel with a red rubber gasket.

8. Installing the Upper Fill Tubes:

- Approx. 2-3 workers
- Lift the upper tubes using the manlift.
- Hold in place while 1-2 workers use man-lift and attach the Victaulic connection outside of tank. Ensure that individuals in/operating the man-lift are properly trained and use proper PPE for working at heights.

- Once the fill tube in in place, connected and over the liner, tighten the wall clamp to prevent movement.

9. Installing the HydrEra Harpoon Monitoring System:

- The HydrEra tank monitoring system can be installed to monitor fluid levels (via pressure sensor or ultrasonic) as well as fluid level.
- The main box will attach to the panel using magnets.
- The antenna magnetic mount should be mounted as high as possible on the outside of the panel, while not being on top of the liner.
- The ultrasonic sensor will be mounted atop the panel wall, aimed down at the fluid.
- The pressure sensor will be installed into the ¾" manifold port, with a T and valve to relieve pressure for a more accurate reading.
- The temperature sensor can be threaded into the manifold port or the manway door port.
- Each connection is specific to its corresponding location.
- Hold the power button until unit turns on.
- Connect your smart phone to the local wireless network
- Open your internet browser and go to the web address 10.10.10.10. The web page will show the information that the system is reading.

10. Tank Completion:

- Prior to adding fluid to the Harpoon Tank, ensure all valves are closed and ports not in use have a blind or blank installed.
- Ensure Manway bolts are torqued to the specifications listed on the safety stickers.
- Do not attempt to use the Harpoon Tank in a manner outside the normal operating procedures outlined on the safety sticker.
- Walk around the tank and do a visual inspection on all connection plates and pins.
- Ensure there is no undue stress on the liner material.
- Ensure that there are no gaps between the bottom of the panels and the ground.
- Contact a representative with any additional questions or concerns.

If any issues arise or you have any questions or concerns please contact HydrEra immediately:

Dan Kubek (587-990-5765)
Kai Magnussen (516-540-9944)
Cody Phillips (307-622-0123)
Billy Logsdon (970-250-9650)

Appendix A

- A minimum 18” of fresh water added to the Harpoon upon completion of setup
- Final walk through of the interior of the Harpoon must performed by a HydrEra trained supervisor
- Once a hydrotest has been performed and 24 hours has passed, HydrEra is cleared of any and all liner liability. At this point the integrity of the Harpoon system has been proven
- A minimum fluid level of 36” must be maintained during normal operation, aside from final emptying/cleanout
- Harpoon not to sit less than one third full for more than 72 hours
- Install/teardown reports to be signed off on by Select rep/customer
- All SOP’s to be signed off on by Select in all regions
- If Harpoon is allowed to freeze the liner integrity may be compromised and must be recertified at a cost to the customer
- Any and all damage to the Harpoon tank or liner system that is deemed to be caused by user error will be repaired/resolved at the cost of the customer

Attachment G

Secondary Containment Analysis

Secondary Containment Volume Analysis

Client: Norfolk Southern Railway Company (NRSC)

Project Location: East Palestine, Ohio

Project: East Palestine Derailment **Project No.: 3016714**

Calc No: CB-03 **Subject: Modular Tank Secondary Containment Evaluation**

Developed By: SMB **Date: June 27, 2023**

Checked By: PTO **Date: June 29, 2023**

OBJECTIVE:

Confirm that the secondary containment area for the two temporary one-million-gallon modular wastewater storage tanks constructed at the East Palestine, Ohio Derailment Site (the Site) complies with USEPA hazardous waste storage requirements.

REFERENCES:

1. Hydrera Engineering Services (Hydrera). *H20P –Harpoon Frac Tank Sales Drawing*. Prepared by RedFox Design & Drafting Inc. September 1, 2022.
2. United States Code of Federal Regulations (CFR). CFR Part 264.193 – *Containment and Detection of Releases*. 2006.
3. National Oceanic and Atmospheric Administration (NOAA). *Precipitation Frequency Data - East Palestine, OH*. NOAA Atlas 14, Volume 11, Version 2. Accessed April 2023.
4. Trimble Navigation Limited Software (Trimble). *Terramodel Software*. Version 10.61. 2021.

ASSUMPTIONS:

1. Two (2) modular tanks are used to store wastewater pumped/collected from the Site during ongoing remediation activities. Both modular tanks are 70 feet in diameter and 36 feet tall with an individual maximum capacity of 138,540 cubic feet (ft^3) when completely full (Hydrera 2022; see Attachment 1). Modular tanks are operated independently (i.e., failure or breach of one tank does not result in discharge from the second tank).
2. Both modular tanks were erected within a secondary containment system consisting of:
   - Cut slope face to the north
   - Constructed embankment to the east
   - Sheet pile walls to the south and west
   - The secondary containment area is lined with a 120-mil mil Linear Low-Density Polyethylene (LLDPE) liner manufactured by ATARFIL. The subgrade on which the geomembrane was placed slopes such that any precipitation, leakage, or spilling will drain to a collection point (i.e., sump), allowing for removal within 24 hours. Refer to

Attachment 2*: Modular Tank Containment Area As-Built Survey Figure* for an illustration of as-built topography.

3. In accordance with Federal Code 40 CFR part 264.193(b), tank systems storing hazardous constituents must provide a secondary containment system to capture a release in the event a tank is breached or ruptured (CFR 2006). The minimum-required secondary containment capacity is the maximum storage volume of the largest storage tank plus the rainfall volume resulting from the 25-year, 24-hour storm event.
4. The rainfall depth associated with a 25-year, 24-hour storm event is 3.96 inches (NOAA 2023; See Attachment 3).
5. The approximate rainfall catchment area of the secondary containment area (including the modular tanks) is 30,100 ft^2 (see Attachment 4).
6. The as-built secondary containment volume is calculated utilizing Terramodel terrain modeling software (Trimble 2021) which can analyze as-built three-dimensional (3D) survey data obtained from Arcadis field survey (illustrated in Attachment 1) and calculate a volume between the survey surface and a given datum. This 3D surface analysis does not consider the volume occupied by the modular tanks or ancillary equipment. For the purposes of this calculation, it is assumed that only one modular tank will occupy the storage volume area during a modular tank breach or rupture scenario given the space occupied by a leaking modular tank (below the secondary containment spillover elevation) would provide secondary containment storage.
7. Ancillary equipment staged within the secondary containment area occupies the following volumes (based on field measurements; see Attachment 4):
   - Pumps (7 total):
     i. 5 ft x 7 ft x 6 ft
     ii. Total volume = 1,470 ft^3
   - Test Water Tank:
     i. 21 ft x 8 ft x 8 ft
     ii. Total volume = 1,350 ft^3
   - Weir Tank:
     i. 43 ft x 9 ft x 8 ft
     ii. Total volume = 3,100 ft^3
8. The lowest elevation along the perimeter of the secondary containment system is 1032.59 feet and is located at the southwestern corner of the sheet pile wall (see Attachment 2).
9. Based on as-built survey conducted by Arcadis (see Attachment 2), the floor elevation of both modular tanks is approximately 1025.4 feet.

CALCULATIONS:

Minimum Required Storage Capacity

The minimum required secondary containment capacity is the maximum storage volume of the largest modular tank within the containment plus the volume corresponding to a 25-year, 24-hour storm event draining to of falling directly on the containment area. Both modular tanks have the same maximum capacity. Therefore, a volume of 138,540 ft^3 (Assumption 1) is used as the modular tank breach/rupture containment quantity.

The rainfall volume captured within the secondary containment area resulting from the 25-year, 24-hour storm event is calculated below:

Rainfall Volume = A x D, where:

- A = Catchment Area, 30,100 ft^2 (Assumption 5)
- D = 25-year, 24-hour rainfall depth, 3.96 inches (0.33 feet; Assumption 4)

Based on the above calculation, the volume of water and/or wastewater captured by the secondary containment area during the 25-Year, 24-hour storm is 9,940 ft^3. Adding the captured rainfall volume to the modular tank breach/rupture containment quantity, the minimum required secondary containment capacity is 148,480 ft^3.

Volume provided within the secondary containment area:

Secondary containment for the modular tanks is provided by a combination of a cut slope face, a constructed embankment, and sheet pile walls (Assumption 2). Using Terramodel terrain modeling software (Trimble 2021), the storage volume of the secondary containment area was calculated by comparing the 3D as-built survey data (collected by Arcadis; see Attachment 2) to a flat plane established at the lowest elevation along the perimeter of the secondary containment system (i.e., the southwestern corner of the sheet pile wall; elevation 1032.59 feet). The volume between the as-built bottom of the secondary containment area and an elevation of 1032.59 feet is calculated as 184,870 ft^3 (see Attachment 5).

The volume occupied by one of the modular tanks (i.e., the un-breached tank during a tank rupture scenario) must be subtracted from the volume calculated via Terramodel to determine the actual secondary containment volume. The volume occupied by an unbreeched modular tank within the secondary containment area is calculated as follows:

$V_{Tank} = \pi \left(\frac{d}{2}\right)^2 h$, where:

V_{Tank} = volume occupied by an unbreeched modular tank

d = radius of modular tank, 70 feet (Assumption 1)

h = height of modular tank below the secondary containment overflow elevation

= Secondary containment overflow elevation – bottom of modular tank elevation

= 1032.59 feet (Assumption 8)– 1025.4 feet (Assumption 9) = 7.2 feet

Based on the above calculation, the volume within the secondary containment area by a single modular tank is 27,710 ft³. The effective secondary containment storage volume can then be calculated via the equation:

$V_{eff} = V_{total} - V_{Tank} - V_{equip}$, where:

V_{eff} = effective secondary containment storage volume

V_{total} = volume of secondary containment area without modular tanks or equipment, 184,870 ft³ (calculated above)

V_{Tank} = Volume of secondary containment area occupied by one modular tank, 27,710 ft^3 (calculated above)

V_{equip} = Volume occupied by ancillary equipment, 5,920 ft³ (Assumption 7).

Based on the equation above, the effective secondary containment storage volume (i.e., volume available to contain the contents of one full modular tank plus the rainfall volume resulting from the 25-year, 24-hour storm event) is 151,240 ft³.

SUMMARY:

Table 1 below compares the secondary containment volume required to meet USEPA requirements (Assumption 3) and the effective secondary containment provided under as-built conditions:

Table 1: Evaluation Results

Required Secondary Containment Volume (ft^3)	Secondary Containment Volume Provided (ft^3)	Additional Secondary Containment Volume Provided above Min. Requirement (ft^3)
148,480	151,240	**2,760 (+1.9%)**

Based on above calculations, the secondary containment for the modular wastewater storage tanks exceeds USEPA requirements with respect to secondary containment storage volume and leak detection/collection.

ATTACHMENTS:

1. Reference 1: Modular Tank Drawings
2. Modular Tank Containment Area As-Built Survey Figure
3. Reference 3: Precipitation Data
4. Modular Tank Site Layout Figure
5. Secondary Containment Volume Calculation

Attachment 1:

Reference 1: Modular Tank Drawings

DRAWING LIST

SHEET	DESCRIPTION
1 of 3	TITLE PAGE
2 of 3	GENERAL ARRANGEMENT
3 of 3	TYPICAL PANEL ASSEMBLY

HYDRERA ENERGY SERVICES

H20P - HARPOON FRAC TANK
SALES DRAWING
RedFox Project No: RF22068
PO: 1011

REVISIONS

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
0	3/12/23	ISSUED FOR INFORMATION PURPOSES	Dan Griffiths		

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REDFOX DESIGN & DRAFTING INC.

Drawn By:	Dan Griffiths
Date:	September-01-2022
Checked By:	-
Approved By:	-
Customer Project No:	1011
RedFox Project No:	RF22068

GENERAL NOTES

1. THE ABOVE GROUND STORAGE TANK HAS BEEN DESIGNED IN ACCORDANCE WITH THE AMERICAN PETROLEUM INSTITUTE STANARD 650.
2. ALL STRUCTURAL STEEL MEMBERS DESIGNED IN ACCORDANCE WITH ANSI/AISC 360-16 SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS.
3. ALL STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING MINIMUM MATERIALS PROPERTIES:

MATERIAL SPECIFICATIONS			Minimum Yield Stress (ksi)	Minimum Rupture Stress (ksi)
SHAPE	CANADA	USA (ASTM)		
HSS	G40.21 50W	A500 Gr. C	50	62
PLATE	G40.21 50W	A572	50	65
PLATE	G40.21 44W	A572	44	65
PLATE	QT-100	A514	100	110
BAR	AISI 1020	A36	36	58

4. FABRICATION SHALL CONFORM TO ANSI/AISC 360-16.
5. ALL WELDING SHALL BE IN ACCORDANCE WITH AWS D1.1 USING E70XX ELECTRODES. WELDING SHALL BE PERFORMED BY WELDERS CERTIFIED FOR THE WELD TYPE AND POSITIONS INVOLVED ACCORDING TO THE CURRENT EDITION OF AWS D1.1.
6. UNLESS OTHERWISE NOTED ALL CONNECTIONS ARE TO BE 3/16" CONTINUOUS FILLET WELDS.
7. MINIMUM FABRICATED THICKNESS OF ALL 10 GAUGE ELEMENTS SHALL BE 0.1345".

ASSEMBLY NOTES

1. ERECTOR SHALL PROVIDE ALL MATERIAL, EQUIPMENT AND LABOR THAT IS REQUIRED FOR TEMPORARY STABILITY OF THE TANK DURING ERECTION.
2. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS COMPLETE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURES AND SEQUENCES TO INSURE SAFETY OF THE BUILDING AND ITS COMPONENTS DURING ERECTION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF NECESSARY SHORING, SHEETING, TEMPORARY BRACING, GUYS, TIE DOWNS, ETC.
3. TANK AND SUMP ARE TO BE SUPPORTED BY LEVEL FOUNDATION, DESIGNED BY OTHERS.
4. TANK IS TO BE USED IN COMPLIANCE WITH LOCAL & FEDERAL JURISDICTION.

SPECIFICATIONS

1. ABOVE GROUND STORAGE TANK IS RATED FOR 20 PANEL ASSEMBLY - SEE DESIGN DATA FOR MORE INFORMATION.
2. TANK VOLUMES (ZERO FREEBOARD):
   - 24,675 US BBL
   - 3,923 m³
   - 138,540 ft³

FINISHING DETAILS

1. PANELS : ENDURA EXCEL D2M (SIGNAL BLUE CLR33994)
2. PANEL CONNECTOR: ENDURA EXCEL D2M (GREEN CLR42186)
3. HYDRERA DECAL CENTERED VERTICALLY ON EVERY SECOND PANEL 72" ABOVE GRADE.
4. STENCIL "MADE IN USA" SHALL BE PLACED ON BOTTOM RIGHT OF EACH PANEL. LOCATED 12" FROM BOTTOM OF PANEL TO THE CENTER OF THE STENCIL.

DESIGN DATA

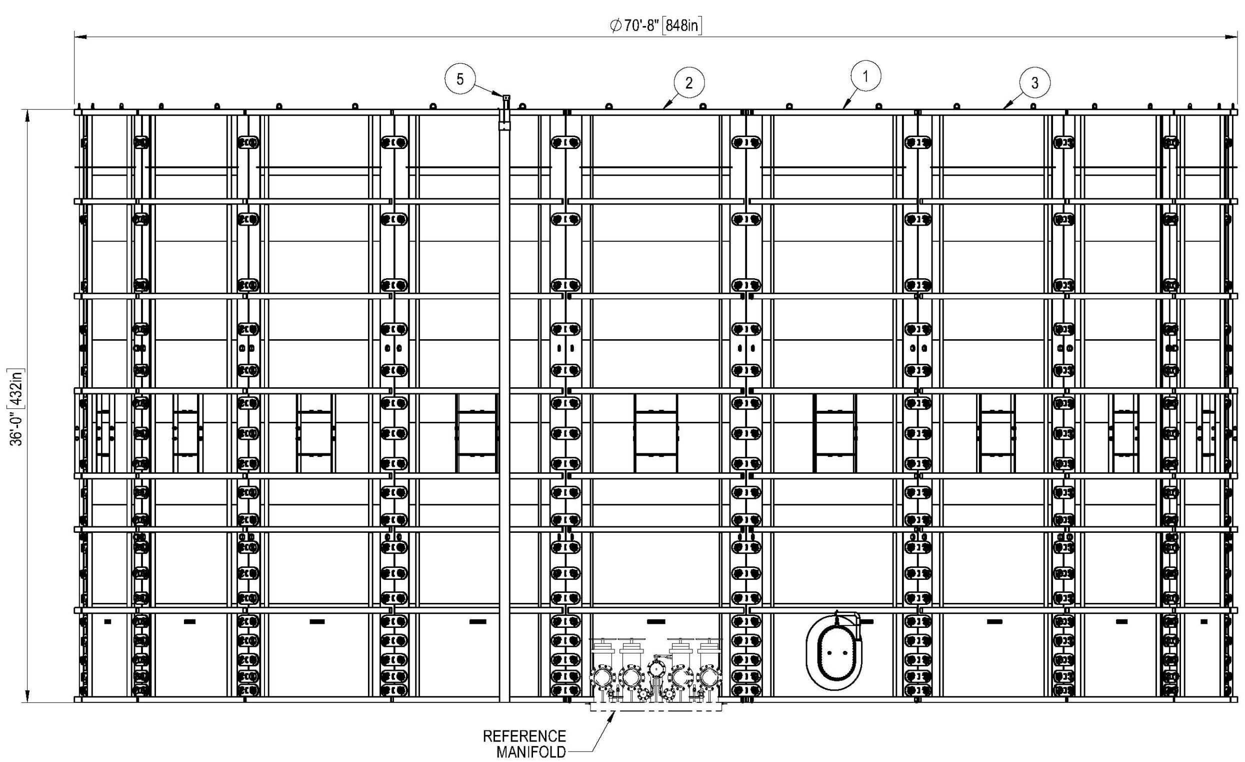
1. DESIGN STANDARDS & REFERENCES:
   a. API 650*
   b. ASCE 7-16
   c. AISC 360-16
   d. ASCE 7 ONLINE HAZARDS TOOL 2022
2. SERVICE LIFE: 25 YEARS
3. GRAVITY LOADS:
   a. SELF WEIGHT OF TANK COMPONENTS
   b. VARIOUS FLUID DEPTHS WITH SPECIFIC GRAVITY (S.G.) = 1.00 - 1.25
4. RISK CATEGORY: I
5. WIND LOAD (MEAN RECURRENCE INTERVAL = 50 YEARS:
   a. BASIC WIND SPEED
      i. NM, WY, OK, ND, WV: 81.3 mph (3-SECOND GUST)
      ii. CO: 86.0 mph (3-SECOND GUST)
      iii. TX, LA: 116.2 mph (3-SECOND GUST)
   b. EXPOSURE CATEGORY: C
   c. DIRECTIONALITY FACTOR: 0.85
   d. TOPOGRAPHIC FACTOR: 1.00
   e. ELEVATION FACTOR: 1.00 (AT SEA LEVEL)
   f. EXPOSURE COEFFICIENT: 1.04
6. SEISMIC LOADS (MEAN RECURRENCE INTERVAL = 50 YEARS)**:
   a. SOIL SITE CLASS: D (DEFAULT)
   b. SEISMIC USE GROUP (SUG): I
   c. SDS
      i. TX, PN, ND, LA, WV: 0.10g
      ii. NM, CO, OK: 0.28g
      iii. WY: 0.30g***
   d. SD1
      i. TX, PN, ND, LA, WV: 0.04g
      ii. NM, CO, OK: 0.13g
      iii. WY: 0.15g***
   e. Rwi (IMPULSIVE RESPONSE MODIFICATION FACTOR): 3.5
   f. Rwc (CONVECTIVE RESPONSE MODIFICATION FACTOR): 2.0

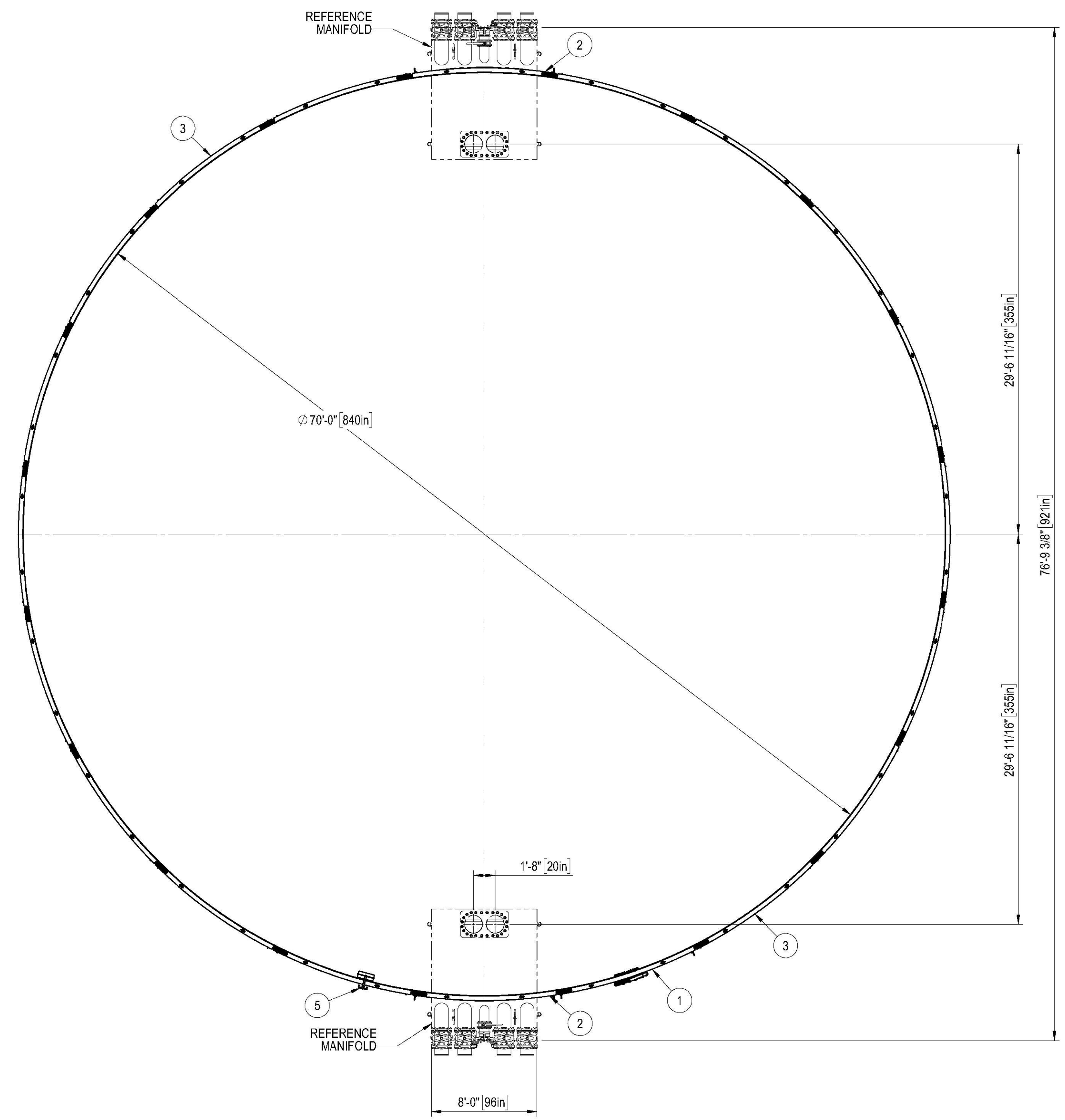
*API 650 REPRESENTS THE RELEVENT INDUSTRY STANDARD FOR TANK CONSTRUCTION.
**SEISMIC DESIGN IS DEFINED AS A PURCHASER'S OPTION PER API 650.
***THE TANK DEPICTED HEREIN IS NOT PERMISSABLE TO BE INSTALLED IN THE FOLLOWING COUNTIES OF WESTERN WYOMING: LINCOLN, PARK, SUBLETTE & TETON

BILL OF MATERIALS

ITEM	PART NUMBER	QTY	DESCRIPTION	WEIGHT (lbs)
1	H20P-1001	1	MANWAY PANEL ASSEMBLY	7837
2	H20P-1002	2	PANEL ASSEMBLY w/ D-RINGS FOR TRANSPORT	7394
3	H20P-1003	17	PANEL ASSEMBLY	7391
4	H20P-1007	1	BLADDER ASSEMBLY	3017
5	H20P-1107	1	TOMCAT GAUGE BOARD ASSEMBLY (36'-0" GUIDED) c/w MAGNETS AND WEIGHTS	169

TOTAL WEIGHT: 148445 lbs





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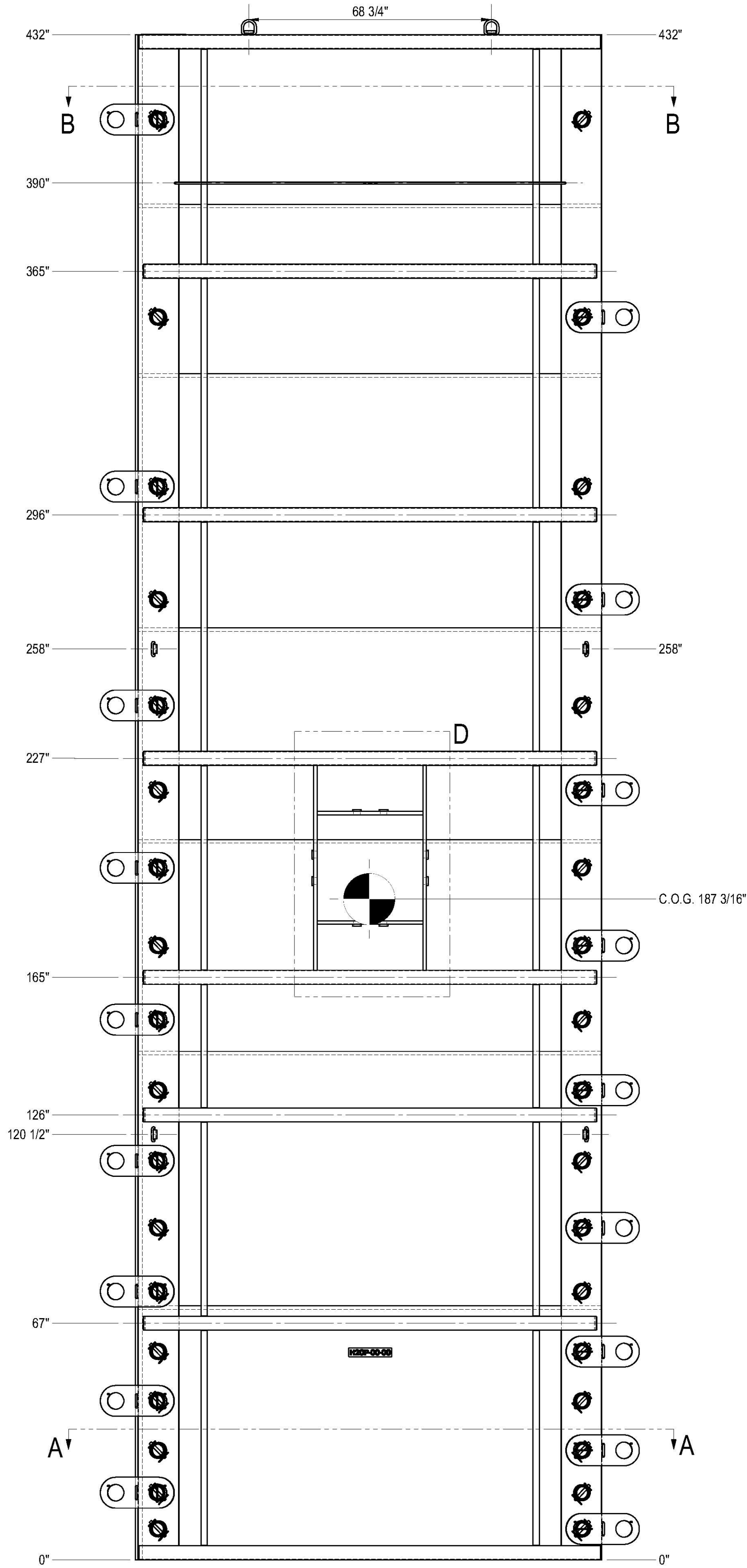
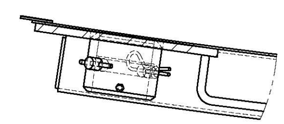
Drawn By: Dan Griffiths	H20P - HARPOON FRAC TANK			
Date: September-01-2022	H20P - HARPOON TANK ASSEMBLY GENERAL ARRANGEMENT			
Checked By: -				
Customer Project No: 1011	RedFox Project No: RF22068	Part Number: H20P-1000	Drawing Number: RF22068-2	Sheet: 2 of 3 / Rev: 0





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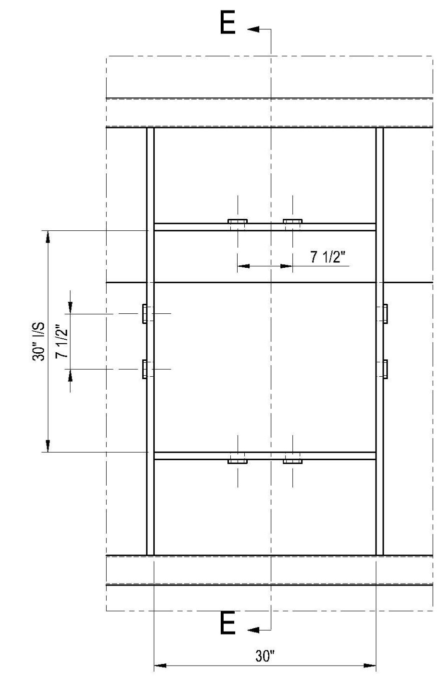
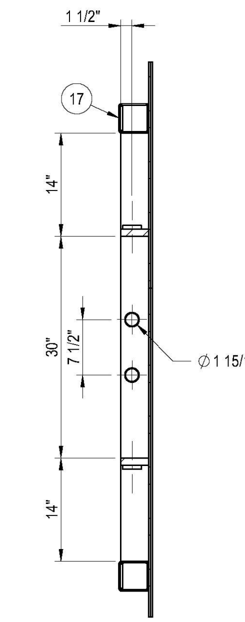


DETAIL D

TELEHANDLER POCKET



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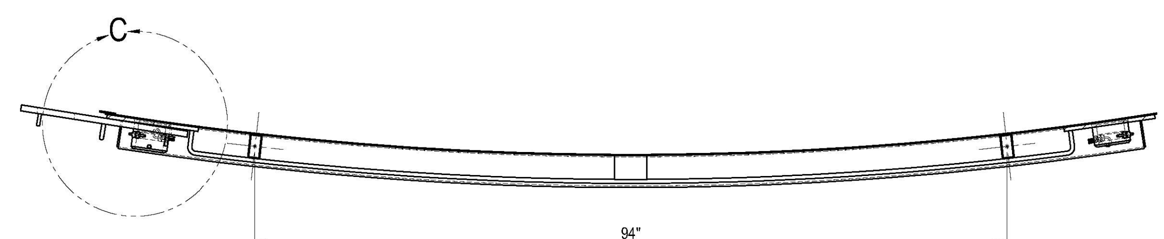

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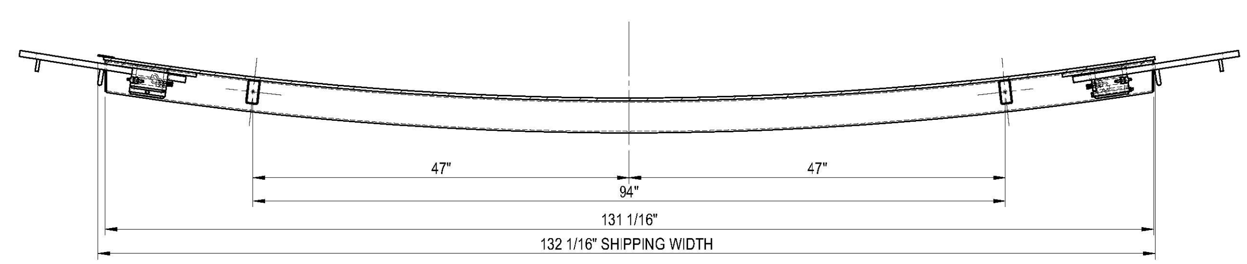

SECTION A-A

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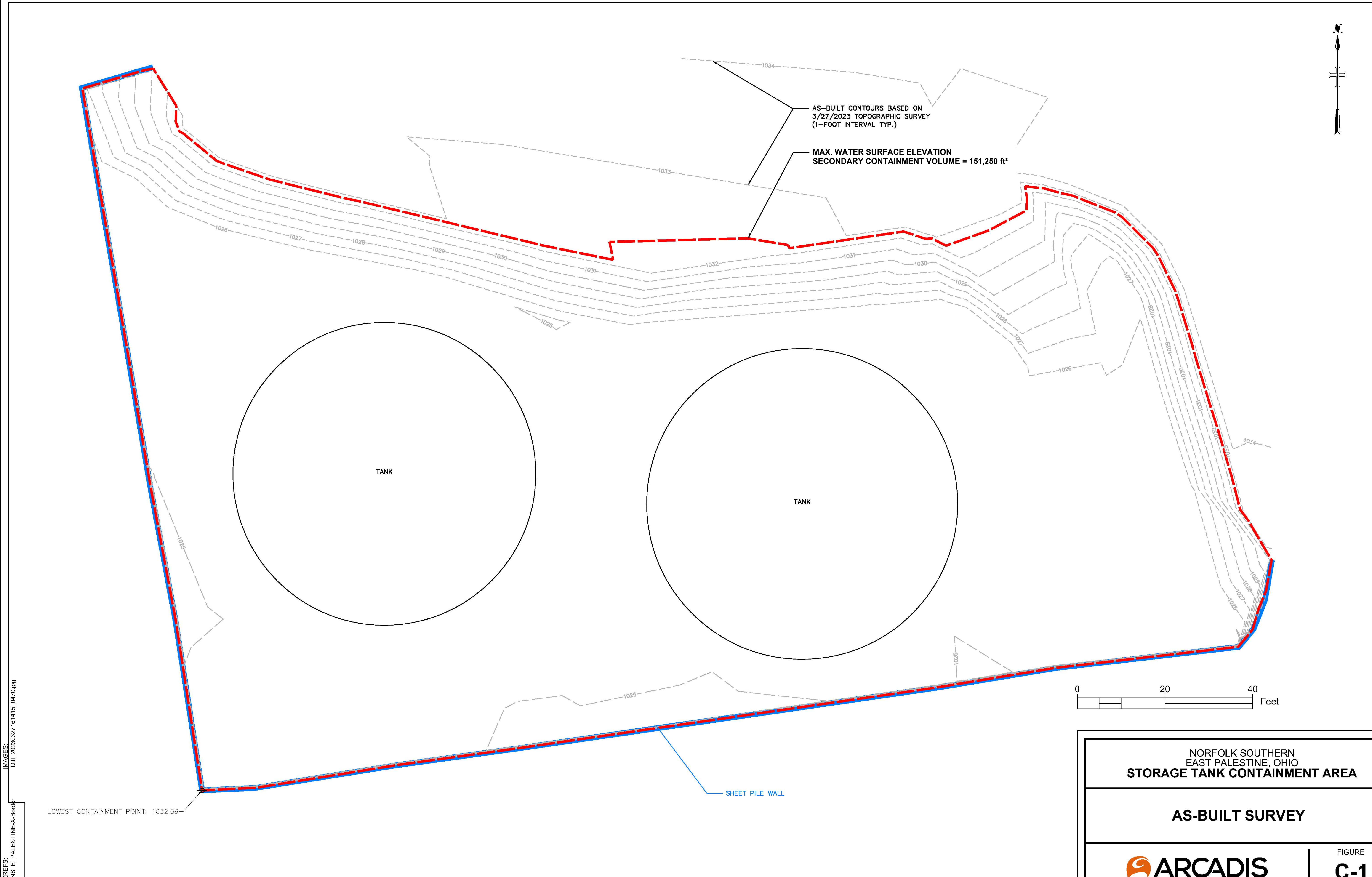
Drawn By: Dan Griffiths	H20P - HARPOON FRAC TANK			
Date: September-01-2022	TYPICAL PANEL ASSEMBLY			
Checked By: -				
Customer Project No: 1011	RedFox Project No: RF22068	Part Number: H20P-1003	Drawing Number: RF22068-3 (Sheet: 3 of 3)	Rev: 0

Attachment 2:

Modular Tank Containment Area As-Built Survey Figure



NORFOLK SOUTHERN
EAST PALESTINE, OHIO
STORAGE TANK CONTAINMENT AREA

AS-BUILT SURVEY

ARCADIS

FIGURE
C-1

C:\Users\VDavis\ARCADIS\NS East Palestine - General\11 Engineering & Design\01 Stormwater Management\Tank Farm Containment Calcs\TANK FARM CONTAINMENT AS-BUILT.dwg LAYOUT: C-1 SAVED: 3/28/2023 2:12 PM ACADVER: 24.2S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ----
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Attachment 3:

Reference 3: Precipitation Data

NOAA Atlas 14, Volume 2, Version 3
Location name: East Palestine, Ohio, USA*
Latitude: 40.8346°, Longitude: -80.5309°
Elevation: 1020 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.314** (0.282-0.350)	**0.375** (0.337-0.419)	**0.454** (0.406-0.505)	**0.515** (0.460-0.572)	**0.592** (0.527-0.657)	**0.651** (0.578-0.721)	**0.708** (0.627-0.783)	**0.766** (0.675-0.847)	**0.844** (0.740-0.931)	**0.901** (0.786-0.993)
10-min	**0.488** (0.438-0.544)	**0.586** (0.525-0.653)	**0.705** (0.631-0.785)	**0.794** (0.710-0.884)	**0.905** (0.807-1.00)	**0.987** (0.876-1.09)	**1.07** (0.943-1.18)	**1.14** (1.01-1.26)	**1.24** (1.09-1.37)	**1.31** (1.14-1.45)
15-min	**0.599** (0.537-0.667)	**0.716** (0.642-0.799)	**0.865** (0.775-0.964)	**0.977** (0.874-1.09)	**1.12** (0.996-1.24)	**1.22** (1.08-1.35)	**1.32** (1.17-1.46)	**1.42** (1.25-1.57)	**1.55** (1.36-1.71)	**1.64** (1.43-1.81)
30-min	**0.792** (0.711-0.883)	**0.958** (0.860-1.07)	**1.18** (1.06-1.32)	**1.36** (1.21-1.51)	**1.58** (1.41-1.75)	**1.75** (1.55-1.93)	**1.91** (1.69-2.12)	**2.08** (1.83-2.29)	**2.29** (2.01-2.53)	**2.46** (2.14-2.71)
60-min	**0.967** (0.868-1.08)	**1.18** (1.06-1.31)	**1.49** (1.33-1.66)	**1.73** (1.54-1.92)	**2.05** (1.82-2.27)	**2.30** (2.04-2.55)	**2.56** (2.26-2.83)	**2.82** (2.48-3.11)	**3.17** (2.78-3.50)	**3.45** (3.01-3.80)
2-hr	**1.12** (1.00-1.24)	**1.36** (1.22-1.50)	**1.71** (1.53-1.90)	**1.99** (1.78-2.20)	**2.36** (2.11-2.60)	**2.66** (2.36-2.92)	**2.96** (2.62-3.25)	**3.28** (2.89-3.59)	**3.70** (3.24-4.04)	**4.02** (3.50-4.39)
3-hr	**1.18** (1.07-1.32)	**1.43** (1.30-1.59)	**1.80** (1.63-2.00)	**2.10** (1.89-2.32)	**2.50** (2.25-2.76)	**2.82** (2.53-3.11)	**3.16** (2.81-3.46)	**3.50** (3.10-3.84)	**3.97** (3.48-4.34)	**4.34** (3.78-4.74)
6-hr	**1.41** (1.29-1.56)	**1.70** (1.55-1.88)	**2.12** (1.94-2.34)	**2.47** (2.24-2.71)	**2.95** (2.66-3.22)	**3.33** (3.00-3.64)	**3.74** (3.35-4.06)	**4.16** (3.70-4.51)	**4.75** (4.19-5.13)	**5.21** (4.57-5.62)
12-hr	**1.67** (1.52-1.84)	**2.00** (1.82-2.21)	**2.47** (2.25-2.72)	**2.86** (2.60-3.14)	**3.41** (3.08-3.73)	**3.86** (3.47-4.21)	**4.34** (3.88-4.71)	**4.83** (4.29-5.24)	**5.54** (4.87-5.98)	**6.10** (5.32-6.57)
24-hr	**1.99** (1.86-2.14)	**2.38** (2.22-2.56)	**2.92** (2.72-3.13)	**3.35** (3.12-3.59)	**3.96** (3.68-4.23)	**4.46** (4.12-4.75)	**4.97** (4.58-5.29)	**5.51** (5.05-5.86)	**6.27** (5.70-6.66)	**6.87** (6.20-7.31)
2-day	**2.31** (2.16-2.47)	**2.75** (2.58-2.95)	**3.34** (3.12-3.58)	**3.81** (3.56-4.07)	**4.46** (4.15-4.76)	**4.98** (4.62-5.32)	**5.52** (5.10-5.88)	**6.07** (5.58-6.47)	**6.82** (6.23-7.28)	**7.41** (6.73-7.92)
3-day	**2.47** (2.32-2.64)	**2.94** (2.76-3.14)	**3.54** (3.32-3.78)	**4.02** (3.77-4.30)	**4.69** (4.38-5.00)	**5.22** (4.86-5.57)	**5.77** (5.35-6.14)	**6.32** (5.84-6.73)	**7.08** (6.49-7.55)	**7.67** (6.99-8.18)
4-day	**2.63** (2.47-2.80)	**3.12** (2.93-3.33)	**3.74** (3.52-3.99)	**4.24** (3.98-4.52)	**4.92** (4.60-5.24)	**5.46** (5.10-5.82)	**6.02** (5.59-6.40)	**6.58** (6.10-7.00)	**7.34** (6.76-7.81)	**7.93** (7.26-8.45)
7-day	**3.13** (2.95-3.32)	**3.70** (3.50-3.93)	**4.40** (4.15-4.66)	**4.95** (4.67-5.25)	**5.70** (5.36-6.04)	**6.29** (5.90-6.66)	**6.88** (6.43-7.29)	**7.48** (6.96-7.92)	**8.28** (7.66-8.78)	**8.89** (8.19-9.45)
10-day	**3.60** (3.41-3.81)	**4.26** (4.03-4.50)	**5.01** (4.74-5.30)	**5.61** (5.30-5.92)	**6.40** (6.04-6.75)	**7.02** (6.61-7.40)	**7.64** (7.17-8.05)	**8.25** (7.72-8.71)	**9.05** (8.43-9.56)	**9.66** (8.95-10.2)
20-day	**5.04** (4.79-5.32)	**5.93** (5.63-6.26)	**6.89** (6.53-7.26)	**7.63** (7.23-8.03)	**8.60** (8.14-9.06)	**9.34** (8.82-9.84)	**10.1** (9.48-10.6)	**10.8** (10.1-11.3)	**11.7** (10.9-12.3)	**12.3** (11.5-13.0)
30-day	**6.32** (5.99-6.66)	**7.41** (7.02-7.81)	**8.52** (8.08-8.98)	**9.39** (8.89-9.89)	**10.5** (9.94-11.1)	**11.4** (10.7-12.0)	**12.2** (11.5-12.9)	**13.0** (12.2-13.7)	**14.0** (13.1-14.8)	**14.8** (13.8-15.6)
45-day	**8.05** (7.66-8.46)	**9.40** (8.94-9.88)	**10.7** (10.2-11.2)	**11.7** (11.1-12.2)	**12.9** (12.3-13.6)	**13.8** (13.1-14.5)	**14.7** (13.9-15.5)	**15.5** (14.7-16.3)	**16.6** (15.6-17.4)	**17.3** (16.3-18.2)
60-day	**9.71** (9.26-10.2)	**11.3** (10.8-11.9)	**12.7** (12.2-13.4)	**13.8** (13.2-14.5)	**15.2** (14.4-15.9)	**16.2** (15.4-16.9)	**17.1** (16.2-17.9)	**17.9** (17.0-18.8)	**18.9** (17.9-19.9)	**19.6** (18.5-20.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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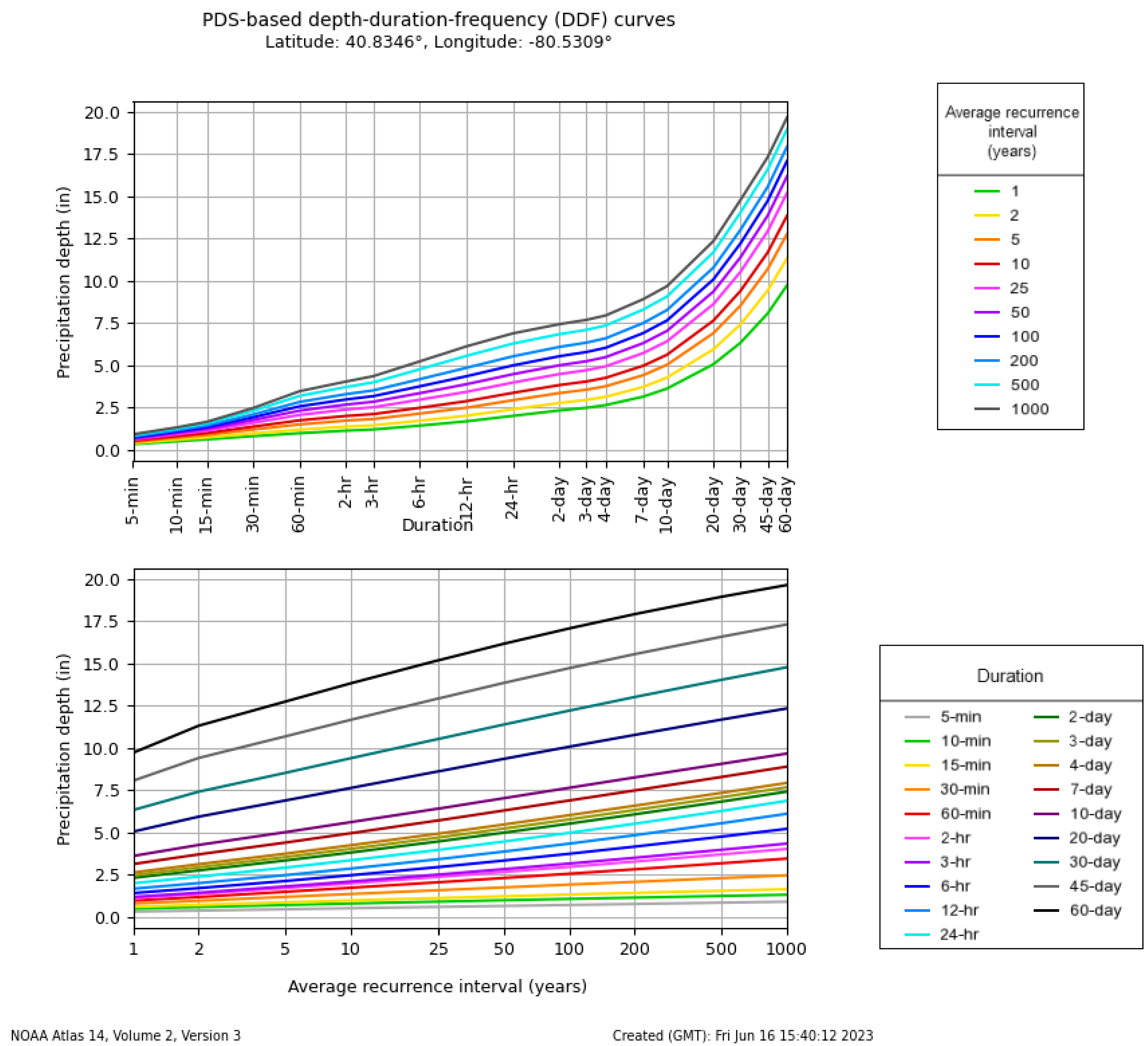
PF graphical



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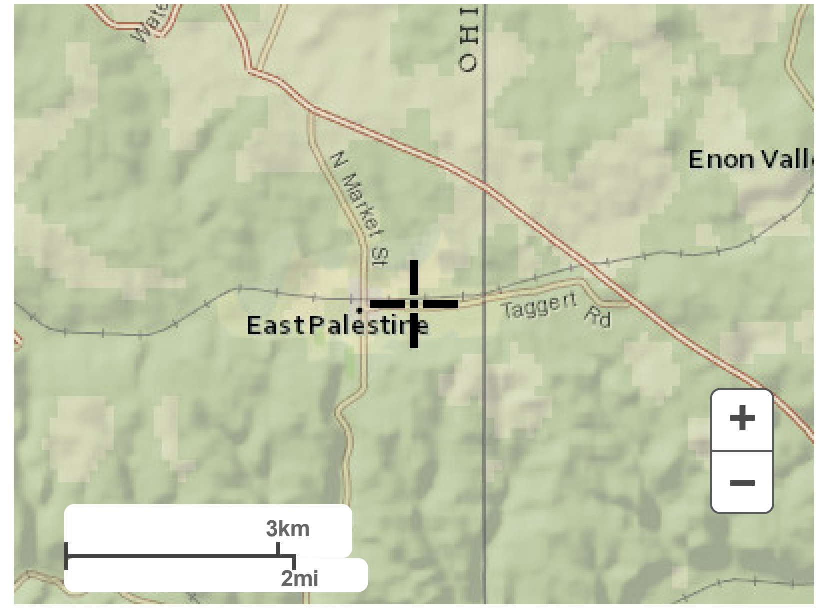
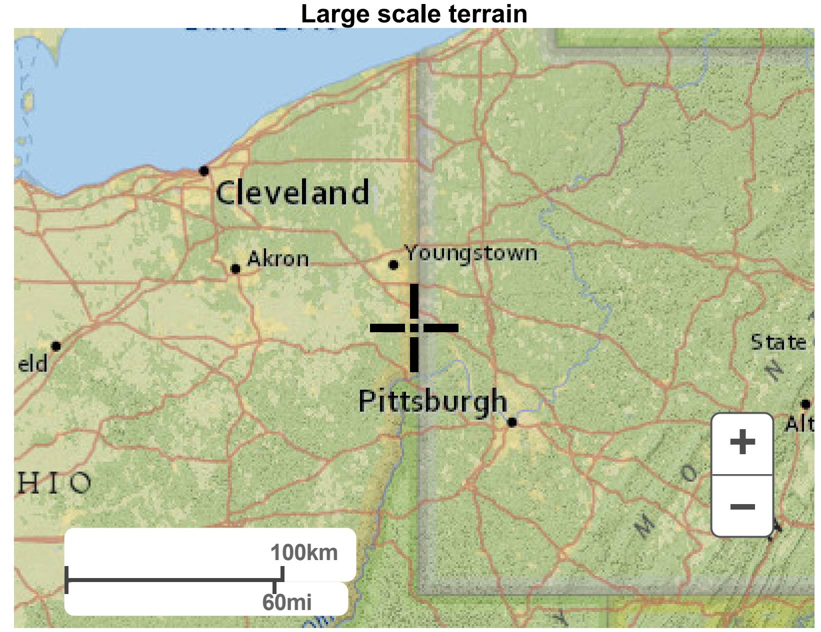
Maps & aerials

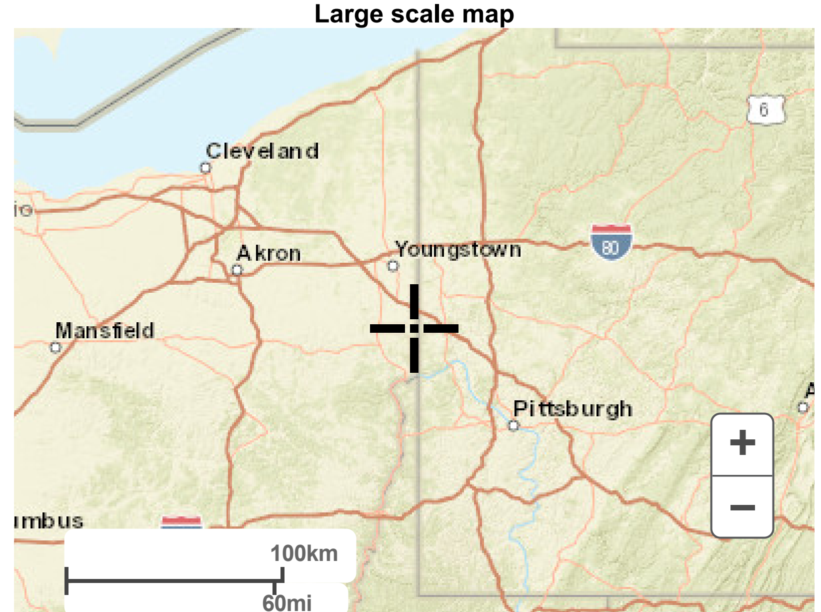
Small scale terrain



Large scale terrain

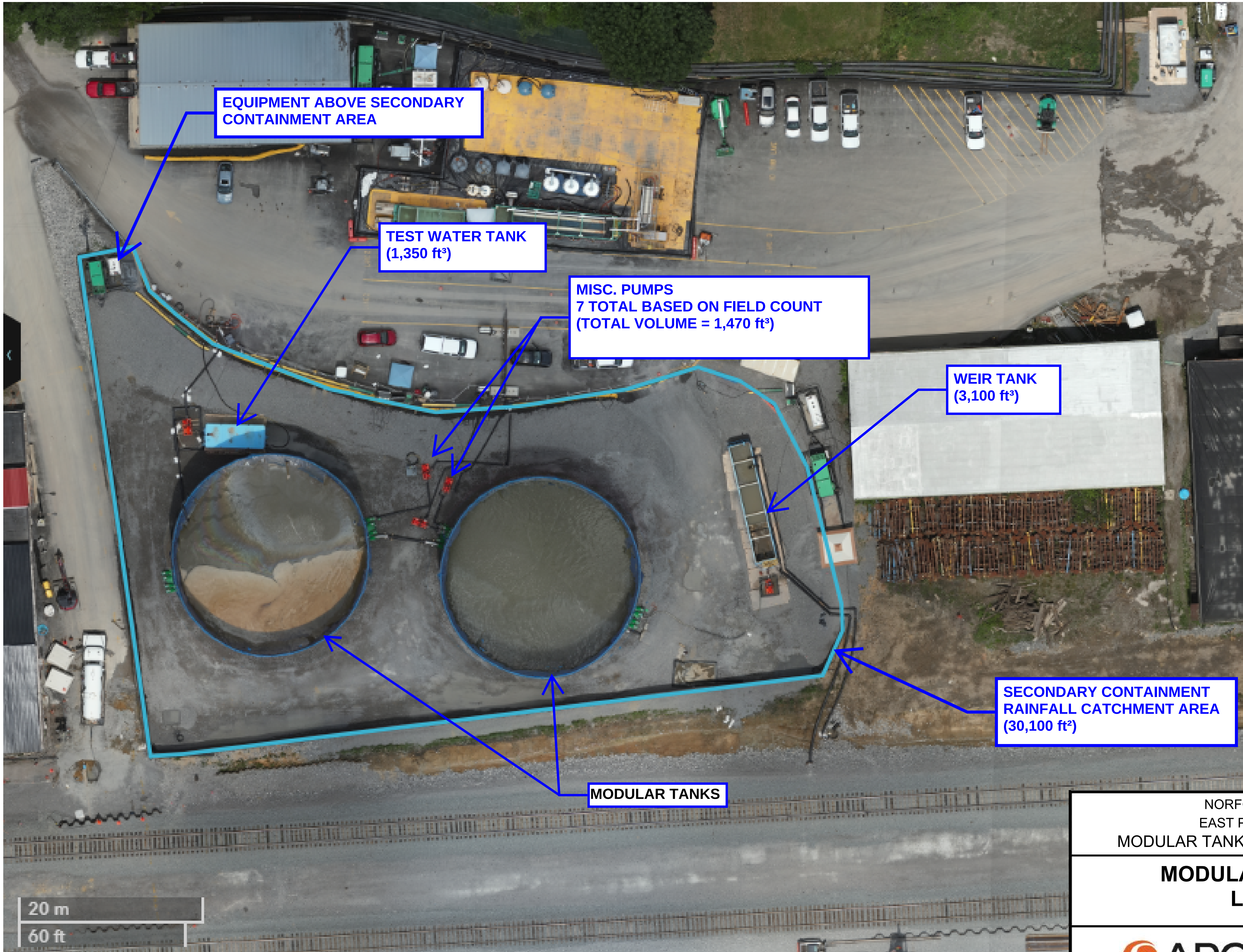


Large scale map



Attachment 4:

Modular Tank Site Layout Figure



NORFOLK SOUTHERN
EAST PALESTINE, OHIO
MODULAR TANK CONTAINMENT AREA

MODULAR TANK SITE LAYOUT

ARCADIS

FIGURE
C-2

Attachment 5:

Secondary Containment Volume Calculation

SURFACE TO DATUM VOLUME REPORT

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: C:\Users\sbogart\ARCADIS\NS East Palestine - Documents\General\11 Engineering & Design\01 Stormwater Management\Pond-Wetland Watershed\TM\Fire Pond Evaluation.pro
Report Generated: Thursday, July 6, 2023 9:42:39 AM

Where the DTM surface is above the datum the volume is reported as fill.
Where the DTM surface is below the datum the volume is reported as excavation.

Shrinkage/swell factors: Excavation 1.0000 Fill 1.0000

DTM Surface Layer Name	Number of Points	Datum Elevation
EG	134	1,032.59

Excavation Volume Beneath Datum (Cu. Yd.)	Fill Volume Above Datum(Cu. Yd.)
6,847.1	301.9

Net Difference: 6,545.2 Cu. Yd. excess volume beneath datum

6,847.1 YD³ x 27 FT³/YD³ = 184,870 FT³

Secondary Containment Sheet Pile Design Existing Conditions (maximum 600K gallons each tank)

CALCULATIONS

Client: Norfolk Southern Railway Company (NSRC) **Project:** 30169714

Title: East Palestine Train Derailment

Prepared by: Samuel Alfaro **Date:** July 5, 2023

Reviewed By: Adam Chwalibog **Date:** July 5, 2023

Subject: Modular Tank Area Secondary Containment Shoring System

Objective:

Determine the maximum wastewater and water (e.g., precipitation) volume that can safely be stored within the existing secondary containment system, currently consisting of PZC-18 sheet pile, with an embedment of 8-ft below ground surface.

Attachments:

A. Shoring Suite Shoring Results Output

Assumptions:

1. Soil classification and parameters used for the shoring evaluations were developed from a review of existing borings SPT-4 through SPT-6, completed adjacent to the secondary containment structure following the placement of the gravel pad.
2. The parameters used in the shoring calculations are shown in Table 1. Soil parameters were developed from published values and correlations for the various soil types and consistencies, and where available, geotechnical laboratory test data.

Table 1. Material Parameters

Material	Unit Weight (pcf)	Undrained Strength Parameters	
		Internal Friction Angle (phi) (degrees)	Cohesion (c) (psf)
Water Surcharge[1]	62.5	0	0
Gravel[2]	125	32	0
Till[3]	125	-	1050

Notes:

1. The Water Surcharge layer represents the wastewater and/or water that would pool on the ground surface in the event of a tank breach or failure. This surcharge imposes lateral earth pressures on the active (driving) side of the sheet pile shoring system and increases the overburden stress of the soils below it.
2. For the Gravel layer, a friction angle of 32 degrees was conservatively assigned to account for a lack of Standard Penetration Test data. The gravel is permeable, therefore will become saturated and buoyant in the event of a tank breach/failure.
3. For the Till layer, soil descriptions from existing borings describe the consistency of this layer as very stiff to hard. N-values recorded in the till in the upper 20-ft bgs ranged from 5 to 23, averaging 12. For conservatism, an undrained cohesion of 1,050 psf was assumed for the shoring modeling. Long-term conditions were not considered for the over-consolidated till.

3. Groundwater Level and Seepage: The groundwater level at the tank site was conservatively estimated at a depth of 5 feet below tank bearing grades, on either side of the sheet pile wall, based on local geotechnical boring data and available site-wide groundwater monitoring data. Seepage was conservatively not considered in our analysis due to the low permeability of the till soil layer in contact with the groundwater surface.
4. Surcharge: A 70-ft wide surcharge pressure of 1800 psf, applied at a distance 12 feet away from the shoring system to represent a fully loaded tank still in service during the event.
5. Lateral Earth Pressures:
   - Triangular Pressure Envelopes.
   - Wall mobilizes enough for active pressure to develop.
   - No seepage at wall tip.
   - Numerical solution (wedge analysis).
   - No wall friction between sheet pile wall and soils.
6. Surcharge Load Lateral Pressures:
   - Flexible Wall conditions
7. Shoring:

- Sheet pile wall with PZC-18 sections (installed sawtooth style), with the following properties:
  - 8-ft minimum embedment
  - Grade 60 Steel
  - Section Modulus: 7.7 (in^3/ft)
- Cantilever wall – no lateral support
- Passive Pressure factor of safety of 1.2 when analyzing the embedment length.

Calculation and Results:

Shoring analysis for the proposed sheet piling shoring system were performed using the Shoring Suite computer program by Civiltech Software.

The analysis was performed using the moment-equilibrium method on a cross-section of the wall, which satisfies both moment and force equilibrium. The shear forces from active and passive earth pressures were evaluated to determine a point of zero moment towards the bottom of the sheet pile. The resulting depth to point of zero moment is multiplied by a cantilever embedment factor to determine the minimum required embedment length and total length of sheet pile wall. When determining the required section modulus, a factor of safety is not applied to the passive lateral earth pressures. Detailed output from the shoring analysis, including figures showing lateral earth pressure distributions, embedment results, and shear force-moment-deflection diagrams are provided in Attachments A, B, and C, respectively. Findings are further discussed below.

Using the design criteria listed in the assumptions section, one scenario for the existing secondary containment section were evaluated for the proposed shoring system.

Results of these evaluations are summarized in Table 2:

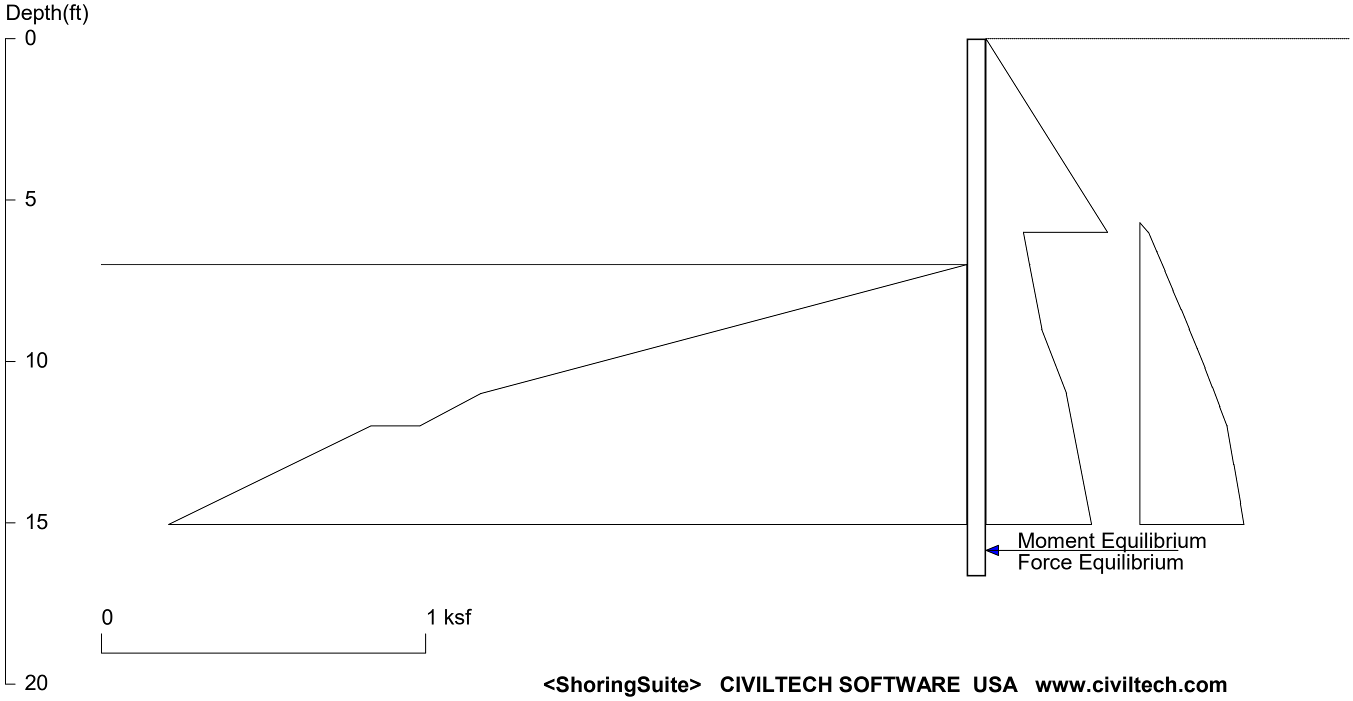
Table 2: Shoring Section Design Requirements

Load Case / Soil Stratigraphy	Min Pile Embedment Length (ft)	Maximum Water Level Retained (ft.)	Minimum Required Section Modulus (in^3/ft)
Containment Wall (South / West)	8	6	2.5

As shown in Table 2, based on the currently installed secondary containment system properties, the maximum allowable volume of stored wastewater or water for the Modular Tank secondary containment area is 6-ft (800k gallons).

Attachment A - Shoring Suite Shoring Results

Influent Tanks
6ft Retained Water Height, FS=1.2



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Wall Height=7.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=8.05 Min. Pile Length=15.05
MOMENT IN PILE: Max. Moment=7.64 per Pile Spacing=1.0 at Depth=11.17

PILE SELECTION:
Request Min. Section Modulus = 2.3 in3/ft=124.43 cm3/m, Fy= 60 ksi = 414 MPa, Fb/Fy=0.66
User Input I (Moment of Inertia):
Top Deflection = 0.11(in) based on E (ksi)=30400.00 and I (in4)/foot=255.5

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	6.000	0.375	0.062500
6.000	0.115	7.000	0.134	0.019204
*	Below	Base		
7.000	0.134	9.000	0.173	0.019204
9.000	0.172	11.000	0.248	0.038214
11.000	0.248	63.000	1.244	0.019138
*	Sur-	charge		
5.700	0.000	6.000	0.026	0.086005
6.000	0.026	6.600	0.052	0.042877
6.600	0.052	7.200	0.077	0.042628
7.200	0.077	7.800	0.102	0.042258
7.800	0.102	8.400	0.128	0.041771
8.400	0.128	9.000	0.152	0.041172
9.000	0.152	9.600	0.177	0.040468
9.600	0.177	10.200	0.200	0.039666
10.200	0.200	10.800	0.224	0.038773
10.800	0.224	11.400	0.246	0.037800

11.400	0.246	12.000	0.268	0.036754
12.000	0.268	13.200	0.290	0.017823
13.200	0.290	14.400	0.310	0.017242
14.400	0.310	15.600	0.330	0.016639
15.600	0.330	16.800	0.350	0.016018

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
*	Below	Base		
7.000	0.000	11.000	1.500	0.375000
11.000	1.500	12.000	1.688	0.187800
12.000	1.839	63.000	12.284	0.204800

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	7.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Secondary Containment Sheet Pile Design – Final Condition (1M gallon tank volume)

CALCULATIONS

Client: Norfolk Southern Railway Company (NSRC) **Project:** 30169714

Title: East Palestine Train Derailment

Prepared by: Samuel Alfaro **Date:** July 5, 2023

Reviewed By: Adam Chwalibog **Date:** July 5, 2023

Subject: Modular Tank Area Secondary Containment Shoring System

Objective:

Determine the sheet pile requirements for the shoring system that will serve as the secondary containment for the Modular Tank area in the event that one tank were to rupture.

Attachments:

A. Shoring Suite Shoring Results

Assumptions:

1. Soil classification and parameters used for the shoring evaluations were developed from a review of existing borings SPT-4 through SPT-6, completed adjacent to the secondary containment structure following the placement of the gravel pad.
2. The parameters used in the shoring calculations are shown in Table 1. Soil parameters were developed from published values and correlations for the various soil types and consistencies, and where available, geotechnical laboratory test data.
3. Maximum anticipated wastewater or water (e.g., precipitation) depth in the secondary containment is approximately 8-ft.

Table 1. Material Parameters

Material	Unit Weight (pcf)	Undrained Strength Parameters	
		Internal Friction Angle (phi) (degrees)	Cohesion (c) (psf)
Water Surcharge(1)	62.5	0	0
Gravel(2)	125	32	0
Till(3)	125	-	1050

Notes:

1. The Water Surcharge layer represents the wastewater and/or water that would pool on the ground surface in the event of a tank breach or failure. This surcharge imposes lateral earth pressures on the active (driving) side of the sheet pile shoring system and increases the overburden stress of the soils below it.
2. For the Gravel layer, a friction angle of 32 degrees was conservatively assigned to account for a lack of Standard Penetration Test data.
3. For the Till layer, soil descriptions from existing borings describe the consistency of this layer as very stiff to hard. N-values recorded in the till in the upper 20-ft bgs ranged from 5 to 23, averaging 12. For conservatism, an undrained cohesion of 1,050 psf was assumed for the shoring modeling. Long-term conditions were not considered for the over-consolidated till.

4. Groundwater Level and Seepage: The groundwater level at the tank site was estimated at a depth of 5 feet below tank bearing grades, on either side of the sheet pile wall, based on local geotechnical boring data and available site-wide groundwater monitoring data. Seepage was conservatively not considered in our analysis due to the low permeability of the till soil layer in contact with the groundwater surface.
5. Surcharge: A 70 ft wide surcharge pressure of 1800 psf was applied at a distance 12 feet away from the shoring system to represent a fully loaded tank still in service during the event.
6. Lateral Earth Pressures:
   - Triangular Pressure Envelopes.
   - Wall mobilizes enough for active pressure to develop.
   - No seepage at wall tip.
   - Numerical solution (wedge analysis).
   - No wall friction between sheet pile wall and soils.

7. Surcharge Load Lateral Pressures:
   - Flexible Wall conditions
8. Shoring:
   - Sheet pile wall with PZC-18 sections, with the following properties:
     - o 25-ft length on road-side (West Side)
     - o 30-ft length on ditch-side (South Side)
     - o Grade 60 Steel
     - o Section Modulus: 33.5 (in^3/ft)
   - Cantilever wall – no lateral support
   - Passive Pressure factor of safety of 1.2 when analyzing the embedment length.

Calculation and Results:

Shoring analysis for the proposed sheet piling shoring system were performed using the Shoring Suite computer program by Civiltech Software.

The analysis was performed using the moment-equilibrium method on a cross-section of the wall, which satisfies both moment and force equilibrium. The shear forces from active and passive earth pressures were evaluated to determine a point of zero moment towards the bottom of the sheet pile. The resulting depth to point of zero moment is multiplied by a cantilever embedment factor to determine the minimum required embedment length and total length of sheet pile wall. When determining the required section modulus, a factor of safety is not applied to the passive lateral earth pressures. Detailed output from the shoring analysis, including figures showing lateral earth pressure distributions, embedment results, and shear force-moment-deflection diagrams are provided in Attachments A, B, and C, respectively. Findings are further discussed below.

Using the design criteria listed in the assumptions section, one scenario for the design section were evaluated for the proposed shoring system.

Results of these evaluations are summarized in Table 2:

Table 2: Shoring Section Design Requirements

Load Case / Soil Stratigraphy	Minimum Required Pile Embedment Length (ft)	Minimum Required Pile Length (ft.)	Minimum Required Section Modulus (in^3/ft)	Maximum Deflection (in.)
West/South Side of Modular Tank Area	11.0	21.84	5.1	0.23
South Side of Modular Tank Area (Ditch-side)	19.5	28.5	5.3	0.4

As shown in Table 2, calculated minimum required pile embedment length and minimum required section modulus values for shoring do not exceed those of the proposed design shoring section.

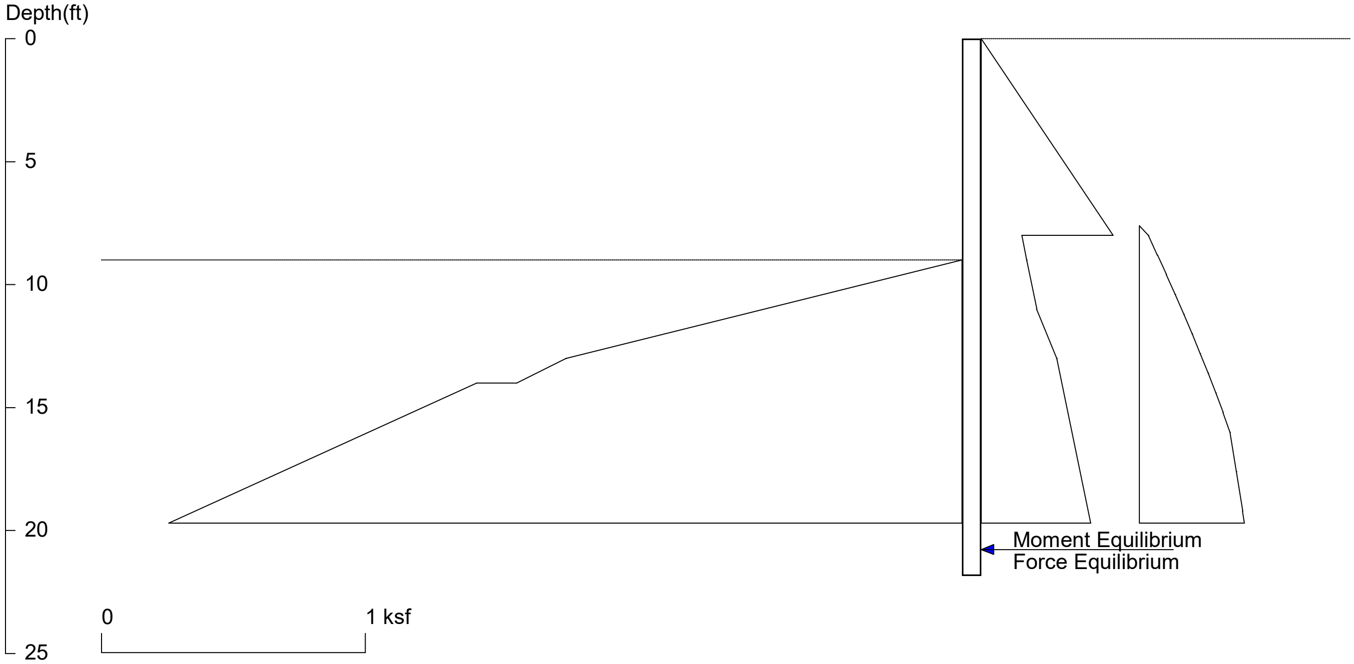
Conclusions:

A sheet pile PZC-18 section, Grade 60 steel, with a length of 25-ft on the west side and 30-ft on the south side, provides a sufficient embedment length and section modulus to meet the secondary containment objective.

Attachment A - Shoring Suite Shoring Results

West Side Shoring Suite Shoring Results

Influent
8-ft Retained Water Height, FS=1.2



<ShoringSuite>   CIVILTECH SOFTWARE USA   www.civiltech.com

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Wall Height=9.0   Pile Diameter=1.0   Pile Spacing=1.0   Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=12.84   Min. Pile Length=21.84
MOMENT IN PILE: Max. Moment=16.67 per Pile Spacing=1.0 at Depth=14.49

PILE SELECTION:
Request Min. Section Modulus = 5.1 in3/ft=271.50 cm3/m, Fy= 60 ksi = 414 MPa, Fb/Fy=0.66
User Input I (Moment of Inertia):
Top Deflection = 0.23(in) based on E (ksi)=30400.00 and I (in4)/foot=255.5

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	8.000	0.500	0.062500
8.000	0.154	9.000	0.173	0.019204
*	Below	Base		
9.000	0.173	11.000	0.211	0.019204
11.000	0.210	13.000	0.287	0.038214
13.000	0.287	81.000	1.588	0.019138
*	Sur-	charge		
7.600	0.000	8.000	0.034	0.085973
8.000	0.034	8.800	0.069	0.042764
8.800	0.069	9.600	0.102	0.042324
9.600	0.102	10.400	0.136	0.041675
10.400	0.136	11.200	0.168	0.040830
11.200	0.168	12.000	0.200	0.039803
12.000	0.200	12.800	0.231	0.038614
12.800	0.231	13.600	0.261	0.037283
13.600	0.261	14.400	0.290	0.035832
14.400	0.290	15.200	0.317	0.034284

15.200	0.317	16.000	0.343	0.032660
16.000	0.343	17.600	0.368	0.015491
17.600	0.368	19.200	0.391	0.014635
19.200	0.391	20.800	0.413	0.013771
20.800	0.413	22.400	0.434	0.012908

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
*	Below	Base		
9.000	0.000	13.000	1.500	0.375000
13.000	1.500	14.000	1.688	0.187800
14.000	1.839	81.000	15.560	0.204787

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	9.00	1.00

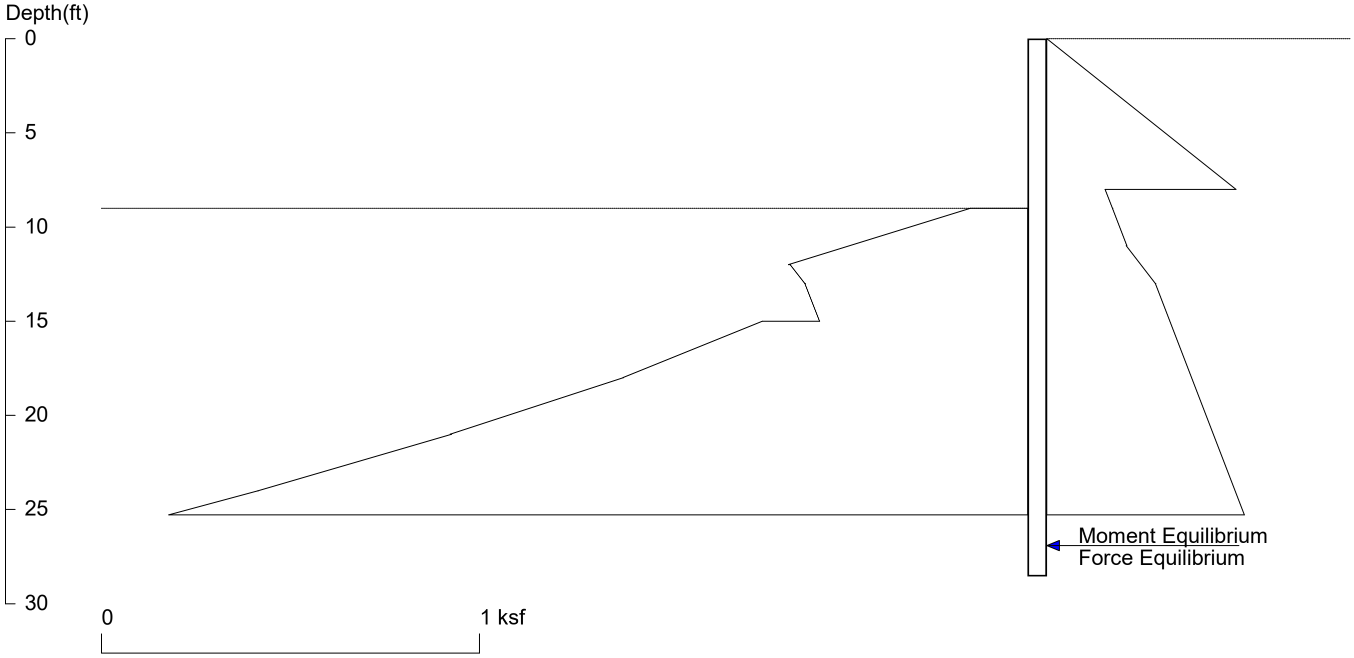
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

South Side Shoring Suite Shoring Results

Influent - PZC-18 Section
Ditch Side



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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Wall Height=9.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=19.54 Min. Pile Length=28.54
MOMENT IN PILE: Max. Moment=20.15 per Pile Spacing=1.0 at Depth=18.12

PILE SELECTION:
Request Min. Section Modulus = 6.1 in3/ft=328.20 cm3/m, Fy= 60 ksi = 414 MPa, Fb/Fy=0.66
User Input I (Moment of Inertia):
Top Deflection = 0.46(in) based on E (ksi)=30400.00 and I (in4)/foot=255.5

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	8.000	0.500	0.062500
8.000	0.154	9.000	0.173	0.019204
*	Below	Base		
9.000	0.173	11.00	0.211	0.019204
11.00	0.210	13.00	0.287	0.038214
13.00	0.287	81.00	1.588	0.019138

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
*	Below	Base		
9.000	0.152	12.00	0.633	0.160117
12.00	0.628	13.00	0.589	-0.03892
13.00	0.589	15.00	0.550	-0.01933
15.00	0.702	18.00	1.070	0.122668
18.00	1.068	21.00	1.528	0.153130
21.00	1.523	24.00	2.036	0.170843
24.00	2.036	27.00	2.585	0.182815

27.00	2.583	30.00	3.159	0.191830

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	9.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Attachment H

Daily Inspection Form

Facility Name:		**Tank System Daily Inspection Log** Tank: stationary waste storage or treatment tank and its associated ancillary equipment and containment system.
Year :	Month:	
Tank ID:		Daily tank inspection required for each tank.

Instructions:

- The person conducting the inspection must also complete this log.
- Check (√) box if ok. For problems, **X** box and explain on the reverse.
- Describe any event, (spills, cracked or compromised containment, non-functional safety equipment, etc.) and corrective actions on the reverse.
- Report spills or leaks to your supervisor immediately.

Day	Printed Name	Signature	Time	System free of corrosion and evident damage?	Secondary containment free of waste and liquid?	Pipes, valves, & pumps free of leaks & in good condition?	There is no evidence of structure failures or releases?	Monitoring equipment data evaluated to ensure proper operation?	Overfill control inspection schedule & procedures followed?	Comment: **X** box and explain on reverse.		
1												
2												
3												
4												
5												
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Note: If the tank system or a component of the tank system is in poor condition or unfit for service, you must take proactive steps to investigate, repair, and/or replace the equipment, parts, or components as required.

Comments/Observations:

Attachment I

Secondary Containment Management

Secondary Containment Management
Norfolk Southern Train Derailment
East Palestine, Ohio
Date: April 12, 2023

Wastes generated as a result of the train derailment are currently stored in staging piles, temporary units (TUs) and containers (drums and totes). Locations of designated waste storage areas are provided in Figure 1 of the Waste Management Plan. All storage areas are equipped with secondary containment that is designed and constructed of suitable materials (e.g., non-earthen materials) to prevent any waste or precipitation collected in the system from reaching the environment. Below is a description of the secondary containment in place at each waste storage area.

- Tank Farms 5 and 6 have welded HDPE liner covering the entire tank farm area with additional HDPE installed under the temporary storage tanks. Rig mats have been placed over the liner to prevent punctures. A containment berm was created using hay bale berms overlain by HDPE liner.
- Tank Farms 2, 3 and 4 and Stand by Tank Farms 1, 2 and 3 and the wastewater treatment plant have individual HDPE liners installed under each temporary storage tank and container storage areas.
- Tank Farm 1 contains two modular tanks were installed within a single secondary containment consisting of an impermeable liner (120 mil Linear Low-Density Polyethylene (LLDPE) liner manufactured by ATARFIL), steel sheet piles, and earthen berms.
- Soil generated within the Area of Contamination is consolidated into staging piles that are placed on a welded HDPE liner system. The containment berm is constructed with hay bale that are covered by the HDPE liner.
- Additional secondary containments (buckets/ kiddie pools) are placed under hose connections during loading and offloading of the temporary storage tanks. Secondary containment utilized during loading and offloading operations for the modular tanks is provided in the Modular Tank Summary Sheet (April 7,2023, Arcadis)

At a minimum, all tanks, containers, staging piles and secondary containment systems are inspected daily. Inspections are recorded in the project files and available for review upon request. If a container or tank is found leaking or unfit for use, the container or tank will be immediately addressed, and the released waste will be immediately transferred to another suitable container or tank. If a secondary containment system is found compromised (unable to collect or prevent a release to the environment), the secondary containment will be repaired. The repair must be sufficient to prevent any waste or precipitation collected in the system from reaching the environment. If unable to be repaired, the unit will be taken out of service.

If waste or rain water is identified in the secondary containment that released waste (solid or liquid) or accumulated precipitation will be removed from the secondary containment as soon as practicable but not later than 24 hours. If waste or precipitation is released outside of secondary containment, the release will be immediately stopped and cleaned-up. Any released waste, accumulated precipitation and/or resulting clean-up materials will be collected and characterized for offsite disposal at a permitted facility.

Any releases outside of secondary containment will be collected and contained. For solid materials, the waste will be returned to the original or intended container or stockpile. Any sidewall of the secondary containment that is compromised will be reenforced with hay bales or similar structurally sound material. For liquids that are released outside of secondary, the impacted surface material will be excavated and containerized in labeled roll-offs or drums and may be consolidated with similar waste streams.

Attachment J

Assessment Certification

Assessment Certification

Based on the documentation gathered and presented and referenced in the Substantive RCRA Requirements for Hazardous Waste Tank Systems ARARs table, I attest that the Modular Tank System has been designed and evaluated to ensure to the extent practicable that the tank system is suitable for the storage of the proposed hazardous waste. This certification is based on the following data gathered and visual inspection of the tanks:

1. Patented tanks that were designed in accordance with applicable standards for structural integrity and have been in use throughout North America.
2. Geotechnical field investigation and testing for the tank and secondary containment foundations.
3. Tank installer's certification that the tanks have been installed in accordance with the manufacturer's installation procedures and that they are ready for service.
4. Secondary containment that has been adequately sized to contain the minimum required plus additional freeboard.
5. Liner compatibility verified for the proposed hazardous waste.
6. Successful operation of the Modular tanks for approximately 5 months confirming they can hold liquid for an extended duration without leak or failure.
7. A June 14th tank inspection, conducted by the tank supplier during tank operation, that indicated the tanks are fit for continued use.

Arcadis was not engaged at the time of selection, procurement, or installation of the tanks and thus all related documentation has been provided by other parties that were engaged during those activities. For the parts of the system that cannot be readily seen by the inspector, this certification is based on best engineering judgment.

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

Name Michael B. Higgins Jr.

Title Principal Engineer

Date July 21, 2023

STATE OF OHIO
Michael B Higgins Jr.
MICHAEL B
HIGGINS JR
E-79115
7 - 21 - 23
REGISTERED
PROFESSIONAL ENGINEER

Norfolk Southern Railway Company

RCRA Tank System Substantive Standards – CID Tanks

East Palestine Train Derailment

Columbiana County, Ohio

August 2023

Substantive RCRA Requirements for Hazardous Waste Tank Systems That May Serve as Applicable or Relevant and Appropriate Requirements (ARARs) to the Tanks Used to Accumulate RCRA Hazardous Wastewater (U043) and Treated Wastewater at the East Palestine Response Action

Norfolk Southern (NS) will use six 200,000-gallon tanks proposed to store the treated wastewater prior to off-site disposal to meet the Substantive RCRA Requirements for Hazardous Waste Tank Systems that may serve as Applicable or Relevant and Appropriate Requirements (ARARs). NS is providing the documentation below to meet the following substantive requirements under RCRA that are applicable to new hazardous waste tank systems (40 CFR Part 264 Subpart J) and tanks identified as "temporary units" (TUs) (40 CFR 264.553) used for managing hazardous remediation waste.

For the purposes of this document, "water" is defined as the following media: surface water, stormwater and/or groundwater. "Wastewater" will be defined as water that has been collected and containerized for offsite disposal.

40 CFR 264.192(a) and OAC Rule 3745-55-92(A) which require a written assessment to show the sufficiency of the tank system's integrity and adequacy of design. Elements of the written assessment must include:

Review Elements	NS Documentation
Design Standard Used for the Tank (e.g., API, ANSI Standard, AISC, etc.)	All tanks (temporary storage tanks and modular tanks) are constructed of high-quality steel and are constructed according to recognized engineering standards. The six, 200,000-gallon, tanks were designed in accordance with: • CSA-S16-01 – Limit States Design of Structural Steel, • CISC Handbook of Steel Construction, and • CSA W59 Welded Steel Construction.
Tank drawings showing the design, dimensions, shell thickness	Tank design drawings illustrating the dimensions and shell thickness are included as Attachment A.
Description of all the ancillary equipment used in the transfer of waste material to the storage tanks, such as feed systems, safety shut-off, by-pass systems, and pressure controls, if necessary (e.g., vents).	The tanks will be filled one at a time by a 6-inch diameter double-walled high density polyethylene (HDPE) pipe manifold constructed on grade. Valves are installed at each tank to isolate the tank being filled. A separate manifold and loading arm will be constructed to fill trucks for off-site disposal. Each tank is fitted with a high-level alarm and automatic pump shut-off and a wastewater level gauge that allows the tank level to be read. The high-level alarm/pump shut-off is set at 10 feet, which is slightly more than one day's treatment volume. This reserves approximately 2 feet of freeboard when full

Review Elements	NS Documentation
	and allows for one foot of wastewater to remain in the tank to anchor the liner following truck load-out for disposal.
Diagram(s) of the piping, instrumentation, and process flow for the tank	See Figure 4d of the *Wastewater Treatment and Contained-In Determination Operational Summary* for a process and instrumentation diagram including the CID Tanks.
Description of controls and practices to prevent spills and overflows	Each tank is fitted with a high-level alarm and system shut-off and a wastewater level gauge that allows the tank level to be read. Inspections will be performed during filling to ensure overfilling does not occur. An additional, centrally located emergency shutoff switch will be available at the truck loading area to shutdown pumping to the tanks if necessary. Only one day's treatment volume will be stored in each tank (approximately 150,000 gallons), which leaves approximately 50,000 gallons or an additional 25 percent of the volume for freeboard. Truck loading and unloading standard operating procedures (SOPs) will be strictly adhered to and continuously reviewed for improvement. SOPs include a dedicated transfer pump operator for safety purposes. Drip pans are used at truck loading and unloading connection points and the activities are constantly monitored. Spills are immediately cleaned-up with spill kits that are readily available.
Compatibility of the tank liner with the waste	The interior of the tanks are lined with a geomembrane liner. The wastewater has been analyzed and there are no contaminants of concern present that would be incompatible with the liner. Refer to Attachment I for tank liner manufacturer's product sheet.
Corrosion protection (e.g., if bottom of tank is in contact with soil)	N/A – The tank liner, which is securing the contents, is not susceptible to corrosion as it is non-metallic. Refer to Attachment I for the tank liner manufacturer's product sheet. The structural tank ring will not be in contact with the underlying native soil as it is bedded on gravel. The gravel is underlain with a 60-Mil HDPE geomembrane liner which is sloped to drain to two sumps collection sumps.
Hydrostatic analysis/calculations (based on maximum liquid content in tank) on the sidewalls and bottom of the tank	Hydrostatic design calculations could not be readily obtained for these manufactured tank systems. However, having been designed in accordance with the design standards listed above, inspection of the tank components by an independent qualified installation inspector, and having been field-tested by filling full and holding clean water for a minimum of 14 hours without

Review Elements	NS Documentation
	leakage or failure demonstrates the tank's intended use for and ability to withstand anticipated hydrostatic pressures.
Evidence of leaks, cracks, corrosion, or erosion in tanks and piping	Tanks have been inspected by an independent, qualified installation inspector for evidence of leaks, cracks, corrosion or erosion. Refer to Attachment B for tank installation inspection reports.
Tank foundation analysis and design, including maintenance of compacted soil tank foundation to prevent edge settlement	The tank foundations consist of a minimum 18-inch-thick layer of compacted gravel. The gravel is underlain with a geotextile cushion layer placed above and below the geomembrane liner for the secondary containment system. The geosynthetics were laid on native subgrade or compacted gravel backfill. Compaction tests were conducted on the tank foundation gravel layer and are provided in Attachment B. The tank foundation was analyzed for bearing capacity and potential settlement. Bearing capacity met minimum factor of safety requirements and the settlement was within tolerances of the tank and appurtenances. Refer to Attachment C for the tank foundation analysis. Tank foundation surfaces are inspected daily for signs of erosion or deterioration to reduce the potential for edge settlement.
Certification of the assessment by a licensed Professional Engineer	Certification of this assessment is provided as Attachment D.

40 CFR 264.192(b) and OAC Rule 3745-55-92(B),(D), and (E) which require proper handling procedures are adhered to in order to prevent damage to the system during installation.

Review Elements	NS Documentation
Tank Installation Procedures	Tanks were delivered and installed in accordance with manufacturer recommendations. Refer to Attachment E for tank installation procedures.
Inspection/testing or other construction quality assurance measures used to ensure tank was installed properly.	An independent, qualified installation inspector was retained to oversee the tank installation. Refer to Attachment B for the installation inspection reports. One June 15th, Hydrera Water Services inspected the CID Tanks following initial filling. The inspection report is included in Attachment B, which included a visual inspection of the exterior of the tank's structural components and the interior liner systems. This inspection, which was performed by the tank supplier, concluded that the tanks are properly installed; being operated in accordance with the standard operating procedure; and are fit for use.

Review Elements	NS Documentation
Tank and ancillary equipment tightness test	Tanks were filled to within 2 feet of the top with clean water and held for a minimum of 14 hours. Tightness test were deemed successful when the level was verified to have not changed and there were no signs of leakage around the perimeter of the tank. Refer to Attachment B for the tank tightness test summary, which is included at the end of the tank installation inspection report.
Evidence of leaks, cracks, corrosion, or erosion in tanks and piping during installation.	An independent, qualified installation inspector was retained to oversee the tank installation. Refer to Attachment B for the tank installation inspection checklist.
Repairs to tank system during installation	A pinhole in the liner of Tank 4 was found during initial test filling. The test water was removed, and the hole was repaired. Tank 4 was subsequently refilled and monitored overnight and no additional leaks were found. Refer to Attachment B for the installation inspection reports.
Ancillary equipment sufficiently supported and protected	Conveyance piping is laid on grade. At the road crossing, piping is buried within a steel pipe casing for pipe protection. Refer to the detail on Figure 2 of the *Wastewater Treatment and Contained-In Determination Operational Summary.*
Licensed Professional Engineer Certification that tank was properly installed/constructed.	Certification provided above. In addition, in accordance with 40 CFR 264.192(a), an independent, qualified installation inspector can be retained to oversee the tank installation. Refer to Attachment B for the independent, qualified installation inspector's report.

40 CFR 264.193 and OAC Rule 3745-55-93 which require secondary containment for new hazardous waste tank systems.

Review Elements	NS Documentation
Design, capacity, and construction of the secondary containment	The secondary containment system consists of a 60-mil-thick HDPE liner installed beneath the tanks and on the sideslopes of the containment. The liner surface is sloped to drain to two sumps for collection of any precipitation that falls within the containment and infiltrates the stone pad covering the liner. A stone pad, varying in thickness from 18 inches to 36 inches, protects the liner and provides structural support for the tanks. In addition, a 16-ounce non-woven geotextile was installed above and below the liner to protect it from punctures or other damage. Secondary containment sideslopes were constructed of earth on the northern, western and eastern sides. Sheet piles are installed along the southern side to limit the required footprint and allow the additional space for truck load-out operations.

Review Elements	NS Documentation
	The secondary containment area was sized to provide for 100 percent of the volume of the largest tank and a minimum of 4 inches of freeboard to account for rainfall from the 25-year, 24-hour storm event (3.96 inches; Reference: National Oceanic and Atmospheric Administration Atlas 14, Volume 2, Version 3, East Palestine, Ohio). The containment calculation also accounts for the displacement of five tanks. Wastewater or other water that accumulates within the secondary containment area is collected by two sumps and will be pumped into the Modular Tanks by direct piping or collected via vac truck. Refer to Attachment F for the secondary containment calculation analysis.
Compatibility with the waste stored in the tank	The secondary containment system is constructed with HDPE liner. The wastewater has been analyzed and there are no contaminants of concern present that would be incompatible with HDPE.
Foundation analysis and design	Liner subgrade was proof-rolled and inspected for any soft or yielding material, which was removed and replaced with stone fill. Once the subgrade was un-yielding, it was inspected for any protrusions greater than 3 inches. A 16-ounce non-woven geotextile was installed over the prepared subgrade prior to liner installation. An engineering analysis was performed on the sheet pile wall located along the southern side of the containment to ensure an adequate embedment depth. Refer to Attachment F for the sheet pile calculation brief.
Leak detection system (in particular, since tank has a flat bottom)	Leak detection for the tanks will be achieved by daily visual inspections that will be documented on daily inspection forms. Leak detection is also achieved by monitoring the secondary containment collection sumps at the southeast and southwest corners of the tank pad for accumulated wastewater or water.
Adequate drainage to leak detection system	As described above, the secondary containment liner surface is sloped to drain to one of two sumps for collection purposes.
Capacity to contain 100 percent of the capacity of largest tank (assumption that both tanks are not connected to each other)	The secondary containment has a total capacity of 460,913 gallons. This capacity includes 100 percent of the capacity of the largest tank (200,000 gallons), 3.96 inches of freeboard to account for the 25-year rainfall depth, and an additional 10 inches of freeboard capacity. Refer to Attachment F for the secondary containment volume analysis.
Meets requirements for external liner system specified in 40 CFR 264.193(e)(1) and OAC Rule 3745-55-93(E)(1)	A geomembrane liner system in the secondary containment provides the following in accordance with the referenced requirements: • Containment for 100% of the capacity of the largest tank.

Review Elements	NS Documentation
	• Prevents run-on of precipitation due to the earthen berms and sheet pile wall at the containment perimeter and designed to provide capacity for the 25-year, 24-hour storm. • Barrier free of cracks and gaps since all seams were non-destructively tested utilizing either air channel or vacuum box testing in accordance with the Manufacturer Installation Manual and industry accepted procedures detailed in Geosynthetics Research Institute Specification "GM13 - Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes • The secondary containment system completely surrounds the tanks and is capable of preventing lateral and vertical migration of waste due to the perimeter berms and sheet pile wall.
Ancillary equipment associated with tank is provided secondary containment or visually inspected on a daily basis (for qualified equipment)	Ancillary equipment (i.e., conveyance piping) is double-walled HDPE pipe and will be inspected on a daily basis.

40 CFR 264.194 and OAC Rule 3745-55-94 which specify general operating requirements.

Review Elements	NS Documentation
Practices employed to prevent spills and overfilling (this information is also discussed in the written assessment requirements identified above)	A high-level alarm that turns-off treatment system pumping will be installed on each tank. In addition, a level gauge will be installed on the exterior of each tank to allow for visual monitoring of tank levels. To ensure the integrity of the tanks and to reduce the potential for spills, the following criteria will be monitored: • All containers and tanks will be maintained in good condition, with no leaks, corrosion, rust, or bulges. • All signs and labels will be properly maintained. • Tanks are in a secure area and protected from traffic. • At a minimum, the tanks will undergo daily visual inspection. Inspections will be documented on the Daily Inspection Form (Attachment G). • All staff performing hazardous waste tasks, including daily inspections of the Temporary Units (includes all tanks and storage areas) are trained in accordance with 40 CFR §262.17(a)(7) and OAC 3745-52-17(a)(7). Training certificates are provided to NSRC and maintained in the project files. • Tank secondary containment will be maintained in accordance with the Secondary Containment Standard Operating Procedures (Attachment H) included in the Waste Management Plan. • The following Preparedness and Prevention Measures will be maintained in the storage area: - A list of emergency contacts, - Personnel working in the storage area will carry an emergency radio/cell phone anytime waste is being placed in the storage area or loaded for offsite transport, and during sampling and inspection activities, - Fire extinguishers if flammable liquids are present, - Materials to control spills (i.e., spill absorbents, extra 55-gallon drums to transfer wastes),

Review Elements	NS Documentation
	- PPE supplies (i.e., eyewash, first aid kit).
Required freeboard	As each tank only will contain one day's treatment volume (144,000 gallons or approximately a 9-foot depth), the typical minimum freeboard for the tank will be approximately 3 feet. This exceeds the minimum required freeboard for precipitation from the 25-year, 24-hour storm.

40 CFR 264.195 and OAC Rule 3745-55-95 which requires the tank operator to develop and follow a schedule and procedure for inspecting overfill controls.

Review Elements	NS Documentation
Inspection procedures and documentation of inspections	At a minimum, all tanks, ancillary equipment and secondary containment systems are inspected daily. Inspections are recorded in the project files and available for review upon request. If a tank is found leaking or unfit for use, the tank will be immediately addressed. If a secondary containment system is found compromised (unable to collect or prevent a release to the environment), the secondary containment will be repaired. If wastewater or water is identified in the secondary containment, accumulated precipitation will be removed from the secondary containment as soon as practicable but not later than 24 hours.
Daily inspection schedule of operating data	
Daily inspection schedule of the tank, ancillary equipment, and secondary containment system	
Procedure to remedy any malfunctions or deterioration of the tank system identified from inspection	

40 CFR 264.196 and OAC Rule 3745-55-96 which require the tank operator to respond to leaks or spills.

Review Elements	NS Documentation
Procedures to respond to leaks or spills from tanks and/or ancillary equipment	If any tank is observed to be leaking, is in a condition that it is likely to leak or has any damage or corrosion that may compromise the integrity of the containment, the Site Waste Coordinator should be immediately notified and necessary corrective actions will be performed. NS personnel must also be notified immediately. For leaks or threats of leaks, efforts will be made to seal or stop the leak (with caulking foam, other sealant, or other safe measures), contain, and collect leaking material. If leaks cannot be readily stopped, then the container and/or tank will be taken out of service and waste transferred to a non-leaking container. Releases to the secondary containment will be recovered as much as possible using common recovery methods such as vacuum trucks, absorbents and shovels.
Management of waste or materials contaminated by spills or leaks.	Management of waste/impacted materials as a result of a spill or leak from a tank will be completed in accordance with the Derailment Waste Management Plan prepared under separate cover that provides procedures for onsite management, characterization, and offsite disposal of waste associated with the derailment. Emergency Response and notification of releases will be performed in accordance with Section XVII of the UAO (USEPA 2023). A summary of the requirements is provided below: *If any event occurs during performance of the Work that causes or threatens to cause a release of any Waste Material on, at, or from the Site that either constitutes an emergency situation or that may present an immediate threat to public health or welfare or the environment, NS will immediately take all appropriate action to prevent, abate, or minimize such release or threat of release. NS will take these actions in accordance with all applicable provisions of this Order, including, but not limited to, the Health and Safety Plan. NS will immediately notify the OSCs or, in the event of his/her unavailability, the Regional Duty Officer for Region 5 (at 312/353-2318) and Region 3 (at 215/814-3255) of the incident or Site conditions.* *If a release of hazardous waste or hazardous substances occurs where NS is required to report pursuant to Section 103 of CERCLA,*

Review Elements	NS Documentation
	42 U.S.C.§ 9603, or Section 304 of the Emergency Planning and Community Right-To-Know Act (EPCRA), 42 U.S.C. § 11004, NS will immediately call the OSC, or, in the event of his/her unavailability, the Regional Duty Officer at Region 5 (at 312/353-2318) and Region 3 (at 215/814-3255) and the National Response Center at (800) 424-8802. This reporting requirement is in addition to, and not in lieu of, the reporting required by CERCLA §§ 103 and 111(g), or EPCRA § 304.
Repair methods for tank and ancillary equipment, including certification for major repairs	Tanks and ancillary equipment will be repaired by qualified personnel and certified by an independent, qualified inspector.
Notification of leaks or spills to USEPA and OEPA	For all Emergencies and releases a written report to USEPA within 7 days after the onset of such event, setting forth the action or event that occurred and the measures taken, and to be taken, to mitigate any release or threat of release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release or threat of release.

40 CFR 264.197 and OAC 3745-55-97 which specify closure requirements.

Review Elements	NSR Documentation
Decontamination method/procedures for tanks, secondary containment, and ancillary equipment.	Ancillary equipment that will be returned to the vendor will be cleaned to the vendors specifications (typically rinsed and visually clean); tank liners, piping and other materials that will be discarded will be managed as U043 hazardous waste or will be decontaminated in accordance with the debris decontamination standards in 40 CFR 268.45 and managed as a non-hazardous waste. Any residuals generated from the decontamination of U043 debris or from cleaning equipment that will be returned to the vendor will be managed as a U043 waste for offsite disposal. Post removal confirmatory sampling will be conducted for material in contact with or surrounding the storage areas to demonstrate contaminants are not present. If contaminants are present, materials will be removed and additional sampling will be conducted until it can be demonstrated that no contamination is present at concentrations that would require long-term monitoring and maintenance (i.e., post-closure care).
Disposition of contaminated materials	
Media sampling demonstrating that no contamination is present at concentrations that would require long-term monitoring and maintenance (i.e., post-closure care)	

Attachments

Attachment A - Tank Design Drawings

Attachment B - Tank Installation Inspection Reports and Field Density Test Results

Attachment C - Tank Foundation Analysis

Attachment D - Assessment Certification

Attachment E - Tank Installation Procedures

Attachment F - Secondary Containment Analysis

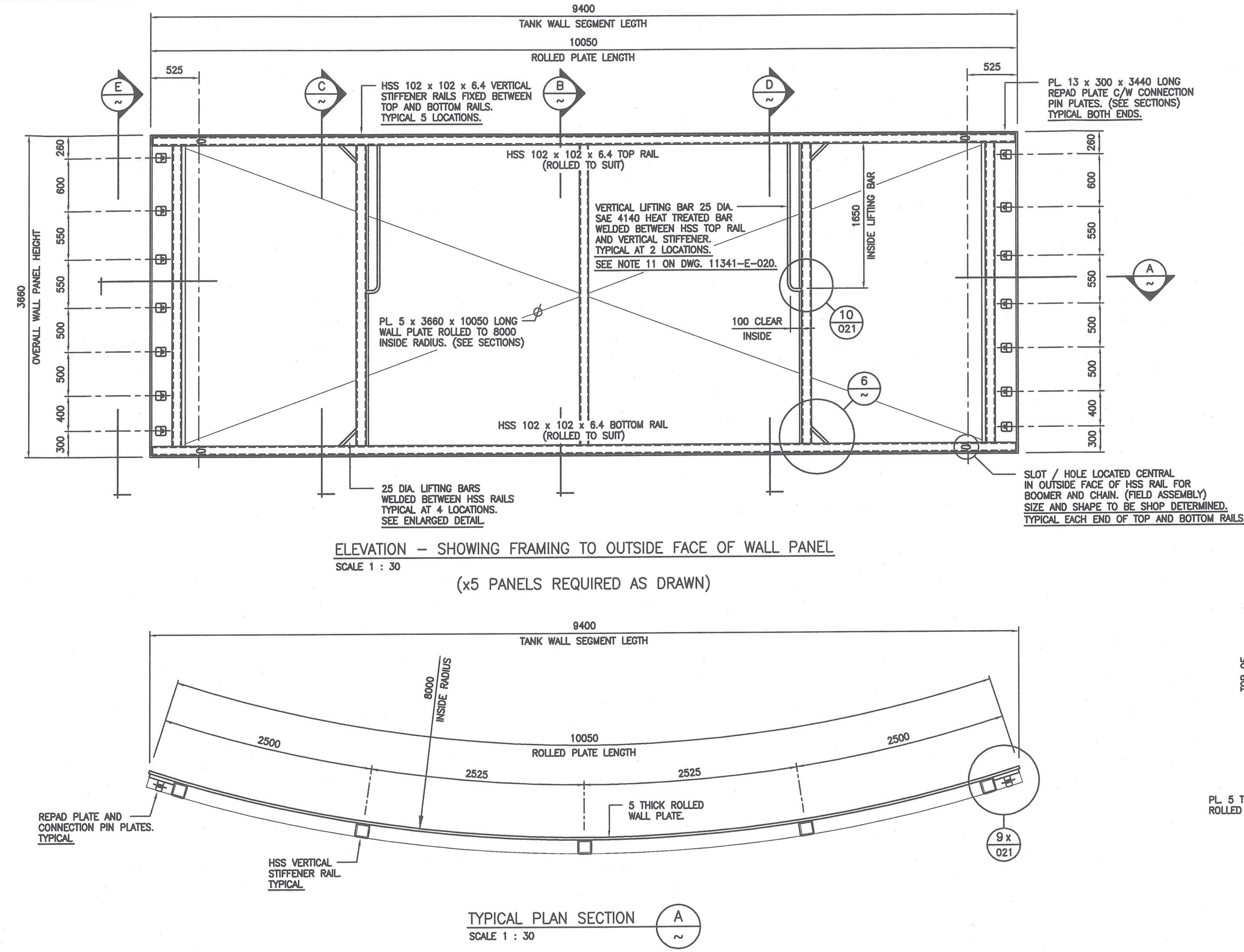
Attachment G - Daily Inspection Form

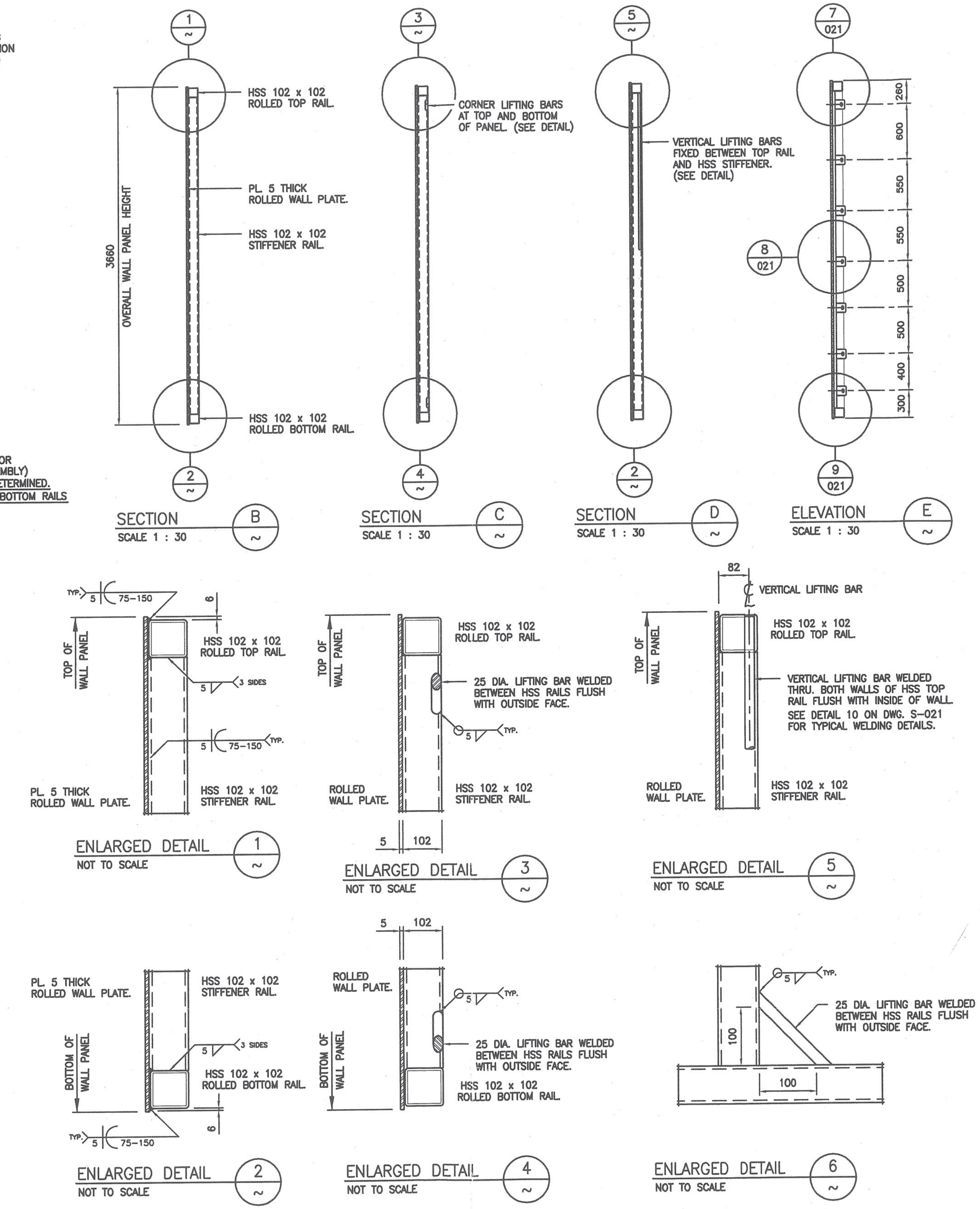
Attachment H - Secondary Containment Management

Attachment I - Tank Liner Product Information

Attachment A

Tank Design Drawings





GENERAL NOTES :

1. STRUCTURAL STEEL DESIGN, FABRICATION AND ERECTION SHALL COMPLY WITH THE LATEST EDITION OF :
   - CSA-S16-01 LIMIT STATES DESIGN OF STRUCTURAL STEEL
   - CISC HANDBOOK OF STEEL CONSTRUCTION
   - CSA W59 WELDED STEEL CONSTRUCTION
2. MATERIALS SHALL CONFORM TO THE FOLLOWING GRADES OF CSA G40.21 :
   - HOLLOW STRUCTURAL SECTIONS – 350W
   - W SHAPES – 350W
   - C AND L SHAPES – 300W
   - PLATE AND ALL OTHER SECTIONS – 300W (UNLESS NOTED OTHERWISE)
3. ALL WELDING SHALL BE IN ACCORDANCE WITH CSA W59-M 'WELDED STEEL CONSTRUCTION (METAL ARC WELDING)'.
4. FRAMING TO BE OF SOLID WELDED CONSTRUCTION (E-49XX) COPE FRAMING MEMBERS INTO ONE ANOTHER.

PROFESSIONAL ENGINEER MICHAEL HAYDEN ALBERTA

June 2/10

APEGGA PERMIT NO. 2042

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE	BY	CHK'D	APP'D	CLIENT APP'D
11341-S-021	TANK WALL PANEL FRAMING DETAILS	A	ISSUED FOR REVIEW	02.06.10	RP	MH		
11341-E-020	TANK ASSEMBLY LAYOUT PLAN & SECTIONS	0	ISSUED FOR CONSTRUCTION	02.06.10	RP	MH		

FILE : 11341-S-020

ENGINEER AND PERMIT STAMPS

Client :

Project : 16m dia. MODULAR WATER TANK

TYPICAL TANK WALL PANEL FRAMING PLAN, ELEVATION, SECTIONS & DETAILS

Designed :	Date :	Drawn :	Date :	Checked :	Date :	Job No.	Scale :	Dwg. No.	
JH	01.12.09	RP	01.06.010	MH	02.06.10	11341	AS NOTED	11341-S-020	0

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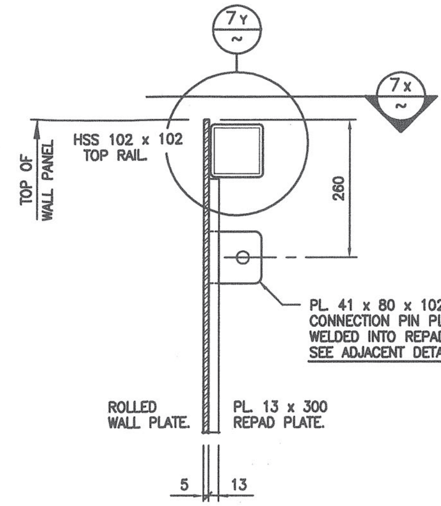

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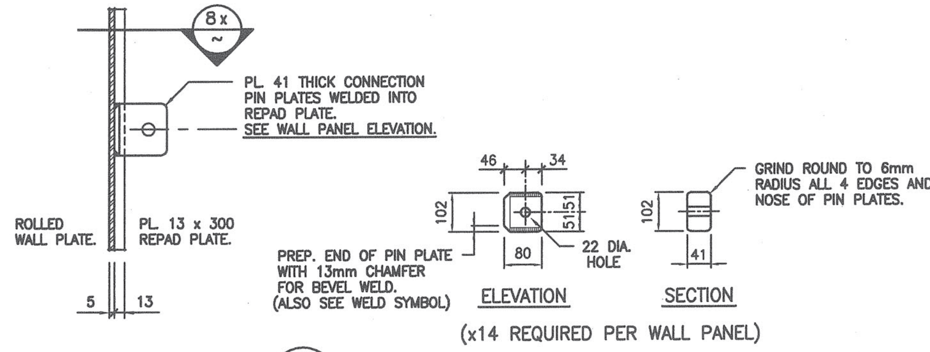

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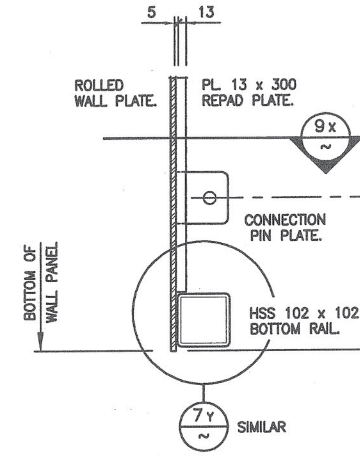

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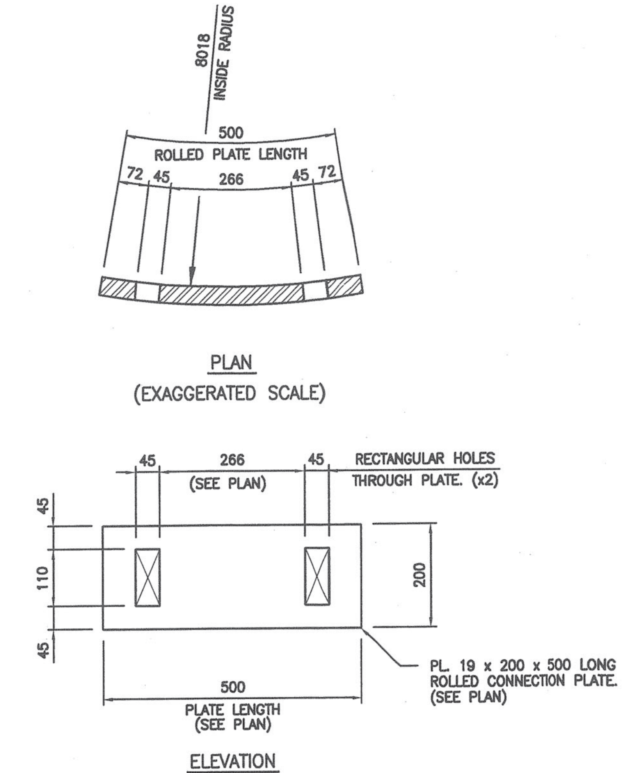
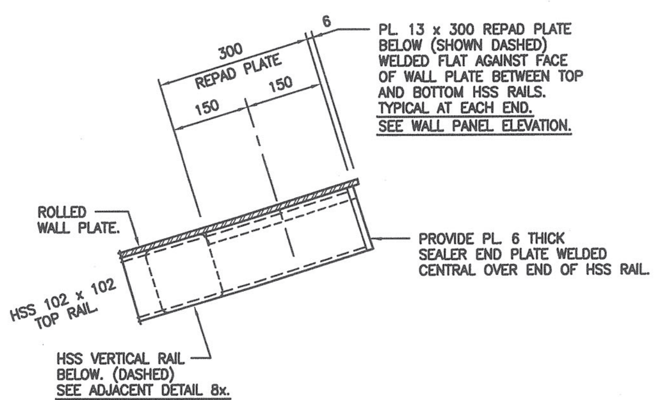


WALL PANEL CONNECTION PLATES

(x7 REQUIRED PER WALL PANEL)

NOTE :
PAINT OUTSIDE FACE OF PLATE FOR IDENTIFICATION PURPOSES ONLY.



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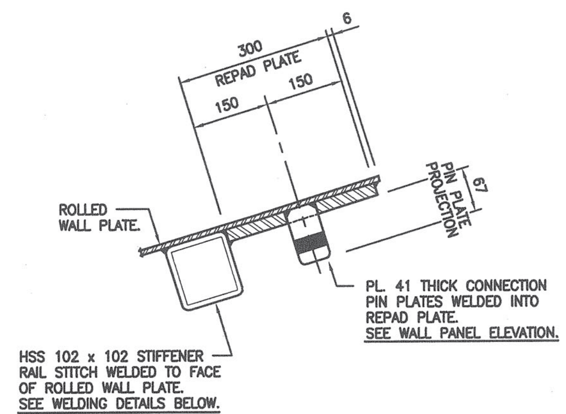

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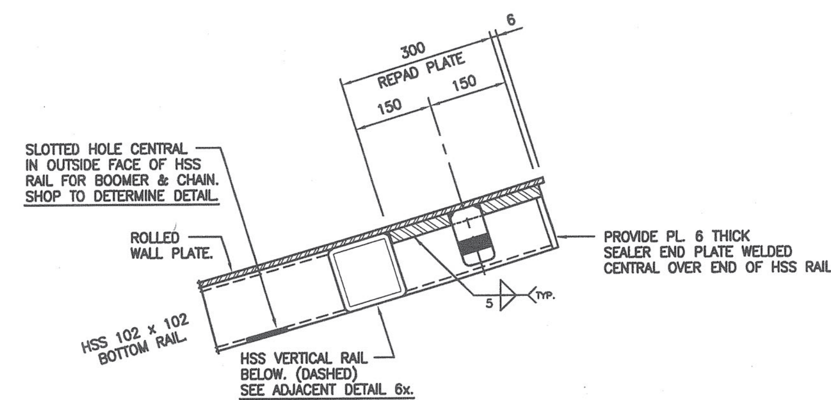

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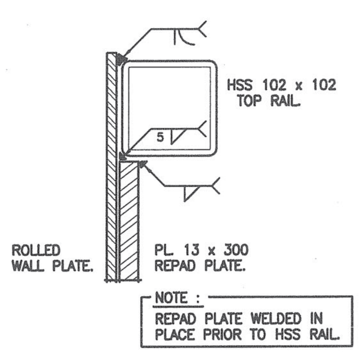

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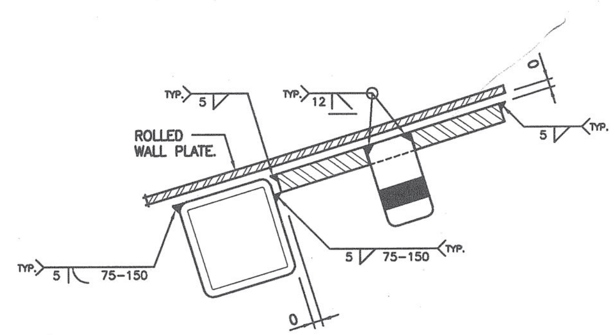
NOT TO SCALE

EXPLODED TO SHOW WELD DETAILS.



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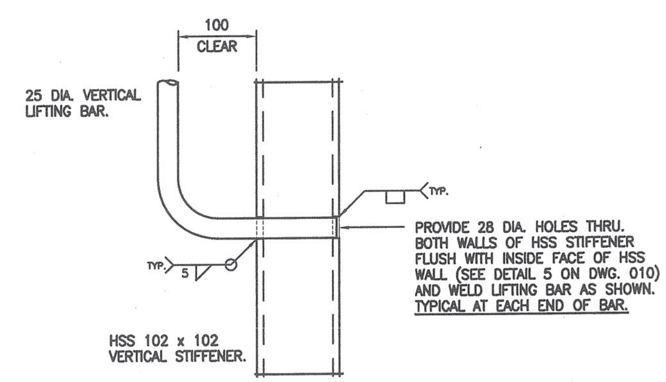

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PROFESSIONAL ENGINEER – MICHAEL HAYDEN – ALBERTA
June 2/10

APEGGA PERMIT NO. 2042

NOTE :
REFER TO DRAWING 11341-S-020 FOR ALL MATERIAL SPECIFICATIONS AND CONSTRUCTION NOTES.

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE	BY	CHK'D	APP'D	CLIENT APP'D
11341-S-020	TANK WALL PANEL FRAMING LAYOUTS	A	ISSUED FOR REVIEW	02.06.10.	RP	MH		
		0	ISSUED FOR CONSTRUCTION	02.06.10	RP	MH		

FILE : 11341-S-021

ENGINEER AND PERMIT STAMPS

Client :
Project : 16m dia. MODULAR WATER TANK

TYPICAL TANK WALL PANEL FRAMING SECTIONS AND DETAILS

Designed :	Date :	Drawn :	Date :	Checked :	Date :	Job No.	Scale :	Dwg. No.	
JH	01.12.09	RP	02.06.10	MH	02.06.10	11341	AS NOTED	11341-S-021	0

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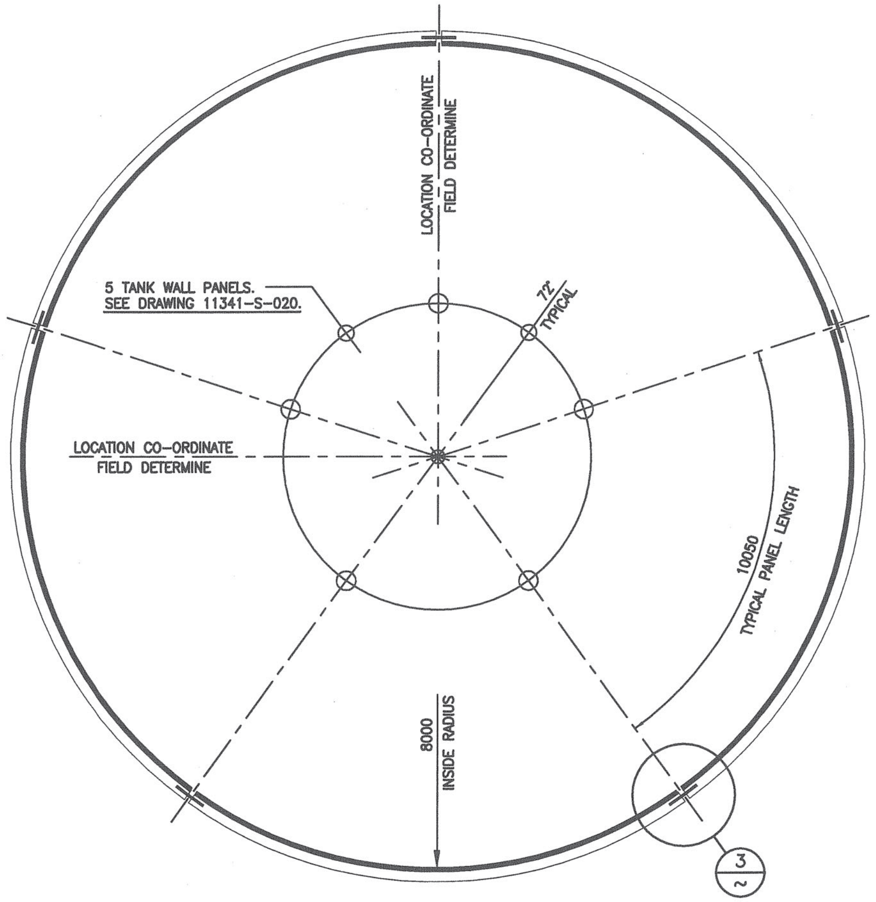

TANK LAYOUT PLAN (A)
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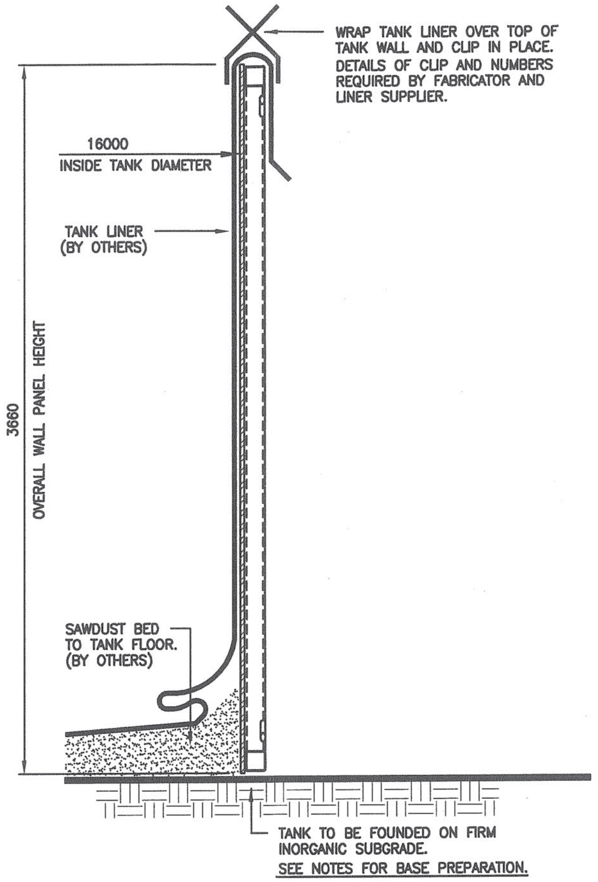

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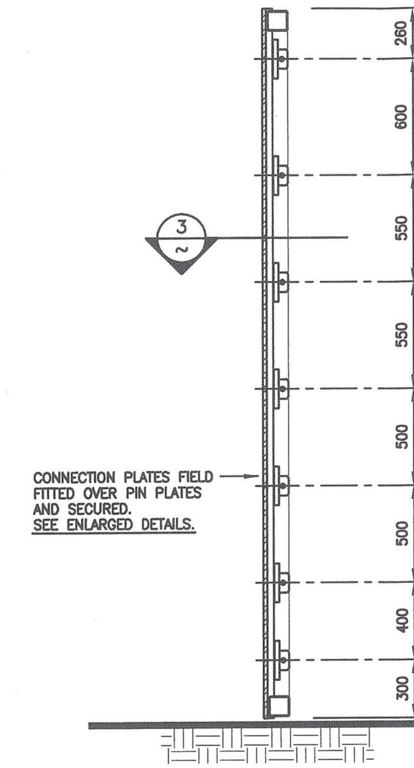

WALL SECTION AT PANEL JOINT (2)
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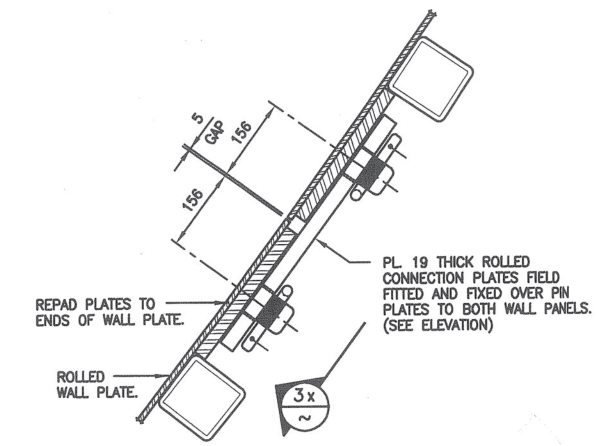

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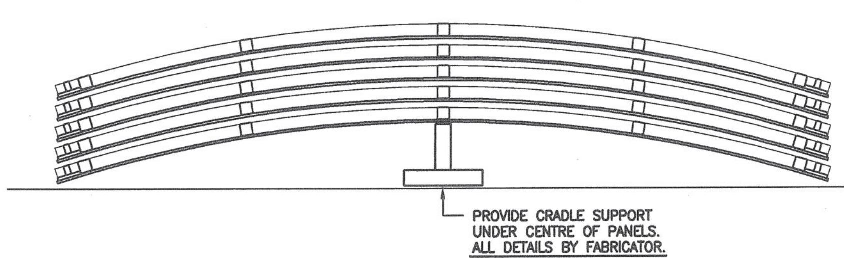

TRANSPORT AND STORAGE DETAILS
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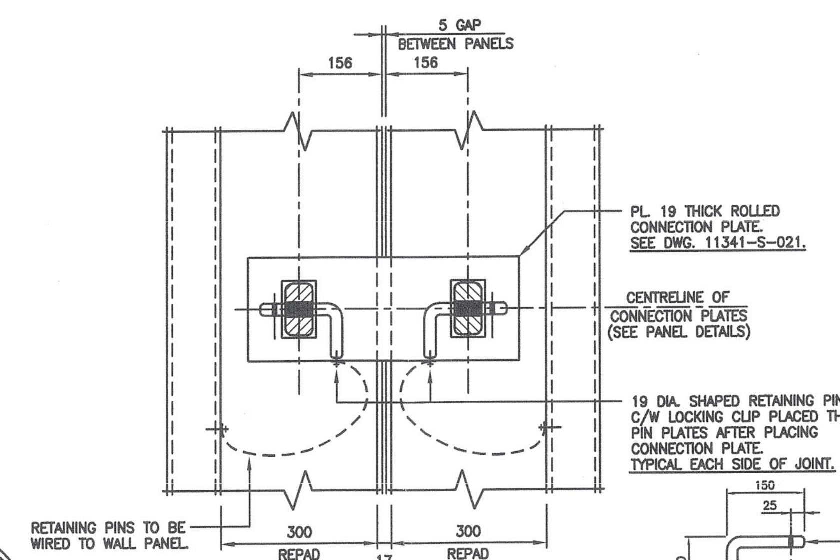

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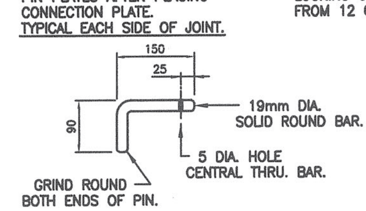
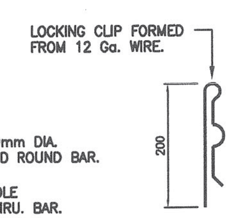
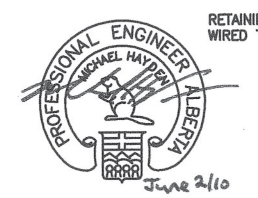


RETAINING PIN



LOCKING CLIP

SUGGESTED PIN AND CLIP DETAILS
SHOP TO CONFIRM ALL DETAILS



APEGGA PERMIT NO. 2042

NOTES :

1. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE AND FOR THE SAFETY OF ALL PERSONNEL DURING ASSEMBLY AND DISASSEMBLY. ALL WORK SHALL BE IN STRICT ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.
2. THE CONTRACTOR SHALL ENSURE ALL THE PANELS ARE ADEQUATELY SUPPORTED OR BRACED UNTIL THE ENTIRE STRUCTURE IS ASSEMBLED.
3. ALL TOPSOIL, ORGANICS, SOFT OR WET SOILS, DEBRIS OR OTHER DELETERIOUS MATERIALS SHALL BE REMOVED FROM THE TANK SITE.
4. THE FINISHED GRADES ALONG THE PERIMETER OF THE TANK SHALL BE LEVEL AND TRUE TO PLANE. THE MAXIMUM ELEVATION DIFFERENCE ACROSS ANY TWO DIAMETRICAL POINTS SHALL BE LESS THAN 250mm.
5. THE MAXIMUM DEVIATION FROM PLANE OVER ANY 3.0 METERS OF CIRCUMFERENCE SHALL BE LESS THAN 5mm AND LESS THAN 12mm OVER ANY 10.0 METERS OF CIRCUMFERENCE.
6. THE AREA SURROUNDING THE TANKS SHALL BE GRADED TO DIRECT SURFACE WATER AWAY FROM THE TANK.
7. THE EDGE OF ANY (EXCAVATED) SUMP SHALL BE A MINIMUM OF 900mm FROM THE EDGE OF THE TANK WALL.
8. THE PANELS SHALL BE ERECTED PLUMB. THE MAXIMUM OUT-OF-PLUMBNESS OF THE TOP OF THE PANEL RELATIVE TO THE BOTTOM SHALL BE LESS THAN 25mm.
9. THE MAXIMUM DEVIATION FROM THE THEORETICAL RADIUS SHALL BE LESS THAN 50mm AT ANY POINT ALONG THE TANK WALL.
10. THE LINER SHALL BE SECURELY FASTENED TO THE TOP OF EACH PANEL IN ACCORDANCE WITH THE LINER'S MANUFACTURER'S RECOMMENDATIONS. THE LINER SHALL BE INSTALLED WITH SUFFICIENT SLACK AT THE BASE OF THE PANEL TO PREVENT ANY TENSION IN THE LINER.
11. THE VERTICAL LIFTING BAR SHALL ONLY BE USED TO LIFT THE PANELS INTO THE VERTICAL POSITION. THE LIFT RIGGING MUST BE WITHIN 250mm OF THE TOP RAIL PRIOR TO LIFTING THE PANEL.

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE	BY	CHK'D	APP'D	CLIENT APP'D
11341-S-020	TANK WALL PANEL FRAMING LAYOUTS	A	ISSUED FOR REVIEW	02.06.10	RP	MH		
11341-S-021	TANK WALL PANEL FRAMING DETAILS	0	ISSUED FOR CONSTRUCTION	02.06.10	RP	MH		

FILE : 11341-E-020

ENGINEER AND PERMIT STAMPS

Client :
Project : 16m dia. MODULAR WATER TANK
TANK INSTALLATION AND ASSEMBLY
LAYOUT PLAN, SECTIONS AND DETAILS

Designed :	Date :	Drawn :	Date :	Checked :	Date :	Job No.	Scale :	Dwg. No.	
JH	01.12.09	RP	01.06.10	MH	02.06.10	11341	AS NOTED	11341-E-020	0

Beck
ENGINEERING (1992) LTD.
www.beckeng.ab.ca

Attachment B

Tank Installation Inspection Reports and Field Density Test Results

Tank Installation Inspection Reports

AST INSTALLATION CHECKLIST

Tank name or ID number# 1

Inspector Name William Umbaugh

Date: 6-11-23

Client Xylem/NS - East Palestine, OH (CDC)

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30	WU		
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures		WU	
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner	WM		
MISC notes			
MISC notes			
MISC notes			
Informed on site personnel that Safety Life Ring is needed. was informed they will be purchased and placed at stairs MISC notes			

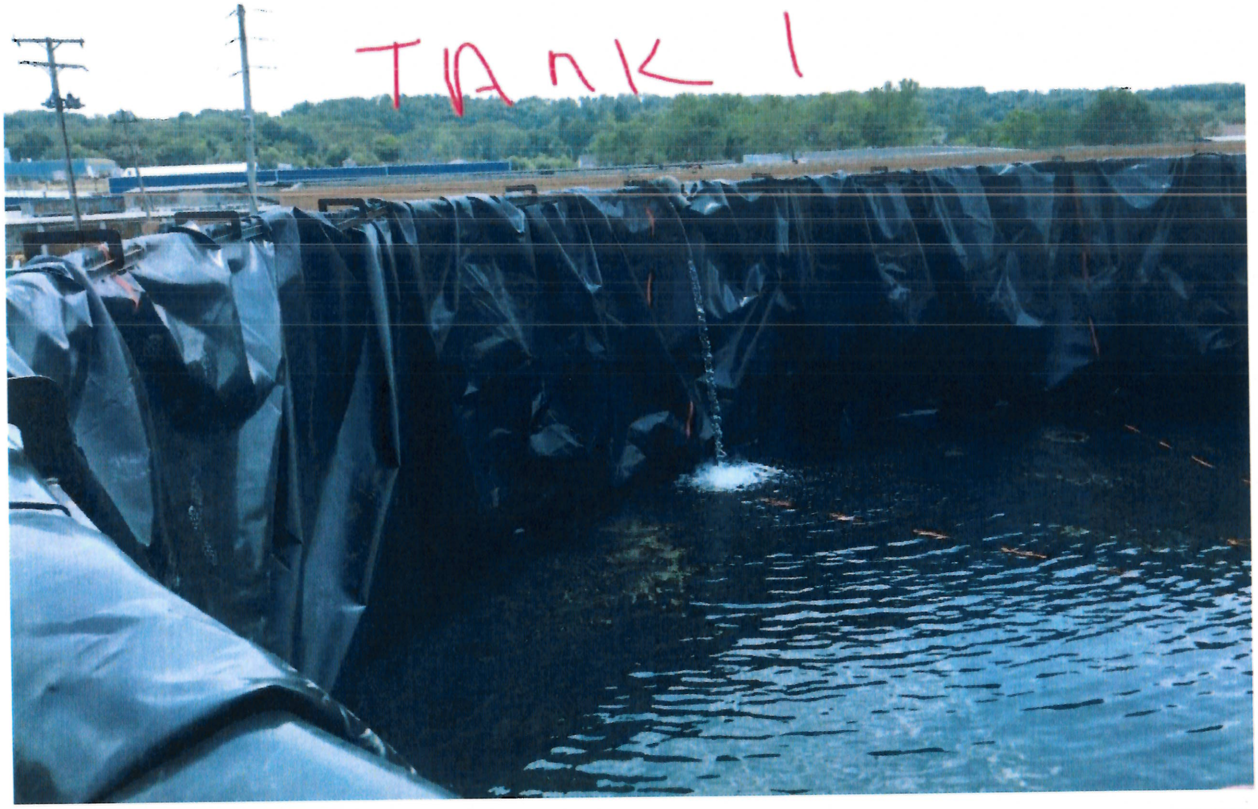
Other Notable Items for this Tank:

PRESSURE TEST/ LEAK TEST

START DATE: 6-11-23
LEVEL FROM TOP OF
TANK: 24 ½"
START TIME: 15:00

END DATE: 6-12-23
LEVEL FROM TOP OF
TANK: 24 ½"
END TIME: 08:30

ANY WET AREAS OUT
SIDE OF TANK? NO


TANK 1


TANK 1


TANK 1


TANK 1


TANK 1
POSEIDON
CONCEPTS
1-877-824-(TANK)


TANK 1
POSEIDON
CONCEPTS
1-877-824-(TANK)

AST INSTALLATION CHECKLIST

Tank name or ID number# 2

Inspector Name William Umbaugh

Date: 6-12-23

Client Xylem/NS- East Palestine OH (CDC)

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30	WU		
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures		WU	
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner	Well		
MISC notes			
MISC notes			
MISC notes			
Informed on site personnel that Safety Life Ring is needed. was informed they will be purchased and placed at stairs MISC notes			

Other Notable Items for this Tank:

PRESSURE TEST/ LEAK TEST

START DATE: 6-12-23
LEVEL FROM TOP OF
TANK: 24 1/8"
START TIME: 14:00

END DATE: 6-13-23
LEVEL FROM TOP OF
TANK: 24 1/8"
END TIME: 08:45

ANY WET AREAS OUT
SIDE OF TANK? No


TANK 2


TANK 2


TANK 2


Tank 2
CONCEPTS
1-877-824-(TANK)


TANK 2


TANK 2

AST INSTALLATION CHECKLIST

Tank name or ID number# 3

Inspector Name William Umbaugh

Date: 6-13-23

Client xylem/NS East Palestine, OH CDL

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30	WU		
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures		WU	
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner	WH		
MISC notes			
MISC notes			
MISC notes			
Informed on site personnel that Safety Life Ring is needed. Was informed they will be purchased and placed at stairs MISC notes			

Other Notable Items for this Tank:

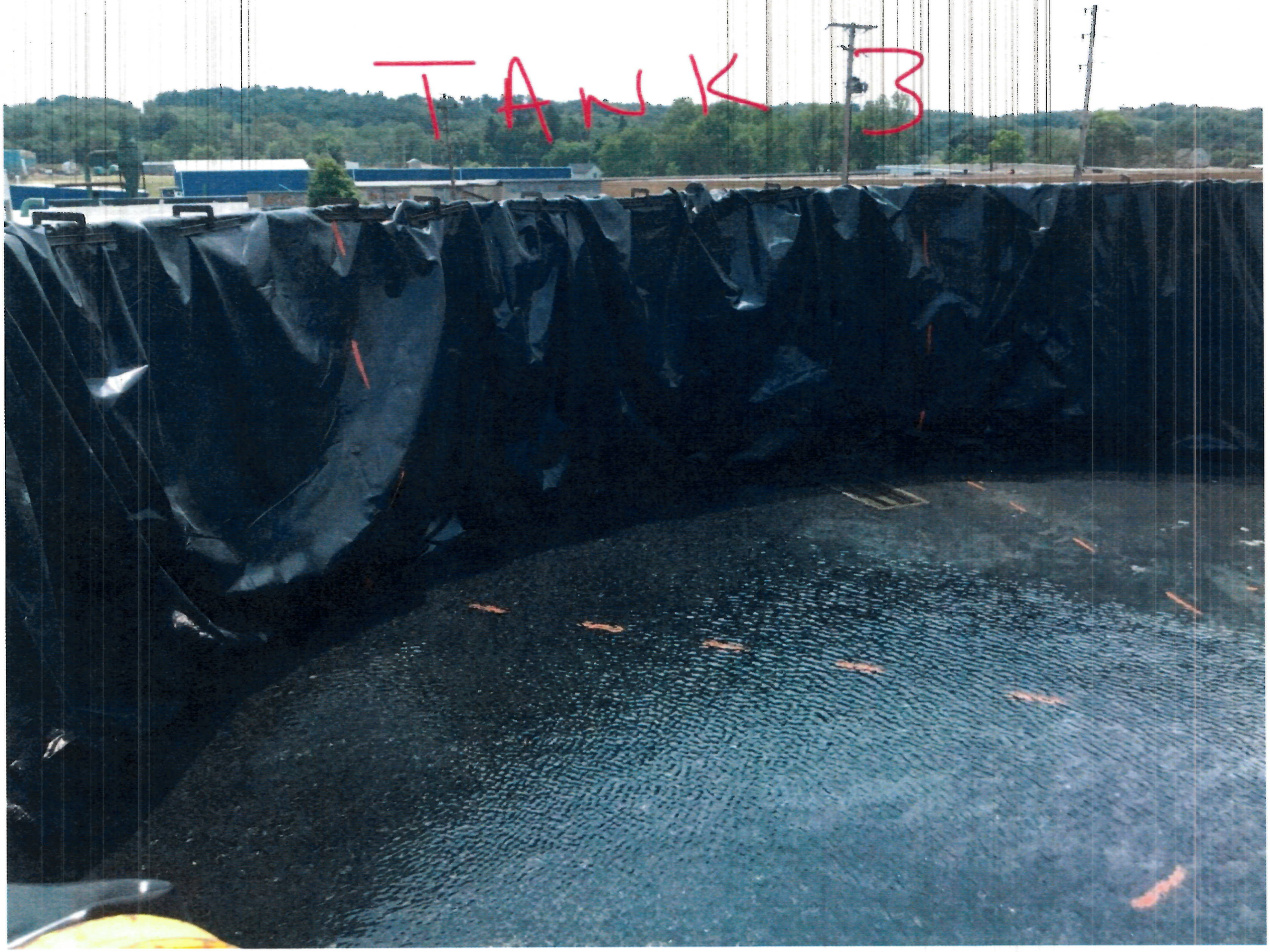
PRESSURE TEST/ LEAK TEST

START DATE: 6-13-23
LEVEL FROM TOP OF
TANK: 24"
START TIME: 13:45

END DATE: 6-14-23
LEVEL FROM TOP OF
TANK: 24"
END TIME: 08:30

ANY WET AREAS OUT
SIDE OF TANK? NO


TANK 3


TANK 3


TANK 3


TANK 3


TANK 3


TANK 3

AST INSTALLATION CHECKLIST

Tank name or ID number# 4 FAILED TEST

Inspector Name William Umbaugh

Date: 6-10-23

Client Xylem/NS East Palestine OH CDC

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30			
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures	WU	SEE	BACK
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner			
MISC notes			
MISC notes			
MISC notes			
A Small pin hole was found. TANK was DRained pin hole was patched. LEAK TEST will be done at a later time. MISC notes			

Other Notable Items for this Tank:

PRESSURE TEST/ LEAK TEST

START DATE: 6-10-23
LEVEL FROM TOP OF
TANK: 24"
START TIME: 17:00

END DATE: 6-11-23
LEVEL FROM TOP OF
TANK: 24"
END TIME: 0700

ANY WET AREAS OUT
SIDE OF TANK? YES

AST INSTALLATION CHECKLIST

Tank name or ID number# 4 RE TEST

Inspector Name William Limbaugh

Date: 6-14-23

Client Xylem

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30	WU		
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures		WU	
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner	WU		
MISC notes			
MISC notes			
MISC notes			
Informed on site personnel that safety life Ring is needed. Was informed they will be purchased and placed on stairs. MISC notes			

Other Notable Items for this Tank:

PRESSURE TEST/ LEAK TEST

START DATE: 6-14-23
LEVEL FROM TOP OF
TANK: 24"
START TIME: 16:30

END DATE: 6-15-23
LEVEL FROM TOP OF
TANK: 24"
END TIME: 08:30

ANY WET AREAS OUT
SIDE OF TANK? NO


Tank 4 Patch


TANK 4


Tank 4


TANK 4
ROCKWATER


Tank 4
ROCKWATER


TANK 4
ROCKWATER
IMPAIRED WATER


Tank 4

AST INSTALLATION CHECKLIST

Tank name or ID number# 5

Inspector Name William Umbaugh

Date: 6-15-23

Client Xylem/NS East Palestine OH [illegible]

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30	WU		
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures		WU	
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner	WY		
MISC notes			
MISC notes			
MISC notes			
Informed on site PERSonnel that Safety Life Ring is needed. Was informed they will be purchased and placed on stairs. MISC notes			

Other Notable Items for this Tank:

PRESSURE TEST/ LEAK TEST

START DATE: 6-15-23
LEVEL FROM TOP OF
TANK: 23"
START TIME: 12:45

END DATE: 6-16-23
LEVEL FROM TOP OF
TANK: 23"
END TIME: 08:45

ANY WET AREAS OUT
SIDE OF TANK? NO


TANK 5
877-824-(TANK)


TANK 5


Tank 5


TANK 5
CONCEPTS
1-877-824-(TANK)


TANK 5


TANK 5

AST INSTALLATION CHECKLIST

Tank name or ID number# 6

Inspector Name William Umbaugh

Date: 6-9-23

Client XYLEM/NS East Palestine, OH CDE

	YES	NO	N/A
Inspect tank panels for any defects, cracks, broken welds, defects- take any defects form service and note		WU	
Inspect area tank to be set up, Anything obvious or sharp that could impale liners		WU	
Geo textile- laid out prior to liner, all seams felted/taped	WU		
LINER-NOTE LINER ML 30	WU		
Tank seams have all bolts/ pins, pins must be secured with cotter keys or other method	WU		
Inside tank seams have felt/ protective layer attached at each seam	WU		
liner inspection- any tears, holes, punctures		WU	
liner inspection- enough slack given for fill	WU		
liner inspection- secured, enough clamps	WU		
Sump- gasket-s applied	WU		
sump -bolts tightened	WU		
Stairs- provided	WU		
Safety equipment provided, Life ring, or stairs inside tank		WU	

Accessories- Candy canes, fill tubes- anything inside the tank is properly gaurded from puncturing liner	WU.		
MISC notes			
MISC notes			
MISC notes			
Informed on site personnel that Safety Life Ring is needed. Was informed they will be purchased and placed at stairs. MISC notes			

Other Notable Items for this Tank:

PRESSURE TEST/ LEAK TEST

START DATE: 6-9-23
LEVEL FROM TOP OF
TANK: 24"
START TIME: 17:00

END DATE: 6-10-23
LEVEL FROM TOP OF
TANK: 24"
END TIME: 12:00

ANY WET AREAS OUT
SIDE OF TANK? NO


TANK 6


TANK 6


TANK 6


TANK 6

TANK 6


TANK 6

Inspection of
20P Harpoon 05 & 06
6 AST 189,000 gal Tank Farm

Inspection Date: 6/15/23

Performed by:

Cody Phillips, C2 Services/Hydrera Water Services

On June 15th, 2023 A site inspection was completed on the 6 AST tank Farm located on the East Palestine, OH Project.

6 AST Tank Farm:

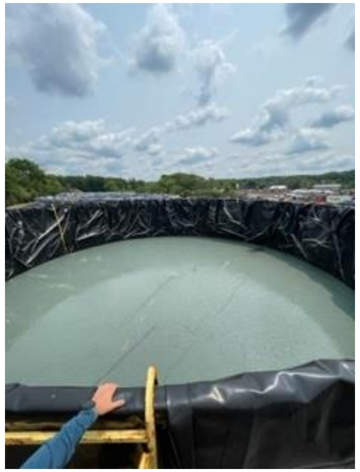
- Tanks 1,2,3,4,6 were sitting with approximately 14” in each tank after undergoing previous hydrotests, Tank 5 was currently undergoing a hydrotest and was sitting with 10’ of fluid.
- All 6 Tanks liner looked as they should per SOP
- Pins/Plates/Clamps/Belly Strap was all installed as per SOP
- Pad looked to be compacted
- Crews were installing fill lines on the backside of tanks for filling.
- Continued observations by Arcadis staff to ensure minimum of 1’ of fluid remaining in each tank at all times

Conclusion of Inspection: 6 AST Tank Farm has been installed per SOP and is Suitable for continued use

Tank #1

Tank #2

Tank #3



Tank #4

Tank #5

Tank #6

On June 15th, 2023 A site inspection was completed on the (2) 1,000,000 gallon Harpoon Tanks H20P-05 and H20P-06 located on the East Palestine OH project.

Harpoon Tanks:

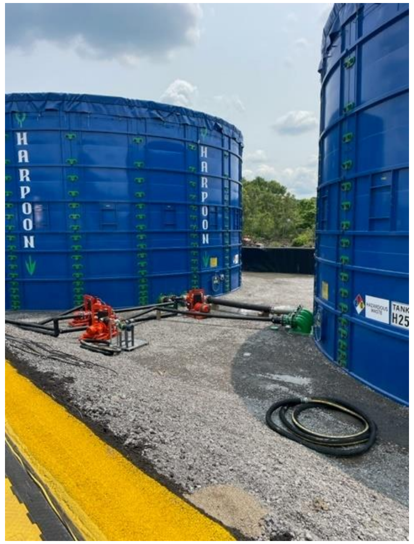
- H20P-05 Tank #1 (east) was holding about 269,304 gallons of fluid
- H20P-06 Tank #2 (west) was holding about 384,342 gallons of fluid
- Plates/Pins/Clips/liner/and external connections were checked visually and installed as per SOP
- H20P-06 Tank #2 had an over the top Fill Line installed by others, fill line was inspected visually with use of a Boom/Manlift to make sure line is clear of all liner. Fill Line stuck out into the tank approximately 2' off the wall and was clear of contact with liner on the wall
- Pumps/manifolding had been setup and connected to both manifolds on the harpoon and looked as they should free of any leaks and was proper supported.

Conclusion of Inspection: Harpoon Tanks are installed and being operated per SOP and suitable for continued use

Tank #1 East

Tank #2 West

Tank #2 West Fill line



Pumps/Manifolding

Manifolding between Tanks

Field Density Test Results

	Project Number 172607922
Project Name: NS East Palestine Derailment	CIP Number:
	Day: Wednesday
	Date: 5/17/2023

Today's Weather: Sunny	High: 61 Low: 42
Site conditions from Past Weather: dry	

Contactor on Site: AlliCon		Starting Time 7:00 AM	Ending Time 7:00 PM

TODAY'S WORK

Contractor	Supt. Name	# workers
AlliCon	Noah	5

AlliCon was on site to continue stone placement on the future tank pad area. The first lift was spread with stone that was stockpiled on site and from dump trucks from the quarry. The ODOT 304 was compacted with a smooth drum roller. The tank pads compaction specification was 95%. Eight nuclear density tests were performed on the first lift in the areas where the tanks will be placed. These density tests met the specified required compaction percentage of 95%. A water truck was used to wet the ODOT 304 on this date to improve the compaction of the ODOT 304 limestone. For more details about the density tests performed please see the attached field density report.

EQUIPMENT USED

DESCRIPTION	MAKE	MODEL	HRS. USED	HRS. IDLE	OWN	RENT

DAILY PAY ITEMS

Plan	Ref.	Item	Pay Item Description	Location (Station's, Bubble, ID)

Is Contractor Maintaining Required E & S Control Measures?	**YES**	**NO**	**N/A**	**(circle one)**

STANTEC Employee Time Record				**Visitors**	
Inspector's Name	Project No.	Reg. Hours	OT Hours	Name	Company
Matthew Macielewicz	172607922				

RPR's Signature: Matthew Macielewicz

Supervisor:

RPR (Print) Matthew Macielewicz

FIELD COMPACTION TEST DATA

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 05/17/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Information
Model No.:_______________________
Serial No.:_______________________
Standard Density Count: 1713
Standard Moisture Count: 636

TEST NUMBER	1	2	3	4
LOCATION	Tank #2	Tank #1	Tank #1	Tank #3
LIFT NUMBER	1	1	1	1
NUMBER OF PASSES	3	3	3	3
LIFT THICKNESS (INCHES)	12	12	12	12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	BS	BS	4	BS
WET DENSITY (PCF)	143.1	148.1	139.3	152.4
DRY DENSITY (PCF)	138	143.4	134.8	145
MOISTURE (PCF)	5.1	4.6	4.5	7.6
MOISTURE (%)	3.7	3.2	3.4	5.2
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	99.57	103.46	97.26	104.62
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller. Personnel with Arcadis was not concerned with moisture readings being below 2% of optimu

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 05/17/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Informati
Model No.:__________________
Serial No.:__________________
Standard Density Count: 1713
Standard Moisture Count: 636

TEST NUMBER	5	6	7	8
LOCATION	Tank #4	Tank #6	Tank #5	Tank #5
LIFT NUMBER	1	1	1	1
NUMBER OF PASSES	3	3	3	3
LIFT THICKNESS (INCHES)	12	12	12	12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	BS	BS	BS	BS
WET DENSITY (PCF)	142.5	145	138.4	141.9
DRY DENSITY (PCF)	136.8	139.7	133	136.5
MOISTURE (PCF)	5.7	5.4	5.4	5.4
MOISTURE (%)	4.2	3.8	4	3.9
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	98.70	100.79	95.96	98.48
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller. Personnel with Arcadis was not concerned with moisture r

	Project Number 172607922
Project Name: NS East Palestine Derailment	CIP Number:
	Day: Thursday
	Date: 5/18/2023

Today's Weather: Sunny	High: 75 Low: 40
Site conditions from Past Weather: dry	

Contactor on Site: AlliCon		Starting Time 7:00 AM	Ending Time 7:00 PM

TODAY'S WORK

Contractor	Supt. Name	# workers
AlliCon	Noah	5

AlliCon was on site to continue stone placement on the future tank pad area. The second lift was placed and compacted on this date. The ODOT 304 was compacted with a smooth drum roller. The tank pads compaction specification was 95%. Eight nuclear density tests were performed on the second lift in the areas where the tanks will be placed. These density tests met the specified required compaction percentage of 95%. A water truck was used to wet the ODOT 304 on this date to improve the compaction of the ODOT 304 limestone. For more details about the density tests performed please see the attached field density report.

EQUIPMENT USED

DESCRIPTION	MAKE	MODEL	HRS. USED	HRS. IDLE	OWN	RENT

DAILY PAY ITEMS

Plan	Ref.	Item	Pay Item Description	Location (Station's, Bubble, ID)

Is Contractor Maintaining Required E & S Control Measures?	**YES**	**NO N/**	**A**	**(circle one)**

STANTEC Employee Time Record				Visitors	
Inspector's Name	Project No.	Reg. Hours	OT Hours	Name	Company
Matthew Macielewicz	172607922				

RPR's Signature: Matthew Macielewicz

Supervisor:

RPR (Print) Matthew Macielewicz

FIELD COMPACTION TEST DATA

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 05/18/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Information
Model No.:_______________________
Serial No.:_______________________
Standard Density Count: 1711
Standard Moisture Count: 638

TEST NUMBER	1	2	3	4
LOCATION	Tank #6	Tank #5	Tank #4	Tank #3
LIFT NUMBER	2	2	2	2
NUMBER OF PASSES	4	4	4	4
LIFT THICKNESS (INCHES)	6 to 12	6 to 12	6 to 12	6 to 12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	BS	BS	BS	BS
WET DENSITY (PCF)	145	148.6	151.3	149.8
DRY DENSITY (PCF)	138.3	142.4	142.7	142.4
MOISTURE (PCF)	6.7	6.2	8.6	7.5
MOISTURE (%)	4.9	4.3	6	5.2
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	99.78	102.74	102.96	102.74
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller. Personnel with Arcadis was not concerned with moisture r

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 05/18/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Informati
Model No.:___________________
Serial No.:___________________
Standard Density Count: 1711
Standard Moisture Count: 638

TEST NUMBER	5	6	7	8
LOCATION	Tank #2	Tank #1	Tank #5	Tank #6
LIFT NUMBER	2	2	2	2
NUMBER OF PASSES	4	4	4	4
LIFT THICKNESS (INCHES)	6 to 12	6 to 12	6 to 12	6 to 12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	BS	BS	BS	BS
WET DENSITY (PCF)	139.4	147.1	154.1	146.3
DRY DENSITY (PCF)	135.8	140.2	146	140.3
MOISTURE (PCF)	3.6	6.9	8.1	6
MOISTURE (%)	2.7	4.9	5.5	4.3
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	97.98	101.15	105.34	101.23
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller. Personnel with Arcadis was not concerned with moisture readings being below 2% of optimu

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

	Project Number 172607922
Project Name: NS East Palestine Derailment	CIP Number:
	Day: Tuesday
	Date: 5/30/2023

Today's Weather: Sunny	High: 86 Low: 63
Site conditions from Past Weather: dry	

Contactor on Site: AlliCon		Starting Time 7:00 AM	Ending Time 12:00 PM

TODAY'S WORK

Contractor	Supt. Name	# workers
AlliCon	Noah	

AlliCon placed the third lift of ODOT 304 stone for the future tank pad prior to Stantec personnel being on site. The ODOT 304 was compacted with a vibratory smooth drum roller. The tank pads compaction specification was 95%. Six nuclear density tests were performed on the third and final lift in the areas where the tanks will be placed. These density tests met the specified required compaction percentage of 95%. A water truck was used to wet the ODOT 304 according to Arcadis personnel that was on site at the time of compaction to improve the compaction of the ODOT 304 limestone. For more details about the density tests performed please see the attached field density report.

EQUIPMENT USED

DESCRIPTION	MAKE	MODEL	HRS. USED	HRS. IDLE	OWN	RENT

DAILY PAY ITEMS

Plan	Ref.	Item	Pay Item Description	Location (Station's, Bubble, ID)

Is Contractor Maintaining Required E & S Control Measures?	**YES**	**NO N/**	**A**	**(circle one)**

STANTEC Employee Time Record				Visitors	
Inspector's Name	Project No.	Reg. Hours	OT Hours	Name	Company
Matthew Macielewicz	172607922	10			

RPR's Signature: Matthew Macielewicz

Supervisor:

RPR (Print) Matthew Macielewicz

FIELD COMPACTION TEST DATA

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 05/30/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Information
Model No.:_______________________
Serial No.:_______________________
Standard Density Count: 1759
Standard Moisture Count: 642

TEST NUMBER	1	2	3	4
LOCATION	Tank 1	Tank 2	Tank 3	Tank 4
LIFT NUMBER	3	3	3	3
NUMBER OF PASSES	4	4	4	4
LIFT THICKNESS (INCHES)	6 to 12	6 to 12	6 to 12	6 to 12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	BS	BS	BS	BS
WET DENSITY (PCF)	147.3	148.4	146.8	143.2
DRY DENSITY (PCF)	143.8	144.5	142.7	139.3
MOISTURE (PCF)	3.5	3.8	4.1	3.8
MOISTURE (%)	2.4	2.7	2.9	2.8
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	103.75	104.26	102.96	100.51
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller. Personnel with Arcadis was not concerned with moisture readings being below 2% of optimu

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 05/30/2023
Checked By:_____________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Informati
Model No.:___________________
Serial No.:___________________
Standard Density Count: 1759
Standard Moisture Count: 642

TEST NUMBER	5	6		
LOCATION	Tank 5	Tank 6		
LIFT NUMBER	3	3		
NUMBER OF PASSES	4	4		
LIFT THICKNESS (INCHES)	6 to 12	6 to 12		
GAUGE READINGS				
PROBE DEPTH [2] (IN)	BS	BS		
WET DENSITY (PCF)	140.1	143.5		
DRY DENSITY (PCF)	135.9	139.3		
MOISTURE (PCF)	4.1	4.2		
MOISTURE (%)	3	3		
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6		
OPTIMUM MOISTURE (%)	8	8		
RESULTS				
% COMPACTION	98.05	100.51		
PASS/NONCOMPLIANCE [3]	PASS	PASS		
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller. Personnel with Arcadis was not concerned with moisture readings being below 2% of optimu

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

Attachment C

Tank Foundation Analysis

Client: **Norfolk Southern Railway Company (NRSC)**

Project Location: **East Palestine, Ohio**

Project: **East Palestine Derailment**

Project No.: **3016714**

Calc No: **CB-01**

Subject: **CID Tank Design**

Developed By: **ARL**

Date: **June 05, 2023**

Checked By: **MBH**

Date: **June 12, 2023**

OBJECTIVE:

Evaluate the bearing capacity and settlement due to consolidation under the CID Tanks at Norfolk Southern (NS) East Palestine derailment site.

REFERENCES:

1. Das, Braja (2011). Principles of Foundation Engineering, SI. Seventh Edition.
2. Coduto, Donald (2016). Foundation Design Principles and Practices. Third Edition.
3. Bowles, J. E., (1977), Foundation Analysis and Design, McGraw-Hill, Inc., New York

ASSUMPTIONS:

1. Six (6) tanks, each tank consisting of a modular interlocking steel framing with the following assumed dimensions:
   - 53 feet (ft) diameter (D)
   - 12 ft framing height (H)
   - 9 ft maximum operatable water level (M), for conservatism the max depth (12 feet) is assumed for calculation purposes.
   - 35,000 pounds (lbs) weight of framing (W)
2. For the purpose of this calculation, it is assumed that no vertical load other than the weight of the framing is transferred to the framing.
3. The interior of the frame is lined with flexible high-density polyethylene (HDPE) liner, which serves as the tank bottom.
4. The foundation consists of 2 feet of compacted crushed gravel. For conservatism, assume the tank is placed directly on subgrade and not buried (q = 0). See Attachment 3 for boring logs and laboratory testing.
5. The strength properties of the soil subgrade are as follows:
   - Lowest average N60 in the top 6 ft is 5.5 blows per foot (bpf)
   - Unconfined compressive strength (q_u) of 1,250 pounds per square foot (psf), conservatively selected using a published correlation between unconfined compressive strength and blow counts in cohesive soils (Reference 3)

- An assumed value of 0 angle of internal friction (phi)

6. Cohesion (c) = 0.5q_u = 0.5(1,250 psf) = 625 psf
7. Unit weight (density) of water is 62.4 pcf (γ_w).
8. Minimum required bearing capacity Factor of Safety (FS) of 3.0.
9. The glacial till is over consolidated (ψ) = 0.4
10. Soil is very slightly compressible $(C) = 0.05$.
11. The footing is perfectly flexible, r for computation of settling at center of foundation is 1.00 (Reference 2).
12. Unit weight (γ) of 110 pcf.

CALCULATIONS:

Bearing Capacity of CID Tanks

To analyze the bearing capacity factor of safety for the tanks, the bearing pressure P must be calculated using the assumed properties of the tanks:

Area of tank: $A = \pi r^2 = (3.14)\left(\frac{53ft}{2}\right)^2 = 2{,}205sf$

Volume of tank: $V = AH = (2205sf)(12ft) = 26{,}460cf$

Weight of water: $W_w = V\gamma_w = (26460cf)(62.4pcf) = 1{,}651{,}104lb$

Bearing pressure: $P = \frac{(W_w + W_T)}{A} = \frac{1651104lb + 35000lb}{2205sf} = 765psf$

Where:

- Radius of tank (r) = 26.5 ft (D/2, Assumption 1)
- Height of tank (H) = 12 ft (Assumption 1)
- Density of water (γ_w) = 62.4 pcf (Assumption 6)
- Weight of tank framing (W_T) = 35,000 lbs (Assumption 1)

The Terzaghi bearing capacity for a circular foundation, using the given soil properties and assumptions can be evaluated using the equation below.

$$q_u = 1.3cN_c + qN_q + 0.3\gamma BN_\gamma$$

By applying the following Terzaghi's Bearing Capacity Factors for a friction angle (φ) of zero (Table 3.1 in Attachment 1):

- $N_c = 5.70$

- $N_q = 1.00$
- $N_\gamma = 0$

The bearing capacity at the bottom of the foundation (q_u) is as follows:

$$q_u = 1.3(625psf)(5.70) + \cancel{(0psf)(1)} + \cancel{(0.3)(110pcf)(53ft)(0)} = 4631psf$$

The bearing capacity of the soil is then compared to the bearing pressure from the tanks found above to determine if the soils on-site can support the weight and pressure from the assumed sized tanks.

$FS = \frac{4631\ psf}{765\ psf} = 6.1$, which is greater than the minimum required FS of 3.0 (Assumption 7).

With a factor of safety greater than the minimum required, it is determined that the soil subgrade on site can support the weight of the assumed sized tanks.

CID Tank Consolidation Settlement

The tank consolidation settlement can be determined by the following equations (Reference 2). Refer to Attachment 2 for equations used to define all variables listed above and discussed herein.

$$\delta_c = r \sum \psi C H_i log\left(\frac{\sigma'_{v0,i} + \Delta\sigma'_{v,i}}{\sigma'_{v0,i}}\right)$$

The methodology below considers the effect of the surcharge load P to a depth equal to one tank diameter (B). The zone of influence of thickness B has been subdivided into two layers of equal height (H_i=B/2=26.5 ft). The depth of each mid-layer Z_f is computed and used to determine the following parameters for each soil layer:

Effective Stress before Surcharge, σ'_{v0}:

$$\sigma'_{v0,1,mid} = \frac{H_{f,1}}{2}\gamma = \frac{(26.5ft)}{2}(110pcf) = 1{,}458psf$$

$$\sigma'_{v0,1,bot} = H_{f,1}\gamma = (26.5ft)(110pcf) = 2{,}915psf$$

$$\sigma'_{v0,2,mid} = \sigma'_{v0,1,bot} + \frac{H_{f,2}}{2}\gamma = 2915psf + \frac{(26.5ft)}{2}(110pcf) = 4{,}374psf$$

Change in Effective Stress from Surcharge, $\Delta\sigma_v'$ can be obtained by computing Z_f/B for each layer and obtaining the parameter $\Delta\sigma_v'$/q from Figure 7.2 (Attachment 2) for each Layer:

$$\frac{Z_{f,1}}{B} = \frac{13.25}{53} = \frac{1}{4}.\ Using\ Figure\ 7.2{:}\frac{\Delta\sigma'_v}{q} = 0.9. It\ follows{:}\ \Delta\sigma'_{v,1} = (0.9)(765psf) = 689psf$$

ARCADIS

$$\frac{Z_{f,2}}{B} = \frac{39.75}{53} = \frac{3}{4}.\ Using\ Figure\ 7.2{:}\ \frac{\Delta\sigma_v'}{q} = 0.50.\ It\ follows{:}\ \Delta\sigma_{v,2}' = (0.50)(765psf) = 383psf$$

Total Consolidation Settlement δ_c, is expressed as the sum of consolidation settlements of each layer $\delta_{c,i}$:

$$\delta_c = r\sum \psi CH_i log\left(\frac{\sigma_{v0,i}^{'} + \Delta\sigma_{v,i}^{'}}{\sigma_{v0,i}^{'}}\right) = r\left(\frac{\delta_{c,1}}{r} + \frac{\delta_{c,2}}{r}\right)$$

$$\frac{\delta_{c,1}}{r} = \psi CH_1 log\left(\frac{\sigma_{v0,1}^{'} + \Delta\sigma_{v,1}^{'}}{\sigma_{v0,1}^{'}}\right) = (0.4)(0.05)(26.5ft)\log\left(\frac{1458psf + 689psf}{1458psf}\right) = 0.09ft$$

$$\frac{\delta_{c,2}}{r} = \psi CH_2 log\left(\frac{\sigma_{v0,2}^{'} + \Delta\sigma_{v,2}^{'}}{\sigma_{v0,2}^{'}}\right) = (0.4)(0.05)(26.5ft)\log\left(\frac{4374psf + 383psf}{4374psf}\right) = 0.02ft$$

$$\delta_c = (1) * (0.09ft + 0.02ft) = 0.11ft$$

The parameters used for each step of the consolidation settlement calculation are summarized below:

Layer	Depth Range (ft)	Height of Layer i H_i (ft)	Depth of Mid-Layer (ft)	Depth below Footing Z_f (ft)	Effective Stress at Depth Before Surcharge σ_{v0}' (psf)	Change in Effective Stress at Depth from Surcharge $\Delta\sigma_v'$ (psf)	ψ	C	r	Settlement (ft)
1	0-26.5	26.5	13.25	13.25	1458	689	0.4	0.05	1	0.09
2	26.5-53	26.5	39.75	39.75	4374	383	0.4	0.05	1	0.02

$$\therefore Total\ Settlement = 0.11ft$$

SUMMARY:

Based on the bearing capacity analysis, the chosen tank parameters bearing capacity is acceptable. For the minimum acceptable bearing capacity, there is an expected amount of 0.11 feet of settlement. Note, some very conservative assumptions were made including the tanks will be filled to the absolute top of the tank for the entire lifespan of the tanks. Furthermore, the lifespan of the tanks will likely be shorter than the duration to reach full settlement, which could be several years.

STATE OF OHIO
ALLEN LONG
E-86556
REGISTERED
PROFESSIONAL ENGINEER

Attachment 1:

Reference 1: Principles of Foundation Engineering (Das, 1999)

For estimating the ultimate bearing capacity of *square* or *circular foundations*, Eq. (3.1) may be modified to

$$q_u = 1.3cN_c + qN_q + 0.4\gamma BN_\gamma \qquad \text{(square foundation)} \tag{3.7}$$

and

$$q_u = 1.3cN_c + qN_q + 0.3\gamma BN_\gamma \qquad \text{(circular foundation)} \tag{3.8}$$

In Eq. (3.7), B equals the dimension of each side of the foundation; in Eq. (3.8), B equals the diameter of the foundation.

For foundations that exhibit the local shear failure mode in soils, Terzaghi suggested modifications to Eqs. (3.3), (3.7), and (3.8) as follows:

$$q_u = \frac{2}{3}cN_c' + qN_q' + \tfrac{1}{2}\gamma BN_\gamma' \qquad \text{(strip foundation)} \tag{3.9}$$

$$q_u = 0.867cN_c' + qN_q' + 0.4\gamma BN_\gamma' \qquad \text{(square foundation)} \tag{3.10}$$

$$q_u = 0.867cN_c' + qN_q' + 0.3\gamma BN_\gamma' \qquad \text{(circular foundation)} \tag{3.11}$$

N_c', N_q', and N_γ' are the *modified bearing capacity factors*. They can be calculated by using the bearing capacity factor equations (for N_c, N_q, and N_γ) by replacing ϕ by $\phi' = \tan^{-1}(\frac{2}{3}\tan\phi)$. The variation of N_c', N_q', and N_γ' with the soil friction angle, ϕ, is given in Table 3.2.

Terzaghi's bearing capacity equations have now been modified to take into account the effects of the foundation shape (B/L), depth of embedment (D_f), and the load inclination. This is given in Section 3.7. Many design engineers, however, still use Terzaghi's equation, which provides fairly good results considering the uncertainty of the soil conditions at various sites.

MODIFICATION OF BEARING CAPACITY EQUATIONS FOR WATER TABLE

Equations (3.3) and (3.7) to (3.11) have been developed for determining the ultimate bearing capacity based on the assumption that the water table is located well below the foundation. However, if the water table is close to the foundation, some modifications of the bearing capacity equations will be necessary, depending on the location of the water table (see Figure 3.6).

Case I

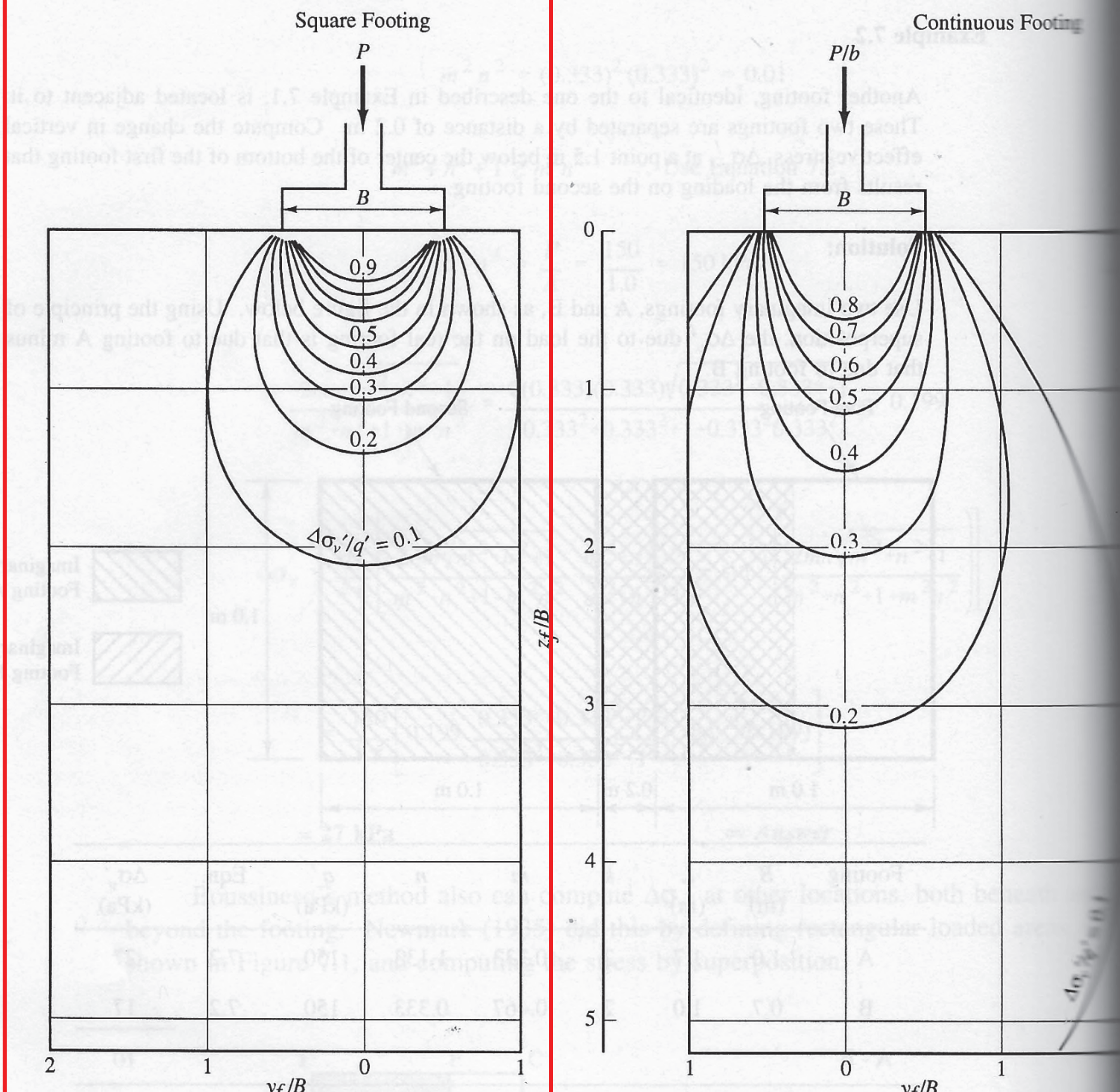
▼ **TABLE 3.1** Terzaghi's Bearing Capacity Factors — Eqs. (3.4), (3.5), and (3.6)

ϕ	N_c	N_q	N_γ[a]	ϕ	N_c	N_q	N_γ[a]
0	5.70	1.00	0.00	26	27.09	14.21	9.84
1	6.00	1.1	0.01	27	29.24	15.90	11.60
2	6.30	1.22	0.04	28	31.61	17.81	13.70
3	6.62	1.35	0.06	29	34.24	19.98	16.18
4	6.97	1.49	0.10	30	37.16	22.46	19.13
5	7.34	1.64	0.14	31	40.41	25.28	22.65
6	7.73	1.81	0.20	32	44.04	28.52	26.87
7	8.15	2.00	0.27	33	48.09	32.23	31.94
8	8.60	2.21	0.35	34	52.64	36.50	38.04
9	9.09	2.44	0.44	35	57.75	41.44	45.41
10	9.61	2.69	0.56	36	63.53	47.16	54.36
11	10.16	2.98	0.69	37	70.01	53.80	65.27
12	10.76	3.29	0.85	38	77.50	61.55	78.61
13	11.41	3.63	1.04	39	85.97	70.61	95.03
14	12.11	4.02	1.26	40	95.66	81.27	115.31
15	12.86	4.45	1.52	41	106.81	93.85	140.51
16	13.68	4.92	1.82	42	119.67	108.75	171.99
17	14.60	5.45	2.18	43	134.58	126.50	211.56
18	15.12	6.04	2.59	44	151.95	147.74	261.60
19	16.56	6.70	3.07	45	172.28	173.28	325.34
20	17.69	7.44	3.64	46	196.22	204.19	407.11
21	18.92	8.26	4.31	47	224.55	241.80	512.84
22	20.27	9.19	5.09	48	258.28	287.85	650.67
23	21.75	10.23	6.00	49	298.71	344.63	831.99
24	23.36	11.40	7.08	50	347.50	415.14	1072.80
25	25.13	12.72	8.34				

[a] From Kumbhojkar (1993)

Attachment 2:

Reference 2: Foundation Design Principles and Practices (Coduto, 1994)



y_f = horizontal distance from Center line of footing
z_f = depth below bottom of footing
$\Delta\sigma_v'$ = change in vertical effective stress
q' = net bearing pressure

Figure 7.2 Pressure bulbs based on Newmark's solution of Boussinesq's method for square and continuous footings.

stress distribution. Some believe Westergaard's (1938) solution is a more accurate solution. He specifically had soil in mind (Boussinesq's method was a general solution for all materials) and considered it to be a soft elastic material reinforced by closely spaced horizontal flexible but unstretchable sheets. The combined thickness of these

Consolidation Settlement

The second component of settlement is that due to the primary consolidation. This is the type of settlement discussed in Chapter 3 in the context of loads created by large loaded areas, such as fills. The same general mechanism governs consolidation beneath small loaded areas, such as a footings, with the following additional considerations:

- The change in vertical effective stress, $\Delta\sigma_v'$, is no longer constant with depth. It is largest immediately below the footing and becomes progressively smaller with depth as discussed earlier.
- The consolidation is no longer one-dimensional because the soil may consolidate both vertically and horizontally.

The formula for computing the consolidation settlement beneath a footing is:

$$\delta_c = r \int \psi\, C \log\left(\frac{\sigma_{v0}' + \Delta\sigma_v'}{\sigma_{v0}'}\right) dz \tag{7.11}$$

Where:

δ_c = consolidation settlement
r = rigidity factor
ψ = 3-dimensional adjustment coefficient
C = compressibility $\frac{C_c \text{ or } C_r}{1+e_0}$
σ_{v0}' = initial vertical effective stress (i.e., before footing load is applied)
$\Delta\sigma_v'$ = increase in vertical effective stress due to footing load
z = depth

Rather than integrating this function, it is customary to divide the soil into n layers, compute the settlement of each layer, and sum them. Thus, Equation 7.11 becomes:

$$\boxed{\delta_c = r \sum_{i=1}^{n} \psi\, C H_i \log\left(\frac{\sigma_{v0}' + \Delta\sigma_v'}{\sigma_{v0}'}\right)} \tag{7.12}$$

where H_i is the thickness of layer i. Usually, about three layers provide sufficient accuracy, but more layers may be necessary if the soil is stratified or if additional accuracy is required. When using three layers, choose their thicknesses approximately as shown in Table 7.2. When solving Equation 7.12, compute σ_{v0}' and $\Delta\sigma_v'$ at the midpoint of each layer.

$$C = \frac{C_r}{1 + e_0} \tag{3.25}$$

$$C = C_{\varepsilon r} \tag{3.26}$$

This procedure treats slightly overconsolidated soils as if they are normally consolidated because of the following:

- The change in effective stress, $\Delta\sigma'$, due to the applied external load may increase the effective stress in the soil to a value greater than σ_c'.
- Soil creep effects may make these soils behave as if they were normally consolidated.
- Sample disturbance effects make σ_c' difficult to measure.

In addition, soils overconsolidated by desiccation appear to have a high OCR when dry. However, when they are wetted, this apparent OCR dissipates (Stark and Duncan, 1991). The soil has little or no memory of this apparent preconsolidation, especially at higher normal stresses. Therefore, desiccated soils that might become wet should be evaluated as if they were normally consolidated.

The compressibility of the soil may be classified using Table 3.7.

TABLE 3.7 CLASSIFICATION OF SOIL COMPRESSIBILITY

Compressibility, C	Classification
0 - 0.05	Very slightly compressible
0.05 - 0.10	Slightly compressible
0.10 - 0.20	Moderately compressible
0.20 - 0.35	Highly compressible
> 0.35	Very highly compressible

Empirical correlations that relate compressibility with other soil properties (Azzouz et al., 1976; Al-Khafaji and Andersland, 1992) also are available. These are useful for preliminary analyses and for checking laboratory test results.

For saturated normally consolidated clays, Kulhawy and Mayne (1990) suggested:

TABLE 7.2 APPROXIMATE THICKNESSES OF SOIL LAYERS FOR MANUAL COMPUTATION OF CONSOLIDATION SETTLEMENT

Layer Number	Approximate Layer Thickness	
	Square Footing	Continuous Footing
1	$B/2$	B
2	B	$2B$
3	$2B$	$4B$

1. Adjust the number and thickness of the layers to account for changes in soil properties. Locate each layer entirely within one soil stratum.
2. For rectangular footings, use layer thicknesses between those given for square and continuous footings.
3. Use somewhat thicker layers (perhaps up to 1.5 times the thicknesses shown) if the groundwater table is very shallow.
4. For quick, but less precise, analyses, use a single layer with a thickness of about $3B$ (square footings) or $6B$ (continuous footings).

The conventional Terzaghi one-dimensional consolidation analysis, as described Chapter 3, often overestimates the settlement of spread footings. Reasons for include:

- Sample disturbance
- Lateral strains in the soil
- The stress path in the laboratory consolidation test is not the same as that in the beneath a loaded footing (Simons, 1987)

These are the reasons for the adjustment coefficient, ψ, in Equations 7.1 and 7. Some engineers have developed values of ψ based on the observed behavior of footin These values are typically between 0.50 and 0.75 and can be very useful when worki in soils similar to those used to develop the factor. When locally derived values are n available, consider those in Table 7.3.

TABLE 7.3 TYPICAL ψ FACTORS

Soil Type	Typical OCR	ψ
Very sensitive clays	1.0	1.0 - 1.2
Normally consolidated clays and silts	1.0 - 1.2	0.7 - 1.0
Overconsolidated clays and silts	1.2 - 5	0.4 - 0.7
Heavily overconsolidated clays and silts	> 5	0.3 - 0.6

Adapted from Skempton and Bjerrum (1957).

TABLE 7.4 RIGIDITY FACTORS

Flexibility of Loaded Area	Rigidity Factor, r
Perfectly flexible	1.00
Perfectly rigid (use for footings)	0.85

Secondary Compression Settlement

Secondary compression is the continued straining of a soil after the excess pore wa pressures that drive primary consolidation have dissipated. Usually, the second compression settlement beneath spread footings is relatively small and may be neglec However, case histories have been reported where the secondary compression wa significant. It is generally a concern only in soils with a high organic conten extremely plastic clays.

Use Equation 3.32 to compute the magnitude of the secondary compress settlement, δ_s.

Rate of Settlement

If the clay is saturated, it is safe to assume the distortion settlement occurs as rapidly the load is applied. The consolidation settlement will occur over some period, depend on the drainage rate.

Terzaghi's theory of consolidation includes a methodology for computing the ra of consolidation settlement in saturated soils. It is controlled by the rate water is able squeeze out of the pores and drain away. However, because the soil beneath a footin is able to drain in three dimensions, not one as assumed in Terzaghi's theory, the wa will drain away more quickly, so consolidation settlement also will occur more quick Davis and Poulos (1968) observed this behavior when they reviewed 14 case histori In four of these cases, the rate was very much faster than predicted, and in another fo cases, the rate was somewhat faster. In the remaining six cases, the rate was very clo to or slightly slower than predicted, but this was attributed to the drainage conditio being close to one-dimensional. They also presented a method of accounting for th effect.

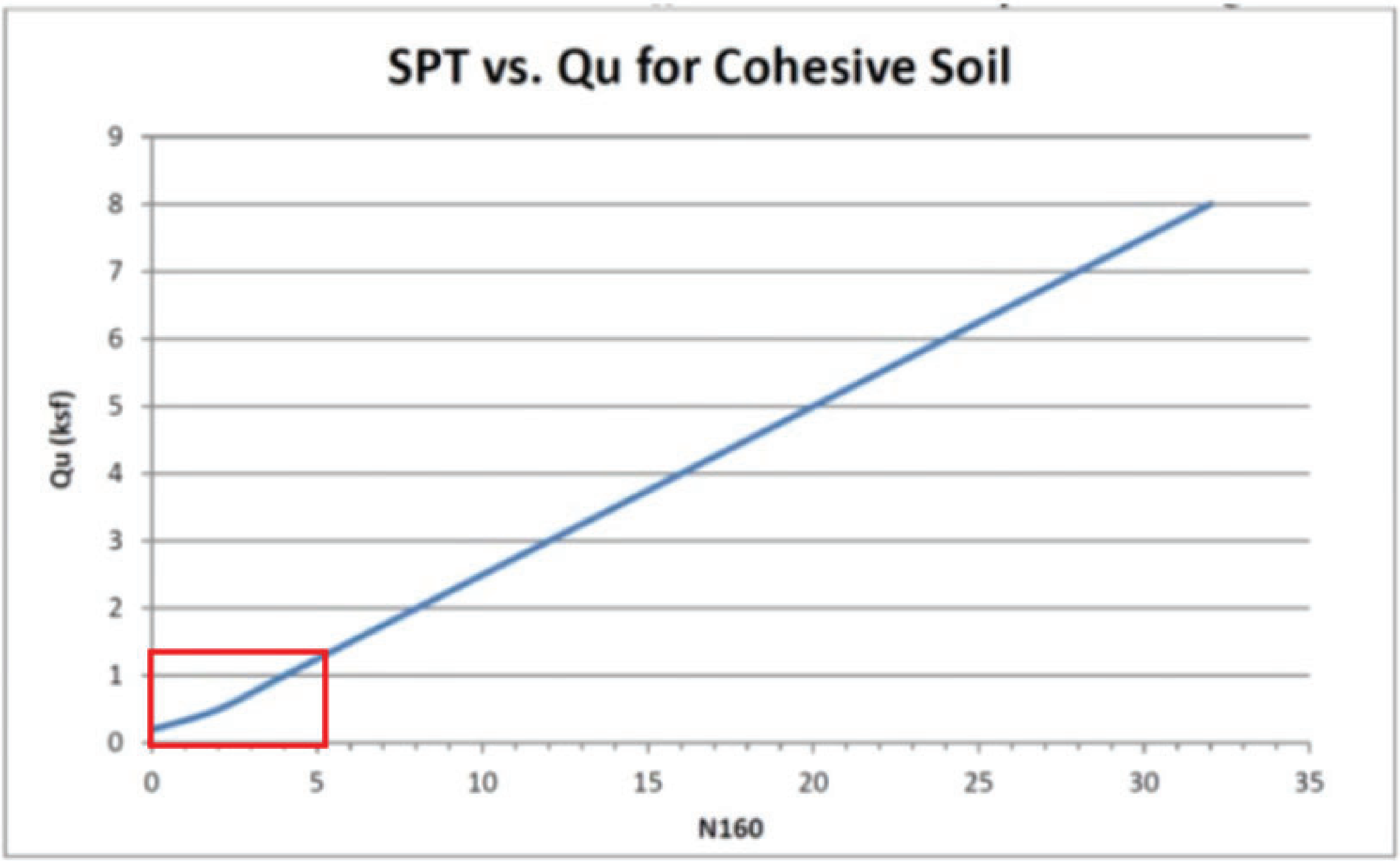
Rate estimates become more complex for some partially saturated soils, as discuss in Chapters 20 and 21.

Computer Software - Program FTGSETT

A computer program that computes the settlement of spread footings on cohesive soi FTGSETT, is included with this book. It uses the analysis techniques described earlier. can consider square, rectangular, circular and continuous footings. The user can easil change the footing dimensions, loads, and soil properties, thus reducing the tedium hand computations and making parametric studies much easier to perform.

Attachment 3:

Reference 3: Foundation Analysis and Design (Bowles, 1977)


SPT vs. Qu for Cohesive Soil
Qu (ksf)
0
1
2
3
4
5
6
7
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Attachment 4:

Boring Logs and Laboratory Testing

EFFLUENT TANK BORING LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: T-1 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 1

Site Location: East Palestine

Drilling Started: 5/10/2023 8:55 AM Drilling Completed: 5/10/2023 9:20 AM

Total Depth Drilled: 24 feet Hole Diameter: 2.25" Type of Sample/ Coring Device: 1.25" MacroCore

Length and Diameter of Coring Device: 4' length, 1.25" diameter MacroCore Sampling Interval: Continuous feet

Land-Surface Elev.: TBD feet ☐ Surveyed ☐ Estimated Datum:

Drilling Fluid Used: N/A Drilling Method Track mount Geoprobe

Drilling Contractor: EnviroCore Driller: Joe Fleck Helper: Bryan

Prepared By: Allen Long Hammer Weight -

Sample/Core Depth		Core Recovery	Pocket Penetrometer	Sample	Description
From	To	(in.)	(tsf)		
0.0	4.0	29	4.5+	0-3'	Sandy Lean Clay (CL), some angular fine gravel, moist, brown. LL=35, PL=22, PI=13, MC=12%
				3-4'	Same as above but gray.
4.0	8.0	40	4.5+	4-8'	Same as above but gravel is more subangular.
8.0	12.0	42	3.5	8-12'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray. LL=37, PL=21, PI=16, MC=12%
12.0	16.0	46	4.5+	12-14.5'	Same as above.
				14.5-15'	Sand and gravel lense, wet.
				15-16'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray.
16.0	20.0	45	4.5	16-20'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray. LL=38, PL=21, PI=17, MC=10%
20.0	24.0	46	4.5+	20-24'	Same as above.
					Bottom of Boring - 24.0'

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: T-2 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 1

Site Location: East Palestine Drilling Started 5/10/2023 9:30 AM Drilling Completed 5/10/2023 9:55 AM

Total Depth Drilled: 24 feet Hole Diameter: 2.25" Type of Sample/ Coring Device: 1.25" MacroCore

Length and Diameter of Coring Device: 4' length, 1.25" diameter MacroCore Sampling Interval: Continuous feet

Land-Surface Elev.: TBD feet ☐ Surveyed ☐ Estimated Datum:

Drilling Fluid Used: N/A Drilling Method Track mount Geoprobe

Drilling Contractor: EnviroCore Driller: Joe Fleck Helper: Bryan

Prepared By: Allen Long Hammer Weight -

Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Pocket Penetrometer (tsf)	Sample	Description
0.0	4.0	24	4.5+	0-2'	Sandy Lean Clay (CL), some angular fine gravel, moist, brown.
				2-4'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray. LL=35, PL=21, PI=14, MC=13%
4.0	8.0	20	2.0	6-8'	Same as above with some larger gravel (>1"). LL=38, PL=21, PI=17, MC=13%
8.0	12.0	28	3.5	10-12'	Same as above but with some thin sand lenses.
12.0	16.0	20	4.0	14-15'	Sand and gravel lense, wet.
				15-16'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray.
16.0	20.0	22	3.25	16-20'	Same as above but with some thin sand lenses.
20.0	24.0	34	3.75	22-24'	Same as above. LL=36, PL=22, PI=14, MC=10%
					Bottom of Boring - 24.0'

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: T-3 | Project/No: East Palestine Emergency Response - 30169714 | Page 1 of 1

Site Location: East Palestine | Drilling Started: 5/10/2023 10:00 AM | Drilling Completed: 5/10/2023 10:40 AM

Total Depth Drilled: 32 feet | Hole Diameter: 2.25" | Type of Sample/Coring Device: 1.25" MacroCore

Length and Diameter of Coring Device: 4' length, 1.25" diameter MacroCore | Sampling Interval: Continuous feet

Land-Surface Elev.: TBD feet | ☐ Surveyed | ☐ Estimated | Datum:

Drilling Fluid Used: N/A | Drilling Method: Track mount Geoprobe

Drilling Contractor: EnviroCore | Driller: Joe Fleck | Helper: Bryan

Prepared By: Allen Long | Hammer Weight: -

Sample/Core Depth		Core Recovery	Pocket Penetrometer	Sample	Description
From	To	(in.)	(tsf)		
0.0	4.0	30	3.75	2-4'	Sandy Lean Clay (CL), some angular fine gravel, moist, brown.
4.0	8.0	26	3.5	4-7'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray.
8.0	12.0	29	4.5+	8-10'	Same as above but with some thin sand lenses.
12.0	16.0	36	4.5	14-16'	Same as above.
16.0	20.0	38	4.0	18-20'	Same as above. LL=37, PL=21, PI=16, MC=12%
20.0	24.0	36	4.5+	22-24'	Same as above.
24.0	28.0	46	3.5	26-28'	Same as above. LL=37, PL=20, PI=17, MC=12%
28.0	32	38	4.5+	30-32'	Lean Clay with Sand (SC) with some sand and gravel lenses. LL=39, PL=22, PI=17, MC=11%
					Bottom of Boring - 32.0'

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: T-4 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 1

Site Location: East Palestine Drilling Started 5/10/2023 1:20 PM Drilling Completed 5/10/2023 1:40 PM

Total Depth Drilled: 24 feet Hole Diameter: 2.25" Type of Sample/ Coring Device: 1.25" MacroCore

Length and Diameter of Coring Device: 4' length, 1.25" diameter MacroCore Sampling Interval: Continuous feet

Land-Surface Elev.: TBD feet ☐ Surveyed ☐ Estimated Datum:

Drilling Fluid Used: N/A Drilling Method Track mount Geoprobe

Drilling Contractor: EnviroCore Driller: Joe Fleck Helper: Bryan

Prepared By: Allen Long Hammer Weight -

Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Pocket Penetrometer (tsf)	Sample	Description
0.0	4.0	36	3.0	0-2'	Clayey Sand (SC), some angular fine gravel, moist, brown.
4.0	8.0	32	3.5	4-6'	Same as above. LL=34, PL=20, PI=14, MC=7%
8.0	12.0	36.0	3.75	8-10'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray.
				11.5-12.5	Sand and gravel, wet, tan.
12.0	16.0	36	4.25	14-16'	Sandy Lean Clay (CL), some subangular fine gravel, moist, gray. LL=37, PL=20, PI=17, MC=11%
16.0	20.0	38	4.5	18-20'	Same as above but with sand and gravel lenses.
20.0	24.0	48	3.5	22-24'	Same as above.
					Bottom of Boring - 24.0'

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: T-5 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 1

Site Location: East Palestine Drilling Started 5/10/2023 1:40 PM Drilling Completed 5/10/2023 2:25 PM

Total Depth Drilled: 24 feet Hole Diameter: 2.25" Type of Sample/ Coring Device: 1.25" MacroCore

Length and Diameter of Coring Device: 4' length, 1.25" diameter MacroCore Sampling Interval: Continuous feet

Land-Surface Elev.: TBD feet ☐ Surveyed ☐ Estimated Datum:

Drilling Fluid Used: N/A Drilling Method Track mount Geoprobe

Drilling Contractor: EnviroCore Driller: Joe Fleck Helper: Bryan

Prepared By: Allen Long Hammer Weight -

Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Pocket Penetrometer (tsf)	Sample	Description
0.0	4.0	44	0-0.5	0-2'	Sandy Lean Clay (CL), some angular fine gravel, moist, brown and gray, soft, possible fill. LL=31, PL=19, PI=12, MC=19%
			0-2.5	2-4'	Same but dark gray. LL=34, PL=21, PI=13, MC=15%
4.0	8.0	44	3-4.5	6-8'	Same but brown.
8.0	12.0	32	3-4.5	10-12'	Same but gray.
12.0	16.0	38	3-3.5	14-16'	Same as above.
16.0	20.0	48	0.0	16-17'	Same but very soft. LL=36, PL=22, PI=14, MC=14%
			-		Same but more stiff.
20.0	24.0	24	2.5-3.5	22-24'	Same as above.
					Bottom of Boring - 24.0'

ARCADIS Design & Consultancy for natural and built assets

Client: Norfolk Southern

Boring Log

Boring: T-6 Project/No: East Palestine Emergency Response - 30169714 Page 1 of 1

Site Location: East Palestine Drilling Started 5/10/2023 2:30 PM Drilling Completed 5/10/2023 2:50 PM

Total Depth Drilled: 24 feet Hole Diameter: 2.25" Type of Sample/Coring Device: 1.25" MacroCore

Length and Diameter of Coring Device: 4' length, 1.25" diameter MacroCore Sampling Interval: Continuous feet

Land-Surface Elev.: TBD feet ☐ Surveyed ☐ Estimated Datum:

Drilling Fluid Used: N/A Drilling Method Track mount Geoprobe

Drilling Contractor: EnviroCore Driller: Joe Fleck Helper: Bryan

Prepared By: Allen Long Hammer Weight -

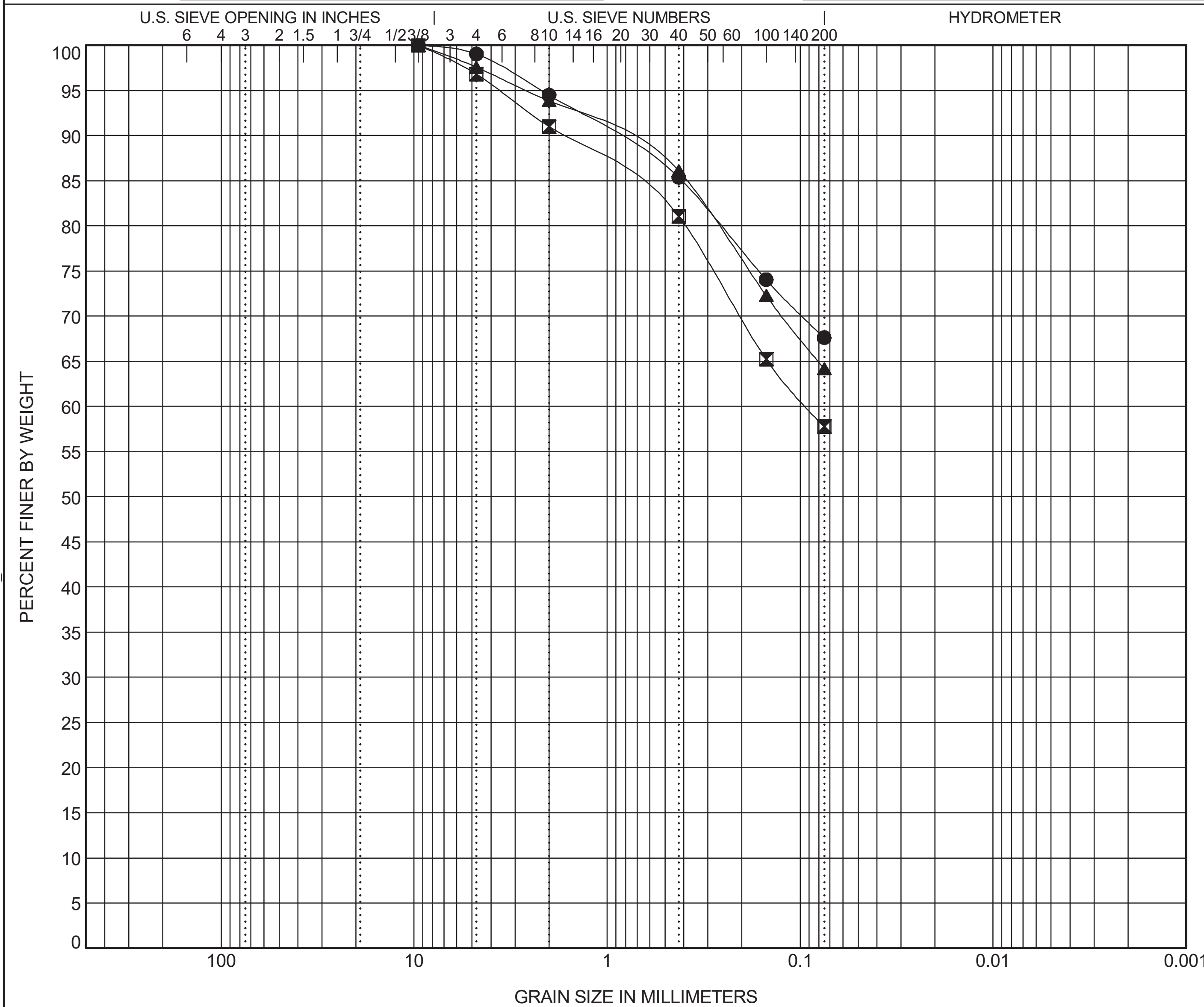
Sample/Core Depth From	Sample/Core Depth To	Core Recovery (in.)	Pocket Penetrometer (tsf)	Sample	Description
0.0	4.0	28	0.5-1	0-2'	Sandy Lean Clay (CL), moist, brown and gray. LL=36, PL=21, PI=15, MC=18%
4.0	8.0	44	0.5-4.0	4-6'	Lean Clay with Sand (CL), moist, gray, some soft zones. LL=35, PL=21, PI=14, MC=26%
8.0	12.0	36	4.5	8-10'	Same but with angular gravel and one sandstone cobble.
12.0	16.0	38	3.5-4.5	14-16'	Same but no cobbles.
16.0	20.0	38	3.5-4.5	18-20'	Clayey Sand (SC), moist, gray LL=33, PL=20, PI=13, MC=12%
20.0	24.0	42	3.5-4.5	22-24'	Same but with sand and gravel lense.
					Bottom of Boring - 24.0'

GRAIN SIZE DISTRIBUTION

DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc. **PROJECT NAME** East Palestine

PROJECT NUMBER **PROJECT LOCATION** Palestine, Ohio



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**T-1**	**0.0**	**SANDY LEAN CLAY(CL)**	**35**	**22**	**13**		
⊠	**T-1**	**8.0**	**SANDY LEAN CLAY(CL)**	**37**	**21**	**16**		
▲	**T-1**	**16.0**	**SANDY LEAN CLAY(CL)**	**38**	**21**	**17**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T-1**	**0.0**	**9.5**				**1.0**	**31.4**	**67.6**	
⊠	**T-1**	**8.0**	**9.5**	**0.092**			**3.2**	**39.1**	**57.8**	
▲	**T-1**	**16.0**	**9.5**				**2.4**	**33.4**	**64.2**	

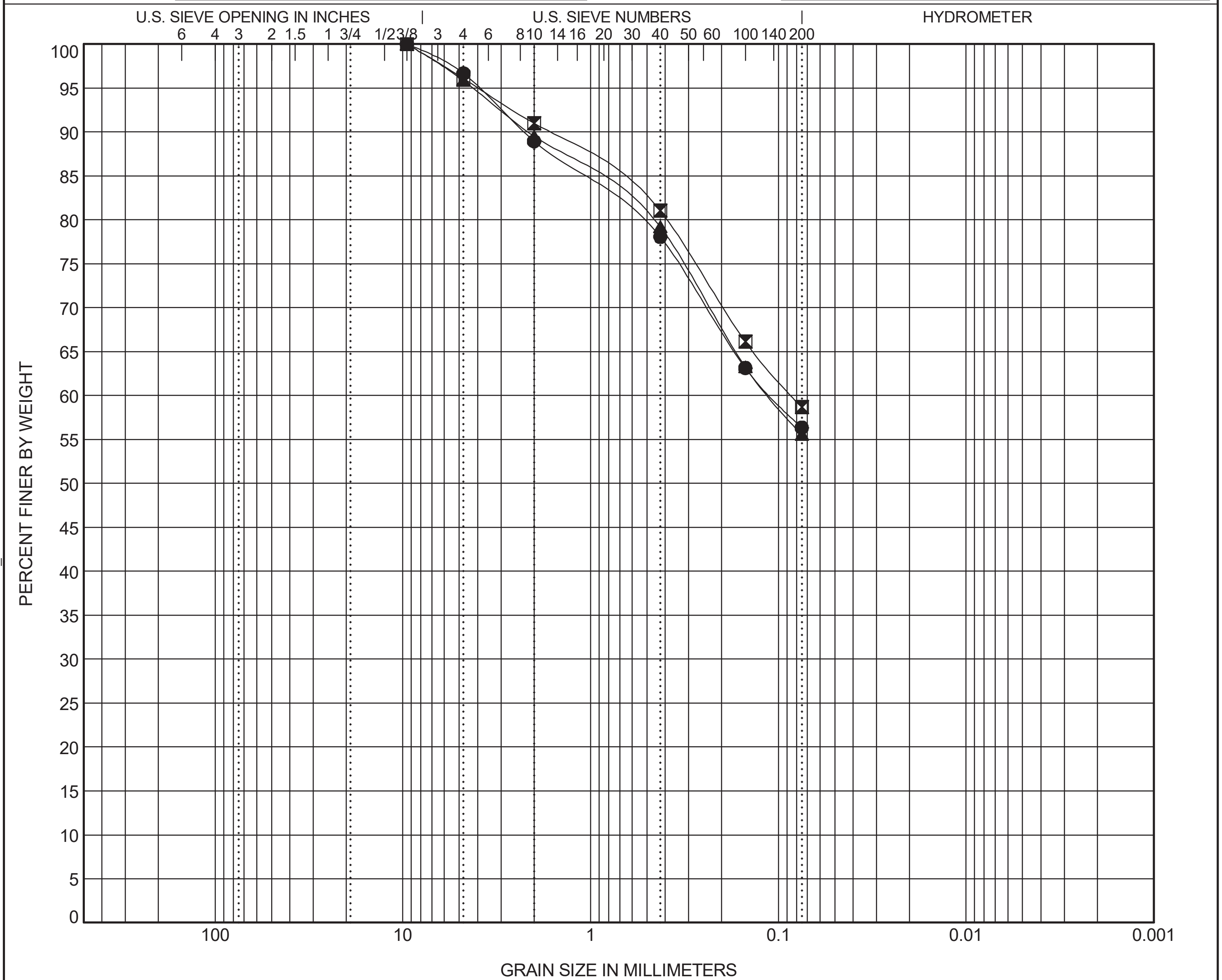
GRAIN SIZE - GINT STD US LAB.GDT - 5/14/23 17:16 - C:\USERS\SUNDE\DROPBOX\FAMILY ROOM\SUNDEEP\GINT FILES\EAST PALESTINE_STANTEC.GPJ

GRAIN SIZE DISTRIBUTION

DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc. **PROJECT NAME** East Palestine

PROJECT NUMBER **PROJECT LOCATION** Palestine, Ohio



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**T-2**	**2.0**	**SANDY LEAN CLAY(CL)**	**35**	**21**	**14**		
⊠	**T-2**	**6.0**	**SANDY LEAN CLAY(CL)**	**38**	**21**	**17**		
▲	**T-2**	**22.0**	**SANDY LEAN CLAY(CL)**	**36**	**22**	**14**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T-2**	**2.0**	**9.5**	**0.109**			**3.3**	**40.3**	**56.4**	
⊠	**T-2**	**6.0**	**9.5**	**0.085**			**3.9**	**37.4**	**58.7**	
▲	**T-2**	**22.0**	**9.5**	**0.112**			**4.1**	**40.3**	**55.6**	

GRAIN SIZE - GINT STD US LAB.GDT - 5/14/23 17:17 - C:\USERS\SUNDE\DROPBOX\FAMILY ROOM\SUNDEEP\GINT FILES\EAST PALESTINE_STANTEC.GPJ

GRAIN SIZE DISTRIBUTION

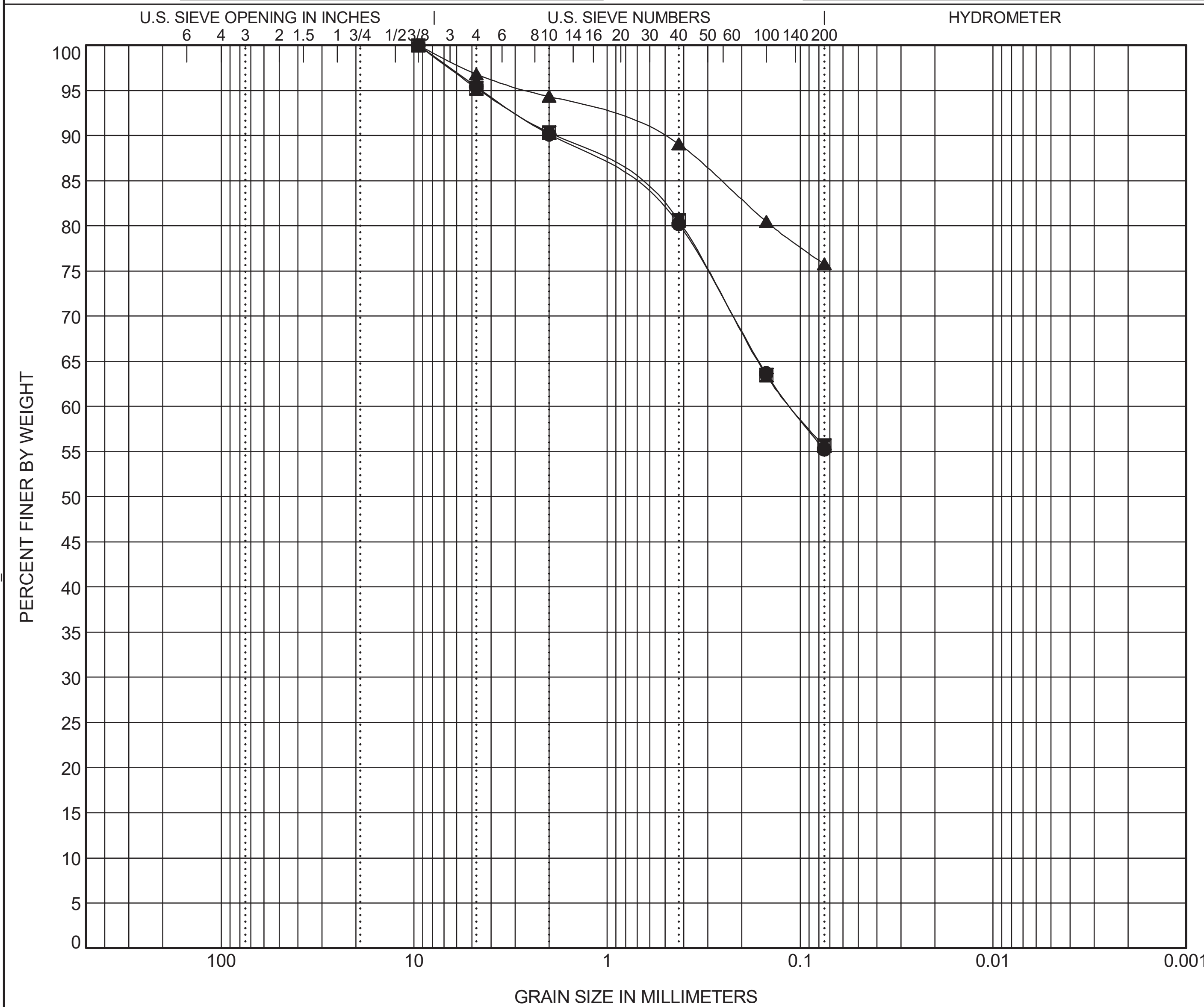
DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc.

PROJECT NAME East Palestine

PROJECT NUMBER

PROJECT LOCATION Palestine, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**T-3**	**18.0**	**SANDY LEAN CLAY(CL)**	**37**	**21**	**16**		
⊠	**T-3**	**26.0**	**SANDY LEAN CLAY(CL)**	**37**	**20**	**17**		
▲	**T-3**	**30.0**	**LEAN CLAY with SAND(CL)**	**39**	**22**	**17**		

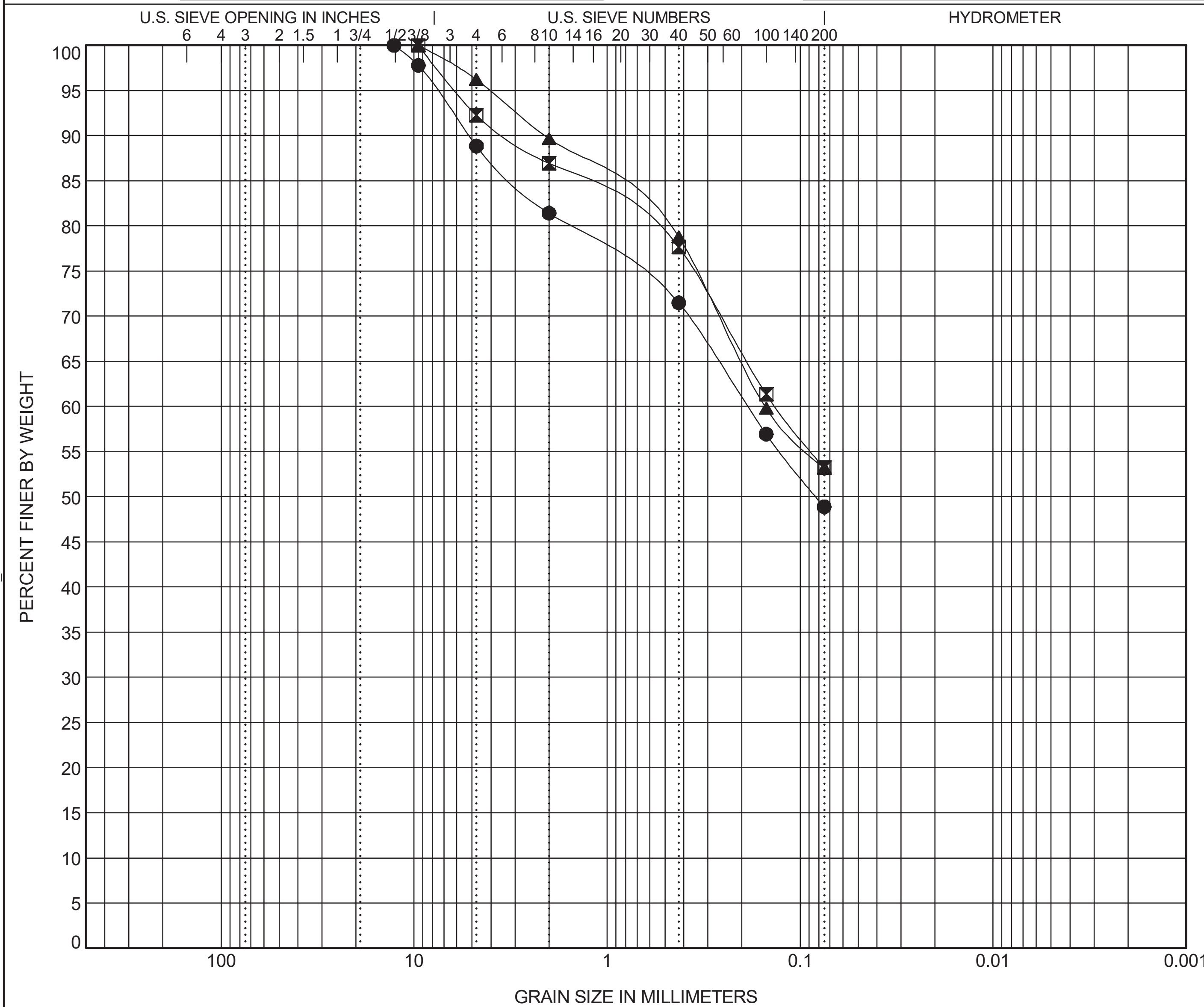
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T-3**	**18.0**	**9.5**	**0.111**			**4.6**	**40.2**	**55.3**	
⊠	**T-3**	**26.0**	**9.5**	**0.11**			**4.7**	**39.6**	**55.7**	
▲	**T-3**	**30.0**	**9.5**				**3.2**	**21.0**	**75.8**	

GRAIN SIZE DISTRIBUTION

DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc. **PROJECT NAME** East Palestine

PROJECT NUMBER **PROJECT LOCATION** Palestine, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**T-4**	**4.0**	**CLAYEY SAND(SC)**	**34**	**20**	**14**		
⊠	**T-4**	**8.0**	**SANDY LEAN CLAY(CL)**	**38**	**21**	**17**		
▲	**T-4**	**14.0**	**SANDY LEAN CLAY(CL)**	**37**	**20**	**17**		

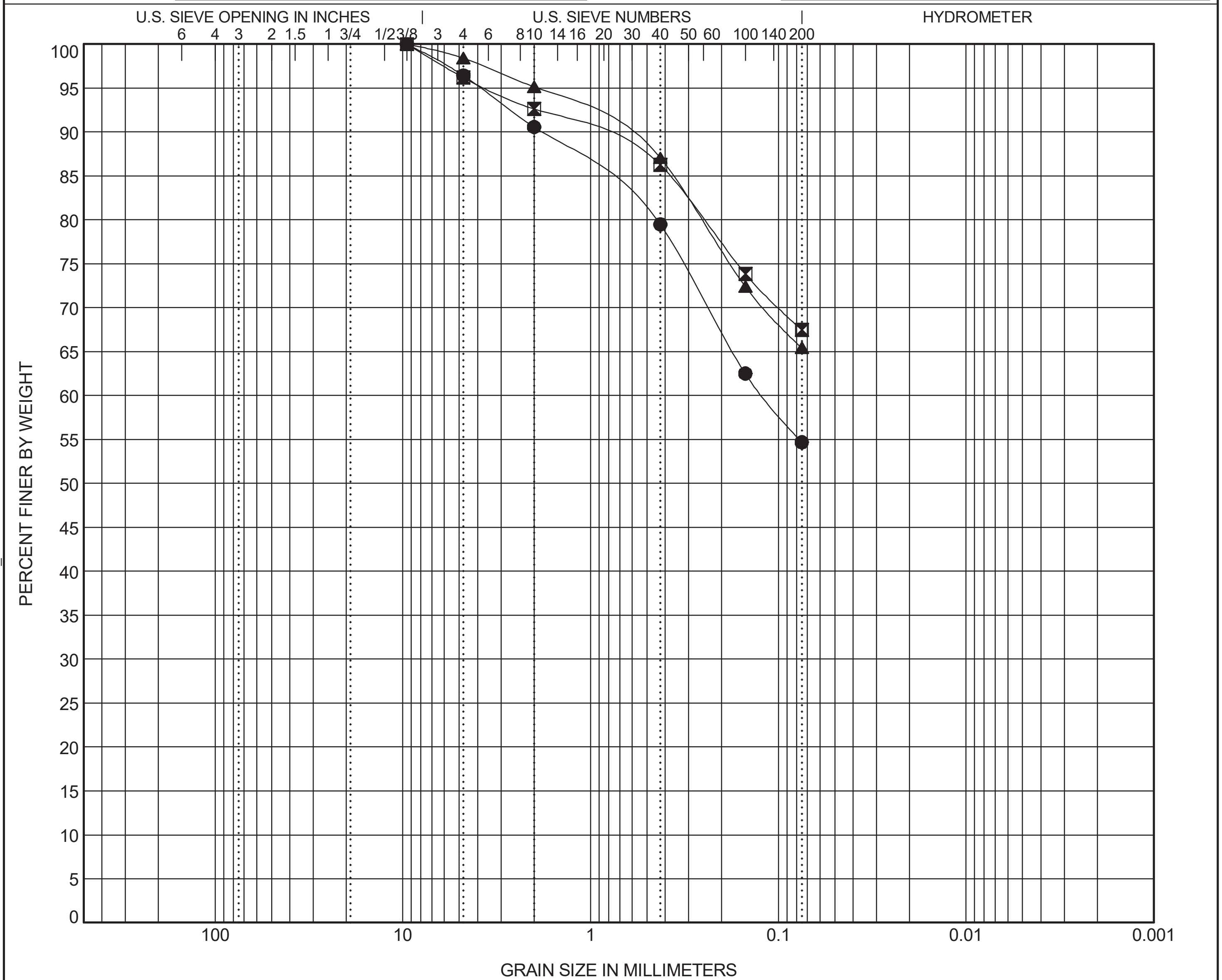
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T-4**	**4.0**	**12.7**	**0.187**			**11.1**	**40.0**	**48.9**	
⊠	**T-4**	**8.0**	**9.5**	**0.133**			**7.7**	**39.0**	**53.2**	
▲	**T-4**	**14.0**	**9.5**	**0.152**			**3.8**	**43.0**	**53.2**	

GRAIN SIZE DISTRIBUTION

DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc. **PROJECT NAME** East Palestine

PROJECT NUMBER **PROJECT LOCATION** Palestine, Ohio



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**T-5**	**0.0**	**SANDY LEAN CLAY(CL)**	**31**	**19**	**12**		
⊠	**T-5**	**2.0**	**SANDY LEAN CLAY(CL)**	**34**	**21**	**13**		
▲	**T-5**	**16.0**	**SANDY LEAN CLAY(CL)**	**36**	**22**	**14**		

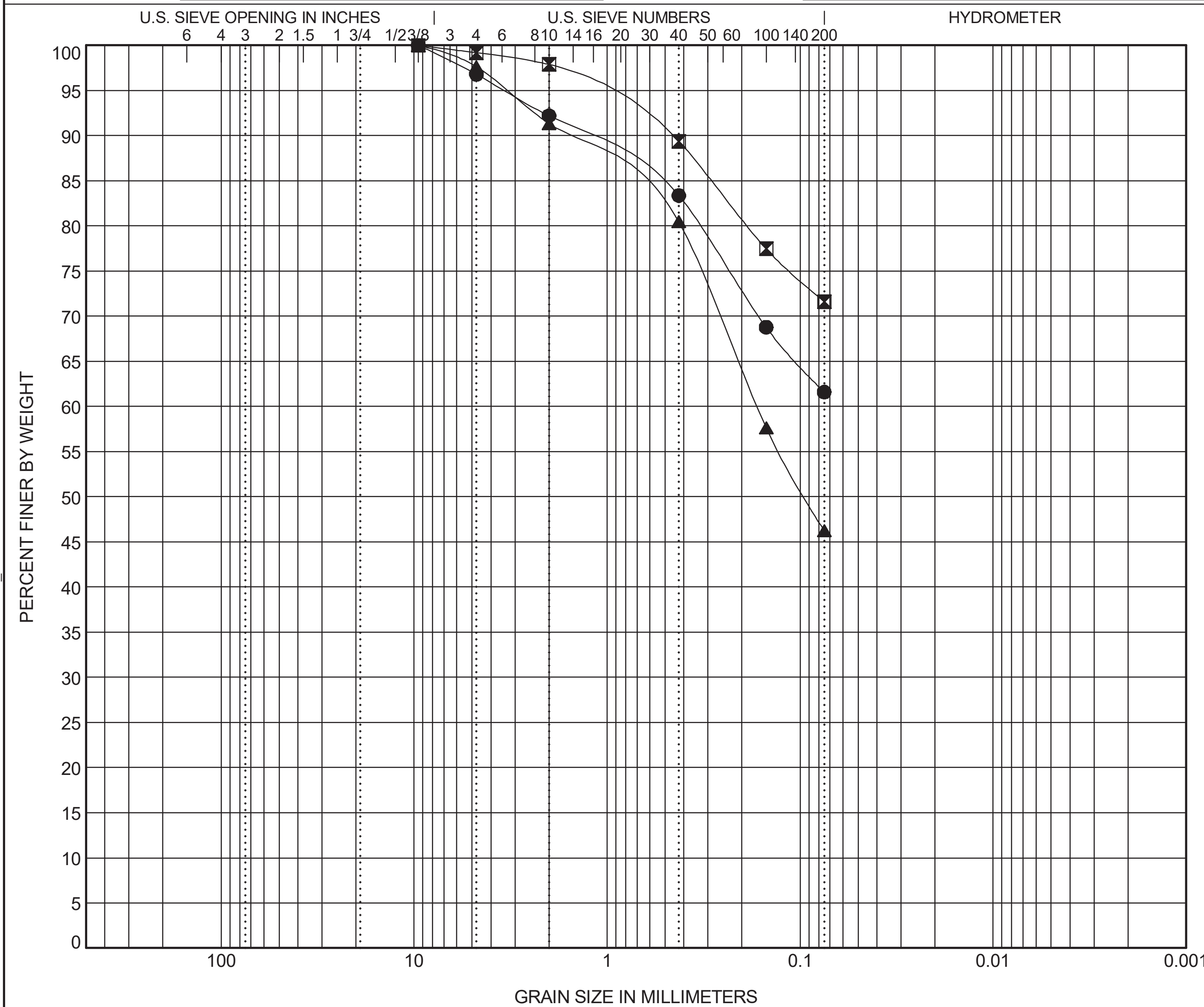
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T-5**	**0.0**	**9.5**	**0.12**			**3.6**	**41.7**	**54.7**	
⊠	**T-5**	**2.0**	**9.5**				**3.8**	**28.7**	**67.5**	
▲	**T-5**	**16.0**	**9.5**				**1.6**	**33.0**	**65.4**	

GRAIN SIZE DISTRIBUTION

DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc. **PROJECT NAME** East Palestine

PROJECT NUMBER **PROJECT LOCATION** Palestine, Ohio



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**T-6**	**0.0**	**SANDY LEAN CLAY(CL)**	**36**	**21**	**15**		
⊠	**T-6**	**4.0**	**LEAN CLAY with SAND(CL)**	**35**	**21**	**14**		
▲	**T-6**	**18.0**	**CLAYEY SAND(SC)**	**33**	**20**	**13**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**T-6**	**0.0**	**9.5**				**3.2**	**35.2**	**61.6**	
⊠	**T-6**	**4.0**	**9.5**				**0.8**	**27.6**	**71.6**	
▲	**T-6**	**18.0**	**9.5**	**0.167**			**2.3**	**51.4**	**46.3**	

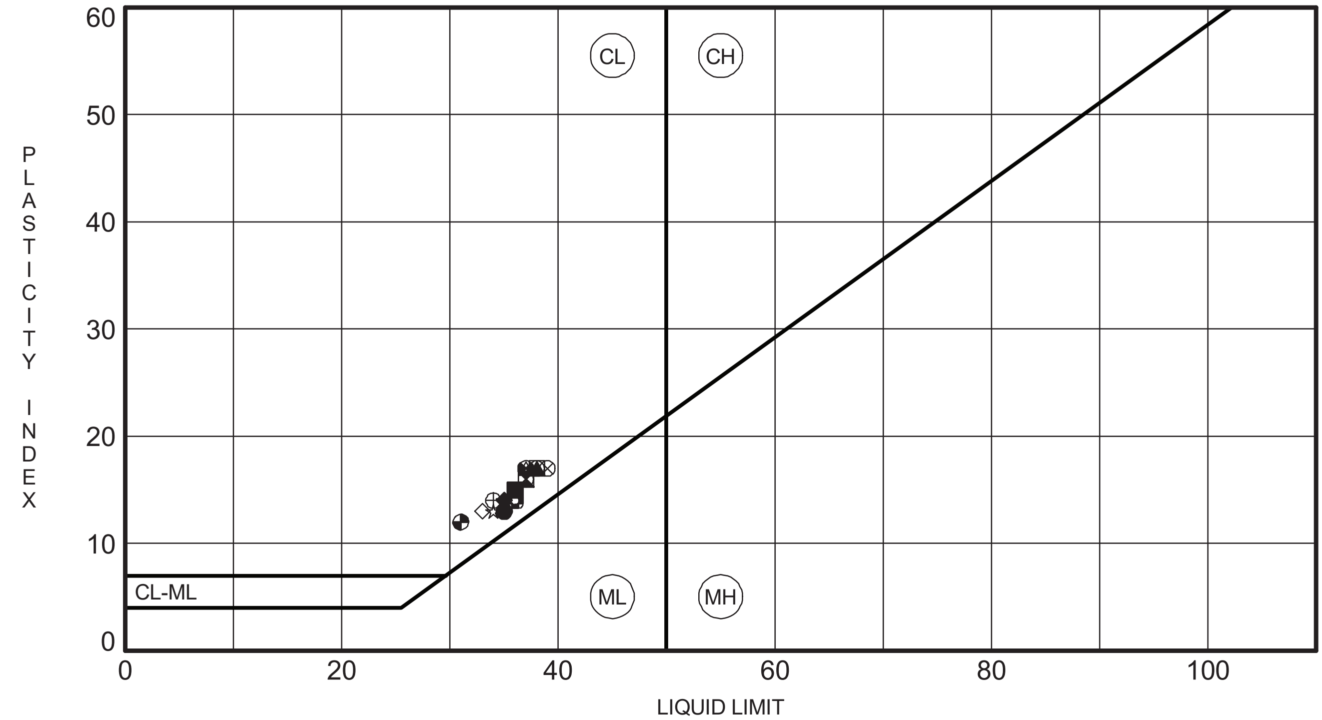
GRAIN SIZE - GINT STD US LAB.GDT - 5/14/23 17:17 - C:\USERS\SUNDE\DROPBOX\FAMILY ROOM\SUNDEEP\GINT FILES\EAST PALESTINE_STANTEC.GPJ

ATTERBERG LIMITS' RESULTS

DHDC Engineering Consulting Services, Inc.

CLIENT Stantec Consulting Services, Inc. **PROJECT NAME** East Palestine

PROJECT NUMBER **PROJECT LOCATION** Palestine, Ohio



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**T-1**	**0.0**	**35**	**22**	**13**	**68**	**SANDY LEAN CLAY(CL)**
⧗	**T-1**	**8.0**	**37**	**21**	**16**	**58**	**SANDY LEAN CLAY(CL)**
▲	**T-1**	**16.0**	**38**	**21**	**17**	**64**	**SANDY LEAN CLAY(CL)**
★	**T-2**	**2.0**	**35**	**21**	**14**	**56**	**SANDY LEAN CLAY(CL)**
⊙	**T-2**	**6.0**	**38**	**21**	**17**	**59**	**SANDY LEAN CLAY(CL)**
✿	**T-2**	**22.0**	**36**	**22**	**14**	**56**	**SANDY LEAN CLAY(CL)**
○	**T-3**	**18.0**	**37**	**21**	**16**	**55**	**SANDY LEAN CLAY(CL)**
△	**T-3**	**26.0**	**37**	**20**	**17**	**56**	**SANDY LEAN CLAY(CL)**
⊗	**T-3**	**30.0**	**39**	**22**	**17**	**76**	**LEAN CLAY with SAND(CL)**
⊕	**T-4**	**4.0**	**34**	**20**	**14**	**49**	**CLAYEY SAND(SC)**
□	**T-4**	**8.0**	**38**	**21**	**17**	**53**	**SANDY LEAN CLAY(CL)**
◉	**T-4**	**14.0**	**37**	**20**	**17**	**53**	**SANDY LEAN CLAY(CL)**
◐	**T-5**	**0.0**	**31**	**19**	**12**	**55**	**SANDY LEAN CLAY(CL)**
☆	**T-5**	**2.0**	**34**	**21**	**13**	**67**	**SANDY LEAN CLAY(CL)**
✾	**T-5**	**16.0**	**36**	**22**	**14**	**65**	**SANDY LEAN CLAY(CL)**
■	**T-6**	**0.0**	**36**	**21**	**15**	**62**	**SANDY LEAN CLAY(CL)**
◆	**T-6**	**4.0**	**35**	**21**	**14**	**72**	**LEAN CLAY with SAND(CL)**
◇	**T-6**	**18.0**	**33**	**20**	**13**	**46**	**CLAYEY SAND(SC)**

ATTERBERG LIMITS - GINT STD US LAB.GDT - 5/14/23 17:17 - C:\USERS\SUNDE\DROPBOX\FAMILY ROOM\SUNDEEP\GINT FILES\EAST PALESTINE_STANTEC.GPJ

JLT Laboratories, Inc.

Geotechnical, Geosynthetic and Materials Testing and Research

938 South Central Avenue
Canonsburg, Pennsylvania, 15317
Tel: 724-746-4441 Fax: 724 -745-4261
e-mail: jboschuk@jltlabs.com
www.jltlabs.com

June 7, 2023
23LS4053

ARCADIS
6041 Wallace Rd Ext
Suite 300
Wexford, PA 15090

Attn: Allen Long

RE: GEOTECHNICAL TEST RESULTS
NS - EAST PALESTINE (30169714)

Submitted herein are the results of Moisture Content, Sieve, Atterberg Limits & Classification performed on bag samples, as requested, based on the attached COC forms, for the above referenced project. Where applicable, testing was performed per ASTM Standards while subject to JLT's internal QA / QC and data validation procedures.

We appreciate the opportunity of being of service to you and look forward to working with you again. Should you have any questions, comments or require additional information, please do not hesitate to call. Thank you.

Sincerely,

JLT LABORATORIES, INC.

Martha Lea Boschuk
Office Manager

cc: Accounts Payable

Enclosures
mlb
MSWord\letter\2359
Inv# 8320

GEOTECHNICAL TEST REQUEST AND CHAIN OF CUSTODY

PAGE 1 of 2

CLIENT: Arcadis U.S., Inc.
PROJECT: 30169714
JOB NAME: NS - East Palestine

JLT JOB No.: 23LS4053
DATE ASSIGNED: 6-1-23

DATE RECEIVED: 6-2-23
DATE COMPLETED: 6-7-23
RECEIVED BY: AE

BORING & SAMPLE No.	DEPTH (feet)	CLASSIFICATION NOTES	PHYSICAL PROPERTIES								PERMEABILITY	SHELBY TUBES / CYLINDERS		Additional Requests		
			M/C ☑ D2216	SIEVE ☑ D422 ☐ D6913	HYDRO ☐ D422 ☐ D7928	ATTERBERG LIMITS ☑ D4318	SPEC GRAVTY ☐ D854	ORG CONT ☐ D2974	CLASS. ☑ D2487	pH ☐ 4972	PERMEABILITY ☐ D5084	UNCONF TEST ☐ D2166	CIU w/pp TEST ☐ D4767			
SPT-1	4-6'		✓	✓		✓			✓							
SPT-1	18-20'		✓	✓		✓			✓							
SPT-1	33-35		✓	✓		✓			✓							
SPT-1	43-45'		✓	✓		✓			✓							
SPT-2	8-10'		✓	✓		✓			✓							
SPT-2	38-40'		✓	✓		✓			✓							
SPT-2	53-55'		✓	✓		✓			✓							

COMPLETE THIS SECTION AND INCLUDE WITH SHIPMENT OR EMAIL ATTACHMENT.

SHIPPER: Allen Long
ADDRESS:
CONTACT:
TEL: 724-466-3355 EMAIL: allen.long@arcadis.com

SHIP TO: JLT Laboratories Inc.
938 South Central Avenue
Canonsburg, PA 15317
Tel: (724) 746-4441
e-mail: mboschuk@jltlabs.com

NOTES / INSTRUCTIONS

JLT GEOTECHNICAL LABORATORY
soilcoc2023.wpd

GEOTECHNICAL TEST REQUEST AND CHAIN OF CUSTODY

CLIENT: Arcadis U.S., Inc.
PROJECT: 30169714
JOB NAME: NS - East Palestine

JLT JOB No.: 23LS4053
DATE ASSIGNED: 6-1-23

DATE RECEIVED: 6-2-23
DATE COMPLETED: 6-7-23
RECEIVED BY: AE

BORING & SAMPLE No.	DEPTH (feet)	CLASSIFICATION NOTES	PHYSICAL PROPERTIES								PERMEABILITY	SHELBY TUBES / CYLINDERS		Additional Requests		
			M/C ☑ D2216	SIEVE ☑ D422 ☐ D6913	HYDRO ☐ D422 ☐ D7928	ATTERBERG LIMITS ☑ D4318	SPEC GRAVTY ☐ D854	ORG CONT ☐ D2974	CLASS. ☑ D2487	pH ☐ 4972	PERMEABILITY ☐ D5084	UNCONF TEST ☐ D2166	CIU w/pp TEST ☐ D4767			
SPT-3	6-8'		✔	✔		✔			✔							
SPT-3	28-30'		✔	✔		✔			✔							
SPT-3	38-40'		✔	✔		✔			✔							
SPT-3	43-45'		✔	✔		✔			✔							

COMPLETE THIS SECTION AND INCLUDE WITH SHIPMENT OR EMAIL ATTACHMENT.

SHIPPER: Allen Long
ADDRESS:
CONTACT:
TEL: 724-466-3355 EMAIL: allen.long@arcadis.com

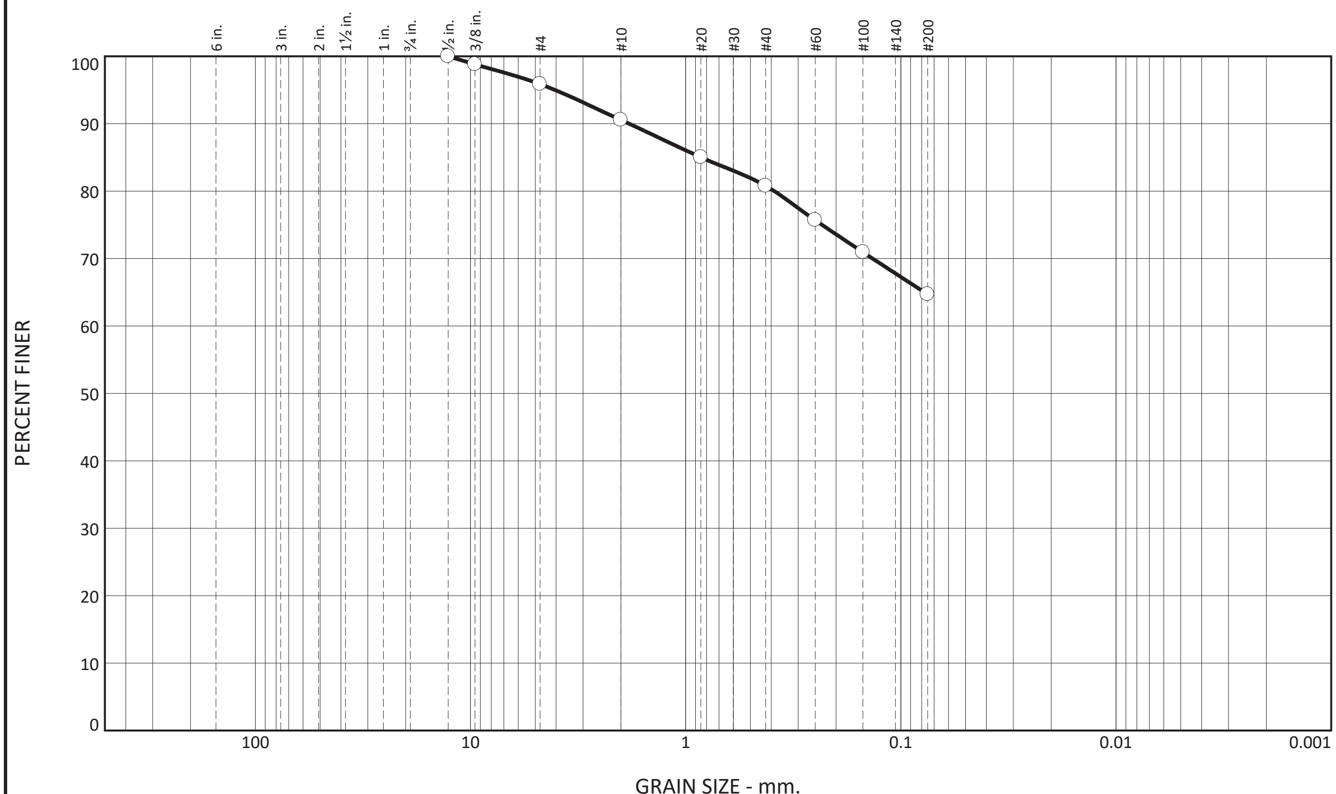
SHIP TO: JLT Laboratories Inc.
938 South Central Avenue
Canonsburg, PA 15317
Tel: (724) 746-4441
e-mail: mboschuk@jltlabs.com

NOTES / INSTRUCTIONS

JLT GEOTECHNICAL LABORATORY
soilcoc2023.wpd

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.1	5.3	9.8	16.1	64.7	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.50	100.0			
0.375	98.8			
#4	95.9			
#10	90.6			
#20	85.0			
#40	80.8			
#60	75.7			
#100	70.9			
#200	64.7			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 14 LL= 24 PI= 10

Coefficients

D_{90}= 1.8304 D_{85}= 0.8459 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Test Remarks

As-Rec'd M/C = 14.73%

Location: East Palestine
Sample Number: SPT-1 **Depth:** 4-6' **Sample Date:**

JLT Laboratories, Inc.

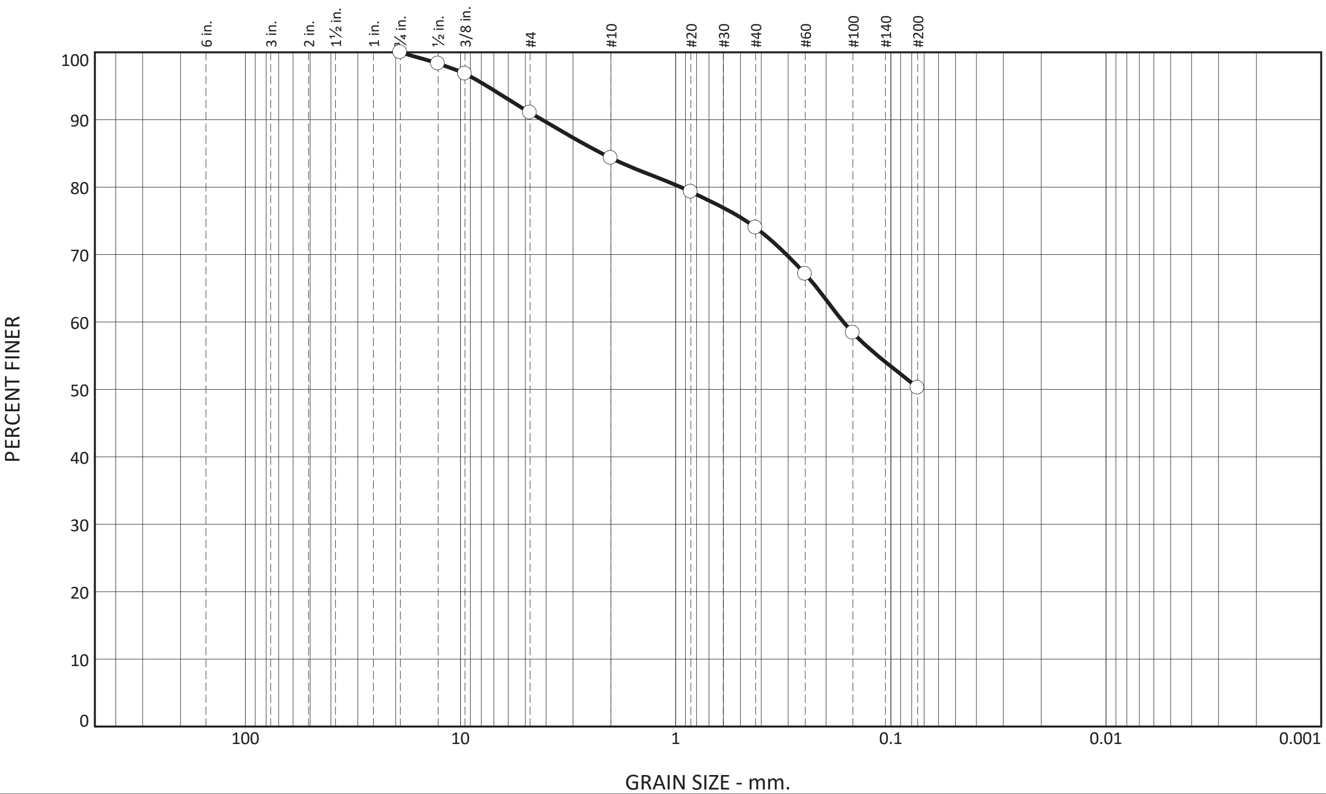
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.0	6.7	10.3	23.8	50.2	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.3			
0.375	96.8			
#4	91.0			
#10	84.3			
#20	79.3			
#40	74.0			
#60	67.1			
#100	58.4			
#200	50.2			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 20 PI= 7

Coefficients

D_{90}= 4.1711 D_{85}= 2.2010 D_{60}= 0.1661
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML-CL AASHTO=

Test Remarks

As-Rec'd M/C = 10.80%

Location: East Palestine
Sample Number: SPT-1 **Depth:** 18-20' **Sample Date:**

JLT Laboratories, Inc.

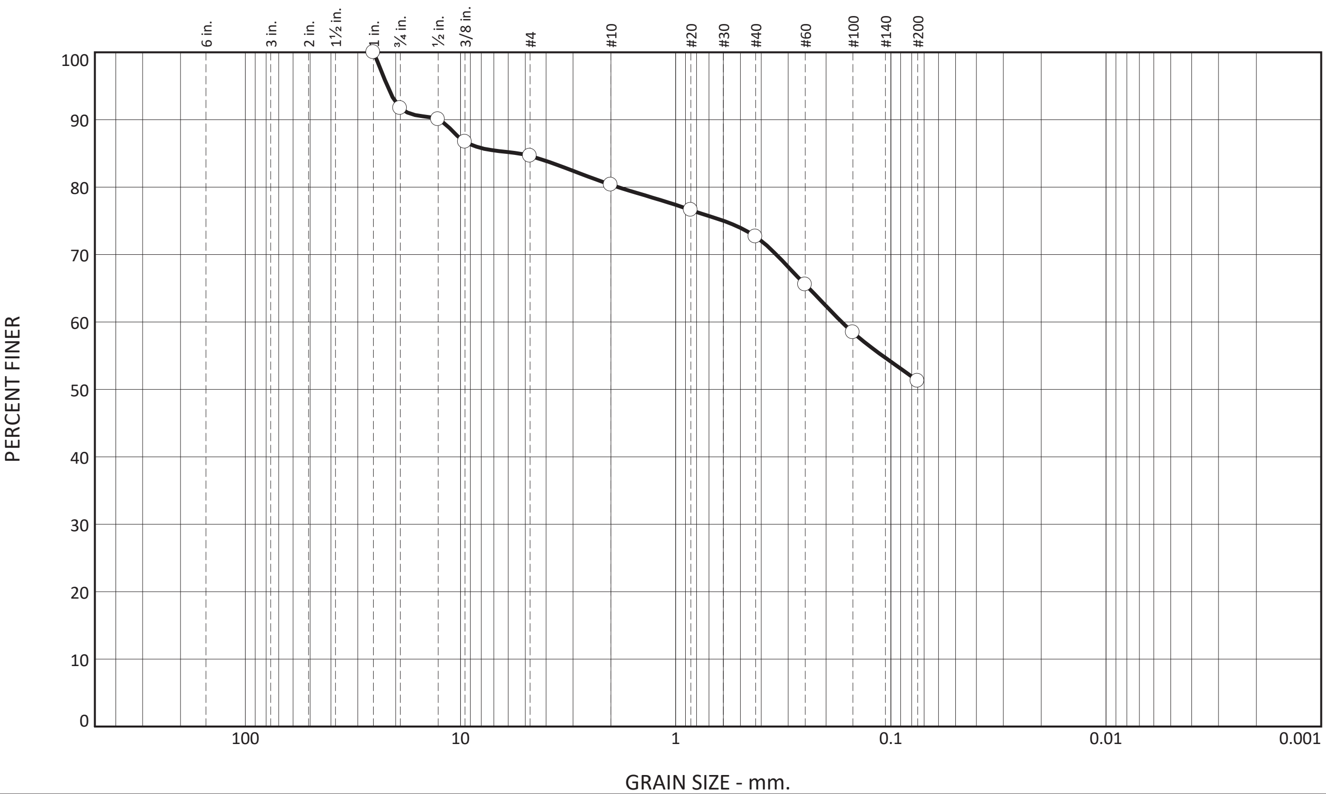
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.3	7.1	4.2	7.7	21.4	51.3	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	91.7			
0.50	90.1			
0.375	86.7			
#4	84.6			
#10	80.4			
#20	76.6			
#40	72.7			
#60	65.6			
#100	58.4			
#200	51.3			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 12 LL= 21 PI= 9

Coefficients

D_{90}= 12.5571 D_{85}= 5.3491 D_{60}= 0.1691
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 10.97%

Location: East Palestine
Sample Number: SPT-1 **Depth:** 33-35' **Sample Date:**

JLT Laboratories, Inc.

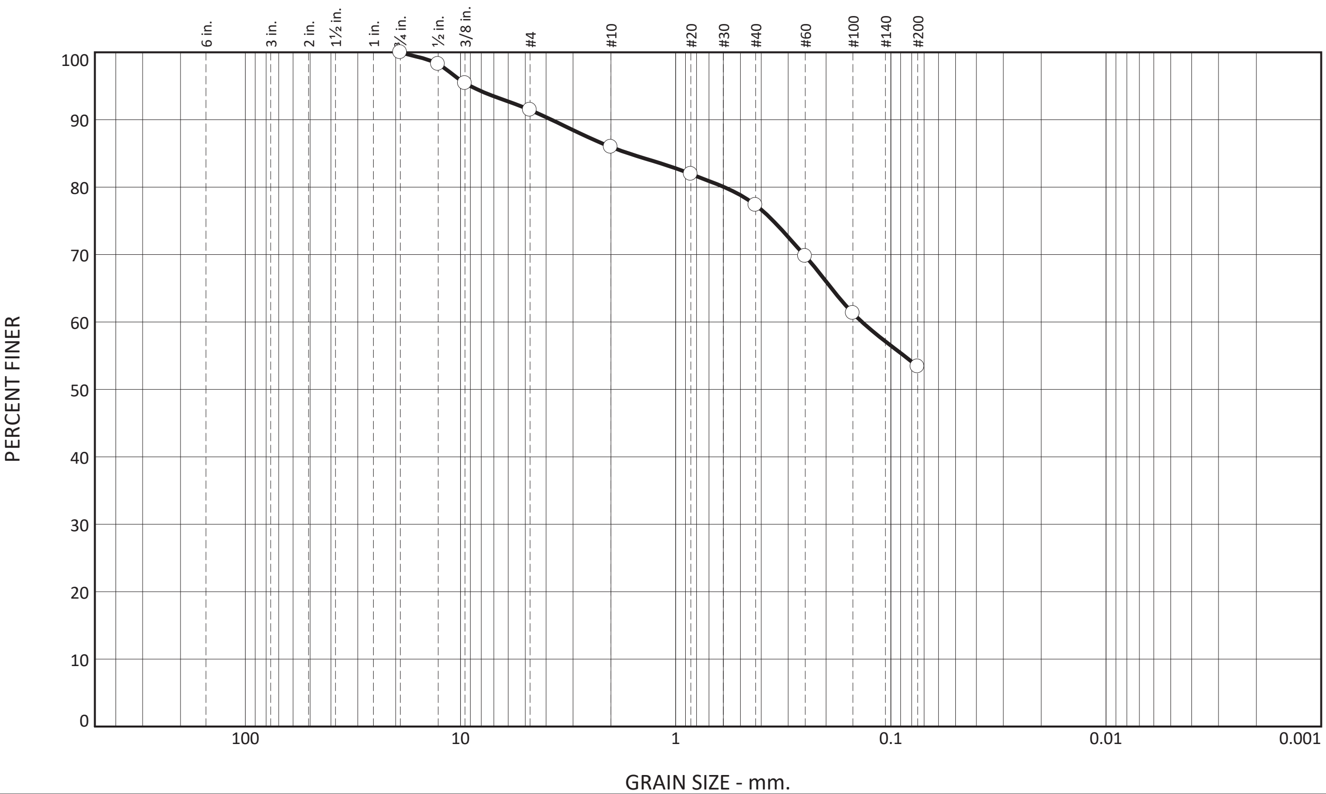
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.5	5.5	8.7	23.9	53.4	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.3			
0.375	95.4			
#4	91.5			
#10	86.0			
#20	82.0			
#40	77.3			
#60	69.8			
#100	61.3			
#200	53.4			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 12 LL= 20 PI= 8

Coefficients

D_{90}= 3.7750 D_{85}= 1.6474 D_{60}= 0.1359
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 11.06%

Location: East Palestine
Sample Number: SPT-1 **Depth:** 43-45' **Sample Date:**

JLT Laboratories, Inc.

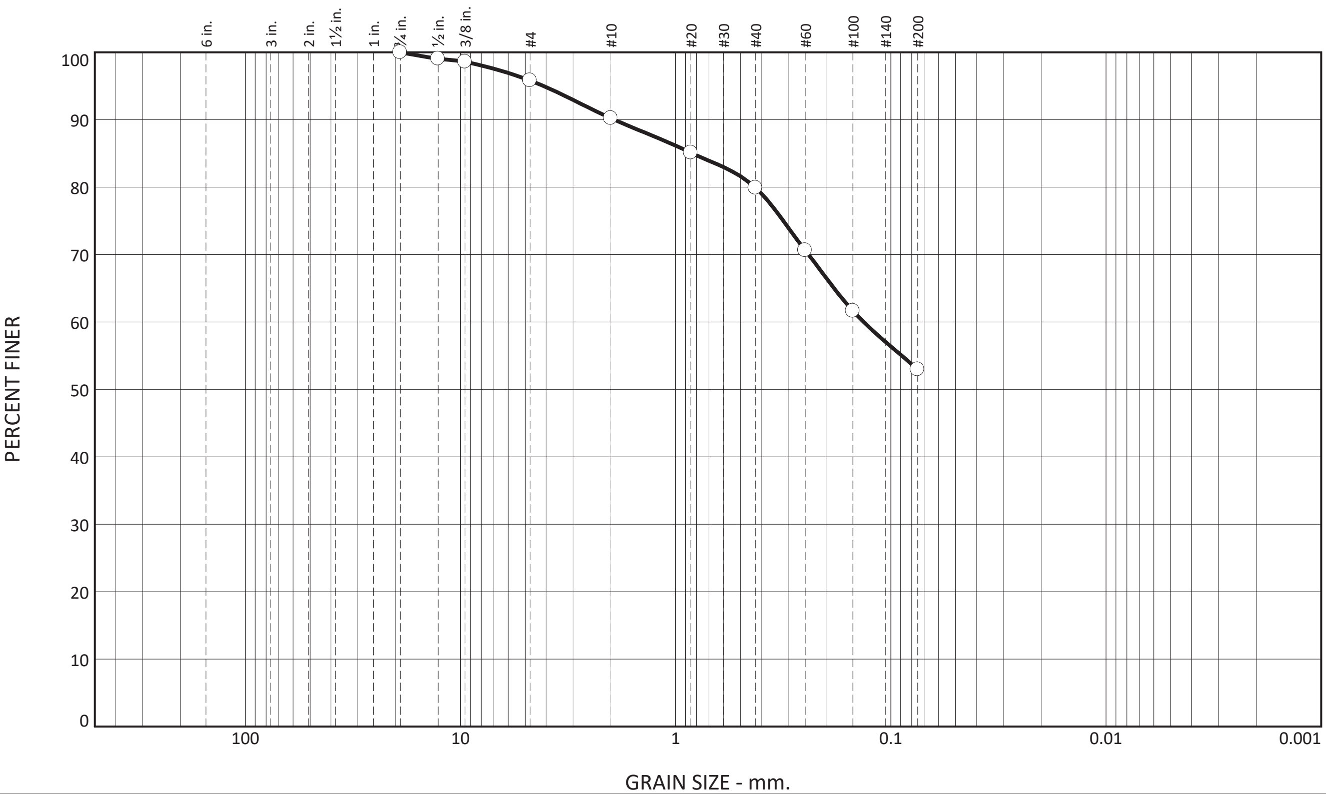
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	5.6	10.3	26.9	53.0	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	99.1			
0.375	98.6			
#4	95.8			
#10	90.2			
#20	85.1			
#40	79.9			
#60	70.6			
#100	61.6			
#200	53.0			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 11 LL= 21 PI= 10

Coefficients

D_{90}= 1.9254 D_{85}= 0.8362 D_{60}= 0.1337
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 10.98%

Location: East Palestine
Sample Number: SPT-2 **Depth:** 8-10' **Sample Date:**

JLT Laboratories, Inc.

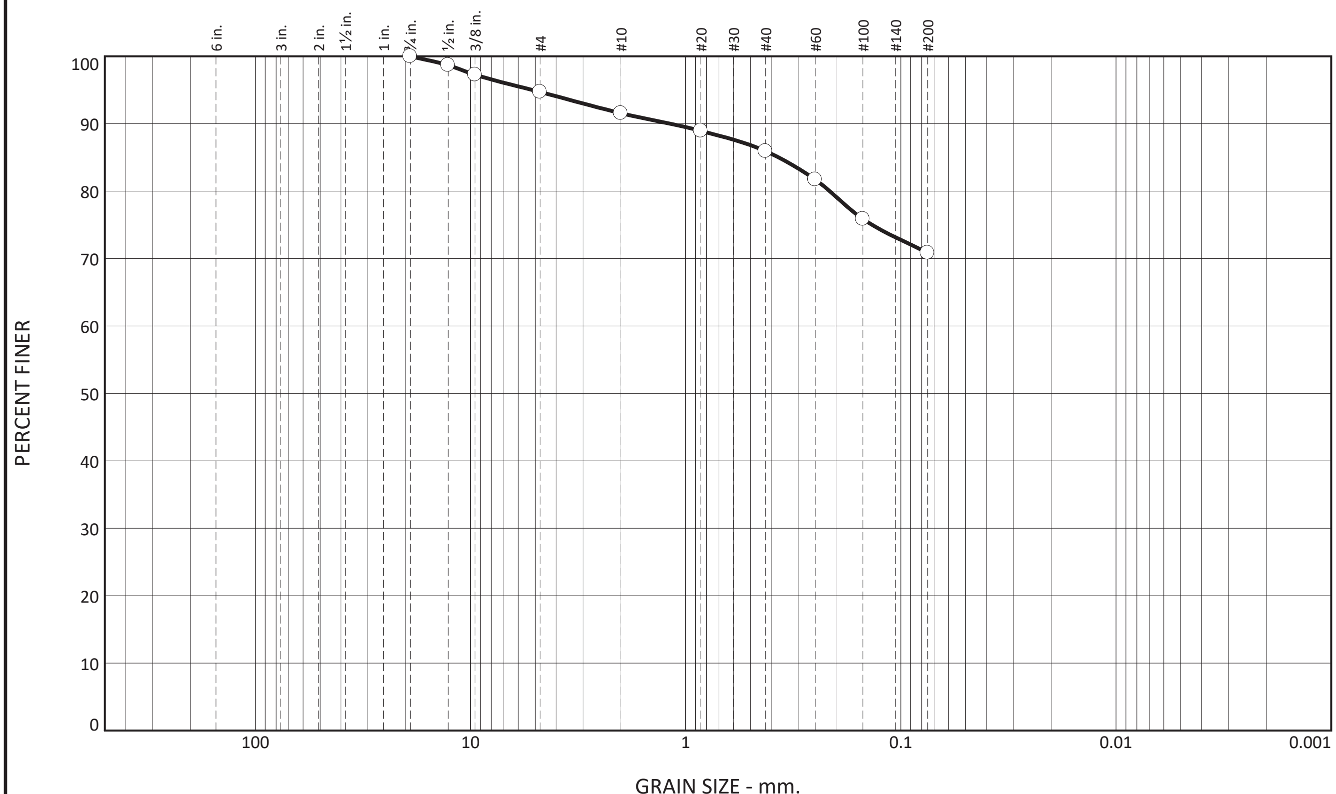
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.3	3.1	5.7	15.1	70.8	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.7			
0.375	97.3			
#4	94.7			
#10	91.6			
#20	88.9			
#40	85.9			
#60	81.7			
#100	75.9			
#200	70.8			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 13 LL= 23 PI= 10

Coefficients

D_{90}= 1.1773 D_{85}= 0.3693 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 17.82%

Location: East Palestine
Sample Number: SPT-2 **Depth:** 38-40' **Sample Date:**

JLT Laboratories, Inc.

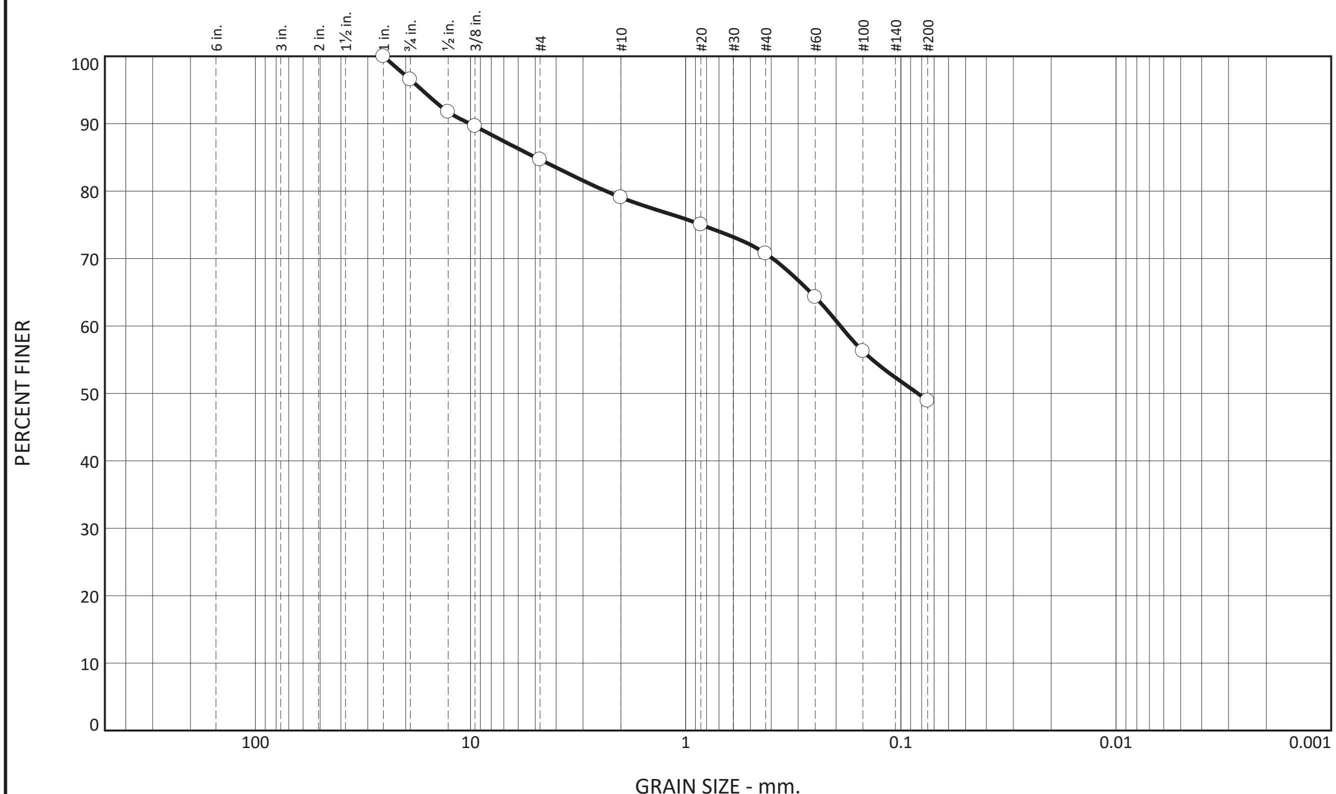
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.4	11.9	5.6	8.4	21.8	48.9	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	96.6			
0.50	91.8			
0.375	89.6			
#4	84.7			
#10	79.1			
#20	75.0			
#40	70.7			
#60	64.3			
#100	56.3			
#200	48.9			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 11 LL= 21 PI= 10

Coefficients

D_{90}= 10.0301 D_{85}= 4.9711 D_{60}= 0.1910
D_{50}= 0.0834 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Test Remarks

As-Rec'd M/C = 11.54%

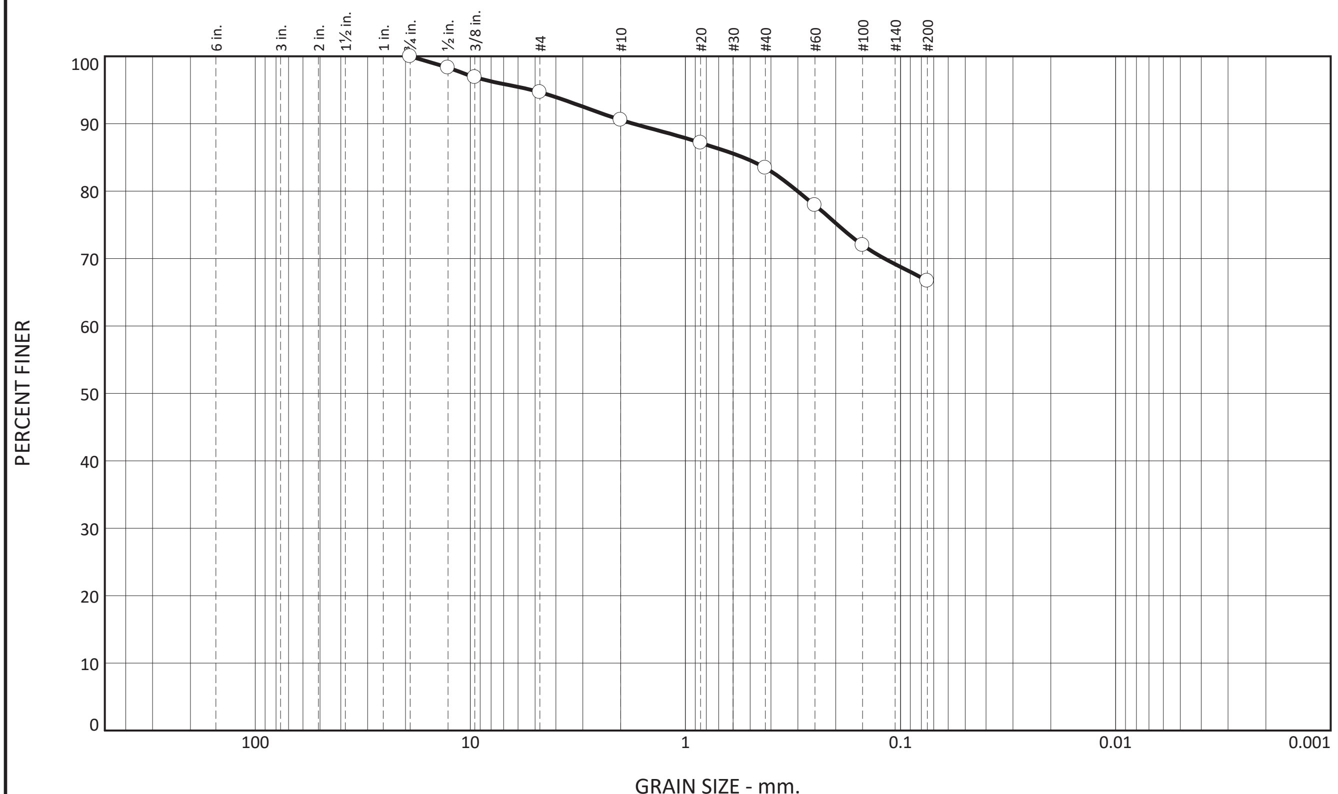
Location: East Palestine
Sample Number: SPT-2 **Depth:** 53-55' **Sample Date:**

JLT Laboratories, Inc. Canonsburg, PA	**Client:** ARCADIS **Project:** NS - East Palestine ARCADIS Project No: 30169714 **Project No:** 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.3	4.1	7.1	16.8	66.7	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	98.3			
0.375	96.9			
#4	94.7			
#10	90.6			
#20	87.2			
#40	83.5			
#60	77.9			
#100	72.0			
#200	66.7			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 16 LL= 26 PI= 10

Coefficients

D_{90}= 1.7389 D_{85}= 0.5365 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

As-Rec'd M/C = 18.17%

Location: East Palestine
Sample Number: SPT-3 **Depth:** 6-8' **Sample Date:**

JLT Laboratories, Inc.

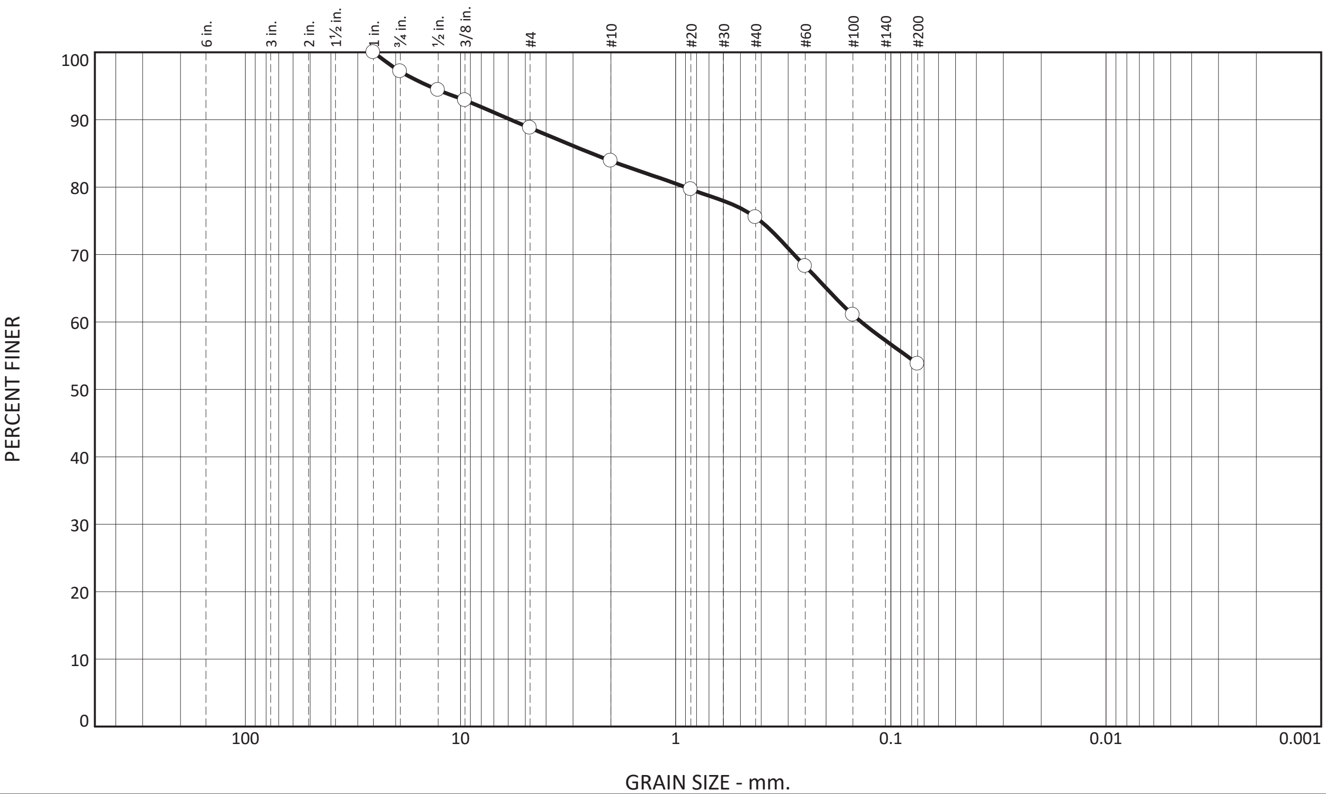
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.8	8.4	4.9	8.4	21.7	53.8	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1.00	100.0			
0.75	97.2			
0.50	94.4			
0.375	92.9			
#4	88.8			
#10	83.9			
#20	79.7			
#40	75.5			
#60	68.3			
#100	61.1			
#200	53.8			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 12   LL= 22   PI= 10

Coefficients

D_{90}= 5.8314 D_{85}= 2.4479 D_{60}= 0.1371
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL   AASHTO=

Test Remarks

As-Rec'd M/C = 10.65%

Location: East Palestine
Sample Number: SPT-3   **Depth:** 28-30'   **Sample Date:**

JLT Laboratories, Inc.

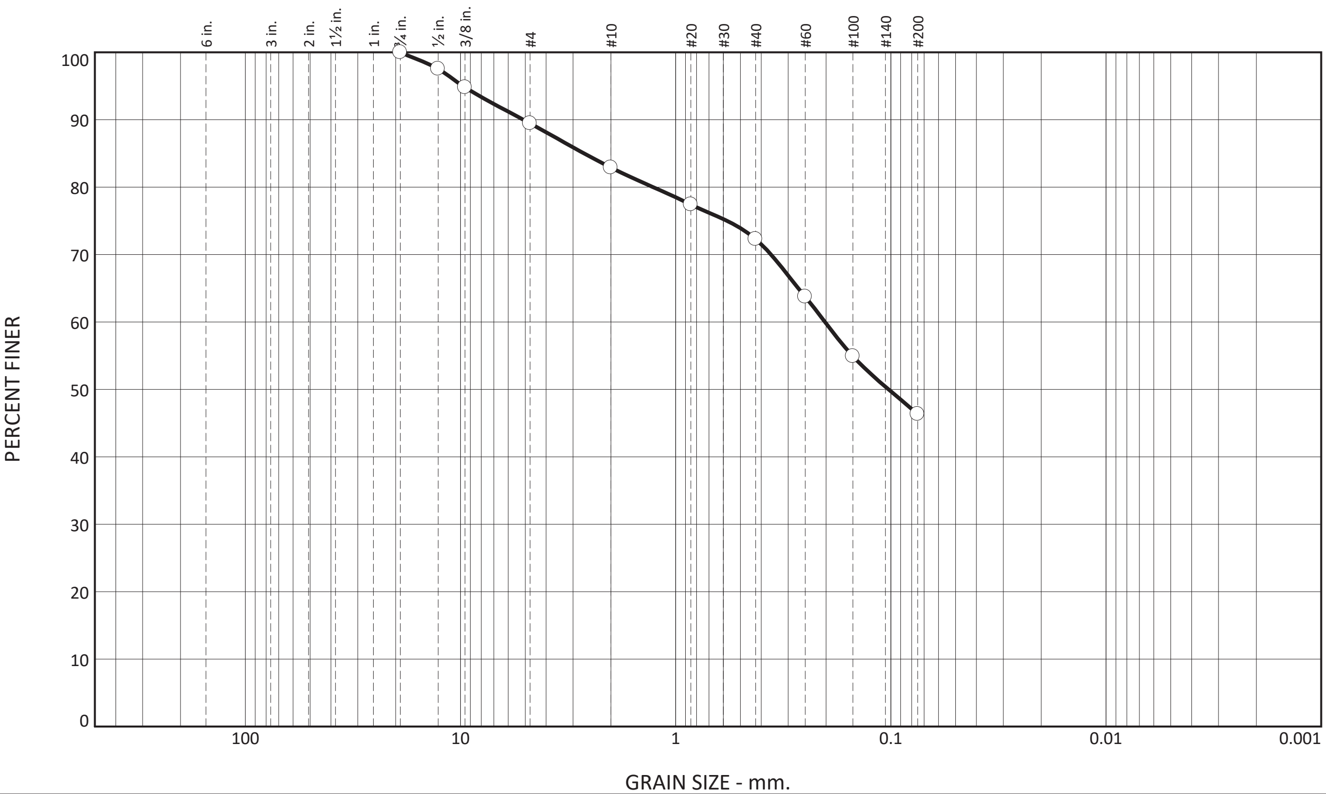
Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053   **Figure**

Tested By: AE   **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.5	6.6	10.6	26.0	46.3	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	97.5			
0.375	94.8			
#4	89.5			
#10	82.9			
#20	77.4			
#40	72.3			
#60	63.7			
#100	54.9			
#200	46.3			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 12 LL= 20 PI= 8

Coefficients

D_{90}= 5.0926 D_{85}= 2.6605 D_{60}= 0.2022
D_{50}= 0.1024 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Test Remarks

As-Rec'd M/C = 11.58%

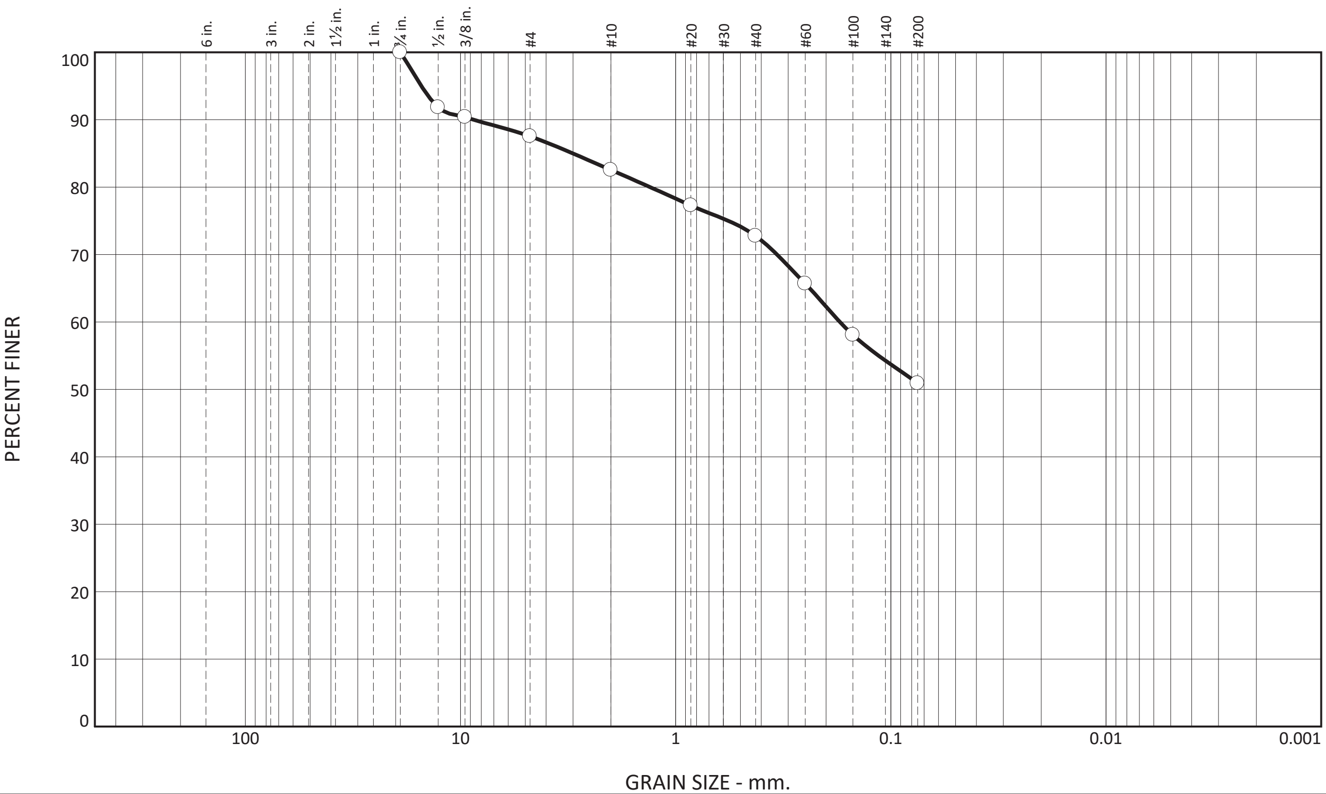
Location: East Palestine
Sample Number: SPT-3 **Depth:** 38-40' **Sample Date:**

JLT Laboratories, Inc. **Canonsburg, PA**	**Client:** ARCADIS **Project:** NS - East Palestine ARCADIS Project No: 30169714 **Project No:** 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Particle Size Distribution Report

ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.5	4.9	9.8	21.9	50.9	

Test Results (ASTM D422)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
0.75	100.0			
0.50	91.8			
0.375	90.4			
#4	87.5			
#10	82.6			
#20	77.3			
#40	72.8			
#60	65.7			
#100	58.1			
#200	50.9			

* (no specification provided)

Material Description

Bag Sample

Atterberg Limits

PL= 14 LL= 21 PI= 7

Coefficients

D_{90}= 8.6851 D_{85}= 2.9983 D_{60}= 0.1723
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML-CL AASHTO=

Test Remarks

As-Rec'd M/C = 13.02%

Location: East Palestine
Sample Number: SPT-3 **Depth:** 43-45' **Sample Date:**

JLT Laboratories, Inc.

Canonsburg, PA

Client: ARCADIS
Project: NS - East Palestine
ARCADIS Project No: 30169714
Project No: 23LS4053 **Figure**

Tested By: AE **Checked By:** MLB

Attachment D

Assessment Certification

Assessment Certification

Based on the documentation gathered and presented and referenced in the Substantive RCRA Requirements for Hazardous Waste Tank Systems ARARs table, I attest that the CID Tank System has been designed and inspected to ensure to the extent practicable that the tank system is suitable for the storage of the proposed hazardous waste. This certification is based on the following data gathered and visual inspection of the tanks:

1. Patented tanks that were designed in accordance with applicable standards for structural integrity and have been in use throughout North America.
2. Tank and secondary containment foundations that have been designed and constructed based on applicable geotechnical field investigation, testing and inspection.
3. Secondary containment that has been adequately sized to contain the minimum required plus additional freeboard.
4. Pre-installation and installation duration inspection by a qualified, independent tank installation inspector.
5. Successful completion of field tightness tests to confirm each tank has been filled and can hold liquid for an extended duration without leak or failure.
6. Liner compatibility verified for the proposed hazardous waste.
7. A June 14th tank inspection, conducted by the tank supplier following initial filling, that indicated the tanks are fit for use.

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

Name <u>Michael B. Higgins Jr.</u>

Title <u>Principal Engineer</u>

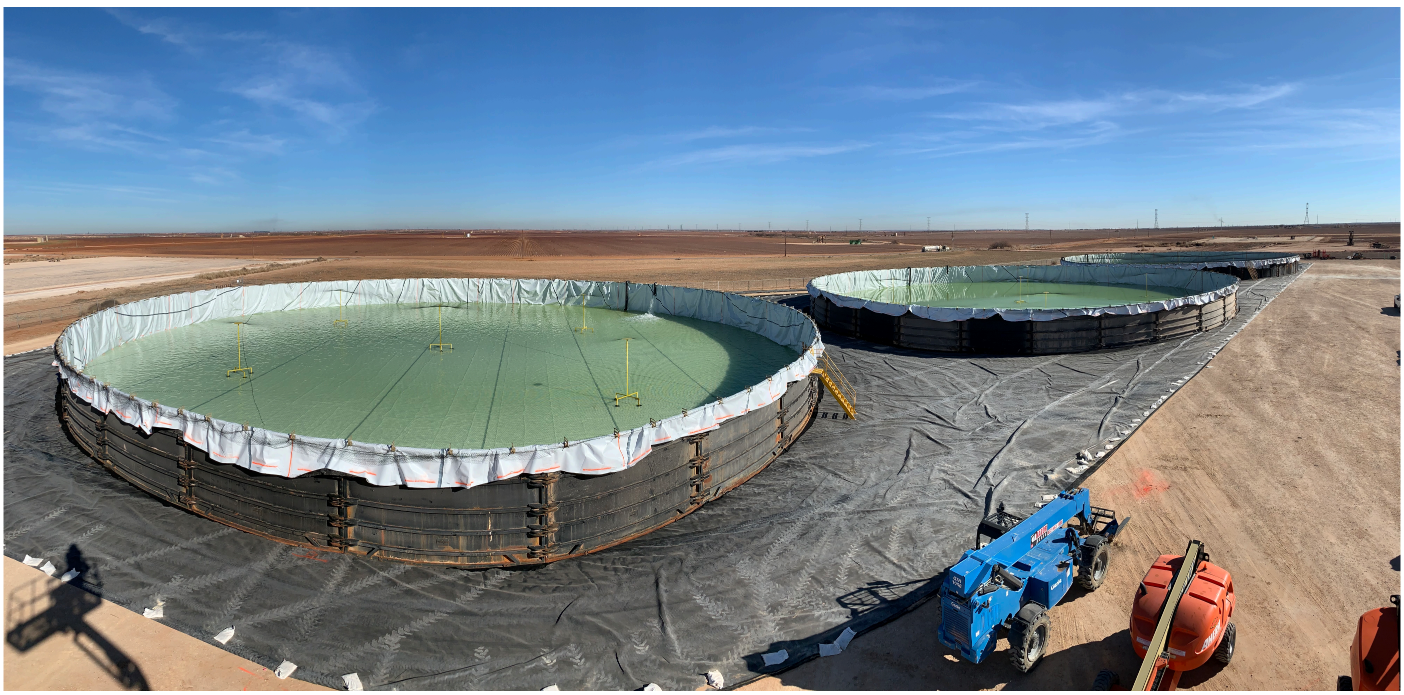
Date <u>July 21, 2023</u>

Attachment E

Tank Installation Procedures

BEST MANAGEMENT PRACTICES FOR

ABOVE GROUND STORAGE TANKS



BEST MANAGEMENT PRACTICE FOR ABOVE GROUND STORAGE TANKS

TABLE OF CONTENTS

Section 1.0 Introduction and Summary

1.1 Introduction and Purpose

C2 Services, LLC is committed to providing its employees a safe working environment and avoiding injury to our contractors, customers, and neighbors. As part of our overall commitment to safety, C2 seeks to prevent acts or conditions that could result in injury and/or illness to any employee, customer, contractor, neighbor, and/or the environment.

In an effort to prevent potentially harmful acts or conditions, C2 has developed this ***Best Management Practice*** (BMP) that focuses on above ground storage tank (AST) systems including planning, set up, operations, and take down. This BMP will discuss steps to be taken to promote a safe process, as well as a list of potential hazards that should be identified and remediated prior to beginning this procedure.

1.2 Background

AST is the industry term for an above ground storage tank. At C2, AST's are used for a variety of field applications within the fluids management operations. AST's can be used in place of traditional tank farms and in-ground water impoundments, and are suitable for fresh water as well as production water. At C2, AST's are available in several standard sizes, ranging from 4,500 barrel (bbl) capacity to 83,000 bbl capacities. C2 currently uses three basic styles of AST's. One is referred to as a "pin" tank that uses large diameter steel pins to attach tank panels together. The second type of AST is a "plate" tank. Steel panels of a plate tank are attached using steel plates. Lastly, the "bolt" tank that connects using one-inch diameter bolts.

1.3 Intended Use

This BMP will be part of training provided to all affected employees when they begin their employment with C2 and any time the plan is changed. This BMP will also be reviewed with an employee if his/her responsibilities change under the plan. A written copy of this plan will remain in the regional Safety Office, and will be available for employee review.
The Vice-President of Environment, Health, and Safety, or his/her agents, may be contacted by any employee if he/she needs additional information about this BMP.

This BMP has been developed to assist affected employees with the operational steps that may be used to complete the task safely. **It must be noted, however, that the experience and background of a trained containment employee is essential to the success of any project or task**.

Nothing contained in this BMP is a substitute for each employee's individual judgment in any given situation. In the event that any employee believes that any task outlined in any BMP cannot be completed safely, then that employee should immediately halt the performance of such task and notify their direct supervisor.

This BMP may also be used to inform customers about C2's typical equipment and procedures for setting up an AST system. This BMP will be reviewed and revised on an ongoing basis to keep pace with best oilfield practices and applicable OSHA regulations.

1.4 Customer Environmental Health and Safety Programs

This BMP recognizes that oil and gas operating companies have developed their own health, safety, and environmental (HSE) programs that contractors who work at customer's sites like C2, must comply with. In addition to this BMP, C2 personnel will strictly observe the policies and procedures of each operating company.

1.5 Summary

This BMP is divided into four separate phases, each organized in chronological order. First is the planning phase that includes a customer-C2 meeting and close coordination to be sure C2 complies with all of customer's

Health, safety, and environmental requirements and that **the site is ready for the AST setup**. This BMP then presents the specific tasks and safety requirements during the second phase - the AST setup phase. The third phase is the AST operation during which periodic checks of the tank are made per customer's requirements. The fourth phase addresses AST takedown during which all materials are removed from the site.

Section 2.0 Planning for AST Rig-Up

The planning phase for AST systems includes several important activities that can impact the safety and success of an AST project. Step by step procedures are presented below for each of the following activities during the planning phase of an AST project. Pad preparation needs to conform to SES BMP and inspected by a qualified SES representative.

AST order information
Customer meeting
Site soil and pad preparation
Pre-mobilization on-site meeting
Notifications
Job Hazard Analysis
AST material deliveries

2.1 AST Order Information

C2 AST Manager/Account Representative will record general AST order information including the customer's site location information (911 Address, NOT only coordinates), specific tank requirements (size, number, liner type, candy canes, etc.), desired schedule, customer's order reference number, and site specific customer contact information. The AST Manager/ Account Representative provides this information, along with customer's contractual and safety requirements, to the appropriate personnel.

2.2 Customer Meeting

Prior to finalizing the delivery schedule, a meeting or conference call is held with C2 and customer representatives including the customer's purchase agent and the customer's health, safety, and environmental (HSE) representative.

This meeting is best done in person, but must at least be covered in a phone call, followed up by a brief email confirming the AST order details, delivery schedule, and noting special conditions, safety requirements, **verification of pad preparation**, etc.

In addition to the above following key topics will typically be discussed.

C2 Services: site specific staff/roles

Review AST intended use and customer safety requirements.

Review AST scope of work, what is normally included, what is not.

Permitting for AST (as needed)

Site access and truck route requirements

Time line for AST to be operational

Confirm AST size(s) to be used

AST layout on pad

NOTE: It is preferable to maintain a 30' clear work area around the perimeter of the tank to provide access for equipment. Regardless of manufacturer, the minimum footprint should be a circle with a radius of at least 24' greater that the radius of the tank.

Current site conditions, status/schedule for site preparation, and soil preparation requirements.

Responsibility for filling the tank, to a minimum of 2 feet deep, immediately after it is set up to protect from wind blowing the liner out of place.

Responsibility for AST inspections during AST operation, any time tank is fully emptied, and the frequency of inspections will be determined by either the permit or customer requirements.

Conditions that could result in standby time charges or additional charges, and what prior customer approvals are required.

Confirm customer is responsible for the used liner, residual solids left in the tank, and site reclamation.

Understand customer's OSHA Process Safety Management – Contractor safety and notification requirements for all activities on customer controlled sites.

Note any special PPE or safety requirements at site.

Notifications: Establish a list of notifications/communications that C2 will be responsible for and timing for each. C2 standard procedure is to notify owners of buried utilities in the AST site area using state-wide "one-call" services at least one week in advance of AST setup. Identify any other notifications that C2 will need to make (e.g. Truck routes, neighbors, etc). Also identify customer's procedures for notifying them if conditions arise that could impact scope, schedule, cost) and get email addresses as needed.

Other Topics

Any additional site preparation to be completed by customer prior to setup
Underground material needs to be taken into account for site preparation.
Other Activities: Discuss AST site activities that will be ongoing during the AST set up. C2 personnel will be aware and courteous of simultaneous operations at all times. **However, C2 prefers very limited, if any, simultaneous operations near AST during set-up phase.**

Follow Up

After customer meeting, C2 will document any changes to the AST scope of work, as needed, for the specific AST site and customer requirements in a brief email.

2.3 Site Soil Preparation

Preparation of the soils on site is required to form a dependable base for the AST. **Preparation of the tank pad is solely the responsibility of the customer/operating company.** The key requirements are:

C2 requires a minimum soil compaction of 95% compaction. Soil testing results shall be shared with C2. In order to meet industry standards, site preparation requirements must be deemed satisfactory by a C2 representative.

C2 recommends soil compaction testing to be conducted via Standard Proctor Test (American Society for Testing and Materials {ASTM} Standard D698) or Modified Proctor Test (ASTM Standard D1557).

Compaction test results must be provided to C2 prior to the commencement of AST construction.

A proof roll test may be used if observed and documented by qualified C2 personnel.

Grade AST footprint and 30 ft work area to 0.25 % or 3" drop per 100 feet, toward sump location.

Site shall be graveled and rolled prior to tank installation, utilizing gravel size 2B or smaller. (3/4" road grade preferred, or coarse sand with minimum thickness of 4 inches).

Do not use crushed rock as sharp edges could puncture the tank liner.

After completion of these steps the tank setup can be approved.

2.4 Pre-Mobilization Onsite Meeting

C2's AST team and customer will conduct a pre-mobilization onsite meeting that documents the customer requirements for the specific pad location and AST system.

2.5 Notifications

Even though the customer or their subcontractor may have already called for utility locates for the sump hole, the AST Manager/Assistant should call the local or state underground utility location service again at least one week in advance before construction/digging begins. C2 AST Manager/Assistant should document the ticket or reference number provided by the one-call service.

The following web site has contacts for all the states and provinces.
http://www.call811.com/state-specific.aspx. The website link below is provided for smart phones:

Call 811 in United States

2.6 AST Material Deliveries

Once the delivery route and schedule are established and the pre-project onsite inspection is completed, the AST materials can be delivered. Notifications will be made as agreed to during the customer meeting. C2 delivery personnel should unload all materials safely and taking care to avoid damage to liners, plates, and all other AST components. They will also stay out of the way of ongoing site activities, and notify the AST Manager/Assistant if site conditions are not suitable for delivery.

Section 3.0 AST Setup

3.1 Job Hazard Analysis (JHA)

A job hazard analysis must be completed on site prior to beginning work and is required for each task being completed. Employees must list the sequence of steps performed to complete the task, tools to be used, hazards associated to each step and tools used, and elimination or mitigation process to protect the worker. The JHA will be completed following C2 approved procedures. Customer's safety requirements will also be communicated during the JHA. All C2 personnel, 3rd party contractors, and customer representatives are expected to participate and sign the JHA when the JHA is completed.

3.2 Check Soil Condition

Preparation of the tank pad is solely the responsibility of the customer. However, weather and rain/snow events can change the soil conditions quickly. Therefore, C2 will check soil compaction prior to setting up the AST.

3.3 Tank Layout

- Check proposed AST site to confirm a 30' clear work area around the perimeter of the tank is possible to provide access for equipment and laydown area for AST materials and erection equipment.
- Check that the minimum distances to existing wells, power lines, etc. are met.
- Regardless of manufacturer, the minimum footprint should be a circle of at least 24'or greater than that of the radius of the tank.
- Establish final location for the suction tube(s) and stairs.

3.4 Equipment (C2 provided)

All equipment is subject to daily inspection. (Check condition, rigging, oil, water, fuel and cleanliness.) Here is a list of the recommended equipment needed to set a tank. Actual equipment used will vary among region and specific projects.

- Two 40' and/or 60'extending straight boom man-lifts.
- 10,000 lb or greater capacity, rough terrain forklift (telehandler).
- 17,000 pound or greater excavator with bucket and thumb attachment.
- Skid steer

3.5 Hand Tools Recommended

All hand tools are subject to daily inspection. (Note: All tools, materials, and equipment must be secured when working at heights of 4' or greater. i.e. Tool Tethers)

- Two 16' ladders
- Four 4 lb. sledgehammers
- 100' or 200' tape measure
- 1 case of marking paint – minimum
- Set of wrenches ¼" – 1 ½"
- Set of sockets ¼" – 1 ½"
- Two 36" pry bars
- 8' rock bar (digging bar)

- ☐ Fall protection when working at heights of 4’ or greater
  - Five safety harnesses with retractable tethers
  - Five retractable lanyards (Note: Double SRL’s are required)
- ☐ 100’ of 3/8” rope
- ☐ Duct tape
- ☐ Covered hook bladed knife
- ☐ Three 40’ lifting straps (minimum of 5,000 lb capacity) Three
- ☐ 20’ 3/8” chains (must have visible certification tags) Two
- ☐ rolling head pry bars
- ☐ 150’ strap
- ☐ Two ½” impact guns
- ☐ Two sets of rigging chains
- ☐ Patch tape
- ☐ Rubbing alcohol
- ☐ Patch roller
- ☐ Cut level 4 impact resistant gloves are required for hand protection
- ☐ Wire brush or wheel with 4” angle grinder
- ☐ Generator
- ☐ Steel toed boots/rubber boots
- ☐ Fire retardant clothing (FRs)

3.6 AST Tank Setup Steps

- ☐ There must be a C2 company representative on site the day prior to setup in order to approve everything for setup.

Tank Layout

- ☐ Determine center of tank and mark with paint. Place a non-abrasive item on the center point; preferably a sandbag. This will be used to find the center of tank after liners have been placed.
- ☐ Measure and double check minimum distance from tank center to existing wells.
- ☐ Measure and paint a line to mark the circumference of each tank for panel placement.
- ☐ mark the circumference of the liner laid out flat to ensure the liner is properly placed.

Suction Pit

- ☐ Determine where tank suction is to be placed.
  - o Dig at least 6’ wide x 6’ long x 24” deep sump hole for the suction tube to set in and taper the edges so there are no sharp corners of the excavation.
  - o Remove any sharp stones and add at least one layer of geotextile.
    - • If multiple suction manifolds are required, the sumps should have a minimum of 8’ of separation.

ATTENTION: Barricade any sump pit with appropriate cones, tape, equipment, and/or have a hole watch if left open.

- ☐ All tank set-ups will require the use of a C2 approved underlayment and liner. Depending on situational factors, 10oz or 16oz geotextile and 30 mil or 40 mil liner will be used. Additional layers of each may be installed in both freshwater and produced water situations if local permits or the customer require it.
- ☐ Check customer specifications and regulatory permit, permitting required by the customer, liner and containment requirements for ASTs that may hold produced water.
- ☐ The crew will walk the entire tank base area to pick up any sharp stones or other sharp debris that could result in damage to the liner.
- ☐ Lay out the geo pad prior to the liner.
- ☐ Perform a visual inspection of the liner – repair any defects as necessary.

- Place all liners and align to the center of the tank and painted line for the tank walls. The preferred 30 ft area around tank allows the liner to be laid out flat so that fold back can be uniform.
- Secure liner from wind using sand bags.
- Fold the inside tank liners toward inside the painted tank edge line to allow placement tank panel walls.
- Fold the outside Tank Liner between the lines for the inside and outside tanks

Tank Wall Erection

- Ensure all tank parts and pieces are accounted for.
- Crew Leader will complete a visual inspection of each panel as it is prepared to be placed.
- Stand the first tank panel in place and secure it with the excavator bucket with thumb attachment. Keep connected to the excavator until the last panel is being set.
- Set inside tank on top of the liner of the outside tank ensuring that the edge of each wall is contacting only the rubber mats placed under the corners and not sitting on the liner itself
- Monitor equipment and first panel closely to ensure they remain stable, especially during higher wind situations.
- Personnel secured on man lift or using a ladder (depending on customer policies) then secure the panels in place with 4 pins each (for pin tanks) or (for plate tanks) with the connecting plates and lug busses, secured with chained cotter pins. Bolt tanks are connected using 1” diameter bolts.

  ATTENTION: Proper hand and foot placement is crucial when connecting AST panels. Keep hands and feet a safe distance from pinch points. Discuss where these pinch points are located when reviewing the JHA. Proper ergonomics is required. Keep the joints in mid-range; i.e. palms are located between waist and shoulders. Create an awareness that never goes away and designate one individual to enforce the awareness when setting panels.

- Roll up excess geo pad into minimum 6” diameter cylinders around the inside of the tank ring to help support the liner at the base of the tank wall as the tank is being filled.
- Prior to lifting liner into place against inside panel, add geo strips over all panel gaps for plate and bolt type tanks.
- Prior to covering sump with the geo pad or liner, confirm sump excavation has smooth sides and corners, and that no sharp stones are present.
- Once inside tank is completed, pull the liner following the listed steps below. Once inside tank is complete set the outside tank following the steps listed above, not including the rubber matting. The outside tank will be set directly on the ground.
- Once Outside tank is complete, continue to pulling/securing liner on the outside tank

Liner Placement and Securing Top with Clamps

- After 4 or 5 panels are set, and all liner protection as described above is in place, unfold the liner in sections, toward the base of each panel, making sure the rolled up geo pad will provide padding at the base of the inside of each panel.
- Crew of 2 inside the tank wall unfolds and pulls the liner toward each panel (final connection of last panel will not be made until all liner to that point is pulled and secured to avoid confined space, all personnel must be out of tank before walls are closed) . Working in small liner sections, this inside crew works with a crew of 2 on a man lift located outside and above each tank panel to pull the liner edge up and over the top of each panel. The man lift crew lifts the liner edge using ropes/straps gently lowered and attached (by the inside crew). The man lift crew lifts a small liner section to the top of the panel and folds it over the top of the panel, being sure there is enough slack in the liner inside the panel wall.

  ATTENTION: Never place hands on the railing of the man basket that faces the AST panel. Proper hand placement would be the side or back rail.

- Once a section of liner is positioned properly (with liner slack inside the tank) and over the top of each panel wall, the man lift crew secures the top of the liner with clamps. (Tools in basket secured with tool lanyards) NOTE: A minimum of 5 clamps or more are required at the top of each tank panel to secure the liner. Add additional clamps as needed to secure liner.
- Both inside and man lift crews continue this process, working around the tank, one or two panels at a time, until the entire liner is in place.
- NOTE: The crew must allow sufficient slack in the liner at the wall to allow for liner movement during filling and draining.

Stairs, Fill Tubes, and Suction Tubes

- Install safety stair system, fill tubes, and suction tubes. Ensure that stair system and tubes are appropriately secured to the tank walls with 2" ratchet straps or 3/8" chains and ratchet binders.

Final Steps, Filling, and Inspection

- Close final panel and secure with pins, plates, or bolts as needed.
- Trim liner and allow approximately 3' of liner to hang over edge of tank.
- Secure liner with sufficient clamps and be sure a 2" seatbelt strap (supplied with liner) is installed around the cut edge of liner on the outside of tank. Pull tight with a ratchet.
- Inspect all connections and equipment, confirming at least 5 liner clamps (or more as needed) are in place on top of each panel.
- Have a minimum of 24 inches of water put in the tank to hold liner in place.
- Fill tank and monitor.
    - Perform periodic inspections of the tank to ensure everything is in proper working order.
    - Every time a tank is fully emptied and refilled, an inspection must be performed.
    - Visibly inspect all tank panels and stairs for cracking, dents, burrs on the inside of the panels, chipping paint on welds or sharp edges on panels.
    - Look for any cracked or broken valves, damage on pipes and tubes, missing D-Rings, damage to chains or ratchets, and bent clips.
    - Pay close attention to hinge plates for chipping paint and cracking.
    - Water should not go below 12 inches at the LOWEST level in the tank. (Mark liner as a caution).

Section 4.0 AST Operation

4.1 Inspections and Monitoring

AST Operation Phase includes periodic AST monitoring, leak detection, and identifying potential hazards that may have developed, change on-site conditions or tank use. If the tank is drained, it should be secured from wind impacts and the liner inspected and re-positioned (to provide sufficient slack during filling) prior to refilling. Specifically, it may be necessary to rearrange the liner folds at the walls prior to refilling if the wind has shifted the liner folds when the tank was empty.

If changes are noted, they should be communicated to the C2 AST Manager/Assistant Manager.

Various state regulations require some level of freeboarding while the ASTs are in operations. Employees should consult the applicable state and/or local requirements, or the applicable HSE representative of C2 , and maintain freeboard levels accordingly

CAUTION – If conditions are observed that could indicate an imminent tank failure, clear the area immediately. Advise others in the vicinity to do so also and contact the customer to drain the tank.

4.2 Initial Leak Detection and Liner Repair

In the event of a leak in the tank due to a hole in the liner, the following steps should be followed.

- If there is a question that it is in fact a leak from the AST, a dye test or a pH balance test may need to be performed on both the water in the tank and on the ground using approved dye or a properly calibrated pH meter. Third party test results are recommended.
- If the leak is found to be coming from the tank, narrow down from which panel the leak is originating.
- Use a strap or rope to mark the point where the water is coming out of the tank.
- Determine if the water is coming out high or low on the tank.
- Locate the puncture or hole in the liner.
- Empty the tank to the point of damage in liner if necessary.
- Clean area of liner that needs to be repaired.
- Cut out piece of material (patch or tape) to overlay liner.
- Either weld the patch to the injured area in the liner or stick the tape (2 types – dry or underwater) over the leak.
- Make sure puncture is completely covered.
- Monitor as needed.

Section 5.0 AST Breakdown

The AST breakdown follows the reverse order of the setup steps presented in Section 3.0 above. The sump will be filled in with the same material taken out during excavation.

The customer is responsible for draining and disposing of all liquids and residual solids that have accumulated in the tank. Additionally, the customer is responsible for proper off site management or recycling of the liner and geo pad materials, and final grading and/or reclamation of AST site.

The Crew Leader will perform a visual inspection of AST panels and accessories for defects.

Attachment F

Secondary Containment Analysis

Secondary Containment Volume Analysis

Client: **Norfolk Southern Railway Company (NRSC)**

Project Location: **East Palestine, Ohio**

Project: **East Palestine Derailment** **Project No.:** **3016714**

Calc No: **CB-02** **Subject:** **CID Tank Area Secondary Containment**

Developed By: **PTO** **Date:** **July 6, 2023**

Checked By: **MBH** **Date:** **July 6, 2023**

OBJECTIVE:

Demonstrate the secondary containment for the CID Tank area complies with the substantive requirements provided by the USEPA regarding secondary containment for tank systems utilized for hazardous waste storage.

REFERENCES:

1. Federal Code 40 CFR part 264.193(b), USEPA, 2011.
2. Precipitation Frequency Data East Palestine, OH. NOAA Atlas 14, Volume 11, Version 2, obtained April 2023.
3. Trimble Navigation Limited Software, Terramodel, Version 10.61.
4. As-built topographic survey collected by Arcadis, June 13, 2023.

ASSUMPTIONS:

1. Wastewater from the onsite treatment system is conveyed to six (6) tanks constructed in what is referred to as the "CID Tank Area". The storage tanks are 53-feet in diameter and approximately 12-feet-tall. The tanks are constructed on an approximately 400-ft by 90-ft gravel platform underlain with 60-mil-thick High-Density Polyethylene (HDPE) geomembrane. A combination of lined earthen berms and steel sheeting are constructed around the perimeter of the tanks and provide secondary containment for the tanks in the event a tank is breached. The grades on which the geomembrane is placed slope such that any precipitation, leaks, or spills drain to collection points at the southeast and southwest corners of the pad so that it can be collected within 24-hours. Refer to Figure 1 for the layout and topography of the CID Tank pad area.
2. Based on Reference 1, tank systems storing hazardous wastes must provide secondary containment around the tanks in the event a tank is breached or ruptured. The minimum capacity of the secondary containment is the storage capacity of the largest storage tank within the containment plus the rainfall volume resulting from the 25-year, 24-hour storm event. Per Reference 2, the rainfall depth associated with a 25-year, 24-hour storm event is 3.96 inches. Per Reference 3, the approximate rainfall catchment area of the CID Tank pad is 37,100 ft^2.

3. The secondary containment volume capacity for the CID Tank pad area is provided within the geomembrane-lined berms noted in Assumption 1. The capacity is calculated utilizing Reference 3, which analyses the as-built 3-dimension surface data obtained from Reference 4. It should be noted that the 3-dimensional surface analysis does not include the volume loss due to the tanks within the assumed containment depth. However, the tank volume is manually subtracted from the volume reported from Reference 3 to determine the actual storage volume provided below the lowest lined perimeter containment elevation. For the purposes of this calculation, it is assumed that only 5 tanks will occupy the storage volume area since the footprint of the ruptured tank would provide storage capacity in the event of a full tank failure. The calculation ignores additional liquid storage capacity within the platform gravel and sumps and is therefore conservative with respect to capacity.

CALCULATIONS:

Minimum Required Storage Capacity

As discussed in Assumption 2, the minimum capacity of the secondary containment is the storage capacity of the largest storage tank within the containment plus the volume corresponding to a 25-year, 24-hour storm event. The tank storage capacity is calculated below:

Area of tank footprint: $A = \pi r^2 = (3.14)\left(\frac{53ft}{2}\right)^2 = 2{,}205sf$

Volume of tank: $V = AH = (2205sf)(12ft) = (26{,}461cf)\left(7.48\frac{gal}{cf}\right) \approx 200{,}000\ gal$

Where:

- Radius of tank (r) = 26.5 ft (D/2, Assumption 1)
- Height of tank (H) = 12 ft (Assumption 1)

The rainfall volume resulting from a 25-year, 24-hour storm event is calculated below:

Rainfall Volume= $AD = (\text{catchment area of the containment})(\text{rainfall depth}) = (37{,}100\ \text{sf})(3.96/12\ \text{ft})(7.48\frac{\text{gal}}{\text{cf}}) \approx 91{,}578\ gal$

Where:

- 25-year, 24-hour rainfall depth, (D)= 3.96 inches (Assumption 2)
- Drainage Catchment Area, (A) = 37,100 ft^2 (Assumption 2)

Therefore, the total required minimum storage capacity is computed as the sum of the storage tank and rainfall volume:

Tank Storage Volume+ Rainfall Volume= 200,000 gal + 91,578 gal = **291,578 gal**

Volume provided within the secondary containment area:

As discussed in Assumption 2, the secondary containment volume provided from the as-built configuration is calculated from Reference 3 based on comparison of the 3-dimensional as-built surface data collected by Arcadis and the lowest liner perimeter berm elevation. The volume occupied by the tanks was then subtracted from the volume obtained from Reference 3 to determine the actual volume provided. Refer to Attachment 3 for additional calculation details. The results of the analysis are provided in Table 1 below:

Table 1: Secondary Containment Design Criteria

Minimum Lined Perimeter Elevation (ft)	Storage Volume Provided (gal)
1043.3	460,913

The secondary containment storage volumes provided is compared to the secondary containment storage required in Table 2 below. As noted in Table 2, the volume provided exceeds the volume required by approximately 58%.

Table 2: Comparison of Required Volume to Volume Provided

Required Secondary Containment Volume (gal)	Secondary Containment Volume Provided (gal)	Surplus Volume Provided (gal, +/-%)
291,578	460,913	169,335 gal, **+58%**

SUMMARY:

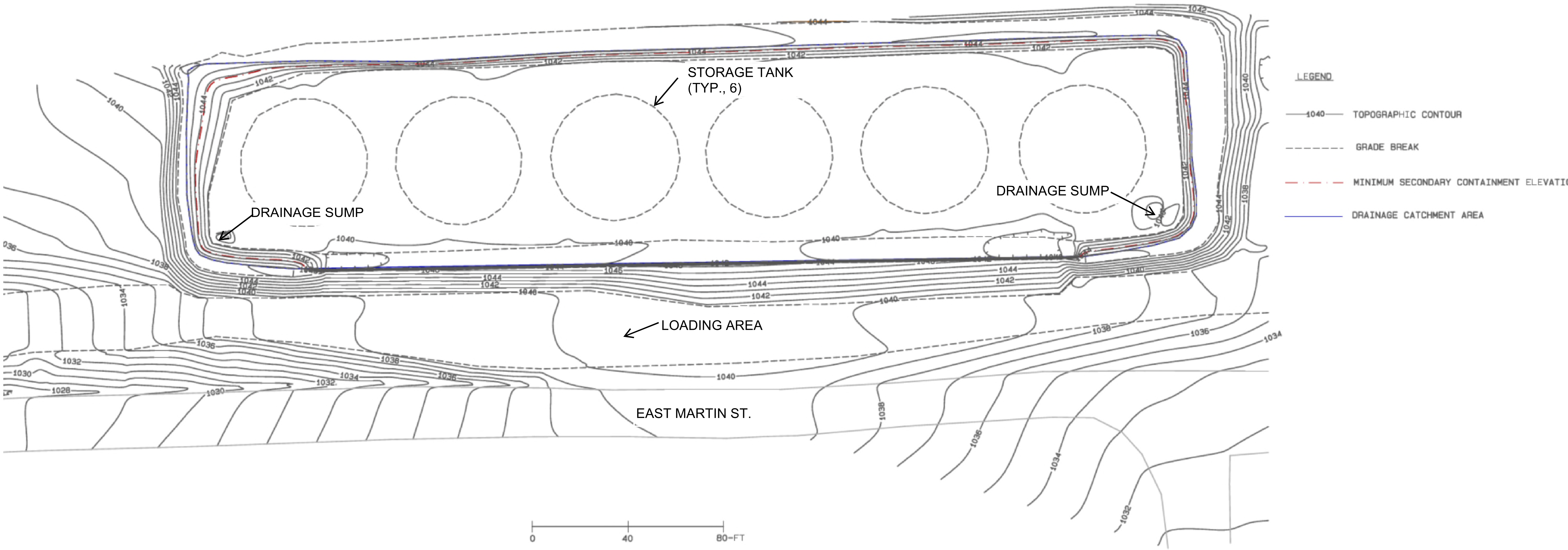
Based on above calculations, the secondary containment for CID Tank pad area meets the USEPA requirements with respect to secondary containment storage volume and leak detection/collection.

ATTACHMENTS:

1. Figure 1: As-built Grading
2. Reference 2: Precipitation Data
3. Storage Volume Report and Calculations

Attachment 1:

As-built Grading



NOTES:
1. GRADES BASED ON 6/13/23 FIELD SURVEY BY ARCADIS.
2. GRADES IN THE VICINITY OF THE LOADING AREA TO BE REVISED UPON COMPLETION OF CONSTRUCTION

NORFOLK SOUTHERN
EAST PALESTINE, OHIO

CID TANK AREA AS-BUILT GRADING PLAN

ARCADIS

FIGURE
1

Attachment 2:

Reference 2: Precipitation Data

NOAA Atlas 14, Volume 2, Version 3
Location name: East Palestine, Ohio, USA*
Latitude: 40.8346°, Longitude: -80.5309°
Elevation: 1020 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.314** (0.282-0.350)	**0.375** (0.337-0.419)	**0.454** (0.406-0.505)	**0.515** (0.460-0.572)	**0.592** (0.527-0.657)	**0.651** (0.578-0.721)	**0.708** (0.627-0.783)	**0.766** (0.675-0.847)	**0.844** (0.740-0.931)	**0.901** (0.786-0.993)
10-min	**0.488** (0.438-0.544)	**0.586** (0.525-0.653)	**0.705** (0.631-0.785)	**0.794** (0.710-0.884)	**0.905** (0.807-1.00)	**0.987** (0.876-1.09)	**1.07** (0.943-1.18)	**1.14** (1.01-1.26)	**1.24** (1.09-1.37)	**1.31** (1.14-1.45)
15-min	**0.599** (0.537-0.667)	**0.716** (0.642-0.799)	**0.865** (0.775-0.964)	**0.977** (0.874-1.09)	**1.12** (0.996-1.24)	**1.22** (1.08-1.35)	**1.32** (1.17-1.46)	**1.42** (1.25-1.57)	**1.55** (1.36-1.71)	**1.64** (1.43-1.81)
30-min	**0.792** (0.711-0.883)	**0.958** (0.860-1.07)	**1.18** (1.06-1.32)	**1.36** (1.21-1.51)	**1.58** (1.41-1.75)	**1.75** (1.55-1.93)	**1.91** (1.69-2.12)	**2.08** (1.83-2.29)	**2.29** (2.01-2.53)	**2.46** (2.14-2.71)
60-min	**0.967** (0.868-1.08)	**1.18** (1.06-1.31)	**1.49** (1.33-1.66)	**1.73** (1.54-1.92)	**2.05** (1.82-2.27)	**2.30** (2.04-2.55)	**2.56** (2.26-2.83)	**2.82** (2.48-3.11)	**3.17** (2.78-3.50)	**3.45** (3.01-3.80)
2-hr	**1.12** (1.00-1.24)	**1.36** (1.22-1.50)	**1.71** (1.53-1.90)	**1.99** (1.78-2.20)	**2.36** (2.11-2.60)	**2.66** (2.36-2.92)	**2.96** (2.62-3.25)	**3.28** (2.89-3.59)	**3.70** (3.24-4.04)	**4.02** (3.50-4.39)
3-hr	**1.18** (1.07-1.32)	**1.43** (1.30-1.59)	**1.80** (1.63-2.00)	**2.10** (1.89-2.32)	**2.50** (2.25-2.76)	**2.82** (2.53-3.11)	**3.16** (2.81-3.46)	**3.50** (3.10-3.84)	**3.97** (3.48-4.34)	**4.34** (3.78-4.74)
6-hr	**1.41** (1.29-1.56)	**1.70** (1.55-1.88)	**2.12** (1.94-2.34)	**2.47** (2.24-2.71)	**2.95** (2.66-3.22)	**3.33** (3.00-3.64)	**3.74** (3.35-4.06)	**4.16** (3.70-4.51)	**4.75** (4.19-5.13)	**5.21** (4.57-5.62)
12-hr	**1.67** (1.52-1.84)	**2.00** (1.82-2.21)	**2.47** (2.25-2.72)	**2.86** (2.60-3.14)	**3.41** (3.08-3.73)	**3.86** (3.47-4.21)	**4.34** (3.88-4.71)	**4.83** (4.29-5.24)	**5.54** (4.87-5.98)	**6.10** (5.32-6.57)
24-hr	**1.99** (1.86-2.14)	**2.38** (2.22-2.56)	**2.92** (2.72-3.13)	**3.35** (3.12-3.59)	**3.96** (3.68-4.23)	**4.46** (4.12-4.75)	**4.97** (4.58-5.29)	**5.51** (5.05-5.86)	**6.27** (5.70-6.66)	**6.87** (6.20-7.31)
2-day	**2.31** (2.16-2.47)	**2.75** (2.58-2.95)	**3.34** (3.12-3.58)	**3.81** (3.56-4.07)	**4.46** (4.15-4.76)	**4.98** (4.62-5.32)	**5.52** (5.10-5.88)	**6.07** (5.58-6.47)	**6.82** (6.23-7.28)	**7.41** (6.73-7.92)
3-day	**2.47** (2.32-2.64)	**2.94** (2.76-3.14)	**3.54** (3.32-3.78)	**4.02** (3.77-4.30)	**4.69** (4.38-5.00)	**5.22** (4.86-5.57)	**5.77** (5.35-6.14)	**6.32** (5.84-6.73)	**7.08** (6.49-7.55)	**7.67** (6.99-8.18)
4-day	**2.63** (2.47-2.80)	**3.12** (2.93-3.33)	**3.74** (3.52-3.99)	**4.24** (3.98-4.52)	**4.92** (4.60-5.24)	**5.46** (5.10-5.82)	**6.02** (5.59-6.40)	**6.58** (6.10-7.00)	**7.34** (6.76-7.81)	**7.93** (7.26-8.45)
7-day	**3.13** (2.95-3.32)	**3.70** (3.50-3.93)	**4.40** (4.15-4.66)	**4.95** (4.67-5.25)	**5.70** (5.36-6.04)	**6.29** (5.90-6.66)	**6.88** (6.43-7.29)	**7.48** (6.96-7.92)	**8.28** (7.66-8.78)	**8.89** (8.19-9.45)
10-day	**3.60** (3.41-3.81)	**4.26** (4.03-4.50)	**5.01** (4.74-5.30)	**5.61** (5.30-5.92)	**6.40** (6.04-6.75)	**7.02** (6.61-7.40)	**7.64** (7.17-8.05)	**8.25** (7.72-8.71)	**9.05** (8.43-9.56)	**9.66** (8.95-10.2)
20-day	**5.04** (4.79-5.32)	**5.93** (5.63-6.26)	**6.89** (6.53-7.26)	**7.63** (7.23-8.03)	**8.60** (8.14-9.06)	**9.34** (8.82-9.84)	**10.1** (9.48-10.6)	**10.8** (10.1-11.3)	**11.7** (10.9-12.3)	**12.3** (11.5-13.0)
30-day	**6.32** (5.99-6.66)	**7.41** (7.02-7.81)	**8.52** (8.08-8.98)	**9.39** (8.89-9.89)	**10.5** (9.94-11.1)	**11.4** (10.7-12.0)	**12.2** (11.5-12.9)	**13.0** (12.2-13.7)	**14.0** (13.1-14.8)	**14.8** (13.8-15.6)
45-day	**8.05** (7.66-8.46)	**9.40** (8.94-9.88)	**10.7** (10.2-11.2)	**11.7** (11.1-12.2)	**12.9** (12.3-13.6)	**13.8** (13.1-14.5)	**14.7** (13.9-15.5)	**15.5** (14.7-16.3)	**16.6** (15.6-17.4)	**17.3** (16.3-18.2)
60-day	**9.71** (9.26-10.2)	**11.3** (10.8-11.9)	**12.7** (12.2-13.4)	**13.8** (13.2-14.5)	**15.2** (14.4-15.9)	**16.2** (15.4-16.9)	**17.1** (16.2-17.9)	**17.9** (17.0-18.8)	**18.9** (17.9-19.9)	**19.6** (18.5-20.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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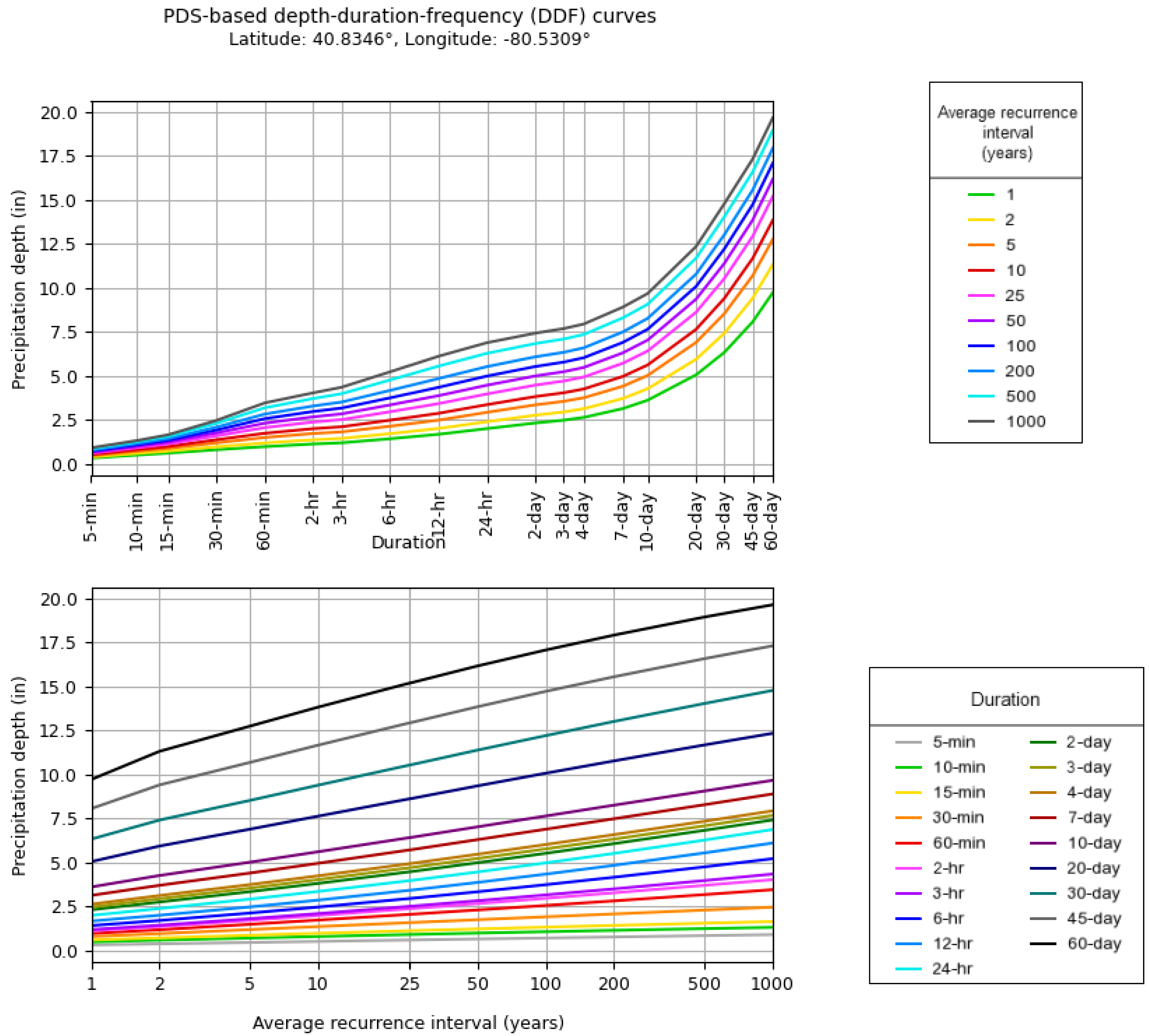
PF graphical



NOAA Atlas 14, Volume 2, Version 3 Created (GMT): Fri Jun 16 15:40:12 2023

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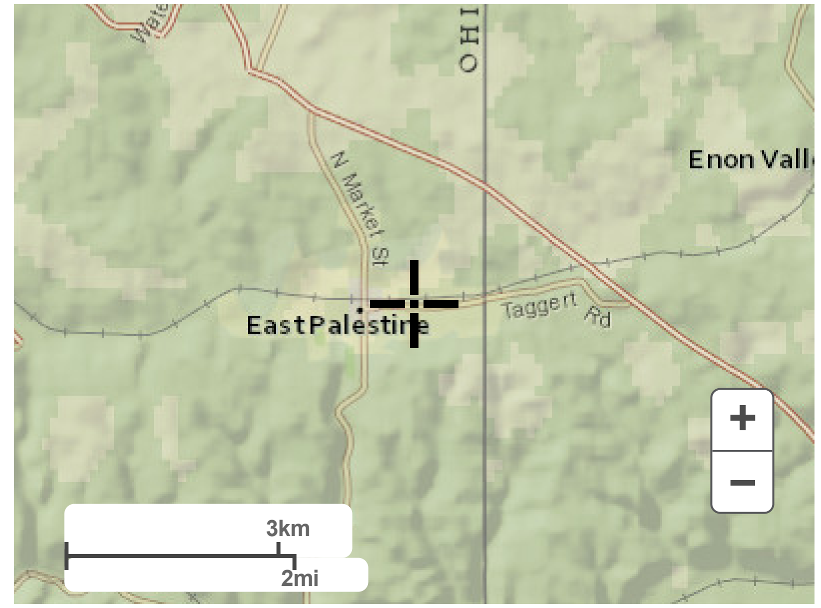
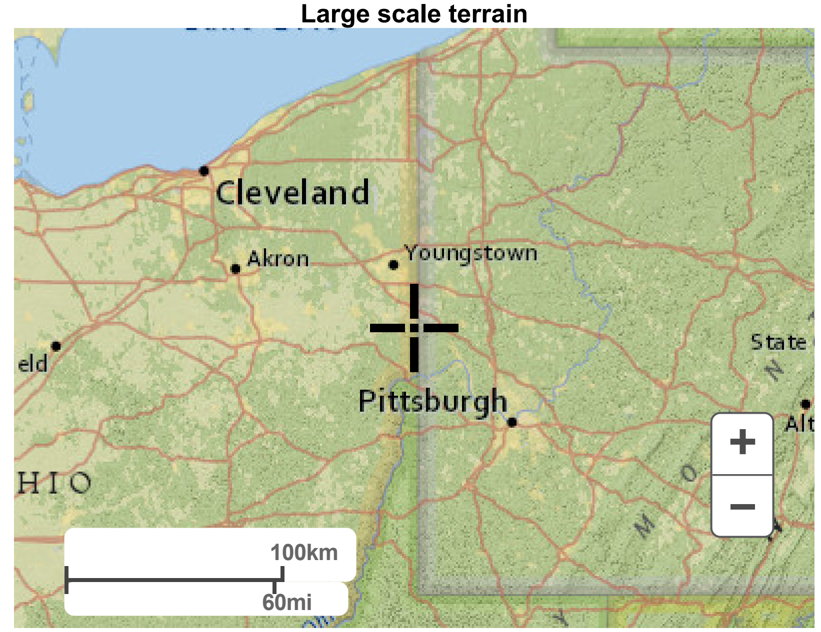
Maps & aerials

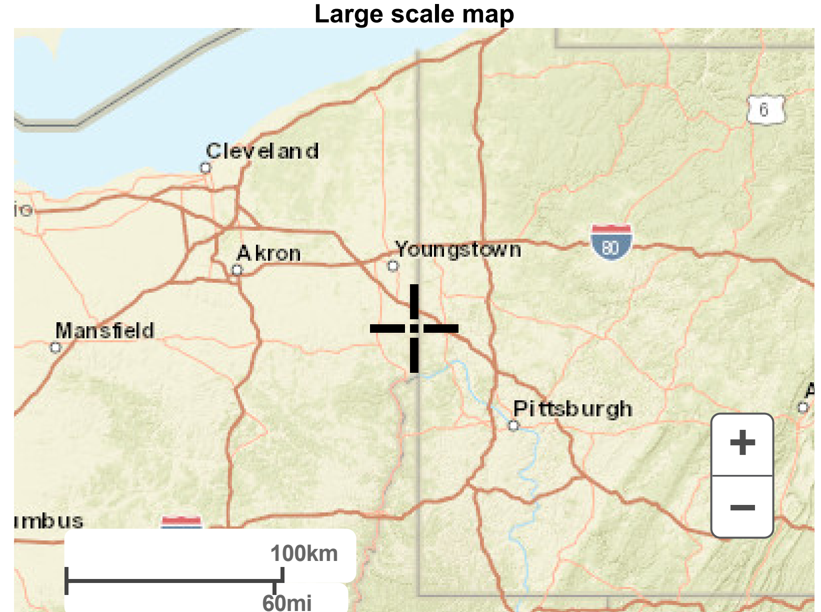
Small scale terrain



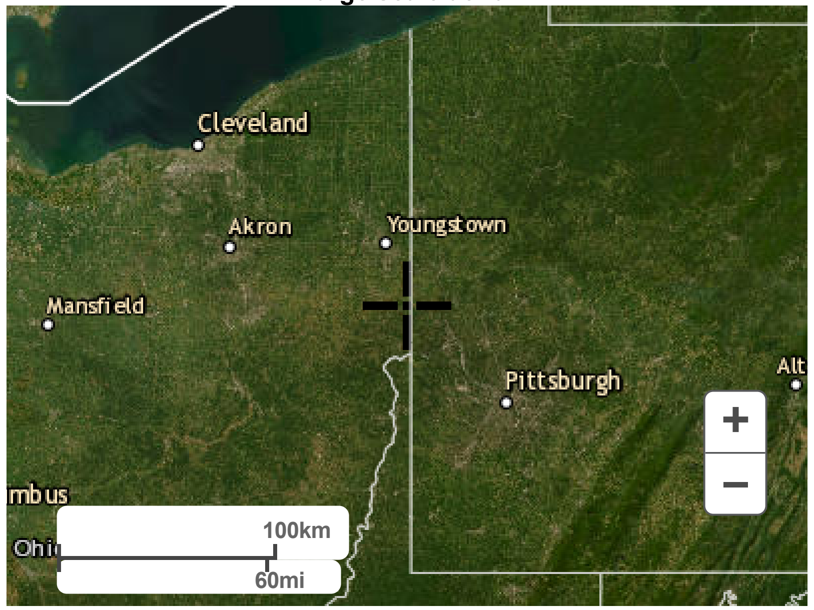
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Attachment 3:

Storage Volume Report and Calculations

East Palestine Derailment Response
Wastewater Storage Tank Farm Secondary Containment Calculations
Norfolk Southern

Pad Elevation (ft)	1040.8
Minimum Berm Elevation (ft)	1043.3
Single Tank Area (ft^2)=	2,205
Tank Height in Containment Volume (ft)	2.5
Tank Volume Within Containment (gal)	206,168
Volume Within Berms Excluding Tanks (gal, from Software)	667,080
Secondary Containment Volume Provided (gal)	460,913
Required Containment Volume (gal)	291,578
Surplus Provided (gal)	**169,335**

SURFACE TO DATUM VOLUME REPORT

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: C:\Users\Potis\OneDrive - ARCADIS\Desktop\Loadout area rev.pro
Report Generated: Thursday, June 29, 2023 8:55:46 AM

Where the DTM surface is above the datum the volume is reported as fill.
Where the DTM surface is below the datum the volume is reported as excavation.

Shrinkage/swell factors: Excavation 1.0000 Fill 1.0000

DTM Surface Layer Name	Number of Points	Datum Elevation
VOLUME TIN 1	674	1,043.30

Volume limited to that within the constraining boundary - Object 226542
Area within boundary: 0.00 Sq. Ft. (0.0000 Acres)
Total triangulated area: 35,434.83 Sq. Ft. (0.8135 Acres)

Excavation Volume Beneath Datum (Cu. Yd.)	Fill Volume Above Datum(Cu. Yd.)
3,302.8	0.0

Net Difference: 3,302.7 Cu. Yd. excess volume beneath datum

3,302.8 CY = 667,080 Gal.

Secondary Containment Sheet Pile Design

CALCULATIONS

Client: Norfolk Southern Railway Company (NSRC) **Project:** 30169714

Title: East Palestine Train Derailment

Prepared by: Samuel Alfaro **Date:** June 29, 2023

Reviewed By: Adam Chwalibog **Date:** July 5, 2023

Subject: CID Tank Area Secondary Containment Shoring System

Objective:

Determine the minimum embedment depth for the sheeting that serves as the secondary containment for the CID Tank area.

Attachments:

A. Shoring Suite Shoring Results Output

Assumptions:

1. Soil classification and parameters used for the shoring evaluations were developed from a review of existing borings T-1 through T-6, completed in the footprint of each tank prior to the construction of the gravel pad underlying the tanks, and SPT-1 through SPT-3, completed adjacent to the secondary containment structure following the placement of the gravel pad and liner system.

2. The parameters used in the shoring calculations are shown in Table 1. Soil parameters were developed from published values and correlations for the various soil types and consistencies, and where available, geotechnical laboratory test data.

Table 1. Material Parameters

Material	Unit Weight (pcf)	Undrained Strength Parameters	
		Internal Friction Angle (phi) (degrees)	Cohesion (c) (psf)
Water Surcharge(1)	62.5	0	0
Gravel(2)	125	32	0
Till(3)	125	-	1050

Notes:

1. The Water Surcharge layer represents the wastewater and/or water (e.g., precipitation) that would pool on the ground surface in the event of a tank breach or failure. This surcharge imposes lateral earth pressures on the active (driving) side of the sheet pile shoring system and increases the overburden stress of the soils below it.
2. For the Gravel layer, a friction angle of 32 degrees was conservatively assigned to account for a lack of Standard Penetration Test data. The gravel is permeable, therefore will become saturated and buoyant in the event of a tank breach/failure.
3. For the Till layer, soil descriptions from existing borings describe the consistency of this layer as very stiff to hard. N-values recorded in the till in the upper 15-ft bgs ranged from 6 to 29, averaging 17. For conservatism, an undrained cohesion of 1,050 psf was assumed for the shoring modeling. Long-term conditions were not considered for the over-consolidated till.

3. Groundwater Level and Seepage: The groundwater level at the CID Tank site was conservatively estimated at a depth of 8 feet below tank bearing grades, on either side of the sheet pile wall, based on local geotechnical boring data and available site-wide groundwater monitoring data. Seepage was conservatively not considered in our analysis due to the low permeability of the till soil layer in contact with the groundwater surface.
4. Surcharge: A 53 ft wide surcharge pressure of 750 psf was applied at a distance 13 feet away from the shoring system to represent a fully loaded tank still in service during the event.
5. Lateral Earth Pressures:
   - Triangular Pressure Envelopes.
   - Wall mobilizes enough for active pressure to develop.
   - No seepage at wall tip.
   - Numerical solution (wedge analysis).
   - No wall friction between sheet pile wall and soils.
6. Surcharge Load Lateral Pressures:
   - Flexible Wall conditions
7. Shoring:
   - Sheet pile wall with S-64 sections, with the following properties:
     - 12-ft length
     - Grade 50 Steel
     - Section Modulus: 7.89 (in^3/ft)
   - Cantilever wall – no lateral support
   - Passive Pressure factor of safety of 1.2 when analyzing the embedment length.
   - Cantilever embedment factor of 1.2.

Calculation and Results:

Shoring analysis for the proposed sheet piling shoring system were performed using the Shoring Suite computer program by Civiltech Software.

The analysis was performed using the moment-equilibrium method on a cross-section of the wall, which satisfies both moment and force equilibrium. The shear forces from active and passive earth pressures were evaluated to determine a point of zero moment towards the bottom of the sheet pile. The resulting depth to point of zero moment is multiplied by a cantilever embedment factor to determine the minimum required embedment length and total length of sheet pile wall. Detailed output from the shoring analysis, including figures showing lateral earth pressure distributions, embedment results, and shear force-moment-deflection diagrams are provided in Attachments A, B, and C, respectively. Findings are further discussed below.

Using the design criteria listed in the assumptions section, one scenario for the design section were evaluated for the proposed shoring system.

Results of these evaluations are summarized in Table 2:

Table 2: Shoring Section Design Requirements

Load Case / Soil Stratigraphy	Minimum Required Pile Embedment Length (ft)	Minimum Required Pile Length (ft)	Minimum Required Section Modulus (in^3/ft)	Maximum Deflection (in.)
All Sides of CID Tank Area	6.5	10.5	0.6	0.9

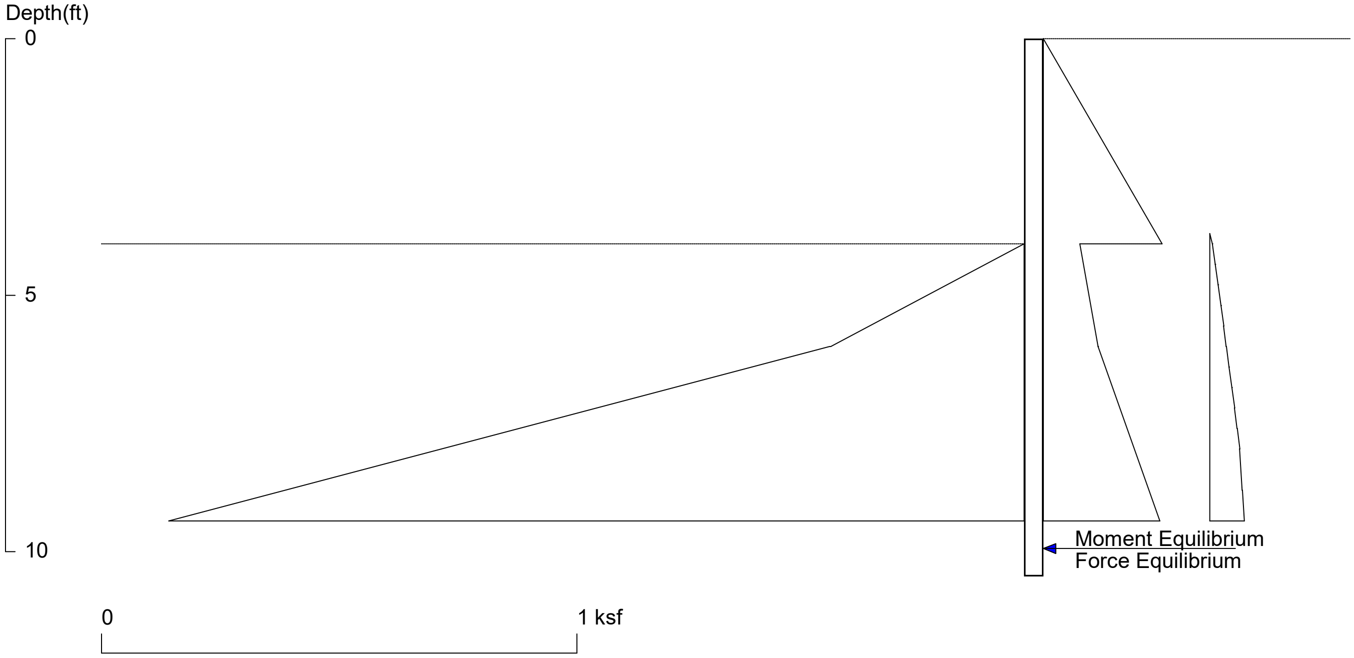
As shown in Table 2, calculated minimum required pile embedment length and minimum required section modulus values for shoring do not exceed those of the proposed design shoring section.

<u>Conclusions:</u>

A sheet pile with a S-64 section, Grade 50 steel, with a length of 12-ft, provides a sufficient embedment length and section modulus for the proposed sheet pile shoring system.

Attachment A - Shoring Suite Shoring Results

Effluent Tanks
FOS=1.2 (Geotechnical)



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to 4324324234 3424343 Date: 6/29/2023
File: C:\Users\SAlfaro\ARCADIS\NS East Palestine - 11 Engineering & Design\04 Effluent Tank Design\Shoring Secondary

Wall Height=4.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=6.48 Min. Pile Length=10.48
MOMENT IN PILE: Max. Moment=1.91 per Pile Spacing=1.0 at Depth=7.12

PILE SELECTION:
Request Min. Section Modulus = 0.7 in3/ft=37.32 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
User Input I (Moment of Inertia):
Top Deflection = 1.06(in) based on E (ksi)=29000.00 and I (in4)/foot=24.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	4.000	0.250	0.062500
*	Below	Base		
4.000	0.077	6.000	0.115	0.019204
6.000	0.115	12.00	0.344	0.038214
*	Sur-	charg		
3.800	0.000	4.000	0.006	0.029488
4.000	0.006	4.400	0.012	0.014727
4.400	0.012	4.800	0.018	0.014692
4.800	0.018	5.200	0.024	0.014641
5.200	0.024	5.600	0.029	0.014573
5.600	0.029	6.000	0.035	0.014488
6.000	0.035	6.400	0.041	0.014387
6.400	0.041	6.800	0.047	0.014271
6.800	0.047	7.200	0.052	0.014139
7.200	0.052	7.600	0.058	0.013992
7.600	0.058	8.000	0.063	0.013831
8.000	0.063	8.800	0.069	0.006829

8.800	0.069	9.600	0.074	0.006735
9.600	0.074	10.40	0.080	0.006635
10.40	0.080	11.20	0.085	0.006530

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
*	Below	Base		
4.000	0.000	6.000	0.407	0.203412
6.000	0.409	12.00	2.862	0.408882

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	4.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Attachment G

Daily Inspection Form

Facility Name:		**Tank System Daily Inspection Log** Tank: stationary waste storage or treatment tank and its associated ancillary equipment and containment system.
Year :	Month:	
Tank ID:		Daily tank inspection required for each tank.

Instructions:

- The person conducting the inspection must also complete this log.
- Check (√) box if ok. For problems, **X** box and explain on the reverse.
- Describe any event, (spills, cracked or compromised containment, non-functional safety equipment, etc.) and corrective actions on the reverse.
- Report spills or leaks to your supervisor immediately.

Day	Printed Name	Signature	Time	System free of corrosion and evident damage?	Secondary containment free of waste and liquid?	Pipes, valves, & pumps free of leaks & in good condition?	There is no evidence of structure failures or releases?	Monitoring equipment data evaluated to ensure proper operation?	Overfill control inspection schedule & procedures followed?	Comment: **X** box and explain on reverse.		
1												
2												
3												
4												
5												
6												
7												
8												
9												
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11												
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31												

Note: If the tank system or a component of the tank system is in poor condition or unfit for service, you must take proactive steps to investigate, repair, and/or replace the equipment, parts, or components as required.

Comments/Observations:

Attachment H

Secondary Containment Management

Secondary Containment Management
Norfolk Southern Train Derailment
East Palestine, Ohio
Date: April 12, 2023

Wastes generated as a result of the train derailment are currently stored in staging piles, temporary units (TUs) and containers (drums and totes). Locations of designated waste storage areas are provided in Figure 1 of the Waste Management Plan. All storage areas are equipped with secondary containment that is designed and constructed of suitable materials (e.g., non-earthen materials) to prevent any waste or precipitation collected in the system from reaching the environment. Below is a description of the secondary containment in place at each waste storage area.

- Tank Farms 5 and 6 have welded HDPE liner covering the entire tank farm area with additional HDPE installed under the temporary storage tanks. Rig mats have been placed over the liner to prevent punctures. A containment berm was created using hay bale berms overlain by HDPE liner.
- Tank Farms 2, 3 and 4 and Stand by Tank Farms 1, 2 and 3 and the wastewater treatment plant have individual HDPE liners installed under each temporary storage tank and container storage areas.
- Tank Farm 1 contains two modular tanks were installed within a single secondary containment consisting of an impermeable liner (120 mil Linear Low-Density Polyethylene (LLDPE) liner manufactured by ATARFIL), steel sheet piles, and earthen berms.
- Soil generated within the Area of Contamination is consolidated into staging piles that are placed on a welded HDPE liner system. The containment berm is constructed with hay bale that are covered by the HDPE liner.
- Additional secondary containments (buckets/ kiddie pools) are placed under hose connections during loading and offloading of the temporary storage tanks. Secondary containment utilized during loading and offloading operations for the modular tanks is provided in the Modular Tank Summary Sheet (April 7,2023, Arcadis)

At a minimum, all tanks, containers, staging piles and secondary containment systems are inspected daily. Inspections are recorded in the project files and available for review upon request. If a container or tank is found leaking or unfit for use, the container or tank will be immediately addressed, and the released waste will be immediately transferred to another suitable container or tank. If a secondary containment system is found compromised (unable to collect or prevent a release to the environment), the secondary containment will be repaired. The repair must be sufficient to prevent any waste or precipitation collected in the system from reaching the environment. If unable to be repaired, the unit will be taken out of service.

If waste or rain water is identified in the secondary containment that released waste (solid or liquid) or accumulated precipitation will be removed from the secondary containment as soon as practicable but not later than 24 hours. If waste or precipitation is released outside of secondary containment, the release will be immediately stopped and cleaned-up. Any released waste, accumulated precipitation and/or resulting clean-up materials will be collected and characterized for offsite disposal at a permitted facility.

Any releases outside of secondary containment will be collected and contained. For solid materials, the waste will be returned to the original or intended container or stockpile. Any sidewall of the secondary containment that is compromised will be reenforced with hay bales or similar structurally sound material. For liquids that are released outside of secondary, the impacted surface material will be excavated and containerized in labeled roll-offs or drums and may be consolidated with similar waste streams.

Attachment I

Tank Liner Product Information

DATA SHEET

ProFlex

High Performance Smooth Geomembrane

An LLDPE geomembrane with a UV stabilized upper white surface used in applications that require increased flexibility and elongation properties as well as additional quality assurance

ProLine High Performance ProFlex smooth is a co-extruded linear low density polyethylene (LLDPE) geomembrane specifically designed to be used in the most stringent applications. It is designed for applications that require increased elasticity and multi-axial break resistance. This product contains only the finest raw materials to enable exceptional elasticity and excellent multi-axial break resistance. Included in this product is a custom additive package that has been engineered to enable extended geomembrane lifetime and improved resilience in extreme temperatures, hazardous waste containment, or a harsh chemical environment. In addition to a superior UV stabilization package, a well-dispersed premium grade of carbon black is utilized in the black layers to deliver superb UV resistance in exposed applications.

These Product Specifications Exceed GRI GM17

Product Specifications

			Minumum Average Value				
Property Tested	**Test Method**	**Frequency**	**30 mil**	**40 mil**	**60 mil**	**80 mil**	**100 mil**
Thickness, Mil Lowest individual Reading	ASTM D 5199	Every Roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm^3	ASTM D 1505	200,000 lbs	0.92	0.92	0.92	0.92	0.92
Tensile Properties (each direction) Strength at Break, lb/in-width Elongationation at Break, %	ASTM D 6693, Type IV Dumbell, 2 ipm G.L. 2.0 in	20,000 lbs	114	170 900	240 900	300 900	380 900
Tear Resistence, lb	ASTM D 1004	45,000 lbs	16	22	33	44	55
Puncture Resistence, lb	ASTM D 4833	45,000 lbs	42	70	100	130	155
Multi-axial Break Resistence, %	ASTM D 5617	per formulation	90	90	90	90	90
Carbon Black Content [3], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note 2	Note 2	Note 2	Note 2	Note 2
Oxidative Induction Time, mins	ASTM D 3895 200°C; O_2, 1atm	200,000 lbs	> 140	> 140	> 140	> 140	> 140
High Pressure Oxidative Induction Time, mins	ASTM D 3895 150°C; O_2, 3.4 MPa	per formulation	> 550	> 550	> 550	> 550	> 550
Oven aging at 85°C High Pressure OIT (min avg) - % retained after 90 days	ASTM D 5721 ASTM D 5885	per formulation	80	80	80	80	80
UV Resistence High Pressure OIT (min avg) - % retained after 1600 hours	GM 11 ASTM D 5885	per formulation	60	60	60	60	60

NOTES:
(1) High Performance ProLine White may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
(2) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
All ProLine geomembranes have dimensional stability of 2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
*Modified.

Western ProLine
PO Box 158
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Attachment 3

Laboratory Analytical Report 240-184875

Environment Testing

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ANALYTICAL REPORT

PREPARED FOR

Attn: Norfolk Southern
Norfolk Southern Corporation
650 W Peachtree St NW
Atlanta, Georgia 30308

Generated 5/16/2023 3:56:35 PM

JOB DESCRIPTION

NS East Palestine

JOB NUMBER

240-184875-1

Eurofins Cleveland
180 S. Van Buren Avenue
Barberton OH 44203

See page two for job notes and contact information.

Eurofins Cleveland

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing North Central, LLC Project Manager.

Authorization

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Table of Contents

Definitions/Glossary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
E	Result exceeded calibration range.
F1	MS and/or MSD recovery exceeds control limits.
F2	MS/MSD RPD exceeds control limits
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC/MS Semi VOA

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
B	Compound was found in the blank and sample.
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
S1-	Surrogate recovery exceeds control limits, low biased.

GC Semi VOA

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
B	Compound was found in the blank and sample.
F2	MS/MSD RPD exceeds control limits
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
S1-	Surrogate recovery exceeds control limits, low biased.

Metals

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 240-184875-1

Laboratory: Eurofins Cleveland

Narrative

Job Narrative
240-184875-1

Receipt
The samples were received on 5/7/2023 6:52 PM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperatures of the 8 coolers at receipt time were 3.9°C, 4.2°C, 4.6°C, 4.7°C, 4.9°C, 5.2°C, 5.4°C and 5.6°C

GC/MS VOA
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

GC/MS Semi VOA
Method 8270E: The method blank for preparation batch 410-373607 and analytical batch 410-374258 contained 2-Butoxyethanol above the method detection limit (MDL). Associated sample(s) were not re-extracted and/or re-analyzed because results were greater than 10X the value found in the method blank.

Method 8270E: The continuing calibration verification (CCV) associated with batch 410-373776 recovered above the upper control limit for 2-Butoxyethanol. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated samples are: WC-TF3-501F (240-184875-4), FB-1-05062023 (240-184875-13) and WC-TF5-514E (240-184875-23).

Method 8270E: The continuing calibration verification (CCV) associated with batch 410-373776 recovered above the upper control limit for 2,4-Dinitrophenol, 4,6-Dinitro-2-methylphenol, bis (2-chloroisopropyl) ether and 2-Butoxyethyl acetate. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated samples are: WC-TF5-538F (240-184875-1), WC-TF5-514D (240-184875-2), WC-TF3-501F (240-184875-4), WC-TF3-251478 (240-184875-5), WC-TF3-AL4944 (240-184875-7), FB-2-05072023 (240-184875-8), WC-TF3-257761 (240-184875-10), DUP-1 (240-184875-11), FB-1-05062023 (240-184875-13), WC-TF5-260119 (240-184875-15), WC-TF5-251320 (240-184875-16), WC-TF3-AL4787 (240-184875-20), WC-TF3-AL4216 (240-184875-21) and WC-TF5-514E (240-184875-23).

Method 8270E: The laboratory control sample (LCS) for preparation batch 410-373607 and analytical batch 410-373776 recovered outside control limits for the following analytes: 2-Butoxyethyl acetate. The stated control limits are advisory only until sufficient data points can be obtained to calculate statistical limits. WC-TF5-538F (240-184875-1), WC-TF5-514D (240-184875-2), WC-TF3-501F (240-184875-4), WC-TF3-251478 (240-184875-5), WC-TF3-AL4944 (240-184875-7), FB-2-05072023 (240-184875-8), WC-TF3-257761 (240-184875-10), DUP-1 (240-184875-11), FB-1-05062023 (240-184875-13), WC-TF5-260119 (240-184875-15), WC-TF5-251320 (240-184875-16), WC-TF3-AL4787 (240-184875-20), WC-TF3-AL4216 (240-184875-21) and WC-TF5-514E (240-184875-23)

Method 8270E: The following sample was diluted due to the nature of the sample matrix: WC-TF5-514E (240-184875-23). Elevated reporting limits (RLs) are provided.

Method 8270E: The laboratory control sample (LCS) for preparation batch 410-373607 and analytical batch 410-374258 recovered outside control limits for the following analytes: 2-Butoxyethyl acetate. The stated control limits are advisory only until sufficient data points can be obtained to calculate statistical limits. WC-TF3-513A (240-184875-18)

Method 8270E: The following sample was diluted due to the nature of the sample matrix: WC-TF3-513A (240-184875-18). Elevated reporting limits (RLs) are provided.

Method 8270E: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 410-373607 and analytical batch 410-374258 were outside control limits for one or more analytes. See QC Sample Results for detail. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery is within acceptance limits.

Method 8270E: The method blank for preparation batch 410-373607 and analytical batch 410-374462 contained 2-Butoxyethanol above the method detection limit (MDL). Associated sample(s) were not re-extracted and/or re-analyzed because results were greater than 10X the value found in the method blank.

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

Job ID: 240-184875-1 (Continued)

Laboratory: Eurofins Cleveland (Continued)

Method 8270E: The laboratory control sample (LCS) for preparation batch 410-374570 and analytical batch 410-374813 recovered outside control limits for the following analytes: 2-Butoxyethyl acetate. The stated control limits are advisory only until sufficient data points can be obtained to calculate statistical limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Diesel Range Organics

Method 8015D_DRO: The following sample was diluted due to the abundance of target analytes: WC-TF5-514E (240-184875-23)

Method 8015D_DRO: The following sample required a dilution due to the nature of the sample matrix: WC-TF5-514E (240-184875-23). Because of this dilution, the surrogate spike concentration in the sample was reduced to a level where the recovery calculation does not provide useful information.

Method 8015D_DRO: The following sample was diluted due to the abundance of target analytes: WC-TF5-538F (240-184875-1)

Method 8015D_DRO: The following samples were diluted due to the abundance of target analytes: WC-TF3-513A (240-184875-18), WC-TF3-513A (240-184875-18[MS]) and WC-TF3-513A (240-184875-18[MSD])

Method 8015D_DRO: The following samples required a dilution due to the nature of the sample matrix: WC-TF3-513A (240-184875-18) and WC-TF3-513A (240-184875-18[MSD]). Because of this dilution, the surrogate spike concentration in the sample was reduced to a level where the recovery calculation does not provide useful information.

Method 8015D_DRO: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 240-572792 and analytical batch 240-572745 were outside control limits for diesel. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery is within acceptance limits.

Method 8015D_DRO: The matrix spike / matrix spike duplicate / sample duplicate (MS/MSD/DUP) precision for preparation batch 240-572792 and analytical batch 240-572745 was outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample / laboratory control sample duplicate (LCS/LCSD) precision was within acceptance limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

General Chemistry

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Method Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method	Method Description	Protocol	Laboratory
8260D	Volatile Organic Compounds by GC/MS	SW846	EET CLE
8270E	Semivolatile Organic Compounds (GC/MS)	SW846	ELLE
8015D	Diesel Range Organics (DRO) (GC)	SW846	EET CLE
6010D	Metals (ICP)	SW846	EET CLE
7470A	Mercury (CVAA)	SW846	EET CLE
1010B	Ignitability, Pensky-Martens Closed-Cup Method	SW846	EET CLE
2540D-2015	Total Suspended Solids (Dried at 103-105°C)	SM	EET CLE
5310 C-2014	Total Organic Carbon/Persulfate - Ultrav	SM	EET CLE
9040C	pH	SW846	EET CLE
1311	TCLP Extraction	SW846	EET CLE
3010A	Preparation, Total Metals	SW846	EET CLE
3510C	Liquid-Liquid Extraction (Separatory Funnel)	SW846	ELLE
3511	Microextraction of Organic Compounds	SW846	EET CLE
5030C	Purge and Trap	SW846	EET CLE
7470A	Preparation, Mercury	SW846	EET CLE

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET CLE = Eurofins Cleveland, 180 S. Van Buren Avenue, Barberton, OH 44203, TEL (330)497-9396

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-184875-1	WC-TF5-538F	Water	05/07/23 10:55	05/07/23 18:52
240-184875-2	WC-TF5-514D	Water	05/07/23 11:25	05/07/23 18:52
240-184875-3	TRIP BLANK	Water	05/07/23 00:00	05/07/23 18:52
240-184875-4	WC-TF3-501F	Water	05/07/23 09:21	05/07/23 18:52
240-184875-5	WC-TF3-251478	Water	05/07/23 09:40	05/07/23 18:52
240-184875-7	WC-TF3-AL4944	Water	05/07/23 11:17	05/07/23 18:52
240-184875-8	FB-2-05072023	Water	05/07/23 11:40	05/07/23 18:52
240-184875-9	TRIP BLANK	Water	05/07/23 00:00	05/07/23 18:52
240-184875-10	WC-TF3-257761	Water	05/07/23 08:35	05/07/23 18:52
240-184875-11	DUP-1	Water	05/07/23 00:00	05/07/23 18:52
240-184875-12	TRIP BLANK	Water	05/07/23 00:00	05/07/23 18:52
240-184875-13	FB-1-05062023	Water	05/06/23 16:00	05/07/23 18:52
240-184875-14	TRIP BLANK	Water	05/06/23 00:00	05/07/23 18:52
240-184875-15	WC-TF5-260119	Water	05/06/23 12:05	05/07/23 18:52
240-184875-16	WC-TF5-251320	Water	05/06/23 12:35	05/07/23 18:52
240-184875-17	TRIP BLANK	Water	05/06/23 00:00	05/07/23 18:52
240-184875-18	WC-TF3-513A	Water	05/06/23 15:30	05/07/23 18:52
240-184875-19	TRIP BLANK	Water	05/06/23 00:00	05/07/23 18:52
240-184875-20	WC-TF3-AL4787	Water	05/07/23 10:10	05/07/23 18:52
240-184875-21	WC-TF3-AL4216	Water	05/07/23 10:45	05/07/23 18:52
240-184875-22	TRIP BLANK	Water	05/07/23 00:00	05/07/23 18:52
240-184875-23	WC-TF5-514E	Water	05/06/23 13:00	05/07/23 18:52
240-184875-25	TRIP BLANK	Water	05/06/23 00:00	05/07/23 18:52

Detection Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF5-538F

Lab Sample ID: 240-184875-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acenaphthene	0.00016	J	0.00050	0.00010	mg/L	1		8270E	Total/NA
Fluoranthene	0.00010	J	0.00050	0.00010	mg/L	1		8270E	Total/NA
Fluorene	0.00012	J	0.00050	0.00012	mg/L	1		8270E	Total/NA
2-Butoxyethanol - DL	1.9		0.10	0.050	mg/L	20		8270E	Total/NA
Diesel Range Organics [C10 - C28]	12000	B	980	130	ug/L	2		8015D	Total/NA
Arsenic	0.0069	J B	0.050	0.0041	mg/L	1		6010D	TCLP
Barium	0.032	J	0.50	0.0030	mg/L	1		6010D	TCLP
Chromium	0.0016	J	0.050	0.00076	mg/L	1		6010D	TCLP
Lead	0.0070	J	0.050	0.0028	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	72		8.0	0.80	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	230		10	3.5	mg/L	10		5310 C-2014	Total/NA
corrosivity by pH	7.3	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: WC-TF5-514D

Lab Sample ID: 240-184875-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.012		0.010	0.0012	mg/L	1		8260D	Total/NA
4-Methyl-2-pentanone (MIBK)	0.0016	J	0.010	0.00099	mg/L	1		8260D	Total/NA
Acetone	0.26		0.033	0.018	mg/L	3.333		8260D	Total/NA
Benzene	0.0021		0.0010	0.00042	mg/L	1		8260D	Total/NA
Chloromethane	0.00081	J	0.0010	0.00063	mg/L	1		8260D	Total/NA
Vinyl chloride	0.065		0.0033	0.0015	mg/L	3.333		8260D	Total/NA
Butyl acrylate	0.0095	J	0.010	0.0023	mg/L	1		8260D	Total/NA
2-Ethylhexyl acrylate	0.034		0.010	0.0033	mg/L	1		8260D	Total/NA
Benzo[b]fluoranthene	0.00024	J	0.00047	0.000094	mg/L	1		8270E	Total/NA
Chrysene	0.00018	J	0.00047	0.000094	mg/L	1		8270E	Total/NA
Fluoranthene	0.00022	J	0.00047	0.000094	mg/L	1		8270E	Total/NA
Naphthalene	0.00016	J	0.00047	0.000094	mg/L	1		8270E	Total/NA
Phenanthrene	0.00017	J	0.00047	0.00010	mg/L	1		8270E	Total/NA
Pyrene	0.00018	J	0.00047	0.000094	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	480	J B	490	67	ug/L	1		8015D	Total/NA
Barium	0.044	J	0.50	0.0030	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	37		10	1.0	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	3.7		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.8	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-3

No Detections.

Client Sample ID: WC-TF3-501F

Lab Sample ID: 240-184875-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Fluoranthene	0.00046	J	0.00051	0.00010	mg/L	1		8270E	Total/NA
Phenanthrene	0.00014	J	0.00051	0.00011	mg/L	1		8270E	Total/NA
Pyrene	0.00042	J	0.00051	0.00010	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	360	J B	500	67	ug/L	1		8015D	Total/NA
Barium	0.020	J	0.50	0.0030	mg/L	1		6010D	TCLP
Chromium	0.0012	J	0.050	0.00076	mg/L	1		6010D	TCLP
Lead	0.0050	J	0.050	0.0028	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: WC-TF3-501F (Continued)
Lab Sample ID: 240-184875-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Total Suspended Solids	86		8.5	0.85	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	4.4		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.7	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: WC-TF3-251478
Lab Sample ID: 240-184875-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.017		0.010	0.0012	mg/L	1		8260D	Total/NA
4-Methyl-2-pentanone (MIBK)	0.0020	J	0.010	0.00099	mg/L	1		8260D	Total/NA
Acetone	0.17		0.10	0.054	mg/L	10		8260D	Total/NA
Butyl acrylate	0.24		0.10	0.023	mg/L	10		8260D	Total/NA
Phenanthrene	0.00014	J	0.00050	0.00011	mg/L	1		8270E	Total/NA
2-Butoxyethanol - RA	0.57	B	0.050	0.025	mg/L	10		8270E	Total/NA
Diesel Range Organics [C10 - C28]	4700	B	500	67	ug/L	1		8015D	Total/NA
Barium	0.057	J	0.50	0.0030	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	30		7.5	0.75	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	74		5.0	1.7	mg/L	5		5310 C-2014	Total/NA
corrosivity by pH	7.6	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: WC-TF3-AL4944
Lab Sample ID: 240-184875-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0035	J	0.010	0.0012	mg/L	1		8260D	Total/NA
Acetone	0.084		0.010	0.0054	mg/L	1		8260D	Total/NA
Acenaphthylene	0.00015	J	0.00050	0.00010	mg/L	1		8270E	Total/NA
Anthracene	0.00012	J	0.00050	0.00010	mg/L	1		8270E	Total/NA
Fluoranthene	0.00011	J	0.00050	0.00010	mg/L	1		8270E	Total/NA
Fluorene	0.00024	J	0.00050	0.00012	mg/L	1		8270E	Total/NA
Phenanthrene	0.00017	J	0.00050	0.00011	mg/L	1		8270E	Total/NA
2-Butoxyethanol	0.020		0.0050	0.0025	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	1100	B	490	67	ug/L	1		8015D	Total/NA
Barium	0.051	J	0.50	0.0030	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	10		4.0	0.40	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	13		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.4	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: FB-2-05072023
Lab Sample ID: 240-184875-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0030	J	0.010	0.0012	mg/L	1		8260D	Total/NA
Acetone	0.0064	J	0.010	0.0054	mg/L	1		8260D	Total/NA
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
corrosivity by pH	6.2	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-9

No Detections.

Client Sample ID: WC-TF3-257761
Lab Sample ID: 240-184875-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0031	J	0.010	0.0012	mg/L	1		8260D	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: WC-TF3-257761 (Continued) Lab Sample ID: 240-184875-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	0.034		0.010	0.0054	mg/L	1		8260D	Total/NA
Butyl acrylate	0.016		0.010	0.0023	mg/L	1		8260D	Total/NA
2-Ethylhexyl acrylate	0.0071	J	0.010	0.0033	mg/L	1		8260D	Total/NA
2-Butoxyethanol	0.016		0.0054	0.0027	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	6100	B	490	67	ug/L	1		8015D	Total/NA
Barium	0.039	J	0.50	0.0030	mg/L	1		6010D	TCLP
Chromium	0.0019	J	0.050	0.00076	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	20		4.0	0.40	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	8.1		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.3	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: DUP-1 Lab Sample ID: 240-184875-11

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0033	J	0.010	0.0012	mg/L	1		8260D	Total/NA
Acetone	0.034		0.010	0.0054	mg/L	1		8260D	Total/NA
Butyl acrylate	0.014		0.010	0.0023	mg/L	1		8260D	Total/NA
2-Ethylhexyl acrylate	0.0067	J	0.010	0.0033	mg/L	1		8260D	Total/NA
2-Butoxyethanol	0.015		0.0050	0.0025	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	6800	B	490	67	ug/L	1		8015D	Total/NA
Barium	0.042	J	0.50	0.0030	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	87		4.0	0.40	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	7.8		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.3	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK Lab Sample ID: 240-184875-12

No Detections.

Client Sample ID: FB-1-05062023 Lab Sample ID: 240-184875-13

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0027	J	0.010	0.0012	mg/L	1		8260D	Total/NA
Acetone	0.0054	J	0.010	0.0054	mg/L	1		8260D	Total/NA
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
corrosivity by pH	5.9	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK Lab Sample ID: 240-184875-14

No Detections.

Client Sample ID: WC-TF5-260119 Lab Sample ID: 240-184875-15

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0030	J	0.010	0.0012	mg/L	1		8260D	Total/NA
4-Methyl-2-pentanone (MIBK)	0.0019	J	0.010	0.00099	mg/L	1		8260D	Total/NA
Acetone	0.052		0.010	0.0054	mg/L	1		8260D	Total/NA
Benzene	0.00057	J	0.0010	0.00042	mg/L	1		8260D	Total/NA
Butyl acrylate	0.082		0.033	0.0076	mg/L	3.333		8260D	Total/NA
Fluoranthene	0.00043	J	0.00048	0.000095	mg/L	1		8270E	Total/NA
Pyrene	0.00032	J	0.00048	0.000095	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	500	B	490	67	ug/L	1		8015D	Total/NA

This Detection Summary does not include radiochemical test results.

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

Client Sample ID: WC-TF5-260119 (Continued)

Lab Sample ID: 240-184875-15

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.027	J	0.50	0.0030	mg/L	1		6010D	TCLP
Chromium	0.00098	J	0.050	0.00076	mg/L	1		6010D	TCLP
Lead	0.0034	J	0.050	0.0028	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	96		10	1.0	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	9.1		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.5	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: WC-TF5-251320

Lab Sample ID: 240-184875-16

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0053	J	0.010	0.0012	mg/L	1		8260D	Total/NA
4-Methyl-2-pentanone (MIBK)	0.0032	J	0.010	0.00099	mg/L	1		8260D	Total/NA
Acetone	0.29		0.10	0.054	mg/L	10		8260D	Total/NA
Benzene	0.00099	J	0.0010	0.00042	mg/L	1		8260D	Total/NA
Vinyl chloride	0.0033		0.0010	0.00045	mg/L	1		8260D	Total/NA
Butyl acrylate	0.21		0.10	0.023	mg/L	10		8260D	Total/NA
2-Ethylhexyl acrylate	0.0035	J	0.010	0.0033	mg/L	1		8260D	Total/NA
Fluoranthene	0.00022	J	0.00048	0.000097	mg/L	1		8270E	Total/NA
Phenol	0.00050	J	0.0019	0.00048	mg/L	1		8270E	Total/NA
Pyrene	0.00017	J	0.00048	0.000097	mg/L	1		8270E	Total/NA
2-Butoxyethanol - RA	0.20	B	0.048	0.024	mg/L	10		8270E	Total/NA
Diesel Range Organics [C10 - C28]	1000	B	480	66	ug/L	1		8015D	Total/NA
Barium	0.034	J	0.50	0.0030	mg/L	1		6010D	TCLP
Lead	0.0038	J	0.050	0.0028	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	69		9.8	0.98	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	34		2.0	0.70	mg/L	2		5310 C-2014	Total/NA
corrosivity by pH	7.5	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-17

No Detections.

Client Sample ID: WC-TF3-513A

Lab Sample ID: 240-184875-18

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0092	J	0.010	0.0012	mg/L	1		8260D	Total/NA
4-Methyl-2-pentanone (MIBK)	0.0017	J	0.010	0.00099	mg/L	1		8260D	Total/NA
Acetone	0.43		0.050	0.027	mg/L	5		8260D	Total/NA
Benzene	0.0011		0.0010	0.00042	mg/L	1		8260D	Total/NA
Vinyl chloride	0.027	F1 F2	0.0010	0.00045	mg/L	1		8260D	Total/NA
2-Ethylhexyl acrylate	0.0066	J	0.010	0.0033	mg/L	1		8260D	Total/NA
2-Methylnaphthalene	0.0014	J	0.0026	0.00053	mg/L	5		8270E	Total/NA
Acenaphthene	0.00075	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Anthracene	0.00072	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Benzo[a]anthracene	0.0014	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Benzo[a]pyrene	0.0020	J F1	0.0026	0.00058	mg/L	5		8270E	Total/NA
Benzo[b]fluoranthene	0.0021	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Benzo[g,h,i]perylene	0.0018	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Benzo[k]fluoranthene	0.00073	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Chrysene	0.0033	F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Dibenz(a,h)anthracene	0.00054	J F1	0.0026	0.00053	mg/L	5		8270E	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-513A (Continued)

Lab Sample ID: 240-184875-18

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Fluoranthene	0.0032	F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
Fluorene	0.00066	J F1	0.0026	0.00063	mg/L	5		8270E	Total/NA
Indeno[1,2,3-cd]pyrene	0.0017	J F1	0.0026	0.00058	mg/L	5		8270E	Total/NA
Naphthalene	0.0012	J	0.0026	0.00053	mg/L	5		8270E	Total/NA
Phenanthrene	0.0031	F1	0.0026	0.00058	mg/L	5		8270E	Total/NA
Pyrene	0.0030	F1	0.0026	0.00053	mg/L	5		8270E	Total/NA
2-Butoxyethanol	0.12	B *+ F1	0.026	0.013	mg/L	5		8270E	Total/NA
Benzo[b]fluoranthene - RE	0.00064	J F1	0.0029	0.00058	mg/L	5		8270E	Total/NA
Fluoranthene - RE	0.0010	J F1	0.0029	0.00058	mg/L	5		8270E	Total/NA
Phenanthrene - RE	0.00074	J	0.0029	0.00064	mg/L	5		8270E	Total/NA
Pyrene - RE	0.0010	J F1	0.0029	0.00058	mg/L	5		8270E	Total/NA
2-Butoxyethanol - RE	0.20		0.029	0.014	mg/L	5		8270E	Total/NA
Diesel Range Organics [C10 - C28]	9700	F2 B	4900	660	ug/L	10		8015D	Total/NA
Arsenic	0.011	J B	0.050	0.0041	mg/L	1		6010D	TCLP
Barium	0.043	J	0.50	0.0030	mg/L	1		6010D	TCLP
Selenium	0.013	J	0.050	0.0060	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	3400		40	4.0	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	69		5.0	1.7	mg/L	5		5310 C-2014	Total/NA
corrosivity by pH	7.4	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-19

No Detections.

Client Sample ID: WC-TF3-AL4787

Lab Sample ID: 240-184875-20

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0088	J	0.010	0.0012	mg/L	1		8260D	Total/NA
Acetone	0.15		0.020	0.011	mg/L	2		8260D	Total/NA
Toluene	0.00044	J	0.0010	0.00044	mg/L	1		8260D	Total/NA
Vinyl chloride	0.0012		0.0010	0.00045	mg/L	1		8260D	Total/NA
Butyl acrylate	0.0083	J	0.010	0.0023	mg/L	1		8260D	Total/NA
Acenaphthene	0.00013	J	0.00049	0.000099	mg/L	1		8270E	Total/NA
Fluoranthene	0.00012	J	0.00049	0.000099	mg/L	1		8270E	Total/NA
Phenol	0.00072	J	0.0020	0.00049	mg/L	1		8270E	Total/NA
2-Butoxyethanol - RA	0.28	B	0.049	0.025	mg/L	10		8270E	Total/NA
Diesel Range Organics [C10 - C28]	940	B	490	67	ug/L	1		8015D	Total/NA
Barium	0.056	J	0.50	0.0030	mg/L	1		6010D	TCLP
Chromium	0.0010	J	0.050	0.00076	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	55		10	1.0	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	22		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.7	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: WC-TF3-AL4216

Lab Sample ID: 240-184875-21

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0061	J	0.010	0.0012	mg/L	1		8260D	Total/NA
4-Methyl-2-pentanone (MIBK)	0.0015	J	0.010	0.00099	mg/L	1		8260D	Total/NA
Acetone	0.12		0.010	0.0054	mg/L	1		8260D	Total/NA
Benzene	0.00056	J	0.0010	0.00042	mg/L	1		8260D	Total/NA
Butyl acrylate	0.052		0.010	0.0023	mg/L	1		8260D	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: WC-TF3-AL4216 (Continued) — Lab Sample ID: 240-184875-21

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Ethylhexyl acrylate	0.0050	J	0.010	0.0033	mg/L	1		8260D	Total/NA
Fluoranthene	0.00014	J	0.00047	0.000094	mg/L	1		8270E	Total/NA
2-Butoxyethanol - RA	0.059	B	0.0047	0.0023	mg/L	1		8270E	Total/NA
Diesel Range Organics [C10 - C28]	1000	B	490	66	ug/L	1		8015D	Total/NA
Barium	0.039	J	0.50	0.0030	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	130		17	1.7	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	17		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
corrosivity by pH	7.6	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK — Lab Sample ID: 240-184875-22

No Detections.

Client Sample ID: WC-TF5-514E — Lab Sample ID: 240-184875-23

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
2-Butanone (MEK)	0.0042	J	0.010	0.0012	mg/L	1		8260D	Total/NA
Acetone	0.91		0.50	0.27	mg/L	50		8260D	Total/NA
Benzene	0.00080	J	0.0010	0.00042	mg/L	1		8260D	Total/NA
Vinyl chloride	0.0019		0.0010	0.00045	mg/L	1		8260D	Total/NA
Butyl acrylate	0.0048	J	0.010	0.0023	mg/L	1		8260D	Total/NA
Benzo[g,h,i]perylene	0.0010	J	0.0024	0.00049	mg/L	5		8270E	Total/NA
Fluoranthene	0.0021	J	0.0024	0.00049	mg/L	5		8270E	Total/NA
Phenanthrene	0.0014	J	0.0024	0.00054	mg/L	5		8270E	Total/NA
Pyrene	0.0017	J	0.0024	0.00049	mg/L	5		8270E	Total/NA
Diesel Range Organics [C10 - C28]	20000	B	5000	680	ug/L	10		8015D	Total/NA
Arsenic	0.0041	J B	0.050	0.0041	mg/L	1		6010D	TCLP
Barium	0.044	J	0.50	0.0030	mg/L	1		6010D	TCLP
Chromium	0.0011	J	0.050	0.00076	mg/L	1		6010D	TCLP
Ignitablity (Flashpoint)	>200				Degrees F	1		1010B	Total/NA
Total Suspended Solids	18000		57	5.7	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	26		5.0	1.7	mg/L	5		5310 C-2014	Total/NA
corrosivity by pH	7.3	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK — Lab Sample ID: 240-184875-25

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Norfolk Southern Corporation
Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: WC-TF5-538F
Lab Sample ID: 240-184875-1

Date Collected: 05/07/23 10:55
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 16:11	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 16:11	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 16:11	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 16:11	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 16:11	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 16:11	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 16:11	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 16:11	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 16:11	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 16:11	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 16:11	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 16:11	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 16:11	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 16:11	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 16:11	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 16:11	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 16:11	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 16:11	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 16:11	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 16:11	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 16:11	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 16:11	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 16:11	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 16:11	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 16:11	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 16:11	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 16:11	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 16:11	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 16:11	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 16:11	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 16:11	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 16:11	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 16:11	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 16:11	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 16:11	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 16:11	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 16:11	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 16:11	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 16:11	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 16:11	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 16:11	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 16:11	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 16:11	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 16:11	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 16:11	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 16:11	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 16:11	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 16:11	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 16:11	1

Client Sample ID: WC-TF5-538F

Lab Sample ID: 240-184875-1

Date Collected: 05/07/23 10:55

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 16:11	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 16:11	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*103*		*78 - 122*		*05/08/23 16:11*	*1*
Dibromofluoromethane (Surr)	*112*		*73 - 120*		*05/08/23 16:11*	*1*
4-Bromofluorobenzene (Surr)	*101*		*56 - 136*		*05/08/23 16:11*	*1*
1,2-Dichloroethane-d4 (Surr)	*112*		*62 - 137*		*05/08/23 16:11*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,4,6-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,4,5-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,4-Dichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,4-Dimethylphenol	ND		0.010	0.0030	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,4-Dinitrotoluene	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
2-Chloronaphthalene	ND		0.0010	0.00040	mg/L		05/11/23 08:29	05/11/23 17:58	1
2-Chlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2-Methylnaphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
2-Methylphenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2-Nitroaniline	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
2-Nitrophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
3,3'-Dichlorobenzidine	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 17:58	1
3-Nitroaniline	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 17:58	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0080	mg/L		05/11/23 08:29	05/11/23 17:58	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
4-Chloro-3-methylphenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
4-Chloroaniline	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 17:58	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
4-Nitroaniline	ND		0.0030	0.00090	mg/L		05/11/23 08:29	05/11/23 17:58	1
Acenaphthene	**0.00016**	**J**	0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Acenaphthylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Acetophenone	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Atrazine	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Benzaldehyde	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Benzo[a]anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Benzo[a]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 17:58	1
Benzo[b]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Benzo[g,h,i]perylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Benzo[k]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 17:58	1
Butyl benzyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 17:58	1
Caprolactam	ND		0.0070	0.0030	mg/L		05/11/23 08:29	05/11/23 17:58	1
Carbazole	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Chrysene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1

Client Sample ID: WC-TF5-538F
Lab Sample ID: 240-184875-1
Date Collected: 05/07/23 10:55
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 17:58	1
Di-n-octyl phthalate	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Dibenz(a,h)anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Dibenzofuran	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Diethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 17:58	1
Dimethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 17:58	1
Fluoranthene	**0.00010**	**J**	0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Fluorene	**0.00012**	**J**	0.00050	0.00012	mg/L		05/11/23 08:29	05/11/23 17:58	1
Hexachlorobenzene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 17:58	1
Hexachlorobutadiene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Hexachlorocyclopentadiene	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Hexachloroethane	ND		0.0050	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Indeno[1,2,3-cd]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 17:58	1
Isophorone	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
N-Nitrosodiphenylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Naphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Nitrobenzene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Pentachlorophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 17:58	1
Phenanthrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 17:58	1
Phenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
Pyrene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 17:58	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
2,6-Dinitrotoluene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 17:58	1
4-Nitrophenol	ND		0.030	0.010	mg/L		05/11/23 08:29	05/11/23 17:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*28*		*10 - 120*	*05/11/23 08:29*	*05/11/23 17:58*	*1*
Nitrobenzene-d5 (Surr)	*67*		*31 - 120*	*05/11/23 08:29*	*05/11/23 17:58*	*1*
2-Fluorophenol (Surr)	*41*		*10 - 120*	*05/11/23 08:29*	*05/11/23 17:58*	*1*
2-Fluorobiphenyl (Surr)	*58*		*44 - 120*	*05/11/23 08:29*	*05/11/23 17:58*	*1*
2,4,6-Tribromophenol (Surr)	*76*		*13 - 138*	*05/11/23 08:29*	*05/11/23 17:58*	*1*
p-Terphenyl-d14 (Surr)	*69*		*30 - 125*	*05/11/23 08:29*	*05/11/23 17:58*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol	**1.9**		0.10	0.050	mg/L		05/11/23 08:29	05/11/23 19:59	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*26*		*10 - 120*	*05/11/23 08:29*	*05/11/23 19:59*	*20*
Nitrobenzene-d5 (Surr)	*64*		*31 - 120*	*05/11/23 08:29*	*05/11/23 19:59*	*20*
2-Fluorophenol (Surr)	*40*		*10 - 120*	*05/11/23 08:29*	*05/11/23 19:59*	*20*
2-Fluorobiphenyl (Surr)	*57*		*44 - 120*	*05/11/23 08:29*	*05/11/23 19:59*	*20*
2,4,6-Tribromophenol (Surr)	*71*		*13 - 138*	*05/11/23 08:29*	*05/11/23 19:59*	*20*
p-Terphenyl-d14 (Surr)	*64*		*30 - 125*	*05/11/23 08:29*	*05/11/23 19:59*	*20*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**12000**	**B**	980	130	ug/L		05/08/23 07:32	05/09/23 12:27	2

Client Sample ID: WC-TF5-538F
Date Collected: 05/07/23 10:55
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-1
Matrix: Water

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*90*		*52 - 121*	*05/08/23 07:32*	*05/09/23 12:27*	*2*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0069**	**J B**	0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:44	1
Barium	**0.032**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:44	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:44	1
Chromium	**0.0016**	**J**	0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:44	1
Lead	**0.0070**	**J**	0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:44	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:44	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:44	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:29	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 13:03	1
Total Suspended Solids (SM 2540D-2015)	**72**		8.0	0.80	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**230**		10	3.5	mg/L			05/10/23 13:23	10
corrosivity by pH (SW846 9040C)	**7.3**	**HF**	0.1	0.1	SU			05/08/23 19:15	1

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

Client Sample ID: WC-TF5-514D

Lab Sample ID: 240-184875-2

Date Collected: 05/07/23 11:25

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 15:24	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 15:24	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 15:24	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 15:24	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 15:24	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 15:24	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 15:24	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 15:24	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 15:24	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 15:24	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 15:24	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 15:24	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 15:24	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 15:24	1
2-Butanone (MEK)	**0.012**		0.010	0.0012	mg/L			05/08/23 15:24	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 15:24	1
4-Methyl-2-pentanone (MIBK)	**0.0016**	**J**	0.010	0.00099	mg/L			05/08/23 15:24	1
Acetone	**0.26**		0.033	0.018	mg/L			05/08/23 20:08	3.333
Benzene	**0.0021**		0.0010	0.00042	mg/L			05/08/23 15:24	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 15:24	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 15:24	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 15:24	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 15:24	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 15:24	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 15:24	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 15:24	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 15:24	1
Chloromethane	**0.00081**	**J**	0.0010	0.00063	mg/L			05/08/23 15:24	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 15:24	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 15:24	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 15:24	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 15:24	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 15:24	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 15:24	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 15:24	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 15:24	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 15:24	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 15:24	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 15:24	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 15:24	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 15:24	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 15:24	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 15:24	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 15:24	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 15:24	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 15:24	1
Vinyl chloride	**0.065**		0.0033	0.0015	mg/L			05/08/23 20:08	3.333
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 15:24	1
Butyl acrylate	**0.0095**	**J**	0.010	0.0023	mg/L			05/08/23 15:24	1

Client Sample ID: WC-TF5-514D Lab Sample ID: 240-184875-2

Date Collected: 05/07/23 11:25 **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 15:24	1
2-Ethylhexyl acrylate	**0.034**		0.010	0.0033	mg/L			05/08/23 15:24	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*102*		*78 - 122*		*05/08/23 15:24*	*1*
Toluene-d8 (Surr)	*98*		*78 - 122*		*05/08/23 20:08*	*3.333*
Dibromofluoromethane (Surr)	*108*		*73 - 120*		*05/08/23 15:24*	*1*
Dibromofluoromethane (Surr)	*108*		*73 - 120*		*05/08/23 20:08*	*3.333*
4-Bromofluorobenzene (Surr)	*111*		*56 - 136*		*05/08/23 15:24*	*1*
4-Bromofluorobenzene (Surr)	*103*		*56 - 136*		*05/08/23 20:08*	*3.333*
1,2-Dichloroethane-d4 (Surr)	*109*		*62 - 137*		*05/08/23 15:24*	*1*
1,2-Dichloroethane-d4 (Surr)	*105*		*62 - 137*		*05/08/23 20:08*	*3.333*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,4,6-Trichlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,4,5-Trichlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,4-Dichlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,4-Dimethylphenol	ND		0.0094	0.0028	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,4-Dinitrophenol	ND		0.028	0.013	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,4-Dinitrotoluene	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
2-Chloronaphthalene	ND		0.00094	0.00038	mg/L		05/09/23 08:16	05/09/23 21:35	1
2-Chlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2-Methylnaphthalene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
2-Methylphenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2-Nitroaniline	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
2-Nitrophenol	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
3,3'-Dichlorobenzidine	ND		0.0094	0.0038	mg/L		05/09/23 08:16	05/09/23 21:35	1
3-Nitroaniline	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/09/23 21:35	1
4,6-Dinitro-2-methylphenol	ND		0.020	0.0076	mg/L		05/09/23 08:16	05/09/23 21:35	1
4-Bromophenyl phenyl ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
4-Chloro-3-methylphenol	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
4-Chloroaniline	ND		0.0094	0.0038	mg/L		05/09/23 08:16	05/09/23 21:35	1
4-Chlorophenyl phenyl ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
4-Nitroaniline	ND		0.0028	0.00085	mg/L		05/09/23 08:16	05/09/23 21:35	1
Acenaphthene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Acenaphthylene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Acetophenone	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Anthracene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Atrazine	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Benzaldehyde	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Benzo[a]anthracene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Benzo[a]pyrene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/09/23 21:35	1
Benzo[b]fluoranthene	**0.00024**	**J**	0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Benzo[g,h,i]perylene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Benzo[k]fluoranthene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Bis(2-chloroethoxy)methane	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Bis(2-chloroethyl)ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Bis(2-ethylhexyl) phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/09/23 21:35	1

Client: Norfolk Southern Corporation | Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: WC-TF5-514D | Lab Sample ID: 240-184875-2

Date Collected: 05/07/23 11:25 | **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/09/23 21:35	1
Caprolactam	ND		0.0066	0.0028	mg/L		05/09/23 08:16	05/09/23 21:35	1
Carbazole	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Chrysene	**0.00018**	**J**	0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Di-n-butyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/09/23 21:35	1
Di-n-octyl phthalate	ND		0.010	0.0047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Dibenz(a,h)anthracene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Dibenzofuran	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Diethyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/09/23 21:35	1
Dimethyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/09/23 21:35	1
Fluoranthene	**0.00022**	**J**	0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Fluorene	ND		0.00047	0.00011	mg/L		05/09/23 08:16	05/09/23 21:35	1
Hexachlorobenzene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/09/23 21:35	1
Hexachlorobutadiene	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Hexachlorocyclopentadiene	ND		0.010	0.0047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Hexachloroethane	ND		0.0047	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Indeno[1,2,3-cd]pyrene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/09/23 21:35	1
Isophorone	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
N-Nitrosodi-n-propylamine	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
N-Nitrosodiphenylamine	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Naphthalene	**0.00016**	**J**	0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Nitrobenzene	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Pentachlorophenol	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/09/23 21:35	1
Phenanthrene	**0.00017**	**J**	0.00047	0.00010	mg/L		05/09/23 08:16	05/09/23 21:35	1
Phenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
Pyrene	**0.00018**	**J**	0.00047	0.000094	mg/L		05/09/23 08:16	05/09/23 21:35	1
bis (2-chloroisopropyl) ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
2,6-Dinitrotoluene	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/09/23 21:35	1
4-Nitrophenol	ND		0.028	0.0094	mg/L		05/09/23 08:16	05/09/23 21:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*28*		*10 - 120*	*05/09/23 08:16*	*05/09/23 21:35*	*1*
Nitrobenzene-d5 (Surr)	*75*		*31 - 120*	*05/09/23 08:16*	*05/09/23 21:35*	*1*
2-Fluorophenol (Surr)	*42*		*10 - 120*	*05/09/23 08:16*	*05/09/23 21:35*	*1*
2-Fluorobiphenyl (Surr)	*78*		*44 - 120*	*05/09/23 08:16*	*05/09/23 21:35*	*1*
2,4,6-Tribromophenol (Surr)	*77*		*13 - 138*	*05/09/23 08:16*	*05/09/23 21:35*	*1*
p-Terphenyl-d14 (Surr)	*77*		*30 - 125*	*05/09/23 08:16*	*05/09/23 21:35*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol	ND		0.0047	0.0024	mg/L		05/09/23 08:16	05/10/23 18:51	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*32*		*10 - 120*	*05/09/23 08:16*	*05/10/23 18:51*	*1*
Nitrobenzene-d5 (Surr)	*86*		*31 - 120*	*05/09/23 08:16*	*05/10/23 18:51*	*1*
2-Fluorophenol (Surr)	*47*		*10 - 120*	*05/09/23 08:16*	*05/10/23 18:51*	*1*
2-Fluorobiphenyl (Surr)	*73*		*44 - 120*	*05/09/23 08:16*	*05/10/23 18:51*	*1*
2,4,6-Tribromophenol (Surr)	*88*		*13 - 138*	*05/09/23 08:16*	*05/10/23 18:51*	*1*
p-Terphenyl-d14 (Surr)	*80*		*30 - 125*	*05/09/23 08:16*	*05/10/23 18:51*	*1*

Client Sample ID: WC-TF5-514D
Date Collected: 05/07/23 11:25
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-2
Matrix: Water

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**480**	**J B**	490	67	ug/L		05/08/23 07:32	05/08/23 16:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*81*		*52 - 121*	*05/08/23 07:32*	*05/08/23 16:07*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:48	1
Barium	**0.044**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:48	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:48	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:48	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:48	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:48	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:48	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:32	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 14:30	1
Total Suspended Solids (SM 2540D-2015)	**37**		10	1.0	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**3.7**		1.0	0.35	mg/L			05/10/23 11:52	1
corrosivity by pH (SW846 9040C)	**7.8**	**HF**	0.1	0.1	SU			05/08/23 19:22	1

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

Client Sample Results

Client: Norfolk Southern Corporation
Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-3

Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 15:47	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 15:47	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 15:47	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 15:47	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 15:47	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 15:47	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 15:47	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 15:47	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 15:47	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 15:47	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 15:47	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 15:47	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 15:47	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 15:47	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 15:47	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 15:47	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 15:47	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 15:47	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 15:47	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 15:47	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 15:47	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 15:47	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 15:47	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 15:47	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 15:47	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 15:47	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 15:47	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 15:47	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 15:47	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 15:47	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 15:47	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 15:47	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 15:47	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 15:47	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 15:47	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 15:47	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 15:47	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 15:47	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 15:47	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 15:47	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 15:47	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 15:47	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 15:47	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 15:47	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 15:47	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 15:47	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 15:47	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 15:47	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 15:47	1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-3

Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 15:47	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 15:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*102*		*78 - 122*		*05/08/23 15:47*	*1*
Dibromofluoromethane (Surr)	*110*		*73 - 120*		*05/08/23 15:47*	*1*
4-Bromofluorobenzene (Surr)	*103*		*56 - 136*		*05/08/23 15:47*	*1*
1,2-Dichloroethane-d4 (Surr)	*115*		*62 - 137*		*05/08/23 15:47*	*1*

Client Sample Results

Client: Norfolk Southern Corporation
Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: WC-TF3-501F
Lab Sample ID: 240-184875-4

Date Collected: 05/07/23 09:21
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 16:35	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 16:35	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 16:35	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 16:35	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 16:35	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 16:35	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 16:35	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 16:35	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 16:35	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 16:35	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 16:35	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 16:35	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 16:35	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 16:35	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 16:35	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 16:35	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 16:35	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 16:35	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 16:35	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 16:35	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 16:35	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 16:35	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 16:35	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 16:35	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 16:35	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 16:35	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 16:35	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 16:35	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 16:35	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 16:35	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 16:35	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 16:35	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 16:35	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 16:35	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 16:35	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 16:35	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 16:35	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 16:35	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 16:35	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 16:35	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 16:35	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 16:35	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 16:35	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 16:35	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 16:35	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 16:35	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 16:35	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 16:35	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 16:35	1

Client Sample ID: WC-TF3-501F

Date Collected: 05/07/23 09:21
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-4
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 16:35	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 16:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*103*		*78 - 122*		*05/08/23 16:35*	*1*
Dibromofluoromethane (Surr)	*112*		*73 - 120*		*05/08/23 16:35*	*1*
4-Bromofluorobenzene (Surr)	*100*		*56 - 136*		*05/08/23 16:35*	*1*
1,2-Dichloroethane-d4 (Surr)	*111*		*62 - 137*		*05/08/23 16:35*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,4,6-Trichlorophenol	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,4,5-Trichlorophenol	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,4-Dichlorophenol	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,4-Dimethylphenol	ND		0.010	0.0031	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,4-Dinitrophenol	ND		0.031	0.014	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,4-Dinitrotoluene	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Chloronaphthalene	ND		0.0010	0.00041	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Chlorophenol	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Methylnaphthalene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Methylphenol	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Nitroaniline	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Nitrophenol	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
3,3'-Dichlorobenzidine	ND		0.010	0.0041	mg/L		05/09/23 08:16	05/09/23 21:54	1
3-Nitroaniline	ND		0.0051	0.0021	mg/L		05/09/23 08:16	05/09/23 21:54	1
4,6-Dinitro-2-methylphenol	ND		0.022	0.0082	mg/L		05/09/23 08:16	05/09/23 21:54	1
4-Bromophenyl phenyl ether	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
4-Chloro-3-methylphenol	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
4-Chloroaniline	ND		0.010	0.0041	mg/L		05/09/23 08:16	05/09/23 21:54	1
4-Chlorophenyl phenyl ether	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
4-Nitroaniline	ND		0.0031	0.00092	mg/L		05/09/23 08:16	05/09/23 21:54	1
Acenaphthene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Acenaphthylene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Acetophenone	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Anthracene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Atrazine	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Benzaldehyde	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Benzo[a]anthracene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Benzo[a]pyrene	ND		0.00051	0.00011	mg/L		05/09/23 08:16	05/09/23 21:54	1
Benzo[b]fluoranthene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Benzo[g,h,i]perylene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Benzo[k]fluoranthene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Bis(2-chloroethoxy)methane	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Bis(2-chloroethyl)ether	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Bis(2-ethylhexyl) phthalate	ND		0.0051	0.0021	mg/L		05/09/23 08:16	05/09/23 21:54	1
Butyl benzyl phthalate	ND		0.0051	0.0021	mg/L		05/09/23 08:16	05/09/23 21:54	1
Caprolactam	ND		0.0072	0.0031	mg/L		05/09/23 08:16	05/09/23 21:54	1
Carbazole	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Chrysene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-501F
Date Collected: 05/07/23 09:21
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-4
Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0051	0.0021	mg/L		05/09/23 08:16	05/09/23 21:54	1
Di-n-octyl phthalate	ND		0.011	0.0051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Dibenz(a,h)anthracene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Dibenzofuran	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Diethyl phthalate	ND		0.0051	0.0021	mg/L		05/09/23 08:16	05/09/23 21:54	1
Dimethyl phthalate	ND		0.0051	0.0021	mg/L		05/09/23 08:16	05/09/23 21:54	1
Fluoranthene	**0.00046**	**J**	0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Fluorene	ND		0.00051	0.00012	mg/L		05/09/23 08:16	05/09/23 21:54	1
Hexachlorobenzene	ND		0.00051	0.00011	mg/L		05/09/23 08:16	05/09/23 21:54	1
Hexachlorobutadiene	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Hexachlorocyclopentadiene	ND		0.011	0.0051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Hexachloroethane	ND		0.0051	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Indeno[1,2,3-cd]pyrene	ND		0.00051	0.00011	mg/L		05/09/23 08:16	05/09/23 21:54	1
Isophorone	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
N-Nitrosodi-n-propylamine	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
N-Nitrosodiphenylamine	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Naphthalene	ND		0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Nitrobenzene	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Pentachlorophenol	ND		0.0051	0.0010	mg/L		05/09/23 08:16	05/09/23 21:54	1
Phenanthrene	**0.00014**	**J**	0.00051	0.00011	mg/L		05/09/23 08:16	05/09/23 21:54	1
Phenol	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
Pyrene	**0.00042**	**J**	0.00051	0.00010	mg/L		05/09/23 08:16	05/09/23 21:54	1
bis (2-chloroisopropyl) ether	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
2,6-Dinitrotoluene	ND		0.0021	0.00051	mg/L		05/09/23 08:16	05/09/23 21:54	1
4-Nitrophenol	ND		0.031	0.010	mg/L		05/09/23 08:16	05/09/23 21:54	1
2-Butoxyethanol	ND	*+	0.0051	0.0026	mg/L		05/09/23 08:16	05/09/23 21:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*30*		*10 - 120*	*05/09/23 08:16*	*05/09/23 21:54*	*1*
Nitrobenzene-d5 (Surr)	*66*		*31 - 120*	*05/09/23 08:16*	*05/09/23 21:54*	*1*
2-Fluorophenol (Surr)	*42*		*10 - 120*	*05/09/23 08:16*	*05/09/23 21:54*	*1*
2-Fluorobiphenyl (Surr)	*70*		*44 - 120*	*05/09/23 08:16*	*05/09/23 21:54*	*1*
2,4,6-Tribromophenol (Surr)	*70*		*13 - 138*	*05/09/23 08:16*	*05/09/23 21:54*	*1*
p-Terphenyl-d14 (Surr)	*71*		*30 - 125*	*05/09/23 08:16*	*05/09/23 21:54*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**360**	**J B**	500	67	ug/L		05/08/23 07:32	05/08/23 16:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*78*		*52 - 121*	*05/08/23 07:32*	*05/08/23 16:35*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:52	1
Barium	**0.020**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:52	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:52	1
Chromium	**0.0012**	**J**	0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:52	1
Lead	**0.0050**	**J**	0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:52	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:52	1

Client Sample ID: WC-TF3-501F

Lab Sample ID: 240-184875-4

Date Collected: 05/07/23 09:21

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:52	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:34	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 15:13	1
Total Suspended Solids (SM 2540D-2015)	**86**		8.5	0.85	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**4.4**		1.0	0.35	mg/L			05/10/23 14:01	1
corrosivity by pH (SW846 9040C)	**7.7**	**HF**	0.1	0.1	SU			05/08/23 19:28	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-251478
Date Collected: 05/07/23 09:40
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-5
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 16:58	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 16:58	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 16:58	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 16:58	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 16:58	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 16:58	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 16:58	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 16:58	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 16:58	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 16:58	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 16:58	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 16:58	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 16:58	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 16:58	1
2-Butanone (MEK)	**0.017**		0.010	0.0012	mg/L			05/08/23 16:58	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 16:58	1
4-Methyl-2-pentanone (MIBK)	**0.0020**	**J**	0.010	0.00099	mg/L			05/08/23 16:58	1
Acetone	**0.17**		0.10	0.054	mg/L			05/09/23 17:35	10
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 16:58	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 16:58	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 16:58	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 16:58	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 16:58	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 16:58	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 16:58	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 16:58	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 16:58	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 16:58	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 16:58	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 16:58	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 16:58	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 16:58	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 16:58	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 16:58	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 16:58	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 16:58	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 16:58	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 16:58	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 16:58	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 16:58	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 16:58	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 16:58	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 16:58	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 16:58	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 16:58	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 16:58	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 16:58	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 16:58	1
Butyl acrylate	**0.24**		0.10	0.023	mg/L			05/09/23 17:35	10

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-251478

Date Collected: 05/07/23 09:40
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-5
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 16:58	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 16:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*105*		*78 - 122*		*05/08/23 16:58*	*1*
Toluene-d8 (Surr)	*96*		*78 - 122*		*05/09/23 17:35*	*10*
Dibromofluoromethane (Surr)	*104*		*73 - 120*		*05/08/23 16:58*	*1*
Dibromofluoromethane (Surr)	*99*		*73 - 120*		*05/09/23 17:35*	*10*
4-Bromofluorobenzene (Surr)	*109*		*56 - 136*		*05/08/23 16:58*	*1*
4-Bromofluorobenzene (Surr)	*97*		*56 - 136*		*05/09/23 17:35*	*10*
1,2-Dichloroethane-d4 (Surr)	*103*		*62 - 137*		*05/08/23 16:58*	*1*
1,2-Dichloroethane-d4 (Surr)	*98*		*62 - 137*		*05/09/23 17:35*	*10*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,4,6-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,4,5-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,4-Dichlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,4-Dimethylphenol	ND		0.010	0.0030	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,4-Dinitrotoluene	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
2-Chloronaphthalene	ND		0.0010	0.00040	mg/L		05/09/23 08:16	05/09/23 22:14	1
2-Chlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2-Methylnaphthalene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
2-Methylphenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2-Nitroaniline	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
2-Nitrophenol	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
3,3'-Dichlorobenzidine	ND		0.010	0.0040	mg/L		05/09/23 08:16	05/09/23 22:14	1
3-Nitroaniline	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 22:14	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0080	mg/L		05/09/23 08:16	05/09/23 22:14	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
4-Chloro-3-methylphenol	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
4-Chloroaniline	ND		0.010	0.0040	mg/L		05/09/23 08:16	05/09/23 22:14	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
4-Nitroaniline	ND		0.0030	0.00090	mg/L		05/09/23 08:16	05/09/23 22:14	1
Acenaphthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Acenaphthylene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Acetophenone	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Anthracene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Atrazine	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Benzaldehyde	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Benzo[a]anthracene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Benzo[a]pyrene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 22:14	1
Benzo[b]fluoranthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Benzo[g,h,i]perylene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Benzo[k]fluoranthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 22:14	1

Client Sample ID: WC-TF3-251478

Lab Sample ID: 240-184875-5

Date Collected: 05/07/23 09:40

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 22:14	1
Caprolactam	ND		0.0070	0.0030	mg/L		05/09/23 08:16	05/09/23 22:14	1
Carbazole	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Chrysene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Di-n-butyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 22:14	1
Di-n-octyl phthalate	ND		0.011	0.0050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Dibenz(a,h)anthracene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Dibenzofuran	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Diethyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 22:14	1
Dimethyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 22:14	1
Fluoranthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Fluorene	ND		0.00050	0.00012	mg/L		05/09/23 08:16	05/09/23 22:14	1
Hexachlorobenzene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 22:14	1
Hexachlorobutadiene	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Hexachlorocyclopentadiene	ND		0.011	0.0050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Hexachloroethane	ND		0.0050	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Indeno[1,2,3-cd]pyrene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 22:14	1
Isophorone	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
N-Nitrosodiphenylamine	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Naphthalene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Nitrobenzene	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Pentachlorophenol	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 22:14	1
Phenanthrene	**0.00014**	**J**	0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 22:14	1
Phenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
Pyrene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 22:14	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
2,6-Dinitrotoluene	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 22:14	1
4-Nitrophenol	ND		0.030	0.010	mg/L		05/09/23 08:16	05/09/23 22:14	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*30*		*10 - 120*	*05/09/23 08:16*	*05/09/23 22:14*	*1*
Nitrobenzene-d5 (Surr)	*80*		*31 - 120*	*05/09/23 08:16*	*05/09/23 22:14*	*1*
2-Fluorophenol (Surr)	*45*		*10 - 120*	*05/09/23 08:16*	*05/09/23 22:14*	*1*
2-Fluorobiphenyl (Surr)	*80*		*44 - 120*	*05/09/23 08:16*	*05/09/23 22:14*	*1*
2,4,6-Tribromophenol (Surr)	*69*		*13 - 138*	*05/09/23 08:16*	*05/09/23 22:14*	*1*
p-Terphenyl-d14 (Surr)	*92*		*30 - 125*	*05/09/23 08:16*	*05/09/23 22:14*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol	**0.57**	**B**	0.050	0.025	mg/L		05/09/23 08:16	05/10/23 19:11	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*29*		*10 - 120*	*05/09/23 08:16*	*05/10/23 19:11*	*10*
Nitrobenzene-d5 (Surr)	*79*		*31 - 120*	*05/09/23 08:16*	*05/10/23 19:11*	*10*
2-Fluorophenol (Surr)	*42*		*10 - 120*	*05/09/23 08:16*	*05/10/23 19:11*	*10*
2-Fluorobiphenyl (Surr)	*65*		*44 - 120*	*05/09/23 08:16*	*05/10/23 19:11*	*10*
2,4,6-Tribromophenol (Surr)	*62*		*13 - 138*	*05/09/23 08:16*	*05/10/23 19:11*	*10*
p-Terphenyl-d14 (Surr)	*82*		*30 - 125*	*05/09/23 08:16*	*05/10/23 19:11*	*10*

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

Client Sample ID: WC-TF3-251478

Lab Sample ID: 240-184875-5

Date Collected: 05/07/23 09:40
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**4700**	**B**	500	67	ug/L		05/08/23 07:32	05/08/23 17:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*54*		*52 - 121*	*05/08/23 07:32*	*05/08/23 17:03*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:57	1
Barium	**0.057**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:57	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:57	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:57	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:57	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:57	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:57	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:40	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 15:56	1
Total Suspended Solids (SM 2540D-2015)	**30**		7.5	0.75	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**74**		5.0	1.7	mg/L			05/10/23 14:14	5
corrosivity by pH (SW846 9040C)	**7.6**	**HF**	0.1	0.1	SU			05/08/23 19:35	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-AL4944

Date Collected: 05/07/23 11:17
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-7

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 17:22	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 17:22	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 17:22	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 17:22	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 17:22	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 17:22	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 17:22	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 17:22	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 17:22	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 17:22	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 17:22	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 17:22	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 17:22	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 17:22	1
2-Butanone (MEK)	**0.0035**	**J**	0.010	0.0012	mg/L			05/08/23 17:22	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 17:22	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 17:22	1
Acetone	**0.084**		0.010	0.0054	mg/L			05/08/23 17:22	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 17:22	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 17:22	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 17:22	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 17:22	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 17:22	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 17:22	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 17:22	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 17:22	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 17:22	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 17:22	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 17:22	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 17:22	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 17:22	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 17:22	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 17:22	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 17:22	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 17:22	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 17:22	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 17:22	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 17:22	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 17:22	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 17:22	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 17:22	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 17:22	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 17:22	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 17:22	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 17:22	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 17:22	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 17:22	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 17:22	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 17:22	1

Client Sample ID: WC-TF3-AL4944

Lab Sample ID: 240-184875-7

Date Collected: 05/07/23 11:17

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 17:22	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 17:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*102*		*78 - 122*		*05/08/23 17:22*	*1*
Dibromofluoromethane (Surr)	*107*		*73 - 120*		*05/08/23 17:22*	*1*
4-Bromofluorobenzene (Surr)	*101*		*56 - 136*		*05/08/23 17:22*	*1*
1,2-Dichloroethane-d4 (Surr)	*105*		*62 - 137*		*05/08/23 17:22*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,4,6-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,4,5-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,4-Dichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,4-Dimethylphenol	ND		0.010	0.0030	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,4-Dinitrotoluene	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Chloronaphthalene	ND		0.0010	0.00040	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Chlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Methylnaphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Methylphenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Nitroaniline	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Nitrophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
3,3'-Dichlorobenzidine	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 18:18	1
3-Nitroaniline	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 18:18	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0081	mg/L		05/11/23 08:29	05/11/23 18:18	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
4-Chloro-3-methylphenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
4-Chloroaniline	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 18:18	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
4-Nitroaniline	ND		0.0030	0.00091	mg/L		05/11/23 08:29	05/11/23 18:18	1
Acenaphthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Acenaphthylene	**0.00015**	**J**	0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Acetophenone	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Anthracene	**0.00012**	**J**	0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Atrazine	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Benzaldehyde	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Benzo[a]anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Benzo[a]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 18:18	1
Benzo[b]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Benzo[g,h,i]perylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Benzo[k]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 18:18	1
Butyl benzyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 18:18	1
Caprolactam	ND		0.0071	0.0030	mg/L		05/11/23 08:29	05/11/23 18:18	1
Carbazole	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Chrysene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1

Client Sample ID: WC-TF3-AL4944

Date Collected: 05/07/23 11:17
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-7

Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 18:18	1
Di-n-octyl phthalate	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Dibenz(a,h)anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Dibenzofuran	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Diethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 18:18	1
Dimethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 18:18	1
Fluoranthene	**0.00011**	**J**	0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Fluorene	**0.00024**	**J**	0.00050	0.00012	mg/L		05/11/23 08:29	05/11/23 18:18	1
Hexachlorobenzene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 18:18	1
Hexachlorobutadiene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Hexachlorocyclopentadiene	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Hexachloroethane	ND		0.0050	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Indeno[1,2,3-cd]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 18:18	1
Isophorone	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
N-Nitrosodiphenylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Naphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Nitrobenzene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Pentachlorophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 18:18	1
Phenanthrene	**0.00017**	**J**	0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 18:18	1
Phenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
Pyrene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 18:18	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
2,6-Dinitrotoluene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 18:18	1
4-Nitrophenol	ND		0.030	0.010	mg/L		05/11/23 08:29	05/11/23 18:18	1
2-Butoxyethanol	**0.020**		0.0050	0.0025	mg/L		05/11/23 08:29	05/11/23 18:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*26*		*10 - 120*	*05/11/23 08:29*	*05/11/23 18:18*	*1*
Nitrobenzene-d5 (Surr)	*67*		*31 - 120*	*05/11/23 08:29*	*05/11/23 18:18*	*1*
2-Fluorophenol (Surr)	*38*		*10 - 120*	*05/11/23 08:29*	*05/11/23 18:18*	*1*
2-Fluorobiphenyl (Surr)	*60*		*44 - 120*	*05/11/23 08:29*	*05/11/23 18:18*	*1*
2,4,6-Tribromophenol (Surr)	*54*		*13 - 138*	*05/11/23 08:29*	*05/11/23 18:18*	*1*
p-Terphenyl-d14 (Surr)	*70*		*30 - 125*	*05/11/23 08:29*	*05/11/23 18:18*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**1100**	**B**	490	67	ug/L		05/08/23 07:32	05/09/23 13:01	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*55*		*52 - 121*	*05/08/23 07:32*	*05/09/23 13:01*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:09	1
Barium	**0.051**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:09	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:09	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:09	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:09	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:09	1

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-AL4944
Date Collected: 05/07/23 11:17
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-7
Matrix: Water

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:09	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:42	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 16:40	1
Total Suspended Solids (SM 2540D-2015)	**10**		4.0	0.40	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**13**		1.0	0.35	mg/L			05/10/23 14:27	1
corrosivity by pH (SW846 9040C)	**7.4**	**HF**	0.1	0.1	SU			05/08/23 19:40	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: FB-2-05072023

Date Collected: 05/07/23 11:40
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-8

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 17:46	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 17:46	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 17:46	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 17:46	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 17:46	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 17:46	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 17:46	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 17:46	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 17:46	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 17:46	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 17:46	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 17:46	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 17:46	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 17:46	1
2-Butanone (MEK)	**0.0030**	**J**	0.010	0.0012	mg/L			05/08/23 17:46	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 17:46	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 17:46	1
Acetone	**0.0064**	**J**	0.010	0.0054	mg/L			05/08/23 17:46	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 17:46	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 17:46	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 17:46	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 17:46	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 17:46	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 17:46	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 17:46	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 17:46	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 17:46	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 17:46	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 17:46	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 17:46	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 17:46	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 17:46	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 17:46	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 17:46	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 17:46	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 17:46	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 17:46	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 17:46	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 17:46	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 17:46	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 17:46	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 17:46	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 17:46	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 17:46	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 17:46	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 17:46	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 17:46	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 17:46	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 17:46	1

Client Sample ID: FB-2-05072023 | Lab Sample ID: 240-184875-8

Date Collected: 05/07/23 11:40 | **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 17:46	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 17:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*100*		*78 - 122*		*05/08/23 17:46*	*1*
Dibromofluoromethane (Surr)	*107*		*73 - 120*		*05/08/23 17:46*	*1*
4-Bromofluorobenzene (Surr)	*97*		*56 - 136*		*05/08/23 17:46*	*1*
1,2-Dichloroethane-d4 (Surr)	*107*		*62 - 137*		*05/08/23 17:46*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,4,6-Trichlorophenol	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,4,5-Trichlorophenol	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,4-Dichlorophenol	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,4-Dimethylphenol	ND		0.0082	0.0025	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,4-Dinitrophenol	ND		0.025	0.011	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,4-Dinitrotoluene	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Chloronaphthalene	ND		0.00082	0.00033	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Chlorophenol	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Methylnaphthalene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Methylphenol	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Nitroaniline	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Nitrophenol	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
3,3'-Dichlorobenzidine	ND		0.0082	0.0033	mg/L		05/11/23 08:29	05/11/23 18:38	1
3-Nitroaniline	ND		0.0041	0.0016	mg/L		05/11/23 08:29	05/11/23 18:38	1
4,6-Dinitro-2-methylphenol	ND		0.017	0.0066	mg/L		05/11/23 08:29	05/11/23 18:38	1
4-Bromophenyl phenyl ether	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
4-Chloro-3-methylphenol	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
4-Chloroaniline	ND		0.0082	0.0033	mg/L		05/11/23 08:29	05/11/23 18:38	1
4-Chlorophenyl phenyl ether	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
4-Nitroaniline	ND		0.0025	0.00074	mg/L		05/11/23 08:29	05/11/23 18:38	1
Acenaphthene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Acenaphthylene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Acetophenone	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Anthracene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Atrazine	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Benzaldehyde	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Benzo[a]anthracene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Benzo[a]pyrene	ND		0.00041	0.000090	mg/L		05/11/23 08:29	05/11/23 18:38	1
Benzo[b]fluoranthene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Benzo[g,h,i]perylene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Benzo[k]fluoranthene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Bis(2-chloroethoxy)methane	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Bis(2-chloroethyl)ether	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Bis(2-ethylhexyl) phthalate	ND		0.0041	0.0016	mg/L		05/11/23 08:29	05/11/23 18:38	1
Butyl benzyl phthalate	ND		0.0041	0.0016	mg/L		05/11/23 08:29	05/11/23 18:38	1
Caprolactam	ND		0.0057	0.0025	mg/L		05/11/23 08:29	05/11/23 18:38	1
Carbazole	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Chrysene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1

Client Sample ID: FB-2-05072023
Lab Sample ID: 240-184875-8

Date Collected: 05/07/23 11:40
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0041	0.0016	mg/L		05/11/23 08:29	05/11/23 18:38	1
Di-n-octyl phthalate	ND		0.0090	0.0041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Dibenz(a,h)anthracene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Dibenzofuran	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Diethyl phthalate	ND		0.0041	0.0016	mg/L		05/11/23 08:29	05/11/23 18:38	1
Dimethyl phthalate	ND		0.0041	0.0016	mg/L		05/11/23 08:29	05/11/23 18:38	1
Fluoranthene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Fluorene	ND		0.00041	0.000098	mg/L		05/11/23 08:29	05/11/23 18:38	1
Hexachlorobenzene	ND		0.00041	0.000090	mg/L		05/11/23 08:29	05/11/23 18:38	1
Hexachlorobutadiene	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Hexachlorocyclopentadiene	ND		0.0090	0.0041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Hexachloroethane	ND		0.0041	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Indeno[1,2,3-cd]pyrene	ND		0.00041	0.000090	mg/L		05/11/23 08:29	05/11/23 18:38	1
Isophorone	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
N-Nitrosodi-n-propylamine	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
N-Nitrosodiphenylamine	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Naphthalene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Nitrobenzene	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Pentachlorophenol	ND		0.0041	0.00082	mg/L		05/11/23 08:29	05/11/23 18:38	1
Phenanthrene	ND		0.00041	0.000090	mg/L		05/11/23 08:29	05/11/23 18:38	1
Phenol	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
Pyrene	ND		0.00041	0.000082	mg/L		05/11/23 08:29	05/11/23 18:38	1
bis (2-chloroisopropyl) ether	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
2,6-Dinitrotoluene	ND		0.0016	0.00041	mg/L		05/11/23 08:29	05/11/23 18:38	1
4-Nitrophenol	ND		0.025	0.0082	mg/L		05/11/23 08:29	05/11/23 18:38	1
2-Butoxyethanol	ND		0.0041	0.0020	mg/L		05/11/23 08:29	05/11/23 18:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*27*		*10 - 120*	*05/11/23 08:29*	*05/11/23 18:38*	*1*
Nitrobenzene-d5 (Surr)	*75*		*31 - 120*	*05/11/23 08:29*	*05/11/23 18:38*	*1*
2-Fluorophenol (Surr)	*44*		*10 - 120*	*05/11/23 08:29*	*05/11/23 18:38*	*1*
2-Fluorobiphenyl (Surr)	*67*		*44 - 120*	*05/11/23 08:29*	*05/11/23 18:38*	*1*
2,4,6-Tribromophenol (Surr)	*86*		*13 - 138*	*05/11/23 08:29*	*05/11/23 18:38*	*1*
p-Terphenyl-d14 (Surr)	*70*		*30 - 125*	*05/11/23 08:29*	*05/11/23 18:38*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	ND		500	68	ug/L		05/08/23 07:32	05/08/23 13:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*87*		*52 - 121*	*05/08/23 07:32*	*05/08/23 13:22*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:14	1
Barium	ND		0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:14	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:14	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:14	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:14	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:14	1

Client Sample ID: FB-2-05072023
Date Collected: 05/07/23 11:40
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-8
Matrix: Water

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:14	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:44	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 17:23	1
Total Suspended Solids (SM 2540D-2015)	ND		4.0	0.40	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	ND		1.0	0.35	mg/L			05/10/23 14:40	1
corrosivity by pH (SW846 9040C)	**6.2**	**HF**	0.1	0.1	SU			05/09/23 10:24	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: TRIP BLANK

Date Collected: 05/07/23 00:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-9

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 18:10	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 18:10	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 18:10	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 18:10	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 18:10	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 18:10	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 18:10	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 18:10	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 18:10	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 18:10	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 18:10	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 18:10	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 18:10	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 18:10	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 18:10	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 18:10	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 18:10	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 18:10	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 18:10	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 18:10	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 18:10	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 18:10	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 18:10	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 18:10	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 18:10	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 18:10	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 18:10	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 18:10	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 18:10	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 18:10	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 18:10	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 18:10	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 18:10	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 18:10	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 18:10	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 18:10	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 18:10	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 18:10	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 18:10	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 18:10	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 18:10	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 18:10	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 18:10	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 18:10	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 18:10	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 18:10	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 18:10	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 18:10	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 18:10	1

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-9
Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 18:10	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 18:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*78 - 122*		*05/08/23 18:10*	*1*
Dibromofluoromethane (Surr)	*110*		*73 - 120*		*05/08/23 18:10*	*1*
4-Bromofluorobenzene (Surr)	*98*		*56 - 136*		*05/08/23 18:10*	*1*
1,2-Dichloroethane-d4 (Surr)	*109*		*62 - 137*		*05/08/23 18:10*	*1*

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-257761

Lab Sample ID: 240-184875-10

Date Collected: 05/07/23 08:35

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 18:34	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 18:34	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 18:34	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 18:34	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 18:34	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 18:34	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 18:34	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 18:34	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 18:34	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 18:34	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 18:34	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 18:34	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 18:34	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 18:34	1
2-Butanone (MEK)	**0.0031**	**J**	0.010	0.0012	mg/L			05/08/23 18:34	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 18:34	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 18:34	1
Acetone	**0.034**		0.010	0.0054	mg/L			05/08/23 18:34	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 18:34	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 18:34	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 18:34	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 18:34	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 18:34	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 18:34	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 18:34	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 18:34	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 18:34	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 18:34	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 18:34	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 18:34	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 18:34	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 18:34	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 18:34	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 18:34	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 18:34	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 18:34	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 18:34	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 18:34	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 18:34	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 18:34	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 18:34	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 18:34	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 18:34	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 18:34	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 18:34	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 18:34	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 18:34	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 18:34	1
Butyl acrylate	**0.016**		0.010	0.0023	mg/L			05/08/23 18:34	1

Client Sample ID: WC-TF3-257761
Lab Sample ID: 240-184875-10
Date Collected: 05/07/23 08:35
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 18:34	1
2-Ethylhexyl acrylate	**0.0071**	**J**	0.010	0.0033	mg/L			05/08/23 18:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*78 - 122*		*05/08/23 18:34*	*1*
Dibromofluoromethane (Surr)	*109*		*73 - 120*		*05/08/23 18:34*	*1*
4-Bromofluorobenzene (Surr)	*103*		*56 - 136*		*05/08/23 18:34*	*1*
1,2-Dichloroethane-d4 (Surr)	*108*		*62 - 137*		*05/08/23 18:34*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,4,6-Trichlorophenol	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,4,5-Trichlorophenol	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,4-Dichlorophenol	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,4-Dimethylphenol	ND		0.011	0.0032	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,4-Dinitrophenol	ND		0.032	0.015	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,4-Dinitrotoluene	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Chloronaphthalene	ND		0.0011	0.00043	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Chlorophenol	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Methylnaphthalene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Methylphenol	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Nitroaniline	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Nitrophenol	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
3,3'-Dichlorobenzidine	ND		0.011	0.0043	mg/L		05/11/23 08:29	05/11/23 18:58	1
3-Nitroaniline	ND		0.0054	0.0022	mg/L		05/11/23 08:29	05/11/23 18:58	1
4,6-Dinitro-2-methylphenol	ND		0.023	0.0087	mg/L		05/11/23 08:29	05/11/23 18:58	1
4-Bromophenyl phenyl ether	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
4-Chloro-3-methylphenol	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
4-Chloroaniline	ND		0.011	0.0043	mg/L		05/11/23 08:29	05/11/23 18:58	1
4-Chlorophenyl phenyl ether	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
4-Nitroaniline	ND		0.0032	0.00097	mg/L		05/11/23 08:29	05/11/23 18:58	1
Acenaphthene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Acenaphthylene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Acetophenone	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Anthracene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Atrazine	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Benzaldehyde	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Benzo[a]anthracene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Benzo[a]pyrene	ND		0.00054	0.00012	mg/L		05/11/23 08:29	05/11/23 18:58	1
Benzo[b]fluoranthene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Benzo[g,h,i]perylene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Benzo[k]fluoranthene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Bis(2-chloroethoxy)methane	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Bis(2-chloroethyl)ether	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Bis(2-ethylhexyl) phthalate	ND		0.0054	0.0022	mg/L		05/11/23 08:29	05/11/23 18:58	1
Butyl benzyl phthalate	ND		0.0054	0.0022	mg/L		05/11/23 08:29	05/11/23 18:58	1
Caprolactam	ND		0.0076	0.0032	mg/L		05/11/23 08:29	05/11/23 18:58	1
Carbazole	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Chrysene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1

Client Sample ID: WC-TF3-257761
Lab Sample ID: 240-184875-10

Date Collected: 05/07/23 08:35
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0054	0.0022	mg/L		05/11/23 08:29	05/11/23 18:58	1
Di-n-octyl phthalate	ND		0.012	0.0054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Dibenz(a,h)anthracene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Dibenzofuran	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Diethyl phthalate	ND		0.0054	0.0022	mg/L		05/11/23 08:29	05/11/23 18:58	1
Dimethyl phthalate	ND		0.0054	0.0022	mg/L		05/11/23 08:29	05/11/23 18:58	1
Fluoranthene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Fluorene	ND		0.00054	0.00013	mg/L		05/11/23 08:29	05/11/23 18:58	1
Hexachlorobenzene	ND		0.00054	0.00012	mg/L		05/11/23 08:29	05/11/23 18:58	1
Hexachlorobutadiene	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Hexachlorocyclopentadiene	ND		0.012	0.0054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Hexachloroethane	ND		0.0054	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Indeno[1,2,3-cd]pyrene	ND		0.00054	0.00012	mg/L		05/11/23 08:29	05/11/23 18:58	1
Isophorone	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
N-Nitrosodi-n-propylamine	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
N-Nitrosodiphenylamine	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Naphthalene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Nitrobenzene	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Pentachlorophenol	ND		0.0054	0.0011	mg/L		05/11/23 08:29	05/11/23 18:58	1
Phenanthrene	ND		0.00054	0.00012	mg/L		05/11/23 08:29	05/11/23 18:58	1
Phenol	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
Pyrene	ND		0.00054	0.00011	mg/L		05/11/23 08:29	05/11/23 18:58	1
bis (2-chloroisopropyl) ether	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
2,6-Dinitrotoluene	ND		0.0022	0.00054	mg/L		05/11/23 08:29	05/11/23 18:58	1
4-Nitrophenol	ND		0.032	0.011	mg/L		05/11/23 08:29	05/11/23 18:58	1
2-Butoxyethanol	**0.016**		0.0054	0.0027	mg/L		05/11/23 08:29	05/11/23 18:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*29*		*10 - 120*	*05/11/23 08:29*	*05/11/23 18:58*	*1*
Nitrobenzene-d5 (Surr)	*71*		*31 - 120*	*05/11/23 08:29*	*05/11/23 18:58*	*1*
2-Fluorophenol (Surr)	*41*		*10 - 120*	*05/11/23 08:29*	*05/11/23 18:58*	*1*
2-Fluorobiphenyl (Surr)	*72*		*44 - 120*	*05/11/23 08:29*	*05/11/23 18:58*	*1*
2,4,6-Tribromophenol (Surr)	*71*		*13 - 138*	*05/11/23 08:29*	*05/11/23 18:58*	*1*
p-Terphenyl-d14 (Surr)	*77*		*30 - 125*	*05/11/23 08:29*	*05/11/23 18:58*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**6100**	**B**	490	67	ug/L		05/08/23 07:32	05/08/23 13:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*86*		*52 - 121*	*05/08/23 07:32*	*05/08/23 13:49*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:18	1
Barium	**0.039**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:18	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:18	1
Chromium	**0.0019**	**J**	0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:18	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:18	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:18	1

Client Sample ID: WC-TF3-257761
Lab Sample ID: 240-184875-10
Date Collected: 05/07/23 08:35
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:18	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:46	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 18:06	1
Total Suspended Solids (SM 2540D-2015)	**20**		4.0	0.40	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**8.1**		1.0	0.35	mg/L			05/10/23 14:53	1
corrosivity by pH (SW846 9040C)	**7.3**	**HF**	0.1	0.1	SU			05/08/23 20:10	1

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: DUP-1
Date Collected: 05/07/23 00:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-11
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 18:57	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 18:57	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 18:57	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 18:57	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 18:57	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 18:57	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 18:57	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 18:57	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 18:57	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 18:57	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 18:57	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 18:57	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 18:57	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 18:57	1
2-Butanone (MEK)	**0.0033**	**J**	0.010	0.0012	mg/L			05/08/23 18:57	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 18:57	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 18:57	1
Acetone	**0.034**		0.010	0.0054	mg/L			05/08/23 18:57	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 18:57	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 18:57	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 18:57	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 18:57	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 18:57	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 18:57	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 18:57	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 18:57	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 18:57	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 18:57	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 18:57	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 18:57	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 18:57	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 18:57	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 18:57	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 18:57	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 18:57	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 18:57	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 18:57	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 18:57	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 18:57	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 18:57	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 18:57	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 18:57	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 18:57	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 18:57	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 18:57	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 18:57	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 18:57	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 18:57	1
Butyl acrylate	**0.014**		0.010	0.0023	mg/L			05/08/23 18:57	1

Client Sample ID: DUP-1
Date Collected: 05/07/23 00:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-11
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 18:57	1
2-Ethylhexyl acrylate	**0.0067**	**J**	0.010	0.0033	mg/L			05/08/23 18:57	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*78 - 122*		*05/08/23 18:57*	*1*
Dibromofluoromethane (Surr)	*110*		*73 - 120*		*05/08/23 18:57*	*1*
4-Bromofluorobenzene (Surr)	*103*		*56 - 136*		*05/08/23 18:57*	*1*
1,2-Dichloroethane-d4 (Surr)	*110*		*62 - 137*		*05/08/23 18:57*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,4,6-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,4,5-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,4-Dichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,4-Dimethylphenol	ND		0.010	0.0030	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,4-Dinitrotoluene	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Chloronaphthalene	ND		0.0010	0.00040	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Chlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Methylnaphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Methylphenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Nitroaniline	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Nitrophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
3,3'-Dichlorobenzidine	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 19:18	1
3-Nitroaniline	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 19:18	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0081	mg/L		05/11/23 08:29	05/11/23 19:18	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
4-Chloro-3-methylphenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
4-Chloroaniline	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 19:18	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
4-Nitroaniline	ND		0.0030	0.00091	mg/L		05/11/23 08:29	05/11/23 19:18	1
Acenaphthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Acenaphthylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Acetophenone	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Atrazine	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Benzaldehyde	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Benzo[a]anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Benzo[a]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 19:18	1
Benzo[b]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Benzo[g,h,i]perylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Benzo[k]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 19:18	1
Butyl benzyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 19:18	1
Caprolactam	ND		0.0071	0.0030	mg/L		05/11/23 08:29	05/11/23 19:18	1
Carbazole	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Chrysene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1

Client Sample ID: DUP-1
Date Collected: 05/07/23 00:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-11
Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 19:18	1
Di-n-octyl phthalate	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Dibenz(a,h)anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Dibenzofuran	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Diethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 19:18	1
Dimethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 19:18	1
Fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Fluorene	ND		0.00050	0.00012	mg/L		05/11/23 08:29	05/11/23 19:18	1
Hexachlorobenzene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 19:18	1
Hexachlorobutadiene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Hexachlorocyclopentadiene	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Hexachloroethane	ND		0.0050	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Indeno[1,2,3-cd]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 19:18	1
Isophorone	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
N-Nitrosodiphenylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Naphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Nitrobenzene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Pentachlorophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 19:18	1
Phenanthrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 19:18	1
Phenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
Pyrene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 19:18	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
2,6-Dinitrotoluene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 19:18	1
4-Nitrophenol	ND		0.030	0.010	mg/L		05/11/23 08:29	05/11/23 19:18	1
2-Butoxyethanol	**0.015**		0.0050	0.0025	mg/L		05/11/23 08:29	05/11/23 19:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*26*		*10 - 120*	*05/11/23 08:29*	*05/11/23 19:18*	*1*
Nitrobenzene-d5 (Surr)	*72*		*31 - 120*	*05/11/23 08:29*	*05/11/23 19:18*	*1*
2-Fluorophenol (Surr)	*39*		*10 - 120*	*05/11/23 08:29*	*05/11/23 19:18*	*1*
2-Fluorobiphenyl (Surr)	*70*		*44 - 120*	*05/11/23 08:29*	*05/11/23 19:18*	*1*
2,4,6-Tribromophenol (Surr)	*68*		*13 - 138*	*05/11/23 08:29*	*05/11/23 19:18*	*1*
p-Terphenyl-d14 (Surr)	*76*		*30 - 125*	*05/11/23 08:29*	*05/11/23 19:18*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**6800**	**B**	490	67	ug/L		05/08/23 07:32	05/08/23 14:17	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*72*		*52 - 121*	*05/08/23 07:32*	*05/08/23 14:17*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:23	1
Barium	**0.042**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:23	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:23	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:23	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:23	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:23	1

Client Sample ID: DUP-1

Lab Sample ID: 240-184875-11

Date Collected: 05/07/23 00:00

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:23	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:48	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 18:50	1
Total Suspended Solids (SM 2540D-2015)	**87**		4.0	0.40	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**7.8**		1.0	0.35	mg/L			05/10/23 15:06	1
corrosivity by pH (SW846 9040C)	**7.3**	**HF**	0.1	0.1	SU			05/08/23 20:16	1

Client Sample ID: TRIP BLANK
Date Collected: 05/07/23 00:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-12
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 19:45	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 19:45	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 19:45	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 19:45	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 19:45	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 19:45	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 19:45	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 19:45	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 19:45	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 19:45	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 19:45	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 19:45	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 19:45	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 19:45	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 19:45	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 19:45	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 19:45	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 19:45	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 19:45	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 19:45	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 19:45	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 19:45	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 19:45	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 19:45	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 19:45	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 19:45	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 19:45	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 19:45	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 19:45	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 19:45	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 19:45	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 19:45	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 19:45	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 19:45	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 19:45	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 19:45	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 19:45	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 19:45	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 19:45	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 19:45	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 19:45	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 19:45	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 19:45	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 19:45	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 19:45	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 19:45	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 19:45	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 19:45	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 19:45	1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-12

Date Collected: 05/07/23 00:00

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 19:45	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 19:45	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*99*		*78 - 122*		*05/08/23 19:45*	*1*
Dibromofluoromethane (Surr)	*109*		*73 - 120*		*05/08/23 19:45*	*1*
4-Bromofluorobenzene (Surr)	*96*		*56 - 136*		*05/08/23 19:45*	*1*
1,2-Dichloroethane-d4 (Surr)	*109*		*62 - 137*		*05/08/23 19:45*	*1*

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

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

Client Sample ID: FB-1-05062023

Date Collected: 05/06/23 16:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-13
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 19:21	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 19:21	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 19:21	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 19:21	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 19:21	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 19:21	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 19:21	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 19:21	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 19:21	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 19:21	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 19:21	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 19:21	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 19:21	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 19:21	1
2-Butanone (MEK)	**0.0027**	**J**	0.010	0.0012	mg/L			05/08/23 19:21	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 19:21	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 19:21	1
Acetone	**0.0054**	**J**	0.010	0.0054	mg/L			05/08/23 19:21	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 19:21	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 19:21	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 19:21	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 19:21	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 19:21	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 19:21	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 19:21	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 19:21	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 19:21	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 19:21	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 19:21	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 19:21	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 19:21	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 19:21	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 19:21	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 19:21	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 19:21	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 19:21	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 19:21	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 19:21	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 19:21	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 19:21	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 19:21	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 19:21	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 19:21	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 19:21	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 19:21	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 19:21	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 19:21	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 19:21	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 19:21	1

Client Sample ID: FB-1-05062023 Lab Sample ID: 240-184875-13

Date Collected: 05/06/23 16:00 **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 19:21	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 19:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*99*		*78 - 122*		*05/08/23 19:21*	*1*
Dibromofluoromethane (Surr)	*108*		*73 - 120*		*05/08/23 19:21*	*1*
4-Bromofluorobenzene (Surr)	*96*		*56 - 136*		*05/08/23 19:21*	*1*
1,2-Dichloroethane-d4 (Surr)	*109*		*62 - 137*		*05/08/23 19:21*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,4,6-Trichlorophenol	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,4,5-Trichlorophenol	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,4-Dichlorophenol	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,4-Dimethylphenol	ND		0.011	0.0032	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,4-Dinitrophenol	ND		0.032	0.015	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,4-Dinitrotoluene	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Chloronaphthalene	ND		0.0011	0.00042	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Chlorophenol	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Methylnaphthalene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Methylphenol	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Nitroaniline	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Nitrophenol	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
3,3'-Dichlorobenzidine	ND		0.011	0.0042	mg/L		05/09/23 08:16	05/09/23 23:50	1
3-Nitroaniline	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/09/23 23:50	1
4,6-Dinitro-2-methylphenol	ND		0.022	0.0084	mg/L		05/09/23 08:16	05/09/23 23:50	1
4-Bromophenyl phenyl ether	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
4-Chloro-3-methylphenol	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
4-Chloroaniline	ND		0.011	0.0042	mg/L		05/09/23 08:16	05/09/23 23:50	1
4-Chlorophenyl phenyl ether	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
4-Nitroaniline	ND		0.0032	0.00095	mg/L		05/09/23 08:16	05/09/23 23:50	1
Acenaphthene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Acenaphthylene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Acetophenone	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Anthracene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Atrazine	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Benzaldehyde	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Benzo[a]anthracene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Benzo[a]pyrene	ND		0.00053	0.00012	mg/L		05/09/23 08:16	05/09/23 23:50	1
Benzo[b]fluoranthene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Benzo[g,h,i]perylene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Benzo[k]fluoranthene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Bis(2-chloroethoxy)methane	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Bis(2-chloroethyl)ether	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Bis(2-ethylhexyl) phthalate	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/09/23 23:50	1
Butyl benzyl phthalate	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/09/23 23:50	1
Caprolactam	ND		0.0074	0.0032	mg/L		05/09/23 08:16	05/09/23 23:50	1
Carbazole	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Chrysene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1

Client: Norfolk Southern Corporation　　Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: FB-1-05062023　　**Lab Sample ID: 240-184875-13**
Date Collected: 05/06/23 16:00　　**Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/09/23 23:50	1
Di-n-octyl phthalate	ND		0.012	0.0053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Dibenz(a,h)anthracene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Dibenzofuran	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Diethyl phthalate	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/09/23 23:50	1
Dimethyl phthalate	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/09/23 23:50	1
Fluoranthene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Fluorene	ND		0.00053	0.00013	mg/L		05/09/23 08:16	05/09/23 23:50	1
Hexachlorobenzene	ND		0.00053	0.00012	mg/L		05/09/23 08:16	05/09/23 23:50	1
Hexachlorobutadiene	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Hexachlorocyclopentadiene	ND		0.012	0.0053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Hexachloroethane	ND		0.0053	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Indeno[1,2,3-cd]pyrene	ND		0.00053	0.00012	mg/L		05/09/23 08:16	05/09/23 23:50	1
Isophorone	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
N-Nitrosodi-n-propylamine	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
N-Nitrosodiphenylamine	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Naphthalene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Nitrobenzene	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Pentachlorophenol	ND		0.0053	0.0011	mg/L		05/09/23 08:16	05/09/23 23:50	1
Phenanthrene	ND		0.00053	0.00012	mg/L		05/09/23 08:16	05/09/23 23:50	1
Phenol	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
Pyrene	ND		0.00053	0.00011	mg/L		05/09/23 08:16	05/09/23 23:50	1
bis (2-chloroisopropyl) ether	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
2,6-Dinitrotoluene	ND		0.0021	0.00053	mg/L		05/09/23 08:16	05/09/23 23:50	1
4-Nitrophenol	ND		0.032	0.011	mg/L		05/09/23 08:16	05/09/23 23:50	1
2-Butoxyethanol	ND	*+	0.0053	0.0026	mg/L		05/09/23 08:16	05/09/23 23:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*27*		*10 - 120*	*05/09/23 08:16*	*05/09/23 23:50*	*1*
Nitrobenzene-d5 (Surr)	*59*		*31 - 120*	*05/09/23 08:16*	*05/09/23 23:50*	*1*
2-Fluorophenol (Surr)	*37*		*10 - 120*	*05/09/23 08:16*	*05/09/23 23:50*	*1*
2-Fluorobiphenyl (Surr)	*68*		*44 - 120*	*05/09/23 08:16*	*05/09/23 23:50*	*1*
2,4,6-Tribromophenol (Surr)	*61*		*13 - 138*	*05/09/23 08:16*	*05/09/23 23:50*	*1*
p-Terphenyl-d14 (Surr)	*84*		*30 - 125*	*05/09/23 08:16*	*05/09/23 23:50*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	ND		500	67	ug/L		05/08/23 07:32	05/08/23 14:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*89*		*52 - 121*	*05/08/23 07:32*	*05/08/23 14:44*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:27	1
Barium	ND		0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:27	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:27	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:27	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:27	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:27	1

Client Sample ID: FB-1-05062023
Date Collected: 05/06/23 16:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-13
Matrix: Water

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:27	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:50	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 19:33	1
Total Suspended Solids (SM 2540D-2015)	ND		4.0	0.40	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	ND		1.0	0.35	mg/L			05/10/23 15:18	1
corrosivity by pH (SW846 9040C)	**5.9**	**HF**	0.1	0.1	SU			05/09/23 10:24	1

Client Sample Results

Client: Norfolk Southern Corporation
Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-14

Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 15:59	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 15:59	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 15:59	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 15:59	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 15:59	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 15:59	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 15:59	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 15:59	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 15:59	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 15:59	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 15:59	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 15:59	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 15:59	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 15:59	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/09/23 15:59	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 15:59	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 15:59	1
Acetone	ND		0.010	0.0054	mg/L			05/09/23 15:59	1
Benzene	ND		0.0010	0.00042	mg/L			05/09/23 15:59	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 15:59	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 15:59	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 15:59	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 15:59	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 15:59	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 15:59	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 15:59	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 15:59	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 15:59	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 15:59	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 15:59	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 15:59	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 15:59	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 15:59	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 15:59	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 15:59	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 15:59	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 15:59	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 15:59	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 15:59	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 15:59	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 15:59	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 15:59	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 15:59	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 15:59	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 15:59	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 15:59	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/09/23 15:59	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 15:59	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/09/23 15:59	1

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: TRIP BLANK
Date Collected: 05/06/23 00:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-14
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 15:59	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 15:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*95*		*78 - 122*		*05/09/23 15:59*	*1*
Dibromofluoromethane (Surr)	*101*		*73 - 120*		*05/09/23 15:59*	*1*
4-Bromofluorobenzene (Surr)	*92*		*56 - 136*		*05/09/23 15:59*	*1*
1,2-Dichloroethane-d4 (Surr)	*101*		*62 - 137*		*05/09/23 15:59*	*1*

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF5-260119

Lab Sample ID: 240-184875-15

Date Collected: 05/06/23 12:05
Date Received: 05/07/23 18:52

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 20:56	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 20:56	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 20:56	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 20:56	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 20:56	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 20:56	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 20:56	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 20:56	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 20:56	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 20:56	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 20:56	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 20:56	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 20:56	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 20:56	1
2-Butanone (MEK)	**0.0030**	**J**	0.010	0.0012	mg/L			05/08/23 20:56	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 20:56	1
4-Methyl-2-pentanone (MIBK)	**0.0019**	**J**	0.010	0.00099	mg/L			05/08/23 20:56	1
Acetone	**0.052**		0.010	0.0054	mg/L			05/08/23 20:56	1
Benzene	**0.00057**	**J**	0.0010	0.00042	mg/L			05/08/23 20:56	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 20:56	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 20:56	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 20:56	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 20:56	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 20:56	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 20:56	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 20:56	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 20:56	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 20:56	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 20:56	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 20:56	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 20:56	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 20:56	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 20:56	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 20:56	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 20:56	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 20:56	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 20:56	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 20:56	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 20:56	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 20:56	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 20:56	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 20:56	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 20:56	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 20:56	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 20:56	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 20:56	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 20:56	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 20:56	1
Butyl acrylate	**0.082**		0.033	0.0076	mg/L			05/09/23 18:23	3.333

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF5-260119
Date Collected: 05/06/23 12:05
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-15
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 20:56	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 20:56	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*98*		*78 - 122*		*05/08/23 20:56*	*1*
Toluene-d8 (Surr)	*96*		*78 - 122*		*05/09/23 18:23*	*3.333*
Dibromofluoromethane (Surr)	*105*		*73 - 120*		*05/08/23 20:56*	*1*
Dibromofluoromethane (Surr)	*102*		*73 - 120*		*05/09/23 18:23*	*3.333*
4-Bromofluorobenzene (Surr)	*104*		*56 - 136*		*05/08/23 20:56*	*1*
4-Bromofluorobenzene (Surr)	*99*		*56 - 136*		*05/09/23 18:23*	*3.333*
1,2-Dichloroethane-d4 (Surr)	*103*		*62 - 137*		*05/08/23 20:56*	*1*
1,2-Dichloroethane-d4 (Surr)	*103*		*62 - 137*		*05/09/23 18:23*	*3.333*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,4,6-Trichlorophenol	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,4,5-Trichlorophenol	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,4-Dichlorophenol	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,4-Dimethylphenol	ND		0.0095	0.0029	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,4-Dinitrophenol	ND		0.029	0.013	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,4-Dinitrotoluene	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Chloronaphthalene	ND		0.00095	0.00038	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Chlorophenol	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Methylnaphthalene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Methylphenol	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Nitroaniline	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Nitrophenol	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
3,3'-Dichlorobenzidine	ND		0.0095	0.0038	mg/L		05/11/23 08:29	05/11/23 19:39	1
3-Nitroaniline	ND		0.0048	0.0019	mg/L		05/11/23 08:29	05/11/23 19:39	1
4,6-Dinitro-2-methylphenol	ND		0.020	0.0076	mg/L		05/11/23 08:29	05/11/23 19:39	1
4-Bromophenyl phenyl ether	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
4-Chloro-3-methylphenol	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
4-Chloroaniline	ND		0.0095	0.0038	mg/L		05/11/23 08:29	05/11/23 19:39	1
4-Chlorophenyl phenyl ether	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
4-Nitroaniline	ND		0.0029	0.00086	mg/L		05/11/23 08:29	05/11/23 19:39	1
Acenaphthene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Acenaphthylene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Acetophenone	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Anthracene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Atrazine	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Benzaldehyde	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Benzo[a]anthracene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Benzo[a]pyrene	ND		0.00048	0.00010	mg/L		05/11/23 08:29	05/11/23 19:39	1
Benzo[b]fluoranthene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Benzo[g,h,i]perylene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Benzo[k]fluoranthene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Bis(2-chloroethoxy)methane	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Bis(2-chloroethyl)ether	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Bis(2-ethylhexyl) phthalate	ND		0.0048	0.0019	mg/L		05/11/23 08:29	05/11/23 19:39	1

Client Sample ID: WC-TF5-260119

Date Collected: 05/06/23 12:05
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-15
Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.0048	0.0019	mg/L		05/11/23 08:29	05/11/23 19:39	1
Caprolactam	ND		0.0067	0.0029	mg/L		05/11/23 08:29	05/11/23 19:39	1
Carbazole	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Chrysene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Di-n-butyl phthalate	ND		0.0048	0.0019	mg/L		05/11/23 08:29	05/11/23 19:39	1
Di-n-octyl phthalate	ND		0.010	0.0048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Dibenz(a,h)anthracene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Dibenzofuran	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Diethyl phthalate	ND		0.0048	0.0019	mg/L		05/11/23 08:29	05/11/23 19:39	1
Dimethyl phthalate	ND		0.0048	0.0019	mg/L		05/11/23 08:29	05/11/23 19:39	1
Fluoranthene	**0.00043**	**J**	0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Fluorene	ND		0.00048	0.00011	mg/L		05/11/23 08:29	05/11/23 19:39	1
Hexachlorobenzene	ND		0.00048	0.00010	mg/L		05/11/23 08:29	05/11/23 19:39	1
Hexachlorobutadiene	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Hexachlorocyclopentadiene	ND		0.010	0.0048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Hexachloroethane	ND		0.0048	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Indeno[1,2,3-cd]pyrene	ND		0.00048	0.00010	mg/L		05/11/23 08:29	05/11/23 19:39	1
Isophorone	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
N-Nitrosodi-n-propylamine	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
N-Nitrosodiphenylamine	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Naphthalene	ND		0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Nitrobenzene	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Pentachlorophenol	ND		0.0048	0.00095	mg/L		05/11/23 08:29	05/11/23 19:39	1
Phenanthrene	ND		0.00048	0.00010	mg/L		05/11/23 08:29	05/11/23 19:39	1
Phenol	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
Pyrene	**0.00032**	**J**	0.00048	0.000095	mg/L		05/11/23 08:29	05/11/23 19:39	1
bis (2-chloroisopropyl) ether	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
2,6-Dinitrotoluene	ND		0.0019	0.00048	mg/L		05/11/23 08:29	05/11/23 19:39	1
4-Nitrophenol	ND		0.029	0.0095	mg/L		05/11/23 08:29	05/11/23 19:39	1
2-Butoxyethanol	ND		0.0048	0.0024	mg/L		05/11/23 08:29	05/11/23 19:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*30*		*10 - 120*	*05/11/23 08:29*	*05/11/23 19:39*	*1*
Nitrobenzene-d5 (Surr)	*71*		*31 - 120*	*05/11/23 08:29*	*05/11/23 19:39*	*1*
2-Fluorophenol (Surr)	*44*		*10 - 120*	*05/11/23 08:29*	*05/11/23 19:39*	*1*
2-Fluorobiphenyl (Surr)	*64*		*44 - 120*	*05/11/23 08:29*	*05/11/23 19:39*	*1*
2,4,6-Tribromophenol (Surr)	*84*		*13 - 138*	*05/11/23 08:29*	*05/11/23 19:39*	*1*
p-Terphenyl-d14 (Surr)	*61*		*30 - 125*	*05/11/23 08:29*	*05/11/23 19:39*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**500**	**B**	490	67	ug/L		05/08/23 07:32	05/08/23 15:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*70*		*52 - 121*	*05/08/23 07:32*	*05/08/23 15:12*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:31	1
Barium	**0.027**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:31	1

Client Sample ID: WC-TF5-260119

Date Collected: 05/06/23 12:05
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-15
Matrix: Water

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:31	1
Chromium	**0.00098**	**J**	0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:31	1
Lead	**0.0034**	**J**	0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:31	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:31	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:31	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:52	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/09/23 20:16	1
Total Suspended Solids (SM 2540D-2015)	**96**		10	1.0	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**9.1**		1.0	0.35	mg/L			05/10/23 15:31	1
corrosivity by pH (SW846 9040C)	**7.5**	**HF**	0.1	0.1	SU			05/08/23 20:29	1

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF5-251320
Date Collected: 05/06/23 12:35
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-16
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 21:19	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 21:19	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 21:19	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 21:19	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 21:19	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 21:19	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 21:19	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 21:19	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 21:19	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 21:19	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 21:19	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 21:19	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 21:19	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 21:19	1
2-Butanone (MEK)	**0.0053**	**J**	0.010	0.0012	mg/L			05/08/23 21:19	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 21:19	1
4-Methyl-2-pentanone (MIBK)	**0.0032**	**J**	0.010	0.00099	mg/L			05/08/23 21:19	1
Acetone	**0.29**		0.10	0.054	mg/L			05/09/23 17:59	10
Benzene	**0.00099**	**J**	0.0010	0.00042	mg/L			05/08/23 21:19	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 21:19	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 21:19	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 21:19	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 21:19	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 21:19	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 21:19	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 21:19	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 21:19	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 21:19	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 21:19	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 21:19	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 21:19	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 21:19	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 21:19	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 21:19	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 21:19	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 21:19	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 21:19	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 21:19	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 21:19	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 21:19	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 21:19	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 21:19	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 21:19	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 21:19	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 21:19	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 21:19	1
Vinyl chloride	**0.0033**		0.0010	0.00045	mg/L			05/08/23 21:19	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 21:19	1
Butyl acrylate	**0.21**		0.10	0.023	mg/L			05/09/23 17:59	10

Client Sample ID: WC-TF5-251320
Date Collected: 05/06/23 12:35
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-16
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 21:19	1
2-Ethylhexyl acrylate	**0.0035**	**J**	0.010	0.0033	mg/L			05/08/23 21:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*99*		*78 - 122*		*05/08/23 21:19*	*1*
Toluene-d8 (Surr)	*95*		*78 - 122*		*05/09/23 17:59*	*10*
Dibromofluoromethane (Surr)	*103*		*73 - 120*		*05/08/23 21:19*	*1*
Dibromofluoromethane (Surr)	*98*		*73 - 120*		*05/09/23 17:59*	*10*
4-Bromofluorobenzene (Surr)	*102*		*56 - 136*		*05/08/23 21:19*	*1*
4-Bromofluorobenzene (Surr)	*96*		*56 - 136*		*05/09/23 17:59*	*10*
1,2-Dichloroethane-d4 (Surr)	*102*		*62 - 137*		*05/08/23 21:19*	*1*
1,2-Dichloroethane-d4 (Surr)	*96*		*62 - 137*		*05/09/23 17:59*	*10*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,4,6-Trichlorophenol	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,4,5-Trichlorophenol	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,4-Dichlorophenol	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,4-Dimethylphenol	ND		0.0097	0.0029	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,4-Dinitrophenol	ND		0.029	0.014	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,4-Dinitrotoluene	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
2-Chloronaphthalene	ND		0.00097	0.00039	mg/L		05/09/23 08:16	05/10/23 00:29	1
2-Chlorophenol	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2-Methylnaphthalene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
2-Methylphenol	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2-Nitroaniline	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
2-Nitrophenol	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
3,3'-Dichlorobenzidine	ND		0.0097	0.0039	mg/L		05/09/23 08:16	05/10/23 00:29	1
3-Nitroaniline	ND		0.0048	0.0019	mg/L		05/09/23 08:16	05/10/23 00:29	1
4,6-Dinitro-2-methylphenol	ND		0.020	0.0077	mg/L		05/09/23 08:16	05/10/23 00:29	1
4-Bromophenyl phenyl ether	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
4-Chloro-3-methylphenol	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
4-Chloroaniline	ND		0.0097	0.0039	mg/L		05/09/23 08:16	05/10/23 00:29	1
4-Chlorophenyl phenyl ether	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
4-Nitroaniline	ND		0.0029	0.00087	mg/L		05/09/23 08:16	05/10/23 00:29	1
Acenaphthene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Acenaphthylene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Acetophenone	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Anthracene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Atrazine	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Benzaldehyde	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Benzo[a]anthracene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Benzo[a]pyrene	ND		0.00048	0.00011	mg/L		05/09/23 08:16	05/10/23 00:29	1
Benzo[b]fluoranthene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Benzo[g,h,i]perylene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Benzo[k]fluoranthene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Bis(2-chloroethoxy)methane	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Bis(2-chloroethyl)ether	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Bis(2-ethylhexyl) phthalate	ND		0.0048	0.0019	mg/L		05/09/23 08:16	05/10/23 00:29	1

Client Sample ID: WC-TF5-251320

Date Collected: 05/06/23 12:35
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-16

Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.0048	0.0019	mg/L		05/09/23 08:16	05/10/23 00:29	1
Caprolactam	ND		0.0068	0.0029	mg/L		05/09/23 08:16	05/10/23 00:29	1
Carbazole	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Chrysene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Di-n-butyl phthalate	ND		0.0048	0.0019	mg/L		05/09/23 08:16	05/10/23 00:29	1
Di-n-octyl phthalate	ND		0.011	0.0048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Dibenz(a,h)anthracene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Dibenzofuran	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Diethyl phthalate	ND		0.0048	0.0019	mg/L		05/09/23 08:16	05/10/23 00:29	1
Dimethyl phthalate	ND		0.0048	0.0019	mg/L		05/09/23 08:16	05/10/23 00:29	1
Fluoranthene	**0.00022**	**J**	0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Fluorene	ND		0.00048	0.00012	mg/L		05/09/23 08:16	05/10/23 00:29	1
Hexachlorobenzene	ND		0.00048	0.00011	mg/L		05/09/23 08:16	05/10/23 00:29	1
Hexachlorobutadiene	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Hexachlorocyclopentadiene	ND		0.011	0.0048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Hexachloroethane	ND		0.0048	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Indeno[1,2,3-cd]pyrene	ND		0.00048	0.00011	mg/L		05/09/23 08:16	05/10/23 00:29	1
Isophorone	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
N-Nitrosodi-n-propylamine	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
N-Nitrosodiphenylamine	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Naphthalene	ND		0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Nitrobenzene	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Pentachlorophenol	ND		0.0048	0.00097	mg/L		05/09/23 08:16	05/10/23 00:29	1
Phenanthrene	ND		0.00048	0.00011	mg/L		05/09/23 08:16	05/10/23 00:29	1
Phenol	**0.00050**	**J**	0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
Pyrene	**0.00017**	**J**	0.00048	0.000097	mg/L		05/09/23 08:16	05/10/23 00:29	1
bis (2-chloroisopropyl) ether	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
2,6-Dinitrotoluene	ND		0.0019	0.00048	mg/L		05/09/23 08:16	05/10/23 00:29	1
4-Nitrophenol	ND		0.029	0.0097	mg/L		05/09/23 08:16	05/10/23 00:29	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*26*		*10 - 120*	*05/09/23 08:16*	*05/10/23 00:29*	*1*
Nitrobenzene-d5 (Surr)	*64*		*31 - 120*	*05/09/23 08:16*	*05/10/23 00:29*	*1*
2-Fluorophenol (Surr)	*34*		*10 - 120*	*05/09/23 08:16*	*05/10/23 00:29*	*1*
2-Fluorobiphenyl (Surr)	*70*		*44 - 120*	*05/09/23 08:16*	*05/10/23 00:29*	*1*
2,4,6-Tribromophenol (Surr)	*68*		*13 - 138*	*05/09/23 08:16*	*05/10/23 00:29*	*1*
p-Terphenyl-d14 (Surr)	*59*		*30 - 125*	*05/09/23 08:16*	*05/10/23 00:29*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol	**0.20**	**B**	0.048	0.024	mg/L		05/09/23 08:16	05/11/23 01:31	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*24*		*10 - 120*	*05/09/23 08:16*	*05/11/23 01:31*	*10*
Nitrobenzene-d5 (Surr)	*63*		*31 - 120*	*05/09/23 08:16*	*05/11/23 01:31*	*10*
2-Fluorophenol (Surr)	*32*		*10 - 120*	*05/09/23 08:16*	*05/11/23 01:31*	*10*
2-Fluorobiphenyl (Surr)	*57*		*44 - 120*	*05/09/23 08:16*	*05/11/23 01:31*	*10*
2,4,6-Tribromophenol (Surr)	*62*		*13 - 138*	*05/09/23 08:16*	*05/11/23 01:31*	*10*
p-Terphenyl-d14 (Surr)	*53*		*30 - 125*	*05/09/23 08:16*	*05/11/23 01:31*	*10*

Client Sample ID: WC-TF5-251320

Lab Sample ID: 240-184875-16

Date Collected: 05/06/23 12:35

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**1000**	**B**	480	66	ug/L		05/10/23 11:48	05/10/23 17:17	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*54*		*52 - 121*	*05/10/23 11:48*	*05/10/23 17:17*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:36	1
Barium	**0.034**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:36	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:36	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:36	1
Lead	**0.0038**	**J**	0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:36	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:36	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:36	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:54	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/10/23 17:10	1
Total Suspended Solids (SM 2540D-2015)	**69**		9.8	0.98	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**34**		2.0	0.70	mg/L			05/10/23 15:43	2
corrosivity by pH (SW846 9040C)	**7.5**	**HF**	0.1	0.1	SU			05/08/23 20:35	1

Client Sample Results

Client: Norfolk Southern Corporation
Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-17
Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 20:32	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 20:32	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 20:32	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 20:32	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 20:32	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 20:32	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 20:32	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 20:32	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 20:32	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 20:32	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 20:32	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 20:32	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 20:32	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 20:32	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 20:32	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 20:32	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 20:32	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 20:32	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 20:32	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 20:32	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 20:32	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 20:32	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 20:32	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 20:32	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 20:32	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 20:32	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 20:32	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 20:32	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 20:32	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 20:32	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 20:32	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 20:32	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 20:32	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 20:32	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 20:32	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 20:32	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 20:32	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 20:32	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 20:32	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 20:32	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 20:32	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 20:32	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 20:32	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 20:32	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 20:32	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 20:32	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 20:32	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 20:32	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 20:32	1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-17

Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 20:32	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 20:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*78 - 122*		*05/08/23 20:32*	*1*
Dibromofluoromethane (Surr)	*107*		*73 - 120*		*05/08/23 20:32*	*1*
4-Bromofluorobenzene (Surr)	*96*		*56 - 136*		*05/08/23 20:32*	*1*
1,2-Dichloroethane-d4 (Surr)	*109*		*62 - 137*		*05/08/23 20:32*	*1*

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-513A
Date Collected: 05/06/23 15:30
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-18
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/11/23 01:12	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/11/23 01:12	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/11/23 01:12	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/11/23 01:12	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/11/23 01:12	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/11/23 01:12	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/11/23 01:12	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/11/23 01:12	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/11/23 01:12	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/11/23 01:12	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/11/23 01:12	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/11/23 01:12	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/11/23 01:12	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/11/23 01:12	1
2-Butanone (MEK)	**0.0092**	**J**	0.010	0.0012	mg/L			05/11/23 01:12	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/11/23 01:12	1
4-Methyl-2-pentanone (MIBK)	**0.0017**	**J**	0.010	0.00099	mg/L			05/11/23 01:12	1
Acetone	**0.43**		0.050	0.027	mg/L			05/10/23 17:37	5
Benzene	**0.0011**		0.0010	0.00042	mg/L			05/11/23 01:12	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/11/23 01:12	1
Bromoform	ND		0.0010	0.00076	mg/L			05/11/23 01:12	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/11/23 01:12	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/11/23 01:12	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/11/23 01:12	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/11/23 01:12	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/11/23 01:12	1
Chloroform	ND		0.0010	0.00047	mg/L			05/11/23 01:12	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/11/23 01:12	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/11/23 01:12	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/11/23 01:12	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/11/23 01:12	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/11/23 01:12	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/11/23 01:12	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/11/23 01:12	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/11/23 01:12	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/11/23 01:12	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/11/23 01:12	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/11/23 01:12	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/11/23 01:12	1
Styrene	ND		0.0010	0.00045	mg/L			05/11/23 01:12	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/11/23 01:12	1
Toluene	ND		0.0010	0.00044	mg/L			05/11/23 01:12	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/11/23 01:12	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/11/23 01:12	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/11/23 01:12	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/11/23 01:12	1
Vinyl chloride	**0.027**	**F1 F2**	0.0010	0.00045	mg/L			05/11/23 01:12	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/11/23 01:12	1
Butyl acrylate	ND	F1	0.010	0.0023	mg/L			05/11/23 01:12	1

Client Sample ID: WC-TF3-513A

Date Collected: 05/06/23 15:30
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-18
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/11/23 01:12	1
2-Ethylhexyl acrylate	**0.0066**	**J**	0.010	0.0033	mg/L			05/11/23 01:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*111*		*78 - 122*		*05/10/23 17:37*	*5*
Toluene-d8 (Surr)	*98*		*78 - 122*		*05/11/23 01:12*	*1*
Dibromofluoromethane (Surr)	*115*		*73 - 120*		*05/10/23 17:37*	*5*
Dibromofluoromethane (Surr)	*108*		*73 - 120*		*05/11/23 01:12*	*1*
4-Bromofluorobenzene (Surr)	*111*		*56 - 136*		*05/10/23 17:37*	*5*
4-Bromofluorobenzene (Surr)	*106*		*56 - 136*		*05/11/23 01:12*	*1*
1,2-Dichloroethane-d4 (Surr)	*113*		*62 - 137*		*05/10/23 17:37*	*5*
1,2-Dichloroethane-d4 (Surr)	*107*		*62 - 137*		*05/11/23 01:12*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,4,6-Trichlorophenol	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,4,5-Trichlorophenol	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,4-Dichlorophenol	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,4-Dimethylphenol	ND		0.053	0.016	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,4-Dinitrophenol	ND	F1	0.16	0.074	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,4-Dinitrotoluene	ND	F1	0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Chloronaphthalene	ND		0.0053	0.0021	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Chlorophenol	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Methylnaphthalene	**0.0014**	**J**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Methylphenol	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Nitroaniline	ND		0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Nitrophenol	ND	F1	0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
3,3'-Dichlorobenzidine	ND		0.053	0.021	mg/L		05/09/23 08:16	05/10/23 17:30	5
3-Nitroaniline	ND		0.026	0.011	mg/L		05/09/23 08:16	05/10/23 17:30	5
4,6-Dinitro-2-methylphenol	ND	F1	0.11	0.042	mg/L		05/09/23 08:16	05/10/23 17:30	5
4-Bromophenyl phenyl ether	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
4-Chloro-3-methylphenol	ND	F1	0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
4-Chloroaniline	ND		0.053	0.021	mg/L		05/09/23 08:16	05/10/23 17:30	5
4-Chlorophenyl phenyl ether	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
4-Nitroaniline	ND		0.016	0.0048	mg/L		05/09/23 08:16	05/10/23 17:30	5
Acenaphthene	**0.00075**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Acenaphthylene	ND	F1	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Acetophenone	ND		0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Anthracene	**0.00072**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Atrazine	ND		0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Benzaldehyde	ND		0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Benzo[a]anthracene	**0.0014**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Benzo[a]pyrene	**0.0020**	**J F1**	0.0026	0.00058	mg/L		05/09/23 08:16	05/10/23 17:30	5
Benzo[b]fluoranthene	**0.0021**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Benzo[g,h,i]perylene	**0.0018**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Benzo[k]fluoranthene	**0.00073**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Bis(2-chloroethoxy)methane	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Bis(2-chloroethyl)ether	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Bis(2-ethylhexyl) phthalate	ND	F1	0.026	0.011	mg/L		05/09/23 08:16	05/10/23 17:30	5

Client Sample ID: WC-TF3-513A
Date Collected: 05/06/23 15:30
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-18
Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.026	0.011	mg/L		05/09/23 08:16	05/10/23 17:30	5
Caprolactam	ND		0.037	0.016	mg/L		05/09/23 08:16	05/10/23 17:30	5
Carbazole	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Chrysene	**0.0033**	**F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Di-n-butyl phthalate	ND	F1	0.026	0.011	mg/L		05/09/23 08:16	05/10/23 17:30	5
Di-n-octyl phthalate	ND		0.058	0.026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Dibenz(a,h)anthracene	**0.00054**	**J F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Dibenzofuran	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Diethyl phthalate	ND		0.026	0.011	mg/L		05/09/23 08:16	05/10/23 17:30	5
Dimethyl phthalate	ND		0.026	0.011	mg/L		05/09/23 08:16	05/10/23 17:30	5
Fluoranthene	**0.0032**	**F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Fluorene	**0.00066**	**J F1**	0.0026	0.00063	mg/L		05/09/23 08:16	05/10/23 17:30	5
Hexachlorobenzene	ND	F1	0.0026	0.00058	mg/L		05/09/23 08:16	05/10/23 17:30	5
Hexachlorobutadiene	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Hexachlorocyclopentadiene	ND	F1	0.058	0.026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Hexachloroethane	ND		0.026	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Indeno[1,2,3-cd]pyrene	**0.0017**	**J F1**	0.0026	0.00058	mg/L		05/09/23 08:16	05/10/23 17:30	5
Isophorone	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
N-Nitrosodi-n-propylamine	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
N-Nitrosodiphenylamine	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Naphthalene	**0.0012**	**J**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Nitrobenzene	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Pentachlorophenol	ND	F1	0.026	0.0053	mg/L		05/09/23 08:16	05/10/23 17:30	5
Phenanthrene	**0.0031**	**F1**	0.0026	0.00058	mg/L		05/09/23 08:16	05/10/23 17:30	5
Phenol	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
Pyrene	**0.0030**	**F1**	0.0026	0.00053	mg/L		05/09/23 08:16	05/10/23 17:30	5
bis (2-chloroisopropyl) ether	ND		0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
2,6-Dinitrotoluene	ND	F1	0.011	0.0026	mg/L		05/09/23 08:16	05/10/23 17:30	5
4-Nitrophenol	ND	F1	0.16	0.053	mg/L		05/09/23 08:16	05/10/23 17:30	5
2-Butoxyethanol	**0.12**	**B *+ F1**	0.026	0.013	mg/L		05/09/23 08:16	05/10/23 17:30	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*20*		*10 - 120*	*05/09/23 08:16*	*05/10/23 17:30*	*5*
Nitrobenzene-d5 (Surr)	*52*		*31 - 120*	*05/09/23 08:16*	*05/10/23 17:30*	*5*
2-Fluorophenol (Surr)	*26*		*10 - 120*	*05/09/23 08:16*	*05/10/23 17:30*	*5*
2-Fluorobiphenyl (Surr)	*44*		*44 - 120*	*05/09/23 08:16*	*05/10/23 17:30*	*5*
2,4,6-Tribromophenol (Surr)	*43*		*13 - 138*	*05/09/23 08:16*	*05/10/23 17:30*	*5*
p-Terphenyl-d14 (Surr)	*31*		*30 - 125*	*05/09/23 08:16*	*05/10/23 17:30*	*5*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,4,6-Trichlorophenol	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,4,5-Trichlorophenol	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,4-Dichlorophenol	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,4-Dimethylphenol	ND	F1	0.058	0.017	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,4-Dinitrophenol	ND		0.17	0.081	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,4-Dinitrotoluene	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
2-Chloronaphthalene	ND		0.0058	0.0023	mg/L		05/11/23 08:29	05/16/23 15:10	5
2-Chlorophenol	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5

Client Sample ID: WC-TF3-513A

Lab Sample ID: 240-184875-18

Date Collected: 05/06/23 15:30

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RE (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Methylnaphthalene	ND		0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
2-Methylphenol	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
2-Nitroaniline	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
2-Nitrophenol	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
3,3'-Dichlorobenzidine	ND		0.058	0.023	mg/L		05/11/23 08:29	05/16/23 15:10	5
3-Nitroaniline	ND		0.029	0.012	mg/L		05/11/23 08:29	05/16/23 15:10	5
4,6-Dinitro-2-methylphenol	ND		0.12	0.046	mg/L		05/11/23 08:29	05/16/23 15:10	5
4-Bromophenyl phenyl ether	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
4-Chloro-3-methylphenol	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
4-Chloroaniline	ND	F1	0.058	0.023	mg/L		05/11/23 08:29	05/16/23 15:10	5
4-Chlorophenyl phenyl ether	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
4-Nitroaniline	ND		0.017	0.0052	mg/L		05/11/23 08:29	05/16/23 15:10	5
Acenaphthene	ND		0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Acenaphthylene	ND		0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Acetophenone	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Anthracene	ND		0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Atrazine	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Benzaldehyde	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Benzo[a]anthracene	ND	F1	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Benzo[a]pyrene	ND	F1	0.0029	0.00064	mg/L		05/11/23 08:29	05/16/23 15:10	5
Benzo[b]fluoranthene	**0.00064**	**J F1**	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Benzo[g,h,i]perylene	ND	F1	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Benzo[k]fluoranthene	ND	F1	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Bis(2-chloroethoxy)methane	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Bis(2-chloroethyl)ether	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Bis(2-ethylhexyl) phthalate	ND		0.029	0.012	mg/L		05/11/23 08:29	05/16/23 15:10	5
Butyl benzyl phthalate	ND		0.029	0.012	mg/L		05/11/23 08:29	05/16/23 15:10	5
Caprolactam	ND		0.040	0.017	mg/L		05/11/23 08:29	05/16/23 15:10	5
Carbazole	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Chrysene	ND	F1	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Di-n-butyl phthalate	ND		0.029	0.012	mg/L		05/11/23 08:29	05/16/23 15:10	5
Di-n-octyl phthalate	ND		0.064	0.029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Dibenz(a,h)anthracene	ND	F1	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Dibenzofuran	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Diethyl phthalate	ND		0.029	0.012	mg/L		05/11/23 08:29	05/16/23 15:10	5
Dimethyl phthalate	ND		0.029	0.012	mg/L		05/11/23 08:29	05/16/23 15:10	5
Fluoranthene	**0.0010**	**J F1**	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Fluorene	ND		0.0029	0.00069	mg/L		05/11/23 08:29	05/16/23 15:10	5
Hexachlorobenzene	ND		0.0029	0.00064	mg/L		05/11/23 08:29	05/16/23 15:10	5
Hexachlorobutadiene	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Hexachlorocyclopentadiene	ND	F1	0.064	0.029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Hexachloroethane	ND		0.029	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Indeno[1,2,3-cd]pyrene	ND	F1	0.0029	0.00064	mg/L		05/11/23 08:29	05/16/23 15:10	5
Isophorone	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
N-Nitrosodi-n-propylamine	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
N-Nitrosodiphenylamine	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Naphthalene	ND		0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
Nitrobenzene	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Pentachlorophenol	ND		0.029	0.0058	mg/L		05/11/23 08:29	05/16/23 15:10	5

Client Sample ID: WC-TF3-513A

Lab Sample ID: 240-184875-18

Date Collected: 05/06/23 15:30
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RE (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phenanthrene	**0.00074**	**J**	0.0029	0.00064	mg/L		05/11/23 08:29	05/16/23 15:10	5
Phenol	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
Pyrene	**0.0010**	**J F1**	0.0029	0.00058	mg/L		05/11/23 08:29	05/16/23 15:10	5
bis (2-chloroisopropyl) ether	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
2,6-Dinitrotoluene	ND		0.012	0.0029	mg/L		05/11/23 08:29	05/16/23 15:10	5
4-Nitrophenol	ND	F1	0.17	0.058	mg/L		05/11/23 08:29	05/16/23 15:10	5
2-Butoxyethanol	**0.20**		0.029	0.014	mg/L		05/11/23 08:29	05/16/23 15:10	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*31*		*10 - 120*	*05/11/23 08:29*	*05/16/23 15:10*	*5*
Nitrobenzene-d5 (Surr)	*78*		*31 - 120*	*05/11/23 08:29*	*05/16/23 15:10*	*5*
2-Fluorophenol (Surr)	*41*		*10 - 120*	*05/11/23 08:29*	*05/16/23 15:10*	*5*
2-Fluorobiphenyl (Surr)	*81*		*44 - 120*	*05/11/23 08:29*	*05/16/23 15:10*	*5*
2,4,6-Tribromophenol (Surr)	*66*		*13 - 138*	*05/11/23 08:29*	*05/16/23 15:10*	*5*
p-Terphenyl-d14 (Surr)	*69*		*30 - 125*	*05/11/23 08:29*	*05/16/23 15:10*	*5*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**9700**	**F2 B**	4900	660	ug/L		05/10/23 11:48	05/10/23 14:06	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*42*	*S1-*	*52 - 121*	*05/10/23 11:48*	*05/10/23 14:06*	*10*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.011**	**J B**	0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:22	1
Barium	**0.043**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:22	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:22	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:22	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:22	1
Selenium	**0.013**	**J**	0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:22	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:22	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:21	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/10/23 18:37	1
Total Suspended Solids (SM 2540D-2015)	**3400**		40	4.0	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**69**		5.0	1.7	mg/L			05/10/23 15:56	5
corrosivity by pH (SW846 9040C)	**7.4**	**HF**	0.1	0.1	SU			05/08/23 19:55	1

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

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-19
Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 16:23	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 16:23	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 16:23	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 16:23	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 16:23	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 16:23	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 16:23	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 16:23	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 16:23	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 16:23	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 16:23	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 16:23	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 16:23	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 16:23	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/09/23 16:23	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 16:23	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 16:23	1
Acetone	ND		0.010	0.0054	mg/L			05/09/23 16:23	1
Benzene	ND		0.0010	0.00042	mg/L			05/09/23 16:23	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 16:23	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 16:23	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 16:23	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 16:23	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 16:23	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 16:23	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 16:23	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 16:23	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 16:23	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 16:23	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 16:23	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 16:23	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 16:23	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 16:23	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 16:23	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 16:23	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 16:23	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 16:23	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 16:23	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 16:23	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 16:23	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 16:23	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 16:23	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 16:23	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 16:23	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 16:23	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 16:23	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/09/23 16:23	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 16:23	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/09/23 16:23	1

Client: Norfolk Southern Corporation | Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: TRIP BLANK | **Lab Sample ID: 240-184875-19**
Date Collected: 05/06/23 00:00 | **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 16:23	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 16:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*78 - 122*		*05/09/23 16:23*	*1*
Dibromofluoromethane (Surr)	*102*		*73 - 120*		*05/09/23 16:23*	*1*
4-Bromofluorobenzene (Surr)	*93*		*56 - 136*		*05/09/23 16:23*	*1*
1,2-Dichloroethane-d4 (Surr)	*102*		*62 - 137*		*05/09/23 16:23*	*1*

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-AL4787
Date Collected: 05/07/23 10:10
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-20
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 19:10	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 19:10	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 19:10	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 19:10	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 19:10	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 19:10	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 19:10	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 19:10	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 19:10	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 19:10	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 19:10	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 19:10	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 19:10	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 19:10	1
2-Butanone (MEK)	**0.0088**	**J**	0.010	0.0012	mg/L			05/09/23 19:10	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 19:10	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 19:10	1
Acetone	**0.15**		0.020	0.011	mg/L			05/10/23 18:01	2
Benzene	ND		0.0010	0.00042	mg/L			05/09/23 19:10	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 19:10	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 19:10	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 19:10	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 19:10	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 19:10	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 19:10	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 19:10	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 19:10	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 19:10	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 19:10	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 19:10	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 19:10	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 19:10	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 19:10	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 19:10	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 19:10	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 19:10	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 19:10	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 19:10	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 19:10	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 19:10	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 19:10	1
Toluene	**0.00044**	**J**	0.0010	0.00044	mg/L			05/09/23 19:10	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 19:10	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 19:10	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 19:10	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 19:10	1
Vinyl chloride	**0.0012**		0.0010	0.00045	mg/L			05/09/23 19:10	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 19:10	1
Butyl acrylate	**0.0083**	**J**	0.010	0.0023	mg/L			05/09/23 19:10	1

Client Sample ID: WC-TF3-AL4787 **Lab Sample ID: 240-184875-20**
Date Collected: 05/07/23 10:10 **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 19:10	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 19:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*78 - 122*		*05/09/23 19:10*	*1*
Toluene-d8 (Surr)	*111*		*78 - 122*		*05/10/23 18:01*	*2*
Dibromofluoromethane (Surr)	*100*		*73 - 120*		*05/09/23 19:10*	*1*
Dibromofluoromethane (Surr)	*113*		*73 - 120*		*05/10/23 18:01*	*2*
4-Bromofluorobenzene (Surr)	*97*		*56 - 136*		*05/09/23 19:10*	*1*
4-Bromofluorobenzene (Surr)	*108*		*56 - 136*		*05/10/23 18:01*	*2*
1,2-Dichloroethane-d4 (Surr)	*99*		*62 - 137*		*05/09/23 19:10*	*1*
1,2-Dichloroethane-d4 (Surr)	*112*		*62 - 137*		*05/10/23 18:01*	*2*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,4,6-Trichlorophenol	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,4,5-Trichlorophenol	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,4-Dichlorophenol	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,4-Dimethylphenol	ND		0.0099	0.0030	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,4-Dinitrotoluene	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
2-Chloronaphthalene	ND		0.00099	0.00040	mg/L		05/09/23 08:16	05/10/23 00:48	1
2-Chlorophenol	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2-Methylnaphthalene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
2-Methylphenol	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2-Nitroaniline	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
2-Nitrophenol	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
3,3'-Dichlorobenzidine	ND		0.0099	0.0040	mg/L		05/09/23 08:16	05/10/23 00:48	1
3-Nitroaniline	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 00:48	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0079	mg/L		05/09/23 08:16	05/10/23 00:48	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
4-Chloro-3-methylphenol	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
4-Chloroaniline	ND		0.0099	0.0040	mg/L		05/09/23 08:16	05/10/23 00:48	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
4-Nitroaniline	ND		0.0030	0.00089	mg/L		05/09/23 08:16	05/10/23 00:48	1
Acenaphthene	**0.00013**	**J**	0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Acenaphthylene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Acetophenone	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Anthracene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Atrazine	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Benzaldehyde	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Benzo[a]anthracene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Benzo[a]pyrene	ND		0.00049	0.00011	mg/L		05/09/23 08:16	05/10/23 00:48	1
Benzo[b]fluoranthene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Benzo[g,h,i]perylene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Benzo[k]fluoranthene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Bis(2-ethylhexyl) phthalate	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 00:48	1

Client Sample ID: WC-TF3-AL4787
Date Collected: 05/07/23 10:10
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-20
Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 00:48	1
Caprolactam	ND		0.0069	0.0030	mg/L		05/09/23 08:16	05/10/23 00:48	1
Carbazole	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Chrysene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Di-n-butyl phthalate	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 00:48	1
Di-n-octyl phthalate	ND		0.011	0.0049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Dibenz(a,h)anthracene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Dibenzofuran	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Diethyl phthalate	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 00:48	1
Dimethyl phthalate	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 00:48	1
Fluoranthene	**0.00012**	**J**	0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Fluorene	ND		0.00049	0.00012	mg/L		05/09/23 08:16	05/10/23 00:48	1
Hexachlorobenzene	ND		0.00049	0.00011	mg/L		05/09/23 08:16	05/10/23 00:48	1
Hexachlorobutadiene	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Hexachlorocyclopentadiene	ND		0.011	0.0049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Hexachloroethane	ND		0.0049	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Indeno[1,2,3-cd]pyrene	ND		0.00049	0.00011	mg/L		05/09/23 08:16	05/10/23 00:48	1
Isophorone	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
N-Nitrosodiphenylamine	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Naphthalene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Nitrobenzene	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Pentachlorophenol	ND		0.0049	0.00099	mg/L		05/09/23 08:16	05/10/23 00:48	1
Phenanthrene	ND		0.00049	0.00011	mg/L		05/09/23 08:16	05/10/23 00:48	1
Phenol	**0.00072**	**J**	0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
Pyrene	ND		0.00049	0.000099	mg/L		05/09/23 08:16	05/10/23 00:48	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
2,6-Dinitrotoluene	ND		0.0020	0.00049	mg/L		05/09/23 08:16	05/10/23 00:48	1
4-Nitrophenol	ND		0.030	0.0099	mg/L		05/09/23 08:16	05/10/23 00:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*25*		*10 - 120*	*05/09/23 08:16*	*05/10/23 00:48*	*1*
Nitrobenzene-d5 (Surr)	*72*		*31 - 120*	*05/09/23 08:16*	*05/10/23 00:48*	*1*
2-Fluorophenol (Surr)	*36*		*10 - 120*	*05/09/23 08:16*	*05/10/23 00:48*	*1*
2-Fluorobiphenyl (Surr)	*77*		*44 - 120*	*05/09/23 08:16*	*05/10/23 00:48*	*1*
2,4,6-Tribromophenol (Surr)	*63*		*13 - 138*	*05/09/23 08:16*	*05/10/23 00:48*	*1*
p-Terphenyl-d14 (Surr)	*69*		*30 - 125*	*05/09/23 08:16*	*05/10/23 00:48*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol	**0.28**	**B**	0.049	0.025	mg/L		05/09/23 08:16	05/11/23 03:31	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*23*		*10 - 120*	*05/09/23 08:16*	*05/11/23 03:31*	*10*
Nitrobenzene-d5 (Surr)	*71*		*31 - 120*	*05/09/23 08:16*	*05/11/23 03:31*	*10*
2-Fluorophenol (Surr)	*33*		*10 - 120*	*05/09/23 08:16*	*05/11/23 03:31*	*10*
2-Fluorobiphenyl (Surr)	*62*		*44 - 120*	*05/09/23 08:16*	*05/11/23 03:31*	*10*
2,4,6-Tribromophenol (Surr)	*58*		*13 - 138*	*05/09/23 08:16*	*05/11/23 03:31*	*10*
p-Terphenyl-d14 (Surr)	*61*		*30 - 125*	*05/09/23 08:16*	*05/11/23 03:31*	*10*

Client Sample ID: WC-TF3-AL4787
Lab Sample ID: 240-184875-20
Date Collected: 05/07/23 10:10
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	940	B	490	67	ug/L		05/08/23 07:32	05/08/23 17:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*63*		*52 - 121*	*05/08/23 07:32*	*05/08/23 17:03*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:40	1
Barium	0.056	J	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:40	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:40	1
Chromium	0.0010	J	0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:40	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:40	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:40	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:40	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:56	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	>200				Degrees F			05/10/23 19:20	1
Total Suspended Solids (SM 2540D-2015)	55		10	1.0	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	22		1.0	0.35	mg/L			05/10/23 16:35	1
corrosivity by pH (SW846 9040C)	7.7	HF	0.1	0.1	SU			05/08/23 20:42	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF3-AL4216
Date Collected: 05/07/23 10:45
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-21
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 19:34	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 19:34	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 19:34	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 19:34	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 19:34	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 19:34	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 19:34	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 19:34	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 19:34	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 19:34	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 19:34	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 19:34	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 19:34	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 19:34	1
2-Butanone (MEK)	**0.0061**	**J**	0.010	0.0012	mg/L			05/09/23 19:34	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 19:34	1
4-Methyl-2-pentanone (MIBK)	**0.0015**	**J**	0.010	0.00099	mg/L			05/09/23 19:34	1
Acetone	**0.12**		0.010	0.0054	mg/L			05/09/23 19:34	1
Benzene	**0.00056**	**J**	0.0010	0.00042	mg/L			05/09/23 19:34	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 19:34	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 19:34	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 19:34	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 19:34	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 19:34	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 19:34	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 19:34	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 19:34	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 19:34	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 19:34	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 19:34	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 19:34	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 19:34	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 19:34	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 19:34	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 19:34	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 19:34	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 19:34	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 19:34	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 19:34	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 19:34	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 19:34	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 19:34	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 19:34	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 19:34	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 19:34	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 19:34	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/09/23 19:34	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 19:34	1
Butyl acrylate	**0.052**		0.010	0.0023	mg/L			05/09/23 19:34	1

Client Sample ID: WC-TF3-AL4216

Date Collected: 05/07/23 10:45
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-21
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 19:34	1
2-Ethylhexyl acrylate	**0.0050**	**J**	0.010	0.0033	mg/L			05/09/23 19:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*94*		*78 - 122*		*05/09/23 19:34*	*1*
Dibromofluoromethane (Surr)	*99*		*73 - 120*		*05/09/23 19:34*	*1*
4-Bromofluorobenzene (Surr)	*98*		*56 - 136*		*05/09/23 19:34*	*1*
1,2-Dichloroethane-d4 (Surr)	*99*		*62 - 137*		*05/09/23 19:34*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,4,6-Trichlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,4,5-Trichlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,4-Dichlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,4-Dimethylphenol	ND		0.0094	0.0028	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,4-Dinitrophenol	ND		0.028	0.013	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,4-Dinitrotoluene	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
2-Chloronaphthalene	ND		0.00094	0.00038	mg/L		05/09/23 08:16	05/10/23 01:07	1
2-Chlorophenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2-Methylnaphthalene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
2-Methylphenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2-Nitroaniline	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
2-Nitrophenol	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
3,3'-Dichlorobenzidine	ND		0.0094	0.0038	mg/L		05/09/23 08:16	05/10/23 01:07	1
3-Nitroaniline	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/10/23 01:07	1
4,6-Dinitro-2-methylphenol	ND		0.020	0.0075	mg/L		05/09/23 08:16	05/10/23 01:07	1
4-Bromophenyl phenyl ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
4-Chloro-3-methylphenol	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
4-Chloroaniline	ND		0.0094	0.0038	mg/L		05/09/23 08:16	05/10/23 01:07	1
4-Chlorophenyl phenyl ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
4-Nitroaniline	ND		0.0028	0.00084	mg/L		05/09/23 08:16	05/10/23 01:07	1
Acenaphthene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Acenaphthylene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Acetophenone	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Anthracene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Atrazine	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Benzaldehyde	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Benzo[a]anthracene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Benzo[a]pyrene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/10/23 01:07	1
Benzo[b]fluoranthene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Benzo[g,h,i]perylene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Benzo[k]fluoranthene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Bis(2-chloroethoxy)methane	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Bis(2-chloroethyl)ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Bis(2-ethylhexyl) phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/10/23 01:07	1
Butyl benzyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/10/23 01:07	1
Caprolactam	ND		0.0066	0.0028	mg/L		05/09/23 08:16	05/10/23 01:07	1
Carbazole	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Chrysene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1

Client Sample ID: WC-TF3-AL4216
Lab Sample ID: 240-184875-21

Date Collected: 05/07/23 10:45
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Di-n-butyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/10/23 01:07	1
Di-n-octyl phthalate	ND		0.010	0.0047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Dibenz(a,h)anthracene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Dibenzofuran	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Diethyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/10/23 01:07	1
Dimethyl phthalate	ND		0.0047	0.0019	mg/L		05/09/23 08:16	05/10/23 01:07	1
Fluoranthene	**0.00014**	**J**	0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Fluorene	ND		0.00047	0.00011	mg/L		05/09/23 08:16	05/10/23 01:07	1
Hexachlorobenzene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/10/23 01:07	1
Hexachlorobutadiene	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Hexachlorocyclopentadiene	ND		0.010	0.0047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Hexachloroethane	ND		0.0047	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Indeno[1,2,3-cd]pyrene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/10/23 01:07	1
Isophorone	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
N-Nitrosodi-n-propylamine	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
N-Nitrosodiphenylamine	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Naphthalene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Nitrobenzene	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Pentachlorophenol	ND		0.0047	0.00094	mg/L		05/09/23 08:16	05/10/23 01:07	1
Phenanthrene	ND		0.00047	0.00010	mg/L		05/09/23 08:16	05/10/23 01:07	1
Phenol	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
Pyrene	ND		0.00047	0.000094	mg/L		05/09/23 08:16	05/10/23 01:07	1
bis (2-chloroisopropyl) ether	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
2,6-Dinitrotoluene	ND		0.0019	0.00047	mg/L		05/09/23 08:16	05/10/23 01:07	1
4-Nitrophenol	ND		0.028	0.0094	mg/L		05/09/23 08:16	05/10/23 01:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*29*		*10 - 120*	*05/09/23 08:16*	*05/10/23 01:07*	*1*
Nitrobenzene-d5 (Surr)	*72*		*31 - 120*	*05/09/23 08:16*	*05/10/23 01:07*	*1*
2-Fluorophenol (Surr)	*43*		*10 - 120*	*05/09/23 08:16*	*05/10/23 01:07*	*1*
2-Fluorobiphenyl (Surr)	*81*		*44 - 120*	*05/09/23 08:16*	*05/10/23 01:07*	*1*
2,4,6-Tribromophenol (Surr)	*75*		*13 - 138*	*05/09/23 08:16*	*05/10/23 01:07*	*1*
p-Terphenyl-d14 (Surr)	*72*		*30 - 125*	*05/09/23 08:16*	*05/10/23 01:07*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol	**0.059**	**B**	0.0047	0.0023	mg/L		05/09/23 08:16	05/11/23 03:51	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*33*		*10 - 120*	*05/09/23 08:16*	*05/11/23 03:51*	*1*
Nitrobenzene-d5 (Surr)	*81*		*31 - 120*	*05/09/23 08:16*	*05/11/23 03:51*	*1*
2-Fluorophenol (Surr)	*49*		*10 - 120*	*05/09/23 08:16*	*05/11/23 03:51*	*1*
2-Fluorobiphenyl (Surr)	*75*		*44 - 120*	*05/09/23 08:16*	*05/11/23 03:51*	*1*
2,4,6-Tribromophenol (Surr)	*90*		*13 - 138*	*05/09/23 08:16*	*05/11/23 03:51*	*1*
p-Terphenyl-d14 (Surr)	*74*		*30 - 125*	*05/09/23 08:16*	*05/11/23 03:51*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**1000**	**B**	490	66	ug/L		05/08/23 07:32	05/08/23 17:31	1

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

Client Sample ID: WC-TF3-AL4216
Date Collected: 05/07/23 10:45
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-21
Matrix: Water

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*71*		*52 - 121*	*05/08/23 07:32*	*05/08/23 17:31*	*1*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:44	1
Barium	**0.039**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:44	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:44	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:44	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:44	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:44	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:44	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 14:05	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/10/23 20:04	1
Total Suspended Solids (SM 2540D-2015)	**130**		17	1.7	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**17**		1.0	0.35	mg/L			05/10/23 16:48	1
corrosivity by pH (SW846 9040C)	**7.6**	**HF**	0.1	0.1	SU			05/08/23 20:48	1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-22

Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 16:47	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 16:47	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 16:47	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 16:47	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 16:47	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 16:47	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 16:47	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 16:47	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 16:47	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 16:47	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 16:47	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 16:47	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 16:47	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 16:47	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/09/23 16:47	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 16:47	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 16:47	1
Acetone	ND		0.010	0.0054	mg/L			05/09/23 16:47	1
Benzene	ND		0.0010	0.00042	mg/L			05/09/23 16:47	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 16:47	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 16:47	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 16:47	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 16:47	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 16:47	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 16:47	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 16:47	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 16:47	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 16:47	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 16:47	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 16:47	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 16:47	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 16:47	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 16:47	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 16:47	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 16:47	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 16:47	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 16:47	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 16:47	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 16:47	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 16:47	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 16:47	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 16:47	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 16:47	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 16:47	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 16:47	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 16:47	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/09/23 16:47	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 16:47	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/09/23 16:47	1

Client: Norfolk Southern Corporation | Job ID: 240-184875-1
Project/Site: NS East Palestine

Client Sample ID: TRIP BLANK | **Lab Sample ID: 240-184875-22**
Date Collected: 05/07/23 00:00 | **Matrix: Water**
Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 16:47	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 16:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*78 - 122*		*05/09/23 16:47*	*1*
Dibromofluoromethane (Surr)	*102*		*73 - 120*		*05/09/23 16:47*	*1*
4-Bromofluorobenzene (Surr)	*95*		*56 - 136*		*05/09/23 16:47*	*1*
1,2-Dichloroethane-d4 (Surr)	*104*		*62 - 137*		*05/09/23 16:47*	*1*

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: WC-TF5-514E

Date Collected: 05/06/23 13:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-23
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 19:58	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 19:58	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 19:58	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 19:58	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 19:58	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 19:58	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 19:58	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 19:58	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 19:58	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 19:58	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 19:58	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 19:58	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 19:58	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 19:58	1
2-Butanone (MEK)	**0.0042**	**J**	0.010	0.0012	mg/L			05/09/23 19:58	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 19:58	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 19:58	1
Acetone	**0.91**		0.50	0.27	mg/L			05/11/23 00:48	50
Benzene	**0.00080**	**J**	0.0010	0.00042	mg/L			05/09/23 19:58	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 19:58	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 19:58	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 19:58	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 19:58	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 19:58	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 19:58	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 19:58	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 19:58	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 19:58	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 19:58	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 19:58	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 19:58	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 19:58	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 19:58	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 19:58	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 19:58	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 19:58	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 19:58	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 19:58	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 19:58	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 19:58	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 19:58	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 19:58	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 19:58	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 19:58	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 19:58	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 19:58	1
Vinyl chloride	**0.0019**		0.0010	0.00045	mg/L			05/09/23 19:58	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 19:58	1
Butyl acrylate	**0.0048**	**J**	0.010	0.0023	mg/L			05/09/23 19:58	1

Client Sample ID: WC-TF5-514E

Lab Sample ID: 240-184875-23

Date Collected: 05/06/23 13:00

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 19:58	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 19:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*93*		*78 - 122*		*05/09/23 19:58*	*1*
Toluene-d8 (Surr)	*99*		*78 - 122*		*05/11/23 00:48*	*50*
Dibromofluoromethane (Surr)	*100*		*73 - 120*		*05/09/23 19:58*	*1*
Dibromofluoromethane (Surr)	*104*		*73 - 120*		*05/11/23 00:48*	*50*
4-Bromofluorobenzene (Surr)	*93*		*56 - 136*		*05/09/23 19:58*	*1*
4-Bromofluorobenzene (Surr)	*96*		*56 - 136*		*05/11/23 00:48*	*50*
1,2-Dichloroethane-d4 (Surr)	*98*		*62 - 137*		*05/09/23 19:58*	*1*
1,2-Dichloroethane-d4 (Surr)	*105*		*62 - 137*		*05/11/23 00:48*	*50*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,4,6-Trichlorophenol	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,4,5-Trichlorophenol	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,4-Dichlorophenol	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,4-Dimethylphenol	ND		0.049	0.015	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,4-Dinitrophenol	ND		0.15	0.068	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,4-Dinitrotoluene	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Chloronaphthalene	ND		0.0049	0.0020	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Chlorophenol	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Methylnaphthalene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Methylphenol	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Nitroaniline	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Nitrophenol	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
3,3'-Dichlorobenzidine	ND		0.049	0.020	mg/L		05/09/23 08:16	05/10/23 01:27	5
3-Nitroaniline	ND		0.024	0.0098	mg/L		05/09/23 08:16	05/10/23 01:27	5
4,6-Dinitro-2-methylphenol	ND		0.10	0.039	mg/L		05/09/23 08:16	05/10/23 01:27	5
4-Bromophenyl phenyl ether	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
4-Chloro-3-methylphenol	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
4-Chloroaniline	ND		0.049	0.020	mg/L		05/09/23 08:16	05/10/23 01:27	5
4-Chlorophenyl phenyl ether	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
4-Nitroaniline	ND		0.015	0.0044	mg/L		05/09/23 08:16	05/10/23 01:27	5
Acenaphthene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Acenaphthylene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Acetophenone	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Anthracene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Atrazine	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Benzaldehyde	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Benzo[a]anthracene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Benzo[a]pyrene	ND		0.0024	0.00054	mg/L		05/09/23 08:16	05/10/23 01:27	5
Benzo[b]fluoranthene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Benzo[g,h,i]perylene	**0.0010**	**J**	0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Benzo[k]fluoranthene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Bis(2-chloroethoxy)methane	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Bis(2-chloroethyl)ether	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Bis(2-ethylhexyl) phthalate	ND		0.024	0.0098	mg/L		05/09/23 08:16	05/10/23 01:27	5

Client Sample ID: WC-TF5-514E
Lab Sample ID: 240-184875-23

Date Collected: 05/06/23 13:00
Date Received: 05/07/23 18:52
Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl benzyl phthalate	ND		0.024	0.0098	mg/L		05/09/23 08:16	05/10/23 01:27	5
Caprolactam	ND		0.034	0.015	mg/L		05/09/23 08:16	05/10/23 01:27	5
Carbazole	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Chrysene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Di-n-butyl phthalate	ND		0.024	0.0098	mg/L		05/09/23 08:16	05/10/23 01:27	5
Di-n-octyl phthalate	ND		0.054	0.024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Dibenz(a,h)anthracene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Dibenzofuran	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Diethyl phthalate	ND		0.024	0.0098	mg/L		05/09/23 08:16	05/10/23 01:27	5
Dimethyl phthalate	ND		0.024	0.0098	mg/L		05/09/23 08:16	05/10/23 01:27	5
Fluoranthene	**0.0021**	**J**	0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Fluorene	ND		0.0024	0.00059	mg/L		05/09/23 08:16	05/10/23 01:27	5
Hexachlorobenzene	ND		0.0024	0.00054	mg/L		05/09/23 08:16	05/10/23 01:27	5
Hexachlorobutadiene	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Hexachlorocyclopentadiene	ND		0.054	0.024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Hexachloroethane	ND		0.024	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Indeno[1,2,3-cd]pyrene	ND		0.0024	0.00054	mg/L		05/09/23 08:16	05/10/23 01:27	5
Isophorone	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
N-Nitrosodi-n-propylamine	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
N-Nitrosodiphenylamine	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Naphthalene	ND		0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Nitrobenzene	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Pentachlorophenol	ND		0.024	0.0049	mg/L		05/09/23 08:16	05/10/23 01:27	5
Phenanthrene	**0.0014**	**J**	0.0024	0.00054	mg/L		05/09/23 08:16	05/10/23 01:27	5
Phenol	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
Pyrene	**0.0017**	**J**	0.0024	0.00049	mg/L		05/09/23 08:16	05/10/23 01:27	5
bis (2-chloroisopropyl) ether	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
2,6-Dinitrotoluene	ND		0.0098	0.0024	mg/L		05/09/23 08:16	05/10/23 01:27	5
4-Nitrophenol	ND		0.15	0.049	mg/L		05/09/23 08:16	05/10/23 01:27	5
2-Butoxyethanol	ND	*+	0.024	0.012	mg/L		05/09/23 08:16	05/10/23 01:27	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*26*		*10 - 120*	*05/09/23 08:16*	*05/10/23 01:27*	*5*
Nitrobenzene-d5 (Surr)	*54*		*31 - 120*	*05/09/23 08:16*	*05/10/23 01:27*	*5*
2-Fluorophenol (Surr)	*35*		*10 - 120*	*05/09/23 08:16*	*05/10/23 01:27*	*5*
2-Fluorobiphenyl (Surr)	*68*		*44 - 120*	*05/09/23 08:16*	*05/10/23 01:27*	*5*
2,4,6-Tribromophenol (Surr)	*61*		*13 - 138*	*05/09/23 08:16*	*05/10/23 01:27*	*5*
p-Terphenyl-d14 (Surr)	*56*		*30 - 125*	*05/09/23 08:16*	*05/10/23 01:27*	*5*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**20000**	**B**	5000	680	ug/L		05/08/23 07:32	05/09/23 13:48	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*24*	*S1-*	*52 - 121*	*05/08/23 07:32*	*05/09/23 13:48*	*10*

Method: SW846 6010D - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.0041**	**J B**	0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 20:49	1
Barium	**0.044**	**J**	0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 20:49	1

Client Sample ID: WC-TF5-514E
Date Collected: 05/06/23 13:00
Date Received: 05/07/23 18:52

Lab Sample ID: 240-184875-23
Matrix: Water

Method: SW846 6010D - Metals (ICP) - TCLP (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 20:49	1
Chromium	**0.0011**	**J**	0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 20:49	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 20:49	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 20:49	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 20:49	1

Method: SW846 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:58	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**				Degrees F			05/10/23 20:47	1
Total Suspended Solids (SM 2540D-2015)	**18000**		57	5.7	mg/L			05/11/23 10:50	1
Total Organic Carbon (SM 5310 C-2014)	**26**		5.0	1.7	mg/L			05/10/23 17:01	5
corrosivity by pH (SW846 9040C)	**7.3**	**HF**	0.1	0.1	SU			05/08/23 20:53	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-25

Date Collected: 05/06/23 00:00
Date Received: 05/07/23 18:52

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 17:11	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 17:11	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 17:11	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 17:11	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 17:11	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 17:11	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 17:11	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 17:11	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 17:11	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 17:11	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 17:11	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 17:11	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 17:11	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 17:11	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/09/23 17:11	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 17:11	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 17:11	1
Acetone	ND		0.010	0.0054	mg/L			05/09/23 17:11	1
Benzene	ND		0.0010	0.00042	mg/L			05/09/23 17:11	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 17:11	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 17:11	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 17:11	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 17:11	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 17:11	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 17:11	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 17:11	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 17:11	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 17:11	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 17:11	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 17:11	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 17:11	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 17:11	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 17:11	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 17:11	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 17:11	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 17:11	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 17:11	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 17:11	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 17:11	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 17:11	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 17:11	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 17:11	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 17:11	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 17:11	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 17:11	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 17:11	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/09/23 17:11	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 17:11	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/09/23 17:11	1

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-25

Date Collected: 05/06/23 00:00

Matrix: Water

Date Received: 05/07/23 18:52

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 17:11	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 17:11	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*93*		*78 - 122*		*05/09/23 17:11*	*1*
Dibromofluoromethane (Surr)	*103*		*73 - 120*		*05/09/23 17:11*	*1*
4-Bromofluorobenzene (Surr)	*90*		*56 - 136*		*05/09/23 17:11*	*1*
1,2-Dichloroethane-d4 (Surr)	*103*		*62 - 137*		*05/09/23 17:11*	*1*

Surrogate Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8260D - Volatile Organic Compounds by GC/MS

Matrix: Water

Prep Type: Total/NA

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	DCA
Lab Sample ID	Client Sample ID	(78-122)	(73-120)	(56-136)	(62-137)
240-184875-1	WC-TF5-538F	103	112	101	112
240-184875-2	WC-TF5-514D	102	108	111	109
240-184875-2	WC-TF5-514D	98	108	103	105
240-184875-2 MS	WC-TF5-514D	99	87	102	87
240-184875-2 MSD	WC-TF5-514D	101	86	102	86
240-184875-3	TRIP BLANK	102	110	103	115
240-184875-4	WC-TF3-501F	103	112	100	111
240-184875-5	WC-TF3-251478	105	104	109	103
240-184875-5	WC-TF3-251478	96	99	97	98
240-184875-7	WC-TF3-AL4944	102	107	101	105
240-184875-8	FB-2-05072023	100	107	97	107
240-184875-9	TRIP BLANK	101	110	98	109
240-184875-10	WC-TF3-257761	101	109	103	108
240-184875-11	DUP-1	101	110	103	110
240-184875-12	TRIP BLANK	99	109	96	109
240-184875-13	FB-1-05062023	99	108	96	109
240-184875-14	TRIP BLANK	95	101	92	101
240-184875-15	WC-TF5-260119	98	105	104	103
240-184875-15	WC-TF5-260119	96	102	99	103
240-184875-16	WC-TF5-251320	99	103	102	102
240-184875-16	WC-TF5-251320	95	98	96	96
240-184875-17	TRIP BLANK	96	107	96	109
240-184875-18	WC-TF3-513A	111	115	111	113
240-184875-18	WC-TF3-513A	98	108	106	107
240-184875-18 MS	WC-TF3-513A	108	96	110	95
240-184875-18 MS	WC-TF3-513A	104	90	108	89
240-184875-18 MSD	WC-TF3-513A	106	94	110	94
240-184875-18 MSD	WC-TF3-513A	99	87	103	86
240-184875-19	TRIP BLANK	96	102	93	102
240-184875-20	WC-TF3-AL4787	96	100	97	99
240-184875-20	WC-TF3-AL4787	111	113	108	112
240-184875-21	WC-TF3-AL4216	94	99	98	99
240-184875-22	TRIP BLANK	96	102	95	104
240-184875-23	WC-TF5-514E	93	100	93	98
240-184875-23	WC-TF5-514E	99	104	96	105
240-184875-25	TRIP BLANK	93	103	90	103
LCS 240-572451/5	Lab Control Sample	113	100	114	101
LCS 240-572451/6	Lab Control Sample	101	97	108	99
LCS 240-572636/5	Lab Control Sample	103	90	105	94
LCS 240-572636/6	Lab Control Sample	94	90	102	92
LCS 240-572810/5	Lab Control Sample	116	103	119	104
LCS 240-572810/6	Lab Control Sample	107	102	115	104
MB 240-572451/8	Method Blank	102	107	98	108
MB 240-572636/8	Method Blank	95	100	92	100
MB 240-572810/8	Method Blank	110	113	107	113

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)

DCA = 1,2-Dichloroethane-d4 (Surr)

Method: 8270E - Semivolatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		PHL	NBZ	2FP	FBP	TBP	TPHd14
Lab Sample ID	Client Sample ID	(10-120)	(31-120)	(10-120)	(44-120)	(13-138)	(30-125)
240-184875-1 - DL	WC-TF5-538F	26	64	40	57	71	64
240-184875-1	WC-TF5-538F	28	67	41	58	76	69
240-184875-2	WC-TF5-514D	28	75	42	78	77	77
240-184875-2 - RA	WC-TF5-514D	32	86	47	73	88	80
240-184875-4	WC-TF3-501F	30	66	42	70	70	71
240-184875-5	WC-TF3-251478	30	80	45	80	69	92
240-184875-5 - RA	WC-TF3-251478	29	79	42	65	62	82
240-184875-7	WC-TF3-AL4944	26	67	38	60	54	70
240-184875-8	FB-2-05072023	27	75	44	67	86	70
240-184875-10	WC-TF3-257761	29	71	41	72	71	77
240-184875-11	DUP-1	26	72	39	70	68	76
240-184875-13	FB-1-05062023	27	59	37	68	61	84
240-184875-15	WC-TF5-260119	30	71	44	64	84	61
240-184875-16	WC-TF5-251320	26	64	34	70	68	59
240-184875-16 - RA	WC-TF5-251320	24	63	32	57	62	53
240-184875-18	WC-TF3-513A	20	52	26	44	43	31
240-184875-18 - RE	WC-TF3-513A	31	78	41	81	66	69
240-184875-18 MS - RE	WC-TF3-513A	34	76	46	79	78	66
240-184875-18 MS	WC-TF3-513A	23	74	30	48	31	24 S1-
240-184875-18 MSD - RE	WC-TF3-513A	29	74	40	73	66	54
240-184875-18 MSD	WC-TF3-513A	28	67	36	45	37	23 S1-
240-184875-20	WC-TF3-AL4787	25	72	36	77	63	69
240-184875-20 - RA	WC-TF3-AL4787	23	71	33	62	58	61
240-184875-21	WC-TF3-AL4216	29	72	43	81	75	72
240-184875-21 - RA	WC-TF3-AL4216	33	81	49	75	90	74
240-184875-23	WC-TF5-514E	26	54	35	68	61	56
LCS 410-373607/2-A	Lab Control Sample	43	75	60	91	85	97
LCS 410-373607/2-A - RA	Lab Control Sample	51	85	68	84	107	102
LCS 410-374570/2-A	Lab Control Sample	37	71	54	64	87	83
MB 410-373607/1-A	Method Blank	36	77	52	83	85	103
MB 410-373607/1-A - RA	Method Blank	44	85	62	75	97	102
MB 410-374570/1-A	Method Blank	32	66	49	55	75	71

Surrogate Legend

PHL = Phenol-d5 (Surr)
NBZ = Nitrobenzene-d5 (Surr)
2FP = 2-Fluorophenol (Surr)
FBP = 2-Fluorobiphenyl (Surr)
TBP = 2,4,6-Tribromophenol (Surr)
TPHd14 = p-Terphenyl-d14 (Surr)

Method: 8015D - Diesel Range Organics (DRO) (GC)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH
Lab Sample ID	Client Sample ID	(52-121)
240-184875-1	WC-TF5-538F	90
240-184875-2	WC-TF5-514D	81

Method: 8015D - Diesel Range Organics (DRO) (GC) (Continued)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH
Lab Sample ID	Client Sample ID	(52-121)
240-184875-4	WC-TF3-501F	78
240-184875-5	WC-TF3-251478	54
240-184875-7	WC-TF3-AL4944	55
240-184875-8	FB-2-05072023	87
240-184875-10	WC-TF3-257761	86
240-184875-11	DUP-1	72
240-184875-13	FB-1-05062023	89
240-184875-15	WC-TF5-260119	70
240-184875-16	WC-TF5-251320	54
240-184875-18	WC-TF3-513A	42 S1-
240-184875-18 MS	WC-TF3-513A	83
240-184875-18 MSD	WC-TF3-513A	50 S1-
240-184875-20	WC-TF3-AL4787	63
240-184875-21	WC-TF3-AL4216	71
240-184875-23	WC-TF5-514E	24 S1-
LCS 240-572386/2-A	Lab Control Sample	94
LCS 240-572792/12-A	Lab Control Sample	94
MB 240-572386/1-A	Method Blank	99
MB 240-572792/1-A	Method Blank	89

Surrogate Legend

OTPH = o-Terphenyl

QC Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8260D - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 240-572451/8
Matrix: Water
Analysis Batch: 572451

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 13:25	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/08/23 13:25	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/08/23 13:25	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/08/23 13:25	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/08/23 13:25	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/08/23 13:25	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/08/23 13:25	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/08/23 13:25	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/08/23 13:25	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/08/23 13:25	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/08/23 13:25	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/08/23 13:25	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/08/23 13:25	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/08/23 13:25	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/08/23 13:25	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/08/23 13:25	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/08/23 13:25	1
Acetone	ND		0.010	0.0054	mg/L			05/08/23 13:25	1
Benzene	ND		0.0010	0.00042	mg/L			05/08/23 13:25	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/08/23 13:25	1
Bromoform	ND		0.0010	0.00076	mg/L			05/08/23 13:25	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/08/23 13:25	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/08/23 13:25	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/08/23 13:25	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/08/23 13:25	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/08/23 13:25	1
Chloroform	ND		0.0010	0.00047	mg/L			05/08/23 13:25	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/08/23 13:25	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/08/23 13:25	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/08/23 13:25	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/08/23 13:25	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/08/23 13:25	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/08/23 13:25	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/08/23 13:25	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/08/23 13:25	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/08/23 13:25	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/08/23 13:25	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/08/23 13:25	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/08/23 13:25	1
Styrene	ND		0.0010	0.00045	mg/L			05/08/23 13:25	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/08/23 13:25	1
Toluene	ND		0.0010	0.00044	mg/L			05/08/23 13:25	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/08/23 13:25	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/08/23 13:25	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/08/23 13:25	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/08/23 13:25	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/08/23 13:25	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/08/23 13:25	1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 240-572451/8
Matrix: Water
Analysis Batch: 572451

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl acrylate	ND		0.010	0.0023	mg/L			05/08/23 13:25	1
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/08/23 13:25	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/08/23 13:25	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*102*		*78 - 122*		*05/08/23 13:25*	*1*
Dibromofluoromethane (Surr)	*107*		*73 - 120*		*05/08/23 13:25*	*1*
4-Bromofluorobenzene (Surr)	*98*		*56 - 136*		*05/08/23 13:25*	*1*
1,2-Dichloroethane-d4 (Surr)	*108*		*62 - 137*		*05/08/23 13:25*	*1*

Lab Sample ID: LCS 240-572451/5
Matrix: Water
Analysis Batch: 572451

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	0.0250	0.0241		mg/L		97	64 - 131
1,1,2,2-Tetrachloroethane	0.0250	0.0266		mg/L		107	58 - 157
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0250	0.0248		mg/L		99	51 - 146
1,1,2-Trichloroethane	0.0250	0.0252		mg/L		101	70 - 138
1,1-Dichloroethane	0.0250	0.0239		mg/L		95	72 - 127
1,1-Dichloroethene	0.0250	0.0245		mg/L		98	63 - 134
1,2,4-Trichlorobenzene	0.0250	0.0266		mg/L		106	44 - 147
1,2-Dibromo-3-Chloropropane	0.0250	0.0236		mg/L		94	53 - 135
Ethylene Dibromide	0.0250	0.0250		mg/L		100	71 - 134
1,2-Dichlorobenzene	0.0250	0.0258		mg/L		103	78 - 120
1,2-Dichloroethane	0.0250	0.0218		mg/L		87	66 - 128
1,2-Dichloropropane	0.0250	0.0248		mg/L		99	75 - 133
1,3-Dichlorobenzene	0.0250	0.0262		mg/L		105	80 - 120
1,4-Dichlorobenzene	0.0250	0.0257		mg/L		103	80 - 120
2-Butanone (MEK)	0.0500	0.0481		mg/L		96	54 - 156
2-Hexanone	0.0500	0.0598		mg/L		120	43 - 167
4-Methyl-2-pentanone (MIBK)	0.0500	0.0537		mg/L		107	46 - 158
Acetone	0.0500	0.0508		mg/L		102	50 - 149
Benzene	0.0250	0.0249		mg/L		99	77 - 123
Dichlorobromomethane	0.0250	0.0227		mg/L		91	69 - 126
Bromoform	0.0250	0.0243		mg/L		97	57 - 129
Bromomethane	0.0125	0.0111		mg/L		89	36 - 142
Carbon disulfide	0.0250	0.0255		mg/L		102	43 - 140
Carbon tetrachloride	0.0250	0.0234		mg/L		94	55 - 137
Chlorobenzene	0.0250	0.0251		mg/L		100	80 - 121
Chloroethane	0.0125	0.0102		mg/L		81	38 - 152
Chloroform	0.0250	0.0234		mg/L		94	74 - 122
Chloromethane	0.0125	0.0132		mg/L		105	47 - 143
cis-1,2-Dichloroethene	0.0250	0.0230		mg/L		92	77 - 123
cis-1,3-Dichloropropene	0.0250	0.0243		mg/L		97	64 - 130
Cyclohexane	0.0250	0.0265		mg/L		106	58 - 146
Chlorodibromomethane	0.0250	0.0239		mg/L		96	70 - 124
Dichlorodifluoromethane	0.0125	0.0111		mg/L		89	34 - 153

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-572451/5
Matrix: Water
Analysis Batch: 572451

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Ethylbenzene	0.0250	0.0259		mg/L		104	80 - 121
Isopropylbenzene	0.0250	0.0284		mg/L		114	74 - 128
Methyl acetate	0.0500	0.0443		mg/L		89	42 - 169
Methyl tert-butyl ether	0.0250	0.0243		mg/L		97	65 - 126
Methylcyclohexane	0.0250	0.0272		mg/L		109	62 - 136
Methylene Chloride	0.0250	0.0256		mg/L		102	71 - 125
Styrene	0.0250	0.0280		mg/L		112	80 - 135
Tetrachloroethene	0.0250	0.0252		mg/L		101	76 - 123
Toluene	0.0250	0.0254		mg/L		102	80 - 123
trans-1,2-Dichloroethene	0.0250	0.0239		mg/L		95	75 - 124
trans-1,3-Dichloropropene	0.0250	0.0263		mg/L		105	57 - 129
Trichloroethene	0.0250	0.0232		mg/L		93	70 - 122
Trichlorofluoromethane	0.0125	0.0103		mg/L		82	30 - 170
Vinyl chloride	0.0125	0.0107		mg/L		85	60 - 144
Xylenes, Total	0.0500	0.0537		mg/L		107	80 - 121
m-Xylene & p-Xylene	0.0250	0.0272		mg/L		109	80 - 120
o-Xylene	0.0250	0.0265		mg/L		106	80 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*113*		*78 - 122*
Dibromofluoromethane (Surr)	*100*		*73 - 120*
4-Bromofluorobenzene (Surr)	*114*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*101*		*62 - 137*

Lab Sample ID: LCS 240-572451/6
Matrix: Water
Analysis Batch: 572451

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Butyl acrylate	0.0250	0.0277		mg/L		111	75 - 120
Methyl acrylate	0.0250	0.0266		mg/L		106	80 - 120
2-Ethylhexyl acrylate	0.0250	0.0300		mg/L		120	61 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*101*		*78 - 122*
Dibromofluoromethane (Surr)	*97*		*73 - 120*
4-Bromofluorobenzene (Surr)	*108*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*99*		*62 - 137*

Lab Sample ID: 240-184875-2 MS
Matrix: Water
Analysis Batch: 572451

Client Sample ID: WC-TF5-514D
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	ND		0.0833	0.0826		mg/L		99	60 - 130
1,1,2,2-Tetrachloroethane	ND		0.0833	0.0927		mg/L		111	54 - 145
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0833	0.0834		mg/L		100	41 - 147

QC Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 240-184875-2 MS
Matrix: Water
Analysis Batch: 572451

Client Sample ID: WC-TF5-514D
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,2-Trichloroethane	ND		0.0833	0.0841		mg/L		101	69 - 131
1,1-Dichloroethane	ND		0.0833	0.0827		mg/L		99	68 - 125
1,1-Dichloroethene	ND		0.0833	0.0840		mg/L		101	56 - 135
1,2,4-Trichlorobenzene	ND		0.0833	0.0916		mg/L		110	29 - 156
1,2-Dibromo-3-Chloropropane	ND		0.0833	0.0828		mg/L		99	41 - 129
Ethylene Dibromide	ND		0.0833	0.0849		mg/L		102	69 - 125
1,2-Dichlorobenzene	ND		0.0833	0.0859		mg/L		103	73 - 120
1,2-Dichloroethane	ND		0.0833	0.0772		mg/L		93	63 - 126
1,2-Dichloropropane	ND		0.0833	0.0887		mg/L		106	69 - 130
1,3-Dichlorobenzene	ND		0.0833	0.0879		mg/L		106	73 - 120
1,4-Dichlorobenzene	ND		0.0833	0.0876		mg/L		105	74 - 120
2-Butanone (MEK)	0.011	J	0.167	0.195		mg/L		111	40 - 151
2-Hexanone	ND		0.167	0.201		mg/L		121	35 - 156
4-Methyl-2-pentanone (MIBK)	ND		0.167	0.188		mg/L		113	31 - 153
Acetone	0.26		0.167	0.408		mg/L		91	33 - 149
Benzene	0.0018	J	0.0833	0.0882		mg/L		104	64 - 128
Dichlorobromomethane	ND		0.0833	0.0769		mg/L		92	62 - 125
Bromoform	ND		0.0833	0.0776		mg/L		93	47 - 125
Bromomethane	ND		0.0417	0.0373		mg/L		90	28 - 150
Carbon disulfide	ND		0.0833	0.0854		mg/L		102	38 - 140
Carbon tetrachloride	ND		0.0833	0.0798		mg/L		96	51 - 133
Chlorobenzene	ND		0.0833	0.0851		mg/L		102	74 - 121
Chloroethane	ND		0.0417	0.0346		mg/L		83	10 - 199
Chloroform	ND		0.0833	0.0798		mg/L		96	70 - 122
Chloromethane	ND		0.0417	0.0463		mg/L		111	32 - 149
cis-1,2-Dichloroethene	ND		0.0833	0.0815		mg/L		98	66 - 128
cis-1,3-Dichloropropene	ND		0.0833	0.0803		mg/L		96	47 - 125
Cyclohexane	ND		0.0833	0.0915		mg/L		110	42 - 147
Chlorodibromomethane	ND		0.0833	0.0782		mg/L		94	65 - 120
Dichlorodifluoromethane	ND		0.0417	0.0358		mg/L		86	38 - 139
Ethylbenzene	ND		0.0833	0.0884		mg/L		106	67 - 127
Isopropylbenzene	ND		0.0833	0.0908		mg/L		109	64 - 129
Methyl acetate	ND		0.167	0.159		mg/L		95	37 - 155
Methyl tert-butyl ether	ND		0.0833	0.0841		mg/L		101	47 - 134
Methylcyclohexane	ND		0.0833	0.0952		mg/L		114	39 - 144
Methylene Chloride	ND		0.0833	0.0869		mg/L		104	62 - 129
Styrene	ND		0.0833	0.0942		mg/L		113	70 - 139
Tetrachloroethene	ND		0.0833	0.0855		mg/L		103	62 - 131
Toluene	ND		0.0833	0.0837		mg/L		101	58 - 135
trans-1,2-Dichloroethene	ND		0.0833	0.0814		mg/L		98	56 - 136
trans-1,3-Dichloropropene	ND		0.0833	0.0863		mg/L		104	47 - 120
Trichloroethene	ND		0.0833	0.0773		mg/L		93	61 - 124
Trichlorofluoromethane	ND		0.0417	0.0351		mg/L		84	24 - 177
Vinyl chloride	0.065		0.0417	0.0936		mg/L		70	43 - 157
Xylenes, Total	ND		0.167	0.184		mg/L		111	71 - 123
m-Xylene & p-Xylene	ND		0.0833	0.0897		mg/L		108	71 - 123
o-Xylene	ND		0.0833	0.0945		mg/L		113	70 - 125
Butyl acrylate	ND	F1	0.0833	0.121	F1	mg/L		146	75 - 120
Methyl acrylate	ND		0.0833	0.0952		mg/L		114	80 - 120

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 240-184875-2 MS **Client Sample ID: WC-TF5-514D**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 572451

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
2-Ethylhexyl acrylate	0.036		0.0833	0.128		mg/L		110	61 - 120		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Toluene-d8 (Surr)	*99*		*78 - 122*
Dibromofluoromethane (Surr)	*87*		*73 - 120*
4-Bromofluorobenzene (Surr)	*102*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*87*		*62 - 137*

Lab Sample ID: 240-184875-2 MSD **Client Sample ID: WC-TF5-514D**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 572451

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,1,1-Trichloroethane	ND		0.0833	0.0810		mg/L		97	60 - 130	2	17
1,1,2,2-Tetrachloroethane	ND		0.0833	0.0892		mg/L		107	54 - 145	4	15
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0833	0.0781		mg/L		94	41 - 147	7	35
1,1,2-Trichloroethane	ND		0.0833	0.0830		mg/L		100	69 - 131	1	14
1,1-Dichloroethane	ND		0.0833	0.0817		mg/L		98	68 - 125	1	13
1,1-Dichloroethene	ND		0.0833	0.0823		mg/L		99	56 - 135	2	26
1,2,4-Trichlorobenzene	ND		0.0833	0.0867		mg/L		104	29 - 156	6	19
1,2-Dibromo-3-Chloropropane	ND		0.0833	0.0810		mg/L		97	41 - 129	2	22
Ethylene Dibromide	ND		0.0833	0.0826		mg/L		99	69 - 125	3	14
1,2-Dichlorobenzene	ND		0.0833	0.0819		mg/L		98	73 - 120	5	14
1,2-Dichloroethane	ND		0.0833	0.0745		mg/L		89	63 - 126	4	12
1,2-Dichloropropane	ND		0.0833	0.0847		mg/L		102	69 - 130	5	13
1,3-Dichlorobenzene	ND		0.0833	0.0843		mg/L		101	73 - 120	4	14
1,4-Dichlorobenzene	ND		0.0833	0.0822		mg/L		99	74 - 120	6	15
2-Butanone (MEK)	0.011	J	0.167	0.191		mg/L		108	40 - 151	2	20
2-Hexanone	ND		0.167	0.202		mg/L		121	35 - 156	0	17
4-Methyl-2-pentanone (MIBK)	ND		0.167	0.184		mg/L		111	31 - 153	2	15
Acetone	0.26		0.167	0.395		mg/L		84	33 - 149	3	34
Benzene	0.0018	J	0.0833	0.0853		mg/L		100	64 - 128	3	14
Dichlorobromomethane	ND		0.0833	0.0751		mg/L		90	62 - 125	2	13
Bromoform	ND		0.0833	0.0745		mg/L		89	47 - 125	4	15
Bromomethane	ND		0.0417	0.0396		mg/L		95	28 - 150	6	26
Carbon disulfide	ND		0.0833	0.0817		mg/L		98	38 - 140	4	23
Carbon tetrachloride	ND		0.0833	0.0752		mg/L		90	51 - 133	6	24
Chlorobenzene	ND		0.0833	0.0807		mg/L		97	74 - 121	5	14
Chloroethane	ND		0.0417	0.0347		mg/L		83	10 - 199	0	30
Chloroform	ND		0.0833	0.0769		mg/L		92	70 - 122	4	14
Chloromethane	ND		0.0417	0.0450		mg/L		108	32 - 149	3	27
cis-1,2-Dichloroethene	ND		0.0833	0.0785		mg/L		94	66 - 128	4	14
cis-1,3-Dichloropropene	ND		0.0833	0.0780		mg/L		94	47 - 125	3	13
Cyclohexane	ND		0.0833	0.0889		mg/L		107	42 - 147	3	35
Chlorodibromomethane	ND		0.0833	0.0773		mg/L		93	65 - 120	1	13
Dichlorodifluoromethane	ND		0.0417	0.0352		mg/L		84	38 - 139	2	35
Ethylbenzene	ND		0.0833	0.0831		mg/L		100	67 - 127	6	15
Isopropylbenzene	ND		0.0833	0.0885		mg/L		106	64 - 129	3	18

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 240-184875-2 MSD
Matrix: Water
Analysis Batch: 572451

Client Sample ID: WC-TF5-514D
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Methyl acetate	ND		0.167	0.155		mg/L		93	37 - 155	2	18
Methyl tert-butyl ether	ND		0.0833	0.0822		mg/L		99	47 - 134	2	16
Methylcyclohexane	ND		0.0833	0.0899		mg/L		108	39 - 144	6	35
Methylene Chloride	ND		0.0833	0.0842		mg/L		101	62 - 129	3	17
Styrene	ND		0.0833	0.0904		mg/L		108	70 - 139	4	18
Tetrachloroethene	ND		0.0833	0.0825		mg/L		99	62 - 131	4	20
Toluene	ND		0.0833	0.0825		mg/L		99	58 - 135	1	14
trans-1,2-Dichloroethene	ND		0.0833	0.0788		mg/L		95	56 - 136	3	15
trans-1,3-Dichloropropene	ND		0.0833	0.0858		mg/L		103	47 - 120	1	14
Trichloroethene	ND		0.0833	0.0763		mg/L		92	61 - 124	1	15
Trichlorofluoromethane	ND		0.0417	0.0339		mg/L		81	24 - 177	3	34
Vinyl chloride	0.065		0.0417	0.0890		mg/L		59	43 - 157	5	24
Xylenes, Total	ND		0.167	0.179		mg/L		107	71 - 123	3	15
m-Xylene & p-Xylene	ND		0.0833	0.0865		mg/L		104	71 - 123	4	16
o-Xylene	ND		0.0833	0.0923		mg/L		111	70 - 125	2	15
Butyl acrylate	ND	F1	0.0833	0.119	F1	mg/L		143	75 - 120	2	35
Methyl acrylate	ND		0.0833	0.0931		mg/L		112	80 - 120	2	35
2-Ethylhexyl acrylate	0.036		0.0833	0.123		mg/L		104	61 - 120	4	35

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*101*		*78 - 122*
Dibromofluoromethane (Surr)	*86*		*73 - 120*
4-Bromofluorobenzene (Surr)	*102*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*86*		*62 - 137*

Lab Sample ID: MB 240-572636/8
Matrix: Water
Analysis Batch: 572636

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 15:35	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/09/23 15:35	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/09/23 15:35	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/09/23 15:35	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/09/23 15:35	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/09/23 15:35	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/09/23 15:35	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/09/23 15:35	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/09/23 15:35	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/09/23 15:35	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/09/23 15:35	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/09/23 15:35	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/09/23 15:35	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/09/23 15:35	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/09/23 15:35	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/09/23 15:35	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/09/23 15:35	1
Acetone	ND		0.010	0.0054	mg/L			05/09/23 15:35	1

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

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 240-572636/8
Client Sample ID: Method Blank
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 572636

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	ND		0.0010	0.00042	mg/L			05/09/23 15:35	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/09/23 15:35	1
Bromoform	ND		0.0010	0.00076	mg/L			05/09/23 15:35	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/09/23 15:35	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/09/23 15:35	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/09/23 15:35	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/09/23 15:35	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/09/23 15:35	1
Chloroform	ND		0.0010	0.00047	mg/L			05/09/23 15:35	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/09/23 15:35	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/09/23 15:35	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/09/23 15:35	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/09/23 15:35	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/09/23 15:35	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/09/23 15:35	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/09/23 15:35	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/09/23 15:35	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/09/23 15:35	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/09/23 15:35	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/09/23 15:35	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/09/23 15:35	1
Styrene	ND		0.0010	0.00045	mg/L			05/09/23 15:35	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/09/23 15:35	1
Toluene	ND		0.0010	0.00044	mg/L			05/09/23 15:35	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/09/23 15:35	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/09/23 15:35	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/09/23 15:35	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/09/23 15:35	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/09/23 15:35	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/09/23 15:35	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/09/23 15:35	1
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/09/23 15:35	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/09/23 15:35	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*95*		*78 - 122*		*05/09/23 15:35*	*1*
Dibromofluoromethane (Surr)	*100*		*73 - 120*		*05/09/23 15:35*	*1*
4-Bromofluorobenzene (Surr)	*92*		*56 - 136*		*05/09/23 15:35*	*1*
1,2-Dichloroethane-d4 (Surr)	*100*		*62 - 137*		*05/09/23 15:35*	*1*

Lab Sample ID: LCS 240-572636/5
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 572636

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	0.0250	0.0244		mg/L		98	64 - 131
1,1,2,2-Tetrachloroethane	0.0250	0.0271		mg/L		108	58 - 157
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0250	0.0234		mg/L		94	51 - 146

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-572636/5
Matrix: Water
Analysis Batch: 572636

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,2-Trichloroethane	0.0250	0.0251		mg/L		100	70 - 138
1,1-Dichloroethane	0.0250	0.0241		mg/L		96	72 - 127
1,1-Dichloroethene	0.0250	0.0243		mg/L		97	63 - 134
1,2,4-Trichlorobenzene	0.0250	0.0265		mg/L		106	44 - 147
1,2-Dibromo-3-Chloropropane	0.0250	0.0234		mg/L		94	53 - 135
Ethylene Dibromide	0.0250	0.0256		mg/L		102	71 - 134
1,2-Dichlorobenzene	0.0250	0.0257		mg/L		103	78 - 120
1,2-Dichloroethane	0.0250	0.0225		mg/L		90	66 - 128
1,2-Dichloropropane	0.0250	0.0257		mg/L		103	75 - 133
1,3-Dichlorobenzene	0.0250	0.0261		mg/L		105	80 - 120
1,4-Dichlorobenzene	0.0250	0.0257		mg/L		103	80 - 120
2-Butanone (MEK)	0.0500	0.0488		mg/L		98	54 - 156
2-Hexanone	0.0500	0.0617		mg/L		123	43 - 167
4-Methyl-2-pentanone (MIBK)	0.0500	0.0557		mg/L		111	46 - 158
Acetone	0.0500	0.0508		mg/L		102	50 - 149
Benzene	0.0250	0.0251		mg/L		101	77 - 123
Dichlorobromomethane	0.0250	0.0233		mg/L		93	69 - 126
Bromoform	0.0250	0.0241		mg/L		96	57 - 129
Bromomethane	0.0125	0.0123		mg/L		98	36 - 142
Carbon disulfide	0.0250	0.0252		mg/L		101	43 - 140
Carbon tetrachloride	0.0250	0.0233		mg/L		93	55 - 137
Chlorobenzene	0.0250	0.0255		mg/L		102	80 - 121
Chloroethane	0.0125	0.0113		mg/L		90	38 - 152
Chloroform	0.0250	0.0232		mg/L		93	74 - 122
Chloromethane	0.0125	0.0148		mg/L		118	47 - 143
cis-1,2-Dichloroethene	0.0250	0.0234		mg/L		94	77 - 123
cis-1,3-Dichloropropene	0.0250	0.0249		mg/L		99	64 - 130
Cyclohexane	0.0250	0.0253		mg/L		101	58 - 146
Chlorodibromomethane	0.0250	0.0240		mg/L		96	70 - 124
Dichlorodifluoromethane	0.0125	0.0128		mg/L		102	34 - 153
Ethylbenzene	0.0250	0.0263		mg/L		105	80 - 121
Isopropylbenzene	0.0250	0.0285		mg/L		114	74 - 128
Methyl acetate	0.0500	0.0454		mg/L		91	42 - 169
Methyl tert-butyl ether	0.0250	0.0251		mg/L		101	65 - 126
Methylcyclohexane	0.0250	0.0262		mg/L		105	62 - 136
Methylene Chloride	0.0250	0.0255		mg/L		102	71 - 125
Styrene	0.0250	0.0285		mg/L		114	80 - 135
Tetrachloroethene	0.0250	0.0251		mg/L		100	76 - 123
Toluene	0.0250	0.0256		mg/L		102	80 - 123
trans-1,2-Dichloroethene	0.0250	0.0236		mg/L		94	75 - 124
trans-1,3-Dichloropropene	0.0250	0.0271		mg/L		108	57 - 129
Trichloroethene	0.0250	0.0232		mg/L		93	70 - 122
Trichlorofluoromethane	0.0125	0.0112		mg/L		90	30 - 170
Vinyl chloride	0.0125	0.0117		mg/L		94	60 - 144
Xylenes, Total	0.0500	0.0540		mg/L		108	80 - 121
m-Xylene & p-Xylene	0.0250	0.0273		mg/L		109	80 - 120
o-Xylene	0.0250	0.0267		mg/L		107	80 - 123

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-572636/5
Matrix: Water
Analysis Batch: 572636

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Toluene-d8 (Surr)	*103*		*78 - 122*
Dibromofluoromethane (Surr)	*90*		*73 - 120*
4-Bromofluorobenzene (Surr)	*105*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*94*		*62 - 137*

Lab Sample ID: LCS 240-572636/6
Matrix: Water
Analysis Batch: 572636

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Butyl acrylate	0.0250	0.0280		mg/L		112	75 - 120
Methyl acrylate	0.0250	0.0266		mg/L		106	80 - 120
2-Ethylhexyl acrylate	0.0250	0.0293		mg/L		117	61 - 120

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Toluene-d8 (Surr)	*94*		*78 - 122*
Dibromofluoromethane (Surr)	*90*		*73 - 120*
4-Bromofluorobenzene (Surr)	*102*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*92*		*62 - 137*

Lab Sample ID: MB 240-572810/8
Matrix: Water
Analysis Batch: 572810

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			05/10/23 16:49	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			05/10/23 16:49	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			05/10/23 16:49	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			05/10/23 16:49	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			05/10/23 16:49	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			05/10/23 16:49	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			05/10/23 16:49	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			05/10/23 16:49	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			05/10/23 16:49	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			05/10/23 16:49	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			05/10/23 16:49	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			05/10/23 16:49	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			05/10/23 16:49	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			05/10/23 16:49	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			05/10/23 16:49	1
2-Hexanone	ND		0.010	0.0011	mg/L			05/10/23 16:49	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			05/10/23 16:49	1
Acetone	ND		0.010	0.0054	mg/L			05/10/23 16:49	1
Benzene	ND		0.0010	0.00042	mg/L			05/10/23 16:49	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			05/10/23 16:49	1
Bromoform	ND		0.0010	0.00076	mg/L			05/10/23 16:49	1
Bromomethane	ND		0.0010	0.00042	mg/L			05/10/23 16:49	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			05/10/23 16:49	1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 240-572810/8
Client Sample ID: Method Blank
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 572810

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			05/10/23 16:49	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			05/10/23 16:49	1
Chloroethane	ND		0.0010	0.00083	mg/L			05/10/23 16:49	1
Chloroform	ND		0.0010	0.00047	mg/L			05/10/23 16:49	1
Chloromethane	ND		0.0010	0.00063	mg/L			05/10/23 16:49	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			05/10/23 16:49	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			05/10/23 16:49	1
Cyclohexane	ND		0.0010	0.00048	mg/L			05/10/23 16:49	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			05/10/23 16:49	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			05/10/23 16:49	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			05/10/23 16:49	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			05/10/23 16:49	1
Methyl acetate	ND		0.010	0.0017	mg/L			05/10/23 16:49	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			05/10/23 16:49	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			05/10/23 16:49	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			05/10/23 16:49	1
Styrene	ND		0.0010	0.00045	mg/L			05/10/23 16:49	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			05/10/23 16:49	1
Toluene	ND		0.0010	0.00044	mg/L			05/10/23 16:49	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			05/10/23 16:49	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			05/10/23 16:49	1
Trichloroethene	ND		0.0010	0.00044	mg/L			05/10/23 16:49	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			05/10/23 16:49	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			05/10/23 16:49	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			05/10/23 16:49	1
Butyl acrylate	ND		0.010	0.0023	mg/L			05/10/23 16:49	1
Methyl acrylate	ND		0.0020	0.00062	mg/L			05/10/23 16:49	1
2-Ethylhexyl acrylate	ND		0.010	0.0033	mg/L			05/10/23 16:49	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*110*		*78 - 122*		*05/10/23 16:49*	*1*
Dibromofluoromethane (Surr)	*113*		*73 - 120*		*05/10/23 16:49*	*1*
4-Bromofluorobenzene (Surr)	*107*		*56 - 136*		*05/10/23 16:49*	*1*
1,2-Dichloroethane-d4 (Surr)	*113*		*62 - 137*		*05/10/23 16:49*	*1*

Lab Sample ID: LCS 240-572810/5
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 572810

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	0.0250	0.0237		mg/L		95	64 - 131
1,1,2,2-Tetrachloroethane	0.0250	0.0266		mg/L		106	58 - 157
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0250	0.0238		mg/L		95	51 - 146
1,1,2-Trichloroethane	0.0250	0.0253		mg/L		101	70 - 138
1,1-Dichloroethane	0.0250	0.0238		mg/L		95	72 - 127
1,1-Dichloroethene	0.0250	0.0239		mg/L		96	63 - 134
1,2,4-Trichlorobenzene	0.0250	0.0258		mg/L		103	44 - 147
1,2-Dibromo-3-Chloropropane	0.0250	0.0236		mg/L		95	53 - 135

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-572810/5
Matrix: Water
Analysis Batch: 572810

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Ethylene Dibromide	0.0250	0.0249		mg/L		100	71 - 134
1,2-Dichlorobenzene	0.0250	0.0251		mg/L		100	78 - 120
1,2-Dichloroethane	0.0250	0.0220		mg/L		88	66 - 128
1,2-Dichloropropane	0.0250	0.0248		mg/L		99	75 - 133
1,3-Dichlorobenzene	0.0250	0.0260		mg/L		104	80 - 120
1,4-Dichlorobenzene	0.0250	0.0253		mg/L		101	80 - 120
2-Butanone (MEK)	0.0500	0.0495		mg/L		99	54 - 156
2-Hexanone	0.0500	0.0618		mg/L		124	43 - 167
4-Methyl-2-pentanone (MIBK)	0.0500	0.0550		mg/L		110	46 - 158
Acetone	0.0500	0.0511		mg/L		102	50 - 149
Benzene	0.0250	0.0246		mg/L		98	77 - 123
Dichlorobromomethane	0.0250	0.0224		mg/L		90	69 - 126
Bromoform	0.0250	0.0242		mg/L		97	57 - 129
Bromomethane	0.0125	0.0115		mg/L		92	36 - 142
Carbon disulfide	0.0250	0.0244		mg/L		98	43 - 140
Carbon tetrachloride	0.0250	0.0229		mg/L		91	55 - 137
Chlorobenzene	0.0250	0.0248		mg/L		99	80 - 121
Chloroethane	0.0125	0.0109		mg/L		88	38 - 152
Chloroform	0.0250	0.0230		mg/L		92	74 - 122
Chloromethane	0.0125	0.0140		mg/L		112	47 - 143
cis-1,2-Dichloroethene	0.0250	0.0228		mg/L		91	77 - 123
cis-1,3-Dichloropropene	0.0250	0.0244		mg/L		98	64 - 130
Cyclohexane	0.0250	0.0259		mg/L		104	58 - 146
Chlorodibromomethane	0.0250	0.0235		mg/L		94	70 - 124
Dichlorodifluoromethane	0.0125	0.0121		mg/L		97	34 - 153
Ethylbenzene	0.0250	0.0258		mg/L		103	80 - 121
Isopropylbenzene	0.0250	0.0279		mg/L		112	74 - 128
Methyl acetate	0.0500	0.0450		mg/L		90	42 - 169
Methyl tert-butyl ether	0.0250	0.0248		mg/L		99	65 - 126
Methylcyclohexane	0.0250	0.0264		mg/L		106	62 - 136
Methylene Chloride	0.0250	0.0253		mg/L		101	71 - 125
Styrene	0.0250	0.0276		mg/L		110	80 - 135
Tetrachloroethene	0.0250	0.0245		mg/L		98	76 - 123
Toluene	0.0250	0.0253		mg/L		101	80 - 123
trans-1,2-Dichloroethene	0.0250	0.0233		mg/L		93	75 - 124
trans-1,3-Dichloropropene	0.0250	0.0264		mg/L		106	57 - 129
Trichloroethene	0.0250	0.0233		mg/L		93	70 - 122
Trichlorofluoromethane	0.0125	0.0109		mg/L		87	30 - 170
Vinyl chloride	0.0125	0.0113		mg/L		90	60 - 144
Xylenes, Total	0.0500	0.0534		mg/L		107	80 - 121
m-Xylene & p-Xylene	0.0250	0.0268		mg/L		107	80 - 120
o-Xylene	0.0250	0.0266		mg/L		106	80 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*116*		*78 - 122*
Dibromofluoromethane (Surr)	*103*		*73 - 120*
4-Bromofluorobenzene (Surr)	*119*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*104*		*62 - 137*

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

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-572810/6
Matrix: Water
Analysis Batch: 572810

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Butyl acrylate	0.0250	0.0278		mg/L		111	75 - 120
Methyl acrylate	0.0250	0.0261		mg/L		105	80 - 120
2-Ethylhexyl acrylate	0.0250	0.0295		mg/L		118	61 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*107*		*78 - 122*
Dibromofluoromethane (Surr)	*102*		*73 - 120*
4-Bromofluorobenzene (Surr)	*115*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*104*		*62 - 137*

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Acetone	0.43		0.250	0.647	E	mg/L		85	33 - 149

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Toluene-d8 (Surr)	*108*		*78 - 122*
Dibromofluoromethane (Surr)	*96*		*73 - 120*
4-Bromofluorobenzene (Surr)	*110*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*95*		*62 - 137*

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	ND		0.0250	0.0223		mg/L		89	60 - 130
1,1,2,2-Tetrachloroethane	ND		0.0250	0.0250		mg/L		100	54 - 145
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0250	0.0217		mg/L		87	41 - 147
1,1,2-Trichloroethane	ND		0.0250	0.0234		mg/L		94	69 - 131
1,1-Dichloroethane	ND		0.0250	0.0229		mg/L		91	68 - 125
1,1-Dichloroethene	ND		0.0250	0.0222		mg/L		89	56 - 135
1,2,4-Trichlorobenzene	ND		0.0250	0.0204		mg/L		82	29 - 156
1,2-Dibromo-3-Chloropropane	ND		0.0250	0.0229		mg/L		92	41 - 129
Ethylene Dibromide	ND		0.0250	0.0226		mg/L		91	69 - 125
1,2-Dichlorobenzene	ND		0.0250	0.0212		mg/L		85	73 - 120
1,2-Dichloroethane	ND		0.0250	0.0208		mg/L		83	63 - 126
1,2-Dichloropropane	ND		0.0250	0.0243		mg/L		97	69 - 130
1,3-Dichlorobenzene	ND		0.0250	0.0209		mg/L		84	73 - 120
1,4-Dichlorobenzene	ND		0.0250	0.0210		mg/L		84	74 - 120
2-Butanone (MEK)	0.0092	J	0.0500	0.0571		mg/L		96	40 - 151
2-Hexanone	ND		0.0500	0.0581		mg/L		116	35 - 156
4-Methyl-2-pentanone (MIBK)	0.0017	J	0.0500	0.0550		mg/L		107	31 - 153
Benzene	0.0011		0.0250	0.0240		mg/L		92	64 - 128
Dichlorobromomethane	ND		0.0250	0.0209		mg/L		84	62 - 125

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Bromoform	ND		0.0250	0.0208		mg/L		83	47 - 125
Bromomethane	ND		0.0125	0.00964		mg/L		77	28 - 150
Carbon disulfide	ND		0.0250	0.0201		mg/L		80	38 - 140
Carbon tetrachloride	ND		0.0250	0.0206		mg/L		83	51 - 133
Chlorobenzene	ND		0.0250	0.0218		mg/L		87	74 - 121
Chloroethane	ND		0.0125	0.0104		mg/L		84	10 - 199
Chloroform	ND		0.0250	0.0219		mg/L		88	70 - 122
Chloromethane	ND		0.0125	0.0140		mg/L		112	32 - 149
cis-1,2-Dichloroethene	ND		0.0250	0.0210		mg/L		84	66 - 128
cis-1,3-Dichloropropene	ND		0.0250	0.0216		mg/L		86	47 - 125
Cyclohexane	ND		0.0250	0.0228		mg/L		91	42 - 147
Chlorodibromomethane	ND		0.0250	0.0216		mg/L		86	65 - 120
Dichlorodifluoromethane	ND		0.0125	0.0115		mg/L		92	38 - 139
Ethylbenzene	ND		0.0250	0.0225		mg/L		90	67 - 127
Isopropylbenzene	ND		0.0250	0.0219		mg/L		88	64 - 129
Methyl acetate	ND		0.0500	0.0499		mg/L		100	37 - 155
Methyl tert-butyl ether	ND		0.0250	0.0239		mg/L		95	47 - 134
Methylcyclohexane	ND		0.0250	0.0199		mg/L		80	39 - 144
Methylene Chloride	ND		0.0250	0.0231		mg/L		92	62 - 129
Styrene	ND		0.0250	0.0238		mg/L		95	70 - 139
Tetrachloroethene	ND		0.0250	0.0215		mg/L		86	62 - 131
Toluene	ND		0.0250	0.0226		mg/L		90	58 - 135
trans-1,2-Dichloroethene	ND		0.0250	0.0204		mg/L		81	56 - 136
trans-1,3-Dichloropropene	ND		0.0250	0.0227		mg/L		91	47 - 120
Trichloroethene	ND		0.0250	0.0199		mg/L		79	61 - 124
Trichlorofluoromethane	ND		0.0125	0.0104		mg/L		83	24 - 177
Vinyl chloride	0.027	F1 F2	0.0125	0.0226	F1	mg/L		-34	43 - 157
Xylenes, Total	ND		0.0500	0.0464		mg/L		93	71 - 123
m-Xylene & p-Xylene	ND		0.0250	0.0225		mg/L		90	71 - 123
o-Xylene	ND		0.0250	0.0239		mg/L		95	70 - 125
Butyl acrylate	ND	F1	0.0250	0.0282		mg/L		113	75 - 120
Methyl acrylate	ND		0.0250	0.0272		mg/L		109	80 - 120
2-Ethylhexyl acrylate	0.0066	J	0.0250	0.0254		mg/L		75	61 - 120

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Toluene-d8 (Surr)	*104*		*78 - 122*
Dibromofluoromethane (Surr)	*90*		*73 - 120*
4-Bromofluorobenzene (Surr)	*108*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*89*		*62 - 137*

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Acetone	0.43		0.250	0.667	E	mg/L		94	33 - 149	3	34

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Surrogate	MSD %Recovery	MSD Qualifier	Limits
Toluene-d8 (Surr)	*106*		*78 - 122*
Dibromofluoromethane (Surr)	*94*		*73 - 120*
4-Bromofluorobenzene (Surr)	*110*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*94*		*62 - 137*

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,1,1-Trichloroethane	ND		0.0250	0.0230		mg/L		92	60 - 130	3	17
1,1,2,2-Tetrachloroethane	ND		0.0250	0.0249		mg/L		100	54 - 145	0	15
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0250	0.0227		mg/L		91	41 - 147	4	35
1,1,2-Trichloroethane	ND		0.0250	0.0230		mg/L		92	69 - 131	2	14
1,1-Dichloroethane	ND		0.0250	0.0236		mg/L		94	68 - 125	3	13
1,1-Dichloroethene	ND		0.0250	0.0236		mg/L		95	56 - 135	6	26
1,2,4-Trichlorobenzene	ND		0.0250	0.0177		mg/L		71	29 - 156	14	19
1,2-Dibromo-3-Chloropropane	ND		0.0250	0.0233		mg/L		93	41 - 129	2	22
Ethylene Dibromide	ND		0.0250	0.0229		mg/L		92	69 - 125	1	14
1,2-Dichlorobenzene	ND		0.0250	0.0213		mg/L		85	73 - 120	1	14
1,2-Dichloroethane	ND		0.0250	0.0212		mg/L		85	63 - 126	2	12
1,2-Dichloropropane	ND		0.0250	0.0239		mg/L		96	69 - 130	2	13
1,3-Dichlorobenzene	ND		0.0250	0.0212		mg/L		85	73 - 120	2	14
1,4-Dichlorobenzene	ND		0.0250	0.0211		mg/L		84	74 - 120	1	15
2-Butanone (MEK)	0.0092	J	0.0500	0.0602		mg/L		102	40 - 151	5	20
2-Hexanone	ND		0.0500	0.0564		mg/L		113	35 - 156	3	17
4-Methyl-2-pentanone (MIBK)	0.0017	J	0.0500	0.0537		mg/L		104	31 - 153	2	15
Benzene	0.0011		0.0250	0.0245		mg/L		94	64 - 128	2	14
Dichlorobromomethane	ND		0.0250	0.0215		mg/L		86	62 - 125	3	13
Bromoform	ND		0.0250	0.0212		mg/L		85	47 - 125	2	15
Bromomethane	ND		0.0125	0.0104		mg/L		83	28 - 150	8	26
Carbon disulfide	ND		0.0250	0.0228		mg/L		91	38 - 140	12	23
Carbon tetrachloride	ND		0.0250	0.0213		mg/L		85	51 - 133	3	24
Chlorobenzene	ND		0.0250	0.0226		mg/L		90	74 - 121	4	14
Chloroethane	ND		0.0125	0.0110		mg/L		88	10 - 199	5	30
Chloroform	ND		0.0250	0.0220		mg/L		88	70 - 122	0	14
Chloromethane	ND		0.0125	0.0140		mg/L		112	32 - 149	0	27
cis-1,2-Dichloroethene	ND		0.0250	0.0223		mg/L		89	66 - 128	6	14
cis-1,3-Dichloropropene	ND		0.0250	0.0220		mg/L		88	47 - 125	2	13
Cyclohexane	ND		0.0250	0.0225		mg/L		90	42 - 147	1	35
Chlorodibromomethane	ND		0.0250	0.0215		mg/L		86	65 - 120	0	13
Dichlorodifluoromethane	ND		0.0125	0.0121		mg/L		96	38 - 139	4	35
Ethylbenzene	ND		0.0250	0.0228		mg/L		91	67 - 127	2	15
Isopropylbenzene	ND		0.0250	0.0218		mg/L		87	64 - 129	0	18
Methyl acetate	ND		0.0500	0.0453		mg/L		91	37 - 155	10	18
Methyl tert-butyl ether	ND		0.0250	0.0234		mg/L		94	47 - 134	2	16
Methylcyclohexane	ND		0.0250	0.0166		mg/L		66	39 - 144	19	35
Methylene Chloride	ND		0.0250	0.0235		mg/L		94	62 - 129	2	17

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 572810

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Styrene	ND		0.0250	0.0246		mg/L		98	70 - 139	3	18
Tetrachloroethene	ND		0.0250	0.0214		mg/L		85	62 - 131	1	20
Toluene	ND		0.0250	0.0228		mg/L		91	58 - 135	1	14
trans-1,2-Dichloroethene	ND		0.0250	0.0223		mg/L		89	56 - 136	9	15
trans-1,3-Dichloropropene	ND		0.0250	0.0235		mg/L		94	47 - 120	3	14
Trichloroethene	ND		0.0250	0.0214		mg/L		85	61 - 124	7	15
Trichlorofluoromethane	ND		0.0125	0.0105		mg/L		84	24 - 177	2	34
Vinyl chloride	0.027	F1 F2	0.0125	0.0332	F2	mg/L		51	43 - 157	38	24
Xylenes, Total	ND		0.0500	0.0478		mg/L		96	71 - 123	3	15
m-Xylene & p-Xylene	ND		0.0250	0.0231		mg/L		92	71 - 123	3	16
o-Xylene	ND		0.0250	0.0247		mg/L		99	70 - 125	3	15
Butyl acrylate	ND	F1	0.0250	0.0317	F1	mg/L		127	75 - 120	11	35
Methyl acrylate	ND		0.0250	0.0260		mg/L		104	80 - 120	5	35
2-Ethylhexyl acrylate	0.0066	J	0.0250	0.0237		mg/L		68	61 - 120	7	35

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*99*		*78 - 122*
Dibromofluoromethane (Surr)	*87*		*73 - 120*
4-Bromofluorobenzene (Surr)	*103*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*86*		*62 - 137*

Method: 8270E - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 410-373607/1-A
Matrix: Water
Analysis Batch: 373776

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 373607

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,4,6-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,4,5-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,4-Dichlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,4-Dimethylphenol	ND		0.010	0.0030	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,4-Dinitrotoluene	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
2-Chloronaphthalene	ND		0.0010	0.00040	mg/L		05/09/23 08:16	05/09/23 17:23	1
2-Chlorophenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2-Methylnaphthalene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
2-Methylphenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2-Nitroaniline	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
2-Nitrophenol	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
3,3'-Dichlorobenzidine	ND		0.010	0.0040	mg/L		05/09/23 08:16	05/09/23 17:23	1
3-Nitroaniline	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 17:23	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0080	mg/L		05/09/23 08:16	05/09/23 17:23	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
4-Chloro-3-methylphenol	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
4-Chloroaniline	ND		0.010	0.0040	mg/L		05/09/23 08:16	05/09/23 17:23	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
4-Nitroaniline	ND		0.0030	0.00090	mg/L		05/09/23 08:16	05/09/23 17:23	1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 410-373607/1-A
Matrix: Water
Analysis Batch: 373776

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 373607

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Acenaphthylene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Acetophenone	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Anthracene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Atrazine	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Benzaldehyde	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Benzo[a]anthracene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Benzo[a]pyrene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 17:23	1
Benzo[b]fluoranthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Benzo[g,h,i]perylene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Benzo[k]fluoranthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 17:23	1
Butyl benzyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 17:23	1
Caprolactam	ND		0.0070	0.0030	mg/L		05/09/23 08:16	05/09/23 17:23	1
Carbazole	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Chrysene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Di-n-butyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 17:23	1
Di-n-octyl phthalate	ND		0.011	0.0050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Dibenz(a,h)anthracene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Dibenzofuran	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Diethyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 17:23	1
Dimethyl phthalate	ND		0.0050	0.0020	mg/L		05/09/23 08:16	05/09/23 17:23	1
Fluoranthene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Fluorene	ND		0.00050	0.00012	mg/L		05/09/23 08:16	05/09/23 17:23	1
Hexachlorobenzene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 17:23	1
Hexachlorobutadiene	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Hexachlorocyclopentadiene	ND		0.011	0.0050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Hexachloroethane	ND		0.0050	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Indeno[1,2,3-cd]pyrene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 17:23	1
Isophorone	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
N-Nitrosodiphenylamine	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Naphthalene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Nitrobenzene	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Pentachlorophenol	ND		0.0050	0.0010	mg/L		05/09/23 08:16	05/09/23 17:23	1
Phenanthrene	ND		0.00050	0.00011	mg/L		05/09/23 08:16	05/09/23 17:23	1
Phenol	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
Pyrene	ND		0.00050	0.00010	mg/L		05/09/23 08:16	05/09/23 17:23	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
2,6-Dinitrotoluene	ND		0.0020	0.00050	mg/L		05/09/23 08:16	05/09/23 17:23	1
4-Nitrophenol	ND		0.030	0.010	mg/L		05/09/23 08:16	05/09/23 17:23	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*36*		*10 - 120*	*05/09/23 08:16*	*05/09/23 17:23*	*1*
Nitrobenzene-d5 (Surr)	*77*		*31 - 120*	*05/09/23 08:16*	*05/09/23 17:23*	*1*
2-Fluorophenol (Surr)	*52*		*10 - 120*	*05/09/23 08:16*	*05/09/23 17:23*	*1*

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 410-373607/1-A
Matrix: Water
Analysis Batch: 373776

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 373607

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	83		44 - 120	05/09/23 08:16	05/09/23 17:23	1
2,4,6-Tribromophenol (Surr)	85		13 - 138	05/09/23 08:16	05/09/23 17:23	1
p-Terphenyl-d14 (Surr)	103		30 - 125	05/09/23 08:16	05/09/23 17:23	1

Lab Sample ID: LCS 410-373607/2-A
Matrix: Water
Analysis Batch: 373776

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1'-Biphenyl	0.0500	0.0486		mg/L		97	55 - 120
2,4,6-Trichlorophenol	0.0500	0.0594		mg/L		119	63 - 133
2,4,5-Trichlorophenol	0.0500	0.0558		mg/L		112	60 - 136
2,4-Dichlorophenol	0.0500	0.0530		mg/L		106	60 - 127
2,4-Dimethylphenol	0.0500	0.0426		mg/L		85	62 - 120
2,4-Dinitrophenol	0.100	0.114		mg/L		114	36 - 147
2,4-Dinitrotoluene	0.0500	0.0509		mg/L		102	66 - 131
2-Chloronaphthalene	0.0500	0.0472		mg/L		94	51 - 120
2-Chlorophenol	0.0500	0.0419		mg/L		84	57 - 120
2-Methylnaphthalene	0.0500	0.0487		mg/L		97	53 - 120
2-Methylphenol	0.0500	0.0384		mg/L		77	58 - 120
2-Nitroaniline	0.0500	0.0503		mg/L		101	63 - 134
2-Nitrophenol	0.0500	0.0526		mg/L		105	57 - 127
3,3'-Dichlorobenzidine	0.100	0.0590		mg/L		59	31 - 120
3-Nitroaniline	0.0500	0.0429		mg/L		86	44 - 125
4,6-Dinitro-2-methylphenol	0.100	0.122		mg/L		122	54 - 148
4-Bromophenyl phenyl ether	0.0500	0.0485		mg/L		97	66 - 120
4-Chloro-3-methylphenol	0.0500	0.0451		mg/L		90	57 - 129
4-Chloroaniline	0.0500	0.0374		mg/L		75	33 - 120
4-Chlorophenyl phenyl ether	0.0500	0.0494		mg/L		99	59 - 120
4-Nitroaniline	0.0500	0.0451		mg/L		90	55 - 126
Acenaphthene	0.0500	0.0473		mg/L		95	59 - 120
Acenaphthylene	0.0500	0.0533		mg/L		107	61 - 121
Acetophenone	0.0500	0.0367		mg/L		73	60 - 120
Anthracene	0.0500	0.0492		mg/L		98	67 - 123
Atrazine	0.0500	0.0533		mg/L		107	53 - 126
Benzaldehyde	0.0500	0.0382		mg/L		76	36 - 120
Benzo[a]anthracene	0.0500	0.0488		mg/L		98	66 - 133
Benzo[a]pyrene	0.0500	0.0539		mg/L		108	64 - 131
Benzo[b]fluoranthene	0.0500	0.0501		mg/L		100	64 - 124
Benzo[g,h,i]perylene	0.0500	0.0532		mg/L		106	60 - 136
Benzo[k]fluoranthene	0.0500	0.0529		mg/L		106	67 - 132
Bis(2-chloroethoxy)methane	0.0500	0.0439		mg/L		88	61 - 123
Bis(2-chloroethyl)ether	0.0500	0.0378		mg/L		76	62 - 120
Bis(2-ethylhexyl) phthalate	0.0500	0.0460		mg/L		92	60 - 133
Butyl benzyl phthalate	0.0500	0.0418		mg/L		84	30 - 128
Caprolactam	0.0500	0.0146		mg/L		29	12 - 120
Carbazole	0.0500	0.0494		mg/L		99	65 - 135
Chrysene	0.0500	0.0494		mg/L		99	70 - 128

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 410-373607/2-A
Matrix: Water
Analysis Batch: 373776

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Di-n-butyl phthalate	0.0500	0.0488		mg/L		98	58 - 132
Di-n-octyl phthalate	0.0500	0.0548		mg/L		110	52 - 146
Dibenz(a,h)anthracene	0.0500	0.0520		mg/L		104	59 - 135
Dibenzofuran	0.0500	0.0481		mg/L		96	63 - 120
Diethyl phthalate	0.0500	0.0452		mg/L		90	46 - 123
Dimethyl phthalate	0.0500	0.0399		mg/L		80	10 - 135
Fluoranthene	0.0500	0.0489		mg/L		98	70 - 128
Fluorene	0.0500	0.0496		mg/L		99	66 - 120
Hexachlorobenzene	0.0500	0.0452		mg/L		90	61 - 126
Hexachlorobutadiene	0.0500	0.0384		mg/L		77	10 - 120
Hexachlorocyclopentadiene	0.0500	0.0179		mg/L		36	10 - 120
Hexachloroethane	0.0500	0.0323		mg/L		65	16 - 120
Indeno[1,2,3-cd]pyrene	0.0500	0.0523		mg/L		105	55 - 134
Isophorone	0.0500	0.0417		mg/L		83	63 - 124
N-Nitrosodi-n-propylamine	0.0500	0.0360		mg/L		72	57 - 120
N-Nitrosodiphenylamine	0.0425	0.0429		mg/L		101	64 - 130
Naphthalene	0.0500	0.0443		mg/L		89	55 - 120
Nitrobenzene	0.0500	0.0415		mg/L		83	59 - 120
Pentachlorophenol	0.100	0.102		mg/L		102	51 - 138
Phenanthrene	0.0500	0.0488		mg/L		98	66 - 120
Phenol	0.0500	0.0277		mg/L		55	22 - 120
Pyrene	0.0500	0.0497		mg/L		99	67 - 126
bis (2-chloroisopropyl) ether	0.0500	0.0513		mg/L		103	43 - 121
2,6-Dinitrotoluene	0.0500	0.0535		mg/L		107	66 - 129
4-Nitrophenol	0.100	0.0626		mg/L		63	17 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Phenol-d5 (Surr)	*43*		*10 - 120*
Nitrobenzene-d5 (Surr)	*75*		*31 - 120*
2-Fluorophenol (Surr)	*60*		*10 - 120*
2-Fluorobiphenyl (Surr)	*91*		*44 - 120*
2,4,6-Tribromophenol (Surr)	*85*		*13 - 138*
p-Terphenyl-d14 (Surr)	*97*		*30 - 125*

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 374258

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,1'-Biphenyl	ND	F1	0.0556	0.0326		mg/L		59	55 - 120
2,4,6-Trichlorophenol	ND	F1	0.0556	0.0213	F1	mg/L		38	63 - 133
2,4,5-Trichlorophenol	ND	F1	0.0556	0.0196	F1	mg/L		35	60 - 136
2,4-Dichlorophenol	ND	F1	0.0556	0.0230	F1	mg/L		41	60 - 127
2,4-Dimethylphenol	ND		0.0556	0.0353	J	mg/L		63	62 - 120
2,4-Dinitrophenol	ND	F1	0.111	ND	F1	mg/L		0	36 - 147
2,4-Dinitrotoluene	ND	F1	0.0556	0.0384		mg/L		69	66 - 131
2-Chloronaphthalene	ND		0.0556	0.0314		mg/L		57	51 - 120
2-Chlorophenol	ND	F1	0.0556	0.0233	F1	mg/L		42	57 - 120

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 374258

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
2-Methylnaphthalene	0.0014	J	0.0556	0.0375		mg/L		65	53 - 120
2-Methylphenol	ND	F1	0.0556	0.0277	F1	mg/L		50	58 - 120
2-Nitroaniline	ND		0.0556	0.0431		mg/L		78	63 - 134
2-Nitrophenol	ND	F1	0.0556	0.0229	J F1	mg/L		41	57 - 127
3,3'-Dichlorobenzidine	ND		0.111	0.0401	J	mg/L		36	31 - 120
3-Nitroaniline	ND		0.0556	0.0381		mg/L		69	44 - 125
4,6-Dinitro-2-methylphenol	ND	F1	0.111	ND	F1	mg/L		0	54 - 148
4-Bromophenyl phenyl ether	ND	F1	0.0556	0.0237	F1	mg/L		43	66 - 120
4-Chloro-3-methylphenol	ND	F1	0.0556	0.0263	J F1	mg/L		47	57 - 129
4-Chloroaniline	ND		0.0556	0.0333	J	mg/L		60	33 - 120
4-Chlorophenyl phenyl ether	ND	F1	0.0556	0.0250	F1	mg/L		45	59 - 120
4-Nitroaniline	ND		0.0556	0.0358		mg/L		64	55 - 126
Acenaphthene	0.00075	J F1	0.0556	0.0329	F1	mg/L		58	59 - 120
Acenaphthylene	ND	F1	0.0556	0.0336		mg/L		61	61 - 121
Acetophenone	ND		0.0556	0.0485		mg/L		87	60 - 120
Anthracene	0.00072	J F1	0.0556	0.0264	F1	mg/L		46	67 - 123
Atrazine	ND		0.0556	0.0475		mg/L		85	53 - 126
Benzaldehyde	ND		0.0556	0.0400		mg/L		72	36 - 120
Benzo[a]anthracene	0.0014	J F1	0.0556	0.0215	F1	mg/L		36	66 - 133
Benzo[a]pyrene	0.0020	J F1	0.0556	0.0190	F1	mg/L		31	64 - 131
Benzo[b]fluoranthene	0.0021	J F1	0.0556	0.0202	F1	mg/L		33	64 - 124
Benzo[g,h,i]perylene	0.0018	J F1	0.0556	0.0189	F1	mg/L		31	60 - 136
Benzo[k]fluoranthene	0.00073	J F1	0.0556	0.0186	F1	mg/L		32	67 - 132
Bis(2-chloroethoxy)methane	ND		0.0556	0.0464		mg/L		84	61 - 123
Bis(2-chloroethyl)ether	ND		0.0556	0.0453		mg/L		82	62 - 120
Bis(2-ethylhexyl) phthalate	ND	F1	0.0556	0.0283	F1	mg/L		51	60 - 133
Butyl benzyl phthalate	ND		0.0556	0.0264	J	mg/L		47	30 - 128
Caprolactam	ND		0.0556	0.0232	J	mg/L		42	12 - 120
Carbazole	ND		0.0556	0.0429		mg/L		77	65 - 135
Chrysene	0.0033	F1	0.0556	0.0239	F1	mg/L		37	70 - 128
Di-n-butyl phthalate	ND	F1	0.0556	0.0262	J F1	mg/L		47	58 - 132
Di-n-octyl phthalate	ND		0.0556	0.0301	J	mg/L		54	52 - 146
Dibenz(a,h)anthracene	0.00054	J F1	0.0556	0.0145	F1	mg/L		25	59 - 135
Dibenzofuran	ND	F1	0.0556	0.0325	F1	mg/L		58	63 - 120
Diethyl phthalate	ND		0.0556	0.0403		mg/L		73	46 - 123
Dimethyl phthalate	ND		0.0556	0.0368		mg/L		66	10 - 135
Fluoranthene	0.0032	F1	0.0556	0.0298	F1	mg/L		48	70 - 128
Fluorene	0.00066	J F1	0.0556	0.0296	F1	mg/L		52	66 - 120
Hexachlorobenzene	ND	F1	0.0556	0.0210	F1	mg/L		38	61 - 126
Hexachlorobutadiene	ND		0.0556	0.0222		mg/L		40	10 - 120
Hexachlorocyclopentadiene	ND	F1	0.0556	ND	F1	mg/L		0	10 - 120
Hexachloroethane	ND		0.0556	0.0328		mg/L		59	16 - 120
Indeno[1,2,3-cd]pyrene	0.0017	J F1	0.0556	0.0180	F1	mg/L		29	55 - 134
Isophorone	ND		0.0556	0.0472		mg/L		85	63 - 124
N-Nitrosodi-n-propylamine	ND		0.0556	0.0487		mg/L		88	57 - 120
N-Nitrosodiphenylamine	ND	F1	0.0472	0.0351		mg/L		74	64 - 130
Naphthalene	0.0012	J	0.0556	0.0401		mg/L		70	55 - 120
Nitrobenzene	ND		0.0556	0.0438		mg/L		79	59 - 120
Pentachlorophenol	ND	F1	0.111	0.0265	J F1	mg/L		24	51 - 138

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 374258

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Phenanthrene	0.0031	F1	0.0556	0.0316	F1	mg/L		51	66 - 120
Phenol	ND		0.0556	0.0150		mg/L		27	22 - 120
Pyrene	0.0030	F1	0.0556	0.0271	F1	mg/L		43	67 - 126
bis (2-chloroisopropyl) ether	ND		0.0556	0.0438		mg/L		79	43 - 121
2,6-Dinitrotoluene	ND	F1	0.0556	0.0439		mg/L		79	66 - 129
4-Nitrophenol	ND	F1	0.111	ND	F1	mg/L		0	17 - 120
2-Butoxyethanol	0.12	B *+ F1	0.0555	0.250	F1	mg/L		230	20 - 135

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Phenol-d5 (Surr)	*23*		*10 - 120*
Nitrobenzene-d5 (Surr)	*74*		*31 - 120*
2-Fluorophenol (Surr)	*30*		*10 - 120*
2-Fluorobiphenyl (Surr)	*48*		*44 - 120*
2,4,6-Tribromophenol (Surr)	*31*		*13 - 138*
p-Terphenyl-d14 (Surr)	*24*	*S1-*	*30 - 125*

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 374258

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,1'-Biphenyl	ND	F1	0.0543	0.0289	F1	mg/L		53	55 - 120	12	30
2,4,6-Trichlorophenol	ND	F1	0.0543	0.0258	F1	mg/L		47	63 - 133	19	30
2,4,5-Trichlorophenol	ND	F1	0.0543	0.0236	F1	mg/L		44	60 - 136	19	30
2,4-Dichlorophenol	ND	F1	0.0543	0.0262	F1	mg/L		48	60 - 127	13	30
2,4-Dimethylphenol	ND		0.0543	0.0363	J	mg/L		67	62 - 120	3	30
2,4-Dinitrophenol	ND	F1	0.109	ND	F1	mg/L		0	36 - 147	NC	30
2,4-Dinitrotoluene	ND	F1	0.0543	0.0322	F1	mg/L		59	66 - 131	18	30
2-Chloronaphthalene	ND		0.0543	0.0280		mg/L		52	51 - 120	12	30
2-Chlorophenol	ND	F1	0.0543	0.0265	F1	mg/L		49	57 - 120	13	30
2-Methylnaphthalene	0.0014	J	0.0543	0.0323		mg/L		57	53 - 120	15	30
2-Methylphenol	ND	F1	0.0543	0.0312		mg/L		58	58 - 120	12	30
2-Nitroaniline	ND		0.0543	0.0370		mg/L		68	63 - 134	15	30
2-Nitrophenol	ND	F1	0.0543	0.0269	J F1	mg/L		49	57 - 127	16	30
3,3'-Dichlorobenzidine	ND		0.109	0.0472	J	mg/L		43	31 - 120	16	30
3-Nitroaniline	ND		0.0543	0.0366		mg/L		67	44 - 125	4	30
4,6-Dinitro-2-methylphenol	ND	F1	0.109	ND	F1	mg/L		0	54 - 148	NC	30
4-Bromophenyl phenyl ether	ND	F1	0.0543	0.0197	F1	mg/L		36	66 - 120	18	30
4-Chloro-3-methylphenol	ND	F1	0.0543	0.0309		mg/L		57	57 - 129	16	30
4-Chloroaniline	ND		0.0543	0.0353	J	mg/L		65	33 - 120	6	30
4-Chlorophenyl phenyl ether	ND	F1	0.0543	0.0214	F1	mg/L		39	59 - 120	15	30
4-Nitroaniline	ND		0.0543	0.0331		mg/L		61	55 - 126	8	30
Acenaphthene	0.00075	J F1	0.0543	0.0284	F1	mg/L		51	59 - 120	15	30
Acenaphthylene	ND	F1	0.0543	0.0286	F1	mg/L		53	61 - 121	16	30
Acetophenone	ND		0.0543	0.0440		mg/L		81	60 - 120	10	30
Anthracene	0.00072	J F1	0.0543	0.0228	F1	mg/L		41	67 - 123	15	30
Atrazine	ND		0.0543	0.0410		mg/L		75	53 - 126	15	30
Benzaldehyde	ND		0.0543	0.0388		mg/L		71	36 - 120	3	30

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 374258

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Benzo[a]anthracene	0.0014	J F1	0.0543	0.0207	F1	mg/L		35	66 - 133	4	30
Benzo[a]pyrene	0.0020	J F1	0.0543	0.0202	F1	mg/L		34	64 - 131	6	30
Benzo[b]fluoranthene	0.0021	J F1	0.0543	0.0205	F1	mg/L		34	64 - 124	1	30
Benzo[g,h,i]perylene	0.0018	J F1	0.0543	0.0188	F1	mg/L		31	60 - 136	0	30
Benzo[k]fluoranthene	0.00073	J F1	0.0543	0.0173	F1	mg/L		30	67 - 132	7	30
Bis(2-chloroethoxy)methane	ND		0.0543	0.0416		mg/L		77	61 - 123	11	30
Bis(2-chloroethyl)ether	ND		0.0543	0.0427		mg/L		79	62 - 120	6	30
Bis(2-ethylhexyl) phthalate	ND	F1	0.0543	0.0291	F1	mg/L		53	60 - 133	3	30
Butyl benzyl phthalate	ND		0.0543	0.0224	J	mg/L		41	30 - 128	16	30
Caprolactam	ND		0.0543	0.0214	J	mg/L		39	12 - 120	8	30
Carbazole	ND		0.0543	0.0371		mg/L		68	65 - 135	14	30
Chrysene	0.0033	F1	0.0543	0.0233	F1	mg/L		37	70 - 128	3	30
Di-n-butyl phthalate	ND	F1	0.0543	0.0216	J F1	mg/L		40	58 - 132	19	30
Di-n-octyl phthalate	ND		0.0543	0.0302	J	mg/L		56	52 - 146	0	30
Dibenz(a,h)anthracene	0.00054	J F1	0.0543	0.0172	F1	mg/L		31	59 - 135	17	30
Dibenzofuran	ND	F1	0.0543	0.0265	F1	mg/L		49	63 - 120	20	30
Diethyl phthalate	ND		0.0543	0.0357		mg/L		66	46 - 123	12	30
Dimethyl phthalate	ND		0.0543	0.0339		mg/L		62	10 - 135	8	30
Fluoranthene	0.0032	F1	0.0543	0.0256	F1	mg/L		41	70 - 128	15	30
Fluorene	0.00066	J F1	0.0543	0.0252	F1	mg/L		45	66 - 120	16	30
Hexachlorobenzene	ND	F1	0.0543	0.0182	F1	mg/L		33	61 - 126	14	30
Hexachlorobutadiene	ND		0.0543	0.0189		mg/L		35	10 - 120	16	30
Hexachlorocyclopentadiene	ND	F1	0.0543	ND	F1	mg/L		0	10 - 120	NC	30
Hexachloroethane	ND		0.0543	0.0266	J	mg/L		49	16 - 120	21	30
Indeno[1,2,3-cd]pyrene	0.0017	J F1	0.0543	0.0193	F1	mg/L		32	55 - 134	7	30
Isophorone	ND		0.0543	0.0420		mg/L		77	63 - 124	12	30
N-Nitrosodi-n-propylamine	ND		0.0543	0.0422		mg/L		78	57 - 120	14	30
N-Nitrosodiphenylamine	ND	F1	0.0462	0.0271	F1	mg/L		59	64 - 130	26	30
Naphthalene	0.0012	J	0.0543	0.0359		mg/L		64	55 - 120	11	30
Nitrobenzene	ND		0.0543	0.0383		mg/L		70	59 - 120	14	30
Pentachlorophenol	ND	F1	0.109	0.0302	F1	mg/L		28	51 - 138	13	30
Phenanthrene	0.0031	F1	0.0543	0.0287	F1	mg/L		47	66 - 120	10	30
Phenol	ND		0.0543	0.0182		mg/L		34	22 - 120	19	30
Pyrene	0.0030	F1	0.0543	0.0238	F1	mg/L		38	67 - 126	13	30
bis (2-chloroisopropyl) ether	ND		0.0543	0.0400		mg/L		74	43 - 121	9	30
2,6-Dinitrotoluene	ND	F1	0.0543	0.0341	F1	mg/L		63	66 - 129	25	30
4-Nitrophenol	ND	F1	0.109	ND	F1	mg/L		0	17 - 120	NC	30
2-Butoxyethanol	0.12	B *+ F1	0.0543	0.224	F1	mg/L		188	20 - 135	11	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Phenol-d5 (Surr)	*28*		*10 - 120*
Nitrobenzene-d5 (Surr)	*67*		*31 - 120*
2-Fluorophenol (Surr)	*36*		*10 - 120*
2-Fluorobiphenyl (Surr)	*45*		*44 - 120*
2,4,6-Tribromophenol (Surr)	*37*		*13 - 138*
p-Terphenyl-d14 (Surr)	*23*	*S1-*	*30 - 125*

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 410-374570/1-A
Matrix: Water
Analysis Batch: 374813

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 374570

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,4,6-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,4,5-Trichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,4-Dichlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,4-Dimethylphenol	ND		0.010	0.0030	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,4-Dinitrophenol	ND		0.030	0.014	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,4-Dinitrotoluene	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Chloronaphthalene	ND		0.0010	0.00040	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Chlorophenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Methylnaphthalene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Methylphenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Nitroaniline	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Nitrophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
3,3'-Dichlorobenzidine	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 16:11	1
3-Nitroaniline	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 16:11	1
4,6-Dinitro-2-methylphenol	ND		0.021	0.0080	mg/L		05/11/23 08:29	05/11/23 16:11	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
4-Chloro-3-methylphenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
4-Chloroaniline	ND		0.010	0.0040	mg/L		05/11/23 08:29	05/11/23 16:11	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
4-Nitroaniline	ND		0.0030	0.00090	mg/L		05/11/23 08:29	05/11/23 16:11	1
Acenaphthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Acenaphthylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Acetophenone	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Atrazine	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Benzaldehyde	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Benzo[a]anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Benzo[a]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 16:11	1
Benzo[b]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Benzo[g,h,i]perylene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Benzo[k]fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Bis(2-chloroethoxy)methane	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Bis(2-chloroethyl)ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 16:11	1
Butyl benzyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 16:11	1
Caprolactam	ND		0.0070	0.0030	mg/L		05/11/23 08:29	05/11/23 16:11	1
Carbazole	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Chrysene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Di-n-butyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 16:11	1
Di-n-octyl phthalate	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Dibenz(a,h)anthracene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Dibenzofuran	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Diethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 16:11	1
Dimethyl phthalate	ND		0.0050	0.0020	mg/L		05/11/23 08:29	05/11/23 16:11	1
Fluoranthene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Fluorene	ND		0.00050	0.00012	mg/L		05/11/23 08:29	05/11/23 16:11	1
Hexachlorobenzene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 16:11	1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 410-374570/1-A
Matrix: Water
Analysis Batch: 374813

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 374570

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hexachlorobutadiene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Hexachlorocyclopentadiene	ND		0.011	0.0050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Hexachloroethane	ND		0.0050	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Indeno[1,2,3-cd]pyrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 16:11	1
Isophorone	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
N-Nitrosodi-n-propylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
N-Nitrosodiphenylamine	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Naphthalene	0.000323	J	0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Nitrobenzene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Pentachlorophenol	ND		0.0050	0.0010	mg/L		05/11/23 08:29	05/11/23 16:11	1
Phenanthrene	ND		0.00050	0.00011	mg/L		05/11/23 08:29	05/11/23 16:11	1
Phenol	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
Pyrene	ND		0.00050	0.00010	mg/L		05/11/23 08:29	05/11/23 16:11	1
bis (2-chloroisopropyl) ether	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
2,6-Dinitrotoluene	ND		0.0020	0.00050	mg/L		05/11/23 08:29	05/11/23 16:11	1
4-Nitrophenol	ND		0.030	0.010	mg/L		05/11/23 08:29	05/11/23 16:11	1
2-Butoxyethanol	ND		0.0050	0.0025	mg/L		05/11/23 08:29	05/11/23 16:11	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Phenol-d5 (Surr)	*32*		*10 - 120*	*05/11/23 08:29*	*05/11/23 16:11*	*1*
Nitrobenzene-d5 (Surr)	*66*		*31 - 120*	*05/11/23 08:29*	*05/11/23 16:11*	*1*
2-Fluorophenol (Surr)	*49*		*10 - 120*	*05/11/23 08:29*	*05/11/23 16:11*	*1*
2-Fluorobiphenyl (Surr)	*55*		*44 - 120*	*05/11/23 08:29*	*05/11/23 16:11*	*1*
2,4,6-Tribromophenol (Surr)	*75*		*13 - 138*	*05/11/23 08:29*	*05/11/23 16:11*	*1*
p-Terphenyl-d14 (Surr)	*71*		*30 - 125*	*05/11/23 08:29*	*05/11/23 16:11*	*1*

Lab Sample ID: LCS 410-374570/2-A
Matrix: Water
Analysis Batch: 374813

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 374570

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1'-Biphenyl	0.0500	0.0359		mg/L		72	55 - 120
2,4,6-Trichlorophenol	0.0500	0.0399		mg/L		80	63 - 133
2,4,5-Trichlorophenol	0.0500	0.0412		mg/L		82	60 - 136
2,4-Dichlorophenol	0.0500	0.0385		mg/L		77	60 - 127
2,4-Dimethylphenol	0.0500	0.0374		mg/L		75	62 - 120
2,4-Dinitrophenol	0.100	0.0707		mg/L		71	36 - 147
2,4-Dinitrotoluene	0.0500	0.0426		mg/L		85	66 - 131
2-Chloronaphthalene	0.0500	0.0339		mg/L		68	51 - 120
2-Chlorophenol	0.0500	0.0374		mg/L		75	57 - 120
2-Methylnaphthalene	0.0500	0.0344		mg/L		69	53 - 120
2-Methylphenol	0.0500	0.0367		mg/L		73	58 - 120
2-Nitroaniline	0.0500	0.0400		mg/L		80	63 - 134
2-Nitrophenol	0.0500	0.0419		mg/L		84	57 - 127
3,3'-Dichlorobenzidine	0.100	0.0565		mg/L		56	31 - 120
3-Nitroaniline	0.0500	0.0377		mg/L		75	44 - 125
4,6-Dinitro-2-methylphenol	0.100	0.0834		mg/L		83	54 - 148
4-Bromophenyl phenyl ether	0.0500	0.0371		mg/L		74	66 - 120

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 410-374570/2-A
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 374813
Prep Batch: 374570

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
4-Chloro-3-methylphenol	0.0500	0.0388		mg/L		78	57 - 129
4-Chloroaniline	0.0500	0.0355		mg/L		71	33 - 120
4-Chlorophenyl phenyl ether	0.0500	0.0363		mg/L		73	59 - 120
4-Nitroaniline	0.0500	0.0379		mg/L		76	55 - 126
Acenaphthene	0.0500	0.0372		mg/L		74	59 - 120
Acenaphthylene	0.0500	0.0361		mg/L		72	61 - 121
Acetophenone	0.0500	0.0397		mg/L		79	60 - 120
Anthracene	0.0500	0.0397		mg/L		79	67 - 123
Atrazine	0.0500	0.0429		mg/L		86	53 - 126
Benzaldehyde	0.0500	0.0378		mg/L		76	36 - 120
Benzo[a]anthracene	0.0500	0.0392		mg/L		78	66 - 133
Benzo[a]pyrene	0.0500	0.0390		mg/L		78	64 - 131
Benzo[b]fluoranthene	0.0500	0.0376		mg/L		75	64 - 124
Benzo[g,h,i]perylene	0.0500	0.0410		mg/L		82	60 - 136
Benzo[k]fluoranthene	0.0500	0.0395		mg/L		79	67 - 132
Bis(2-chloroethoxy)methane	0.0500	0.0392		mg/L		78	61 - 123
Bis(2-chloroethyl)ether	0.0500	0.0390		mg/L		78	62 - 120
Bis(2-ethylhexyl) phthalate	0.0500	0.0392		mg/L		78	60 - 133
Butyl benzyl phthalate	0.0500	0.0304		mg/L		61	30 - 128
Caprolactam	0.0500	0.0119		mg/L		24	12 - 120
Carbazole	0.0500	0.0403		mg/L		81	65 - 135
Chrysene	0.0500	0.0389		mg/L		78	70 - 128
Di-n-butyl phthalate	0.0500	0.0381		mg/L		76	58 - 132
Di-n-octyl phthalate	0.0500	0.0391		mg/L		78	52 - 146
Dibenz(a,h)anthracene	0.0500	0.0399		mg/L		80	59 - 135
Dibenzofuran	0.0500	0.0380		mg/L		76	63 - 120
Diethyl phthalate	0.0500	0.0346		mg/L		69	46 - 123
Dimethyl phthalate	0.0500	0.0243		mg/L		49	10 - 135
Fluoranthene	0.0500	0.0394		mg/L		79	70 - 128
Fluorene	0.0500	0.0379		mg/L		76	66 - 120
Hexachlorobenzene	0.0500	0.0377		mg/L		75	61 - 126
Hexachlorobutadiene	0.0500	0.0239		mg/L		48	10 - 120
Hexachlorocyclopentadiene	0.0500	0.0107	J	mg/L		21	10 - 120
Hexachloroethane	0.0500	0.0250		mg/L		50	16 - 120
Indeno[1,2,3-cd]pyrene	0.0500	0.0379		mg/L		76	55 - 134
Isophorone	0.0500	0.0381		mg/L		76	63 - 124
N-Nitrosodi-n-propylamine	0.0500	0.0375		mg/L		75	57 - 120
N-Nitrosodiphenylamine	0.0425	0.0341		mg/L		80	64 - 130
Naphthalene	0.0500	0.0344		mg/L		69	55 - 120
Nitrobenzene	0.0500	0.0369		mg/L		74	59 - 120
Pentachlorophenol	0.100	0.0778		mg/L		78	51 - 138
Phenanthrene	0.0500	0.0388		mg/L		78	66 - 120
Phenol	0.0500	0.0218		mg/L		44	22 - 120
Pyrene	0.0500	0.0388		mg/L		78	67 - 126
bis (2-chloroisopropyl) ether	0.0500	0.0365		mg/L		73	43 - 121
2,6-Dinitrotoluene	0.0500	0.0415		mg/L		83	66 - 129
4-Nitrophenol	0.100	0.0531		mg/L		53	17 - 120
2-Butoxyethanol	0.0500	0.0504		mg/L		101	20 - 135

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 410-374570/2-A
Matrix: Water
Analysis Batch: 374813

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 374570

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Phenol-d5 (Surr)	37		10 - 120
Nitrobenzene-d5 (Surr)	71		31 - 120
2-Fluorophenol (Surr)	54		10 - 120
2-Fluorobiphenyl (Surr)	64		44 - 120
2,4,6-Tribromophenol (Surr)	87		13 - 138
p-Terphenyl-d14 (Surr)	83		30 - 125

Method: 8270E - Semivolatile Organic Compounds (GC/MS) - RA

Lab Sample ID: MB 410-373607/1-A
Matrix: Water
Analysis Batch: 374258

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 373607

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Butoxyethanol - RA	0.00427	J	0.0050	0.0025	mg/L		05/09/23 08:16	05/10/23 19:31	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Phenol-d5 (Surr) - RA	44		10 - 120	05/09/23 08:16	05/10/23 19:31	1
Nitrobenzene-d5 (Surr) - RA	85		31 - 120	05/09/23 08:16	05/10/23 19:31	1
2-Fluorophenol (Surr) - RA	62		10 - 120	05/09/23 08:16	05/10/23 19:31	1
2-Fluorobiphenyl (Surr) - RA	75		44 - 120	05/09/23 08:16	05/10/23 19:31	1
2,4,6-Tribromophenol (Surr) - RA	97		13 - 138	05/09/23 08:16	05/10/23 19:31	1
p-Terphenyl-d14 (Surr) - RA	102		30 - 125	05/09/23 08:16	05/10/23 19:31	1

Lab Sample ID: LCS 410-373607/2-A
Matrix: Water
Analysis Batch: 374462

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 373607

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
2-Butoxyethanol - RA	0.0500	0.0530	B	mg/L		106	20 - 135

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Phenol-d5 (Surr) - RA	51		10 - 120
Nitrobenzene-d5 (Surr) - RA	85		31 - 120
2-Fluorophenol (Surr) - RA	68		10 - 120
2-Fluorobiphenyl (Surr) - RA	84		44 - 120
2,4,6-Tribromophenol (Surr) - RA	107		13 - 138
p-Terphenyl-d14 (Surr) - RA	102		30 - 125

Method: 8270E - Semivolatile Organic Compounds (GC/MS) - RE

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 376263

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 374570

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,1'-Biphenyl - RE	ND		0.0415	0.0357		mg/L		86	55 - 120
2,4,6-Trichlorophenol - RE	ND		0.0415	0.0364		mg/L		88	63 - 133

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) - RE (Continued)

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 376263

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 374570

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
2,4,5-Trichlorophenol - RE	ND		0.0415	0.0371		mg/L		89	60 - 136
2,4-Dichlorophenol - RE	ND		0.0415	0.0383		mg/L		92	60 - 127
2,4-Dimethylphenol - RE	ND	F1	0.0415	0.0215	J F1	mg/L		52	62 - 120
2,4-Dinitrophenol - RE	ND		0.0829	0.0840	J	mg/L		101	36 - 147
2,4-Dinitrotoluene - RE	ND		0.0415	0.0347		mg/L		84	66 - 131
2-Chloronaphthalene - RE	ND		0.0415	0.0358		mg/L		86	51 - 120
2-Chlorophenol - RE	ND		0.0415	0.0323		mg/L		78	57 - 120
2-Methylnaphthalene - RE	ND		0.0415	0.0360		mg/L		87	53 - 120
2-Methylphenol - RE	ND		0.0415	0.0297		mg/L		72	58 - 120
2-Nitroaniline - RE	ND		0.0415	0.0371		mg/L		89	63 - 134
2-Nitrophenol - RE	ND		0.0415	0.0378		mg/L		91	57 - 127
3,3'-Dichlorobenzidine - RE	ND		0.0829	0.0401	J	mg/L		48	31 - 120
3-Nitroaniline - RE	ND		0.0415	0.0311		mg/L		75	44 - 125
4,6-Dinitro-2-methylphenol - RE	ND		0.0829	0.0610	J	mg/L		73	54 - 148
4-Bromophenyl phenyl ether - RE	ND		0.0415	0.0346		mg/L		83	66 - 120
4-Chloro-3-methylphenol - RE	ND		0.0415	0.0344		mg/L		83	57 - 129
4-Chloroaniline - RE	ND	F1	0.0415	0.0174	J	mg/L		42	33 - 120
4-Chlorophenyl phenyl ether - RE	ND		0.0415	0.0326		mg/L		79	59 - 120
4-Nitroaniline - RE	ND		0.0415	0.0301		mg/L		73	55 - 126
Acenaphthene - RE	ND		0.0415	0.0365		mg/L		88	59 - 120
Acenaphthylene - RE	ND		0.0415	0.0370		mg/L		89	61 - 121
Acetophenone - RE	ND		0.0415	0.0364		mg/L		88	60 - 120
Anthracene - RE	ND		0.0415	0.0338		mg/L		81	67 - 123
Atrazine - RE	ND		0.0415	0.0443		mg/L		107	53 - 126
Benzaldehyde - RE	ND		0.0415	0.0311		mg/L		75	36 - 120
Benzo[a]anthracene - RE	ND	F1	0.0415	0.0278		mg/L		67	66 - 133
Benzo[a]pyrene - RE	ND	F1	0.0415	0.0294		mg/L		71	64 - 131
Benzo[b]fluoranthene - RE	0.00064	J F1	0.0415	0.0260	F1	mg/L		61	64 - 124
Benzo[g,h,i]perylene - RE	ND	F1	0.0415	0.0250		mg/L		60	60 - 136
Benzo[k]fluoranthene - RE	ND	F1	0.0415	0.0279		mg/L		67	67 - 132
Bis(2-chloroethoxy)methane - RE	ND		0.0415	0.0362		mg/L		87	61 - 123
Bis(2-chloroethyl)ether - RE	ND		0.0415	0.0331		mg/L		80	62 - 120
Bis(2-ethylhexyl) phthalate - RE	ND		0.0415	0.0311		mg/L		75	60 - 133
Butyl benzyl phthalate - RE	ND		0.0415	0.0257		mg/L		62	30 - 128
Caprolactam - RE	ND		0.0415	0.0350		mg/L		84	12 - 120
Carbazole - RE	ND		0.0415	0.0401		mg/L		97	65 - 135
Chrysene - RE	ND	F1	0.0415	0.0290		mg/L		70	70 - 128
Di-n-butyl phthalate - RE	ND		0.0415	0.0336		mg/L		81	58 - 132
Di-n-octyl phthalate - RE	ND		0.0415	0.0378	J	mg/L		91	52 - 146
Dibenz(a,h)anthracene - RE	ND	F1	0.0415	0.0246		mg/L		59	59 - 135
Dibenzofuran - RE	ND		0.0415	0.0367		mg/L		88	63 - 120
Diethyl phthalate - RE	ND		0.0415	0.0361		mg/L		87	46 - 123
Dimethyl phthalate - RE	ND		0.0415	0.0311		mg/L		75	10 - 135
Fluoranthene - RE	0.0010	J F1	0.0415	0.0324		mg/L		76	70 - 128
Fluorene - RE	ND		0.0415	0.0349		mg/L		84	66 - 120
Hexachlorobenzene - RE	ND		0.0415	0.0310		mg/L		75	61 - 126
Hexachlorobutadiene - RE	ND		0.0415	0.0260		mg/L		63	10 - 120
Hexachlorocyclopentadiene - RE	ND	F1	0.0415	ND	F1	mg/L		0	10 - 120
Hexachloroethane - RE	ND		0.0415	0.0234		mg/L		56	16 - 120

Method: 8270E - Semivolatile Organic Compounds (GC/MS) - RE (Continued)

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 376263

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 374570

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Indeno[1,2,3-cd]pyrene - RE	ND	F1	0.0415	0.0234		mg/L		56	55 - 134
Isophorone - RE	ND		0.0415	0.0372		mg/L		90	63 - 124
N-Nitrosodi-n-propylamine - RE	ND		0.0415	0.0345		mg/L		83	57 - 120
N-Nitrosodiphenylamine - RE	ND		0.0353	0.0344		mg/L		98	64 - 130
Naphthalene - RE	ND		0.0415	0.0355		mg/L		86	55 - 120
Nitrobenzene - RE	ND		0.0415	0.0339		mg/L		82	59 - 120
Pentachlorophenol - RE	ND		0.0829	0.0608		mg/L		73	51 - 138
Phenanthrene - RE	0.00074	J	0.0415	0.0351		mg/L		83	66 - 120
Phenol - RE	ND		0.0415	0.0176		mg/L		43	22 - 120
Pyrene - RE	0.0010	J F1	0.0415	0.0320		mg/L		75	67 - 126
bis (2-chloroisopropyl) ether - RE	ND		0.0415	0.0436		mg/L		105	43 - 121
2,6-Dinitrotoluene - RE	ND		0.0415	0.0370		mg/L		89	66 - 129
4-Nitrophenol - RE	ND	F1	0.0829	ND	F1	mg/L		0	17 - 120
2-Butoxyethanol - RE	0.20		0.0415	0.194	4	mg/L		-14	20 - 135

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Phenol-d5 (Surr) - RE	*34*		*10 - 120*
Nitrobenzene-d5 (Surr) - RE	*76*		*31 - 120*
2-Fluorophenol (Surr) - RE	*46*		*10 - 120*
2-Fluorobiphenyl (Surr) - RE	*79*		*44 - 120*
2,4,6-Tribromophenol (Surr) - RE	*78*		*13 - 138*
p-Terphenyl-d14 (Surr) - RE	*66*		*30 - 125*

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 376263

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 374570

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,1'-Biphenyl - RE	ND		0.0437	0.0340		mg/L		78	55 - 120	5	30
2,4,6-Trichlorophenol - RE	ND		0.0437	0.0328		mg/L		75	63 - 133	11	30
2,4,5-Trichlorophenol - RE	ND		0.0437	0.0331		mg/L		76	60 - 136	11	30
2,4-Dichlorophenol - RE	ND		0.0437	0.0331		mg/L		76	60 - 127	15	30
2,4-Dimethylphenol - RE	ND	F1	0.0437	0.0241	J F1	mg/L		55	62 - 120	12	30
2,4-Dinitrophenol - RE	ND		0.0873	0.0832	J	mg/L		95	36 - 147	1	30
2,4-Dinitrotoluene - RE	ND		0.0437	0.0363		mg/L		83	66 - 131	5	30
2-Chloronaphthalene - RE	ND		0.0437	0.0339		mg/L		78	51 - 120	6	30
2-Chlorophenol - RE	ND		0.0437	0.0283		mg/L		65	57 - 120	13	30
2-Methylnaphthalene - RE	ND		0.0437	0.0344		mg/L		79	53 - 120	5	30
2-Methylphenol - RE	ND		0.0437	0.0273		mg/L		63	58 - 120	9	30
2-Nitroaniline - RE	ND		0.0437	0.0375		mg/L		86	63 - 134	1	30
2-Nitrophenol - RE	ND		0.0437	0.0343		mg/L		78	57 - 127	10	30
3,3'-Dichlorobenzidine - RE	ND		0.0873	0.0387	J	mg/L		44	31 - 120	3	30
3-Nitroaniline - RE	ND		0.0437	0.0310		mg/L		71	44 - 125	0	30
4,6-Dinitro-2-methylphenol - RE	ND		0.0873	0.0585	J	mg/L		67	54 - 148	4	30
4-Bromophenyl phenyl ether - RE	ND		0.0437	0.0312		mg/L		71	66 - 120	10	30
4-Chloro-3-methylphenol - RE	ND		0.0437	0.0303		mg/L		69	57 - 129	13	30
4-Chloroaniline - RE	ND	F1	0.0437	ND	F1	mg/L		0	33 - 120	NC	30
4-Chlorophenyl phenyl ether - RE	ND		0.0437	0.0311		mg/L		71	59 - 120	5	30

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) - RE (Continued)

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 376263

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 374570

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
4-Nitroaniline - RE	ND		0.0437	0.0317		mg/L		73	55 - 126	5	30
Acenaphthene - RE	ND		0.0437	0.0350		mg/L		80	59 - 120	4	30
Acenaphthylene - RE	ND		0.0437	0.0361		mg/L		83	61 - 121	3	30
Acetophenone - RE	ND		0.0437	0.0352		mg/L		81	60 - 120	3	30
Anthracene - RE	ND		0.0437	0.0316		mg/L		72	67 - 123	7	30
Atrazine - RE	ND		0.0437	0.0447		mg/L		102	53 - 126	1	30
Benzaldehyde - RE	ND		0.0437	0.0315		mg/L		72	36 - 120	1	30
Benzo[a]anthracene - RE	ND	F1	0.0437	0.0263	F1	mg/L		60	66 - 133	6	30
Benzo[a]pyrene - RE	ND	F1	0.0437	0.0243	F1	mg/L		56	64 - 131	19	30
Benzo[b]fluoranthene - RE	0.00064	J F1	0.0437	0.0244	F1	mg/L		54	64 - 124	6	30
Benzo[g,h,i]perylene - RE	ND	F1	0.0437	0.0224	F1	mg/L		51	60 - 136	11	30
Benzo[k]fluoranthene - RE	ND	F1	0.0437	0.0251	F1	mg/L		58	67 - 132	11	30
Bis(2-chloroethoxy)methane - RE	ND		0.0437	0.0356		mg/L		82	61 - 123	2	30
Bis(2-chloroethyl)ether - RE	ND		0.0437	0.0319		mg/L		73	62 - 120	4	30
Bis(2-ethylhexyl) phthalate - RE	ND		0.0437	0.0274		mg/L		63	60 - 133	13	30
Butyl benzyl phthalate - RE	ND		0.0437	0.0264		mg/L		61	30 - 128	3	30
Caprolactam - RE	ND		0.0437	0.0372		mg/L		85	12 - 120	6	30
Carbazole - RE	ND		0.0437	0.0390		mg/L		89	65 - 135	3	30
Chrysene - RE	ND	F1	0.0437	0.0267	F1	mg/L		61	70 - 128	8	30
Di-n-butyl phthalate - RE	ND		0.0437	0.0316		mg/L		72	58 - 132	6	30
Di-n-octyl phthalate - RE	ND		0.0437	0.0355	J	mg/L		81	52 - 146	6	30
Dibenz(a,h)anthracene - RE	ND	F1	0.0437	0.0213	F1	mg/L		49	59 - 135	14	30
Dibenzofuran - RE	ND		0.0437	0.0338		mg/L		77	63 - 120	8	30
Diethyl phthalate - RE	ND		0.0437	0.0351		mg/L		80	46 - 123	3	30
Dimethyl phthalate - RE	ND		0.0437	0.0310		mg/L		71	10 - 135	0	30
Fluoranthene - RE	0.0010	J F1	0.0437	0.0309	F1	mg/L		68	70 - 128	5	30
Fluorene - RE	ND		0.0437	0.0332		mg/L		76	66 - 120	5	30
Hexachlorobenzene - RE	ND		0.0437	0.0271		mg/L		62	61 - 126	13	30
Hexachlorobutadiene - RE	ND		0.0437	0.0233		mg/L		53	10 - 120	11	30
Hexachlorocyclopentadiene - RE	ND	F1	0.0437	ND	F1	mg/L		0	10 - 120	NC	30
Hexachloroethane - RE	ND		0.0437	0.0247		mg/L		56	16 - 120	5	30
Indeno[1,2,3-cd]pyrene - RE	ND	F1	0.0437	0.0207	F1	mg/L		47	55 - 134	12	30
Isophorone - RE	ND		0.0437	0.0369		mg/L		85	63 - 124	1	30
N-Nitrosodi-n-propylamine - RE	ND		0.0437	0.0356		mg/L		81	57 - 120	3	30
N-Nitrosodiphenylamine - RE	ND		0.0371	0.0328		mg/L		88	64 - 130	5	30
Naphthalene - RE	ND		0.0437	0.0353		mg/L		81	55 - 120	1	30
Nitrobenzene - RE	ND		0.0437	0.0338		mg/L		77	59 - 120	0	30
Pentachlorophenol - RE	ND		0.0873	0.0560		mg/L		64	51 - 138	8	30
Phenanthrene - RE	0.00074	J	0.0437	0.0332		mg/L		74	66 - 120	6	30
Phenol - RE	ND		0.0437	0.0146		mg/L		33	22 - 120	19	30
Pyrene - RE	0.0010	J F1	0.0437	0.0296	F1	mg/L		65	67 - 126	8	30
bis (2-chloroisopropyl) ether - RE	ND		0.0437	0.0423		mg/L		97	43 - 121	3	30
2,6-Dinitrotoluene - RE	ND		0.0437	0.0373		mg/L		85	66 - 129	1	30
4-Nitrophenol - RE	ND	F1	0.0873	ND	F1	mg/L		0	17 - 120	NC	30
2-Butoxyethanol - RE	0.20		0.0436	0.178	4	mg/L		-49	20 - 135	9	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Phenol-d5 (Surr) - RE	*29*		*10 - 120*

Eurofins Cleveland

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) - RE (Continued)

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 376263

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA
Prep Batch: 374570

Surrogate	MSD %Recovery	MSD Qualifier	Limits
Nitrobenzene-d5 (Surr) - RE	*74*		*31 - 120*
2-Fluorophenol (Surr) - RE	*40*		*10 - 120*
2-Fluorobiphenyl (Surr) - RE	*73*		*44 - 120*
2,4,6-Tribromophenol (Surr) - RE	*66*		*13 - 138*
p-Terphenyl-d14 (Surr) - RE	*54*		*30 - 125*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 240-572386/1-A
Matrix: Water
Analysis Batch: 572425

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 572386

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	87.4	J	500	68	ug/L		05/08/23 07:32	05/08/23 13:22	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	*99*		*52 - 121*	*05/08/23 07:32*	*05/08/23 13:22*	*1*

Lab Sample ID: LCS 240-572386/2-A
Matrix: Water
Analysis Batch: 572425

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 572386

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Diesel Range Organics [C10 - C28]	2000	1420		ug/L		71	56 - 120

Surrogate	LCS %Recovery	LCS Qualifier	Limits
o-Terphenyl	*94*		*52 - 121*

Lab Sample ID: MB 240-572792/1-A
Matrix: Water
Analysis Batch: 572745

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 572792

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	107	J	500	68	ug/L		05/10/23 11:48	05/10/23 13:38	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	*89*		*52 - 121*	*05/10/23 11:48*	*05/10/23 13:38*	*1*

Lab Sample ID: LCS 240-572792/12-A
Matrix: Water
Analysis Batch: 572745

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 572792

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Diesel Range Organics [C10 - C28]	2000	1710		ug/L		85	56 - 120

Method: 8015D - Diesel Range Organics (DRO) (GC) (Continued)

Lab Sample ID: LCS 240-572792/12-A | **Client Sample ID: Lab Control Sample**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572745 | **Prep Batch: 572792**

Surrogate	LCS %Recovery	LCS Qualifier	Limits
o-Terphenyl	94		52 - 121

Lab Sample ID: 240-184875-18 MS | **Client Sample ID: WC-TF3-513A**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572745 | **Prep Batch: 572792**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Diesel Range Organics [C10 - C28]	9700	F2 B	1970	21200	4	ug/L		587	45 - 120

Surrogate	MS %Recovery	MS Qualifier	Limits
o-Terphenyl	83		52 - 121

Lab Sample ID: 240-184875-18 MSD | **Client Sample ID: WC-TF3-513A**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572745 | **Prep Batch: 572792**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Diesel Range Organics [C10 - C28]	9700	F2 B	1950	48200	4 F2	ug/L		1974	45 - 120	78	28

Surrogate	MSD %Recovery	MSD Qualifier	Limits
o-Terphenyl	50	S1-	52 - 121

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 240-572485/2-A | **Client Sample ID: Method Blank**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572766 | **Prep Batch: 572485**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:05	1
Barium	ND		0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:05	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:05	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:05	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:05	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:05	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:05	1

Lab Sample ID: LCS 240-572485/3-A | **Client Sample ID: Lab Control Sample**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572766 | **Prep Batch: 572485**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	2.00	2.16		mg/L		108	50 - 150
Barium	2.00	1.94		mg/L		97	50 - 150
Cadmium	1.00	1.03		mg/L		103	50 - 150
Chromium	1.00	1.03		mg/L		103	50 - 150
Lead	1.00	0.945		mg/L		95	50 - 150

Method: 6010D - Metals (ICP) (Continued)

Lab Sample ID: LCS 240-572485/3-A
Matrix: Water
Analysis Batch: 572766

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 572485

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Selenium	2.00	2.25		mg/L		112	50 - 150
Silver	0.100	0.109		mg/L		109	50 - 150

Lab Sample ID: LB 240-572477/1-B
Matrix: Water
Analysis Batch: 572766

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 572485

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.00518	J	0.050	0.0041	mg/L		05/08/23 14:00	05/09/23 19:01	1
Barium	ND		0.50	0.0030	mg/L		05/08/23 14:00	05/09/23 19:01	1
Cadmium	ND		0.050	0.00045	mg/L		05/08/23 14:00	05/09/23 19:01	1
Chromium	ND		0.050	0.00076	mg/L		05/08/23 14:00	05/09/23 19:01	1
Lead	ND		0.050	0.0028	mg/L		05/08/23 14:00	05/09/23 19:01	1
Selenium	ND		0.050	0.0060	mg/L		05/08/23 14:00	05/09/23 19:01	1
Silver	ND		0.050	0.00062	mg/L		05/08/23 14:00	05/09/23 19:01	1

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 572766

Client Sample ID: WC-TF3-513A
Prep Type: TCLP
Prep Batch: 572485

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.011	J B	5.00	5.08		mg/L		101	75 - 125
Barium	0.043	J	50.0	48.9		mg/L		98	75 - 125
Cadmium	ND		1.00	1.01		mg/L		101	75 - 125
Chromium	ND		5.00	5.06		mg/L		101	75 - 125
Lead	ND		5.00	5.06		mg/L		101	75 - 125
Selenium	0.013	J	1.00	1.08		mg/L		107	75 - 125
Silver	ND		1.00	1.00		mg/L		100	75 - 125

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 572766

Client Sample ID: WC-TF3-513A
Prep Type: TCLP
Prep Batch: 572485

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	0.011	J B	5.00	5.02		mg/L		100	75 - 125	1	20
Barium	0.043	J	50.0	48.6		mg/L		97	75 - 125	1	20
Cadmium	ND		1.00	0.993		mg/L		99	75 - 125	1	20
Chromium	ND		5.00	4.99		mg/L		100	75 - 125	1	20
Lead	ND		5.00	4.98		mg/L		100	75 - 125	2	20
Selenium	0.013	J	1.00	1.03		mg/L		102	75 - 125	5	20
Silver	ND		1.00	0.996		mg/L		100	75 - 125	1	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-572488/2-A
Matrix: Water
Analysis Batch: 572546

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 572488

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:17	1

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

Method: 7470A - Mercury (CVAA)

Lab Sample ID: LCS 240-572488/3-A
Matrix: Water
Analysis Batch: 572546

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 572488

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			0.00500	0.00420		mg/L		84	80 - 120		

Lab Sample ID: LB 240-572477/1-C
Matrix: Water
Analysis Batch: 572546

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 572488

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		05/08/23 14:00	05/09/23 13:15	1

Lab Sample ID: 240-184875-18 MS
Matrix: Water
Analysis Batch: 572546

Client Sample ID: WC-TF3-513A
Prep Type: TCLP
Prep Batch: 572488

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury	ND		0.00500	0.00423		mg/L		85	80 - 120		

Lab Sample ID: 240-184875-18 MSD
Matrix: Water
Analysis Batch: 572546

Client Sample ID: WC-TF3-513A
Prep Type: TCLP
Prep Batch: 572488

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	ND		0.00500	0.00416		mg/L		83	80 - 120	2	20

Method: 1010B - Ignitability, Pensky-Martens Closed-Cup Method

Lab Sample ID: LCS 240-572685/1
Matrix: Water
Analysis Batch: 572685

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Ignitablity (Flashpoint)			81.0	82.8		Fahrenheit		102	97 - 103		

Lab Sample ID: 240-184875-1 DU
Matrix: Water
Analysis Batch: 572685

Client Sample ID: WC-TF5-538F
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Ignitablity (Flashpoint)	>200			>200		Degrees F				NC	20

Lab Sample ID: LCS 240-572857/1
Matrix: Water
Analysis Batch: 572857

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Ignitablity (Flashpoint)			81.0	82.7		Fahrenheit		102	97 - 103		

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

Method: 1010B - Ignitability, Pensky-Martens Closed-Cup Method (Continued)

Lab Sample ID: 240-184875-16 DU
Matrix: Water
Analysis Batch: 572857

Client Sample ID: WC-TF5-251320
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Ignitablity (Flashpoint)	>200			>200		Degrees F				NC	20

Method: 2540D-2015 - Total Suspended Solids (Dried at 103-105°C)

Lab Sample ID: MB 240-572953/1
Matrix: Water
Analysis Batch: 572953

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Suspended Solids	ND		4.0	0.40	mg/L			05/11/23 10:50	1

Lab Sample ID: LCS 240-572953/2
Matrix: Water
Analysis Batch: 572953

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Total Suspended Solids			77.7	76.5		mg/L		98	64 - 120		

Lab Sample ID: 240-184875-1 DU
Matrix: Water
Analysis Batch: 572953

Client Sample ID: WC-TF5-538F
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Total Suspended Solids	72			74.2		mg/L				4	10

Lab Sample ID: 240-184875-18 DU
Matrix: Water
Analysis Batch: 572953

Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Total Suspended Solids	3400			3700		mg/L				8	10

Method: 5310 C-2014 - Total Organic Carbon/Persulfate - Ultrav

Lab Sample ID: MB 240-572903/4
Matrix: Water
Analysis Batch: 572903

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.35	mg/L			05/10/23 11:26	1

Lab Sample ID: LCS 240-572903/5
Matrix: Water
Analysis Batch: 572903

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Total Organic Carbon			18.3	18.3		mg/L		100	85 - 115		
TOC Result 1			18.3	19.1		mg/L		104	85 - 115		
TOC Result 2			18.3	17.5		mg/L		95	85 - 115		

Method: 5310 C-2014 - Total Organic Carbon/Persulfate - Ultrav (Continued)

Lab Sample ID: 240-184875-2 MS
Matrix: Water
Analysis Batch: 572903
Client Sample ID: WC-TF5-514D
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Total Organic Carbon	3.7		10.0	13.9		mg/L		102	65 - 134
TOC Result 1	3.9		10.0	14.5		mg/L		107	65 - 134
TOC Result 2	3.6		10.0	13.3		mg/L		97	65 - 134

Lab Sample ID: 240-184875-2 MSD
Matrix: Water
Analysis Batch: 572903
Client Sample ID: WC-TF5-514D
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Total Organic Carbon	3.7		10.0	13.7		mg/L		100	65 - 134	1	10
TOC Result 1	3.9		10.0	14.4		mg/L		105	65 - 134	1	10
TOC Result 2	3.6		10.0	13.1		mg/L		95	65 - 134	2	10

Lab Sample ID: MB 240-573112/40
Matrix: Water
Analysis Batch: 573112
Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.35	mg/L			05/11/23 22:19	1

Lab Sample ID: LCS 240-573112/41
Matrix: Water
Analysis Batch: 573112
Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Organic Carbon	18.3	18.3		mg/L		100	85 - 115
TOC Result 1	18.3	19.1		mg/L		104	85 - 115
TOC Result 2	18.3	17.4		mg/L		95	85 - 115

Lab Sample ID: 240-184875-18MS
Matrix: Water
Analysis Batch: 573112
Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Total Organic Carbon	57		50.0	105		mg/L		95	65 - 134
TOC Result 1	61		50.0	110		mg/L		100	65 - 134
TOC Result 2	54		50.0	99.2		mg/L		89	65 - 134

Lab Sample ID: 240-184875-18MSD
Matrix: Water
Analysis Batch: 573112
Client Sample ID: WC-TF3-513A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Total Organic Carbon	57		50.0	105		mg/L		94	65 - 134	0	10
TOC Result 1	61		50.0	110		mg/L		99	65 - 134	0	10
TOC Result 2	54		50.0	99.1		mg/L		89	65 - 134	0	10

Method: 9040C - pH

Lab Sample ID: LCS 240-572602/2 | **Client Sample ID: Lab Control Sample**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572602

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
corrosivity by pH			9.20	9.2		SU		100	97 - 103		

Lab Sample ID: LCS 240-572647/3 | **Client Sample ID: Lab Control Sample**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572647

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
corrosivity by pH			9.20	9.2		SU		100	97 - 103		

Lab Sample ID: 240-184875-18 DU | **Client Sample ID: WC-TF3-513A**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 572647

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
corrosivity by pH	7.4	HF		7.4	HF	SU				0.1	20

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Analysis Batch: 572451

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	8260D	
240-184875-2	WC-TF5-514D	Total/NA	Water	8260D	
240-184875-2	WC-TF5-514D	Total/NA	Water	8260D	
240-184875-3	TRIP BLANK	Total/NA	Water	8260D	
240-184875-4	WC-TF3-501F	Total/NA	Water	8260D	
240-184875-5	WC-TF3-251478	Total/NA	Water	8260D	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	8260D	
240-184875-8	FB-2-05072023	Total/NA	Water	8260D	
240-184875-9	TRIP BLANK	Total/NA	Water	8260D	
240-184875-10	WC-TF3-257761	Total/NA	Water	8260D	
240-184875-11	DUP-1	Total/NA	Water	8260D	
240-184875-12	TRIP BLANK	Total/NA	Water	8260D	
240-184875-13	FB-1-05062023	Total/NA	Water	8260D	
240-184875-15	WC-TF5-260119	Total/NA	Water	8260D	
240-184875-16	WC-TF5-251320	Total/NA	Water	8260D	
240-184875-17	TRIP BLANK	Total/NA	Water	8260D	
MB 240-572451/8	Method Blank	Total/NA	Water	8260D	
LCS 240-572451/5	Lab Control Sample	Total/NA	Water	8260D	
LCS 240-572451/6	Lab Control Sample	Total/NA	Water	8260D	
240-184875-2 MS	WC-TF5-514D	Total/NA	Water	8260D	
240-184875-2 MSD	WC-TF5-514D	Total/NA	Water	8260D	

Analysis Batch: 572636

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-5	WC-TF3-251478	Total/NA	Water	8260D	
240-184875-14	TRIP BLANK	Total/NA	Water	8260D	
240-184875-15	WC-TF5-260119	Total/NA	Water	8260D	
240-184875-16	WC-TF5-251320	Total/NA	Water	8260D	
240-184875-19	TRIP BLANK	Total/NA	Water	8260D	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	8260D	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	8260D	
240-184875-22	TRIP BLANK	Total/NA	Water	8260D	
240-184875-23	WC-TF5-514E	Total/NA	Water	8260D	
240-184875-25	TRIP BLANK	Total/NA	Water	8260D	
MB 240-572636/8	Method Blank	Total/NA	Water	8260D	
LCS 240-572636/5	Lab Control Sample	Total/NA	Water	8260D	
LCS 240-572636/6	Lab Control Sample	Total/NA	Water	8260D	

Analysis Batch: 572810

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-18	WC-TF3-513A	Total/NA	Water	8260D	
240-184875-18	WC-TF3-513A	Total/NA	Water	8260D	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	8260D	
240-184875-23	WC-TF5-514E	Total/NA	Water	8260D	
MB 240-572810/8	Method Blank	Total/NA	Water	8260D	
LCS 240-572810/5	Lab Control Sample	Total/NA	Water	8260D	
LCS 240-572810/6	Lab Control Sample	Total/NA	Water	8260D	
240-184875-18 MS	WC-TF3-513A	Total/NA	Water	8260D	
240-184875-18 MS	WC-TF3-513A	Total/NA	Water	8260D	
240-184875-18 MSD	WC-TF3-513A	Total/NA	Water	8260D	
240-184875-18 MSD	WC-TF3-513A	Total/NA	Water	8260D	

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Prep Batch: 373607

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-2 - RA	WC-TF5-514D	Total/NA	Water	3510C	
240-184875-2	WC-TF5-514D	Total/NA	Water	3510C	
240-184875-4	WC-TF3-501F	Total/NA	Water	3510C	
240-184875-5 - RA	WC-TF3-251478	Total/NA	Water	3510C	
240-184875-5	WC-TF3-251478	Total/NA	Water	3510C	
240-184875-13	FB-1-05062023	Total/NA	Water	3510C	
240-184875-16 - RA	WC-TF5-251320	Total/NA	Water	3510C	
240-184875-16	WC-TF5-251320	Total/NA	Water	3510C	
240-184875-18	WC-TF3-513A	Total/NA	Water	3510C	
240-184875-20 - RA	WC-TF3-AL4787	Total/NA	Water	3510C	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	3510C	
240-184875-21 - RA	WC-TF3-AL4216	Total/NA	Water	3510C	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	3510C	
240-184875-23	WC-TF5-514E	Total/NA	Water	3510C	
MB 410-373607/1-A - RA	Method Blank	Total/NA	Water	3510C	
MB 410-373607/1-A	Method Blank	Total/NA	Water	3510C	
LCS 410-373607/2-A - RA	Lab Control Sample	Total/NA	Water	3510C	
LCS 410-373607/2-A	Lab Control Sample	Total/NA	Water	3510C	
240-184875-18 MS	WC-TF3-513A	Total/NA	Water	3510C	
240-184875-18 MSD	WC-TF3-513A	Total/NA	Water	3510C	

Analysis Batch: 373776

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-2	WC-TF5-514D	Total/NA	Water	8270E	373607
240-184875-4	WC-TF3-501F	Total/NA	Water	8270E	373607
240-184875-5	WC-TF3-251478	Total/NA	Water	8270E	373607
240-184875-13	FB-1-05062023	Total/NA	Water	8270E	373607
240-184875-16	WC-TF5-251320	Total/NA	Water	8270E	373607
240-184875-20	WC-TF3-AL4787	Total/NA	Water	8270E	373607
240-184875-21	WC-TF3-AL4216	Total/NA	Water	8270E	373607
240-184875-23	WC-TF5-514E	Total/NA	Water	8270E	373607
MB 410-373607/1-A	Method Blank	Total/NA	Water	8270E	373607
LCS 410-373607/2-A	Lab Control Sample	Total/NA	Water	8270E	373607

Analysis Batch: 374258

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-2 - RA	WC-TF5-514D	Total/NA	Water	8270E	373607
240-184875-5 - RA	WC-TF3-251478	Total/NA	Water	8270E	373607
240-184875-18	WC-TF3-513A	Total/NA	Water	8270E	373607
MB 410-373607/1-A - RA	Method Blank	Total/NA	Water	8270E	373607
240-184875-18 MS	WC-TF3-513A	Total/NA	Water	8270E	373607
240-184875-18 MSD	WC-TF3-513A	Total/NA	Water	8270E	373607

Analysis Batch: 374462

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-16 - RA	WC-TF5-251320	Total/NA	Water	8270E	373607
240-184875-20 - RA	WC-TF3-AL4787	Total/NA	Water	8270E	373607
240-184875-21 - RA	WC-TF3-AL4216	Total/NA	Water	8270E	373607
LCS 410-373607/2-A - RA	Lab Control Sample	Total/NA	Water	8270E	373607

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Prep Batch: 374570

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	3510C	
240-184875-1 - DL	WC-TF5-538F	Total/NA	Water	3510C	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	3510C	
240-184875-8	FB-2-05072023	Total/NA	Water	3510C	
240-184875-10	WC-TF3-257761	Total/NA	Water	3510C	
240-184875-11	DUP-1	Total/NA	Water	3510C	
240-184875-15	WC-TF5-260119	Total/NA	Water	3510C	
240-184875-18 - RE	WC-TF3-513A	Total/NA	Water	3510C	
MB 410-374570/1-A	Method Blank	Total/NA	Water	3510C	
LCS 410-374570/2-A	Lab Control Sample	Total/NA	Water	3510C	
240-184875-18 MS - RE	WC-TF3-513A	Total/NA	Water	3510C	
240-184875-18 MSD - RE	WC-TF3-513A	Total/NA	Water	3510C	

Analysis Batch: 374813

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	8270E	374570
240-184875-1 - DL	WC-TF5-538F	Total/NA	Water	8270E	374570
240-184875-7	WC-TF3-AL4944	Total/NA	Water	8270E	374570
240-184875-8	FB-2-05072023	Total/NA	Water	8270E	374570
240-184875-10	WC-TF3-257761	Total/NA	Water	8270E	374570
240-184875-11	DUP-1	Total/NA	Water	8270E	374570
240-184875-15	WC-TF5-260119	Total/NA	Water	8270E	374570
MB 410-374570/1-A	Method Blank	Total/NA	Water	8270E	374570
LCS 410-374570/2-A	Lab Control Sample	Total/NA	Water	8270E	374570

Analysis Batch: 376263

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-18 - RE	WC-TF3-513A	Total/NA	Water	8270E	374570
240-184875-18 MS - RE	WC-TF3-513A	Total/NA	Water	8270E	374570
240-184875-18 MSD - RE	WC-TF3-513A	Total/NA	Water	8270E	374570

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Prep Batch: 572386

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	3511	
240-184875-2	WC-TF5-514D	Total/NA	Water	3511	
240-184875-4	WC-TF3-501F	Total/NA	Water	3511	
240-184875-5	WC-TF3-251478	Total/NA	Water	3511	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	3511	
240-184875-8	FB-2-05072023	Total/NA	Water	3511	
240-184875-10	WC-TF3-257761	Total/NA	Water	3511	
240-184875-11	DUP-1	Total/NA	Water	3511	
240-184875-13	FB-1-05062023	Total/NA	Water	3511	
240-184875-15	WC-TF5-260119	Total/NA	Water	3511	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	3511	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	3511	
240-184875-23	WC-TF5-514E	Total/NA	Water	3511	
MB 240-572386/1-A	Method Blank	Total/NA	Water	3511	
LCS 240-572386/2-A	Lab Control Sample	Total/NA	Water	3511	

GC Semi VOA

Analysis Batch: 572423

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-8	FB-2-05072023	Total/NA	Water	8015D	572386
240-184875-10	WC-TF3-257761	Total/NA	Water	8015D	572386
240-184875-11	DUP-1	Total/NA	Water	8015D	572386
240-184875-13	FB-1-05062023	Total/NA	Water	8015D	572386
240-184875-15	WC-TF5-260119	Total/NA	Water	8015D	572386
240-184875-20	WC-TF3-AL4787	Total/NA	Water	8015D	572386
240-184875-21	WC-TF3-AL4216	Total/NA	Water	8015D	572386

Analysis Batch: 572425

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-2	WC-TF5-514D	Total/NA	Water	8015D	572386
240-184875-4	WC-TF3-501F	Total/NA	Water	8015D	572386
240-184875-5	WC-TF3-251478	Total/NA	Water	8015D	572386
MB 240-572386/1-A	Method Blank	Total/NA	Water	8015D	572386
LCS 240-572386/2-A	Lab Control Sample	Total/NA	Water	8015D	572386

Analysis Batch: 572573

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	8015D	572386
240-184875-7	WC-TF3-AL4944	Total/NA	Water	8015D	572386

Analysis Batch: 572576

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-23	WC-TF5-514E	Total/NA	Water	8015D	572386

Analysis Batch: 572745

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-18	WC-TF3-513A	Total/NA	Water	8015D	572792
MB 240-572792/1-A	Method Blank	Total/NA	Water	8015D	572792
LCS 240-572792/12-A	Lab Control Sample	Total/NA	Water	8015D	572792
240-184875-18 MS	WC-TF3-513A	Total/NA	Water	8015D	572792
240-184875-18 MSD	WC-TF3-513A	Total/NA	Water	8015D	572792

Analysis Batch: 572747

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-16	WC-TF5-251320	Total/NA	Water	8015D	572792

Prep Batch: 572792

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-16	WC-TF5-251320	Total/NA	Water	3511	
240-184875-18	WC-TF3-513A	Total/NA	Water	3511	
MB 240-572792/1-A	Method Blank	Total/NA	Water	3511	
LCS 240-572792/12-A	Lab Control Sample	Total/NA	Water	3511	
240-184875-18 MS	WC-TF3-513A	Total/NA	Water	3511	
240-184875-18 MSD	WC-TF3-513A	Total/NA	Water	3511	

Metals

Leach Batch: 572477

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	TCLP	Water	1311	

Metals (Continued)

Leach Batch: 572477 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-2	WC-TF5-514D	TCLP	Water	1311	
240-184875-4	WC-TF3-501F	TCLP	Water	1311	
240-184875-5	WC-TF3-251478	TCLP	Water	1311	
240-184875-7	WC-TF3-AL4944	TCLP	Water	1311	
240-184875-8	FB-2-05072023	TCLP	Water	1311	
240-184875-10	WC-TF3-257761	TCLP	Water	1311	
240-184875-11	DUP-1	TCLP	Water	1311	
240-184875-13	FB-1-05062023	TCLP	Water	1311	
240-184875-15	WC-TF5-260119	TCLP	Water	1311	
240-184875-16	WC-TF5-251320	TCLP	Water	1311	
240-184875-18	WC-TF3-513A	TCLP	Water	1311	
240-184875-20	WC-TF3-AL4787	TCLP	Water	1311	
240-184875-21	WC-TF3-AL4216	TCLP	Water	1311	
240-184875-23	WC-TF5-514E	TCLP	Water	1311	
LB 240-572477/1-B	Method Blank	TCLP	Water	1311	
LB 240-572477/1-C	Method Blank	TCLP	Water	1311	
240-184875-18 MS	WC-TF3-513A	TCLP	Water	1311	
240-184875-18 MSD	WC-TF3-513A	TCLP	Water	1311	

Prep Batch: 572485

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	TCLP	Water	3010A	572477
240-184875-2	WC-TF5-514D	TCLP	Water	3010A	572477
240-184875-4	WC-TF3-501F	TCLP	Water	3010A	572477
240-184875-5	WC-TF3-251478	TCLP	Water	3010A	572477
240-184875-7	WC-TF3-AL4944	TCLP	Water	3010A	572477
240-184875-8	FB-2-05072023	TCLP	Water	3010A	572477
240-184875-10	WC-TF3-257761	TCLP	Water	3010A	572477
240-184875-11	DUP-1	TCLP	Water	3010A	572477
240-184875-13	FB-1-05062023	TCLP	Water	3010A	572477
240-184875-15	WC-TF5-260119	TCLP	Water	3010A	572477
240-184875-16	WC-TF5-251320	TCLP	Water	3010A	572477
240-184875-18	WC-TF3-513A	TCLP	Water	3010A	572477
240-184875-20	WC-TF3-AL4787	TCLP	Water	3010A	572477
240-184875-21	WC-TF3-AL4216	TCLP	Water	3010A	572477
240-184875-23	WC-TF5-514E	TCLP	Water	3010A	572477
LB 240-572477/1-B	Method Blank	TCLP	Water	3010A	572477
MB 240-572485/2-A	Method Blank	Total/NA	Water	3010A	
LCS 240-572485/3-A	Lab Control Sample	Total/NA	Water	3010A	
240-184875-18 MS	WC-TF3-513A	TCLP	Water	3010A	572477
240-184875-18 MSD	WC-TF3-513A	TCLP	Water	3010A	572477

Prep Batch: 572488

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	TCLP	Water	7470A	572477
240-184875-2	WC-TF5-514D	TCLP	Water	7470A	572477
240-184875-4	WC-TF3-501F	TCLP	Water	7470A	572477
240-184875-5	WC-TF3-251478	TCLP	Water	7470A	572477
240-184875-7	WC-TF3-AL4944	TCLP	Water	7470A	572477
240-184875-8	FB-2-05072023	TCLP	Water	7470A	572477
240-184875-10	WC-TF3-257761	TCLP	Water	7470A	572477

Metals (Continued)

Prep Batch: 572488 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-11	DUP-1	TCLP	Water	7470A	572477
240-184875-13	FB-1-05062023	TCLP	Water	7470A	572477
240-184875-15	WC-TF5-260119	TCLP	Water	7470A	572477
240-184875-16	WC-TF5-251320	TCLP	Water	7470A	572477
240-184875-18	WC-TF3-513A	TCLP	Water	7470A	572477
240-184875-20	WC-TF3-AL4787	TCLP	Water	7470A	572477
240-184875-21	WC-TF3-AL4216	TCLP	Water	7470A	572477
240-184875-23	WC-TF5-514E	TCLP	Water	7470A	572477
LB 240-572477/1-C	Method Blank	TCLP	Water	7470A	572477
MB 240-572488/2-A	Method Blank	Total/NA	Water	7470A	
LCS 240-572488/3-A	Lab Control Sample	Total/NA	Water	7470A	
240-184875-18 MS	WC-TF3-513A	TCLP	Water	7470A	572477
240-184875-18 MSD	WC-TF3-513A	TCLP	Water	7470A	572477

Analysis Batch: 572546

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	TCLP	Water	7470A	572488
240-184875-2	WC-TF5-514D	TCLP	Water	7470A	572488
240-184875-4	WC-TF3-501F	TCLP	Water	7470A	572488
240-184875-5	WC-TF3-251478	TCLP	Water	7470A	572488
240-184875-7	WC-TF3-AL4944	TCLP	Water	7470A	572488
240-184875-8	FB-2-05072023	TCLP	Water	7470A	572488
240-184875-10	WC-TF3-257761	TCLP	Water	7470A	572488
240-184875-11	DUP-1	TCLP	Water	7470A	572488
240-184875-13	FB-1-05062023	TCLP	Water	7470A	572488
240-184875-15	WC-TF5-260119	TCLP	Water	7470A	572488
240-184875-16	WC-TF5-251320	TCLP	Water	7470A	572488
240-184875-18	WC-TF3-513A	TCLP	Water	7470A	572488
240-184875-20	WC-TF3-AL4787	TCLP	Water	7470A	572488
240-184875-21	WC-TF3-AL4216	TCLP	Water	7470A	572488
240-184875-23	WC-TF5-514E	TCLP	Water	7470A	572488
LB 240-572477/1-C	Method Blank	TCLP	Water	7470A	572488
MB 240-572488/2-A	Method Blank	Total/NA	Water	7470A	572488
LCS 240-572488/3-A	Lab Control Sample	Total/NA	Water	7470A	572488
240-184875-18 MS	WC-TF3-513A	TCLP	Water	7470A	572488
240-184875-18 MSD	WC-TF3-513A	TCLP	Water	7470A	572488

Analysis Batch: 572766

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	TCLP	Water	6010D	572485
240-184875-2	WC-TF5-514D	TCLP	Water	6010D	572485
240-184875-4	WC-TF3-501F	TCLP	Water	6010D	572485
240-184875-5	WC-TF3-251478	TCLP	Water	6010D	572485
240-184875-7	WC-TF3-AL4944	TCLP	Water	6010D	572485
240-184875-8	FB-2-05072023	TCLP	Water	6010D	572485
240-184875-10	WC-TF3-257761	TCLP	Water	6010D	572485
240-184875-11	DUP-1	TCLP	Water	6010D	572485
240-184875-13	FB-1-05062023	TCLP	Water	6010D	572485
240-184875-15	WC-TF5-260119	TCLP	Water	6010D	572485
240-184875-16	WC-TF5-251320	TCLP	Water	6010D	572485
240-184875-18	WC-TF3-513A	TCLP	Water	6010D	572485

Metals (Continued)

Analysis Batch: 572766 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-20	WC-TF3-AL4787	TCLP	Water	6010D	572485
240-184875-21	WC-TF3-AL4216	TCLP	Water	6010D	572485
240-184875-23	WC-TF5-514E	TCLP	Water	6010D	572485
LB 240-572477/1-B	Method Blank	TCLP	Water	6010D	572485
MB 240-572485/2-A	Method Blank	Total/NA	Water	6010D	572485
LCS 240-572485/3-A	Lab Control Sample	Total/NA	Water	6010D	572485
240-184875-18 MS	WC-TF3-513A	TCLP	Water	6010D	572485
240-184875-18 MSD	WC-TF3-513A	TCLP	Water	6010D	572485

General Chemistry

Analysis Batch: 572602

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-8	FB-2-05072023	Total/NA	Water	9040C	
240-184875-13	FB-1-05062023	Total/NA	Water	9040C	
LCS 240-572602/2	Lab Control Sample	Total/NA	Water	9040C	

Analysis Batch: 572647

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	9040C	
240-184875-2	WC-TF5-514D	Total/NA	Water	9040C	
240-184875-4	WC-TF3-501F	Total/NA	Water	9040C	
240-184875-5	WC-TF3-251478	Total/NA	Water	9040C	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	9040C	
240-184875-10	WC-TF3-257761	Total/NA	Water	9040C	
240-184875-11	DUP-1	Total/NA	Water	9040C	
240-184875-15	WC-TF5-260119	Total/NA	Water	9040C	
240-184875-16	WC-TF5-251320	Total/NA	Water	9040C	
240-184875-18	WC-TF3-513A	Total/NA	Water	9040C	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	9040C	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	9040C	
240-184875-23	WC-TF5-514E	Total/NA	Water	9040C	
LCS 240-572647/3	Lab Control Sample	Total/NA	Water	9040C	
240-184875-18 DU	WC-TF3-513A	Total/NA	Water	9040C	

Analysis Batch: 572685

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	1010B	
240-184875-2	WC-TF5-514D	Total/NA	Water	1010B	
240-184875-4	WC-TF3-501F	Total/NA	Water	1010B	
240-184875-5	WC-TF3-251478	Total/NA	Water	1010B	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	1010B	
240-184875-8	FB-2-05072023	Total/NA	Water	1010B	
240-184875-10	WC-TF3-257761	Total/NA	Water	1010B	
240-184875-11	DUP-1	Total/NA	Water	1010B	
240-184875-13	FB-1-05062023	Total/NA	Water	1010B	
240-184875-15	WC-TF5-260119	Total/NA	Water	1010B	
LCS 240-572685/1	Lab Control Sample	Total/NA	Water	1010B	
240-184875-1 DU	WC-TF5-538F	Total/NA	Water	1010B	

QC Association Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

General Chemistry

Analysis Batch: 572857

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-16	WC-TF5-251320	Total/NA	Water	1010B	
240-184875-18	WC-TF3-513A	Total/NA	Water	1010B	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	1010B	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	1010B	
240-184875-23	WC-TF5-514E	Total/NA	Water	1010B	
LCS 240-572857/1	Lab Control Sample	Total/NA	Water	1010B	
240-184875-16 DU	WC-TF5-251320	Total/NA	Water	1010B	

Analysis Batch: 572903

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	5310 C-2014	
240-184875-2	WC-TF5-514D	Total/NA	Water	5310 C-2014	
240-184875-4	WC-TF3-501F	Total/NA	Water	5310 C-2014	
240-184875-5	WC-TF3-251478	Total/NA	Water	5310 C-2014	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	5310 C-2014	
240-184875-8	FB-2-05072023	Total/NA	Water	5310 C-2014	
240-184875-10	WC-TF3-257761	Total/NA	Water	5310 C-2014	
240-184875-11	DUP-1	Total/NA	Water	5310 C-2014	
240-184875-13	FB-1-05062023	Total/NA	Water	5310 C-2014	
240-184875-15	WC-TF5-260119	Total/NA	Water	5310 C-2014	
240-184875-16	WC-TF5-251320	Total/NA	Water	5310 C-2014	
240-184875-18	WC-TF3-513A	Total/NA	Water	5310 C-2014	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	5310 C-2014	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	5310 C-2014	
240-184875-23	WC-TF5-514E	Total/NA	Water	5310 C-2014	
MB 240-572903/4	Method Blank	Total/NA	Water	5310 C-2014	
LCS 240-572903/5	Lab Control Sample	Total/NA	Water	5310 C-2014	
240-184875-2 MS	WC-TF5-514D	Total/NA	Water	5310 C-2014	
240-184875-2 MSD	WC-TF5-514D	Total/NA	Water	5310 C-2014	

Analysis Batch: 572953

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-184875-1	WC-TF5-538F	Total/NA	Water	2540D-2015	
240-184875-2	WC-TF5-514D	Total/NA	Water	2540D-2015	
240-184875-4	WC-TF3-501F	Total/NA	Water	2540D-2015	
240-184875-5	WC-TF3-251478	Total/NA	Water	2540D-2015	
240-184875-7	WC-TF3-AL4944	Total/NA	Water	2540D-2015	
240-184875-8	FB-2-05072023	Total/NA	Water	2540D-2015	
240-184875-10	WC-TF3-257761	Total/NA	Water	2540D-2015	
240-184875-11	DUP-1	Total/NA	Water	2540D-2015	
240-184875-13	FB-1-05062023	Total/NA	Water	2540D-2015	
240-184875-15	WC-TF5-260119	Total/NA	Water	2540D-2015	
240-184875-16	WC-TF5-251320	Total/NA	Water	2540D-2015	
240-184875-18	WC-TF3-513A	Total/NA	Water	2540D-2015	
240-184875-20	WC-TF3-AL4787	Total/NA	Water	2540D-2015	
240-184875-21	WC-TF3-AL4216	Total/NA	Water	2540D-2015	
240-184875-23	WC-TF5-514E	Total/NA	Water	2540D-2015	
MB 240-572953/1	Method Blank	Total/NA	Water	2540D-2015	
LCS 240-572953/2	Lab Control Sample	Total/NA	Water	2540D-2015	
240-184875-1 DU	WC-TF5-538F	Total/NA	Water	2540D-2015	
240-184875-18 DU	WC-TF3-513A	Total/NA	Water	2540D-2015	

QC Association Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-184875-1

General Chemistry

Analysis Batch: 573112

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 240-573112/40	Method Blank	Total/NA	Water	5310 C-2014	
LCS 240-573112/41	Lab Control Sample	Total/NA	Water	5310 C-2014	
240-184875-18MS	WC-TF3-513A	Total/NA	Water	5310 C-2014	
240-184875-18MSD	WC-TF3-513A	Total/NA	Water	5310 C-2014	

Client Sample ID: WC-TF5-538F

Lab Sample ID: 240-184875-1

Date Collected: 05/07/23 10:55

Matrix: Water

Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 16:11
Total/NA	Prep	3510C			374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E		1	374813	P7EB	ELLE	05/11/23 17:58
Total/NA	Prep	3510C	DL		374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E	DL	20	374813	P7EB	ELLE	05/11/23 19:59
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		2	572573	EPF	EET CLE	05/09/23 12:27
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 19:44
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:29
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 13:03
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		10	572903	MED	EET CLE	05/10/23 13:23
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 19:15

Client Sample ID: WC-TF5-514D

Lab Sample ID: 240-184875-2

Date Collected: 05/07/23 11:25

Matrix: Water

Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 15:24
Total/NA	Analysis	8260D		3.333	572451	SAM	EET CLE	05/08/23 20:08
Total/NA	Prep	3510C	RA		373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E	RA	1	374258	P7EB	ELLE	05/10/23 18:51
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/09/23 21:35
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572425	EPF	EET CLE	05/08/23 16:07
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 19:48
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:32
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 14:30
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 11:52
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 19:22

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-3
Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 15:47

Client Sample ID: WC-TF3-501F
Lab Sample ID: 240-184875-4
Date Collected: 05/07/23 09:21
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 16:35
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/09/23 21:54
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572425	EPF	EET CLE	05/08/23 16:35
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 19:52
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:34
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 15:13
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 14:01
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 19:28

Client Sample ID: WC-TF3-251478
Lab Sample ID: 240-184875-5
Date Collected: 05/07/23 09:40
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 16:58
Total/NA	Analysis	8260D		10	572636	SAM	EET CLE	05/09/23 17:35
Total/NA	Prep	3510C	RA		373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E	RA	10	374258	P7EB	ELLE	05/10/23 19:11
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/09/23 22:14
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572425	EPF	EET CLE	05/08/23 17:03
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 19:57
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:40
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 15:56
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50

Client Sample ID: WC-TF3-251478 — Lab Sample ID: 240-184875-5

Date Collected: 05/07/23 09:40 — **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	5310 C-2014		5	572903	MED	EET CLE	05/10/23 14:14
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 19:35

Client Sample ID: WC-TF3-AL4944 — Lab Sample ID: 240-184875-7

Date Collected: 05/07/23 11:17 — **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 17:22
Total/NA	Prep	3510C			374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E		1	374813	P7EB	ELLE	05/11/23 18:18
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572573	EPF	EET CLE	05/09/23 13:01
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:09
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:42
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 16:40
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 14:27
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 19:40

Client Sample ID: FB-2-05072023 — Lab Sample ID: 240-184875-8

Date Collected: 05/07/23 11:40 — **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 17:46
Total/NA	Prep	3510C			374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E		1	374813	P7EB	ELLE	05/11/23 18:38
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 13:22
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:14
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:44
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 17:23
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 14:40
Total/NA	Analysis	9040C		1	572602	BLW	EET CLE	05/09/23 10:24

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-9
Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 18:10

Client Sample ID: WC-TF3-257761
Lab Sample ID: 240-184875-10
Date Collected: 05/07/23 08:35
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 18:34
Total/NA	Prep	3510C			374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E		1	374813	P7EB	ELLE	05/11/23 18:58
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 13:49
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:18
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:46
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 18:06
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 14:53
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:10

Client Sample ID: DUP-1
Lab Sample ID: 240-184875-11
Date Collected: 05/07/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 18:57
Total/NA	Prep	3510C			374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E		1	374813	P7EB	ELLE	05/11/23 19:18
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 14:17
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:23
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:48
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 18:50
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 15:06
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:16

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-12

Date Collected: 05/07/23 00:00

Matrix: Water

Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 19:45

Client Sample ID: FB-1-05062023

Lab Sample ID: 240-184875-13

Date Collected: 05/06/23 16:00

Matrix: Water

Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 19:21
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/09/23 23:50
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 14:44
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:27
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:50
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 19:33
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 15:18
Total/NA	Analysis	9040C		1	572602	BLW	EET CLE	05/09/23 10:24

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-184875-14

Date Collected: 05/06/23 00:00

Matrix: Water

Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 15:59

Client Sample ID: WC-TF5-260119

Lab Sample ID: 240-184875-15

Date Collected: 05/06/23 12:05

Matrix: Water

Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 20:56
Total/NA	Analysis	8260D		3.333	572636	SAM	EET CLE	05/09/23 18:23
Total/NA	Prep	3510C			374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E		1	374813	P7EB	ELLE	05/11/23 19:39
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 15:12
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:31

Client Sample ID: WC-TF5-260119
Lab Sample ID: 240-184875-15
Date Collected: 05/06/23 12:05
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:52
Total/NA	Analysis	1010B		1	572685	JWW	EET CLE	05/09/23 20:16
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 15:31
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:29

Client Sample ID: WC-TF5-251320
Lab Sample ID: 240-184875-16
Date Collected: 05/06/23 12:35
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 21:19
Total/NA	Analysis	8260D		10	572636	SAM	EET CLE	05/09/23 17:59
Total/NA	Prep	3510C	RA		373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E	RA	10	374462	P7EB	ELLE	05/11/23 01:31
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/10/23 00:29
Total/NA	Prep	3511			572792	EPF	EET CLE	05/10/23 11:48
Total/NA	Analysis	8015D		1	572747	EPF	EET CLE	05/10/23 17:17
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:36
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:54
Total/NA	Analysis	1010B		1	572857	JWW	EET CLE	05/10/23 17:10
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		2	572903	MED	EET CLE	05/10/23 15:43
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:35

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-17
Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572451	SAM	EET CLE	05/08/23 20:32

Client Sample ID: WC-TF3-513A
Lab Sample ID: 240-184875-18

Date Collected: 05/06/23 15:30
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		5	572810	SAM	EET CLE	05/10/23 17:37
Total/NA	Analysis	8260D		1	572810	SAM	EET CLE	05/11/23 01:12
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		5	374258	P7EB	ELLE	05/10/23 17:30
Total/NA	Prep	3510C	RE		374570	QKX3	ELLE	05/11/23 08:29
Total/NA	Analysis	8270E	RE	5	376263	P7EB	ELLE	05/16/23 15:10
Total/NA	Prep	3511			572792	EPF	EET CLE	05/10/23 11:48
Total/NA	Analysis	8015D		10	572745	EPF	EET CLE	05/10/23 14:06
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 19:22
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:21
Total/NA	Analysis	1010B		1	572857	JWW	EET CLE	05/10/23 18:37
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		5	572903	MED	EET CLE	05/10/23 15:56
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 19:55

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-19

Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 16:23

Client Sample ID: WC-TF3-AL4787
Lab Sample ID: 240-184875-20

Date Collected: 05/07/23 10:10
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 19:10
Total/NA	Analysis	8260D		2	572810	SAM	EET CLE	05/10/23 18:01
Total/NA	Prep	3510C	RA		373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E	RA	10	374462	P7EB	ELLE	05/11/23 03:31
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/10/23 00:48
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 17:03
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:40

Client Sample ID: WC-TF3-AL4787 Lab Sample ID: 240-184875-20

Date Collected: 05/07/23 10:10 **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:56
Total/NA	Analysis	1010B		1	572857	JWW	EET CLE	05/10/23 19:20
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 16:35
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:42

Client Sample ID: WC-TF3-AL4216 Lab Sample ID: 240-184875-21

Date Collected: 05/07/23 10:45 **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 19:34
Total/NA	Prep	3510C	RA		373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E	RA	1	374462	P7EB	ELLE	05/11/23 03:51
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		1	373776	P7EB	ELLE	05/10/23 01:07
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		1	572423	EPF	EET CLE	05/08/23 17:31
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:44
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 14:05
Total/NA	Analysis	1010B		1	572857	JWW	EET CLE	05/10/23 20:04
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		1	572903	MED	EET CLE	05/10/23 16:48
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:48

Client Sample ID: TRIP BLANK Lab Sample ID: 240-184875-22

Date Collected: 05/07/23 00:00 **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 16:47

Client Sample ID: WC-TF5-514E Lab Sample ID: 240-184875-23

Date Collected: 05/06/23 13:00 **Matrix: Water**
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 19:58

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

Client Sample ID: WC-TF5-514E
Lab Sample ID: 240-184875-23
Date Collected: 05/06/23 13:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		50	572810	SAM	EET CLE	05/11/23 00:48
Total/NA	Prep	3510C			373607	YDF5	ELLE	05/09/23 08:16
Total/NA	Analysis	8270E		5	373776	P7EB	ELLE	05/10/23 01:27
Total/NA	Prep	3511			572386	LKG	EET CLE	05/08/23 07:32
Total/NA	Analysis	8015D		10	572576	EPF	EET CLE	05/09/23 13:48
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	3010A			572485	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	6010D		1	572766	KLC	EET CLE	05/09/23 20:49
TCLP	Leach	1311			572477	DRJ	EET CLE	05/08/23 12:05 - 05/08/23 13:30 [1]
TCLP	Prep	7470A			572488	MRL	EET CLE	05/08/23 14:00
TCLP	Analysis	7470A		1	572546	AJC	EET CLE	05/09/23 13:58
Total/NA	Analysis	1010B		1	572857	JWW	EET CLE	05/10/23 20:47
Total/NA	Analysis	2540D-2015		1	572953	MS	EET CLE	05/11/23 10:50
Total/NA	Analysis	5310 C-2014		5	572903	MED	EET CLE	05/10/23 17:01
Total/NA	Analysis	9040C		1	572647	JWW	EET CLE	05/08/23 20:53

Client Sample ID: TRIP BLANK
Lab Sample ID: 240-184875-25
Date Collected: 05/06/23 00:00
Matrix: Water
Date Received: 05/07/23 18:52

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	572636	SAM	EET CLE	05/09/23 17:11

[1] This procedure uses a method stipulated length of time for the process. Both start and end times are displayed.

Laboratory References:

EET CLE = Eurofins Cleveland, 180 S. Van Buren Avenue, Barberton, OH 44203, TEL (330)497-9396

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: Norfolk Southern Corporation　　Job ID: 240-184875-1
Project/Site: NS East Palestine

Laboratory: Eurofins Cleveland

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
California	State	2927	02-27-24
Connecticut	State	PH-0590	06-29-23
Florida	NELAP	E87225	06-30-23
Georgia	State	4062	02-28-24
Illinois	NELAP	200004	07-31-23
Iowa	State	421	06-01-23
Kentucky (UST)	State	112225	02-28-24
Kentucky (WW)	State	KY98016	12-31-23
Michigan	State	9135	02-27-24
Minnesota	NELAP	039-999-348	12-31-23
Minnesota (Petrofund)	State	3506	08-01-23
New Jersey	NELAP	OH001	06-30-23
New York	NELAP	10975	04-01-24
Ohio	State	8303	02-27-24
Ohio VAP	State	ORELAP 4062	02-27-24
Oregon	NELAP	4062	02-28-24
Pennsylvania	NELAP	68-00340	08-31-23
Texas	NELAP	T104704517-22-17	08-31-23
Virginia	NELAP	460175	09-14-23
West Virginia DEP	State	210	12-31-23

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	0001.01	11-30-24
A2LA	ISO/IEC 17025	0001.01	11-30-24
Alaska	State	PA00009	06-30-23
Alaska (UST)	State	17-027	02-28-24
Arizona	State	AZ0780	03-12-24
Arkansas DEQ	State	88-00660	08-09-23
California	State	2792	11-30-23
Colorado	State	PA00009	06-30-23
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-24
Delaware (DW)	State	N/A	01-31-24
Florida	NELAP	E87997	07-02-23
Georgia (DW)	State	C048	01-31-24
Hawaii	State	N/A	01-31-24
Illinois	NELAP	200027	01-31-24
Iowa	State	361	03-01-24
Kansas	NELAP	E-10151	10-31-23
Kentucky (DW)	State	KY90088	12-31-23
Kentucky (UST)	State	0001.01	11-30-24
Kentucky (WW)	State	KY90088	12-31-23
Louisiana (All)	NELAP	02055	06-30-23
Maine	State	2019012	03-12-25
Maryland	State	100	06-30-23
Massachusetts	State	M-PA009	06-30-23
Michigan	State	9930	01-31-24

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Minnesota	NELAP	042-999-487	12-31-23
Mississippi	State	023	01-31-24
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-24
Nebraska	State	NE-OS-32-17	01-31-24
New Hampshire	NELAP	2730	01-10-24
New Jersey	NELAP	PA011	06-30-23
New York	NELAP	10670	04-01-24
North Carolina (DW)	State	42705	07-31-23
North Carolina (WW/SW)	State	521	12-31-23
North Dakota	State	R-205	01-31-24
Oklahoma	NELAP	R-205	08-31-23
Oregon	NELAP	PA200001	09-11-23
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-24
Rhode Island	State	LAO00338	12-31-23
South Carolina	State	89002	01-31-24
Tennessee	State	02838	01-31-24
Texas	NELAP	T104704194-22-45	08-31-23
USDA	US Federal Programs	525-22-298-19481	10-25-25
Vermont	State	VT - 36037	10-28-23
Virginia	NELAP	460182	06-14-23
West Virginia (DW)	State	9906 C	12-31-23
West Virginia DEP	State	055	07-31-23
Wyoming	State	8TMS-L	01-31-24
Wyoming (UST)	A2LA	0001.01	11-30-24

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other: CERCLA

Eurofins Environment Testing America

Client Contact	**Project Manager: Jason Artrip**
Arcadis	Email: jason.artrip@arcadis.com
111-D Sanders Lane	Tel/Fax:
Bluefield, VA 24605	**Analysis Turnaround Time** ☐ CALENDAR DAYS ☐ WORKING DAYS
304-396-9424 Phone	TAT if different from Below 24-hour RUSH
(xxx) xxx-xxxx FAX	☐ 2 weeks
Project Name: East Palestine Train Derailment Site	☐ 1 week Rush
Site: East Palestine, OH	☐ 2 days
P O # 24030745	☐ 1 day

Site Contact: mc 5/7/23 Date: 5/07/23
Lab Contact: mc 5/7/23 Carrier:

COC No:
1 of 1 COCs
TALS Project #:
Sampler: Grace Gegick
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
WC-TF5-538F	05-06-23	1055	C	W	13	N	N	X	X	X	X	X	X	X	X	
WC-TF5-514D	05-06-23	1125	C	W	13	N	N	X	X	X	X	X	X	X	X	
TRIP Blank	05-0 -23	—	G	W	1	N	N	X								

GG 05-07-23

240-184875 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☑ Yes ☐ No
Custody Seal No.:
Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ Therm ID No.: ____

Relinquished by: Grace Gegick /	Company: Arcadis	Date/Time: 05.07.23 1645	Received by:	Company: WAYPOINT	Date/Time: 5/7/23 1440
Relinquished by:	Company: WAYPOINT	Date/Time: 5/7/23 1852	Received by:	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
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Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other: CERCLA

Eurofins Environment Testing America

Client Contact	Project Manager: Jason Artrip	Site Contact: mk 5/7/23	Date: 5/07/23	COC No: 1 of 1 COCs
Arcadis	Email: jason.artrip@arcadis.com			
111-D Sanders Lane	Tel/Fax:	Lab Contact: mk 5/7/23	Carrier:	TALS Project #:
Bluefield, VA 24605	Analysis Turnaround Time: ☐ CALENDAR DAYS ☐ WORKING DAYS			Sampler: Grace Gegick
304-396-9424 Phone	TAT if different from Below 24-hour RUSH			For Lab Use Only:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Walk-in Client:
Project Name: East Palestine Train Derailment Site	☐ 1 week Rush			Lab Sampling:
Site: East Palestine, OH	☐ 2 days			
P O # 24030745	☐ 1 day			Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
WC-TF3-501F	5/7/23	0921	C	W	13	N	N	X	X	X	X	X	X	X	X	
WC-TF3-251478	5/7/23	0940	C	W	13	N	N	X	X	X	X	X	X	X	X	
Trip Blanks mk 5/7/23	5/7/23	—	G	W	1			X								

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☑ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: Corr'd:		Therm ID No.:
Relinquished by: Grace Gegick / [illegible]	Company: Arcadis	Date/Time: 05-07-23 16:45	Received by: [illegible]	Company: WAYPOINT	Date/Time: 5/7/23 [illegible]
Relinquished by: [illegible]	Company: WAYPOINT	Date/Time: 5/7/23 6:50pm	Received by: [illegible]	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
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Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other: CERCLA

Eurofins Environment Testing America

Client Contact	Project Manager: Jason Artrip	Site Contact:	Date: 5/ /23	COC No:
Arcadis	Email: jason.artrip@arcadis.com	Lab Contact:	Carrier:	1 of 1 COCs
111-D Sanders Lane	Tel/Fax:			TALS Project #:
Bluefield, VA 24605	Analysis Turnaround Time: ☐ CALENDAR DAYS ☐ WORKING DAYS			Sampler: Grace Gegick
304-396-9424 Phone	TAT if different from Below 24-hour RUSH			For Lab Use Only:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Walk-in Client:
Project Name: East Palestine Train Derailment Site	☐ 1 week			Lab Sampling:
Site: East Palestine, OH	☐ 2 days Rush			Job / SDG No.:
P O # 24030745	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
WC-TF3-AL4944	5/7/23	1117	C	W	13	N	N	X	X	X	X	X	X	X	X	
FB-2-05072023	5/7/23	1140		W	13	N	N	X	X	X	X	X	X	X	X	
Trip Blank	5/7/23	—	G	W	1	N	N	X								

mk 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☒ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ Therm ID No.: ____		
Relinquished by: Grace Gegick	Company: Arcadis	Date/Time: 05-07-23 16:44	Received by:	Company: WAYPOINT	Date/Time: 5/7/23 16:44
Relinquished by:	Company: WAYPOINT	Date/Time: 5/7/23 6:52 PM	Received by:	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

Chain of Custody Record

eurofins
Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other: CERCLA

Eurofins Environment Testing America

Client Contact		
Arcadis		
111-D Sanders Lane		
Bluefield, VA 24605		
304-396-9424	Phone	
(xxx) xxx-xxxx	FAX	
Project Name: East Palestine Train Derailment Site		
Site: East Palestine, OH		
P O # 24030745		

Project Manager: Jason Artrip
Email: jason.artrip@arcadis.com
Tel/Fax:

Analysis Turnaround Time
☐ CALENDAR DAYS ☐ WORKING DAYS
TAT if different from Below 24-hour RUSH
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day
Rush

Site Contact: MK 5/7/23
Lab Contact: MK 5/7/23
Date: 5/07/23
Carrier:

COC No:
1 of 1 COCs
TALS Project #:
Sampler: Grace Gegick
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	PH	DRO	Flashpoint	Sample Specific Notes:
WC-TF3-257761	5/7/23	0835	C	W	13	N	N	X	X	X	X	X	X	X	X	
MK 5/7/23 Dup-1	5/7/23	—	C	W	13	N	N	X	X	X	X	X	X	X	X	
Trip Blank	5/7/23	—	G	W	1	N	N	X								

MK 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
U043 (Vinyl chloride)
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ | Therm ID No.: ____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Grace Gegick	Arcadis	05-07-23 1613	[illegible]	Waypoint	5/7/23 4:00
Relinquished by: [illegible]	Company: Waypoint	Date/Time: 5/7/23 [illegible]	Received by: [illegible]	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other: CERCLA

Eurofins Environment Testing America

Client Contact	Project Manager: Jason Artrip	Site Contact: mk 5/7/23	Date: 5/07/23	COC No:
Arcadis	Email: jason.artrip@arcadis.com	Lab Contact: mk 5/7/23	Carrier:	1 of 1 COCs
111-D Sanders Lane	Tel/Fax:			TALS Project #:
Bluefield, VA 24605	Analysis Turnaround Time			Sampler: Grace Gegick
304-396-9424 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below 24-hour RUSH			Walk-in Client:
Project Name: East Palestine Train Derailment Site	☐ 2 weeks			Lab Sampling:
Site: East Palestine, OH	☐ 1 week Rush			Job / SDG No.:
P O # 24030745	☐ 2 days			
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
FB-1-05062023	5/6/23	1600	G	W	13	N	N	X	X	X	X	X	X	X	X	
Trip Blank	5/6/23	—	G	W	1	N	N	X								

mk 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☒ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ | Therm ID No.: ____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Grace Gegick	Arcadis	05.07.23 14:35		Waypoint	5/7/23 1430
Relinquished by:	Company: WAYPOINT	Date/Time: 5/7/23 1652	Received by:	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other: CERCLA

Eurofins Environment Testing America

Client Contact	Project Manager: Jason Artrip	Site Contact: MK 5/7/23	Date: 5/07/23	COC No:
Arcadis	Email: jason.artrip@arcadis.com	Lab Contact: MK 5/7/23	Carrier:	1 of 1 COCs
111-D Sanders Lane	Tel/Fax:			TALS Project #:
Bluefield, VA 24605	Analysis Turnaround Time			Sampler: Grace Gegick
304-396-9424 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below 24-hour RUSH			Walk-in Client:
Project Name: East Palestine Train Derailment Site	☐ 2 weeks ☐ 1 week ☐ 2 days ☐ 1 day — Rush			Lab Sampling:
Site: East Palestine, OH				Job / SDG No.:
P O # 24030745				

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
WC-TF5-260119	5/4/23	1205	C	W	13	N	N	X	X	X	X	X	X	X	X	
WC-TF5-251320	5/6/23	1235	C	W	13	N	N	X	X	X	X	X	X	X	X	
Trip Blank	5/6/23	—	G	W	1	N	N	X								

MK 5/7/23 MK 5/7/23 MK 5/7/23 MK 5/7/23 MK 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl Chloride)

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: **Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)**

Custody Seals Intact: ☑ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: Corr'd:		Therm ID No.:
Relinquished by: Grace Gegick	Company: Arcadis	Date/Time: 05-06-23 14:37	Received by:	Company: WayPoint	Date/Time: 5/7/23
Relinquished by:	Company: AlphaN	Date/Time: 5/7/23	Received by:	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Chain of Custody Record

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other: CERCLA

Eurofins Environment Testing America

Client Contact	Project Manager: Jason Artrip	Site Contact: ME 5/7/23	Date: 5/07/23	COC No:
Arcadis	Email: jason.artrip@arcadis.com	Lab Contact: ME 5/7/23	Carrier:	1 of 1 COCs
111-D Sanders Lane	Tel/Fax:			TALS Project #:
Bluefield, VA 24605	Analysis Turnaround Time			Sampler: Grace Gegick
304-396-9424 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below 24-hour RUSH			Walk-in Client:
Project Name: East Palestine Train Derailment Site	☐ 2 weeks			Lab Sampling:
Site: East Palestine, OH	☐ 1 week			
P O # 24030745	☐ 2 days Rush			Job / SDG No.:
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
WC-TF3-513A	5/6/23	1530	C	W	26	N	Y	X	X	X	X	X	X	X	X	in 2 coolers
Trip Blank	5/6/23	—	G	W	1	N	N	X								

ME 5/7/23
ME 5/7/23
ME 5/7/23
ME 5/7/23
ME 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☑ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ Therm ID No.:		
Relinquished by: Grace Gegick	Company: Arcadis	Date/Time: 05-07-23 16:40	Received by: [signature]	Company: Waypoint	Date/Time: 5/7/23 16:40
Relinquished by: [signature]	Company: Waypoint	Date/Time: 5/7/23 1655	Received by: [signature]	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave

Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other: CERCLA

Eurofins Environment Testing America

Client Contact			
Arcadis	Project Manager: Jason Artrip	Site Contact: MK 5/7/23	Date: 5/07/23
111-D Sanders Lane	Email: jason.artrip@arcadis.com	Lab Contact: MK 5/7/23	Carrier:
Bluefield, VA 24605	Tel/Fax:		
304-396-9424 Phone	**Analysis Turnaround Time**		
(xxx) xxx-xxxx FAX	☐ CALENDAR DAYS ☐ WORKING DAYS		
Project Name: East Palestine Train Derailment Site	TAT if different from Below 24-hour RUSH		
Site: East Palestine, OH	☐ 2 weeks ☐ 1 week ☐ 2 days ☐ 1 day — Rush		
P O # 24030745			

COC No: 1 of 1 COCs
TALS Project #:
Sampler: Grace Gegick
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
WC-TF3-AL4787	5/7/23	1010	C	W	13	N	N	X	X	X	X	X	X	X	X	
WC-TF3-AL4216	5/7/23	1045	C	W	13	N	N	X	X	X	X	X	X	X	X	
Trip Blank	5/7/23	—	G	W	1	N	N	X								

MK 5/7/23 MK 5/7/23 MK 5/7/23 MK 5/7/23 MK 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☒ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: ____ Corr'd: ____		Therm ID No.:
Relinquished by: Grace Gegick	Company: Arcadis	Date/Time: 05-07-23 1414	Received by: [signature]	Company: NAYPOINT	Date/Time: 5/7/23 16:44 HR
Relinquished by: [signature]	Company: NAYPOINT	Date/Time: 5/7/23 1651	Received by: [signature]	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins Canton
180 S. Van Buren Ave
Barberton, OH 44203-3543
phone 330.497.9396 fax 330.497.0772

Chain of Custody Record

eurofins Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☒ Other: CERCLA

Eurofins Environment Testing America

COC No:
1 of 1 COCs
TALS Project #:
Sampler: Grace Gegick
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Client Contact	
Arcadis	
111-D Sanders Lane	
Bluefield, VA 24605	
304-396-9424	Phone
(xxx) xxx-xxxx	FAX
Project Name: East Palestine Train Derailment Site	
Site: East Palestine, OH	
P O # 24030745	

Project Manager: Jason Artrip
Email: jason.artrip@arcadis.com
Tel/Fax:
Site Contact: ~~mk 5/7/23~~ Date: 5/07/23
Lab Contact: ~~mk 5/7/23~~ Carrier:

Analysis Turnaround Time
☐ CALENDAR DAYS ☐ WORKING DAYS
TAT if different from Below 24-hour RUSH
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day
Rush

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	8260D - Full List VOCs + Site-specific COCs	8270E - Full List SVOCs + Site-specific COCs	Total Metals	TSS	TOC	pH	DRO	Flashpoint	Sample Specific Notes:
~~FS~~ mk 5/7/23 WC-TF5-514E	5/6/23	1300	C	W	13	N	N	X	X	X	X	X	X	X	X	~~mk 5/7/23~~
WC-TF3-513A	5/6/23	1530	C	W	13	N	Y	X	X	X	X	X	X	X	X	In 2 coolers
Trip Blank	5/6/23	—	G	W	1	N	N	X								

mk 5/7/23 mk 5/7/23 mk 5/7/23 mk 5/7/23 mk 5/7/23

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. U043 (Vinyl chloride)
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Butyl acrylate (USEPA Method 8260), Ethyl hexyl acrylate (USEPA Method 8260), Methyl acrylate (USEPA Method 8260), 2-Butoxyethanol (USEPA Method 8270)

Custody Seals Intact: ☒ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ | Therm ID No.: ____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Grace Gegick / [signature]	Arcadis	05-07-23 16:37	[signature]	Waypoint	5/7/23 [illegible]
Relinquished by: [signature]	Company: Waypoint	Date/Time: 5/7/23 1652	Received by: [signature]	Company: EETNC	Date/Time: 5-7-23 1852
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Eurofins - Canton Sample Receipt Form/Narrative **Login # :** ______
Barberton Facility

Client NSRR-ER Site Name ______ Cooler unpacked by: [initials]

Cooler Received on 5-7-23 Opened on 5-7-23

FedEx: 1st Grd Exp UPS FAS Clipper Client Drop Off Eurofins Courier Other ______

Receipt After-hours: Drop-off Date/Time ______ Storage Location ______

Eurofins Cooler # EC Foam Box Client Cooler Box Other ______

Packing material used: Bubble Wrap Foam Plastic Bag None Other ______

COOLANT: Wet Ice Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☒ See Multiple Cooler Form

IR GUN # ______ (CF ______ °C) Observed Cooler Temp. ______ °C Corrected Cooler Temp. ______ °C

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 ec Yes No
   - Were the seals on the outside of the cooler(s) signed & dated? Yes No NA
   - Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes No
   - Were tamper/custody seals intact and uncompromised? Yes No NA
3. Shippers' packing slip attached to the cooler(s)? Yes No
4. Did custody papers accompany the sample(s)? Yes No
5. Were the custody papers relinquished & signed in the appropriate place? Yes No
6. Was/were the person(s) who collected the samples clearly identified on the COC? Yes No
7. Did all bottles arrive in good condition (Unbroken)? Yes No
8. Could all bottle labels (ID/Date/Time) be reconciled with the COC? Yes No
9. For each sample, does the COC specify preservatives (Y/N), # of containers (Y/N), and sample type of grab/comp(Y/N)?
10. Were correct bottle(s) used for the test(s) indicated? Yes No
11. Sufficient quantity received to perform indicated analyses? Yes No
12. Are these work share samples and all listed on the COC? Yes No
    If yes, Questions 13-17 have been checked at the originating laboratory.
13. Were all preserved sample(s) at the correct pH upon receipt? Yes No NA pH Strip Lot# **HC208070**
14. Were VOAs on the COC? Yes No
15. Were air bubbles >6 mm in any VOA vials? ● ← Larger than this. Yes No NA
16. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # D1042016 Yes No
17. Was a LL Hg or Me Hg trip blank present? ______ Yes No

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ______ Date ______ by ______ via Verbal Voice Mail Other

Concerning ______

18. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES ☐ additional next page Samples processed by:

One TB with samples WC-TF3-501F and WC-TF3-251478 arrived broken and could not be salvaged.
All samples with ID WC-TF3-513A are logged as Parent, MS/MSD on sample #18. [initials] 5-7-23

19. SAMPLE CONDITION

Sample(s) ______ were received after the recommended holding time had expired.
Sample(s) ______ were received in a broken container.
Sample(s) ______ were received with bubble >6 mm in diameter. (Notify PM)

20. SAMPLE PRESERVATION

Sample(s) ______ were further preserved in the laboratory.
Time preserved: ______ Preservative(s) added/Lot number(s): ______

VOA Sample Preservation - Date/Time VOAs Frozen: ______

WI-NC-099

Login # : 184875

Eurofins - Canton Sample Receipt Multiple Cooler Form				
Cooler Description (Circle)	IR Gun # (Circle)	Observed Temp °C	Corrected Temp °C	Coolant (Circle)
EC Client Box Other	IR GUN #: 22	4.7	4.7	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	3.9	3.9	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	5.6	5.6	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	5.2	5.2	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	4.2	4.2	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	5.4	5.4	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	4.6	4.6	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #: 22	4.9	4.9	Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
EC Client Box Other	IR GUN #:			Wet Ice Blue Ice Dry Ice Water None
			☐ See Temperature Excursion Form	

WI-NC-099 Cooler Receipt Form Page 2 – Multiple Coolers

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

Eurofins Cleveland
180 S. Van Buren Avenue
Barberton, OH 44203
Phone: 330-497-9396 Fax: 330-497-0772

Chain of Custody Record

eurofins | Environment Testing

Client Information (Sub Contract Lab)	Sampler:	Lab PM: DelMonico, Michael	Carrier Tracking No(s):	COC No: 240-167771.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: Michael.DelMonico@et.eurofinsus.com	State of Origin: Ohio	Page: Page 1 of 2
Company: Eurofins Lancaster Laboratories Environm		Accreditations Required (See note):		Job #: 240-184875-1
Address: 2425 New Holland Pike, ,	Due Date Requested: 5/11/2023	Analysis Requested		Preservation Codes:
City: Lancaster	TAT Requested (days):			
State, Zip: PA, 17601				
Phone: 717-656-2300(Tel)	PO #:			
Email:	WO #:			
Project Name: NSEP - Privileged & Confidential	Project #: 24030745			
Site:	SSOW#:			Other:

Preservation Codes: A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Y - Trizma, Z - other (specify)

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270E/3510C_LVI TCL SVOCs w Special Compound	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
WC-TF5-538F (240-184875-1)	5/7/23	10:55 Eastern		Water			X	2	
WC-TF5-514D (240-184875-2)	5/7/23	11:25 Eastern		Water			X	2	
WC-TF3-501F (240-184875-4)	5/7/23	09:21 Eastern		Water			X	2	
WC-TF3-251478 (240-184875-5)	5/7/23	09:40 Eastern		Water			X	2	
WC-TF3-AL4944 (240-184875-7)	5/7/23	11:17 Eastern		Water			X	2	
FB-2-05072023 (240-184875-8)	5/7/23	11:40 Eastern		Water			X	2	
WC-TF3-257761 (240-184875-10)	5/7/23	08:35 Eastern		Water			X	2	
DUP-1 (240-184875-11)	5/7/23	Eastern		Water			X	2	
FB-1-05062023 (240-184875-13)	5/6/23	16:00 Eastern		Water			X	2	

Note: Since laboratory accreditations are subject to change, Eurofins Environment Testing North Central, LLC places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins Environment Testing North Central, LLC laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins Environment Testing North Central, LLC attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to Eurofins Environment Testing North Central, LLC.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) | Primary Deliverable Rank: 2 | Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date: 5/29/23	Time: 17:45	Method of Shipment:		
Relinquished by:	Date/Time: 5/8/23 1110	Company: EETNC	Received by: Stan King Nok	Date/Time: 5/8/23 17:45	Company: ELLE
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 5/8/23 2320	Company: ELLE
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: 2.5°C		

Eurofins Cleveland
180 S. Van Buren Avenue
Barberton, OH 44203
Phone: 330-497-9396 Fax: 330-497-0772

Chain of Custody Record

eurofins | Environment Testing

Client Information (Sub Contract Lab)	Sampler:	Lab PM: DelMonico, Michael	Carrier Tracking No(s):	COC No: 240-167771.2
Client Contact: Shipping/Receiving	Phone:	E-Mail: Michael.DelMonico@et.eurofinsus.com	State of Origin: Ohio	Page: Page 2 of 2
Company: Eurofins Lancaster Laboratories Environm		Accreditations Required (See note):		Job #: 240-184875-1
Address: 2425 New Holland Pike, ,	Due Date Requested: 5/11/2023			
City: Lancaster	TAT Requested (days):			
State, Zip: PA, 17601				
Phone: 717-656-2300(Tel)	PO #:			
Email:	WO #:			
Project Name: NSEP - Privileged & Confidential	Project #: 24030745			
Site:	SSOW#:			

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Y - Trizma, Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270E/3510C_LVI TCL SVOCs w Special Compound	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
WC-TF5-260119 (240-184875-15)	5/6/23	12:05 Eastern		Water			X	2	
WC-TF5-251320 (240-184875-16)	5/6/23	12:35 Eastern		Water			X	2	
WC-TF3-513A (240-184875-18)	5/6/23	15:30 Eastern		Water			X	6	
WC-TF3-AL4787 (240-184875-20)	5/7/23	10:10 Eastern		Water			X	2	
WC-TF3-AL4216 (240-184875-21)	5/7/23	10:45 Eastern		Water			X	2	
WC-TF5-514E (240-184875-23)	5/6/23	13:00 Eastern		Water			X	2	

Note: Since laboratory accreditations are subject to change, Eurofins Environment Testing North Central, LLC places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins Environment Testing North Central, LLC laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins Environment Testing North Central, LLC attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to Eurofins Environment Testing North Central, LLC.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date: 5/28/23	Time: 17:45		Method of Shipment:	
Relinquished by: RA	Date/Time: 5/8/23 1110	Company: EETNC	Received by: Stan King	Date/Time: 5/8/23 17:45	Company: Ellen
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time: 5/8/23 2320	Company: ELLE

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 2.5°C

Login Sample Receipt Checklist

Client: Norfolk Southern Corporation | Job Number: 240-184875-1

Login Number: 184875
List Number: 2
Creator: Renner, Melissa

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC
List Creation: 05/09/23 01:59 AM

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	Not present
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	False	Received project as a subcontract.
Sample custody seals are intact.	N/A	Not present.
VOA sample vials do not have headspace >6mm in diameter (none, if from WV)?	N/A	

Attachment 4

August 2023 Results and Air Modeling Report

Summary of Total Daily Volatile Organic Compound Emissions
Two Water Tanks

CTEH developed emission estimates of volatile organic compounds (VOCs) from two water storage tanks associated with cleanup operations in East Palastine, OH. Potential VOC emissions were calculated from the surface of two open top Harpoon water storage tanks. Each tank has a capacity of 1,036,350 gallons, 70-foot diameter, and is 36 feet high. The maximum fill level for each tank is 80 percent of tank capacity. The VOC emission estimates were made to assess the applicability of air permitting requirements of the Ohio Environmental Protection Agency (OEPA), Division of Air Pollution Control (APCD), Ohio Administrative Code (OAC) 3745-15-05(B).

The potential VOC evaporation rate from the water surface of the open-top tanks was calculated using an evaporation equation provided by the National Oceanic and Atmospheric Administration (NOAA). Information on this equation is provided online at http://www2.arnes.si/~gljsentvid10/evap.html#. Emission calculations were completed to determine the water concentrations of VOCs necessary to result in 10 pounds per day of air emissions from the tanks. Emissions were calculated separately for three VOC volatility assumptions. The first emission scenario assumed that VOC emissions from the water tanks are vinyl chloride. Thus, the physical and chemical properties of vinyl chloride were used in the evaporation equations. The second emission scenario assumed that VOC air emissions were butyl acrylate and used the properties of butyl acrylate for the calculations. The third emission scenario used average VOC properties that would likely represent a more realistic evaporation scenario. The average properties were identified using data provided in EPA's AP-42 Emission Factor Handbook, Section 4.3, Waste Water Collection, Treatment And Storage. Medium volatility VOCs are identified in this AP-42 section as those with Henry's Law Constant values between 0.00001 and 0.001. The NOAA emission equation requires input of molecular weight (MW) and vapor pressure (VP). Therefore, average values of MW and VP were identified from the list of analytes in Section 4.3, Table 4.3-4 that are VOCs with medium volatility based on Henry's Law Constant values. The average values input to the Scenario 2 emission equation were MW = 79.45, VP = 346.82 mm Hg at 25 °C.

The VOC concentration neccesary to result in 10 pounds per day VOC emissions for each scenerio are given below:

Analyte	Assume VOC is Vinyl Chloride VOC Concentration that results in 10 lb/day Emission Rate (pounds/day)	Assume VOC is Butyl Acrylate VOC Concentration that results in 10 lb/day Emission Rate (pounds/day)	Average VOC Volatility Properties VOC Concentration that results in 10 lb/day Emission Rate (pounds/day)
VOC Concentration (mg/L)	4.485	3,115	41.72
VOC (lbs/day)	10.00	10.00	10.00

Volatile Organic Compounds (VOC) Emissions from one open top tank

An estimate of volatile organic compound (**VOC)** vapor emissions from the surface of the tanks is based on the following evaporation equation provided by the National Oceanic and Atmospheric Administration (NOAA) as part of the Areal Locations of Hazardous Atmospheres (ALOHA) model (NOAA 2003). The physical and chemical properties of vinyl chloride (VC) were used as a surrogate for total VOCs.

Data Entry

E = A * Km * (Mw * Pv)/(R * T)

Where,

		Data	
E	= evaporation rate (kg/s)	**2.63E-05**	kg/s
E	= evaporation rate (lb/hr)	**0.208**	lb/hr
A	= evaporating surface area (m^2); [357.5 m^2 based on the surface area of the tank]	**357.50**	m^2
Km	= mass transfer coefficient (m/s)	5.62E-03	m/s
Mw	= molecular weight of the selected chemical (g/mol)	62.59	g/gmol
Pv	= vapor pressure (Pa); [partial pressure of VC]	0.51245	Pa
R	= the gas constant (8314 J/(kmol K))	8314.00	J/(kmol K)
T	= ambient temperature (K); [estimated 22°C or 295 K which is standard ambient temperature]	**295.0**	

E = 2.63E-05 kg/s

E = 2.08E-01 lb/hr

Km is calculated using the following equation from Mackay and Matsugu (1973).

Km = 0.0048 * $U^{(7/9)}$ * $Z^{(-1/9)}$ * $Sc^{(-2/3)}$ (m/s)

Where,

U	= wind speed at a height of 10 m (m/s); [average wind speed for East Palastine, OH]	**2.16**	m/s
Z	= the liquid surface diameter in the along-wind direction (m); [21.34 m]	**21.3**	m
Sc	= the laminar Schmidt number (unitless)	1.1655	

Km = 5.62E-03 m/s

Following NOAA calculation methodology, Sc is estimated as Sc = (v/DM), where v is the kinematic viscosity of air [1.5E-5 m^2/s] and Dm is the molecular diffusivity of the chemical (m^2/s).

Dm is approximated using Graham's Law (Thibodeaux 1979),

Dm	$= D(H2O) * [Mw(H2O)/Mw(chem)]^{(1/2)}$		
Where,			
$D(H_2O)$	= molecular diffusivity of water; [2.4E-5 m^2/s]	2.40E-05	m^2/s
$Mw(H_2O)$	= molecular weight of water	18.00	g/gmol
Mw(chem)	= molecular weight of the chemical	**62.59**	g/gmol

Dm = 1.29E-05

Sc = v/Dm
Sc = 1.1655

VOC vapor pressure aqueous solution

Liters water	3923011.502
moles of water (water density =1000 g/L; MW=18)	217945083.4
Concentration of VOC (mg/ L)	4.485
VC (mg)	17594706.59
VC (g)	17594.70659
VC (mole)	281.1105063
VC molar fraction	1.28982E-06

Raoult Law [PVC]=[P*VC] [x]

Vapor pressure VC (mm Hg at 25 °C)	2980	https://pubchem.ncbi.nlm.nih.gov/compound/Vinyl-Chloride#section=Vapor-Pressure
Vapor pressure VC (Pa)	397299.56	
Partial pressure of VC (Pa)	0.512445312	

Volatile Organic Compounds (VOC) Emissions from one open top tank

An estimate of volatile organic compound (**VOC)** vapor emissions from the surface of the tanks is based on the following evaporation equation provided by the National Oceanic and Atmospheric Administration (NOAA) as part of the Areal Locations of Hazardous Atmospheres (ALOHA) model (NOAA 2003). The physical and chemical properties of butyl acrylate (BA) were used as a surrogate for total VOCs.

Data Entry

E = A * Km * (Mw * Pv)/(R * T)

Where,

		Data	
E	= evaporation rate (kg/s)	**2.63E-05**	kg/s
E	= evaporation rate (lb/hr)	**0.208**	lb/hr
A	= evaporating surface area (m^2); [357.5 m^2 based on the surface area of the tank]	**357.50**	m^2
Km	= mass transfer coefficient (m/s)	4.42E-03	m/s
Mw	= molecular weight of the selected chemical (g/mol)	128.00	g/gmol
Pv	= vapor pressure (Pa); [partial pressure of BA]	0.31815	Pa
R	= the gas constant (8314 J/(kmol K))	8314.00	J/(kmol K)
T	= ambient temperature (K); [estimated 22°C or 295 K which is standard ambient temperature]	**295.0**	

E = 2.63E-05 kg/s

E = 2.08E-01 lb/hr

Km is calculated using the following equation from Mackay and Matsugu (1973).

$$Km = 0.0048 * U^{(7/9)} * Z^{(-1/9)} * Sc^{(-2/3)} \text{ (m/s)}$$

Where,

U	= wind speed at a height of 10 m (m/s); [average wind speed for East Palastine, OH]	**2.16**	m/s
Z	= the liquid surface diameter in the along-wind direction (m); [21.34 m]	**21.3**	m
Sc	= the laminar Schmidt number (unitless)	1.6667	

Km = 4.42E-03 m/s

Following NOAA calculation methodology, Sc is estimated as Sc = (v/DM), where v is the kinematic viscosity of air [1.5E-5 m^2/s] and Dm is the molecular diffusivity of the chemical (m^2/s).

Dm is approximated using Graham's Law (Thibodeaux 1979),

Dm	$= D(H2O) * [Mw(H2O)/Mw(chem)]^{(1/2)}$		
Where,			
$D(H_2O)$	= molecular diffusivity of water; [2.4E-5 m^2/s]	2.40E-05	m^2/s
$Mw(H_2O)$	= molecular weight of water	18.00	g/gmol
Mw(chem)	= molecular weight of the chemical	**128.00**	g/gmol

Dm = 9.00E-06

Sc = v/Dm
Sc = 1.6667

VOC vapor pressure aqueous solution

Liters water	3923011.502
moles of water (water density =1000 g/L; MW=18)	217945083.4
Concentration of VOC (mg/ L)	3115
BA (mg)	12220180829
BA (g)	12220180.83
BA (mole)	95470.16272
BA molar fraction	0.000437855

Raoult Law [PBA]=[P*BA] [x]

Vapor pressure BA (mm Hg at 25 °C)	5.45	https://pubchem.ncbi.nlm.nih.gov/compound/Butyl-acrylate#section=Vapor-Pressure
Vapor pressure BA (Pa)	726.6049	
Partial pressure of BA (Pa)	0.318147642	

Volatile Organic Compounds (VOC) Emissions from one open top tank

An estimate of volatile organic compound (**VOC)** vapor emissions from the surface of the tanks is based on the following evaporation equation provided by the National Oceanic and Atmospheric Administration (NOAA) as part of the Areal Locations of Hazardous Atmospheres (ALOHA) model (NOAA 2003). Average physical and chemical properties for VOCs with medium volatility were assumed for the calculations. Data for physical and chemical properties and volatility assumptions were take from EPA's AP-42, Section 4.3.

Data Entry

E = A * Km * (Mw * Pv)/(R * T)

Where,

		Data	
E	= evaporation rate (kg/s)	**2.62E-05**	kg/s
E	= evaporation rate (lb/hr)	**0.208**	lb/hr
A	= evaporating surface area (m^2); [357.5 m^2 based on the surface area of the tank]	**357.50**	m^2
Km	= mass transfer coefficient (m/s)	5.19E-03	m/s
Mw	= molecular weight of the selected chemical (g/mol)	79.45	g/gmol
Pv	= vapor pressure (Pa); [partial pressure of VOCs]	0.43704	Pa
R	= the gas constant (8314 J/(kmol K))	8314.00	J/(kmol K)
T	= ambient temperature (K); [estimated 22°C or 295 K which is standard ambient temperature]	**295.0**	

E = 2.62E-05 kg/s
E = 2.08E-01 lb/hr

Km is calculated using the following equation from Mackay and Matsugu (1973).

$$Km = 0.0048 * U^{(7/9)} * Z^{(-1/9)} * Sc^{(-2/3)} \text{ (m/s)}$$

Where,

U	= wind speed at a height of 10 m (m/s); [average wind speed for East Palastine, OH]	**2.2**	m/s
Z	= the liquid surface diameter in the along-wind direction (m); [21.34 m]	**21.3**	m
Sc	= the laminar Schmidt number (unitless)	1.3131	

Km = 5.19E-03 m/s

Following NOAA calculation methodology, Sc is estimated as Sc = (v/DM), where v is the kinematic viscosity of air [1.5E-5 m^2/s] and Dm is the molecular diffusivity of the chemical (m^2/s).

Dm is approximated using Graham's Law (Thibodeaux 1979),

Dm	= D(H2O) * [Mw(H2O)/Mw(chem)]$^{(1/2)}$		
Where,			
$D(H_2O)$	= molecular diffusivity of water; [2.4E-5 m^2/s]	2.40E-05	m^2/s
$Mw(H_2O)$	= molecular weight of water	18.00	g/gmol
Mw(chem)	= molecular weight of the chemical	**79.45**	g/gmol **

Dm = 1.14E-05

Sc = v/Dm
Sc = 1.3131

VOC vapor pressure aqueous solution

Liters water	3923011.502
moles of water (water density =1000 g/L; MW=18)	217945083.4
Concentration of VOC (mg/ L)	41.72
VOC (mg)	163668039.9
VOC (g)	163668.0399
VOC (mole)	2060.013088
VOC molar fraction	9.45189E-06

Raoult Law [PVOC]=[P*VOC] [x]

Vapor pressure VOC (mm Hg at 25 °C)	346.82 **
Vapor pressure VOC (Pa)	46238.73604
Partial pressure of VOC (Pa)	0.437043587

** Average of VOCs in medium volatility range from AP-42, Section 4.3

East Palestine Average Windspeed (mph)

Month	Average Wind Speed
Jan	6.4
Feb	6.5
Mar	6.1
Apr	5.3
May	4.3
Jun	3.7
Jul	3.5
Aug	3.4
Sep	3.8
Oct	4.4
Nov	5
Dec	5.6
Annual (mph)	4.83
Annual (m/s)	2.16

Source: https://weatherspark.com/y/19060/Average-Weather-in-East-Palestine-Ohio-United-States-Year-Round

Environment Testing

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ANALYTICAL REPORT

PREPARED FOR

Attn: Norfolk Southern
Norfolk Southern Corporation
650 W Peachtree St NW
Atlanta, Georgia 30308
Generated 8/7/2023 3:40:13 PM

JOB DESCRIPTION

NS East Palestine

JOB NUMBER

240-189394-1

Eurofins Cleveland
180 S. Van Buren Avenue
Barberton OH 44203

See page two for job notes and contact information.

my EOL.

Eurofins Cleveland

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing North Central, LLC Project Manager.

Authorization

Authorized for release by
Michael DelMonico, Project Manager I
Michael.DelMonico@et.eurofinsus.com
(330)497-9396

Generated
8/7/2023 3:40:13 PM

Table of Contents

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 240-189394-1

Laboratory: Eurofins Cleveland

Narrative

Job Narrative
240-189394-1

Receipt
The samples were received on 8/1/2023 7:17 PM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 2.2°C

GC/MS VOA
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

GC/MS Semi VOA
Method 8270E: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 240-582761.

Method 8270E: The continuing calibration verification (CCV) associated with batch 240-583037 recovered above the upper control limit for 2,4-Dinitrophenol and 3-Nitroaniline. The sample associated with this CCV was non-detect for the affected analytes; therefore, the data have been reported. The following sample was impacted: WC-H24-WATER (240-189394-1).

Method 8270E: The continuing calibration verification (CCV) associated with batch 240-583037 recovered outside acceptance criteria, low biased, for 2,4-Dichlorophenol. A reporting limit (RL) standard was analyzed, and the analyte was detected. Since the associated sample was non-detect for the analyte, the data are reported. Sample WC-H24-WATER (240-189394-1) was affected.

Method 8270E: The method blank for preparation batch 240-582761 contained Phenol above the reporting limit (RL). Sample WC-H24-WATER (240-189394-1) was ND the target compound; therefore, re-extraction and/or re-analysis of sample was not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Diesel Range Organics
Method 8015D_DRO: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 240-582816.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

General Chemistry
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Method Summary

Method	Method Description	Protocol	Laboratory
8260D	Volatile Organic Compounds by GC/MS	SW846	EET CLE
8270E	Semivolatile Organic Compounds (GC/MS)	SW846	EET CLE
8015D	Diesel Range Organics (DRO) (GC)	SW846	EET CLE
6010D	Metals (ICP)	SW846	EET CLE
7470A	Mercury (CVAA)	SW846	EET CLE
1010B	Ignitability, Pensky-Martens Closed-Cup Method	SW846	EET CLE
2540D-2015	Total Suspended Solids (Dried at 103-105°C)	SM	EET CLE
5310 C-2014	Total Organic Carbon/Persulfate - Ultrav	SM	EET CLE
9040C	pH	SW846	EET CLE
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	EET CLE
3510C LVI	Liquid-Liquid Extraction (Separatory Funnel) LVI	SW846	EET CLE
3511	Microextraction of Organic Compounds	SW846	EET CLE
5030C	Purge and Trap	SW846	EET CLE
7470A	Preparation, Mercury	SW846	EET CLE

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET CLE = Eurofins Cleveland, 180 S. Van Buren Avenue, Barberton, OH 44203, TEL (330)497-9396

Sample Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-189394-1	WC-H24-WATER	Water	08/01/23 11:05	08/01/23 19:17
240-189394-2	TRIP BLANK	Water	08/01/23 00:00	08/01/23 19:17

Detection Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Client Sample ID: WC-H24-WATER

Lab Sample ID: 240-189394-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	0.012		0.010	0.0054	mg/L	1		8260D	Total/NA
Diesel Range Organics [C10 - C28]	350	J	490	66	ug/L	1		8015D	Total/NA
Barium	92	J	200	3.0	ug/L	1		6010D	Total Recoverable
Chromium	5.3	J	10	0.76	ug/L	1		6010D	Total Recoverable
Lead	4.4	J	10	2.8	ug/L	1		6010D	Total Recoverable
Selenium	25		20	6.0	ug/L	1		6010D	Total Recoverable
Ignitablity (Flashpoint)	>200		1.0	1.0	Degrees F	1		1010B	Total/NA
Total Suspended Solids	53		5.1	0.51	mg/L	1		2540D-2015	Total/NA
Total Organic Carbon	4.9		1.0	0.35	mg/L	1		5310 C-2014	Total/NA
pH	7.8	HF	0.1	0.1	SU	1		9040C	Total/NA

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-189394-2

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Client Sample ID: WC-H24-WATER
Date Collected: 08/01/23 11:05
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-1
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			08/03/23 23:42	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			08/03/23 23:42	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			08/03/23 23:42	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			08/03/23 23:42	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			08/03/23 23:42	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			08/03/23 23:42	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			08/03/23 23:42	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			08/03/23 23:42	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			08/03/23 23:42	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			08/03/23 23:42	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			08/03/23 23:42	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			08/03/23 23:42	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			08/03/23 23:42	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			08/03/23 23:42	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			08/03/23 23:42	1
2-Hexanone	ND		0.010	0.0011	mg/L			08/03/23 23:42	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			08/03/23 23:42	1
Acetone	**0.012**		0.010	0.0054	mg/L			08/03/23 23:42	1
Benzene	ND		0.0010	0.00042	mg/L			08/03/23 23:42	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			08/03/23 23:42	1
Bromoform	ND		0.0010	0.00076	mg/L			08/03/23 23:42	1
Bromomethane	ND		0.0010	0.00042	mg/L			08/03/23 23:42	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			08/03/23 23:42	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			08/03/23 23:42	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			08/03/23 23:42	1
Chloroethane	ND		0.0010	0.00083	mg/L			08/03/23 23:42	1
Chloroform	ND		0.0010	0.00047	mg/L			08/03/23 23:42	1
Chloromethane	ND		0.0010	0.00063	mg/L			08/03/23 23:42	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			08/03/23 23:42	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			08/03/23 23:42	1
Cyclohexane	ND		0.0010	0.00048	mg/L			08/03/23 23:42	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			08/03/23 23:42	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			08/03/23 23:42	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			08/03/23 23:42	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			08/03/23 23:42	1
Methyl acetate	ND		0.010	0.0017	mg/L			08/03/23 23:42	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			08/03/23 23:42	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			08/03/23 23:42	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			08/03/23 23:42	1
Styrene	ND		0.0010	0.00045	mg/L			08/03/23 23:42	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			08/03/23 23:42	1
Toluene	ND		0.0010	0.00044	mg/L			08/03/23 23:42	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			08/03/23 23:42	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			08/03/23 23:42	1
Trichloroethene	ND		0.0010	0.00044	mg/L			08/03/23 23:42	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			08/03/23 23:42	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			08/03/23 23:42	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			08/03/23 23:42	1
Butyl acrylate	ND		0.010	0.0023	mg/L			08/04/23 22:00	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Client Sample ID: WC-H24-WATER
Date Collected: 08/01/23 11:05
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-1
Matrix: Water

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*99*		*78 - 122*		*08/03/23 23:42*	*1*
Toluene-d8 (Surr)	*99*		*78 - 122*		*08/04/23 22:00*	*1*
Dibromofluoromethane (Surr)	*101*		*73 - 120*		*08/03/23 23:42*	*1*
Dibromofluoromethane (Surr)	*99*		*73 - 120*		*08/04/23 22:00*	*1*
4-Bromofluorobenzene (Surr)	*97*		*56 - 136*		*08/03/23 23:42*	*1*
4-Bromofluorobenzene (Surr)	*100*		*56 - 136*		*08/04/23 22:00*	*1*
1,2-Dichloroethane-d4 (Surr)	*100*		*62 - 137*		*08/03/23 23:42*	*1*
1,2-Dichloroethane-d4 (Surr)	*99*		*62 - 137*		*08/04/23 22:00*	*1*

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.00096	0.00047	mg/L		08/03/23 09:28	08/07/23 12:26	1
bis (2-chloroisopropyl) ether	ND		0.00096	0.00023	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,4,5-Trichlorophenol	ND		0.0048	0.0019	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,4,6-Trichlorophenol	ND		0.0048	0.0017	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,4-Dichlorophenol	ND		0.0019	0.00025	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,4-Dimethylphenol	ND		0.0019	0.00024	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,4-Dinitrophenol	ND		0.0096	0.0025	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,4-Dinitrotoluene	ND		0.0048	0.0020	mg/L		08/03/23 09:28	08/07/23 12:26	1
2,6-Dinitrotoluene	ND		0.0048	0.0010	mg/L		08/03/23 09:28	08/07/23 12:26	1
2-Chloronaphthalene	ND		0.00096	0.00022	mg/L		08/03/23 09:28	08/07/23 12:26	1
2-Chlorophenol	ND		0.00096	0.00026	mg/L		08/03/23 09:28	08/07/23 12:26	1
2-Methylnaphthalene	ND		0.00019	0.00011	mg/L		08/03/23 09:28	08/07/23 12:26	1
2-Methylphenol	ND		0.00096	0.00020	mg/L		08/03/23 09:28	08/07/23 12:26	1
2-Nitroaniline	ND		0.0019	0.00049	mg/L		08/03/23 09:28	08/07/23 12:26	1
2-Nitrophenol	ND		0.0019	0.00054	mg/L		08/03/23 09:28	08/07/23 12:26	1
3,3'-Dichlorobenzidine	ND		0.0048	0.0011	mg/L		08/03/23 09:28	08/07/23 12:26	1
3-Nitroaniline	ND		0.0019	0.00054	mg/L		08/03/23 09:28	08/07/23 12:26	1
4,6-Dinitro-2-methylphenol	ND		0.0048	0.0027	mg/L		08/03/23 09:28	08/07/23 12:26	1
4-Bromophenyl phenyl ether	ND		0.0019	0.00048	mg/L		08/03/23 09:28	08/07/23 12:26	1
4-Chloro-3-methylphenol	ND		0.0019	0.00028	mg/L		08/03/23 09:28	08/07/23 12:26	1
4-Chloroaniline	ND		0.0019	0.00030	mg/L		08/03/23 09:28	08/07/23 12:26	1
4-Chlorophenyl phenyl ether	ND		0.0019	0.00053	mg/L		08/03/23 09:28	08/07/23 12:26	1
4-Nitroaniline	ND		0.0019	0.00031	mg/L		08/03/23 09:28	08/07/23 12:26	1
4-Nitrophenol	ND		0.0096	0.0021	mg/L		08/03/23 09:28	08/07/23 12:26	1
Acenaphthene	ND		0.00019	0.00017	mg/L		08/03/23 09:28	08/07/23 12:26	1
Acenaphthylene	ND		0.00019	0.00012	mg/L		08/03/23 09:28	08/07/23 12:26	1
Acetophenone	ND		0.00096	0.00035	mg/L		08/03/23 09:28	08/07/23 12:26	1
Anthracene	ND		0.00019	0.00013	mg/L		08/03/23 09:28	08/07/23 12:26	1
Atrazine	ND		0.0019	0.00092	mg/L		08/03/23 09:28	08/07/23 12:26	1
Benzaldehyde	ND		0.0019	0.00073	mg/L		08/03/23 09:28	08/07/23 12:26	1
Benzo[a]anthracene	ND		0.00019	0.000065	mg/L		08/03/23 09:28	08/07/23 12:26	1
Benzo[a]pyrene	ND		0.00019	0.00017	mg/L		08/03/23 09:28	08/07/23 12:26	1
Benzo[b]fluoranthene	ND		0.00019	0.00015	mg/L		08/03/23 09:28	08/07/23 12:26	1
Benzo[g,h,i]perylene	ND		0.00019	0.00017	mg/L		08/03/23 09:28	08/07/23 12:26	1
Benzo[k]fluoranthene	ND		0.00019	0.00013	mg/L		08/03/23 09:28	08/07/23 12:26	1
Bis(2-chloroethoxy)methane	ND		0.00096	0.00021	mg/L		08/03/23 09:28	08/07/23 12:26	1
Bis(2-chloroethyl)ether	ND		0.00096	0.00039	mg/L		08/03/23 09:28	08/07/23 12:26	1
Bis(2-ethylhexyl) phthalate	ND		0.0048	0.0021	mg/L		08/03/23 09:28	08/07/23 12:26	1
Butyl benzyl phthalate	ND		0.0019	0.00064	mg/L		08/03/23 09:28	08/07/23 12:26	1

Client Sample ID: WC-H24-WATER

Date Collected: 08/01/23 11:05
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-1

Matrix: Water

Method: SW846 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Caprolactam	ND		0.0048	0.00090	mg/L		08/03/23 09:28	08/07/23 12:26	1
Carbazole	ND		0.00096	0.00047	mg/L		08/03/23 09:28	08/07/23 12:26	1
Chrysene	ND		0.00019	0.000063	mg/L		08/03/23 09:28	08/07/23 12:26	1
Dibenz(a,h)anthracene	ND		0.00019	0.00015	mg/L		08/03/23 09:28	08/07/23 12:26	1
Dibenzofuran	ND		0.00096	0.00026	mg/L		08/03/23 09:28	08/07/23 12:26	1
Diethyl phthalate	ND		0.0048	0.0037	mg/L		08/03/23 09:28	08/07/23 12:26	1
Dimethyl phthalate	ND		0.0019	0.00050	mg/L		08/03/23 09:28	08/07/23 12:26	1
Di-n-butyl phthalate	ND		0.0048	0.0017	mg/L		08/03/23 09:28	08/07/23 12:26	1
Di-n-octyl phthalate	ND		0.0019	0.00079	mg/L		08/03/23 09:28	08/07/23 12:26	1
Fluoranthene	ND		0.00019	0.00015	mg/L		08/03/23 09:28	08/07/23 12:26	1
Fluorene	ND		0.00019	0.000076	mg/L		08/03/23 09:28	08/07/23 12:26	1
Hexachlorobenzene	ND		0.00019	0.00015	mg/L		08/03/23 09:28	08/07/23 12:26	1
Hexachlorobutadiene	ND		0.00096	0.00052	mg/L		08/03/23 09:28	08/07/23 12:26	1
Hexachlorocyclopentadiene	ND		0.0096	0.0017	mg/L		08/03/23 09:28	08/07/23 12:26	1
Hexachloroethane	ND		0.00096	0.00038	mg/L		08/03/23 09:28	08/07/23 12:26	1
Indeno[1,2,3-cd]pyrene	ND		0.00019	0.00013	mg/L		08/03/23 09:28	08/07/23 12:26	1
Isophorone	ND		0.00096	0.00031	mg/L		08/03/23 09:28	08/07/23 12:26	1
N-Nitrosodi-n-propylamine	ND		0.00096	0.00024	mg/L		08/03/23 09:28	08/07/23 12:26	1
N-Nitrosodiphenylamine	ND		0.00096	0.00042	mg/L		08/03/23 09:28	08/07/23 12:26	1
Naphthalene	ND		0.00019	0.00010	mg/L		08/03/23 09:28	08/07/23 12:26	1
Nitrobenzene	ND		0.00096	0.00049	mg/L		08/03/23 09:28	08/07/23 12:26	1
Pentachlorophenol	ND		0.0096	0.0030	mg/L		08/03/23 09:28	08/07/23 12:26	1
Phenanthrene	ND		0.00019	0.000077	mg/L		08/03/23 09:28	08/07/23 12:26	1
Phenol	ND		0.00096	0.00012	mg/L		08/03/23 09:28	08/07/23 12:26	1
Pyrene	ND		0.00019	0.000080	mg/L		08/03/23 09:28	08/07/23 12:26	1
3 & 4 Methylphenol	ND		0.0019	0.00018	mg/L		08/03/23 09:28	08/07/23 12:26	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Terphenyl-d14 (Surr)	*82*		*31 - 140*	*08/03/23 09:28*	*08/07/23 12:26*	*1*
Phenol-d5 (Surr)	*51*		*18 - 120*	*08/03/23 09:28*	*08/07/23 12:26*	*1*
Nitrobenzene-d5 (Surr)	*62*		*13 - 120*	*08/03/23 09:28*	*08/07/23 12:26*	*1*
2-Fluorophenol (Surr)	*66*		*12 - 120*	*08/03/23 09:28*	*08/07/23 12:26*	*1*
2-Fluorobiphenyl (Surr)	*65*		*23 - 120*	*08/03/23 09:28*	*08/07/23 12:26*	*1*
2,4,6-Tribromophenol (Surr)	*81*		*10 - 126*	*08/03/23 09:28*	*08/07/23 12:26*	*1*

Method: SW846 8015D - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	**350**	**J**	490	66	ug/L		08/03/23 13:02	08/03/23 15:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*86*		*52 - 121*	*08/03/23 13:02*	*08/03/23 15:13*	*1*

Method: SW846 6010D - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Barium	**92**	**J**	200	3.0	ug/L		08/03/23 14:00	08/04/23 12:57	1
Cadmium	ND		5.0	0.45	ug/L		08/03/23 14:00	08/04/23 12:57	1
Chromium	**5.3**	**J**	10	0.76	ug/L		08/03/23 14:00	08/04/23 12:57	1
Silver	ND		10	0.62	ug/L		08/03/23 14:00	08/04/23 12:57	1
Arsenic	ND		15	4.1	ug/L		08/03/23 14:00	08/04/23 12:57	1
Lead	**4.4**	**J**	10	2.8	ug/L		08/03/23 14:00	08/04/23 12:57	1

Client Sample ID: WC-H24-WATER

Date Collected: 08/01/23 11:05
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-1
Matrix: Water

Method: SW846 6010D - Metals (ICP) - Total Recoverable (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	**25**		20	6.0	ug/L		08/03/23 14:00	08/04/23 12:57	1

Method: SW846 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		08/03/23 14:00	08/04/23 12:17	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ignitablity (Flashpoint) (SW846 1010B)	**>200**		1.0	1.0	Degrees F			08/07/23 12:12	1
Total Suspended Solids (SM 2540D-2015)	**53**		5.1	0.51	mg/L			08/03/23 09:50	1
Total Organic Carbon (SM 5310 C-2014)	**4.9**		1.0	0.35	mg/L			08/03/23 21:18	1
pH (SW846 9040C)	**7.8**	**HF**	0.1	0.1	SU			08/02/23 12:41	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Client Sample ID: TRIP BLANK

Date Collected: 08/01/23 00:00
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-2
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			08/03/23 22:55	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			08/03/23 22:55	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			08/03/23 22:55	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			08/03/23 22:55	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			08/03/23 22:55	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			08/03/23 22:55	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			08/03/23 22:55	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			08/03/23 22:55	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			08/03/23 22:55	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			08/03/23 22:55	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			08/03/23 22:55	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			08/03/23 22:55	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			08/03/23 22:55	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			08/03/23 22:55	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			08/03/23 22:55	1
2-Hexanone	ND		0.010	0.0011	mg/L			08/03/23 22:55	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			08/03/23 22:55	1
Acetone	ND		0.010	0.0054	mg/L			08/03/23 22:55	1
Benzene	ND		0.0010	0.00042	mg/L			08/03/23 22:55	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			08/03/23 22:55	1
Bromoform	ND		0.0010	0.00076	mg/L			08/03/23 22:55	1
Bromomethane	ND		0.0010	0.00042	mg/L			08/03/23 22:55	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			08/03/23 22:55	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			08/03/23 22:55	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			08/03/23 22:55	1
Chloroethane	ND		0.0010	0.00083	mg/L			08/03/23 22:55	1
Chloroform	ND		0.0010	0.00047	mg/L			08/03/23 22:55	1
Chloromethane	ND		0.0010	0.00063	mg/L			08/03/23 22:55	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			08/03/23 22:55	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			08/03/23 22:55	1
Cyclohexane	ND		0.0010	0.00048	mg/L			08/03/23 22:55	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			08/03/23 22:55	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			08/03/23 22:55	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			08/03/23 22:55	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			08/03/23 22:55	1
Methyl acetate	ND		0.010	0.0017	mg/L			08/03/23 22:55	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			08/03/23 22:55	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			08/03/23 22:55	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			08/03/23 22:55	1
Styrene	ND		0.0010	0.00045	mg/L			08/03/23 22:55	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			08/03/23 22:55	1
Toluene	ND		0.0010	0.00044	mg/L			08/03/23 22:55	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			08/03/23 22:55	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			08/03/23 22:55	1
Trichloroethene	ND		0.0010	0.00044	mg/L			08/03/23 22:55	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			08/03/23 22:55	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			08/03/23 22:55	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			08/03/23 22:55	1
Butyl acrylate	ND		0.010	0.0023	mg/L			08/04/23 21:36	1

Client Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Client Sample ID: TRIP BLANK

Date Collected: 08/01/23 00:00
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-2
Matrix: Water

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Toluene-d8 (Surr)	97		78 - 122		08/03/23 22:55	1
Toluene-d8 (Surr)	99		78 - 122		08/04/23 21:36	1
Dibromofluoromethane (Surr)	99		73 - 120		08/03/23 22:55	1
Dibromofluoromethane (Surr)	100		73 - 120		08/04/23 21:36	1
4-Bromofluorobenzene (Surr)	98		56 - 136		08/03/23 22:55	1
4-Bromofluorobenzene (Surr)	97		56 - 136		08/04/23 21:36	1
1,2-Dichloroethane-d4 (Surr)	100		62 - 137		08/03/23 22:55	1
1,2-Dichloroethane-d4 (Surr)	100		62 - 137		08/04/23 21:36	1

Method: 8260D - Volatile Organic Compounds by GC/MS

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	DCA
Lab Sample ID	Client Sample ID	(78-122)	(73-120)	(56-136)	(62-137)
240-189394-1	WC-H24-WATER	99	101	97	100
240-189394-1	WC-H24-WATER	99	99	100	99
240-189394-2	TRIP BLANK	97	99	98	100
240-189394-2	TRIP BLANK	99	100	97	100
LCS 240-582812/5	Lab Control Sample	96	99	97	97
LCS 240-582946/18	Lab Control Sample	93	93	91	94
LCS 240-582946/5	Lab Control Sample	97	97	96	95
MB 240-582812/8	Method Blank	98	100	97	102
MB 240-582946/21	Method Blank	96	97	95	99

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
DCA = 1,2-Dichloroethane-d4 (Surr)

Method: 8270E - Semivolatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		TPHL	PHL	NBZ	2FP	FBP	TBP
Lab Sample ID	Client Sample ID	(31-140)	(18-120)	(13-120)	(12-120)	(23-120)	(10-126)
240-189394-1	WC-H24-WATER	82	51	62	66	65	81
LCS 240-582761/9-A	Lab Control Sample	81	69	72	105	68	91
MB 240-582761/8-A	Method Blank	107	71	78	100	82	78

Surrogate Legend

TPHL = Terphenyl-d14 (Surr)
PHL = Phenol-d5 (Surr)
NBZ = Nitrobenzene-d5 (Surr)
2FP = 2-Fluorophenol (Surr)
FBP = 2-Fluorobiphenyl (Surr)
TBP = 2,4,6-Tribromophenol (Surr)

Method: 8015D - Diesel Range Organics (DRO) (GC)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH
Lab Sample ID	Client Sample ID	(52-121)
240-189394-1	WC-H24-WATER	86
LCS 240-582816/2-A	Lab Control Sample	112
MB 240-582816/1-A	Method Blank	67

Surrogate Legend

OTPH = o-Terphenyl

QC Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Method: 8260D - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 240-582812/8
Matrix: Water
Analysis Batch: 582812

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			08/03/23 16:09	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			08/03/23 16:09	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			08/03/23 16:09	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			08/03/23 16:09	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			08/03/23 16:09	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			08/03/23 16:09	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			08/03/23 16:09	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			08/03/23 16:09	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			08/03/23 16:09	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			08/03/23 16:09	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			08/03/23 16:09	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			08/03/23 16:09	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			08/03/23 16:09	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			08/03/23 16:09	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			08/03/23 16:09	1
2-Hexanone	ND		0.010	0.0011	mg/L			08/03/23 16:09	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			08/03/23 16:09	1
Acetone	ND		0.010	0.0054	mg/L			08/03/23 16:09	1
Benzene	ND		0.0010	0.00042	mg/L			08/03/23 16:09	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			08/03/23 16:09	1
Bromoform	ND		0.0010	0.00076	mg/L			08/03/23 16:09	1
Bromomethane	ND		0.0010	0.00042	mg/L			08/03/23 16:09	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			08/03/23 16:09	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			08/03/23 16:09	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			08/03/23 16:09	1
Chloroethane	ND		0.0010	0.00083	mg/L			08/03/23 16:09	1
Chloroform	ND		0.0010	0.00047	mg/L			08/03/23 16:09	1
Chloromethane	ND		0.0010	0.00063	mg/L			08/03/23 16:09	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			08/03/23 16:09	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			08/03/23 16:09	1
Cyclohexane	ND		0.0010	0.00048	mg/L			08/03/23 16:09	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			08/03/23 16:09	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			08/03/23 16:09	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			08/03/23 16:09	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			08/03/23 16:09	1
Methyl acetate	ND		0.010	0.0017	mg/L			08/03/23 16:09	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			08/03/23 16:09	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			08/03/23 16:09	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			08/03/23 16:09	1
Styrene	ND		0.0010	0.00045	mg/L			08/03/23 16:09	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			08/03/23 16:09	1
Toluene	ND		0.0010	0.00044	mg/L			08/03/23 16:09	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			08/03/23 16:09	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			08/03/23 16:09	1
Trichloroethene	ND		0.0010	0.00044	mg/L			08/03/23 16:09	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			08/03/23 16:09	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			08/03/23 16:09	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			08/03/23 16:09	1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 240-582812/8
Matrix: Water
Analysis Batch: 582812
Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Butyl acrylate	NC		0.010	0.0023	mg/L			08/03/23 16:09	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*98*		*78 - 122*		*08/03/23 16:09*	*1*
Dibromofluoromethane (Surr)	*100*		*73 - 120*		*08/03/23 16:09*	*1*
4-Bromofluorobenzene (Surr)	*97*		*56 - 136*		*08/03/23 16:09*	*1*
1,2-Dichloroethane-d4 (Surr)	*102*		*62 - 137*		*08/03/23 16:09*	*1*

Lab Sample ID: LCS 240-582812/5
Matrix: Water
Analysis Batch: 582812
Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	0.0250	0.0250		mg/L		100	64 - 131
1,1,2,2-Tetrachloroethane	0.0250	0.0245		mg/L		98	58 - 157
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0250	0.0263		mg/L		105	51 - 146
1,1,2-Trichloroethane	0.0250	0.0230		mg/L		92	70 - 138
1,1-Dichloroethane	0.0250	0.0241		mg/L		96	72 - 127
1,1-Dichloroethene	0.0250	0.0255		mg/L		102	63 - 134
1,2,4-Trichlorobenzene	0.0250	0.0258		mg/L		103	44 - 147
1,2-Dibromo-3-Chloropropane	0.0250	0.0239		mg/L		96	53 - 135
Ethylene Dibromide	0.0250	0.0235		mg/L		94	71 - 134
1,2-Dichlorobenzene	0.0250	0.0248		mg/L		99	78 - 120
1,2-Dichloroethane	0.0250	0.0235		mg/L		94	66 - 128
1,2-Dichloropropane	0.0250	0.0243		mg/L		97	75 - 133
1,3-Dichlorobenzene	0.0250	0.0246		mg/L		99	80 - 120
1,4-Dichlorobenzene	0.0250	0.0245		mg/L		98	80 - 120
2-Butanone (MEK)	0.0500	0.0466		mg/L		93	54 - 156
2-Hexanone	0.0500	0.0474		mg/L		95	43 - 167
4-Methyl-2-pentanone (MIBK)	0.0500	0.0467		mg/L		93	46 - 158
Acetone	0.0500	0.0481		mg/L		96	50 - 149
Benzene	0.0250	0.0234		mg/L		94	77 - 123
Dichlorobromomethane	0.0250	0.0241		mg/L		96	69 - 126
Bromoform	0.0250	0.0243		mg/L		97	57 - 129
Bromomethane	0.0125	0.0115		mg/L		92	36 - 142
Carbon disulfide	0.0250	0.0260		mg/L		104	43 - 140
Carbon tetrachloride	0.0250	0.0252		mg/L		101	55 - 137
Chlorobenzene	0.0250	0.0237		mg/L		95	80 - 121
Chloroethane	0.0125	0.0101		mg/L		81	38 - 152
Chloroform	0.0250	0.0237		mg/L		95	74 - 122
Chloromethane	0.0125	0.00732		mg/L		59	47 - 143
cis-1,2-Dichloroethene	0.0250	0.0239		mg/L		96	77 - 123
cis-1,3-Dichloropropene	0.0250	0.0230		mg/L		92	64 - 130
Cyclohexane	0.0250	0.0259		mg/L		103	58 - 146
Chlorodibromomethane	0.0250	0.0242		mg/L		97	70 - 124
Dichlorodifluoromethane	0.0125	0.00493		mg/L		39	34 - 153
Ethylbenzene	0.0250	0.0240		mg/L		96	80 - 121
Isopropylbenzene	0.0250	0.0245		mg/L		98	74 - 128

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-582812/5
Matrix: Water
Analysis Batch: 582812

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Methyl acetate	0.0500	0.0457		mg/L		91	42 - 169
Methyl tert-butyl ether	0.0250	0.0242		mg/L		97	65 - 126
Methylcyclohexane	0.0250	0.0262		mg/L		105	62 - 136
Methylene Chloride	0.0250	0.0246		mg/L		98	71 - 125
Styrene	0.0250	0.0244		mg/L		98	80 - 135
Tetrachloroethene	0.0250	0.0251		mg/L		100	76 - 123
Toluene	0.0250	0.0232		mg/L		93	80 - 123
trans-1,2-Dichloroethene	0.0250	0.0242		mg/L		97	75 - 124
trans-1,3-Dichloropropene	0.0250	0.0250		mg/L		100	57 - 129
Trichloroethene	0.0250	0.0246		mg/L		98	70 - 122
Trichlorofluoromethane	0.0125	0.0106		mg/L		85	30 - 170
Vinyl chloride	0.0125	0.00804		mg/L		64	60 - 144
Xylenes, Total	0.0500	0.0476		mg/L		95	80 - 121
m-Xylene & p-Xylene	0.0250	0.0239		mg/L		96	80 - 120
o-Xylene	0.0250	0.0237		mg/L		95	80 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*96*		*78 - 122*
Dibromofluoromethane (Surr)	*99*		*73 - 120*
4-Bromofluorobenzene (Surr)	*97*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*97*		*62 - 137*

Lab Sample ID: MB 240-582946/21
Matrix: Water
Analysis Batch: 582946

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	ND		0.0010	0.00048	mg/L			08/04/23 20:49	1
1,1,2,2-Tetrachloroethane	ND		0.0010	0.00060	mg/L			08/04/23 20:49	1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0010	0.00041	mg/L			08/04/23 20:49	1
1,1,2-Trichloroethane	ND		0.0010	0.00048	mg/L			08/04/23 20:49	1
1,1-Dichloroethane	ND		0.0010	0.00047	mg/L			08/04/23 20:49	1
1,1-Dichloroethene	ND		0.0010	0.00049	mg/L			08/04/23 20:49	1
1,2,4-Trichlorobenzene	ND		0.0010	0.00077	mg/L			08/04/23 20:49	1
1,2-Dibromo-3-Chloropropane	ND		0.0020	0.00091	mg/L			08/04/23 20:49	1
Ethylene Dibromide	ND		0.0010	0.00041	mg/L			08/04/23 20:49	1
1,2-Dichlorobenzene	ND		0.0010	0.00048	mg/L			08/04/23 20:49	1
1,2-Dichloroethane	ND		0.0010	0.00046	mg/L			08/04/23 20:49	1
1,2-Dichloropropane	ND		0.0010	0.00047	mg/L			08/04/23 20:49	1
1,3-Dichlorobenzene	ND		0.0010	0.00045	mg/L			08/04/23 20:49	1
1,4-Dichlorobenzene	ND		0.0010	0.00041	mg/L			08/04/23 20:49	1
2-Butanone (MEK)	ND		0.010	0.0012	mg/L			08/04/23 20:49	1
2-Hexanone	ND		0.010	0.0011	mg/L			08/04/23 20:49	1
4-Methyl-2-pentanone (MIBK)	ND		0.010	0.00099	mg/L			08/04/23 20:49	1
Acetone	ND		0.010	0.0054	mg/L			08/04/23 20:49	1
Benzene	ND		0.0010	0.00042	mg/L			08/04/23 20:49	1
Dichlorobromomethane	ND		0.0010	0.00038	mg/L			08/04/23 20:49	1
Bromoform	ND		0.0010	0.00076	mg/L			08/04/23 20:49	1

QC Sample Results

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 240-582946/21
Matrix: Water
Analysis Batch: 582946

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromomethane	ND		0.0010	0.00042	mg/L			08/04/23 20:49	1
Carbon disulfide	ND		0.0010	0.00059	mg/L			08/04/23 20:49	1
Carbon tetrachloride	ND		0.0010	0.00026	mg/L			08/04/23 20:49	1
Chlorobenzene	ND		0.0010	0.00038	mg/L			08/04/23 20:49	1
Chloroethane	ND		0.0010	0.00083	mg/L			08/04/23 20:49	1
Chloroform	ND		0.0010	0.00047	mg/L			08/04/23 20:49	1
Chloromethane	ND		0.0010	0.00063	mg/L			08/04/23 20:49	1
cis-1,2-Dichloroethene	ND		0.0010	0.00046	mg/L			08/04/23 20:49	1
cis-1,3-Dichloropropene	ND		0.0010	0.00061	mg/L			08/04/23 20:49	1
Cyclohexane	ND		0.0010	0.00048	mg/L			08/04/23 20:49	1
Chlorodibromomethane	ND		0.0010	0.00039	mg/L			08/04/23 20:49	1
Dichlorodifluoromethane	ND		0.0010	0.00035	mg/L			08/04/23 20:49	1
Ethylbenzene	ND		0.0010	0.00042	mg/L			08/04/23 20:49	1
Isopropylbenzene	ND		0.0010	0.00049	mg/L			08/04/23 20:49	1
Methyl acetate	ND		0.010	0.0017	mg/L			08/04/23 20:49	1
Methyl tert-butyl ether	ND		0.0010	0.00047	mg/L			08/04/23 20:49	1
Methylcyclohexane	ND		0.0010	0.00033	mg/L			08/04/23 20:49	1
Methylene Chloride	ND		0.0050	0.0026	mg/L			08/04/23 20:49	1
Styrene	ND		0.0010	0.00045	mg/L			08/04/23 20:49	1
Tetrachloroethene	ND		0.0010	0.00044	mg/L			08/04/23 20:49	1
Toluene	ND		0.0010	0.00044	mg/L			08/04/23 20:49	1
trans-1,2-Dichloroethene	ND		0.0010	0.00051	mg/L			08/04/23 20:49	1
trans-1,3-Dichloropropene	ND		0.0010	0.00067	mg/L			08/04/23 20:49	1
Trichloroethene	ND		0.0010	0.00044	mg/L			08/04/23 20:49	1
Trichlorofluoromethane	ND		0.0010	0.00045	mg/L			08/04/23 20:49	1
Vinyl chloride	ND		0.0010	0.00045	mg/L			08/04/23 20:49	1
Xylenes, Total	ND		0.0020	0.00042	mg/L			08/04/23 20:49	1
Butyl acrylate	ND		0.010	0.0023	mg/L			08/04/23 20:49	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*96*		*78 - 122*		*08/04/23 20:49*	*1*
Dibromofluoromethane (Surr)	*97*		*73 - 120*		*08/04/23 20:49*	*1*
4-Bromofluorobenzene (Surr)	*95*		*56 - 136*		*08/04/23 20:49*	*1*
1,2-Dichloroethane-d4 (Surr)	*99*		*62 - 137*		*08/04/23 20:49*	*1*

Lab Sample ID: LCS 240-582946/18
Matrix: Water
Analysis Batch: 582946

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Butyl acrylate	0.0250	0.0261		mg/L		104	75 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*93*		*78 - 122*
Dibromofluoromethane (Surr)	*93*		*73 - 120*
4-Bromofluorobenzene (Surr)	*91*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*94*		*62 - 137*

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-582946/5
Matrix: Water
Analysis Batch: 582946

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	0.0250	0.0254		mg/L		101	64 - 131
1,1,2,2-Tetrachloroethane	0.0250	0.0246		mg/L		99	58 - 157
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0250	0.0259		mg/L		104	51 - 146
1,1,2-Trichloroethane	0.0250	0.0241		mg/L		96	70 - 138
1,1-Dichloroethane	0.0250	0.0249		mg/L		100	72 - 127
1,1-Dichloroethene	0.0250	0.0255		mg/L		102	63 - 134
1,2,4-Trichlorobenzene	0.0250	0.0252		mg/L		101	44 - 147
1,2-Dibromo-3-Chloropropane	0.0250	0.0235		mg/L		94	53 - 135
Ethylene Dibromide	0.0250	0.0243		mg/L		97	71 - 134
1,2-Dichlorobenzene	0.0250	0.0250		mg/L		100	78 - 120
1,2-Dichloroethane	0.0250	0.0240		mg/L		96	66 - 128
1,2-Dichloropropane	0.0250	0.0248		mg/L		99	75 - 133
1,3-Dichlorobenzene	0.0250	0.0250		mg/L		100	80 - 120
1,4-Dichlorobenzene	0.0250	0.0249		mg/L		99	80 - 120
2-Butanone (MEK)	0.0500	0.0482		mg/L		96	54 - 156
2-Hexanone	0.0500	0.0490		mg/L		98	43 - 167
4-Methyl-2-pentanone (MIBK)	0.0500	0.0478		mg/L		96	46 - 158
Acetone	0.0500	0.0510		mg/L		102	50 - 149
Benzene	0.0250	0.0238		mg/L		95	77 - 123
Dichlorobromomethane	0.0250	0.0244		mg/L		97	69 - 126
Bromoform	0.0250	0.0244		mg/L		98	57 - 129
Bromomethane	0.0125	0.0118		mg/L		95	36 - 142
Carbon disulfide	0.0250	0.0263		mg/L		105	43 - 140
Carbon tetrachloride	0.0250	0.0250		mg/L		100	55 - 137
Chlorobenzene	0.0250	0.0245		mg/L		98	80 - 121
Chloroethane	0.0125	0.0134		mg/L		107	38 - 152
Chloroform	0.0250	0.0238		mg/L		95	74 - 122
Chloromethane	0.0125	0.0130		mg/L		104	47 - 143
cis-1,2-Dichloroethene	0.0250	0.0246		mg/L		98	77 - 123
cis-1,3-Dichloropropene	0.0250	0.0232		mg/L		93	64 - 130
Cyclohexane	0.0250	0.0258		mg/L		103	58 - 146
Chlorodibromomethane	0.0250	0.0248		mg/L		99	70 - 124
Dichlorodifluoromethane	0.0125	0.0120		mg/L		96	34 - 153
Ethylbenzene	0.0250	0.0250		mg/L		100	80 - 121
Isopropylbenzene	0.0250	0.0252		mg/L		101	74 - 128
Methyl acetate	0.0500	0.0474		mg/L		95	42 - 169
Methyl tert-butyl ether	0.0250	0.0244		mg/L		97	65 - 126
Methylcyclohexane	0.0250	0.0251		mg/L		101	62 - 136
Methylene Chloride	0.0250	0.0248		mg/L		99	71 - 125
Styrene	0.0250	0.0251		mg/L		101	80 - 135
Tetrachloroethene	0.0250	0.0251		mg/L		101	76 - 123
Toluene	0.0250	0.0239		mg/L		96	80 - 123
trans-1,2-Dichloroethene	0.0250	0.0243		mg/L		97	75 - 124
trans-1,3-Dichloropropene	0.0250	0.0250		mg/L		100	57 - 129
Trichloroethene	0.0250	0.0249		mg/L		100	70 - 122
Trichlorofluoromethane	0.0125	0.0131		mg/L		104	30 - 170
Vinyl chloride	0.0125	0.0123		mg/L		99	60 - 144
Xylenes, Total	0.0500	0.0491		mg/L		98	80 - 121

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 240-582946/5
Matrix: Water
Analysis Batch: 582946

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
m-Xylene & p-Xylene	0.0250	0.0245		mg/L		98	80 - 120
o-Xylene	0.0250	0.0246		mg/L		98	80 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*97*		*78 - 122*
Dibromofluoromethane (Surr)	*97*		*73 - 120*
4-Bromofluorobenzene (Surr)	*96*		*56 - 136*
1,2-Dichloroethane-d4 (Surr)	*95*		*62 - 137*

Method: 8270E - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 240-582761/8-A
Matrix: Water
Analysis Batch: 583037

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 582761

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1'-Biphenyl	ND		0.0010	0.00049	mg/L		08/03/23 09:28	08/07/23 10:31	1
bis (2-chloroisopropyl) ether	ND		0.0010	0.00024	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,4,5-Trichlorophenol	ND		0.0050	0.0020	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,4,6-Trichlorophenol	ND		0.0050	0.0018	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,4-Dichlorophenol	ND		0.0020	0.00026	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,4-Dimethylphenol	ND		0.0020	0.00025	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,4-Dinitrophenol	ND		0.010	0.0026	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,4-Dinitrotoluene	ND		0.0050	0.0021	mg/L		08/03/23 09:28	08/07/23 10:31	1
2,6-Dinitrotoluene	ND		0.0050	0.0011	mg/L		08/03/23 09:28	08/07/23 10:31	1
2-Chloronaphthalene	ND		0.0010	0.00023	mg/L		08/03/23 09:28	08/07/23 10:31	1
2-Chlorophenol	ND		0.0010	0.00027	mg/L		08/03/23 09:28	08/07/23 10:31	1
2-Methylnaphthalene	ND		0.00020	0.00011	mg/L		08/03/23 09:28	08/07/23 10:31	1
2-Methylphenol	ND		0.0010	0.00021	mg/L		08/03/23 09:28	08/07/23 10:31	1
2-Nitroaniline	ND		0.0020	0.00051	mg/L		08/03/23 09:28	08/07/23 10:31	1
2-Nitrophenol	ND		0.0020	0.00056	mg/L		08/03/23 09:28	08/07/23 10:31	1
3,3'-Dichlorobenzidine	ND		0.0050	0.0012	mg/L		08/03/23 09:28	08/07/23 10:31	1
3-Nitroaniline	ND		0.0020	0.00057	mg/L		08/03/23 09:28	08/07/23 10:31	1
4,6-Dinitro-2-methylphenol	ND		0.0050	0.0028	mg/L		08/03/23 09:28	08/07/23 10:31	1
4-Bromophenyl phenyl ether	ND		0.0020	0.00050	mg/L		08/03/23 09:28	08/07/23 10:31	1
4-Chloro-3-methylphenol	ND		0.0020	0.00030	mg/L		08/03/23 09:28	08/07/23 10:31	1
4-Chloroaniline	ND		0.0020	0.00032	mg/L		08/03/23 09:28	08/07/23 10:31	1
4-Chlorophenyl phenyl ether	ND		0.0020	0.00055	mg/L		08/03/23 09:28	08/07/23 10:31	1
4-Nitroaniline	ND		0.0020	0.00033	mg/L		08/03/23 09:28	08/07/23 10:31	1
4-Nitrophenol	ND		0.010	0.0022	mg/L		08/03/23 09:28	08/07/23 10:31	1
Acenaphthene	ND		0.00020	0.00017	mg/L		08/03/23 09:28	08/07/23 10:31	1
Acenaphthylene	ND		0.00020	0.00013	mg/L		08/03/23 09:28	08/07/23 10:31	1
Acetophenone	ND		0.0010	0.00037	mg/L		08/03/23 09:28	08/07/23 10:31	1
Anthracene	ND		0.00020	0.00014	mg/L		08/03/23 09:28	08/07/23 10:31	1
Atrazine	ND		0.0020	0.00095	mg/L		08/03/23 09:28	08/07/23 10:31	1
Benzaldehyde	ND		0.0020	0.00076	mg/L		08/03/23 09:28	08/07/23 10:31	1
Benzo[a]anthracene	ND		0.00020	0.000068	mg/L		08/03/23 09:28	08/07/23 10:31	1
Benzo[a]pyrene	ND		0.00020	0.00017	mg/L		08/03/23 09:28	08/07/23 10:31	1
Benzo[b]fluoranthene	ND		0.00020	0.00015	mg/L		08/03/23 09:28	08/07/23 10:31	1

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 240-582761/8-A | **Client Sample ID: Method Blank**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 583037 | **Prep Batch: 582761**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzo[g,h,i]perylene	ND		0.00020	0.00018	mg/L		08/03/23 09:28	08/07/23 10:31	1
Benzo[k]fluoranthene	ND		0.00020	0.00014	mg/L		08/03/23 09:28	08/07/23 10:31	1
Bis(2-chloroethoxy)methane	ND		0.0010	0.00022	mg/L		08/03/23 09:28	08/07/23 10:31	1
Bis(2-chloroethyl)ether	ND		0.0010	0.00040	mg/L		08/03/23 09:28	08/07/23 10:31	1
Bis(2-ethylhexyl) phthalate	ND		0.0050	0.0022	mg/L		08/03/23 09:28	08/07/23 10:31	1
Butyl benzyl phthalate	ND		0.0020	0.00067	mg/L		08/03/23 09:28	08/07/23 10:31	1
Caprolactam	ND		0.0050	0.00093	mg/L		08/03/23 09:28	08/07/23 10:31	1
Carbazole	ND		0.0010	0.00049	mg/L		08/03/23 09:28	08/07/23 10:31	1
Chrysene	ND		0.00020	0.000066	mg/L		08/03/23 09:28	08/07/23 10:31	1
Dibenz(a,h)anthracene	ND		0.00020	0.00015	mg/L		08/03/23 09:28	08/07/23 10:31	1
Dibenzofuran	ND		0.0010	0.00027	mg/L		08/03/23 09:28	08/07/23 10:31	1
Diethyl phthalate	ND		0.0050	0.0038	mg/L		08/03/23 09:28	08/07/23 10:31	1
Dimethyl phthalate	ND		0.0020	0.00052	mg/L		08/03/23 09:28	08/07/23 10:31	1
Di-n-butyl phthalate	ND		0.0050	0.0018	mg/L		08/03/23 09:28	08/07/23 10:31	1
Di-n-octyl phthalate	ND		0.0020	0.00082	mg/L		08/03/23 09:28	08/07/23 10:31	1
Fluoranthene	ND		0.00020	0.00016	mg/L		08/03/23 09:28	08/07/23 10:31	1
Fluorene	ND		0.00020	0.000079	mg/L		08/03/23 09:28	08/07/23 10:31	1
Hexachlorobenzene	ND		0.00020	0.00016	mg/L		08/03/23 09:28	08/07/23 10:31	1
Hexachlorobutadiene	ND		0.0010	0.00054	mg/L		08/03/23 09:28	08/07/23 10:31	1
Hexachlorocyclopentadiene	ND		0.010	0.0018	mg/L		08/03/23 09:28	08/07/23 10:31	1
Hexachloroethane	ND		0.0010	0.00040	mg/L		08/03/23 09:28	08/07/23 10:31	1
Indeno[1,2,3-cd]pyrene	ND		0.00020	0.00014	mg/L		08/03/23 09:28	08/07/23 10:31	1
Isophorone	ND		0.0010	0.00032	mg/L		08/03/23 09:28	08/07/23 10:31	1
N-Nitrosodi-n-propylamine	ND		0.0010	0.00025	mg/L		08/03/23 09:28	08/07/23 10:31	1
N-Nitrosodiphenylamine	ND		0.0010	0.00044	mg/L		08/03/23 09:28	08/07/23 10:31	1
Naphthalene	ND		0.00020	0.00011	mg/L		08/03/23 09:28	08/07/23 10:31	1
Nitrobenzene	ND		0.0010	0.00051	mg/L		08/03/23 09:28	08/07/23 10:31	1
Pentachlorophenol	ND		0.010	0.0031	mg/L		08/03/23 09:28	08/07/23 10:31	1
Phenanthrene	ND		0.00020	0.000080	mg/L		08/03/23 09:28	08/07/23 10:31	1
Phenol	0.00199		0.0010	0.00013	mg/L		08/03/23 09:28	08/07/23 10:31	1
Pyrene	ND		0.00020	0.000083	mg/L		08/03/23 09:28	08/07/23 10:31	1
3 & 4 Methylphenol	ND		0.0020	0.00019	mg/L		08/03/23 09:28	08/07/23 10:31	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Terphenyl-d14 (Surr)	*107*		*31 - 140*	*08/03/23 09:28*	*08/07/23 10:31*	*1*
Phenol-d5 (Surr)	*71*		*18 - 120*	*08/03/23 09:28*	*08/07/23 10:31*	*1*
Nitrobenzene-d5 (Surr)	*78*		*13 - 120*	*08/03/23 09:28*	*08/07/23 10:31*	*1*
2-Fluorophenol (Surr)	*100*		*12 - 120*	*08/03/23 09:28*	*08/07/23 10:31*	*1*
2-Fluorobiphenyl (Surr)	*82*		*23 - 120*	*08/03/23 09:28*	*08/07/23 10:31*	*1*
2,4,6-Tribromophenol (Surr)	*78*		*10 - 126*	*08/03/23 09:28*	*08/07/23 10:31*	*1*

Lab Sample ID: LCS 240-582761/9-A | **Client Sample ID: Lab Control Sample**
Matrix: Water | **Prep Type: Total/NA**
Analysis Batch: 583037 | **Prep Batch: 582761**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,1'-Biphenyl	0.0320	0.0188		mg/L		59	48 - 120
bis (2-chloroisopropyl) ether	0.0320	0.0190		mg/L		59	41 - 120

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

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 240-582761/9-A
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 583037
Prep Batch: 582761

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
2,4,5-Trichlorophenol	0.0320	0.0230		mg/L		72	52 - 123
2,4,6-Trichlorophenol	0.0320	0.0230		mg/L		72	51 - 120
2,4-Dichlorophenol	0.0320	0.0224		mg/L		70	53 - 120
2,4-Dimethylphenol	0.0320	0.0207		mg/L		65	44 - 120
2,4-Dinitrophenol	0.0640	0.0490		mg/L		77	11 - 139
2,4-Dinitrotoluene	0.0320	0.0250		mg/L		78	58 - 125
2,6-Dinitrotoluene	0.0320	0.0265		mg/L		83	54 - 132
2-Chloronaphthalene	0.0320	0.0191		mg/L		60	51 - 120
2-Chlorophenol	0.0320	0.0246		mg/L		77	46 - 120
2-Methylnaphthalene	0.0320	0.0187		mg/L		58	49 - 120
2-Methylphenol	0.0320	0.0234		mg/L		73	45 - 120
2-Nitroaniline	0.0320	0.0223		mg/L		70	57 - 121
2-Nitrophenol	0.0320	0.0234		mg/L		73	51 - 120
3,3'-Dichlorobenzidine	0.0640	0.0501		mg/L		78	51 - 154
3-Nitroaniline	0.0320	0.0326		mg/L		102	47 - 123
4,6-Dinitro-2-methylphenol	0.0640	0.0494		mg/L		77	49 - 130
4-Bromophenyl phenyl ether	0.0320	0.0248		mg/L		78	58 - 125
4-Chloro-3-methylphenol	0.0320	0.0222		mg/L		69	52 - 120
4-Chloroaniline	0.0320	0.00763		mg/L		24	10 - 126
4-Chlorophenyl phenyl ether	0.0320	0.0240		mg/L		75	55 - 120
4-Nitroaniline	0.0320	0.0318		mg/L		100	56 - 127
4-Nitrophenol	0.0640	0.0329		mg/L		51	10 - 120
Acenaphthene	0.0320	0.0198		mg/L		62	54 - 120
Acenaphthylene	0.0320	0.0202		mg/L		63	50 - 120
Acetophenone	0.0320	0.0225		mg/L		70	47 - 120
Anthracene	0.0320	0.0238		mg/L		74	58 - 121
Atrazine	0.0320	0.0258		mg/L		81	68 - 126
Benzaldehyde	0.0320	0.0319		mg/L		100	26 - 147
Benzo[a]anthracene	0.0320	0.0244		mg/L		76	61 - 120
Benzo[a]pyrene	0.0320	0.0208		mg/L		65	56 - 131
Benzo[b]fluoranthene	0.0320	0.0241		mg/L		75	57 - 130
Benzo[g,h,i]perylene	0.0320	0.0256		mg/L		80	58 - 120
Benzo[k]fluoranthene	0.0320	0.0244		mg/L		76	53 - 137
Bis(2-chloroethoxy)methane	0.0320	0.0210		mg/L		66	49 - 120
Bis(2-chloroethyl)ether	0.0320	0.0210		mg/L		66	40 - 120
Bis(2-ethylhexyl) phthalate	0.0320	0.0214		mg/L		67	60 - 126
Butyl benzyl phthalate	0.0320	0.0221		mg/L		69	58 - 124
Caprolactam	0.0320	0.00893		mg/L		28	10 - 120
Carbazole	0.0320	0.0253		mg/L		79	60 - 130
Chrysene	0.0320	0.0232		mg/L		72	57 - 120
Dibenz(a,h)anthracene	0.0320	0.0238		mg/L		74	58 - 120
Dibenzofuran	0.0320	0.0227		mg/L		71	54 - 120
Diethyl phthalate	0.0320	0.0235		mg/L		73	55 - 120
Dimethyl phthalate	0.0320	0.0238		mg/L		74	49 - 125
Di-n-butyl phthalate	0.0320	0.0243		mg/L		76	59 - 130
Di-n-octyl phthalate	0.0320	0.0203		mg/L		64	57 - 126
Fluoranthene	0.0320	0.0259		mg/L		81	58 - 128
Fluorene	0.0320	0.0226		mg/L		71	55 - 120
Hexachlorobenzene	0.0320	0.0239		mg/L		75	55 - 120

Method: 8270E - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 240-582761/9-A
Matrix: Water
Analysis Batch: 583037

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 582761

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Hexachlorobutadiene	0.0320	0.0174		mg/L		54	41 - 120
Hexachlorocyclopentadiene	0.0320	0.0108		mg/L		34	15 - 120
Hexachloroethane	0.0320	0.0153		mg/L		48	39 - 120
Indeno[1,2,3-cd]pyrene	0.0320	0.0221		mg/L		69	59 - 122
Isophorone	0.0320	0.0215		mg/L		67	51 - 120
N-Nitrosodi-n-propylamine	0.0320	0.0222		mg/L		69	49 - 120
N-Nitrosodiphenylamine	0.0320	0.0227		mg/L		71	56 - 125
Naphthalene	0.0320	0.0184		mg/L		58	46 - 120
Nitrobenzene	0.0320	0.0214		mg/L		67	47 - 120
Pentachlorophenol	0.0640	0.0397		mg/L		62	19 - 132
Phenanthrene	0.0320	0.0226		mg/L		71	55 - 120
Phenol	0.0320	0.0205		mg/L		64	10 - 120
Pyrene	0.0320	0.0243		mg/L		76	59 - 120
3 & 4 Methylphenol	0.0320	0.0220		mg/L		69	40 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Terphenyl-d14 (Surr)	*81*		*31 - 140*
Phenol-d5 (Surr)	*69*		*18 - 120*
Nitrobenzene-d5 (Surr)	*72*		*13 - 120*
2-Fluorophenol (Surr)	*105*		*12 - 120*
2-Fluorobiphenyl (Surr)	*68*		*23 - 120*
2,4,6-Tribromophenol (Surr)	*91*		*10 - 126*

Method: 8015D - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 240-582816/1-A
Matrix: Water
Analysis Batch: 582760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 582816

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10 - C28]	ND		500	68	ug/L		08/03/23 13:02	08/03/23 14:19	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*67*		*52 - 121*	*08/03/23 13:02*	*08/03/23 14:19*	*1*

Lab Sample ID: LCS 240-582816/2-A
Matrix: Water
Analysis Batch: 582760

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 582816

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Diesel Range Organics [C10 - C28]	2000	1760		ug/L		88	56 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*112*		*52 - 121*

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 240-582800/1-A
Matrix: Water
Analysis Batch: 583032

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 582800

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Barium	ND		200	3.0	ug/L		08/03/23 14:00	08/04/23 11:26	1
Cadmium	ND		5.0	0.45	ug/L		08/03/23 14:00	08/04/23 11:26	1
Chromium	ND		10	0.76	ug/L		08/03/23 14:00	08/04/23 11:26	1
Silver	ND		10	0.62	ug/L		08/03/23 14:00	08/04/23 11:26	1
Arsenic	ND		15	4.1	ug/L		08/03/23 14:00	08/04/23 11:26	1
Lead	ND		10	2.8	ug/L		08/03/23 14:00	08/04/23 11:26	1
Selenium	ND		20	6.0	ug/L		08/03/23 14:00	08/04/23 11:26	1

Lab Sample ID: LCS 240-582800/2-A
Matrix: Water
Analysis Batch: 583032

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 582800

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Barium	2000	1810		ug/L		91	80 - 120
Cadmium	1000	961		ug/L		96	80 - 120
Chromium	1000	921		ug/L		92	80 - 120
Silver	100	95.6		ug/L		96	80 - 120
Arsenic	2000	1930		ug/L		97	80 - 120
Lead	1000	915		ug/L		91	80 - 120
Selenium	2000	1960		ug/L		98	80 - 120

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-582797/1-A
Matrix: Water
Analysis Batch: 582960

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 582797

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		08/03/23 14:00	08/04/23 11:54	1

Lab Sample ID: LCS 240-582797/2-A
Matrix: Water
Analysis Batch: 582960

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 582797

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	5.00	5.14		ug/L		103	80 - 120

Method: 1010B - Ignitability, Pensky-Martens Closed-Cup Method

Lab Sample ID: LCS 240-583113/1
Matrix: Water
Analysis Batch: 583113

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Ignitablity (Flashpoint)	81.0	81.2		Degrees F		100	97 - 103

Method: 1010B - Ignitability, Pensky-Martens Closed-Cup Method (Continued)

Lab Sample ID: 240-189394-1 DU
Matrix: Water
Analysis Batch: 583113

Client Sample ID: WC-H24-WATER
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Ignitablity (Flashpoint)	>200			>200		Degrees F				NC	20

Method: 2540D-2015 - Total Suspended Solids (Dried at 103-105°C)

Lab Sample ID: MB 240-582768/1
Matrix: Water
Analysis Batch: 582768

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Suspended Solids	ND		4.0	0.40	mg/L			08/03/23 09:50	1

Lab Sample ID: LCS 240-582768/2
Matrix: Water
Analysis Batch: 582768

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Suspended Solids			35.6	32.5		mg/L		91	64 - 120

Method: 5310 C-2014 - Total Organic Carbon/Persulfate - Ultrav

Lab Sample ID: MB 240-582903/4
Matrix: Water
Analysis Batch: 582903

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon	ND		1.0	0.35	mg/L			08/03/23 15:15	1

Lab Sample ID: LCS 240-582903/5
Matrix: Water
Analysis Batch: 582903

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Organic Carbon			18.3	18.6		mg/L		101	85 - 115
TOC Result 1			18.3	19.1		mg/L		104	85 - 115
TOC Result 2			18.3	18.1		mg/L		99	85 - 115

Method: 9040C - pH

Lab Sample ID: LCS 240-582663/59
Matrix: Water
Analysis Batch: 582663

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
pH			9.24	9.2		SU		100	97 - 103

Lab Sample ID: 240-189394-1 DU
Matrix: Water
Analysis Batch: 582663

Client Sample ID: WC-H24-WATER
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.8	HF		7.8		SU				0.1	20

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

QC Association Summary

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

GC/MS VOA

Analysis Batch: 582812

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	8260D	
240-189394-2	TRIP BLANK	Total/NA	Water	8260D	
MB 240-582812/8	Method Blank	Total/NA	Water	8260D	
LCS 240-582812/5	Lab Control Sample	Total/NA	Water	8260D	

Analysis Batch: 582946

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	8260D	
240-189394-2	TRIP BLANK	Total/NA	Water	8260D	
MB 240-582946/21	Method Blank	Total/NA	Water	8260D	
LCS 240-582946/18	Lab Control Sample	Total/NA	Water	8260D	
LCS 240-582946/5	Lab Control Sample	Total/NA	Water	8260D	

GC/MS Semi VOA

Prep Batch: 582761

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	3510C LVI	
MB 240-582761/8-A	Method Blank	Total/NA	Water	3510C LVI	
LCS 240-582761/9-A	Lab Control Sample	Total/NA	Water	3510C LVI	

Analysis Batch: 583037

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	8270E	582761
MB 240-582761/8-A	Method Blank	Total/NA	Water	8270E	582761
LCS 240-582761/9-A	Lab Control Sample	Total/NA	Water	8270E	582761

GC Semi VOA

Analysis Batch: 582760

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	8015D	582816
MB 240-582816/1-A	Method Blank	Total/NA	Water	8015D	582816
LCS 240-582816/2-A	Lab Control Sample	Total/NA	Water	8015D	582816

Prep Batch: 582816

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	3511	
MB 240-582816/1-A	Method Blank	Total/NA	Water	3511	
LCS 240-582816/2-A	Lab Control Sample	Total/NA	Water	3511	

Metals

Prep Batch: 582797

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	7470A	
MB 240-582797/1-A	Method Blank	Total/NA	Water	7470A	
LCS 240-582797/2-A	Lab Control Sample	Total/NA	Water	7470A	

Prep Batch: 582800

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total Recoverable	Water	3005A	

Metals (Continued)

Prep Batch: 582800 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 240-582800/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 240-582800/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Analysis Batch: 582960

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	7470A	582797
MB 240-582797/1-A	Method Blank	Total/NA	Water	7470A	582797
LCS 240-582797/2-A	Lab Control Sample	Total/NA	Water	7470A	582797

Analysis Batch: 583032

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total Recoverable	Water	6010D	582800
MB 240-582800/1-A	Method Blank	Total Recoverable	Water	6010D	582800
LCS 240-582800/2-A	Lab Control Sample	Total Recoverable	Water	6010D	582800

General Chemistry

Analysis Batch: 582663

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	9040C	
LCS 240-582663/59	Lab Control Sample	Total/NA	Water	9040C	
240-189394-1 DU	WC-H24-WATER	Total/NA	Water	9040C	

Analysis Batch: 582768

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	2540D-2015	
MB 240-582768/1	Method Blank	Total/NA	Water	2540D-2015	
LCS 240-582768/2	Lab Control Sample	Total/NA	Water	2540D-2015	

Analysis Batch: 582903

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	5310 C-2014	
MB 240-582903/4	Method Blank	Total/NA	Water	5310 C-2014	
LCS 240-582903/5	Lab Control Sample	Total/NA	Water	5310 C-2014	

Analysis Batch: 583113

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-189394-1	WC-H24-WATER	Total/NA	Water	1010B	
LCS 240-583113/1	Lab Control Sample	Total/NA	Water	1010B	
240-189394-1 DU	WC-H24-WATER	Total/NA	Water	1010B	

Lab Chronicle

Client: Norfolk Southern Corporation
Project/Site: NS East Palestine

Job ID: 240-189394-1

Client Sample ID: WC-H24-WATER
Date Collected: 08/01/23 11:05
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	582812	CDG	EET CLE	08/03/23 23:42
Total/NA	Analysis	8260D		1	582946	SAM	EET CLE	08/04/23 22:00
Total/NA	Prep	3510C LVI			582761	LK2	EET CLE	08/03/23 09:28
Total/NA	Analysis	8270E		1	583037	MRU	EET CLE	08/07/23 12:26
Total/NA	Prep	3511			582816	EPF	EET CLE	08/03/23 13:02
Total/NA	Analysis	8015D		1	582760	EPF	EET CLE	08/03/23 15:13
Total Recoverable	Prep	3005A			582800	BN	EET CLE	08/03/23 14:00
Total Recoverable	Analysis	6010D		1	583032	RKT	EET CLE	08/04/23 12:57
Total/NA	Prep	7470A			582797	BN	EET CLE	08/03/23 14:00
Total/NA	Analysis	7470A		1	582960	GK	EET CLE	08/04/23 12:17
Total/NA	Analysis	1010B		1	583113	JMR	EET CLE	08/07/23 12:12
Total/NA	Analysis	2540D-2015		1	582768	GH	EET CLE	08/03/23 09:50
Total/NA	Analysis	5310 C-2014		1	582903	MED	EET CLE	08/03/23 21:18
Total/NA	Analysis	9040C		1	582663	MS	EET CLE	08/02/23 12:41

Client Sample ID: TRIP BLANK
Date Collected: 08/01/23 00:00
Date Received: 08/01/23 19:17

Lab Sample ID: 240-189394-2
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	8260D		1	582812	CDG	EET CLE	08/03/23 22:55
Total/NA	Analysis	8260D		1	582946	SAM	EET CLE	08/04/23 21:36

Laboratory References:

EET CLE = Eurofins Cleveland, 180 S. Van Buren Avenue, Barberton, OH 44203, TEL (330)497-9396

Accreditation/Certification Summary

Client: Norfolk Southern Corporation — Job ID: 240-189394-1
Project/Site: NS East Palestine

Laboratory: Eurofins Cleveland

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
California	State	2927	02-27-24
Georgia	State	4062	02-27-24
Illinois	NELAP	200004	07-31-24
Iowa	State	421	06-01-25
Kentucky (UST)	State	112225	02-28-24
Kentucky (WW)	State	KY98016	12-31-23
Michigan	State	9135	02-27-24
Minnesota	NELAP	039-999-348	12-31-23
Minnesota (Petrofund)	State	3506	08-01-23 *
New Jersey	NELAP	OH001	07-01-24
New York	NELAP	10975	04-02-24
Ohio	State	8303	02-27-24
Ohio VAP	State	ORELAP 4062	02-27-24
Oregon	NELAP	4062	02-27-24
Pennsylvania	NELAP	68-00340	08-31-24
Texas	NELAP	T104704517-22-17	08-31-23
Virginia	NELAP	460175	09-14-23
West Virginia DEP	State	210	12-31-23

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Chain of Custody Record

1.8/2.2

eurofins Environment Testing America

Client Information	Sampler: Steven Rhodes	Lab PM: Mike DelMonico	Carrier Tracking No(s):	COC No: --------
Client Contact: Jason Artrip	Phone: 5857394536	E-Mail: Michael.DelMonico@et.eurofinsus.com	State of Origin: Ohio	Page: 1 of 1
Company: ARCADIS				Job #:
Address: 111-D Sanders Lane	Due Date Requested: 8/2/2023			
City: Bluefield	TAT Requested (days): RUSH			
State, Zip: Virginia 24605	Compliance Project: X Yes Δ No			
Phone: 304-395-9424	PO #: G/L: 58682000 CC: 66716			
Email: jason.artrip@arcadis.com	WO #: WBS: SP-88984			
Project Name: East Palestine, Ohio	Project #: 30169714			
Site: East Palestine, Ohio				

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Total VOCs - 8260	Total SVOCs - 8270	Total Metals	TSS	TOC	pH	DRO	Flash Point	Trip Blannk - Total VOC	Total Number of containers	Special Instructions/Note:
				Preservation Code:			A,S,I	I	I	I	I	I	I	I	A,I		
WC-H24-Water	8/1/23	1105	G	W	N	N	X	X	X	X	X	X	X	X		14	No Sheen or Product for Falsh Point
Trip Blank	8/1/23	------	G	W	N	N									X	3	

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA

M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

240-189394 Chain of Custody

Possible Hazard Identification
Non-Hazard   Flammable   Skin Irritant   Poison B   X Unknown   Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Return To Client SL 8/1/23 X   Disposal By Lab X   Archive For ________ Months

Deliverable Requested: I, II, III, IV, Other (specify)   Level 2

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: ----------------------   Time: ---------------------------   Method of Shipment: ----------------------------

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Steven Rhodes	8/1/23 / 1650	Arcadis	[illegible]	8-1-23 16:50	WaypointS
			[illegible]	8-1-23 1917	EETNC

Custody Seals Intact: Δ Yes Δ No   Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Garberton Facility

Login # :

Client Arcadis - NSRR Site Name	Cooler unpacked by:
Cooler Received on 8-1-23 Opened on 8-2-23	

FedEx: 1st Grd Exp UPS FAS Waypoint Client Drop Off Eurofins Courier Other

Receipt After-hours: Drop-off Date/Time Storage Location

Eurofins Cooler # EC Foam Box Client Cooler Box Other

Packing material used: Bubble Wrap Foam Plastic Bag None Other

COOLANT: Wet Ice Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form

IR GUN # 19 (CF +0.4 °C) Observed Cooler Temp. 1.8 °C Corrected Cooler Temp. 2.2 °C

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 — Yes No
 - Were the seals on the outside of the cooler(s) signed & dated? — Yes No NA
 - Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? — Yes No
 - Were tamper/custody seals intact and uncompromised? — Yes No NA
3. Shippers' packing slip attached to the cooler(s)? — Yes No
4. Did custody papers accompany the sample(s)? — Yes No
5. Were the custody papers relinquished & signed in the appropriate place? — Yes No
6. Was/were the person(s) who collected the samples clearly identified on the COC? — Yes No
7. Did all bottles arrive in good condition (Unbroken)? — Yes No
8. Could all bottle labels (ID/Date/Time) be reconciled with the COC? — Yes No
9. For each sample, does the COC specify preservatives (Y/N), # of containers (Y/N), and sample type of grab/comp(Y/N)?
10. Were correct bottle(s) used for the test(s) indicated? — Yes No
11. Sufficient quantity received to perform indicated analyses? — Yes No
12. Are these work share samples and all listed on the COC? — Yes No

 If yes, Questions 13-17 have been checked at the originating laboratory.
13. Were all preserved sample(s) at the correct pH upon receipt? — Yes No NA pH Strip Lot# HC312502
14. Were VOAs on the COC? — Yes No
15. Were air bubbles >6 mm in any VOA vials? ● ← Larger than this. — Yes No NA
16. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # — Yes No
17. Was a LL Hg or Me Hg trip blank present? — Yes No

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM Date by via Verbal Voice Mail Other

Concerning

18. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES ☐ additional next page Samples processed by:

There was no Nitric preserved bottle for metals. An aliquot was split off and preserved from a 1L Amber unpreserved bottle. 8-2-23

19. SAMPLE CONDITION

Sample(s) were received after the recommended holding time had expired.

Sample(s) were received in a broken container.

Sample(s) were received with bubble >6 mm in diameter. (Notify PM)

20. SAMPLE PRESERVATION

Sample(s) were further preserved in the laboratory.

Time preserved: Preservative(s) added/Lot number(s):

VOA Sample Preservation - Date/Time VOAs Frozen:

WI-NC-099

Login Container Summary Report

Temperature readings: ____________________

Client Sample ID	Lab ID	Container Type	Container pH	Temp	Preservative Added (mls)	Lot #
WC-H24-WATER	240-189394-O-1	Plastic 250ml - with Nitric Acid	<2	____	________	__________

Chain of Custody Record

1.8/2.2

eurofins Environment Testing America

Rev 1
rbr 8/3/2023

Client Information	Sampler: Steven Rhodes	Lab PM: Mike DelMonico	Carrier Tracking No(s):	COC No: --------
Client Contact: Jason Artrip	Phone: 5857394536	E-Mail: Michael.DelMonico@et.eurofinsus.com	State of Origin: Ohio	Page: 1 of 1
Company: ARCADIS				Job #:

Client	Project
Address: 111-D Sanders Lane	Due Date Requested: 8/2/2023
City: Bluefield	TAT Requested (days): RUSH
State, Zip: Virginia 24605	Compliance Project: X Yes Δ No
Phone: 304-395-9424	PO #: G/L: 58682000 CC: 66716
Email: jason.artrip@arcadis.com	WO #: WBS: SP-88984
Project Name: East Palestine, Ohio	Project #: 30169714
Site: East Palestine, Ohio	

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Total VOCs - 8260	Total SVOCs – 8270	Total Metals	TSS	TOC	pH	DRO	Flash Point	Trip Blannk - Total VOC	Total Number of containers	Special Instructions/Note:
			Preservation Code:				A,S,I	I	I	I	I	I	I	I	A,I		
WC-H24-Water	8/1/23	1105	G	W	N	N	X	X	X	X	X	X	X	X		14	No Sheen or Product for Falsh Point
Trip Blank	8/1/23	------	G	W	N	N									X	3	Include Butyl Acrylate to the VOC analysis.

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)
Other:

240-189394 Chain of Custody

Possible Hazard Identification
Non-Hazard *Flammable* *Skin Irritant* *Poison B* X *Unknown* *Radiological*

Deliverable Requested: I, II, III, IV, Other (specify) Level 2

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Return To Client SL 8/1/23 X *Disposal By Lab* X *Archive For* ________ *Months*

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date: ----------------------	Time: ---------------------------	Method of Shipment: ------------------------------

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Steven Rhodes	8/1/23 / 1650	Arcadis	[illegible]	8-1-23 16:50	Waypoint
			[illegible]	8-1-23 1917	EETNK

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Attachment 5

Supporting Modeling and Calculations

Not modeled: Ethanol, 2-Ethylhexyl acrylate, n-Butyl acrylate, Methylcyclohexane, cyclohexane, Cumene.

Diesel Range Organics (C10)-(C28) modeled as Napthalene

ShallowTray®
low profile air strippers

HIGH FLOW

System Performance Estimate

Client and Proposal Information:

Series chosen:	2600	2600
Water Flow Rate:	100.0 GPM US	22.7 m3/hr
Air Flow Rate:	600 CFM	1019 m3/hr
Water Temp:	50 °F	10.0 °C
Air Temp:	60 °F	15.6 °C
A/W Ratio:	45 :1	45 :1
Safety Factor:	5%	5%
Water Discharge Temp.	50.1 °F	10.1 °C

INDUCED DRAF

Contaminant	Untreated Influent / Effluent Target		Model 2611 Effluent Lbs/hr	ppmv	Model 2621 Effluent Lbs/hr	ppmv	Model 2631 Effluent Lbs/hr	ppmv	Model 2641 Effluent Lbs/hr	ppmv	Model 2651 Effluent Lbs/hr	ppmv	Model 2661 Effluent Lbs/hr	ppmv
			%removal		%removal		%removal		%removal		%removal		%removal	
Acetone	21.1	ppb	21 ppb		21 ppb		21 ppb		21 ppb		21 ppb		21 ppb	
Solubility 50,000 ppm		ppb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mwt 58.08 67-64-1			0.00%		0.00%		0.00%		0.00%		0.00%		0.00%	
Due to its miscibility with water, acetone removal is difficult to predict. Call your representative for more information														
Vinyl Chloride	12	ppb	2 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 2,700 ppm		ppb	0.00	0.09	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10
Mwt 62.5 75-01-4			84.95%		97.73%		99.66%		99.95%		99.99%		100.00%	
Styrene	10	ppb	4 ppb		2 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 300 ppm		ppb	0.00	0.03	0.00	0.04	0.00	0.05	0.00	0.05	0.00	0.05	0.00	0.05
Mwt 104.14 100-42-5			58.15%		82.48%		92.67%		96.93%		98.72%		99.46%	
Toluene	2.2	ppb	<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 515 ppm		ppb	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Mwt 92.13 108-88-3			66.65%		88.88%		96.29%		98.76%		99.59%		99.86%	
Benzene	1.9	ppb	<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 1,780 ppm		ppb	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Mwt 78.12 71-43-2			68.79%		90.26%		96.96%		99.05%		99.70%		99.91%	
Xylenes	6.9	ppb	2 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 175 ppm		ppb	0.00	0.02	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03
Mwt 106 1330-20-7			69.25%		90.55%		97.09%		99.11%		99.73%		99.92%	
MEK	2.5	ppb	3 ppb		3 ppb		3 ppb		3 ppb		3 ppb		3 ppb	
Solubility 353,000 ppm		ppb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mwt 72.1 78-93-3			0.00%		0.00%		0.00%		0.00%		0.00%		0.00%	
Due to its high solubility, MEK removal is difficult to predict. Call your representative for more information														
Tetrachloroethylene	2.9	ppb	<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 150 ppm		ppb	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Mwt 165.83 127-18-4			70.47%		91.28%		97.43%		99.24%		99.78%		99.93%	
Ethyl Benzene	2.4	ppb	<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb		<1 ppb	
Solubility 152 ppm		ppb	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Mwt 106.16 100-41-4			70.49%		91.29%		97.43%		99.24%		99.78%		99.93%	
Naphthalene	4200	ppb	4200 ppb		4200 ppb		4200 ppb		4200 ppb		4200 ppb		4200 ppb	
Solubility 30 ppm		ppb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mwt 128.16 91-20-3			0.00%		0.00%		0.00%		0.00%		0.00%		0.00%	
Total ppb	4262	ppb	4235 ppb		4227 ppb		4225 ppb		4224 ppb		4224 ppb		4224 ppb	
Total VOC Lbs/hr - ppmv			0.00	0.17	0.00	0.21	0.00	0.23	0.00	0.23	0.00	0.23	0.00	0.23
Total			0.64%		0.81%		0.87%		0.89%		0.89%		0.90%	

Report Generated: 4/20/2023

Modeler VIMP June 2019

tetraSOLV FILTRATION

Tetrasolv Filtration Inc
Vapor Phase Adsorption Model

System Conditions	
System Temperature (oF)	90.000
Flow Rate (acfm)	600.000
System Pressure (mmHg)	760.000
System Operation (hrs/day)	24.000

Rev 13
45036.447

Project

Component	Inlet Concentration ppm	Inlet Concentration lb/day	Activated carbon 55 CTC Capacity % (w/w)	Usage lb/day	
ACETALDEHYDE	0.000	0.000	0.000	0.000	
ACETONE	0.230	0.029	0.464	6.196	
ACETIC ACID	0.000	0.000	0.000	0.000	
ACRYLONITRILE	0.000	0.000	0.000	0.000	
ALLYLCHLORIDE	0.000	0.000	0.000	0.000	
ANILINE	0.000	0.000	0.000	0.000	
BENZENE	0.015	0.003	2.900	0.087	
BUTANE-n	0.000	0.000	0.000	0.000	
BUTANOL-n	0.000	0.000	0.000	0.000	
BUTOXY ETHANOL-2	0.000	0.000	0.000	0.000	
BUTYL ACETATE-n	0.000	0.000	0.000	0.000	
BTEX	15.680	5.592	53.444	10.463	*
CARBON TETRACHLORIDE	0.000	0.000	0.000	0.000	
CHLOROBENZENE	0.000	0.000	0.000	0.000	
CHLOROFORM	0.000	0.000	0.000	0.000	
CUMENE	0.009	0.002	16.244	0.014	
CYCLOHEXANE	0.050	0.009	4.621	0.196	*
DICHLOROBENZENE	0.000	0.000	0.000	0.000	
DICHLOROETHANE-1,2	0.000	0.000	0.000	0.000	
DICHLOROETHYLENE-1,1	0.000	0.000	0.000	0.000	
DICHLOROMETHANE	0.000	0.000	0.000	0.000	
DIETHYLENE GLYCOL MONOBUTYL ETHER	0.000	0.000	0.000	0.000	
DIETHYL ANILINE	0.000	0.000	0.000	0.000	
DIMETHYLPENTANE-2,2	0.000	0.000	0.000	0.000	
ETHANOL	57.890	5.735	7.208	79.572	
ETHYL ACETATE	0.000	0.000	0.000	0.000	
ETHYLBENZENE	0.014	0.003	12.491	0.026	
ETHYL CHLORIDE	0.000	0.000	0.000	0.000	
ETHYLENE GLYCOL MONOPROPYL ETHER	0.000	0.000	0.000	0.000	
HEPTANE-n	0.000	0.000	0.000	0.000	
HEXANE-n	0.000	0.000	0.000	0.000	
ISOPRENE	0.000	0.000	0.000	0.000	

ISOPROPANOL	0.000	0.000	0.000	0.000	
ISOPROPYL ACETATE	0.000	0.000	0.000	0.000	
ISOPENTYL ACETATE	7.080	1.982	34.954	5.671	*
METHANOL	0.000	0.000	0.000	0.000	
METHYL-2-PYROLIDONE	0.000	0.000	0.000	0.000	
METHYL ACRYLATE	0.000	0.000	0.000	0.000	
METHYL CHLORIDE	0.000	0.000	0.000	0.000	
METHYL ETHYL KETONE	0.018	0.003	0.883	0.316	
METHYL ISOBUTYL KETONE	0.000	0.000	0.000	0.000	
METHYL METHACRYLATE	0.000	0.000	0.000	0.000	
METHYL TERT BUTYL ETHER	0.000	0.000	0.000	0.000	
METHYLENE CHLORIDE	0.000	0.000	0.000	0.000	
NAPTHALENE	0.000	0.000	0.000	0.000	
PENTANE-n	0.000	0.000	0.000	0.000	
PHENOL	0.000	0.000	0.000	0.000	
PROPANE	0.000	0.000	0.000	0.000	
PROPANOL	0.000	0.000	0.000	0.000	
PROPYLENE GLYCOL-1,2	0.780	0.128	30.427	0.420	*
STYRENE	0.064	0.014	19.034	0.075	
TPH-GRP	0.000	0.000	0.000	0.000	
TETRACHLOROETHYLENE	0.010	0.004	12.778	0.028	
TETRACHLOROETHANE	0.000	0.000	0.000	0.000	
TETRAHYDROFURAN	0.000	0.000	0.000	0.000	
TOLUENE	0.015	0.003	7.222	0.041	
TRI-O-CRESYL PHOSPHATE	0.000	0.000	0.000	0.000	
TRICHLOROETHANE-1,1,1	0.000	0.000	0.000	0.000	
TRICHLOROETHYLENE (TCE)	0.000	0.000	0.000	0.000	
TRICHLOROTRIFLUOROETHANE-1,1,2	0.000	0.000	0.000	0.000	
TRIMETHYLAMINE	0.000	0.000	0.000	0.000	
VINYLCHLORIDE	0.124	0.017	0.042	39.800	
XYLENE	0.043	0.010	16.166	0.061	*
Total Usage	82.022	13.533		142.966	
Average Adsorption Capacity (% w/w)			0.095		

The Adsorption Capacity Is Estimated Using The Polanyi Adsorption Theory And Toluene

Note: estimated based on models, results not guaranteed.

* Compound	Surrogate used
2-Ethylhexyl acrylate	PROPYLENE GLYCOL-1,2
n-Butyl acrylate	ISOPENTYL ACETATE
Methylcyclohexane	CYCLOHEXANE. Added to cyclohexane
Diesel Range Organics (C10)-(C28)	BTEX
o-xylene	included in total xylenes

Note: Surrogate are used for compounds where isotherms were not available for carbon modeling. Surrogates were chosen based on similar chemical characteristics (i.e. chemical structure, MW, etc.).

HYDROSIL INTERNATIONAL LTD.

Hydrosil HS-600 Product Usage on Vapors

Contaminant	CAS	HAP	Input Concentration	HS-600 Usage
			lb/day	lb/day
2-Ethylhexyl acrylate	103-11-7		0.01	0
Acetone	67-64-1		0.001	0
Ethanol	64-17-5		0.29	0
n-Butyl acrylate	141-32-2		0.10	0
Vinyl chloride	75-01-4	HAP	0.02	1.2
Styrene	100-42-5	HAP	0.001	0
Toluene	108-88-3	HAP	0.0001	0
Benzene	71-43-2	HAP	0.0001	0
o-xylene	95-47-6	HAP	0.0002	0
xylenes, total	1330-20-7	HAP	0.0005	0
2-Butanone (MEK)	78-93-3		0.0002	0.009
Tetrachloroethene	127-18-4	HAP	0.0002	0.008
Ethylbenzene	100-41-4	HAP	0.0002	0
Cyclohexane	110-82-7		0.0001	0
Isopropylbenzene (cumene)	98-82-8	HAP	0.0001	0
Methylcyclohexane	108-87-2		0.0004	0
Diesel Range Organics (C10)-(C28)	n/a		0.29	0

Note: Influent vapor concentrations assume 0% of Vinyl Chloride mass in air stripper effluent is removed by carbon and 95% of remaining VOC mass is removed by carbon.

Total 1.2

Attachment 6

Wastewater Treatment System Equipment Specification Sheets

ShallowTray®
low profile air strippers

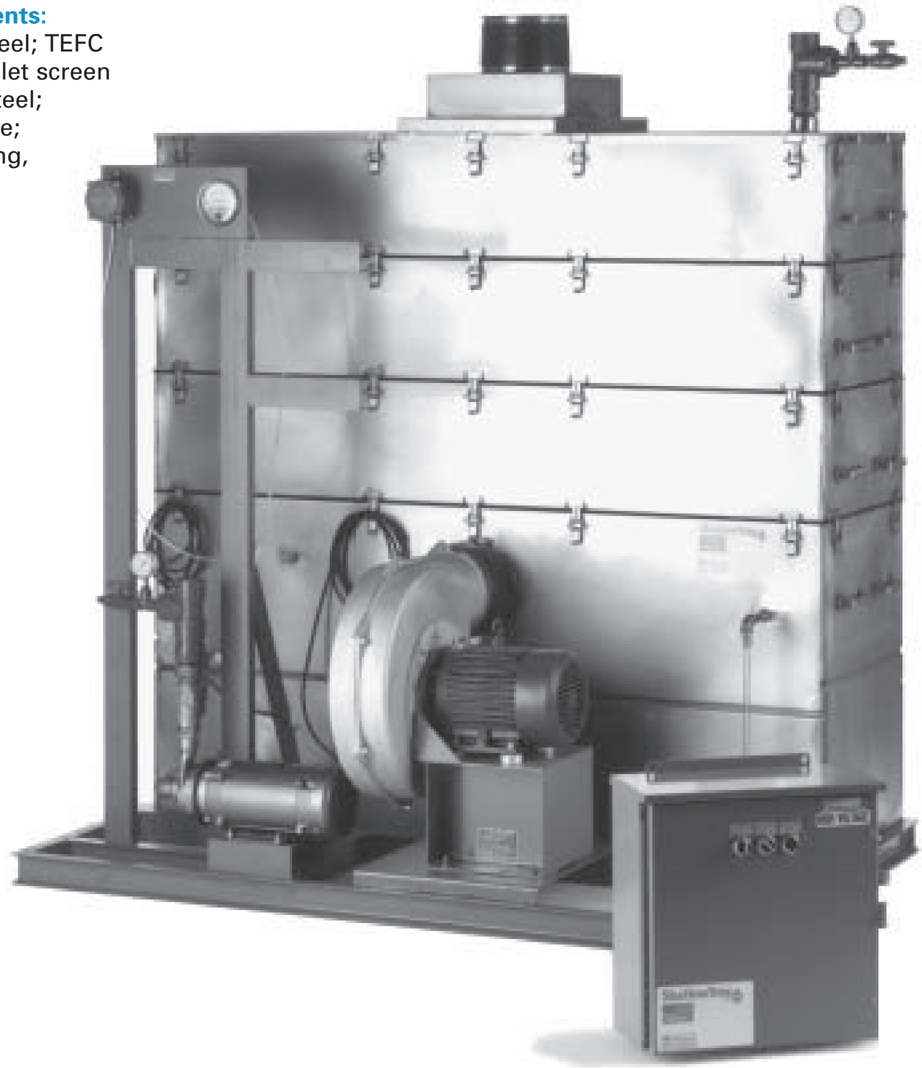
2600 Series

Model Pictured: 2631

Basic system includes the following components:
Sump tank, cover, and trays, 304L stainless steel; TEFC air blower sized to number of trays; Blower inlet screen and damper; Mist eliminator, 304L stainless steel; Water inlet spray nozzle; Water level sight tube; Gaskets; Latches, stainless steel; Internal piping, Schedule 80 PVC; Tray cleanout ports.

Options chosen for model pictured:

- ☑ Air pressure gauge
- ❑ Gravity discharge
- ☑ Steel frame
- ☑ EXP blower motors
- ☑ Discharge and/or feed pump, TEFC or EXP
- ❑ Blower start/stop panel only
- ❑ Main disconnect switch
- ❑ Standard NEMA 3R system control panel with alarm interlocks, motor starter, relays, alarm light, UL listed
- ☑ NEMA 3R control panel with level controls for pumps, alarm interlocks, motor starters, relays, alarm light, UL listed
- ❑ PurgePanel™: NEMA 4X enclosure, small blower, pressure switch, and a small explosion-proof enclosure (NEMA 7)
- ☑ Control panel IS components for remote mounted NEMA 3R panel, UL listed
- ❑ NEMA 7 and/or custom control panel
- ❑ Strobe alarm light
- ❑ Alarm horn
- ☑ Low air pressure alarm switch
- ☑ High water level alarm switch
- ☑ Discharge pump level switch
- ☑ Water pressure gauges
- ❑ Digital water flow indicator and totalizer
- ❑ Air flow meter
- ❑ Temperature gauges
- ☑ Line sampling ports
- ❑ Air blower silencer
- ❑ Auto dialer
- ❑ Automatic operation components for multiple wells
- ❑ Viewports
- ☑ Other custom requirements (Please call)
  Intermittent operation for the blower



The full range of options are available to meet your project's specifications.

Models	flow rate	# trays	width	length	height	cfm
2611	2-115gpm 0.5-26m^3/hr	1	4'2" 1.3m	6'2" 1.9m	4'5" 1.3m	600 1020m^3/hr
2621	2-115gpm 0.5-26m^3/hr	2	4'2" 1.3m	6'2" 1.9m	5'2" 1.6m	600 1020m^3/hr
2631	2-115gpm 0.5-26m^3/hr	3	4'2" 1.3m	6'2" 1.9m	5'11" 1.8m	600 1020m^3/hr
2641	2-115gpm 0.5-26m^3/hr	4	4'2" 1.3m	6'2" 1.9m	6'8" 2.1m	600 1020m^3/hr
2651	2-115gpm 0.5-26m^3/hr	5	4'2" 1.3m	6'2" 1.9m	7'5" 2.3m	600 1020m^3/hr

ShallowTray®
Low Profile Air Stripper

Installation, Operation,
&
Maintenance Manual

Serial Number:

____

108 Pond Street
Seekonk, MA 02771
Phone: (508) 399-5771 Fax: (508) 399-5352

Rev:March2015

Not modeled: Ethanol, 2-Ethylhexyl acrylate, n-Butyl acrylate, Methylcyclohexane, cyclohexane, Cumene.

Diesel Range Organics (C10)-(C28) modeled as Napthalene

ShallowTray® low profile air strippers

HIGH FLOW

System Performance Estimate

Client and Proposal Information:

Series chosen:	2600	2600
Water Flow Rate:	100.0 GPM US	22.7 m3/hr
Air Flow Rate:	600 CFM	1019 m3/hr
Water Temp:	50 °F	10.0 °C
Air Temp:	60 °F	15.6 °C
A/W Ratio:	45 :1	45 :1
Safety Factor:	5%	5%
Water Discharge Temp.	50.1 °F	10.1 °C

INDUCED DRAF

Contaminant	Untreated Influent / Effluent Target		Model 2611 Effluent Lbs/hr ppmv %removal	Model 2621 Effluent Lbs/hr ppmv %removal	Model 2631 Effluent Lbs/hr ppmv %removal	Model 2641 Effluent Lbs/hr ppmv %removal	Model 2651 Effluent Lbs/hr ppmv %removal	Model 2661 Effluent Lbs/hr ppmv %removal
Acetone	21.1	ppb	21 ppb	21 ppb	21 ppb	21 ppb	21 ppb	21 ppb
Solubility 50,000 ppm		ppb	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
Mwt 58.08 67-64-1			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Due to its miscibility with water, acetone removal is difficult to predict. Call your representative for more information								
Vinyl Chloride	12	ppb	2 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 2,700 ppm		ppb	0.00 0.09	0.00 0.10	0.00 0.10	0.00 0.10	0.00 0.10	0.00 0.10
Mwt 62.5 75-01-4			84.95%	97.73%	99.66%	99.95%	99.99%	100.00%
Styrene	10	ppb	4 ppb	2 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 300 ppm		ppb	0.00 0.03	0.00 0.04	0.00 0.05	0.00 0.05	0.00 0.05	0.00 0.05
Mwt 104.14 100-42-5			58.15%	82.48%	92.67%	96.93%	98.72%	99.46%
Toluene	2.2	ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 515 ppm		ppb	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01
Mwt 92.13 108-88-3			66.65%	88.88%	96.29%	98.76%	99.59%	99.86%
Benzene	1.9	ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 1,780 ppm		ppb	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01
Mwt 78.12 71-43-2			68.79%	90.26%	96.96%	99.05%	99.70%	99.91%
Xylenes	6.9	ppb	2 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 175 ppm		ppb	0.00 0.02	0.00 0.03	0.00 0.03	0.00 0.03	0.00 0.03	0.00 0.03
Mwt 106 1330-20-7			69.25%	90.55%	97.09%	99.11%	99.73%	99.92%
MEK	2.5	ppb	3 ppb	3 ppb	3 ppb	3 ppb	3 ppb	3 ppb
Solubility 353,000 ppm		ppb	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
Mwt 72.1 78-93-3			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Due to its high solubility, MEK removal is difficult to predict. Call your representative for more information								
Tetrachloroethylene	2.9	ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 150 ppm		ppb	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01
Mwt 165.83 127-18-4			70.47%	91.28%	97.43%	99.24%	99.78%	99.93%
Ethyl Benzene	2.4	ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb	<1 ppb
Solubility 152 ppm		ppb	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01	0.00 0.01
Mwt 106.16 100-41-4			70.49%	91.29%	97.43%	99.24%	99.78%	99.93%
Naphthalene	4200	ppb	4200 ppb	4200 ppb	4200 ppb	4200 ppb	4200 ppb	4200 ppb
Solubility 30 ppm		ppb	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
Mwt 128.16 91-20-3			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total ppb	4262 ppb		4235 ppb	4227 ppb	4225 ppb	4224 ppb	4224 ppb	4224 ppb
Total VOC Lbs/hr - ppmv			0.00 0.17	0.00 0.21	0.00 0.23	0.00 0.23	0.00 0.23	0.00 0.23
Total			0.64%	0.81%	0.87%	0.89%	0.89%	0.90%

Report Generated: 4/20/2023

Modeler VIMP June 2019

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Section 1: ShallowTray Process

1-1 THE SHALLOWTRAY TREATMENT PROCESS

The purpose of air stripping is to remove dissolved volatiles from liquids. Such dissolved volatiles include radon and carbon dioxide removed from potable well water, volatile organic compounds (VOCs) removed from contaminated groundwater plumes, and VOCs removed from industrial process and wastewater treatment streams.

The stripping mechanism of the proprietary ShallowTray low profile perforated plate air stripper is dependent on the flow of an influent liquid through a long, narrow channel on a discrete number of trays while subject to a countercurrent flow of ambient air at a fixed flowrate.

The intense formation and rupture of billions of bubbles in the confined narrow path of water flowing counter-current to multiple fresh air vents is a dynamic process that provides a mass transfer mechanism that displaces the dissolved volatiles from the aqueous stream into the vapor stream.

The ShallowTray low profile air stripper mechanism is a proprietary process protected under U.S. Patent # 5045,215 and 5,240,595.

1-2 THE SHALLOWTRAY BASIC SYSTEM

ShallowTray systems are fabricated from 304L stainless steel, 316L stainless steel, or rotationally molded polyethylene, and are provided with components to facilitate the requirements of the process, including the following:

Forced Draft Versus Induced Draft

Forced Draft (F.D.) System: The blower is installed so that the air is fed under positive pressure into the stripper sump below the stripper trays. This arrangement is used when the maximum total blower discharge pressure (air stripper plus other downstream pressure losses) does not exceed 26 inches (56cm) water column (w.c.) pressure for plastic strippers, or 32 inches (82cm) w.c. for stainless steel strippers.

Induced Draft (I.D.) System The blower is installed such that it pulls air into the stripper sump, up through the trays, and into the blower inlet, thus subjecting the stripper interior to a slight vacuum. Removal efficiency is not changed by this arrangement. The blower is therefore sized to provide the pressure drop required for the ShallowTray, plus the pressure drop required by downstream offgas treatment devices.

High Water Flow Versus Low Water Flow

Due to increased froth heights on the trays at higher flowrates, two water flow ranges are considered in the design of the basic system, **Low Flow** and **High Flow**. The high flow system requires a blower that produces an additional 4 inches (10.2 cm) w.c. pressure drop across the stripper as compared to the low flow system blower. The Low and High water flow ranges for each ShallowTray series are listed in the table below:

ShallowTray Series	Low Water Flow Range	High Water Flow Range
1300P	0.5 - 15 gpm	N/A
1300	0.5 - 15 gpm	16 - 22.5 gpm
2300P	1 – 30 gpm	31 - 50 gpm
2300	1 - 30 gpm	31 - 45 gpm
2400	1 - 32 gpm	33 - 65 gpm
2500	2 - 37 gpm	38 - 75 gpm
2600	2 - 60 gpm	61 - 115 gpm
3600	3 - 90 gpm	91 - 160 gpm
3800	4 - 100 gpm	126 - 250 gpm
31000	4 - 120 gpm	121-375 gpm
31200	4 - 150 gpm	151 - 425gpm
41200	6 - 200 gpm	201- 550 gpm
51200	10 – 275 gpm	278 - 800 gpm
61200	12 - 350 gpm	351 - 1000 gpm
71400	16 - 540 gpm	541 - 1300 gpm
81200	16 - 540 gpm	541 - 1300 gpm

1-3 Basic System Components

Components information sheets (“cut sheets”) from the manufacturer are included in the Components Information Section (Section 5) at the back of this manual

Blower

The blower supplied with the ShallowTray low profile air stripper unit is typically type B spark resistant with a cast aluminum wheel, direct driven @ 3450 rpm, with motor options of Totally Enclosed Fan Cooled (TEFC) or Explosion Proof (EXP), as determined by the power available and electrical code classification of the site.

Each blower is selected to provide air flow that exceeds the minimum standard cubic feet per minute (SCFM) air flow required at the required working pressure (inches of w.c.) of the system. It is important that the blower damper be set to provide the unit with the required fresh air flow.

It is also important that water not enter the blower housing while the blower is in operation; this will damage the blower and void the warranty. During normal operation, the high water level alarm switch prevents this from happening. Confirm that this switch is installed properly.

The installed motor horsepower is selected to provide an operating range with a significant safety margin. However, there is the potential for the blower motor to overload if it is not working against sufficient pressure drop. Therefore, the blower must be protected with a thermal overload switch.

The blower damper should be set so that the blower produces the minimum stripper air flow requirement (see table below), and at the same time the motor does not exceed its nameplate amperage maximum.

Air Flow Damper

The stripper blower is fitted with an adjustable damper, used to make air flow rate (SCFM) adjustments to the stripper. Open the damper to increase air flow rate, and close the damper to decrease air flow rate. Note that air pressure may vary as the air flow rate is changed. To get an accurate air flow measurement, install an air flow meter in the air duct.

If air flow meter installation is not possible, an estimated air flow can be obtained by measuring the stripper pressure drop. At initial start-up, adjust the damper until the air pressure is at the minimum required for the system. (Refer to the pressure gauge description for minimum pressure readings).

Be aware that when making damper adjustments after the system has been operating, fouling may occur in the system, which may reduce the air flow rate and may increase the air pressure reading.

The following table gives the minimum and maximum airflow rate for each ShallowTray series:

ShallowTray Series	Air Flow Minimum	Air Flow Maximum
1300 & 1300P	150 SCFM (255 m3/hr)	180 SCFM (305 m3/hr)
2300 & 2300P	300 SCFM (510 m3/hr)	360 SCFM (610 m3/hr)
2400	400 SCFM (680 m3/hr)	480 SCFM (816 m3/hr)
2500	500 SCFM (850 m3hr)	600 SCFM (1020 m3/hr)
2600	600 SCFM (1020 m3/hr)	720 SCFM (1220 m3/hr)
3600	900 SCFM (1530 m3/hr)	1080 SCFM (1830 m3/hr)
3800	1200 SCFM (2040 m3/hr)	1440 SCFM (2448 m3/hr)
31000	1500 SCFM (2550 m3/hr)	1800 SCFM (3060 m3/hr)
31200	1800 SCFM (3060 m3/hr)	2160 SCFM (3670 m3/hr)
41200	2400 SCFM (4080 m3hr)	2880 SCFM (4900 m3/hr)
51200	3000 SCFM (5100 m3/hr)	3600 SCFM (6120 m3/hr)
61200	3600 SCFM (6120 m3/hr)	4320 SCFM (7340 m3/hr)
71400	4800 SCFM (8160 m3/hr)	5760 SCFM (9797 m3/hr)
81200	4800 SCFM (8155 m3/hr)	5760 SCFM (9785 m3/hr)

Mist Eliminator

A wire mesh mist eliminator is installed beneath the air exhaust port, located on the top cover of the ShallowTray. The purpose of the mist eliminator is to remove water droplets that would have blown through the vent line. It is possible, though unlikely, that the mist eliminator may become plugged or fouled. If this occurs, the mist eliminator is easily removed for cleaning. Disconnect the vent line, take off the top cover, and remove the retaining plates on the bottom of the cover. The mist eliminator can be cleaned with a pressure washer, or replaced with a new one.

Gasket

A black nitrile (or neoprene on the 2300-P) sponge is used to form an airtight/watertight seal between the sump tank, cover, and stripper trays. A replacement gasket can be glued to the sealing flange using an industrial contact adhesive. Please contact Hydro Quip, Inc.. prior to making any gasket repairs or adjustments.

Sight Tube

The sight tube provides a means of visually monitoring the water level in the sump tank. Make sure the valve to the sight tube is open during stripper operation.

Inlet Dip Tube / Spray Nozzle

An inlet spray nozzle is only installed upon request. The dip tube directs the influent water to the top tray inlet chamber.

Note: System performance is based on ShallowTray operation without a nozzle, and the performance warranty is valid whether a nozzle is installed or not.

SHALLOWTRAY ACCESSORY OPTIONS

ShallowTray System Options

ShallowTray low profile air strippers are custom built to meet site and project specifications. Please refer to the components list insert (Section 5) to see which options were selected for this system. Component information cut sheets are included in (Section 5) of this manual.

Air Blower Silencer

An air blower silencer can reduce the noise level of the blower. The size of the silencer and the type of connection used to mount it are dictated by the size of the blower, and whether the silencer is mounted horizontally or vertically. Silencers should be supported to avoid over-stressing the connections, and should be secured if exposed to high wind loads.

Air Flow Meter

An air flow meter measures the amount of air flowing through the system. It consists of a pitot tube mounted in the air duct and connected via two (2) lengths of tubing to a differential pressure gauge. The measured velocity pressure can be converted to an airflow velocity. The pitot tube must be located at least 8 1/2 pipe diameters downstream of any pipe fitting or transition, and at least 1 1/2 diameters of straight pipe upstream of the end of the duct or any elbow. The best pitot tube location is before the stripper because the air is less humid and the gauge tubing is less likely to fill with condensate.

The air flow meter typically gives readings in inches of water column, (w.c.), which is converted to feet per minute (FPM) using the provided chart or the gauge scale calibrated for the specific duct inside diameter. As stated in the damper section, the air flow meter in conjunction with the pressure gauge provides the most accurate damper adjustments, especially after initial start-up.

The table below lists the minimum vapor exhaust duct diameters.

Stripper Series	Minimum Exhaust Duct Diameter
1300	6 “Ø (16 cm)
2300	6 “Ø (16 cm)
2400	8 “Ø (20 cm)
2500	8 “Ø (25 cm)
2600	8 “Ø (40cm)
3600	10 “Ø (45cm)
3800	12 “Ø (45cm)
31000	16 “Ø (45cm)
31200	16 “Ø (20 cm)
41200	18 “Ø (25 cm)
51200	18 “Ø (40cm)
61200	18 “Ø (45cm)
71400	18 “Ø (45cm)
81200	18 “Ø (45cm)

Note: Restricted airflow is the most common cause of poor removal efficiencies. An airflow meter is highly recommended to help ensure adequate air flow.

Air Pressure Gauge
The air pressure gauge reads the pressure differential across the stripper trays in inches of water column (w.c.). The gauge is connected to the system via tubing that attaches to a pressure port on the system. Instructions to connect the gauge for the types of systems are as follows:

Forced Draft System – Using tubing, connect the "High" pressure port on the gauge to the 1/8"Ø (3mm) shutoff valve/hose barb located on the air stripper sump. The "Low" pressure port on the gauge is left open to the atmosphere. The highest pressure drop is between the sump tank and the surrounding atmosphere.

Induced Draft System - Using tubing, connect the "Low" pressure port on the gauge to the hose barb located on the exhaust vent line on the air stripper. The "High" pressure port on the gauge is left open to the atmosphere. The highest pressure drop (vacuum) is between the cover exhaust and the surrounding atmosphere.

Note: there are two pairs of pressure ports on the gauge, one pair for side entry, the other pair for rear entry. One pair should be used to measure the differential pressure, and the other unused pair must be sealed with a plug.

At initial start-up, the pressure gauge can be used to measure blower damper adjustments. Adjustments should be made according to the following nominal differential air pressure table:

Nominal Differential Air Pressure

Number of trays	Low Water Flow Sys	High Water Flow System
1 tray system	4-6 in. w.c. (10-15 cm.)	7-10 in. w.c. (18-25 cm.)
2 tray system	7-10 in. w.c. (18-25 cm.)	11-14 in. w.c. (28-36 cm.)
3 tray system	11-14 in. w.c. (28-36 cm.)	16-18 in. w.c. (40-46 cm.)
4 tray system	16-18 in. w.c.(40-46 cm.)	20-22 in. w.c. (50-56 cm.)
5 tray system	20-22 in. w.c. (50-56 cm.)	24-26 in. w.c. (60-66 cm.)
6 tray system	24-26 in. w.c. (60-66 cm.)	28-30 in. w.c. (71-76 cm.)

Refer to high/low water flow range description in Section 1-3 above.

Note: The nominal differential pressures shown are for the air stripper pressure drop only, and do not include additional air stream equipment pressure requirements.

After initial start-up, fouling may occur in the system, which may increase the nominal air pressure reading, and may decrease the airflow rate.

Control Panel

The control panel serves two basic functions for operation of the system. The first is to provide the necessary starting and circuit protection components for each motor load, consistent with NEC electrical code. These components include fuses, circuit breakers, motor starter contactors, overload relays, and lock-out/tag-out (LOTO) features.

The second function is to provide process control and alarm status/interlock components. Alarm circuit monitors several conditions, most basically the low air pressure alarm switch and the high water level alarm switch. If either of these alarms occurs, the alarm interlock will provide shut off signal to the incoming water source (feed or well pumps), if the appropriate interconnects have been made. Other alarm options are also available.

Control Panel: Intrinsically-Safe (I.S.) Components

ShallowTray low profile air stripper systems that operate in or near potentially explosive concentrations of vapors will require special hardware to meet code requirements for power wiring and for instrument and switch connections. In such cases, intrinsically safe (I.S.) isolation of signals to and from switches and instruments is employed to limit the energy to a level lower than the energy required to generate a spark. Typical components that need I.S. protected signals are float switches and well probes. Determination of when I.S. signals are required is the responsibility of the design engineer with knowledge of the site-specific code requirements.

Digital Water Flow Indicator/Totalizer

Water flow meters with totalization are often supplied as part of the ShallowTray air stripper. Available in several designs and sizes, flowmeters are typically installed in the water feed piping to the stripper, and usually provide a local readout of flowrate (gpm) and the totalized flow (gallons). Refer to the components list insert Section 5 to see which flowmeter was provided with this system. Component information cut sheets are included in Section 5 of this manual.

Flowmeters are sensitive mechanisms that require proper care and maintenance for reliable service. It is prudent to install a strainer or bag filter upstream of the flowmeter to protect it from mechanical damage from debris in the pipeline. If the strainer and/or flowmeter become plugged, disassemble and clean in accordance with the manufacturer's instructions.

Feed and Discharge Pumps

If pump(s) are included by HYDRO QUIP, INC. as part of your system, they have been selected to meet the required flow and pressure requirements. The pumps are typically end suction, flooded inlet, direct coupled, centrifugal pumps, with either EXP or TEFC motors. The pumps are not self-priming. Prior to initial start-up, the pumps must be primed by filling the pump impeller housing with clean water. Throttling valves are typically installed on the effluent pump discharge**.** If the pump is running wide open and it is not pumping against the required head, the pump may cavitate. This is the nature of centrifugal pumps; they must be throttled back if they are not pumping against the required head. The valve should be throttled until the motor amperage is less than the nameplate motor amps rating.

Before system start-up, it is important to check for proper rotation of the impeller. A pump rotating in the wrong direction could cause the pump impeller to spin off, causing serious damage to the pump.

Systems using discharge pumps must have the flow rates balanced so that the discharge flow rate is greater than the inlet flow rate.

Refer to the components list insert (Section 5) to see which pump(s) were provided with this system. Component information cut sheets are included in (Section 5) of this manual.

High Water Level Alarm Float Switch

The high water level alarm float switch is one of the alarm sensors that must be connected prior to system start-up. The purpose of the high water level alarm float switch is to sense an excessively high level of water in the stripper sump, and provide a signal to communicate to the upstream water source to shut off the incoming water. The high water level float switch is a normally closed microswitch that opens when the float rises approximately 3 1/2 inches (9cm) above its coupling's centerline.

Component information cut sheets for the float switch are included in (Section 5) of this manual.

Line Sampling Ports

Line sampling port(s) (when included) are provided to take water samples of incoming contaminated water and outgoing clean water. The sampling ports are typically 1/2” (1cm) ball valves.

When taking a water sample, open the valve and let the water flow for at least 1 minute prior to bottling the sample. This purges the sample port of any stagnant water.

When purging the sample ports be sure to capture the water and properly dispose of it. When starting the unit for the first time double check that the valves on the sample ports are closed.

Low Air Pressure/Vacuum Alarm Switch

The low air pressure/Vacuum alarm switch monitors the blower for continuous water treatment. This switch is one of the alarm interlocks that must be properly connected by a licensed electrician prior to the system’s initial start-up. Please see Special Precautions at the beginning of Operating Instructions section for more information.

Should the blower fail, the low air pressure switch is wired to shutoff all incoming water. Using tubing, connect the switch to the hose barb on the tank (pressure system) or the hose barb in the cover exhaust duct (vacuum system).

Pressure system – The air hose is connected from the sump rank 1/8 " (3mm) hose barb (without valve) to the "high" pressure port on the switch using the provided hose barb. The "low" pressure port must be open to the atmosphere. The switch measures the differential pressure between the sump tank and the atmosphere.

Vacuum system – The air hose is connected from the exhaust piping 1/8" (3mm) hose barb to the "low" pressure port on the switch using the provided hose barb. The "high" pressure port must be open to the atmosphere. The switch measures the differential pressure between the top tray and the atmosphere.

Periodically inspect the air hose for water build-up, which will affect the switch's operation. The tubing must remain open at all times.

Test the switch at initial start-up by removing the air hose from the hose barb on the sump tank or exhaust pipe once the system is in full operation. This should set the system into an alarm condition and shut off the incoming contaminated water.

High Air Pressure/Vacuum Alarm Switch

The high air pressure/vacuum alarm switch prevents the system from exceeding its highest rated pressure/vacuum value. If the blower has the ability to produce pressure/vacuum higher than 32 inches (82cm) W.C, for stainless units or 26 inches (56cm) W.C. for plastic units then it should have a high pressure/vacuum alarm switch. Be sure to check that the setpoint for alarm shutdown is at the proper setting for the system.

Panel Disconnect Switch

The panel disconnects switch removes power from the ShallowTray low Profile air stripper control panel. Make sure a qualified licensed electrician installs the power supply into the disconnect switch. Be sure to ground the switch to the main service ground.

Water Temperature Gauge

Water temperature gauges can be installed on both the inlet and outlet piping. Influent water temperature is an important variable affecting the system's removal efficiency.

Water Pressure Gauge

Water pressure gauges can be installed on both the inlet and outlet water piping. Excessively high readings could signal that something in the piping system is plugged. Large pressure fluctuation could be a sign that the water flow rate is varying.

Section 2: Operating Instructions

2-1 Special Precautions:

It is important that a qualified licensed electrician perform these installations.

The following operations must be carried out prior to initial system start-up:

Step 1: Connect the Interlock switches.

High Water level Interlock
If the water level in the sump tank rises beyond the maximum level, it could flood the blower. This may damage the blower and void the warranty. The high water level interlock switch is used to shut off the feed water pump in an emergency situation.

Low Air Pressure/Vacuum Interlock
If the blower fails, untreated water could be discharged. The low air pressure/vacuum interlock switch will shut off the feed water pump to prevent additional water from entering the stripper.

High Air Pressure/ Vacuum Interlock
If the system has a blower capable of producing more than 32 inches (82cm) of water column (w.c.) for a stainless stripper or more than 26 inches (56cm) w.c. for a polyethylene stripper, then the system requires a high pressure/vacuum switch. If a unit fouls or pressure increases due to off-gas treatment, it may exceed the maximum pressure rating of the system and cause damage to the gaskets, sump, or trays.

Note: These interlock options might not have been provided as part HYDRO QUIP, INC.'s scope of supply.

Step 2: Fill the Sump Tank and each tray's inlet Chamber.

On initial start-up the sump tank must be filled with **clean water** to a height of about 5 inches (13cm). Make sure the valve to the sight tube is open. The sump tank can be filled via the clean-out ports on the end of the stainless units, or through the inlet water port located on the cover. The inlet chamber on each tray (referred to as seal pots) can be filled manually by pouring **clean water** through the 1 inch (3cm) inlet chamber filling ports, or the 4 inches (10cm) clean out ports located on the ends of the stainless units, or by disassembling the plastic units and filling the seal pots as you reassemble. The seal pots on both the plastic and stainless systems can also be filled at initial start-up by connecting a **clean water** line to the inlet water port and running the system for ten minutes with the blower on and the damper 1/4 open. For complete instructions on this method, please follow initial Start-up procedures later in this section.

Do Not Run Free-Product Through the ShallowTray Air Stripper.

Free product contaminates the unit by coating the side walls with a film of free-product. ShallowTray units are designed to remove dissolved VOC's only.

Fresh air is required for the system air intake. Air that is heavily contaminated with VOC's will significantly reduce the ShallowTray's performance.

2-2 EQUIPMENT SET-UP

Drawings: Drawings referred to in the following sections are located in Section 5.

Follow codes. The plumbing and electrical installations must be performed by qualified personnel, and must be done in accordance with local, state, and national codes.

Protect critical items from the environment. In areas that could be below freezing, the stripper should be installed in a heated building. Plastic units, control panels, and motors should be protected from direct sun. Explosion-proof motors should be protected from rain due to the absence of motor gaskets.

Install adequate supports. Since **none** of the external piping associated with the ShallowTray unit is designed to support process water lines or air piping, adequate supports must be installed.

Assemble Unit. All ShallowTray units are assembled and hydraulically tested at the factory. However, to safeguard the units from shipping damage, some components are removed prior to shipping and will require reassembly. Follow all relevant steps in this section to set-up the ShallowTray system.

Check for loose fittings. Shipping the system to the site may have caused pipe joints or assembly hardware to loosen. Re-tighten as necessary.

Bolt unit together. For shipping purposes, the ShallowTray unit may come in two sections; the blower skid assembly and the sump and tray skid assembly. Bolt the base frames together using the bolts and spacers provided. (This step is done at the factory for the 1300 and 2300 series.)

Connect Blower. For forced draft (F.D., or positive pressure) systems, install the provided rubber coupling to connect the blower outlet to the air inlet on the sump tank. (See Section 5 coupling layout drawing for air inlet location.) For induced draft (I.D., or vacuum) systems, install an exhaust duct from the stripper air exhaust located on the top cover to the blower intake. Hydro Quip, Inc.. may not have provided this piping. Make sure the pipe diameter is large enough to maintain the required airflow without adding a pressure drop. Also, be sure the pipe has a suitable vacuum rating to prevent collapse.

Caution: Blower must draw air. Do not vent storage tanks that contain substances that will contaminate the air in the same room the blower draws air from. Do not duct intake air from an area that has contaminated air. Contaminated air will contaminate the water.

Assemble trays and level the ShallowTray unit. Large ShallowTrays may have the top tray and cover shipped separately. Install trays shipped separately by lining up the match-marked arrows and numbers on the trays and cover. To prevent damaging the gasket, do not drag the trays or cover across the gasket during assembly. Fasten all latches properly. The tray being installed must have the downcomers from each upper tray line up with the sealpots on the tray below. Check all the trays to make sure they are installed correctly, and not backwards. If the system is not set up properly, the water could bypass a tray allowing water to miss a large portion of the treatment path. Refer to the "basic subassembly" exploded view drawing in Section 5.

Level the ShallowTray. This is a critical step in the proper assembly of the equipment. If not level, the water depth on the trays will be uneven, causing the water to weep through the tray holes untreated.

For a gravity discharge unit (no discharge pump): Install the outlet pipe.
The plumbing components are typically shipped in a separate box. Refer to the Section 5 outlet piping drawings to assemble.

F.D. systems require a riser pipe (inverted U-trap) to compensate for the pressure generated by the blower. It is important that the riser pipe height be adjusted to create a 5 inch (13 cm) water depth in the sump tank during normal operating conditions. The provided anti-siphon valve must be installed in the high point of the riser pipe to prevent the sump from siphoning to below the 5inch depth. It is essential that the riser pipe be properly supported. Use proper pipe sealant and PVC cement for the riser pipe. We recommend running the system and adjusting the riser pipe before permanently bonding the fitting.

The purpose of having the 5 inch (13cm) water depth in the sump tank is twofold. First, it is to keep the downcomer (from the bottom tray) and the water discharge port (which elbows down internally) submerged. Both are set to a height of 2 inches (5cm) from the bottom of the sump. Keeping them submerged forms a water seal, which prevents air from escaping up the downcomer pipe or out the discharge trap.

Second, the 5 inch (13cm) depth is low enough to allow our high water level switch to reset. The switch, located in its typical position, has an approximate reset deadband of six inches, meaning the water level must drop 6 inches (15cm) below the alarm trip point before it resets. Consult HYDRO QUIP, INC. for additional options or questions about float switch location or normal operating water depth.

For a unit with a discharge pump: Install the outlet pipe.
For a pumped discharge unit: Refer to the Section 5 outlet piping drawing to assemble the water line from the sump tank to the pump suction, using components delivered in a separate box. Install downstream piping to the pump discharge port. A ball valve is typically provided and should be

used to adjust flow. Use proper pipe sealant or PVC cement as required. If a check valve is required, install on discharge side of pump. To reduce pressure losses, it is recommended that the connected pipe size remain at least as large as the pump discharge fitting.

Prime the pump.
Pour clean water in the pump's inlet port until it has filled the entire pump chamber. Remove the top air bleed plug on the pump housing to let air bleed out, then replace plug.

Install the inlet piping manifold.
Install the inlet piping manifold (typically shipped in a separate box). Follow the Section 5 inlet piping diagram for proper installation.

Caution: For systems other than 31200 , 41200, 61200 and 81200, there are two inlet port couplings on the cover; one is over the discharge side of the tray and cannot be used, so it is plugged. The other coupling is the active inlet, and has the dip tube inside the top cover. The 31200 , 41200, 61200 and 81200 series have three, four, six and 8 ports respectively, and all are used. The feed must enter the inlet located above the sealpot of the top tray. Otherwise contaminated water will bypass the treatment path of the first tray and fall directly into the downcomer to the next tray. This will result in poor removal efficiency.

Install the sump drain valve and the sight tube.
Install the sump drain valve and the sight tube. Refer to the Section 5 coupling layout drawing for port locations. Be sure to open the valve to the sight tube during start-up and operation. The valve should be closed only to replace a damaged sight tube.

Connect the water lines.
If the seal pots have not yet been filled with clean water, connect a clean water line to the inlet port or piping manifold and fill the seal pots according to the steps outlined in the initial start-up section above. If the seal pots are filled with clean water, connect the process water line to the inlet piping manifold. Connect the discharge water line. Firmly support the process water lines to prevent stress on the piping and ports. The system is not designed to support the weight of the process water lines.

Connect the air pressure tubing.
Connect the tubing from the ShallowTray to the low air pressure/vacuum switch (if provided), and/or the high air pressure/vacuum gauge (if provided). Read the component description on each for detailed connection information, and also refer to the Section 5 drawings. For the air pressure gauge, be sure to install the tubing to the 1/8" (3mm) shutoff valve. Open the valve only when a reading is required. This will reduce condensation build-up in the gauge. The air pressure switch tubing should always be open for continuous sensing. The switch is designed to drain excess condensation.

Connect the air discharge line.
Connect an air exhaust duct to the air outlet, either on the top of the unit for F.D. installations, or at the blower discharge for I.D. installations. Do not use an exhaust duct with a smaller diameter that the discharge port. A smaller diameter may cause a pressure drop larger than the blower was

designed for, resulting in low air flow and poor removal efficiency. Support the vent line independently of the air stripper so that it can be easily disconnected for maintenance purposes.

Wire the electrical components.
Have a qualified licensed electrician wire the electrical components in compliance with local, state, and national codes. Make sure the safety interlocks, described in the Special Precautions section, are connected properly. If Hydro Quip supplied the control panel, see Section 5 wiring diagrams.

Install optional items:

Air flow meter
Mount the pitot tube on the vent line per Dwyer bulletin # H-11 (located in the separate shipping box) or per the Section 5 "air flow meter assembly" drawings using the mounting hardware provided. Connect pitot tube to the 0-0.5 or 0-1.0 inches w.c.. air pressure gauge using the tubing provided. (See pitot tube mounting diagram in Section 5.) There are two air hoses required, one connects to the high pressure port on the gauge and on the pitot tube, and measures internal static pressure plus velocity pressure. The other connects to the low pressure ports on the gauge and on the pitot tube, and measures the internal static pressure only. The optimum pitot tube location is before the stripper, because the air is less humid and the tubing will be less prone to filling with condensation.

Blower Silencer:
Forced Draft system – Install the silencer on the inlet side of the blower. If the silencer is to be in the vertical position, install the piping and elbow as shown on the Section 5 silencer diagram. If the silencer is in the horizontal position, attach it directly to the blower inlet using a rubber coupling.

Induced Draft system – Install the silencer on the blower. The standard silencer's maximum pressure/vacuum rating is 20 inches (50cm) w.c. Be sure not to exceed the silencer's limit

Water flow meter

Install the water flow meter into the inlet piping per the Section 5 water inlet piping diagrams. The flow meter owner's manual was sent with the unit. Be sure to refer to it when installing the meter. It is prudent to install a strainer in the incoming process water line prior to the water flow meter. This will prevent rotor jamming.

Note: There may be other optional equipment that requires installation or assembly. Please refer to the Section 5 specification sheet and drawings for more information.

2-3 INITIAL SYSTEM START UP

Upon completion of the equipment set-up and mechanical/electrical installation, proceed with the following steps:

Step 1: Check all connections and close drain and sample valves.
Double check that all electrical, water, and vent connections are properly made. Close drain port and sample valves. Be sure that the sight valve is open.

Step 2: Power up.
Turn all panel control switches to the 'OFF' position, then turn 'ON' the panel disconnect switch. Systems with intermittent operation feature will show an alarm condition (low air pressure) five seconds after power is applied because the blower is not operating. Once the blower is supplying proper pressure, the alarm low air pressure condition will reset. Some systems may require pushing an 'Alarm Reset' button.

Step 3: Check the blower rotation.
Check the blower rotation by momentarily switching 'ON' (bumping) the blower switch and observing whether the blades turn in the direction of the arrow on the blower casing. You can also observe the motor's cooling fan blades for proper rotation. If system panel has the intermittent operation feature, the blower motor must be bumped in the 'Hand" position. Refer to the Routine Operation Section for a description of "intermittent operation". If blower rotates in the wrong direction, turn the main disconnect off and have a electrician make wiring changes to correct the rotation.

Step 4: Attach clean water line to the inlet.
If you did not fill the seal pots on each tray manually, fill them now by attaching a (clean) water line to the water inlet piping manifold or port, and then follow Step 5. If you have already filled the seal pots manually, skip Step 5 and go to Step 6.

Step 5: Fill the seal pots (inlet chamber) with clean water.
Use clean water when filling the seal pots. If contaminated water is used it will go through the system untreated.

To fill the seal pots (inlet chambers), set the blower damper to 1/4 open, and start the blower and the clean water flow to the unit. Let the blower and clean water run for about five to ten minutes, then shut them off. Setting the damper at 1/4 open reduces the air flow enough to allow the water to flow through the downcomers and into the seal pots.

If the system has the intermittent operation feature, the blower must be started in the 'Hand" position for this procedure. If you have trouble filling the seal pots by this method you can fill them manually, either by using the one inch sealpot filling ports (stainless units only), or by spraying a stream of clean water through the clean-out ports (stainless units only). The stream of water must be directed into the sealpots on the opposite side of the unit, until the sealpot is full. For plastic units you must remove the trays and fill the sealpots manually.

Step 6: Connect contaminated feed water line.
Connect contaminated feed line. Install all piping allowing provision for future removal for maintenance or repair. Make sure piping is supported independently of the ShallowTray. Start system with the blower damper 1/2 open. For systems with intermittent operation, you must turn 'OFF' the power at the panel disconnect, turn all control switches to the auto position, and then reapply panel disconnect power. All motors will start automatically based on control function. Each control panel is custom designed for each site. Become familiar with the panel logic and proper operation before attempting to start the system. The panel might have been provided by a panel manufacturer other then HYDRO QUIP, INC..

Step 7: Check the air pressure reading and set damper.
Run the unit for 5 minutes, and then adjust the blower damper setting to produce the required air pressure/vacuum reading on the pressure gauge. Since the blowers provided by HYDRO QUIP, INC. are selected and tested to exceed the minimum flow requirements of the system, you can use the table in Section 1-3 to set the damper during initial start-up.

Double check pressure reading after system has been running for about 1/2 hour. Adjust damper again if needed. Also check the airflow meter for proper airflow rate. Pressure readings may vary somewhat depending on your venting system.

The System is ready for operation.
It is not necessary to perform initial start-up procedures each time the system is shut down. However, note that anytime water is completely removed from the seal pots or sump tank, the initial start-up procedure must be done again. For example, after the system has been taken apart for cleaning, or after an extended shutdown where the water have may evaporated from the tank or seal pots.

2-4 Routine Operation

From the tables in Section 1-3 adjust the airflow to within the required operating range in SCFM. The airflow must be a least the minimum shown for proper stripping efficiency.

Adjust water flow rate by setting the water throttle valves. Now that the system has been primed per the initial start-up procedures, it is ready for fine tuning. Adjust throttle valves on inlet and outlet piping to obtain the desired water flow rates and minimum pump cycles, if applicable. Refer to the Section 5 specification sheet for your systems design and maximum water flow rates. To prevent a high water level alarm, it is critical that the discharge pump flow rate exceed the influent water flow rate.

Pumps provided by HYDRO QUIP, INC. have throttle valves on the discharge side of the pump. Once the desired water flow rate is achieved, check the amp draw of the motor. It must not exceed the pump nameplate amp draw.

High water level alarm switch: The switch is typically installed in the middle of three half inch switch ports located on the front of the unit (refer to the Section 5 coupling layout drawings). If the float is moved to the highest port and the discharge line plugs or the discharge pump fails, the water level could rise above the air inlet port, allowing water to drain into the F.D. blower housing or onto the floor. The blower may become damaged if it is running while water is in the blower housing. Be sure to check that the 1/8”Ø (3mm) coupling in the bottom of the blower housing is open to allow for drainage of water that may get into the housing.

Section 3: Cleaning Procedures

Minerals dissolved in high concentrations tend to precipitate out of groundwater during air stripping processes. These minerals form insoluble deposits commonly referred to as ‘fouling.’ Although the ShallowTray low profile air stripper system is designed to be fouling resistant, proper steps must be taken when treating water with high mineral concentrations. Deposits from iron-rich feed water can be reduced by pretreating the feed stream with sequestering agents. The recommended cleaning procedure for deposits is pressure washing with detailed instructions as follows:

Equipment Required:

Pressure Washer: 2 gpm minimum flow at 900 psig (minimum). Equipment rental companies can usually supply electric or gasoline driven units on a daily rental basis.

Washer Wand: Washer wand with spray nozzle, (obtainable from HYDRO QUIP, INC. as an option) and an adapter to connect the wand to the pressure washer hose end. All washer connections are 1/4” (6mm) NPT.

Clean Water Supply: Clean water supply with a capacity of at least 2 gpm at 20 psig. Connect to the pressure washer using an ordinary garden hose.

System Shut Down:
Shut feed water off.
Shut off the water feed to the system.
Wait 5 minutes to allow the water in the stripper trays to be completely treated, then shut off the blower. Treated water in the trays will drain into the sump tank, so it is important to keep the outlet pump in “auto” to remove this extra water.
Shut off the power at the main disconnect switch if the shutdown is more than temporary.

Caution: If proper shut down procedures are not followed, contaminated water will drain into the sump tank. This will contaminate the water that has been collected in the tank. Therefore, always allow the blower to run an additional 5 minutes after the feed water is shut-off.

Cleaning the Unit:

Step 1: Turn off equipment.
Turn off the feed water to the stripper.

Step 2: Provide for Waste Disposal.
Make provisions for disposing of the sludge and waste generated during cleaning. A wet/dry vacuum may be required, or possibly the outlet pump (if provided) can pump out to a storage tank. Be aware that large pieces of debris might possibly clog the outlet pump or check valve.

Step 3: Remove cleanout port covers.
Remove all cleanout port covers.

Step 4: Turn on water and pressure washer.
Turn on the water supply to the pressure washer. Then, turn on the pressure washer. Wear protective goggles or face shield while spraying.

Step 5: Insert wand and start pressure washer water flow.
Insert the wand all the way through the 8” (20cm) cleanout port on the sump tank. Have the spray nozzle pointed up toward the bottom of the bottom tray. Holding the wand tightly, pull the trigger to start the pressurized water flow. Expect the wand to kick back as flow starts.

Step 6: Move wand side to side.
Move the wand side to side at a rate of about 1 inch (3cm) per second. Be sure to cover the entire tray bottom area. Recommended cleaning times for one side of one tray are given below:

Model 1300	2 min
Model 2300	4 min
Model 2400	5 min
Model 2500	6 min
Model 2600	8 min
Model 3600	12 min
Model 3800	16 min
Model 31000	18 min
Model 31200	23 min
Model 41200	32 min
Model 51200	40 min
Model 61200	48 min
Model 71400	60 min
Model 81200	64 min

Step 7: Inspect cleaned area.
Periodically stop the cleaning operation and inspect the cleaned area by shining a light into the unit. The area is clean when there are no deposits in or around the stripper tray holes.

Step 8: Clean top side of tray.
When the bottom surface appears clean, move the wand to the top side of the same tray by inserting it in the next highest cleanout port. Continue spraying with the nozzle pointed down onto the top surface of the tray. Remove all visible deposits from the tray baffles and the walls of the unit.

Step 9: Repeat for all trays.
Repeat the procedure for the bottom of the next higher tray, etc., working up to the top tray.

Step 10: Rinse.
After the cleaning operation is finished, rinse the trays, baffles, and walls with the pressure sprayer. Work down from the top tray to the sump tank. Make sure the surfaces are clean and the holes are not blocked by loosened debris.

Step 11: Clean cover.
Remove the top cover. Flip it over, and wash the bottom side. Inspect spray nozzle and the wire mesh mist eliminator pad for fouling. Clean the spray nozzle and the mist eliminator pad.

Step 12: Replace the mist eliminator pad.
Mist eliminator pads that are excessively plugged should be replaced. The old pad is removed by loosening the retainer plates on the corners of the pad. Reinstall the new pad in the same orientation as the old one.

Section 4: Trouble Shooting

Note: A competent electrician should perform any work inside the electrical control panel. Do not perform troubleshooting if you are not familiar with the procedures or the equipment.

Problem — Blower Won't Start Or Run

No power to blower

Check that all switches are in "ON" or "AUTO" position.
Position main disconnect switch to "ON" position. Turn control switches to" on" or "AUTO".

Blown Fuse

Check to see if fuses are ok.
Check fuses in main disconnect switch and in control panel. If blown, replace with fuse of the same size and rating to avoid the risk of fire or electrical shock.

Overload relay Trips

Locate reset button on blower overload relay.
Push reset button in. Reasons for tripping; incorrect line voltage, motor wired incorrectly, inadequate ventilation, worn bearings.

Tubing to air pressure switch plugged

Remove tubing from air pressure switch and blow into it towards tank. Clean or replace tubing if plugged or kinked.

Blower dose not rotate freely.

TURN OFF ALL POWER to the system. Try to spin wheel by hand. Wheel should rotate freely. If not, call HYDRO QUIP, INC..

Problem — Outlet Pump Won't Shut Off

Suction or Discharge piping to pump is clogged.

Check water flow from discharge pipe. Piping should be clean inside. Look for narrowing caused by scale or iron accumulation. Remove piping. Inspect, clean, or replace as necessary.

Float switch in tank is stuck in down position.

Remove 8"Ø or 12"Ø (30cm) inspection cap and check that all floats are floating on the water. Clean all deposits from float. Replace float if necessary.

Normal Operation: Water level in sump is OK. Pump will stop when water level reaches predetermined height in tank. Allow water level to decrease until pump turns off. Let water level reach predetermined lower level, which will cause outlet pump to turn off. Water level may be just below the bottom of clear sight tube before pump shuts off – this is normal.

Problem — Outlet Pump Won't Run Or Pump Water

No power to Pump

Check that all switches are in "ON' or "AUTO" position.
Position panel disconnect switch to "ON position. Turn control switches to "ON" or "AUTO."

Blown fuse

Check to see if fuses are ok.
Check fuses in main disconnect Switch and in control panel. If blown, replace with fuse of the sane size and rating to avoid the risk of fire or electrical shock.

Overload relay trips

Locate reset button on pump overload relay.
Push reset button in. Reasons for tripping; incorrect line voltage, motor wired incorrectly, inadequate ventilation, worn bearings.

Normal operation: Water level in sump is OK. Pump will start when water level reaches predetermined height in tank. Allow water level to increase until pump turns on. Be sure pump switch is in "AUTO" position. Let water level reach predetermined upper level, which will cause outlet pump to turn on.

Level switch in tank is wired incorrectly in control panel

Check wiring circuit against diagram. See that all connections are tight and no short circuits exist because of worn insulation, crossed wires, etc. Rewire any incorrect circuits. Tighten connections, replace defective wires.

Pump does not rotate freely

TURN OFF ALL POWER TO THE SYSTEM. Try to turn impeller by hand.If impeller won't turn, remove housing and locate source of binding. It could be due to impeller, seal, or bearing damage, or excessive fouling.

Impeller or check valve is fouled.

TURN OFF POWER**.** Remove pump outer housing and inspect impeller for blocked openings. Be sure to have a new housing gasket kit available before removing housing. Remove check valve from line and inspect for stuck or fouled valve. Clean or replace impeller or check valve as necessary.

Problem Low Air Pressure/Vacuum in Stripper Tank.

Blower damper closed.

Visually check position of damper on inlet of blower. Open damper to get proper reading on pressure gauge. Firmly tighten damper set screw.

Motor rotation backwards

Watch rotation of blower wheel at slow speed. It must match direction of the rotation arrow on the blower housing. Have electrician reconnect wiring for proper rotation as per motor diagram.

Gravity discharge trap installed incorrectly

Trap should be positioned vertically, as an "upside down U." Install discharge trap per outlet plumbing drawings located in Section 5.

Inlet chamber (sealpot) in each tray not full of water.

Remove 4"Ø (10cm) rubber caps, or slide tray aside and look at water level in chambers. Remove 4 inch (10cm) rubber caps on end of trays. Fill up inlet chambers with a hose, or follow the sealpot fill procedure as described in the initial Start Up section.

Rubber clean out caps not in place.

All cleanout ports must have a rubber cap installed. Tighten clamps on all rubber caps.

Tubing to pressure gauge

Remove tubing from pressure gauge and blow into it towards tank. Clean or replace tubing if plugged or kinked.

Gravity feed not flowing

Unit has gravity feed and inlet pipe on inside of ShallowTray cover is not submerged in inlet chamber water. Remove cover and measure length of piping hanging from inside of cover. Length is to be about 10 1/2 inches (27cm) from cover surface. Adjust length of inlet pipe on inside of cover until total length is about 10 1/2 inches (27cm). DO NOT INSTALL NOZZLE ON A GRAVITY FEED UNIT.

Blocked blower intake

Look at blower intake screen. Remove debris from screen.

Normal operation: When inlet pump starts, the blower will start and air pressure will increase to required operational level. No action necessary.

Problem High Pressure/Vacuum in Stripper

Air exhaust is restricted

Check vent piping for bird nest or other obstructions. Check that vent pipe diameter does not decrease. Intake or exhaust air pipe diameter must be at least as big as the cover vent or blower intake diameters.

Air holes in trays plugged

Remove inspection and cleanout caps and visually inspect holes. For iron fouling, clean out the unit with a pressure washer. For scaling, scrape or bang the scale from all surfaces, then use a pressure washer to open the 3/16 inch (5mm) diameter holes. Consider using a sequestering agent to prevent scaling.

Mist eliminator is plugged

Remove cover from ShallowTray and inspect the bottom of the mist eliminator pad in the cover. Remove mist eliminator pad from cover and clean. If fouled, replace with a new mist eliminator.

Problem Water won't flow into unit

Inlet/well pump function

Allow water level to rise in well pump, which will turn on the inlet pump and start water flow to system. No action necessary.

Stripper air pressure in low alarm condition

Read sump tank air pressure from pressure gauge. System should be in alarm condition if pressure is below about 2" inches (5cm) w.c. Check that blower is operating properly, and has correct rotation. Check that all rubber caps are in place on end of trays.

Inlet piping plugged

Remove cover and inspect nozzle and piping for debris and buildup. Clean or replace clogged parts.

Problem Iron Fouling Is A Problem

Iron build-up

Iron precipitates out of water when treated with an air stripper, causing iron build up in unit. Remove cleanout caps and inspect inside of tray for buildup/fouling. Clean out unit with pressure washer on a routine basis. Pretreat incoming water to reduce fouling problems in stripper. Meter a sequestering agent into the water.

Problem VOC Removal Is Less Than Expected

There are many possible reasons for poor stripper efficiency. Review the following list of questions to troubleshoot what the problem might be.

1. Have the trays been taken apart? Are they put back together as supplied from the factory, i.e., dip tube over sealpot, downcomers from each tray underwater in the sealpot of the tray below?

2. What is the sump tank air pressure reading? Is it steady, slowly changing over time, or rapidly fluctuating?

3. What is the flow rate through the stripper? How is it measured? Where is the sensor mounted?

4. What is the air intake and exhaust piping design (size of ducts, number of elbows, length of pipe run, GAC, heaters, other restrictions)? Are sample ports installed on each tray to verify pre-tray removal efficiency?

5. Is sump tank contaminated? Where are effluent samples taken from?

6. Are sample ports purged for 30 seconds-1 minute before taking sample?

7. Are samples being taken, stored, and tested per approved methods?

8. Are seal pots on each tray full of water?

9. Dose the sump tank have at least 4 inches (10cm) of water at all times?

10. Is the water suction elbow in the tank pointing down and always underwater?

11. What is the inlet water temperature?

12. What else is in the water besides the contaminates in question?

13. Are there occasional slugs of free product, or much higher than normal contaminant concentrations that could enter the stripper?

14. Is inlet water supplied as a continuous stream (as from an electric pump.)? Or is the flow pulsed (as from a pneumatic pump)?

15. Are their surfactants, detergents, greases, fats, etc. in the water that are causing foaming in the stripper?

16. Is there equipment near the blower intake that could be contaminating the air?

17.Has the air entering the blower been tested for VOCs?

18. How far away from each other are the air intake and air exhaust points? Is the air intake downwind of upwind from the exhaust? Is it possible for contaminated air to be sucked back into the stripper air intake?

19. Is the blower spinning in the correct direction (top of blower wheel spinning towards tank)? Watch wheel when it is almost stopped.

20. Is there air coming out of the discharge pipe?

21. Is outlet piping siphoning all water out of the sump tank, until it sucks air from tank?

22. What is the outlet plumbing design (gravity discharge, pumped discharge, uphill, downhill, other equipment in-line, size of piping. etc.)?

23. What do the bubbles look like in each tray? Install view ports to see.

24. Are the undersides of the trays free of drips and drizzles?

25. Are tray holes closed or plugged? Is there any scaling or fouling on the trays?

26. Is the system level and plumb?

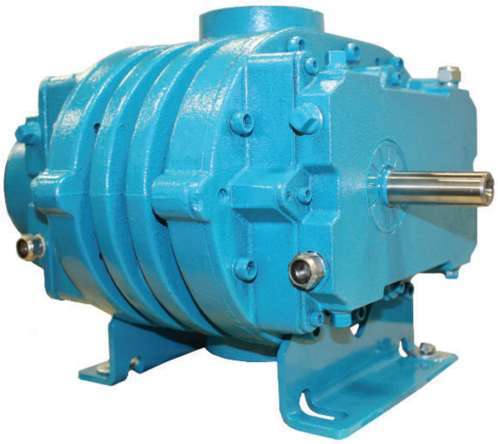
27. When shutting system down, is inlet water shut off, blower allowed to operate for an additional 5 minutes, then blower shut off?

Section 5: Components List, Drawings, & Cutsheets

Tuthill

M-D Pneumatics™
Rotary Positive Displacement Blowers

CP Series



CP Series rotary blowers are designed to be interchangeable with equivalent sizes of Roots Universal RAI®, and many Sutorbilt® Legend® blowers. CP Series models are rated up to 18 PSIG discharge pressure or 16” Hg dry vacuum. All models have sight glasses and triple lip seals as standard features.

Reduced Noise Versions Available
CP Series standard models feature a bi-lobe design. Many models are available with tri-lobe rotors and a specially tuned housing to reduce blower noise.

Triple Lip Seals
Standard on all models, triple lip seals provide improved lubrication to extend the life of the seal up to 50% also resulting in longer bearing life.

Helical Gearing
CP Series blowers are timed with precision helical gears, keyed to the rotor shafts, not taper fit spur gears as offered by other manufacturers, which have greater backlash, can slip and lose timing. Helical gears are also quieter, reducing mechanical noise.

Stronger Bearings
All CP Series blowers include double-row ball bearings at the gear end, stronger than single row ball bearings offered by other manufacturers. Drive shaft bearing is cylindrical roller type for additional strength against side loading from V-belt drives. As a result of this superior design, CP Series blowers offer design bearing life as much as 50% greater than models offered by other manufacturers.

Rotors with Integral Shafts
CP Series blowers include precision machined ductile iron rotors with large, integrally cast shafts, not press fit and/or pinned shafts offered by other manufacturers, which can loosen over time and cause rotor clash.

Versatility
CP Series blowers can be field converted from horizontal to vertical flow, or vice versa, without any special tools or additional components.

Metric Availability
CP Series blowers are available with metric drive shaft and process connections.

Lubrication
Many CP Series models include dual oil splash lubrication at both the gear end and drive end of the blower. Splash lubrication provides for longer bearing and seal life through improved heat dissipation versus grease lubrication.

Material Specifications:
Housing: Cast iron
End Plates: Cast iron
End Cover: Cast iron
Rotors: Ductile iron
Shafts: Ductile iron, cast integrally with rotors
Bearings: Gear end - Double row ball, both rotors
Drive end - Cylindrical roller on drive rotor
Single row ball on driven rotor
Drive Shaft: Ductile iron, cast integrally with drive rotor
Gears: Heat treated alloy steel, helical cut
Seals: Lip seals on rotor shafts and drive shaft
Lubrication: Oil splash on gear end, grease on drive end
Models available with dual oil splash lubrication

All blowers are factory tested to meet ISO 9001 registered quality standards. Rotors are dynamically balanced to meet ISO1940 Grade 6.3 specifications.

Performance

Pressure performance is based on inlet conditions of 14.70 PSIA (1.03 kg/sq cm) and 70°F (21°C). Vacuum performance is based on inlet temperature of 70°F (21°C) and discharge pressure of 14.70 PSIA (1.03 kg/sq cm). In conjunction with our program of continuous testing and upgrading, all specifications are subject to change without notice. All data are approximate. Request a quotation for your specific application.

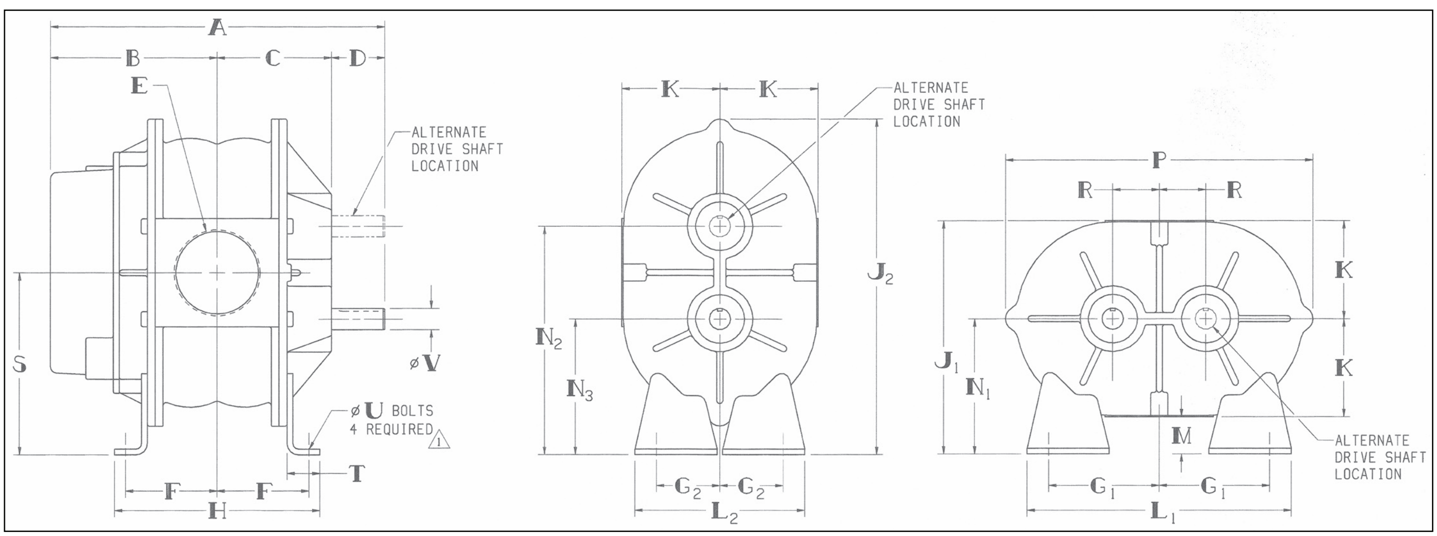
Model	Lobe	RPM	6 psig		7 psig		8 psig		10 psig		12 psig		13 psig		14 psig		15 psig		16 psig		17 psig		18 psig		Max. Vacuum		
			CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	" Hg	CFM	BHP
2002	2-lobe	1750	8	0.9	6	1.0	5	1.1	2	1.4															9	7	0.7
2002	2-lobe	3600	38	1.8	36	2.1	35	2.3	32	2.8	29	3.3													14	28	2.1
2002	2-lobe	5275	64	2.7	63	3.1	61	3.4	59	4.2	56	4.9													16	51	3.4
2004	2-lobe	1750	24	1.6	21	1.9																			10	20	1.4
2004	2-lobe	3600	83	3.3	80	3.8																			15	65	4.0
2004	2-lobe	5275	137	4.9	134	5.6																			16	115	6.3
3002	2-lobe	1150	22	1.6	19	1.8	17	2.1																	10	18	1.3
3002	2-lobe	2700	94	3.8	92	4.3	89	4.9	85	6.0	81	7.1													16	72	4.8
3002	2-lobe	3600	136	5.0	134	5.7	131	6.5	127	7.9	123	9.4	121	10.1	119	10.9	118	11.6							16	114	6.4
3003	2-lobe	1150	30	2.0	27	2.4																			10	26	1.7
3003	2-lobe	2700	126	4.8	122	5.5	119	6.3	114	7.7	109	9.2	106	9.9											14	107	5.4
3003	2-lobe	3600	181	6.4	178	7.4	175	8.3	169	10.3	164	12.2	162	13.2	160	14.1	157	15.1							15	158	7.7
3003	3-lobe	1150	32	2.1	28	2.5																			10	27	1.8
3003	3-lobe	2700	132	5.0	129	5.8	126	6.6																	14	112	5.7
3003	3-lobe	3600	191	6.7	187	7.7	184	8.8	178	10.8	173	12.8													15	166	8.1
3006	2-lobe	1150	60	4.8	55	5.3																			11	49	4.5
3006	2-lobe	2700	218	11.3	213	12.5	209	13.7	201	16.1	194	18.5	191	19.7											15	185	12.9
3006	2-lobe	3600	310	15.0	305	16.6	301	18.2	293	21.4	286	24.6	283	26.2	279	27.8	276	29.4	273	31.0					15	277	17.2
3006	3-lobe	1150	58	6.0	53	6.5																			11	46	5.7
3006	3-lobe	2700	218	14.0	213	15.2																			15	183	15.7
3006	3-lobe	3600	310	18.7	305	20.3																			15	276	20.9
4002	2-lobe	850	18	1.5	15	1.7																			10	14	1.3
4002	2-lobe	1760	73	3.1	70	3.6	68	4.1	63	5.0	59	5.9	57	6.4											14	58	3.5
4002	2-lobe	3600	184	6.4	182	7.4	179	8.3	175	10.2	171	12.1	169	13.1	167	14.0	165	15.0							16	162	8.2
4005	2-lobe	850	40	2.9	35	3.3	30	3.8																	9	38	2.2
4005	2-lobe	1760	150	5.9	145	6.9	140	7.8	132	9.6															14	121	6.7
4005	2-lobe	3600	373	12.1	368	14.0	363	15.9	354	19.7	347	23.5	343	25.4	340	27.3	336	29.2	333	31.1					16	330	15.7
4005	3-lobe	850	44	3.5	40	3.9	36	4.3																	9	43	2.8
4005	3-lobe	1760	149	7.2	145	8.1	141	9.0	133	10.8															14	124	8.0
4005	3-lobe	3600	360	14.8	356	16.6	352	18.4	345	22.0															16	324	18.1
4007	2-lobe	850	54	3.7	47	4.3																			10	45	3.1
4007	2-lobe	1760	199	7.7	192	8.9	186	10.1	175	12.6	165	15.0	160	16.3											14	160	8.8
4007	2-lobe	3600	492	15.8	486	18.3	479	20.8	468	25.8	458	30.8	453	33.3	449	35.8	444	38.3	440	40.8	436	43.3			16	437	20.4
4007	3-lobe	850	59	4.2	53	4.8																			10	51	3.6
4007	3-lobe	1760	193	8.8	188	9.9																			14	162	9.7
4007	3-lobe	3600	466	17.9	460	20.2																			16	420	22.2
5003	2-lobe	700	41	2.6	36	3.0	33	3.4																	10	35	2.2
5003	2-lobe	1760	180	6.6	176	7.6	172	8.6	165	10.7	159	12.7	156	13.7	153	14.7	150	15.7							14	156	7.5
5003	2-lobe	2850	324	10.7	320	12.3	316	14.0	309	17.2	303	20.5	300	22.2	297	23.8	294	25.4	291	27.1	289	28.7			16	289	13.7
5006	2-lobe	700	68	4.3	61	4.9	55	5.6																	10	59	3.5
5006	2-lobe	1760	302	10.7	295	12.4	289	14.1	277	17.5	266	20.9	261	22.6	257	24.3	252	26.0							14	262	12.2
5006	2-lobe	2850	543	17.3	536	20.1	530	22.8	518	28.3	507	33.8	502	36.6	498	39.3	493	42.1	488	44.8	484	47.6	480	50.3	16	485	22.5
5006	3-lobe	700	65	4.6	57	5.3	51	6.0																	10	55	3.9
5006	3-lobe	1760	300	11.7	293	13.4	286	15.1	273	18.5	262	21.9	257	23.6	252	25.3	247	27.0							14	257	13.2
5006	3-lobe	2850	542	18.9	535	21.7	528	24.4	515	30.0	504	35.5	499	38.2	494	41.0	489	43.8							16	480	24.1
5009	2-lobe	700	130	6.1	122	7.1	115	8.1																	11	111	5.5
5009	2-lobe	1760	472	15.4	464	17.9	457	20.4	444	25.3	432	30.3	426	32.8	421	35.2									14	427	17.6
5009	2-lobe	2850	824	25.0	816	29.0	809	33.0	796	41.0	784	49.0													15	769	30.4
5009	3-lobe	700	116	6.8	107	7.8	98	8.8																	11	93	6.1
5009	3-lobe	1760	473	17.0	464	19.6	455	22.2																	14	417	19.2
5009	3-lobe	2850	841	27.5	831	31.7	822	35.9																	15	773	33.2

Performance continued

Model	Lobe	RPM	6 psig		7 psig		8 psig		10 psig		12 psig		13 psig		14 psig		15 psig		16 psig		17 psig		18 psig		Max. Vacuum		
			CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	" Hg	CFM	BHP
6005	2-lobe	700	91	4.9	84	5.6	78	6.4	67	7.9															12	68	4.8
6005	2-lobe	1760	352	12.3	345	14.2	339	16.1	328	19.9	318	23.6	313	25.5	309	27.4	304	29.3	300	31.2					16	296	15.8
6005	2-lobe	2350	497	16.4	490	19.0	484	21.5	473	26.5	463	31.6	458	34.1	454	36.6	449	39.1	445	41.6	441	44.2	437	46.7	16	442	21.1
6008	2-lobe	700	146	7.6	135	8.8	126	10.0	108	12.4															12	109	7.5
6008	2-lobe	1760	565	19.2	554	22.2	544	25.2	527	31.3	510	37.4	503	40.4	496	43.4	489	46.4	482	49.5					15	490	23.3
6008	2-lobe	2350	798	25.6	787	29.6	777	33.7	760	41.8	744	49.9	736	53.9	729	58.0	722	62.0	715	66.1	708	70.1	702	74.2	16	709	33.1
6015	2-lobe	700	273	13.9	254	16.2																			10	247	11.5
6015	2-lobe	1760	1058	35.0	1038	40.7																			14	943	40.0
6015	2-lobe	2350	1494	46.8	1475	54.4																			14	1380	53.4
7006	2-lobe	650	171	7.2	163	8.3	157	9.5	144	11.8	133	14.0	128	15.2											13	137	7.6
7006	2-lobe	1760	617	19.5	610	22.6	603	25.7	591	31.8	579	38.0	574	41.1	569	44.2	564	47.3							16	556	25.2
7006	2-lobe	2050	734	22.7	726	26.3	719	29.9	707	37.1	696	44.3	691	47.8	686	51.4	681	55.0							16	672	29.4
7011	2-lobe	650	322	12.9	310	15.0	298	17.1	277	21.3															13	264	13.7
7011	2-lobe	1760	1142	35.0	1129	40.6	1117	46.3	1096	57.6															16	1035	45.5
7011	2-lobe	2050	1356	40.7	1343	47.3	1331	53.9	1310	67.1															16	1249	53.0
7018	2-lobe	650	560	20.8																					10	536	17.1
7018	2-lobe	1760	1892	56.2																					12	1830	55.3
7018	2-lobe	2050	2240	65.5																					12	2178	64.4

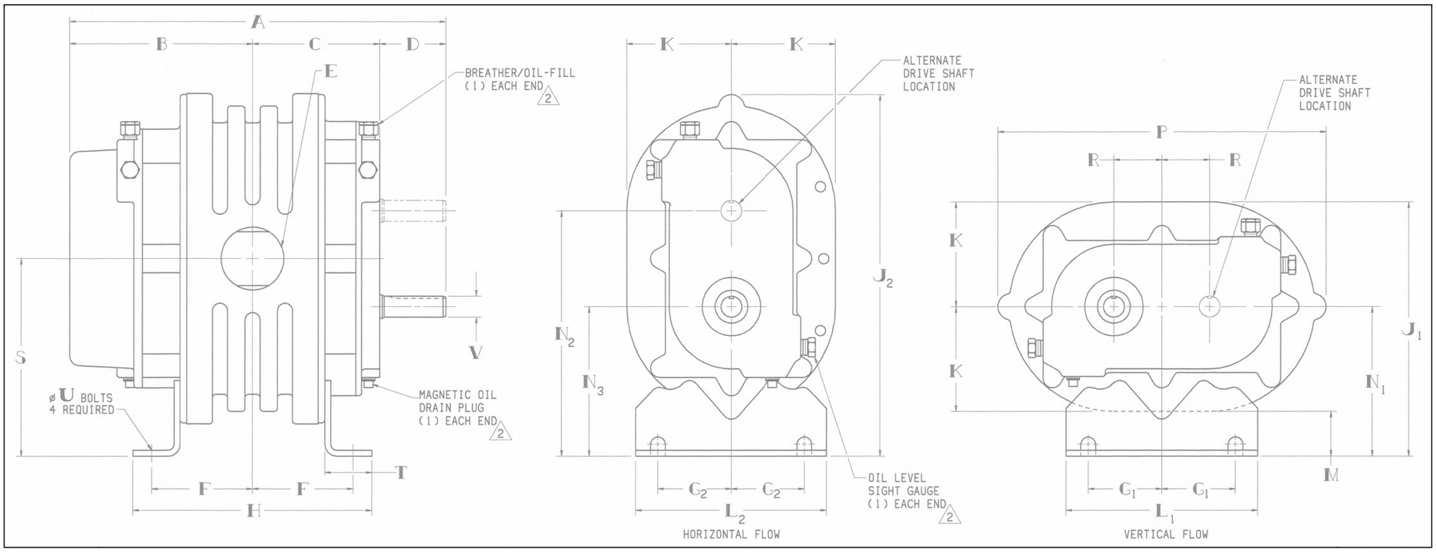
Dimensions: Standard Models

Model Size	A	B	C	D	E	H	J1	J2	K	L1	L2	M	N1	N2	N3	P	R	S	T	V	Weight (lbs.)
2002	10.13	5.00	2.63	2.50	1" NPT	5.06	6.88	9.69	3.13	5.13	5.13	.63	3.75	6.25	3.75	9.38	1.25	5.00	1.25	.625	41
2004	12.13	6.00	3.63		2" NPT	7.06															53
3002	11.50	5.69	3.38		1¼" NPT	6.75															78
3003	12.38	6.13	3.81	2.44	2" NPT	7.63	8.94	12.81	3.94	7.25	7.25	5.00	5.00	8.50	5.00	12.19	1.75	6.75	1.75	.875	83
3006	14.75	7.31	5		2½" NPT	10.00															113
4002	12.94	6.25	3.69		1½" NPT	7.25															95
4005	15.69	7.63	5.06	3.00	2½" NPT	10.00	10.63	15.13	4.38	8.00	8.00	6.25	6.25	10.25	6.25	13.69	2.00	8.25	2.00	.875	119
4007	17.44	8.50	5.94		3" NPT	11.75															138
5003	15.25	7.38	4.50		2½" NPT	8.44															152
5006	17.88	8.69	5.81	3.38	4" NPT	11.06	12.13	17.38	5.38	10.50	10.50	6.75	6.75	11.25	6.25	17.19	2.50	8.75	1.88	1.125	185
5009	20.88	10.19	7.31		4" NPT	14.06															222
6005	18.69	9.38	5.63		3" NPT	10.00	15.00		6.25												250
6008	21.69	10.88	7.13	3.69	5" NPT	13.00	15.00	21.69	6.25	17.06	11.00	8.75	8.75	14.75	8.75	19.81	3.00	11.75	2.13	1.375	310
6015	28.69	14.38	10.63		6" FLG	20.00	16.25		7.50												456
7006	20.31	10.31	5.94		4" NPT	11.75	20.69		9.69												425
7011	25.31	12.81	8.44	4.06	6" FLG	16.75	19.50	26.13	8.50	21.06	14.00	11.00	11.00	18.00	11.00	23.25	3.50	14.50	2.38	1.562	555
7018	32.31	16.31	11.94		8" FLG	23.75	19.50		8.50												675



Dimensions: Splash Lube Models

Model Size	A	B	C	D	E	H	J1	J2	K	L1	L2	M	N1	N2	N3	P	R	S	T	V	Weight (lbs.)
3002	11.50	5.69	3.75		1¼" NPT	6.75															82
3003	12.38	6.13	4.19	2.06	2" NPT	7.63	8.94	12.81	3.94	7.25	7.25	1.06	5.00	8.50	5.00	12.19	1.75	6.75	1.75	.875	88
3006	14.75	7.31	5.38		2½" NPT	10.00															120
4002	12.94	6.25	3.94		1½" NPT	7.25															102
4005	15.69	7.63	5.31	2.75	2½" NPT	10.00	10.63	15.13	4.38	8.00	8.00	1.88	6.25	10.25	6.25	13.69	2.00	8.25	2.00	.875	127
4007	17.44	8.50	6.19		3" NPT	11.75															146
5003	15.25	7.38	4.81		2½" NPT	8.44															161
5006	17.88	8.69	6.13	3.06	4" NPT	11.06	12.13	17.38	5.38	10.50	10.50	1.38	6.75	11.25	6.25	17.19	2.50	8.75	1.88	1.125	196
5009	20.88	10.19	7.63		4" NPT	14.06															235
6005	18.06	9.38	5.63		3" NPT	10.00	15.00		6.25												255
6008	21.06	10.88	7.13	3.69	5" NPT	13.00	15.00	21.69	6.25	17.06	11.00	2.50	8.75	14.75	8.75	19.81	3.00	11.75	2.13	1.375	315
6015	28.06	14.38	10.63		6" FLG	20.00	16.25		7.50												461



Values shown are approximate and should not be used for construction. Certified drawings are available through your local Tuthill Vacuum & Blower Systems Sales Professional.

The tri-lobe CP Series units have a cast-in noise reduction on the discharge port. This will reduce the sound level of the blower 3-5dB, or by half.

Your Local Tuthill Vacuum Blower Systems Sales Professional:

Tuthill
PUMP YOUR HEART INTO IT

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ISO 9001

M-D Pneumatics™
Rotary Positive Displacement Blower

Manual 2017 Rev C p/n 2017

WARNING: Do Not Operate Before Reading Manual

CP Series
OPERATOR'S MANUAL

Models

2002	3002	4002	5003	6005	7006
2004	3003	4005	5006	6008	7011
	3006	4007	5009	6015	7018

Grease Lubrication / Air Service
Splash Lubrication / Air Service

Operator's Manual: Tuthill CP Series Rotary Positive Displacement Blower

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Table of Contents

01

INTRODUCTION

CONGRATULATIONS on the purchase of a new **CP Series Rotary Positive Displacement Blower** from Tuthill Vacuum & Blower Systems. Please examine the blower for shipping damage, and if any damage is found, report it immediately to the carrier. If the blower is to be installed at a later date, make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If the blower is stored outdoors, be sure to protect it from weather and corrosion.

CP Series blowers are built to exacting standards and, if properly installed and maintained, will provide many years of reliable service. Read and follow every step of these instructions when installing and maintaining the blower.

NOTE: Record the blower model and serial numbers of the machine in the OPERATING DATA form on the inside back cover of this manual. Use this identification on any replacement part orders, or if service or application assistance is required.

APPLICABLE DOCUMENTATION

The applicable documents associated with this manual are:

- 2006/42/CE – Machinery Directive
- EN 1012-1:1996 - Compressors and vacuum pumps - Safety Requirements - Part 1: Compressors

SCOPE OF MANUAL

The scope of this manual and the Declaration of Incorporation includes the bare shaft rotary positive displacement blower.

Tuthill

02

CONVENTIONS AND DATA PLATE

GRAPHIC CONVENTIONS IN THIS MANUAL

This manual is the result of a risk assessment according to the applicable documents referenced in ***Applicable Documentation on page 1***. The following hazard levels are referenced within this manual:

⚠ DANGER
Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE
Indicates a situation that can cause damage to the engine, personal property, and/or the environment or cause the equipment to operate improperly.

NOTE: Indicates a procedure, practice, or condition that should be followed in order for the equipment to function in the manner intended.

⚠ CAUTION

Read manual before operation or bodily harm may result. Attention should be given to the safety related sections of this manual.

DATA PLATE

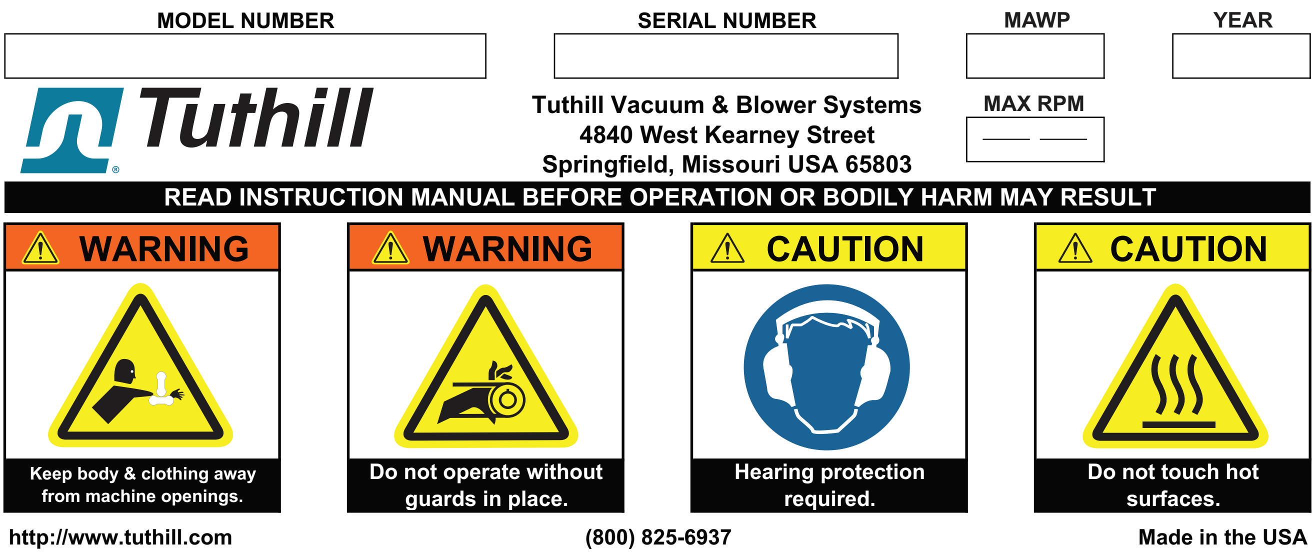


Figure 2-1 – General Operation and Symbols on Data Plate

The following information is contained on the data plate:

WARNING

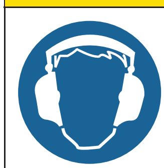
Keep body and clothing away from machine.

During operation, keep body and clothing away from inlet and outlet of the blower.

WARNING

Do not operate without guards in place.

CAUTION



Hearing protection is required while the blower is in operation. Noise levels may reach as high as 81 dBA.

CAUTION

Do not touch hot surfaces.

The upper limit of the blower operation is 400°F (205°C). Do not touch the blower while it is in operation and assure blower is cool when not in operation.

MODEL NUMBER:	The specific model of the blower
SERIAL NUMBER:	Unique to each blower
YEAR:	Year of manufacture
MAWP:	Maximum Allowable Working Pressure The standard MAWP is per ***Table 4-2 – Maximum Operating Limits on page 9***. The MAWP shall not be exceeded.

03

LIFTING

⚠ WARNING

The blower must be handled using an appropriate device such as a fork truck or appropriate lifting device. ***See Table 4-1 on page 8*** **for approximate weights. Care should be taken to assure blower does not over-turn during handling and installation.**

04

DESCRIPTION

NOTICE

Refer to specific data sheets for flow capacities and vacuum capacities.

NOTE: Refer to diagrams in this manual for proper rotation and orientation in inlet and discharge.

Tuthill Vacuum & Blower Systems CP Series model rotary lobe blowers are positive displacement type units, whose pumping capacity is determined by size, operating speed, and differential pressure conditions. Blowers employ rotors rotating in opposite directions within a housing closed at the ends by end plates.

The inlet to the discharge is sealed with operating clearances that are very small. Internal lubrication is not needed, as there is no moving contact.

Clearances between the rotors during rotation are maintained by a pair of accurately machined helical timing gears, mounted on the two shafts extended outside the air chamber. The intermeshing rotary lobes are designed to rotate and trap air or gas between each rotor and the housing. As the rotor lobes rotate past the edge of the suction port, the trapped air or gas is essentially at suction pressure and temperature. Since the blower is a constant volume device, the trapped air remains at suction pressure until the leading rotor lobe opens into the discharge port. The close clearances between the rotors inhibit back slippage of the trapped volume from between the rotors, and the trapped volume is forced into the discharge piping. Compression occurs not internal to the blower but by the amount of restriction, either downstream of the blower discharge port or upstream of the blower inlet port.

Figure 4-1 illustrates the air movement within the machine. In addition, the machine can operate in either direction.

Never attempt to control capacity by means of a throttle valve in the intake or discharge piping. This will increase the power load on the drive system, will increase operating temperatures, and can overload and/or seriously damage the blower. Likewise, if the possibility exists that flow to the blower inlet may be cut off during normal operation of a process, install an adequate vacuum relief valve. A pressure-type relief valve in the discharge line near the blower is also recommended for protection against cutoff or blocking in this line. Use check valves on each blower when more than one blower is connected to a discharge line.

When a belt drive is used, it is possible to adjust blower speed to obtain the desired capacity by changing the diameter of one or both sheaves, or by using a variable-speed motor pulley. In a direct-coupled arrangement, a variable-speed motor or transmission is required. Gas blowers can use bypasses, but some applications may require additional cooling. If there is a large volume of high-pressure air or gas downstream of the blower, a check valve in the piping downstream of the blower will protect the blower from overspeeding in a backward direction upon shutdown.

Consult a Tuthill Vacuum & Blower Systems sales professional if questions arise.

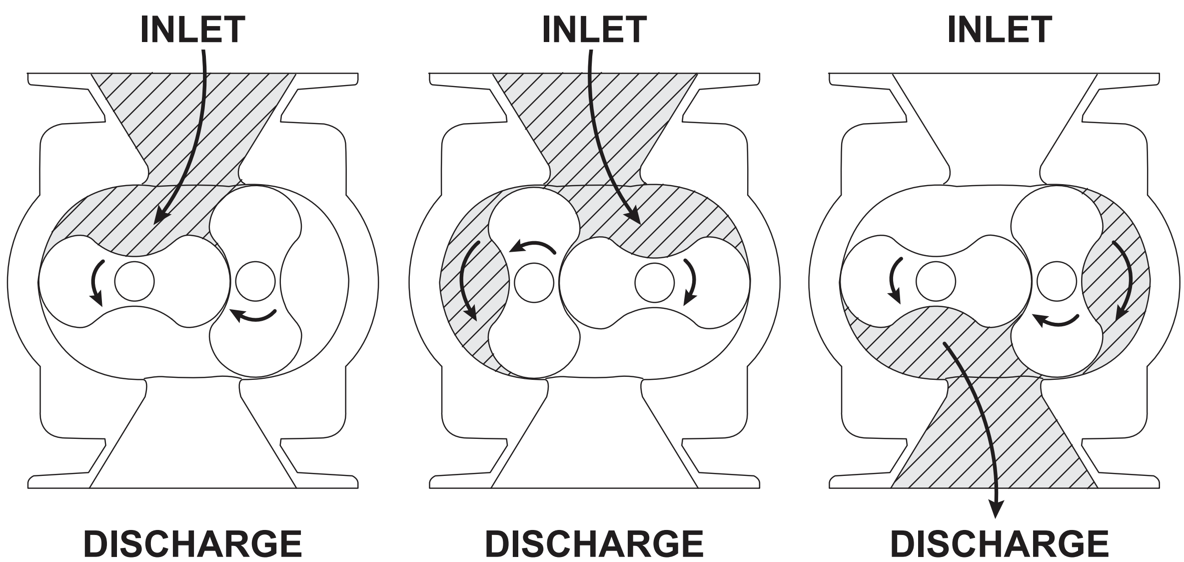


Figure 4-1 – General Operation Principle

FLOW BY DIRECTION AND ROTATION

⚠ WARNING

Refer to diagrams in this manual for proper rotation and orientation in inlet and discharge.

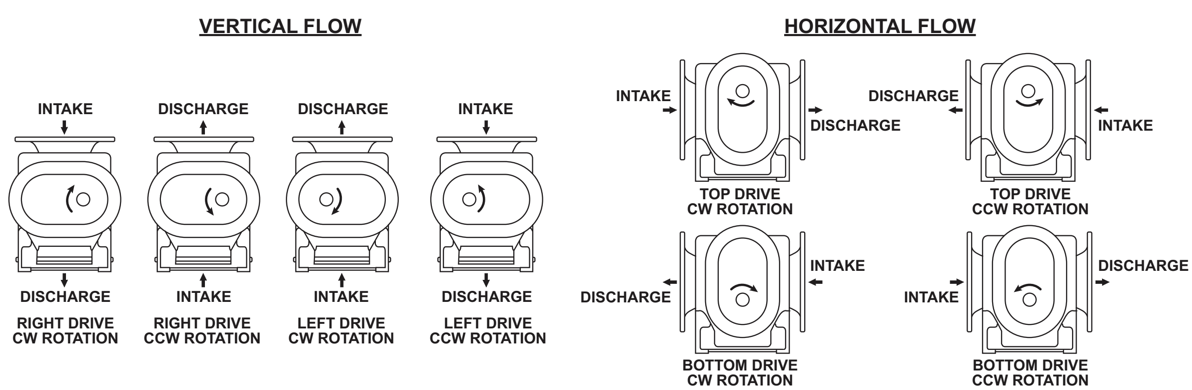


Figure 4-2 – Flow Direction by Rotation

SPECIFICATIONS

MODEL	APPROXIMATE OIL CAPACITY[1]				PORT SIZE	MAXIMUM RPM	APPROXIMATE WEIGHT
	VERTICAL FLOW		HORIZONTAL FLOW				
	GEAR END[2]	DRIVE END[3]	GEAR END[2]	DRIVE END[3]			
2002	3.4 oz (101 mL)	–	1.7 oz (50 mL)	–	1 in. (25 mm)	5,275	41 lb (19 kg)
2004	3.4 oz (101 mL)	–	1.7 oz (50 mL)	–	2 in. (51 mm)	5,275	53 lb (24 kg)
3002	6.0 oz (177 mL)	4.0 oz (118 mL)	3.4 oz (101 mL)	2.5 oz (74 mL)	1.25 in. (32 mm)	3,600	78 lb (35 kg)
3003	6.0 oz (177 mL)	4.0 oz (118 mL)	3.4 oz (101 mL)	2.5 oz (74 mL)	2 in. (51 mm)	3,600	83 lb (38 kg)
3006	6.0 oz (177 mL)	4.0 oz (118 mL)	3.4 oz (101 mL)	2.5 oz (74 mL)	2.5 in. (64 mm)	3,600	113 lb (51 kg)
4002	8.5 oz (251 mL)	6.4 oz (189 mL)	5.8 oz (172 mL)	4.7 oz (139 mL)	1.5 in. (38 mm)	3,600	95 lb (43 kg)
4005	8.5 oz (251 mL)	6.4 oz (189 mL)	5.8 oz (172 mL)	4.7 oz (139 mL)	2.5 in. (64 mm)	3,600	127 lb (58 kg)
4007	8.5 oz (251 mL)	6.4 oz (189 mL)	5.8 oz (172 mL)	4.7 oz (139 mL)	3 in. (76 mm)	3,600	146 lb (66 kg)
5003	18.3 oz (541 mL)	10.2 oz (302 mL)	7.1 oz (210 mL)	5.4 oz (160 mL)	2.5 in. (64 mm)	2,850	152 lb (69 kg)
5006	18.3 oz (541 mL)	10.2 oz (302 mL)	7.1 oz (210 mL)	5.4 oz (160 mL)	4 in. (102 mm)	2,850	185 lb (84 kg)
5009	18.3 oz (541 mL)	10.2 oz (302 mL)	7.1 oz (210 mL)	5.4 oz (160 mL)	4 in. (102 mm)	2,850	222 lb (101 kg)
6005	25.5 oz (754 mL)	18.0 oz (532 mL)	16.9 oz (500 mL)	9.0 oz (266 mL)	3 in. (76 mm)	2,350	250 lb (113 kg)
6008	25.5 oz (754 mL)	18.0 oz (532 mL)	16.9 oz (500 mL)	9.0 oz (266 mL)	5 in. (127 mm)	2,350	310 lb (141 kg)
6015	25.5 oz (754 mL)	18.0 oz (532 mL)	16.9 oz (500 mL)	9.0 oz (266 mL)	6 in. (152 mm)	2,350	456 lb (207 kg)
7006	28.7 oz (849 mL)	–	20.3 oz (600 mL)	–	4 in. (102 mm)	2,050	425 lb (193 kg)
7011	28.7 oz (849 mL)	–	20.3 oz (600 mL)	–	6 in. (152 mm)	2,050	555 lb (252 kg)
7018	28.7 oz (849 mL)	–	20.3 oz (600 mL)	–	8 in. (152 mm)	2,050	675 lb (306 kg)

[1] Oil capacities are based on filling from dry condition. Less oil may be needed depending on emptiness of oil reservoir(s) after draining. Always fill the gear housing until oil drips out of the oil level hole. Replace plugs in their respective holes. Following this procedure will ensure proper oil level.
[2] Gear End amounts apply to all CP Series blowers.
[3] Drive End amounts apply only to Splash Lubrication models.

Table 4-1 – Specifications

MODEL	MAXIMUM RPM	MAXIMUM PRESSURE DIFFERENTIAL*	MAXIMUM VACUUM*	MAXIMUM TEMPERATURE RISE*	MAWP
2002	5,275	12 psi (827 mbar)	16 inch-Hg (542 mbar)	225°F (125°C)	15 psi (1,034 bar)
2004	5,275	7 psi (483 mbar)	16 inch-Hg (542 mbar)	185°F (103°C)	15 psi (1,034 bar)
3002	3,600	15 psi (1,034 mbar)	16 inch-Hg (542 mbar)	210°F (117°C)	15 psi (1,034 bar)
3003	3,600	12 psi (827 mbar)	15 inch-Hg (508 mbar)	180°F (100°C)	15 psi (1,034 bar)
3006	3,600	7 psi (483 mbar)	15 inch-Hg (508 mbar)	170°F (94°C)	15 psi (1,034 bar)
4002	3,600	15 psi (1,034 mbar)	16 inch-Hg (542 mbar)	220°F (122°C)	17 psi (1,172 bar)
4005	3,600	10 psi (690 mbar)	16 inch-Hg (542 mbar)	210°F (117°C)	15 psi (1,034 bar)
4007	3,600	7 psi (483 mbar)	15 inch-Hg (508 mbar)	170°F (94°C)	15 psi (1,034 bar)
5003	2,850	15 psi (1,034 mbar)	16 inch-Hg (542 mbar)	195°F (108°C)	17 psi (1,172 bar)
5006	2,850	15 psi (1,034 mbar)	16 inch-Hg (542 mbar)	195°F (108°C)	15 psi (1,034 bar)
5009	2,850	7 psi (483 mbar)	15 inch-Hg (508 mbar)	160°F (89°C)	15 psi (1,034 bar)
6005	2,350	18 psi (1,241 mbar)	16 inch-Hg (542 mbar)	250°F (139°C)	18 psi (1,241 bar)
6008	2,350	14 psi (965 mbar)	16 inch-Hg (542 mbar)	240°F (133°C)	15 psi (1,034 bar)
6015	2,350	7 psi (483 mbar)	12 inch-Hg (406 mbar)	180°F (100°C)	15 psi (1,034 bar)
7006	2,050	15 psi (1,034 mbar)	16 inch-Hg (542 mbar)	235°F (131°C)	17 psi (1,172 bar)
7011	2,050	10 psi (690 mbar)	16 inch-Hg (542 mbar)	210°F (117°C)	15 psi (1,034 bar)
7018	2,050	6 psi (414 mbar)	12 inch-Hg (406 mbar)	120°F (67°C)	15 psi (1,034 bar)

* Maximum conditions based upon 70°F (21°C) inlet temperature and 14.7 psi (1 bar) absolute inlet pressure.

Table 4-2 – Maximum Operating Limits

⚠ WARNING

The maximum pressure differential is based on the difference between the inlet pressure and the outlet pressure. The maximum pressure differential shall not be exceeded. Exceeding the maximum pressure differential will cause serious damage to the equipment and could cause bodily injury.

⚠ WARNING

The maximum allowable working pressure (MAWP) is based on the absolute pressure of the blower housing and is NOT the maximum allowable pressure differential. Exceeding the MAWP will cause serious damage to the equipment and could cause bodily injury.

To permit continued satisfactory performance, a blower must be operated within certain approved limiting conditions. The manufacturer's warranty is, of course, also contingent on such operation.

Maximum limits for pressure, temperature, and speed are specified in ***Table 4-2 on page 9*** for various blower sizes when operated under the standard atmospheric conditions. Do not exceed any of these limits.

NOTICE

Specially ordered blowers with nonstandard construction, or with rotor end clearances greater than shown in ***Assembly Clearances on page 40****, will not have the operating limits specified here. Contact your Tuthill Vacuum & Blower Systems sales representative for specific information.*

NOTICE

Special attention must be paid when a blower has a higher than standard ambient suction temperature. Special recommendations for operating parameters and/or additional cooling may be recommended. Consult the factory or local representative for appropriate information.

Tuthill

05 INSTALLATION

GENERAL

DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.

DANGER

It is the responsibility of the installer to assure that proper guarding is in place and compliant with all applicable regulatory requirements.

WARNING

The bare shaft blower can generate excessive noise. Methods to reduce the noise levels by installing inlet and outlet silencers will be required. Even with inlet and outlet silencers, hearing protection will be required.

WARNING

Customers are warned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards in the installation and operation of this equipment in the system or facility.

WARNING

The standard MAWP is per *Table 4-2*. The MAWP shall not be exceeded unless specific factory testing of the pressure containing components of the blower has been performed.

WARNING

Table 4-2 states the maximum operating speed in RPM (rotations per minute) and maximum temperature. Do not exceed these limits. The installation of the blower shall take these critical operating parameters into account and adequate control features implemented.

⚠ WARNING

Upon completion of the installation, and before applying power, rotate the drive shaft by hand. It must move freely. If it does not, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment or any other cause of binding. If blower is removed and still does not move freely, check inside the blower housing for foreign material.

NOTICE

Remove the protective covers from the shaft and inspect for damage.

Carefully check to ensure that no transit damage has been sustained. If damage has occurred from shipment, file a claim with the carrier immediately. Preserve the shipping container for inspection by the carrier.

NOTICE

In the event that your unit sustains damage while being shipped to your facility, do not return it to the factory without first obtaining shipping instructions from us.

Do not remove protective covers and plugs until the connections are complete. Mount the blower on a flat, level surface. Use a baseplate that is rigid, solidly supported, and structurally sound. Shim under the legs where necessary so that each leg of the blower supports an equal share of the blower weight. This is necessary to prevent twisting of the blower. Make sure the feet rest evenly on the mounting surface before fastening down. Twisting or cramping the blower during mounting will cause rotor contact and binding during operation, resulting in a condition called “soft foot.” ***See Soft Foot on page 14*** for further details and preventative measures.

A blower that is factory-mounted on a base should not require such adjustments. However, since the assembly can become twisted in shipping or installation, check for soft foot after installing the base. Shims may be needed for alignment. Loosen the foot hold-down screws to check foot contact with the mounting surface. Mount the base on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly.

Transmission of small operating vibrations to a support structure may be objectionable in some applications. Use of vibration isolators or vibration-absorbing materials can be effective in overcoming this transmission. To avoid causing distortion, apply the treatment under the common motor/blower base or mounting plate rather than directly under the feet alone.

Make sure piping is accurately squared with the blower and supported independently. Stress imparted from incorrectly aligned piping or mounting will create problems with bearing and seal life, possibly leading to premature internal contact. The blower should sit stress free and evenly on its supporting surface. Take care to evenly tighten the mounting bolts to avoid imparting undue stress into the blower. Stress can be checked in a free state with feeler stock or verified on a previously installed blower with the aid of a dial indicator. Spring or gap should be less than 0.002 in. (0.05 mm).

Use only clean, new pipe and make certain it is free of scale, cuttings, weld beads, dirt, or any other foreign material. To guard against damage to the blower, make sure that an inlet filter is used. Clean the filter of collected debris after 3 hours of operation and periodically thereafter. ***See Piping Connections on page 18*** for additional details.

Figure 5-1 shows a typical complete installation of the blower and accessories. Note the absence of throttle or shut-off valves in both discharge and intake piping. If it is possible for airflow to be cut off in either line, add a pressure and/or vacuum relief valve. In some installations, it may be desirable to use only an inlet silencer-cleaner supported directly from the blower connection. Keep the weight of accessories and piping to a minimum to prevent blower casing distortion. If the weight exceeds 10% of blower weight, support the components independently of the blower and connect them with a flexible hose or connectors. The approximate weight of the blower is listed in ***Table 4-1 on page 8***.

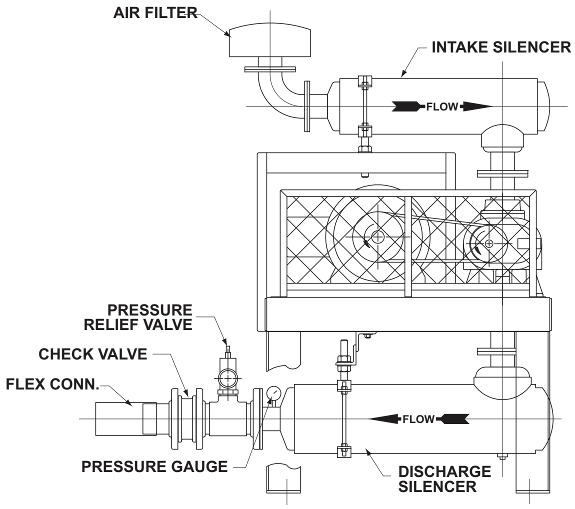


Figure 5-1 – Typical Blower Installation

A blower may be driven by direct-coupling to the driver or by V-belt drive for the purpose of obtaining other speeds within the approved range. ***See Motor Drives on page 19*** for more information.

Blowers from Tuthill Vacuum & Blower Systems are internally and externally treated after factory assembly and testing to protect against rusting in normal atmospheric conditions prior to installation. The maximum period of internal protection is considered to be 6 months under average conditions, provided closing plugs and seals are not removed. Protection against chemical or salt-water atmosphere is not provided. Avoid opening the blower until ready to begin installation, as protection will be quickly lost due to evaporation. For recommended preparations for long-term storage (longer than 6 months), ***see Long-Term Storage on page 29***.

Location

Install the blower in a room or outdoor area that supplies adequate space and lighting for routine maintenance. Make sure that indoor installation areas are well ventilated and kept as cool as possible, because operating the blower at elevated temperatures can result in nuisance overload or temperature shutdowns. An unprotected outdoor installation is satisfactory only when correct lubrication for the expected temperatures is provided, as per ***Recommended Lubricants on page 42***.

Foundation

The blower does not need a special foundation. However, it does require a solid, level floor and adequate frame support. Bolt the blower system to the floor and seal any cracks.

Blower Air Intake

To minimize maintenance, supply the blower with the cleanest air possible. The air must not contain any flammable or toxic gases, as the blower will concentrate these gases. This could result in damage to the blower and surrounding property and lead to personal injury or death. Do not block or restrict the opening of the blower, as the motor could overheat and fail.

Do not use blowers on explosive or hazardous gases. Do not exceed the limits described in ***Table 4-2 on page 9*** on performance criteria such as pressure differential, running speed, and discharge temperature.

If it is necessary to take air from a remote source, such as in a vacuum application, make sure the diameter of the piping is at least equal to the diameter of the blower inlet. For distances greater than 20 ft (6 m), enlarge the pipe diameter to reduce inlet restriction. Excessive restriction will reduce the efficiency of the blower and elevate its discharge temperature. The piping used should also be corrosion-resistant and free of scale and dirt. Keep the inlet covered to keep out foreign objects and rain. Vacuum kits are available.

Soft Foot

Soft foot is a condition in which one of the blower feet does not sit flat on the base. Soft foot is usually due to irregularities in the surface to which the blower is mounted. When the bolt on the foot gets tightened, a slight distortion occurs that can affect bearing and seal life as well as internal contact between parts.

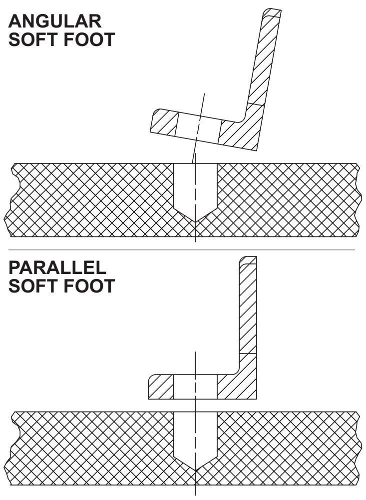


Figure 5-2 – Illustrations of Soft Foot

1. Place the blower on the base.
2. Check each foot for gaps between the foot and base (soft foot). Shim as necessary to fill the gap within 0.002 in. (0.05 mm).
   Figure 5-2 shows the two most common types of soft foot conditions. If either type is present at a measurement of more than 0.003 in. (0.076 mm), the blower may fail prematurely.
3. Tighten all bolts.
4. Mount a dial indicator on the base contacting one foot at 12 o’clock position.
5. Loosen the bolt on that foot. Observe indicator travel and add shims as needed to reduce “spring” to less than 0.002 in. (0.05 mm). Repeat steps 4 and 5 on the remaining feet.

SAFETY

Tuthill Vacuum & Blower Systems recommends the use of relief valves to protect against excessive pressure or vacuum conditions. Test these valves at initial start-up to be sure they are properly adjusted to relieve at or below the maximum pressure differential rating of the blower.

DANGER

It is the responsibility of the installer to assure that proper guarding is in place and compliant with all applicable regulatory requirements.

DANGER

Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. The blower should never be run with the inlet or discharge piping removed. If it becomes necessary to inspect the rotating parts of the blower or to change V-belts, be absolutely sure that all power to the motor controls has been shut off, the motor controls are locked out, and properly tagged before proceeding.

⚠ DANGER

Assure that properly sized vacuum breaks/relief valves are used on the inlet side of the blower. Also assure that properly sized pressure relief valves are used on the outlet of the blower. The sizing shall be such to assure that the proper flow can be achieved without exceeding the rated vacuum and pressure ratings.

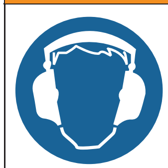
⚠ DANGER

Blower housing and associated piping or accessories may become hot enough to cause major skin burns on contact.

⚠ WARNING

Use lock out/tag out procedures to disable the electrical energy source before any service or work is done on the blower.

⚠ WARNING



Avoid extended exposure in close proximity to machinery with high intensity noise levels. Wear adequate ear protection.

NOTE: Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.

LUBRICATION

Every blower from Tuthill Vacuum & Blower Systems is factory-tested, oil-drained, and shipped dry to its installation point. Fill both independent oil reservoirs to the proper level before operation.

Shaft bearings at the gear end of the blower are splash-lubricated by one or both gears dipping into an oil reservoir formed in the gear end plate and cover. Shaft bearings at the drive end of the blower are lubricated by a slinger assembly dipping into an oil reservoir. Before starting the blower, fill the oil sumps as described in ***Filling Procedure on page 16***.

Add oil to the blower in the quantity listed in***Table 4-1 on page 8***. Make sure oil level is maintained within the notched area of the sight glass. ***See Figure 5-3***. Lower drive blowers have "bull's eye" type oil level gauges. Maintain oil levels at the center of the glass.

⚠ WARNING

Never attempt to change or add lubrication while the blower is running. Failure to heed this warning could result in damage to the equipment or personal injury. Oil must be checked when the blower is NOT running.

⚠ WARNING

Properly dispose of the spent lubricants. Refer to the manufacturer of the lubricant and any regulations to assure proper and safe disposal.

⚠ WARNING

Do not start the blower until you are sure oil has been put in the gear housing and rear cover. Operation of the blower without proper lubrication will cause the blower to fail and void the warranty.

NOTICE

Most CP Series blowers are shipped from the factory in a left hand drive, vertical flow configuration. If drive shaft location is changed, the oil level plugs, sight glasses and breathers must be relocated to proper positions, as shown in ***Figure 5-3****. Failure to change plug location will result in blower failure and void the product warranty.*

Filling Procedure

See Figure 5-3. See Recommended Lubricants on page 42 for suggested lubricants and grease.

1. Remove the fill plugs or breathers from both gear end and drive end plates.
2. Slowly pour oil through the fill until oil appears in the oil sight glass. Bring the oil level to the center of the sight glass.
3. Verify oil level is at proper level in both gear end and drive end sight glasses.
4. Replace the fill plugs or breathers that were removed in step 1.

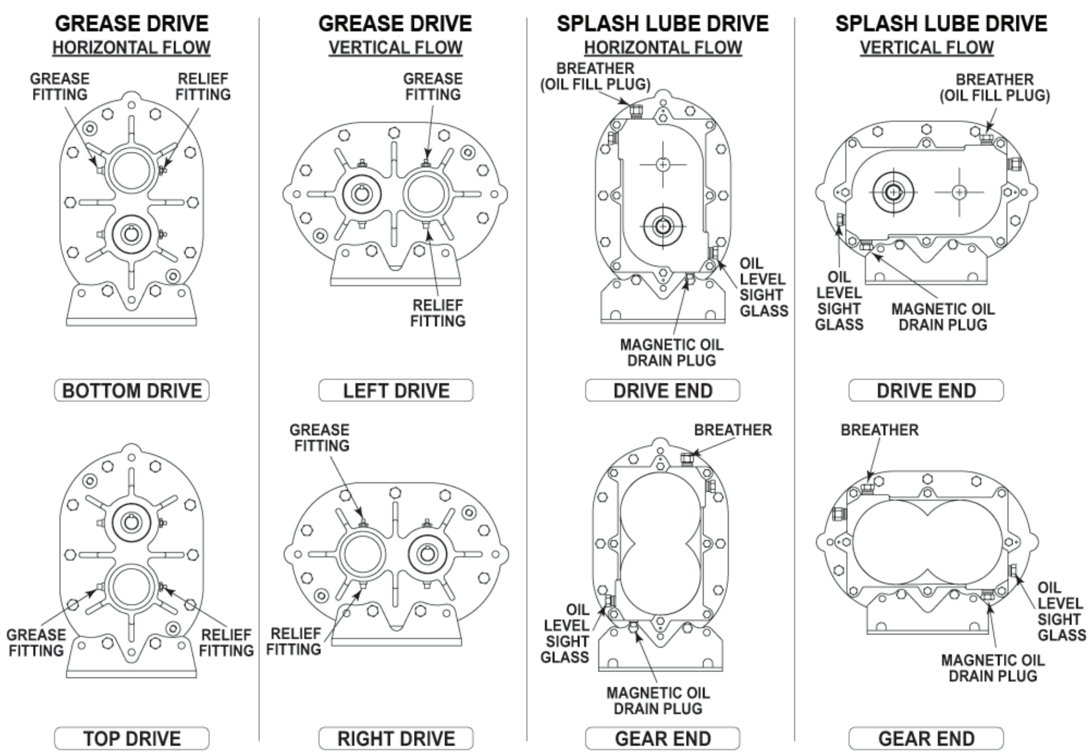


Figure 5-3 – Location of Oil Fill, Drain and Level Gauges on CP Series Blowers

Frequently Asked Questions Regarding Lubrication

What is the functional detriment if the "wrong oil" is used?

The lubricant is selected based on bearing speed, gear speed, and operating temperature. If the lubricant is too light, it increases wear by not separating the sliding surfaces and it will not remove the heat adequately. If the lubricant is too thick, the drag in the bearings is increased, causing them to run hotter. Thicker lubricant will not flow as readily into the gears and it will reduce the available backlash. Lubricants at our conditions are incompressible.

What is the functional detriment if the oil is not serviced?

If the lubricant is not serviced at the proper interval, the shearing action in the bearing and the gears will begin to take its toll and the lubricant will thicken. The blower will run hotter and the wear on moving parts will increase. The lubricant will generally appear dirtier, caused by material rubbing off the components. The lubricant will discolor because of overheating. An indicator of the breakdown of a lubricant is the increase in the Total Acid Number (TAN) and a change of 10 percent in the base viscosity.

Several things are happening as the lubricant goes through the blower. First, it is absorbing frictional energy in the form of heat. This heat has to be dissipated through either surface contact with cooler materials or in a rest volume of lubricant. While reducing the friction, the lubricant is also going through a shearing process and the molecular structure is broken down.

The result is that the lubricant will begin to thicken because of the shorter molecular chains and the drop out of additive packages. The thickened lubricant will cause more drag, increasing the friction and heat and further degrading the lubricant.

Operation of the blower (environment, run time, speed, and pressure) has a direct effect on duty cycles. The published cycles are based on worst-case conditions.

Hazards Associated With Breakdown or Ignition of Lubrication

DANGER

There is a risk associated with the lubrication media breaking down and resulting in a hazardous fluid or vapor. There may also be a hazard associated with the ignition of the lubrication media. Refer to the lubrication manufacturer's applicable instruction for safety precautions.

Release Lubricated Bearings – Grease Lubrication Series Only

Service the drive end bearing at regular intervals (see ***Table 5-1***). Use NLGI #2 premium-grade, petroleum-base grease with high temperature resistance and good mechanical stability, such as PneuLube grease, available from a local Tuthill Vacuum & Blower System professional. Use a pressure gun to force new grease into each bearing until traces of clean grease come out of the relief fitting.

SPEED IN RPM	OPERATING HOURS PER DAY		
	8	16	24
	GREASING INTERVALS IN WEEKS		
750 – 1,000	7	4	2
1,000 – 1,500	5	2	1
1,500 – 2,000	4	2	1
2,000 – 2,500	3	1	1
2,500 – 3,000	2	1	1
3,000 and up	1	1	1

Table 5-1 – Suggested Lubrication Intervals for Grease Lubricated Bearings

NOTICE

To avoid blowing out the drive shaft seal, do not grease too rapidly.

NOTE: See *Figure 5-3* for locations of grease fittings and grease reliefs for horizontal and vertical flow blowers.

PIPING CONNECTIONS

WARNING

Pipe loading on the blower should be negligible as pipe loading can cause distortion of the blower. Use proper supports and pipe hangers to assure that there is no loading.

NOTICE

Remove the protective covers from the inlet and outlet ports and inspect for dirt and foreign material.

Inlet and outlet connections on all blowers are large enough to handle maximum volume with minimum friction loss. Maintain same-diameter piping. Do not support silencers by the blower. Avoid stress loads and bending moments.

Be certain all piping is clean internally before connecting to the blower. Place a 16-mesh wire screen backed with hardware cloth at or near the inlet connections for the first 50 hours of use until the system is clean. Clean the screen after 3 hours of operation and completely discard it once the system is clean, as it will eventually deteriorate and small pieces going into the blower can cause serious damage. A horizontal or vertical airflow piping configuration is easily achieved by rearranging the mounting feet position.

Hazards Associated With Hazardous Process Fluids

DANGER

It shall be the responsibility of the installer to ensure that piping is adequate, sealing between pipe joints is adequate for the process fluids and proper process and pressure protection devices are in place. It is also the responsibility of the installer to assure that process gases are not vented in a manner that would be hazardous.

Refer to the manufacturer of the process media to assure that proper safety precautions are in place.

Blockage or Restriction

WARNING

Damage to the blower could occur if there is blockage in the inlet or outlet ports or piping. Care should be taken when installing the blower to assure that there are no foreign objects or restrictions in the ports or piping.

MOTOR DRIVES

Two drive connections commonly used are direct drive and V-belt drive.

Direct Coupled

When installing the motor directly to the blower, align the shafts to the coupling according to the coupling manufacturer's instructions. Blowers shipped with the motor directly coupled and mounted on a common base have been aligned prior to shipment. Further alignment is not normally necessary, but be sure to check the alignment and make adjustments if necessary prior to starting the blower.

Coupling halves must correctly fit the blower and drive shafts so that only light tapping is required to install each half. The two shafts must be accurately aligned. A direct-coupled blower and motor must be aligned with the two shafts having no more than 0.005 in. (13 mm) Total Indicator Reading (TIR). Make sure the face is aligned within 0.002 in. (0.05 mm).

Establish proper gap between coupling halves according to the coupling manufacturer's instructions with the motor armature. Proper gap will minimize the chance for end thrust on the blower shaft. Re-align and grease all direct-coupled base-mounted blowers after field installation.

V-Belts

If the motor and blower are V-belt connected, the sheaves on both the motor and blower shafts should be as close to the shaft bearings as possible. Blower sheave is not more than 1/4 in. (6.5 mm) from the blower drive end cover. The drive sheave is as close to the driver bearing as possible. Take care when installing sheaves on the blower and motor shafts. Make sure the face is accurately in line to minimize belt wear.

Adjust the belt tension to the manufacturer's specifications using a belt tension tester. Check new belts for proper tension after 24 hours of run time. When manufacturer data is not available, industry guidelines recommend 1/64 in. deflection for each inch of span (0.157 mm deflection per centimeter of span) at 8 – 10 lb (3.6 – 4.5 kg) of force in the center of the belt.

Insufficient tensioning is often indicated by slipping (squealing) at start-up. Do not use belt dressing on V-belts. Keep sheaves and V-belts free of oil and grease. Remove tension from belts if the drive is to be inactive for an extended period of time. For more specific information, consult the drive manufacturer. In a V-belt drive, the blower sheave must fit its shaft accurately, run true, and be mounted as close to the bearing housing as possible to minimize bearing loads.

A tight or driving fit will force the drive shaft out of its normal position and cause internal damage. A loose fit will result in shaft damage or breaking. Make sure the motor sheave fits correctly and is properly aligned with the blower sheave.

Adjust the motor position on its sliding base so that belt tension is in accordance with drive manufacturer's instructions. Always avoid excessive belt tension. Recheck tension after the first 10 hours of operation and periodically thereafter to avoid slippage and loss of blower speed.

Check the blower after installation and before applying power by rotating the drive shaft by hand.

If the drive shaft does not rotate freely:

- Look for uneven mounting, piping strain, excessive belt tension, or coupling misalignment
- Check the blower to make sure oil was added to the reservoirs

Setting V-Belt Tension

Proper belt tension is essential to long blower life. ***Figure 5-4***, ***Figure 5-5***, and the following procedure are provided to aid in field-adjusting V-belts (when the blower is so equipped) for maximum performance. A visual inspection of the V-belt drive should yield the appearance shown in ***Figure 5-4***.

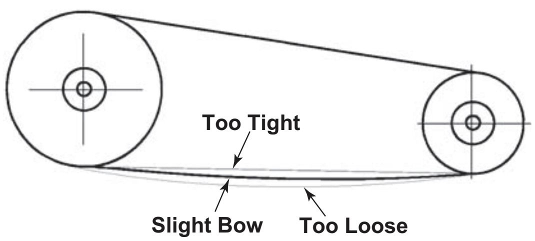


Figure 5-4 – General appearance of a V-belt drive

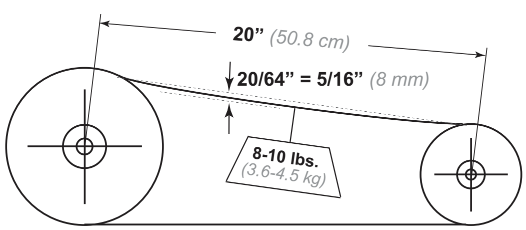


Figure 5-5 – Setting of proper tension for a V-belt drive

Factors outside the control of the belt tensioning system used on an individual blower package assembly, such as environmental factors and quality of the belts installed, may contribute to decreased belt life. Such factors can cause wear of the belts beyond the ability of the tensioning system to compensate.

As such, it is recommended to check belt tension monthly and make any manual adjustments found necessary.

1. Turn off and lock out power.
2. Remove the belt guard fasteners (if equipped).
3. Remove the belt guard.
4. Check and adjust the belt tension as necessary. Tension should be 1/64 in. deflection per inch of span (0.157 mm deflection per centimeter of span) between sheaves, with 8 – 10 lb (3.6 – 4.5 kg) force applied at the center point of the top section of belt.
5. Install the belt guard, making sure that all drive components are free of contact with the guard.
6. Install the belt guard fasteners that were removed in step 2.
7. Unlock the power and start the blower.
8. Resume normal operation.

V-Belt Troubleshooting

PROBLEM	POSSIBLE CAUSES	SOLUTION
Belts slip (sidewalls glazed)	Not enough tension	Replace belts; apply proper tension.
Drive squeals	Shock load	Apply proper tension.
	Not enough arc of contact	Increase center distance.
	Heavy starting load	Increase belt tension.
Belt(s) turned over	Broken cord caused by prying on sheave	Replace set of belts and install correctly.
	Overloaded drive	Redesign drive.
	Impulse loads	Apply proper tension.
	Misalignment of sheave and shaft	Re-align drive.
	Worn sheave grooves	Replace sheaves.
	Excessive belt vibration	Check drive design. Check equipment for solid mounting. Consider use of banded belts.
Mismatched belts	New belts installed with old belts	Replace belts in matched sets only.
Breakage of belt(s)	Shock loads	Apply proper tension; recheck drive.
	Heavy starting loads	Apply proper tension; recheck drive. Use compensator starting.
	Belt pried over sheaves	Replace set of belts correctly.
	Foreign objects in drives	Provide drive guard.
Rapid belt wear	Sheave grooves worn	Replace sheaves.
	Sheave diameter too small	Redesign drive.
	Mismatched belts	Replace with matched belts.
	Drive overloaded	Redesign drive.
	Belt slips	Increase tension.
	Sheaves misaligned	Align sheaves.
	Oil or heat condition	Eliminate oil. Ventilate drive.

MOTOR AND ELECTRICAL CONNECTIONS

⚠ WARNING
The motor and connections shall be protected to assure that product and environmental condensation does not come in contact with the electrical connections.

NOTICE
It is the responsibility of the installer to assure that the motor is in compliance with the latest edition of IEC 60204-1 and all electrical connections are performed per IEC 60204-1, this includes overcurrent protection.

Wire the motor and other electrical devices, such as solenoid valves and temperature switch, to the proper voltage and amperage as indicated on the nameplate of the component being wired. Turn the blower by hand after wiring is completed to determine that there are no obstructions and that the blower turns freely. Then, momentarily start the blower to check the direction of rotation. ***Figure 4-2*** shows direction of airflow in relation to rotor rotation. The airflow direction can be reversed by reversing the appropriate motor leads.

06

OPERATION

GENERAL

DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.

WARNING

Do not operate without guards in place.

WARNING

Maximum operating speed: *Table 4-2* states the maximum operating speed in RPM (rotations per minute), the maximum pressure differential, maximum vacuum and maximum temperature rise. Do not exceed these limits.

WARNING

The blower can generate excessive noise. Hearing protection is required while the unit is in operation.

Before starting the blower for the first time under power, recheck the installation thoroughly to reduce the likelihood of difficulties. Use the following checklist as a guide, but consider any other special conditions in your installation.

1. Be certain no bolts, rags, or dirt have been left in blower.
2. Be certain that inlet piping is free of debris. If an open outdoor air intake is used, be sure the opening is clean and protected by an inlet filter. This also applies to indoor use.
3. If installation is not recent, check blower leveling, drive alignment, belt tension, and tightness of all mounting bolts.
4. Be certain the proper volume of oil is in the oil reservoir chambers.
5. Be certain the driving motor is properly lubricated and connected through suitable electrical overload devices.
6. With electrical power off and locked out to prevent accidental starting, rotate the blower shaft several times by hand to make sure the blower is rotating freely. Unevenness or tight spots are indicators of a condition that should be corrected before progressing.

7. Check motor rotation by momentarily pushing the START button and then checking the flow direction of the blower. Reverse the motor connections if the flow is in the wrong direction.

Carry out initial operation under “no load” conditions by opening all valves and venting the discharge to the atmosphere, if possible. Then, start the motor briefly, listen for unusual noises, and make sure the blower coasts freely to a stop. If no problem appears, repeat this check and let the motor run slightly longer. If any questions exist, investigate before proceeding.

Assuming all tests are satisfactory, the blower will now be ready for continuous full-load operation. During the first several days, check periodically to make sure all conditions remain acceptable and steady. These checks may be particularly important if the blower is part of a process system where conditions may vary. At the first opportunity, stop the blower and clean or remove the inlet filter. Also recheck leveling, coupling alignment or belt tension, and mounting bolts for tightness.

START-UP CHECKLIST

It is recommended that these start-up procedures be followed in sequence and checked off (☑) in the boxes provided in any of the following cases.

• During initial installation • After any shutdown period	• After maintenance work has been performed • After blower has been moved to a new location
DATES CHECKED:	☐ ☐ ☐
☐ ☐ ☐ ☐	Check the unit for proper lubrication. Proper oil level is critical. ***See Lubrication on page 15***. ***See Recommended Lubricants on page 42*** for information on acceptable lubricants for the product.
☐ ☐ ☐ ☐	Check the V-belt drive for proper belt alignment and tension.
☐ ☐ ☐ ☐	Carefully turn the rotors by hand to be certain they do not bind.

⚠ WARNING

Disconnect power. Make certain power is off and locked out before touching any rotating element of the blower, motor, or drive components.

☐☐☐☐	"Bump" the unit with the motor to check rotation (counterclockwise when facing the shaft) and to be certain it turns freely and smoothly.
☐☐☐☐	Start the unit and operate it for 30 minutes at no load. During this time, feel the cylinder for hot spots. If minor hot spots occur, ***see Troubleshooting on page 38.***
☐☐☐☐	Apply the load and observe the operation of the unit for 1 hour.
☐☐☐☐	If minor malfunctions occur, discontinue operation and ***see Troubleshooting on page 38***.

⚠ DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.

⚠ WARNING

Physical harm may occur if human body parts are in contact or exposed to the process vacuum. Assure that all connections are protected from human contact.

⚠ WARNING

If rated vacuum or pressure levels are exceeded, process fluids will migrate to other parts of the blower and system.

⚠ CAUTION

Do not touch hot surfaces.

Do not touch the blower while it is in operation and assure blower is cool when not in operation.

NOTICE

The upper temperature limits are not intended for continuous operation. Consult with factory for detailed information assistance.

STOPPING

⚠ CAUTION

Do not stop the blower if there are high outlet pressures in the outlet piping. Unload the outlet piping prior to shutting down the blower.

Stop the blower by turning off the motor. Isolate the blower from the vacuum system and vent the blower to the atmosphere.

RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

When an air piping system has high humidity or moisture, water condensation can occur after the blower is shut down and it begins to cool. Condensation creates an environment favorable to corrosion of the iron internal surfaces and to ice formation in cold weather. Both conditions can close the operating clearances, causing the blower to fail upon future start-up.

The following shutdown procedure minimizes the risk of moisture condensation, corrosion, and freezing.

NOTICE
Care must be taken not to overload or overheat the blower during this procedure.

1. Isolate the blower from the moist system piping, allowing the blower to intake atmospheric air. Operate the blower under a slight load, allowing the blower to heat within safe limits. The heat generated by the blower will quickly evaporate residual moisture.

2. For carpet cleaning applications, after the work is completed, allow the blower to run 3 – 5 minutes with the suction hose and wand attached. The suction hose and wand will provide enough load to the blower to evaporate the moisture quickly.

3. For extended shutdown, inject a small amount of a light lubricating oil such as 3-in-One® or a spray lubricant such as WD-40® into the inlet of the blower just before shutdown *(3-in-One and WD-40 are registered trademarks of WD-40 Company)*. The lubricant will provide an excellent protective coating on the internal surfaces. If using a spray lubricant, take care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, likely to a degree where repair would be required.

4. If the blower is being taken out of commission for an extended period of time, ***see Long-Term Storage on page 29***.

07

MAINTENANCE

GENERAL

Regular inspection of the blower and its installation, along with complete checks on operating conditions, will pay dividends in added life and usefulness. Also, service the drive per the manufacturer's instructions and lubricate the coupling or check the belt drive tension. Use thermometers and gauges to make sure that blower operating temperature and pressure remain within allowed limits.

⚠ DANGER

The blower and parts may contain hazardous media. Assure that pump and parts are evacuated of hazardous media prior to servicing.

⚠ CAUTION

The electrical service must be isolated and de-energized prior to maintenance. Apply appropriate procedures to assure electrical supply is de-energized and cannot be inadvertently energized during maintenance.

Assure piping and product is isolated prior to maintenance of blower. Apply appropriate procedures to assure piping and product is isolated and that inadvertent opening of valves cannot occur during maintenance.

⚠ CAUTION

During routine maintenance, inspect and assure that guards are in place and secure.

Pay special attention to lubrication of timing gears and bearings according to the information in ***Lubrication on page 15***.

When a blower is taken out of service, it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgment based on existing conditions as well as length of downtime. Under atmospheric conditions producing rapid corrosion, protect the blower immediately. ***See Long-Term Storage on page 29***.

REGULAR MAINTENANCE

A well-designed maintenance program will add years of service to the blower.

Check a newly installed blower frequently during the first month of operation, especially lubrication. With the blower at rest, check the oil level in both the gear (drive) end and free (non-drive) end of the blower and add oil as needed. Complete oil changes are recommended every 1,000 – 1,200 operating hours, or more frequently depending on the type of oil and operating temperature. Also change the oil more frequently if pumping corrosive vapors or where excessive operating temperatures are encountered. The following is recommended as a minimum maintenance program.

DAILY	WEEKLY	MONTHLY
1. Check and maintain oil level, and add oil as necessary. 2. Check for unusual noise or vibration (***see Troubleshooting on page 38***).	1. Clean all air filters. A clogged air filter can seriously affect the efficiency of the blower and cause overheating and oil usage. 2. Check the relief valve to make sure it is operating properly.	1. Inspect the entire system for leaks. 2. Inspect the condition of the oil and change if necessary. 3. Check drive belt tension and tighten if necessary.

NOTICE

Oil levels should be checked every 24 hours of operation.

Proper oil drain schedules require oil be changed before the contaminant load becomes so great that the lubricating function of the oil is impaired or heavy disposition of suspended contaminants occurs. To check the condition of the oil, drain a sample into a clean container and check for the presence of water or solids. Slight discoloration of the oil should not necessitate an oil change.

SPARE PARTS

Should adjustments or replacement be needed, repairs can often be performed locally as described in this manual after obtaining the required parts. Personnel should have a good background of mechanical experience and be thoroughly familiar with the procedures outlined in this manual. For major repairs not covered in this manual, contact the nearest Tuthill Vacuum & Blower Systems service representative.

When ordering parts, supply the blower nameplate information, as well as the item number and parts description as per the parts lists and assembly drawings. Repair kits are available for all models. These kits contain all the seals, bearings, O-rings, locks, and special retaining screws necessary for an overhaul. For convenience when ordering parts, complete the **Operating Data Form** included on the inside back cover of this manual.

In developing a stock of spare parts, consider the following factors:

- The degree of importance in maintaining the blower in a “ready” condition
- The time lag in parts procurement
- Cost
- Shelf life (seals and O-rings)

FACTORY SERVICE AND REPAIR

With proper care, Tuthill Vacuum & Blower Systems blowers will give years of reliable service. The parts are machined to close tolerances and require special tools by mechanics who are skilled at this work. Should major repairs become necessary, contact the factory for the location of the nearest service facility. Blowers that are still under warranty must be returned to the factory, freight prepaid, for service.

NOTICE

Current regulations require Material Safety Data Sheet to be completed and forwarded to Tuthill Corporation on any unit being returned for any reason which has been handling or involved with hazardous gases or materials. This is for the protection of the employees of Tuthill Corporation who are required to perform service on this equipment. Failure to do so will result in service delays.

NOTICE

When returning a blower to the factory for repair, under warranty, please note the factory will not accept any unit that arrives without authorization. Contact the Service Department for return authorization.

LONG-TERM STORAGE

Any time the blower will be stored for an extended period of time, make sure it is protected from corrosion by following this procedure:

1. Spray the interior (lobes, housing, and end plates) with rust preventative. Repeat as conditions dictate and on an at least a yearly basis.
2. Fill both end covers completely full of oil.
3. Firmly attach a prominent tag stating that the end covers are full of oil and must be drained and refilled to proper levels before start-up.
4. Apply a rust-preventative grease to the drive shaft.
5. Spray all exposed surfaces, including the inlet and discharge flanges, with rust preventative.
6. Seal the inlet, discharge, and vent openings. It is not recommended that the blower be set in place, piped to the system, and allowed to remain idle for a prolonged amount of time. If any component is left open to the atmosphere, the rust preventative will escape and lose its effectiveness.
7. During storage, make sure the blower does not experience excessive vibration.
8. Attach a desiccant bag to one of the covers to prevent condensation from occurring inside the blower. Make sure any desiccant bag (or bags) is attached to the covers so that they will be removed before start-up of the blower.
9. Store the blower in an air conditioned and heated building if possible. If air conditioned and heated storage is not possible, make conditions as dry as possible.
10. If possible, rotate the drive shaft by hand at least monthly to prevent seals from setting in one position.

08

DISASSEMBLY AND REASSEMBLY

DISASSEMBLY OF BLOWER

⚠ WARNING

Before performing any repair or replacement, disconnect and lock out power.

With proper maintenance and lubrication, normal life expectancy for gears, bearings, and seals can be achieved. However, over time these parts must be repaired or replaced to maintain the efficiency of the blower. This section is written in a way that will allow you to completely disassemble the blower. The inspection of certain repairable or replaceable parts is referred to at the point of disassembly where these parts are exposed. If repair or replacement is deemed necessary at any point of inspection, appropriate instruction is given to achieve.

1. Remove the oil drain plugs in the bottom of the end covers and drain the oil.
2. Remove eight cap screws and remove the gear cover.

NOTE: It may be necessary to tap the sides with a mallet or wooden block to break the seal joint.

Gears are not exposed for visual inspection prior to disassembly.

Inspect the gears for the following:

- Broken teeth
- Chipped teeth
- Uneven wear
- Excessive wear
- Any other abnormalities

3. Position the blower with the drive gear on the left when facing the gears. Remove the socket-head screws and washers.
4. Align the timing marks, count 3 teeth up, and place reference marks on the gears (see ***Figure 8-1***).

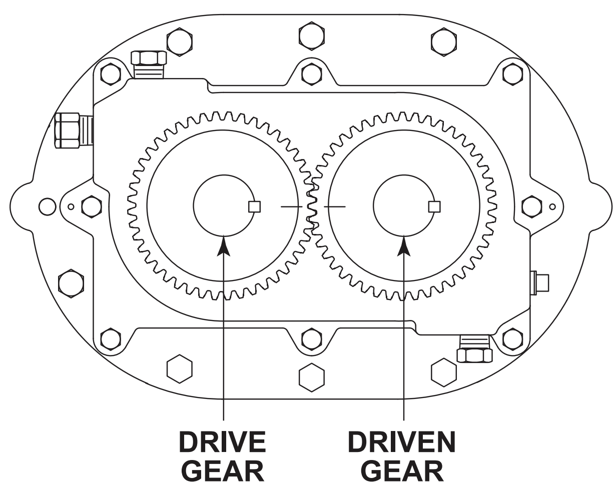


Figure 8-1 – Timing Marks Matched

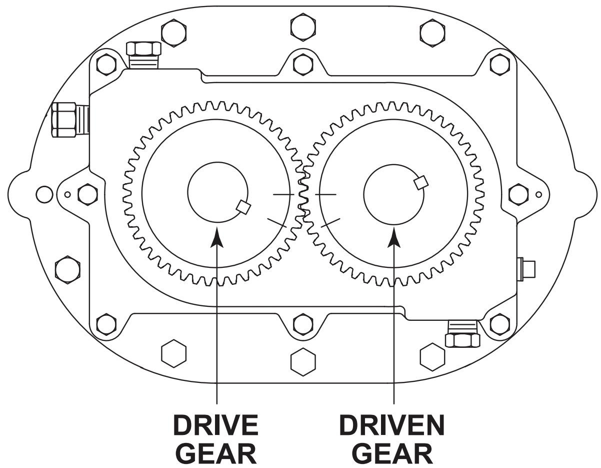


Figure 8-2 – Timing Marks Advanced 3 Teeth (Reference Marks Aligned)

5. Align the reference marks (see ***Figure 8-2***).
6. Use a puller to remove the driven gear. A bar puller or jaw puller (see ***Figure 8-3***) can be used.

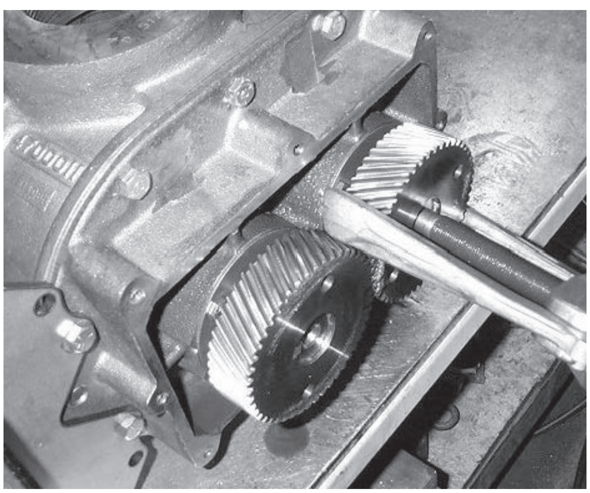


Figure 8-3 – Pulling Driven Gear with Jaw Puller or Bar Puller

7. Remove the drive gear using a bar puller or jaw puller (see ***Figure 8-4***).

Figure 8-4 – Pulling Driven Gear with Bar Puller

NOTE: If the unit becomes locked up, switch gears.

8. Remove the shim and spacer, and note from which shaft the shim is removed.
9. Turn the blower around and remove the 8 cap screws securing the drive end cover.
10. Remove the cover.
11. Loosen the set screws on the oil slingers and remove the oil slingers from the rotor shafts (see ***Figure 8-5***).

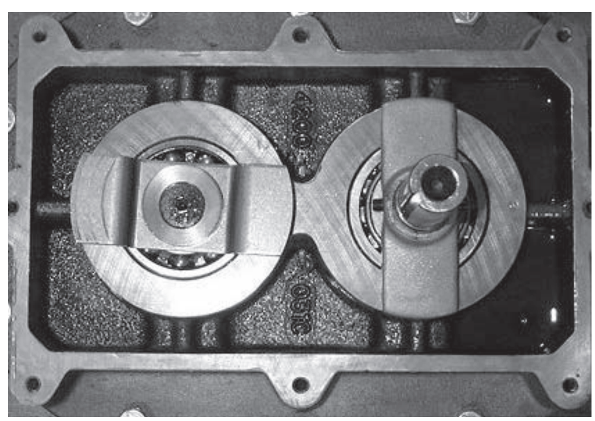


Figure 8-5 – Set Screws for Slingers

12. Remove the 10 cap screws that secure the drive end plate to the housing.

13. Use a jaw puller or jackscrews to remove the drive end plate (see ***Figure 8-6*** and ***Figure 8-7***).

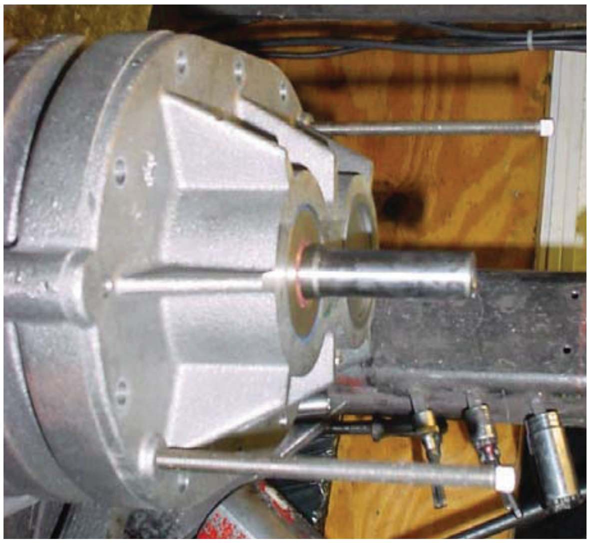


Figure 8-6 – Removing Drive End End Plate Using Jackscrews (21 Series)

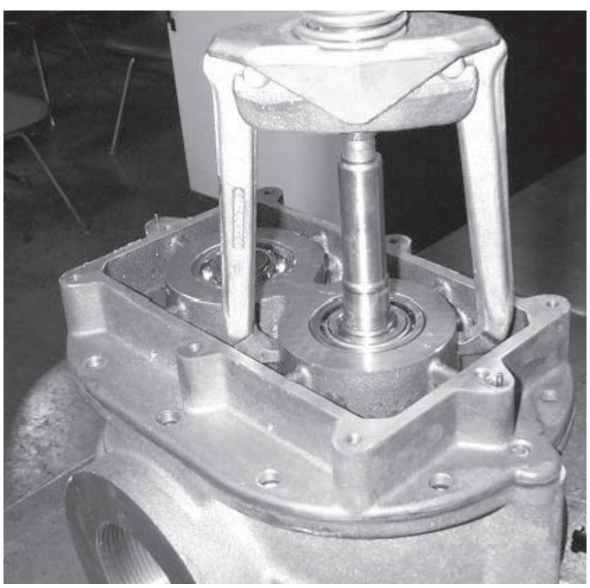


Figure 8-7 – Pulling Drive End Plate (22 Series)

14. Press the rotors out of the free (non-drive) end plate in press if available. If press is not available, support the end plate and rotors in the housing. Block up the housing and use a soft mallet to drive the rotors out (see ***Figure 8-8***). A jaw-type puller can also be used.

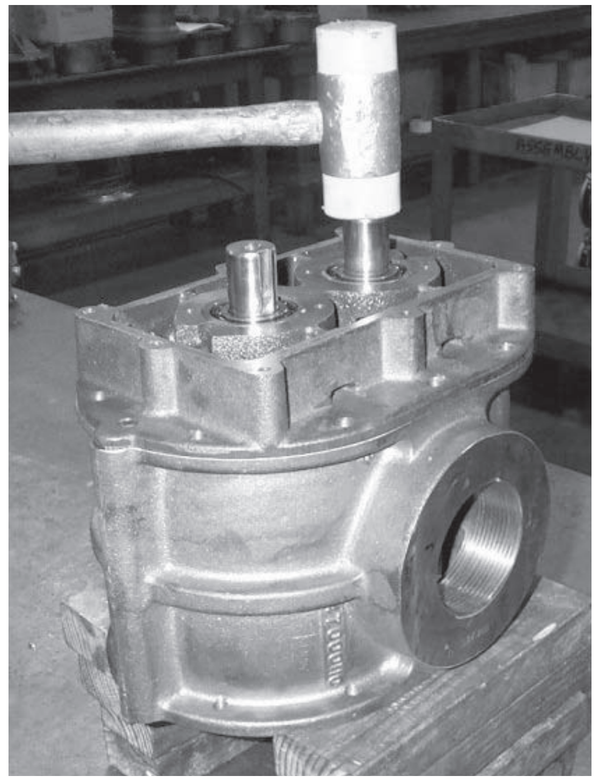


Figure 8-8 – Driving Rotors Out Using Soft Mallet

15. Using a tube or round bar of a slightly smaller diameter than the shaft clearance holes in the end plates, tap the bearings out of the end plates. Remove the bearing retainers before knocking out the bearings (see ***Figure 8-9***).

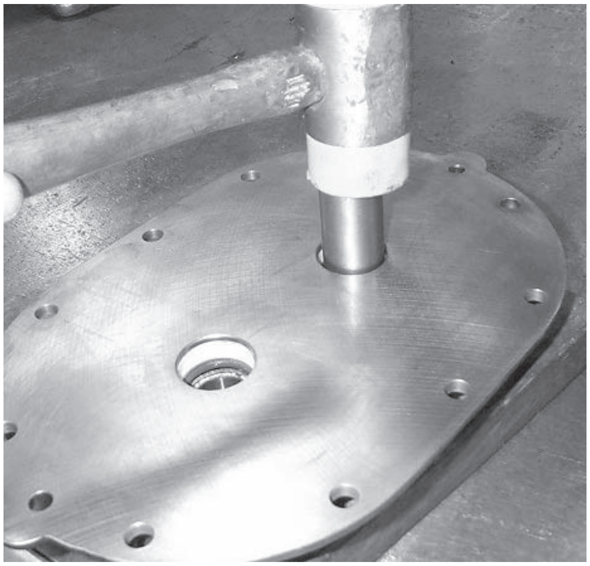


Figure 8-9 – Tapping Bearings Out of End Plates

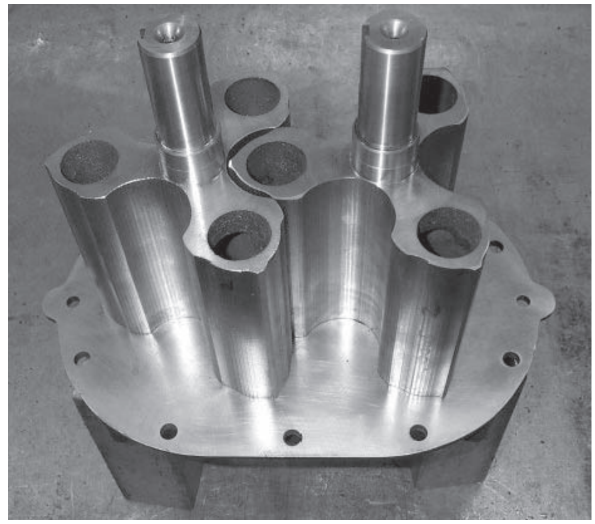


Figure 8-10 – Rotors Assembled on Drive End Plate (Model 4000 with Tri-Lobe Rotors Shown)

16. Remove the seals from both end plates with a punch or dull chisel. The seals will be damaged during removal and must be replaced. Inspect all parts for wear or damage.
17. Clean and inspect all parts for burrs, and polish the seal journals with at least 320-grit emery or crocus cloth.

REASSEMBLY OF BLOWER

After thoroughly cleaning the seal and bearing bores of both end plates, apply a thin coat of sealant on the outside diameter of the new seals and press them into the end plate using a tool that will bear on the outer edge of the seal. The spring side of the seal should be facing you. Apply a thin coat of grease to the seal lip.

See ***Special Tool Drawings on page 44*** for drawings and dimensions of the seal and bearing pressing tools.

Using the drive end plate as a fixture, support the plate high enough so the input shaft of the drive rotor clears the assembly surface (see ***Figure 8-10***). Place the rotors in the fixture with the drive rotor to the left (see ***Figure 8-10*** and ***Figure 8-14***).

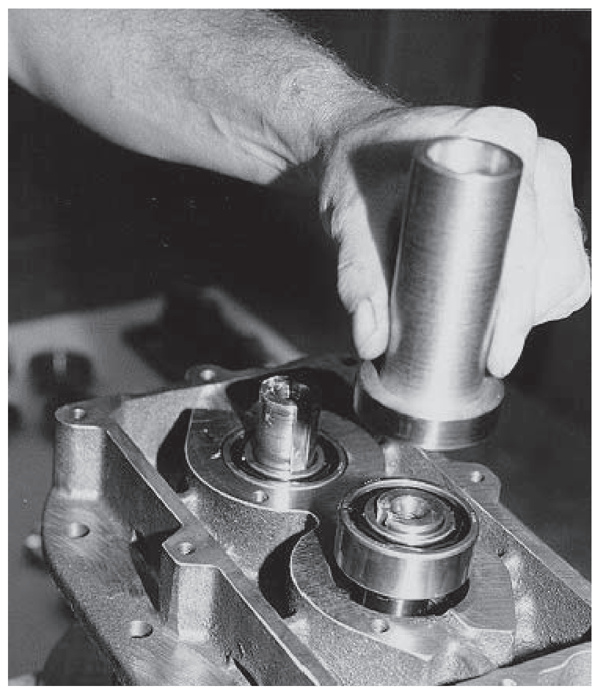


Figure 8-11 – Tapping Bearings into End Plates

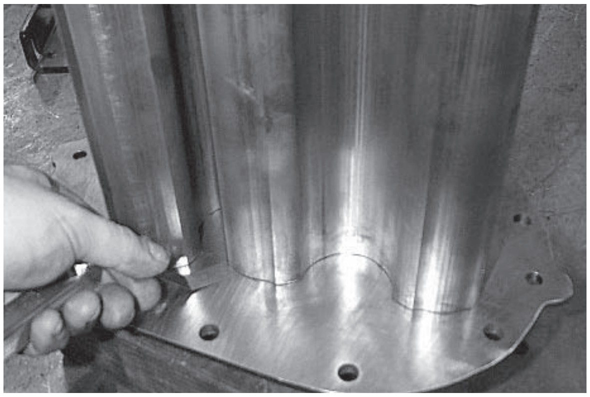


Figure 8-12 – Checking Gear End Clearances

Figure 8-13 – Check Drive End Clearances

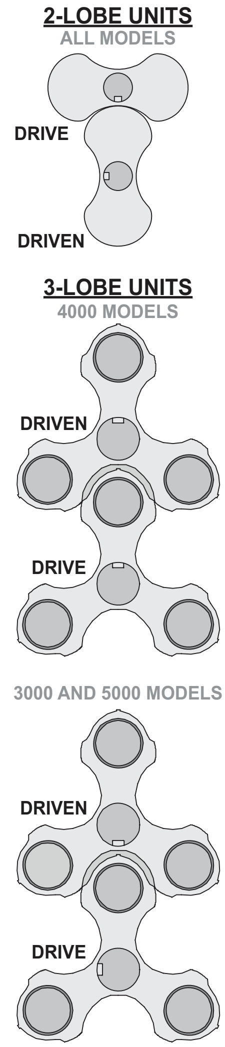


Figure 8-14 – Rotor Keyway Positions

1. Place end plate on rotors.
2. Apply a thin coat of lubricant on the rotor shafts and the inner race of the bearings. Tap the bearings into place using a tube with a flanged end that will contact both the inner and outer bearing races (see ***Figure 8-11***).
3. Install bearing retainers to both bearings.
4. Check clearances between the end of the rotors and the face of the end plate. ***See Assembly Clearances on page 40*** for proper clearances for your model blower.

5. If clearances check OK, put a spacer on each shaft. Timing shims that were removed should be put back on the shaft from which they were removed.

6. Add keys to keyways.

7. Lubricate shafts and bores on gears. Begin by pressing on the DRIVE gear. This will be pressed on the drive rotor, which is to the left.

8. Start the driven gear on the shaft and align the reference timing marks and press gear on. Lock gears in place with socket head screw and washer. Turn assembly over and rest the unit on the socket head screws and washers on the gear end, securing the unit with support blocks.

9. Set dowel pins in housing and position housing over the rotors and fasten with cap screws. Check drive end clearance (see ***Figure 8-13***). A depth mic can be used.

10. Press seals into drive endplate.

11. Set on drive end plate and fasten with cap screws.

12. Lubricate shafts and bearings. Install the ball bearing on the driven rotor and the roller bearing on the input shaft. Install oil slingers to appropriate rotors.

NOTE: Oil slingers are on the Splash Lubrication/ Air Service models only. The Grease Lubrication/Air Service blowers will not have oil slingers.

13. Apply a bead of a good quality RTV silicone sealant to the inner surface of the drive end cover that mates to the drive end plate. Install drive end cover and drive shaft seal.

14. Install any removed plugs and sight glasses, and replace breather if required.

⚠ WARNING

Keep hands and loose clothing away from lobes and gears.

Adjusting Rotor Interlobe Clearance

1. Use feeler gauges to take interlobe readings, and record them on each side of housing as indicated in ***Figure 8-15***. As shim is removed or added behind the helical gear, the gear rotates as it is moved in or out and the driven rotor turns with it, thus changing the clearance between rotor lobes.

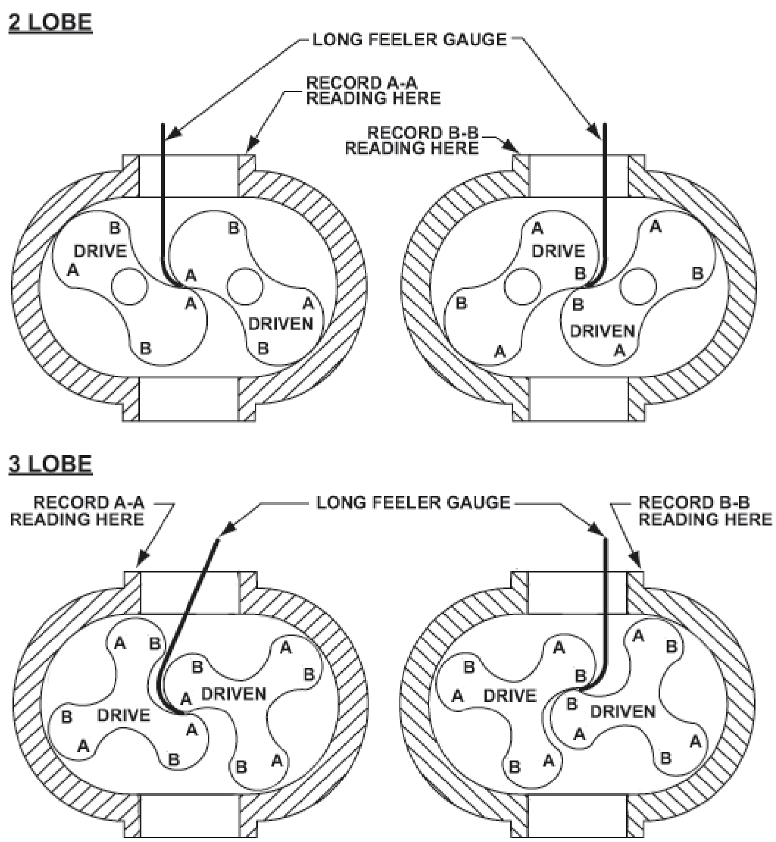


Figure 8-15 – Checking Rotor Interlobe Clearances

2. Changing the shim thickness will change the rotor lobe clearance.

3. To determine the amount of shim to add or remove, subtract the smaller value from the larger value.

<u>*EXAMPLE:*</u> Referring to ***Figure 8-15***, check the clearance at AA (right-hand reading) and BB (left-hand reading). If the AA reading is 0.009 in. (0.23 mm) and the BB reading 0.003 in. (0.08 mm), adjust by removing 0.006 in. (0.15 mm) shims from the driven rotor. The readings will change one half the amount removed: 0.003 in. (0.08 mm). AA should then read 0.006 in. (0.15 mm) and BB should read 0.006 in. (0.15 mm). The final readings should be within 0.002 in. (0.05 mm) of each other.

MODEL	CHANGE	SHIM CHANGE
2000	1	1
3000/4000/5000	1	1
6000	1	1.5
7000	1	1.8

NOTE: Both the drive and driven gears can be shimmed.

Lubrication, Final Assembly and Mounting

1. Apply a bead of a high-quality RTV silicone sealant to the inner surface of the gear end cover that mates to the gear end plate. Install the gear end cover with cap screws and tighten evenly.

2. Fill both end covers with oil. ***See Lubrication on page 15*** for the filling procedure, and see ***Recommended Lubricants on page 42*** for recommended lubricants.

3. To make sure the blower has not been distorted during mounting in the installation, turn the lobes by hand to make sure they are not making contact before connecting to the driver.

09

TROUBLESHOOTING

Although Tuthill Vacuum & Blower Systems blowers are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The following chart lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Loss of oil	Gear housing not tightened properly	Tighten gear housing bolts.
	Lip seal failure	Disassemble and replace lip seal.
	Insufficient sealant	Remove gear housing and replace sealant. ***See Disassembly of Blower on page 30***.
	Loose drain plug	Tighten drain plug.
Excessive bearing or gear wear	Improper lubrication	Correct oil level. Replace dirty oil. ***See Lubrication on page 15***.
	Excessive belt tension	Check belt manufacturer's specifications for tension and adjust accordingly.
	Coupling misalignment	Check carefully. Re-align if necessary.
Lack of volume	Slipping belts	Check belt manufacturer's specifications for tension and adjust accordingly.
	Worn lobe clearances	Check for proper clearances. ***See Assembly Clearances on page 40***.
	Speed too low	Increase blower speed within limits.
	Obstruction in piping	Check system to ensure an open flow path.
Knocking	Blower out of time	Re-time.
	Distortion due to improper mounting or pipe strains	Check mounting alignment and relieve pipe strains.
	Excessive pressure differential	Reduce to manufacturer's recommended pressure. Examine relief valve and reset if necessary.
	Worn gears	Replace timing gears. ***See Disassembly of Blower on page 30***.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Excessive blower temperature	Too much or too little oil in gear reservoir	Check oil level. ***See Lubrication on page 15***.
	Too low operating speed	Increase blower speed within limits.
	Clogged filter or silencer	Remove cause of obstruction.
	Excessive pressure differential	Reduce pressure differential across the blower.
	Elevated inlet temperature	Reduce inlet temperature.
	Worn lobe clearances	Check for proper clearances. ***See Assembly Clearances on page 40***.
Rotor end or tip drag	Insufficient assembled clearances	Correct clearances. ***See Assembly Clearances on page 40***.
	Case or frame distortion	Check mounting and pipe strain.
	Excessive operating pressure	Reduce pressure differential.
	Excessive operating temperature	Reduce pressure differential or reduce inlet temperature.
Vibration	Belt or coupling misalignment	Check carefully. Re-align if necessary.
	Lobes rubbing	Check cylinder for hot spots, and then check for lobe contact at these points. Correct clearances. ***See Assembly Clearances on page 40***.
	Worn bearings or gears	Check condition of gears and bearings. Replace if necessary.
	Unbalanced or rubbing lobes	Possible build-up on casing or lobes, or inside lobes. Remove build-up and restore clearances.
	Driver or blower loose	Check mounting and tighten if necessary.
	Piping resonance	Check pipe supports, check resonance of nearby equipment, and check foundation.

10

ASSEMBLY CLEARANCES

MODEL	LOBES TO END PLATES			INTERLOBE	LOBE TO CASING	
	DRIVE END	GEAR END	TOTAL		TIP-DOWEL	TIP-PORT
2002	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.003 – 0.005 in. (0.08 – 0.13 mm)	0.008 – 0.011 in. (0.20 – 0.28 mm)	0.005 – 0.009 in. (0.13 – 0.23 mm)	0.002 – 0.004 in. (0.05 – 0.10 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)
2004	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.003 – 0.005 in. (0.08 – 0.13 mm)	0.008 – 0.011 in. (0.20 – 0.28 mm)	0.005 – 0.009 in. (0.13 – 0.23 mm)	0.002 – 0.004 in. (0.05 – 0.10 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)
3002	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.003 – 0.005 in. (0.08 – 0.13 mm)	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.006 – 0.012 in. (0.15 – 0.30 mm)	0.002 – 0.005 in. (0.05 – 0.13 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)
3003	0.005 – 0.008 in. (0.13 – 0.20 mm)	0.003 – 0.005 in. (0.08 – 0.13 mm)	0.009 – 0.012 in. (0.23 – 0.30 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.002 – 0.005 in. (0.05 – 0.13 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)
3006	0.006 – 0.010 in. (0.15 – 0.25 mm)	0.003 – 0.005 in. (0.08 – 0.13 mm)	0.010 – 0.013 in. (0.25 – 0.33 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.002 – 0.005 in. (0.05 – 0.13 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)
4002	0.004 – 0.009 in. (0.10 – 0.23 mm)	0.004 – 0.006 in. (0.10 – 0.15 mm)	0.009 – 0.013 in. (0.23 – 0.33 mm)	0.012 – 0.016 in. (0.30 – 0.41 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)	0.005 – 0.008 in. (0.13 – 0.20 mm)
4005	0.005 – 0.010 in. (0.12 – 0.25 mm)	0.004 – 0.006 in. (0.10 – 0.15 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.012 – 0.016 in. (0.30 – 0.41 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)	0.005 – 0.008 in. (0.13 – 0.20 mm)
4007	0.005 – 0.010 in. (0.12 – 0.25 mm)	0.004 – 0.006 in. (0.10 – 0.15 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.012 – 0.016 in. (0.30 – 0.41 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)	0.005 – 0.008 in. (0.13 – 0.20 mm)
5003	0.004 – 0.009 in. (0.10 – 0.23 mm)	0.004 – 0.006 in. (0.10 – 0.15 mm)	0.009 - 0.013 in. (0.29 - 0.33 mm)	0.014 – 0.018 in. (0.36 – 0.46 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)	0.005 – 0.008 in. (0.13 – 0.20 mm)
5006	0.005 – 0.010 in. (0.13 – 0.25 mm)	0.004 – 0.006 in. (0.10 – 0.15 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.014 – 0.018 in. (0.36 – 0.46 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)	.005 – .008 in. (0.13 – 0.20 mm)
5009	0.005 – 0.010 in. (0.13 – 0.25 mm)	0.004 – 0.006 in. (0.10 – 0.15 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.014 – 0.018 in. (0.36 – 0.46 mm)	0.003 – 0.006 in. (0.08 – 0.15 mm)	0.005 – 0.008 in. (0.13 – 0.20 mm)
6005	0.008 – 0.013 in. 0.20 – 0.33 mm)	0.005 – 0.007 in. (0.12 – 0.18 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.006 – 0.009 in. (0.15 – 0.23 mm)
6008	0.008 - 0.013 in. (0.20 - 0.33 mm)	0.005 – 0.007 in. (0.12 – 0.18 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.006 – 0.009 in. (0.15 – 0.23 mm)
6015	0.009 – 0.014 in. (0.23 – 0.36 mm)	0.005 – 0.007 in. (0.13 – 0.18 mm)	0.016 – 0.020 in. (0.40 – 0.50 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.006 – 0.009 in. (0.15 – 0.23 mm)
7006	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.005 – 0.007 in. (0.13 – 0.18 mm)	0.015 – 0.018 in. (0.38 – 0.46 mm)	0.012 – 0.016 in. (0.30 – 0.41 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.006 – 0.009 in. (0.15 – 0.23 mm)
7011	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.005 – 0.007 in. (0.13 – 0.18 mm)	0.017 – 0.020 in. (0.43 – 0.51 mm)	0.012 – 0.016 in. (0.30 – 0.41 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.006 – 0.009 in. (0.15 – 0.23 mm)
7018	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.005 – 0.007 in. (0.13 – 0.18 mm)	0.017 – 0.020 in. (0.43 – 0.51 mm)	0.012 – 0.016 in. (0.30 – 0.41 mm)	0.004 – 0.007 in. (0.10 – 0.18 mm)	0.006 – 0.009 in. (0.15 – 0.23 mm)

11

TORQUE CHART

Data shown represents “wet” torque values in foot-pounds and *(Newton-meters)*.

PART DESCRIPTION	TORQUE
CAP SCREW 10-32UNF	3 ft-lb *(4 N-m)*
CAP SCREW 1/4"-20UNC GR5	6 ft-lb *(8 N-m)*
CAP SCREW 5/16"-18UNC GR5	13 ft-lb *(17 N-m)*
CAP SCREW 3/8"-16UNC GR5	23 ft-lb *(31 N-m)*
CAP SCREW 1/2"-13UNC GR5	57 ft-lb *(77 N-m)*
CAP SCREW 5/8"-14UNC GR5	113 ft-lb *(153 N-m)*
CAP SCREW 3/4"-10UNC GR5	200 ft-lb *(271 N-m)*

12

RECOMMENDED LUBRICANTS

RECOMMENDED LUBRICANTS FOR ROTARY BLOWERS AND VACUUM BOOSTERS

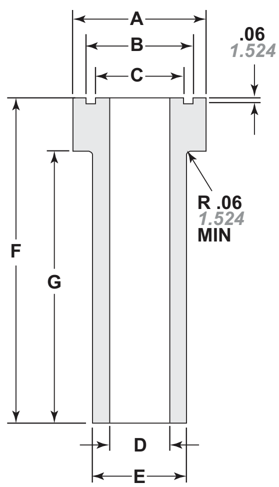
RECOMMENDED SYNTHETIC BASED LUBRICANTS FOR BLOWERS				
AMBIENT TEMPERATURE	**TUTHILL**	**VISCOSITY GRADE**	**ISO 100**	**ISO 150**
0° to 32°F (-18° to 0°C)	PneuLube™ (ISO 100)	Specific Gravity 16°C (62°F)	0.859	0.865
32° to 90°F (0° to 32°C)		Viscosity 40°C (104°F)	91.8 cSt	142.7 cSt
90° to 120°F* (32° to 50°C)		Viscosity 100°C (212°F)	13.1 cSt	18.0 cSt
		Viscosity Index	142	140
		Pour Point	-51°C (-60°F)	-51°C (-60°F)
		Flash Point	246°C (475°F)	246°C (475°F)
		Copper Corrosion Rating	1A	1A

RECOMMENDED SYNTHETIC BASED, FOOD GRADE LUBRICANTS FOR BLOWERS		
AMBIENT TEMPERATURE	**LUBRICANT MEETING U.S. FDA REGULATION 21 CFR 178.3570 GOVERNING PETROLEUM PRODUCTS WHICH MAY HAVE INCIDENTAL CONTACT WITH FOOD, AND USDA H1 REQUIREMENTS**	**LUBRICANT MEETING U.S. FDA REGULATIONS 21 CFR 172.878 AND 178.3620(A) FOR DIRECT AND INDIRECT FOOD CONTACT**
0° to 32°F (-18° to 0°C)	PneuLube™ FG (ISO 100)	CONSULT FACTORY
32° to 90°F (0° to 32°C)		
90° to 120°F* (32° to 50°C)		

RECOMMENDED LUBRICANTS FOR M-D VACUUM BOOSTERS	
REQUIREMENTS	
• Suitable for high vacuum service • 100 cSt @ 40°C • Vapor pressure of 1 micron or less @ 70°F (21°C) • Straight mineral (no additives) or PAO synthetic oil	
RECOMMENDED GREASE FOR CP BLOWERS:	
TUTHILL	
Tuthill PneuLube™ NLGI #2 premium grade, petroleum base lithium grease.	Food Grade HTEP grease, NLGI No. 2 grade. Must meet all requirements of FDA Regulation 21 CFR 178.3570 (the former USDA H-1 approval requirements) for lubricants having incidental contact with food.
* For higher ambient temperatures, please consult the factory.	
RECOMMENDED OIL FOR OXYGEN-ENRICHED SERVICE	
Blowers used in oxygen-enriched service should use only non-flammable, PFPEsynthetic lubricant. Blowers used in hydrogen service should use only PneuLube synthetic oil. Tuthill Vacuum & Blower Systems cannot accept responsibility for damage to seals, O-rings and gaskets caused by use of synthetic lubricants not recommended by Tuthill Vacuum and Blower Systems	

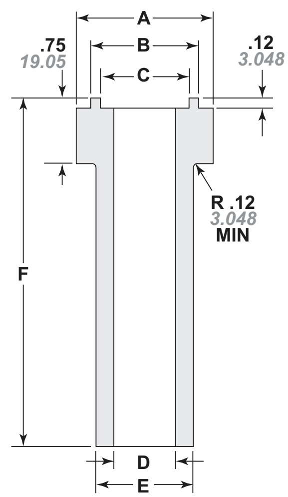
13

SPECIAL TOOL DRAWINGS



MODEL	A ±.001 ± 0.0254	B ±.005 ± 0.127	C ±.005 ± 0.127	D ±.005 ± 0.127	E ±.005 ± 0.127	F ±.005 ± 0.127	G ±.005 ± 0.127
2000	1.560 39.624	1.27 32.258	.98 24.892	.70 17.78	1.10 27.94	3.50 88.9	3.00 76.2
3000	2.035 51.689	1.70 43.18	1.335 33.909	1.015 25.781	1.415 35.941	3.75 95.25	3.00 76.2
4000	2.425 61.595	2.02 51.308	1.61 40.894	1.21 30.734	1.61 40.894	4.50 114.3	3.75 95.25
5000	2.820 71.628	2.42 61.468	1.81 45.974	1.41 35.814	1.81 45.974	5.00 127	4.25 107.95
6000	3.135 79.629	2.73 69.342	2.00 50.8	1.605 40.767	2.00 50.8	6.25 158.75	5.50 139.7
7000	3.525 89.535	2.98 75.692	2.46 62.484	1.605 40.767	2.00 50.8	6.25 158.75	5.50 139.7

Figure 13-1 – Bearing Pressing Tool



MODEL	A ±.001 ± 0.0254	B ±.005 ± 0.127	C ±.005 ± 0.127	D ±.005 ± 0.127	E ±.005 ± 0.127	F ±.005 ± 0.127
2000	1.560 39.624	1.24 31.496	1.04 26.416	.70 17.78	1.10 27.94	4.00 101.6
3000	2.035 51.689	1.74 44.196	1.54 39.116	1.015 25.781	1.415 35.941	4.37 110.99
4000	2.425 61.595	1.865 47.371	1.665 42.291	1.21 30.734	1.61 40.894	5.25 133.35
5000	2.820 71.628	2.427 61.645	2.227 56.565	1.41 35.814	1.81 45.974	5.68 144.272
6000	3.135 79.629	2.74 69.596	2.54 64.516	1.605 40.767	2.00 50.8	7.00 177.8
7000	3.525 89.535	2.99 75.946	2.79 70.866	1.605 40.767	2.00 50.8	7.00 177.8

Figure 13-2 – Seal Pressing Tool

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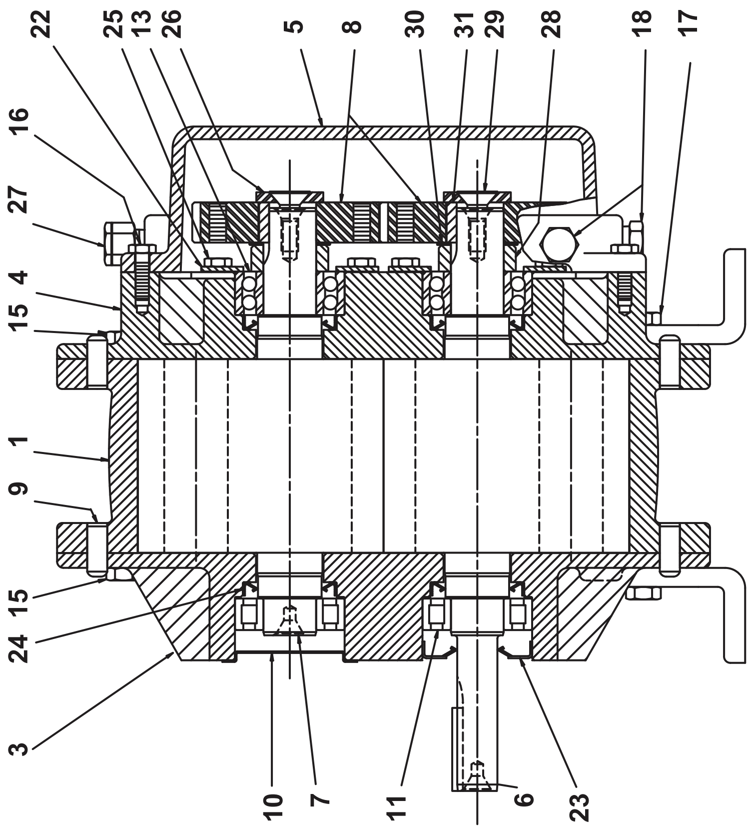
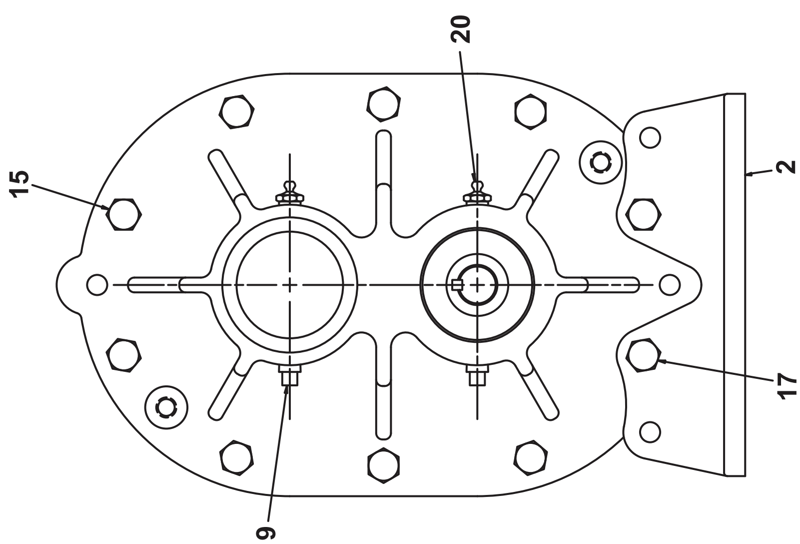
Cutaway Drawing for Grease Lubrication / Air Service





PARTS LIST

Parts List for Model CP Series – Grease Lubrication / Air Service

ITEM NO.	PART DESCRIPTION	QTY
1	Housing	1
2	Mounting Foot	2
3	Drive End Plate	1
4	Gear End Plate	1
5	Gear Cover	1
6	Drive Rotor	1
7	Driven Rotor	1
8	Gear Set	1
9	Dowel Pin	4
10	Cover Grease	1
11	Bearing	1
12*	Bearing	1
13	Bearing	2
15	Screw, Socket Head	14
16	Screw, Socket Head	8
17	Screw, Socket Head	6
18	Pipe Plug	3
18	Magnetic Plug	2
19	Relief Fitting	2
20	Grease Fitting	2
22	Bearing Retainer	2
23	Lip Seal	1
24	Lip Seal	4
25	Screw, Hex Head	8
26	Washer	2
27	Breather	1
28	Spacer	2
29	Cap Screw	2
30	Shim	6
30	Shim	2
30	Shim	2
31	Key Gear	2
42*	Nameplate	1

ITEM NO.	PART DESCRIPTION	QTY
45*	Lifting Lug	2

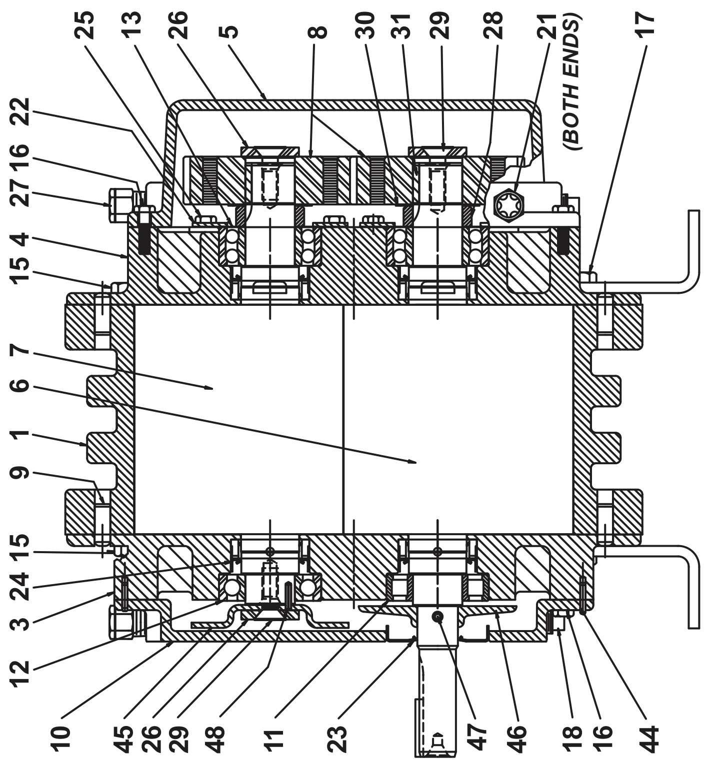
* Not shown

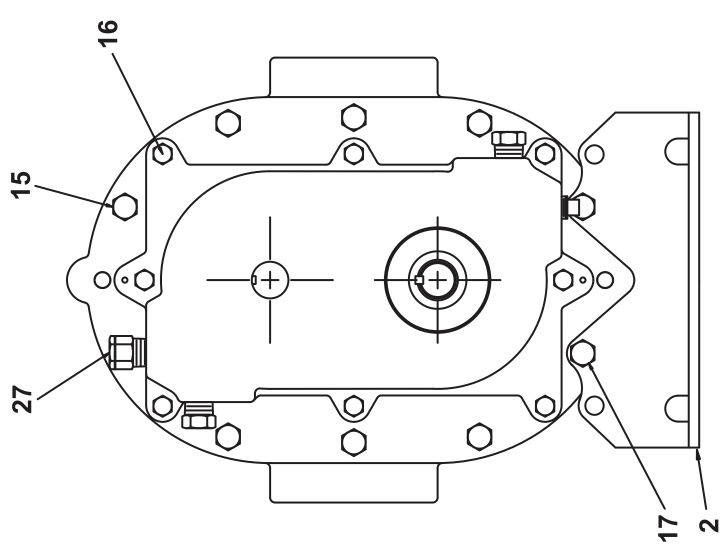
NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES. QUANTITIES MAY VARY BETWEEN BLOWER.

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

Cutaway Drawing for Splash Lubrication / Air Service





Parts List for Model CP Series – Splash Lubrication / Air Service

ITEM NO.	PART DESCRIPTION	QTY
1	Housing	1
2	Mounting Foot	2
3	Drive End Plate	1
4	Gear End Plate	1
5	Gear End Cover	1
6	Drive Rotor	1
7	Driven Rotor	1
8	Gear Set	1
9	Dowel Pin	4
10	Drive End Cover	1
11	Bearing	1
12	Bearing	1
13	Bearing Ball	2
15	Screw, Socket Head	14
16	Screw, Socket Head	16
17	Screw, Socket Head	6
18	Pipe Plug	8
18	Magnetic Plug	4
21	Oil Sight Glass	4
22	Bearing Retainer	2
23	Lip Seal	1
24	Lip Seal	4
25	Screw, Hex Head	8
26	Washer	3
27	Breather	2
28	Spacer	2
29	Cap Screw	3
30	Shim	6
30	Shim	2
30	Shim	2
31	Key Gear	2
42*	Nameplate	1
44	Roll Pin	2
45*	Lifting Lug	2
46*	Slinger Oil-2, Machine-1	2
48*	Roll Pin	2

* Not shown

NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES. QUANTITIES MAY VARY BETWEEN BLOWER.

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

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Tuthill
PUMP YOUR HEART INTO IT

4840 W. KEARNEY ST., SPRINGFIELD, MO 65803 • P (417) 865-8715 • F (417) 865-2950

CE

DECLARATION OF INCORPORATION

Herewith we declare that the items detailed below are in conformity with the provisions of the Machinery Directive 2006/42/EC.

Information on the items detailed are compiled per the Machinery Directive 2006/42/EC, Annex VII, part A and are the responsibility of the person listed below.

The items detailed below must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the relevant directive(s).

Other directives and standards that apply to this Declaration of Incorporation:

EN 1012-1:1996 - Compressors and vacuum pumps - Safety requirements - Part 1: Compressors

The scope of the Declaration of Incorporation is for bare shaft Rotary Positive Displacement (CP Series) Blowers

2000, 3000, 4000, 5000, 6000, 7000

David L. Schardt

David Schardt
Vice President of Engineering
Tuthill Vacuum & Blower Systems

WARRANTY – BLOWER PRODUCTS

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Vacuum & Blower Systems (the Seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation)

PRODUCT TYPE	**TYPE OF APPLICATION**	
	ATMOSPHERIC AIR OR PROCESS AIR WITHOUT LIQUIDS PRESENT	**PROCESS GASES OTHER THAN AIR, OR ANY LIQUID INJECTED APPLICATION**
New *(Qx™ models only)*	30 months from date of shipment, or 24 months after initial startup date, whichever occurs first.	Consult Factory
New *(all other models)*	24 months from date of shipment, or 18 months after initial startup date, whichever occurs first	18 months from date of shipment, or 12 months after initial startup date, whichever occurs first
Repair/Reman	12 months from date of shipment, or remaining warranty period, whichever is greater	12 months from date of shipment, or remaining warranty period, whichever is greater

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

May 2008

OPERATING DATA FORM / PRODUCT REGISTRATION

It is to the user's advantage to have the requested data filled in below and available in the event a problem should develop in the blower or the system. This information is also helpful when ordering spare parts.

Model No. ____________________ V-Belt Size ____________________ Length __________

Serial No. ____________________ Type of Lubrication ____________________

Start-up Date ____________________ ____________________

Pump RPM ____________________ Operating Vacuum ____________________

Pump Sheave Diameter ____________________ Any Other Special Accessories Supplied or in Use:

Motor Sheave Diameter ____________________ ____________________

Motor RPM __________ HP __________ ____________________

NOTES: ____________________

____

____

____

IMPORTANT

All blowers manufactured by Tuthill Vacuum & Blower Systems are date-coded at time of shipment. In order to assure you of the full benefits of the product warranty, please complete, tear out and return the product registration card, or register online at **tuthillvacuumblower.com**.

Technical Support: 1-877-955-TECH (8324)

Service & Repair or Product Sales:

Tuthill Vacuum & Blower Systems
4840 West Kearney Street
Springfield, Missouri USA 65803-8702
O 417.865.8715   800.825.6937
F 417.865.2950
www.tuthillvacuumblower.com

Manual 2017 Rev C p/n 2017
4/18

SEPARATOR START-UP INSTRUCTIONS

1. Before putting hydrocarbon contaminated water through the separator, it should first be primed with clean, cold water to prevent contamination of the outlet piping.
2. Check the product draw off elbows for proper adjustment. The product draw off elbows should be approximately 1/2" - 3/4" above the water level in the separator at its operating, flow. To simplify the adjustment, the operator may choose to turn the elbows to their highest position to insure that water cannot be skimmed into the product storage compartment. The elbows can then be readjusted to skim the product layer. It is a good idea to leave 1/2" - 3/4" layer of product in the separator to insure that only clean product is skimmed into the product storage compartment.
3. The separator has one 1-1/2" vents on the separator which have to be piped to the outside of the building to prevent abnormal operation of the separator due to pressurizaton. Consult local codes for standards covering placement and sizing of tank vent piping.
4. There is a 1-1/4" product drain port that will have to be piped and fitted with a valve to allow the accumulated product to be pumped by a scavenger service.
5. Separator should be installed on a level pad. It should be level to within a 1/4" over the lenght of the separator and 1/8" over the width of the separator.

SEPARATOR MAINTENANCE

The MKE corrugated plate Oil/Water Separator contains no moving parts and the adjustable product draw off elbows are set at the time of start-up; therefore, there is very little maintenance required. Once the Separator is put into operation, it should never be allowed to stand dry. If the unit is to be taken out of service or cleaned, the following procedures should be used to minimize the amount of contamination of the outlet side of the unit.

1. Turn the product draw off elbows down to skim off all product.
2. Pump all oil out of the product holding compartment.
3. Open the two drain valves to remove any sediment and the water in the Separator.

   (Note: The water in the Separator may contain dissolved contaminants and should be dealt in an appropriate manner.)
4. A high pressure water hose may be used to clean sludge from the Separator. The packing can be removed for further cleaning and inspection.
5. Replace all packing, close all valves, and fill with clean, cold water.

Fulflo® CB Filter Vessels

- Carbon Steel
- 304 Stainless Steel

Bag Filter Vessel Series

CB Model Bag Filter Vessels are Designed for Economical Filtration of a Wide Variety of Industrial Liquids

The CB bag filter vessel series is an economical design that features the integrity of a bolted closure. The CB series is available in either carbon steel or 304 stainless steel. Both models have zinc plated closure bolts and zinc plated legs for corrosion resistance. The integral basket support provides a smooth interior for easy cleaning and bag installation. The CB is for use with either single or double length bags with flex type bag bands and can also be used with solid ring and plastic ring bags by using the optional bag sealing insert and adding an o-ring under the basket rim. The adjustable legs offer installation flexibility by allowing various inlet elevations and nozzle orientations.

Applications

- Potable Water
- Process Water
- Edible Oils
- Coatings
- Lubricants
- Coolants
- Cutting Oils
- Solvents

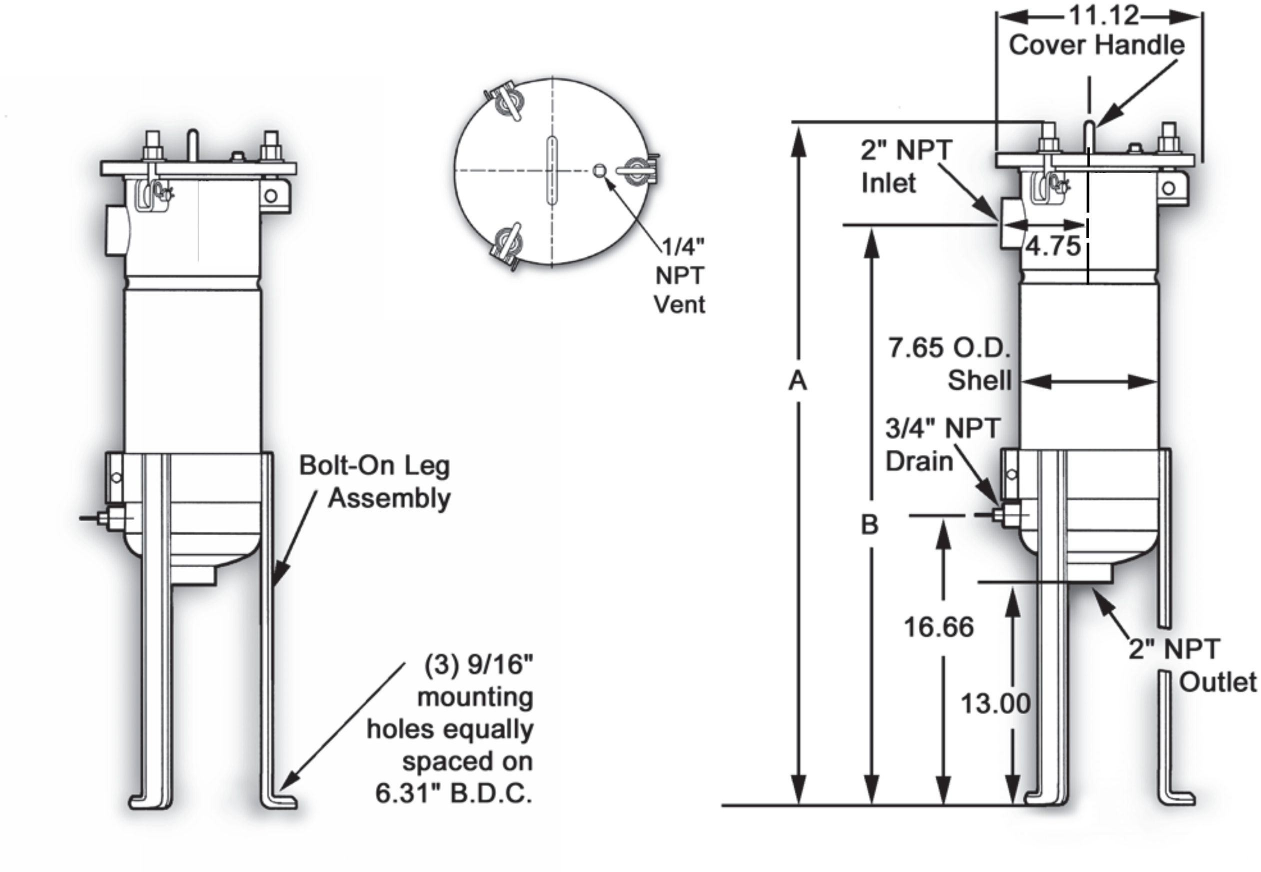
Features and Benefits

- Single o-ring design closure assures quick, positive cover sealing.
- Swing bolts for fast, easy and safe opening and closing of cover.
- Buna-N o-ring standard with optional EPR and Viton*.
- Maximum design pressure is 175 psi (12 bar) at 250°F** (121°C).
- Good manufacturing practice industrial design.
- Threaded vent and drain connections.
- Carbon steel with zinc plated support basket or 304SS with 316SS support basket.
- Adjustable leg height.
- Side inlet allows cover to open without disconnecting piping.
- Integral basket support design provides a smooth interior for easy wash-out and cleaning.
- Pivot pin cover allows cover to remain attached when opened.
- Positive seal of "C" style flex band bags prior to closing the vessel cover.
- Optional hold-down assembly for conversion to solid ring and plastic ring style bags.
- Zinc plated closure bolts and legs for corrosion resistance.

Process Filtration Division

Bulletin C-5006 Effective 08/02

Parker Filtration



Design Specifications

Model	Bag Style	Typical Aqueous Flow+(gpm)	Dimensions *(in)* A	Dimensions *(in)* B	Shipping Weight (lbs)	Volume (gallons)
CB11-2	Single	80	40.50	33.25	65	4.3
CB12-2	Double	160	55.50	48.25	90	7.2

+Actual flow rate is dependent on fluid viscosity, micron rating, contaminant and media type. Consult flow charts for each application.

Ordering Information

4	CB	11 —	2
Material	*Model*	*Media Requirement*	*Inlet/Outlet Size*
No Symbol = Carbon Steel 4 = 304 Stainless Steel		11 = One Single Bag 12 = One Double Bag	2" NPT

Process Filtration Division

* A trademark of E. I. du Pont de Nemours & Co.

** Operating temperature limited to 250°F (121°C) by standard Buna-N O-ring and exterior paint on carbon steel models. Optional O-ring materials are available.

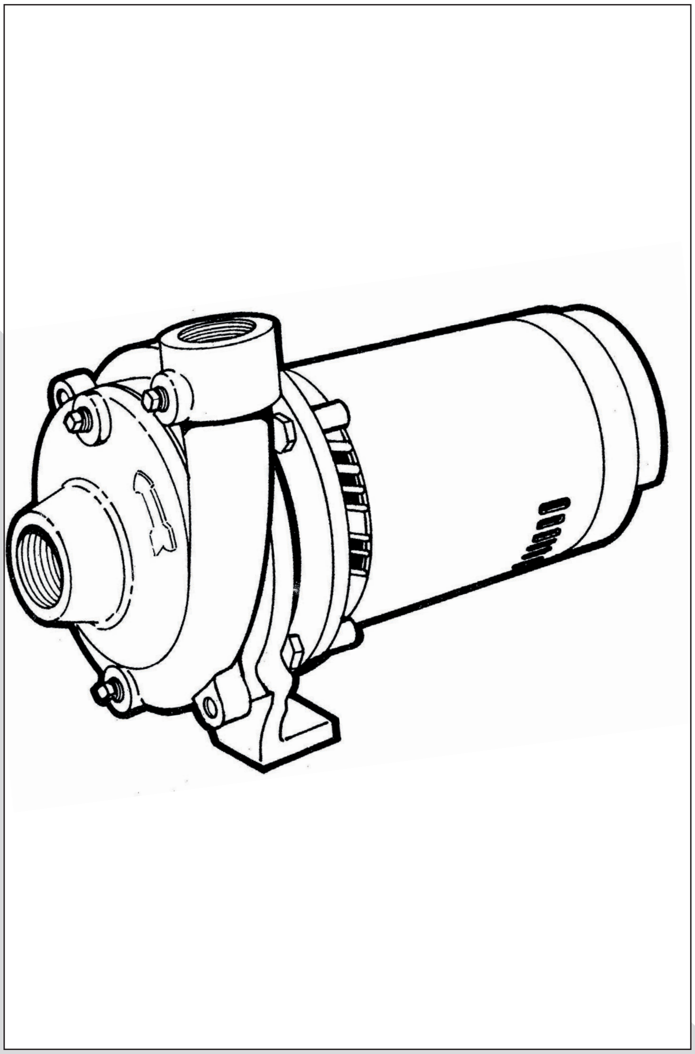
Parker Hannifin Corporation
Process Filtration Division
6640 Intech Boulevard
Indianapolis, Indiana 46278
Toll Free 1-888-C-FULFLO (238-5356)
Telephone (317) 275-8300
Fax (317) 275-8410
http://www.parker.com

Parker Filtration

INSTALLATION AND SERVICE MANUAL

CENTRI-THRIFT CENTRIFUGAL PUMPS

Models
125M/B, 150M/B
and 200M/B



ENGLISH: PAGES 2-8

Installation and Service Manual

NOTE! To the installer: Please make sure you provide this manual to the owner of the equipment or to the responsible party who maintains the system.

PENTAIR
MYERS

Important safety instructions! Read carefully before installation.

California Proposition 65 Warning:

⚠ WARNING This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Safe Drinking Water Act:

⚠ WARNING This product is to be used exclusively for non-potable water services. This product is not anticipated to be used for human consumption so is not designed for the low lead levels stated in the Safe Drinking Water Act. It is illegal to use this product for potable water applications for human consumption, such as drinking water, oral hygiene, hand washing, food preparation and dishwashing.

Failure to follow these instructions and comply with all codes may cause serious bodily injury and/or property damage.

Before installing or servicing your pump, be certain the pump power source is turned off and disconnected.

All installation and electrical wiring must adhere to state and local codes. Check with appropriate community agencies or contact your local electrical and pump professionals for help.

Pump must be connected to a separate electrical circuit directly from the entrance box. There must be an appropriately sized fuse or circuit breaker in this line. Tying into existing circuits may cause circuit overloading, blown fuses, tripped circuit breakers or a burned-up motor.

Do not connect pump to a power supply until the pump is grounded. For maximum safety, a ground fault interrupter should be used. Failure to ground this unit properly may result in severe electrical shock.

Reduced risk of electric shock during operation of this pump requires acceptable grounding. If the means of connection to the supply-connection box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit conductors supplying the pump, to the grounding screw provided within the wiring compartment.

This pump is provided with a means for grounding. To reduce the risk of electric shock from contact with adjacent metal parts, bond supply box to the pump-motor-grounding means and to all metal parts accessible including metal discharge pipes, by means of a clamp, a weld or both if necessary, secured to the equipment-grounding terminal.

The voltage and phase of the power supply must match the voltage and phase of the pump.

Do not use an extension cord. Above ground joints must be made in an approved junction box.

Never operate a pump with a frayed or brittle power cord, and always protect it from sharp objects, hot surfaces, oil and chemicals. Avoid kinking the cord.

Never service a motor or power cord with wet hands or while standing in or near water or damp ground.

Do not use this pump in or near a swimming pool.

The three phase units must be wired by a qualified electrician, using an approved starter box and switching device.

Single phase motors are equipped with automatic resetting thermal protectors. The motor may restart unexpectedly, causing the leads to energize or pump to turn on. Three phase motors should be protected by proper thermal and amperage protection. (Check local codes.)

Check for nicks in the wire and pump insulation by using an ohmmeter and checking resistance to ground after installing the pump. If in doubt on the proper procedure, check with a qualified electrician.

Do not pump gasoline, chemicals, corrosives or flammable liquids; they could ignite, explode or damage the pump, causing injury and voiding the warranty.

Never work on the pump or system without relieving the internal pressure.

Do not pump water above 120° F.

Never exceed the pressure rating of any system component.

INSTALLATION

Piping

Pipes must line up and not be forced into position by unions. Piping should be independently supported near the pump so that no strain will be placed on the pump casing. Where any noise is objectionable, pump should be insulated from the piping with rubber connections. Always keep pipe size as large as possible and use a minimum of fittings to reduce friction losses.

Suction Piping

Suction pipe should be direct and as short as possible. It should be at least one size larger than suction inlet tapping and should have a minimum of elbows and fittings. The piping should be laid out so that it slopes upward to pump without dips or high points to eliminate air pockets. The highest point in the suction piping should be the pump inlet except where liquid flows to the pump inlet under pressure. A foot valve must be used to keep pump primed. Where liquid flows to the pump, it may be desirable to use a check valve in the suction line or discharge line to keep pump primed.

To prevent air from being drawn into suction pipe due to a suction whirlpool, the foot valve should be submerged at least three feet below the low water level. The suction pipe must be tight and free of air leaks.

Discharge Piping

Discharge piping should never be smaller than pump tapping and should preferably be one size larger. A gate valve should always be installed in discharge line to serve as a shut-off for throttling if capacity is not correct. To protect the pump and foot valve from water hammer and to prevent back flow, a check valve should be installed in the discharge line between the pump and gate valve.

Electrical Connections

Be sure motor wiring is connected for voltage being used.

Unit should be connected to a separate circuit, direct from main switch. A fused disconnect switch or circuit breaker must be used in this circuit. Wire of sufficient size should be used to keep voltage drop to a maximum of 5%. All motors, unless provided with built-in overload protection, must be protected with an overload switch, either manual or magnetic. Three phase motors require overload protection. Single phase motors are equipped with built-in overload protection. Never install a pump without proper overload protection. A flexible metallic conduit should be used to protect the motor leads.

Priming
The pump must be primed before starting. The pump casing and suction piping must be filled with water before starting motor. Remove vent plug in top of casing while pouring in priming water. A hand pump or ejector can be used for priming when desired. Use care to remove all air before starting motor. If pump does not start immediately, stop and reprime.

Starting
Close the discharge valve when starting the pump as it puts less starting load on the motor. When the pump is up to operating speed, open the discharge valve to obtain desired capacity or pressure. Do not allow the pump to run for long periods with the discharge valve tightly closed. This will create superheated water, which could damage the seal and shorten the life of the motor. This superheated water could also cause severe burns. Always use a pressure relief valve, set below the rating of the tank system.

Rotation
The pump must run in direction of arrow on pump case. All single phase motors are single rotation. Three phase motors may run either direction. If rotation is wrong when first starting motor, interchange any two line leads to change rotation.

Stopping
Before stopping pump, close the discharge valve. This will prevent water hammer and is especially important on high head pumps.

Freezing
Care should be taken to prevent the pump from freezing during cold weather. Drain the pump casing when not in operation. Drain by removing the pipe plug in the bottom of the casing.

Rotary Seal
Centrifugal pumps are fitted with rotary seal. This seal is recommended for water free from abrasives. If liquid contains abrasives, the centrifugal pump should not be used.

Bearings
Lubricate motor bearings in accordance with motor manufacturer's instructions.

Single seal ball bearings are used on 125B, 150B and 200B bearing bracket units. Proper amount of grease has been provided in the bracket cavity between the bearings. This should be sufficient grease for 4,000 hours of operation. After 4,000 hours of operation the old grease should be cleaned out and new grease added. Use only best grade ball bearing greases

DISASSEMBLY INSTRUCTIONS

Open the power supply switch contacts and remove fuses. Disconnect the electrical wiring from the motor. Then drain pump case by removing drain plugs.

Remove the bolts securing volute case to pump bracket, and pry components apart. Then remove impeller.

Always replace both rotating assembly and stationary ceramic seat. Do not use old stationary seat with new rotating seal assembly. Pry out rotating assembly of shaft seal and remove ceramic ring from housing. A new shaft seal should always be used when rebuilding a pump. All pump parts should be cleaned thoroughly before being reassembled.

Remove four bolts holding bracket to motor and remove motor. Then remove set screw in stub shaft coupling to disconnect motor pump shaft.

ASSEMBLY INSTRUCTIONS

Place rubber deflector over motor shaft, slide shaft extension into position and tighten set screws. Assemble motor and shaft onto bracket.

Insert seal seat in position by using finger pressure to press firmly and squarely until it bottoms. The use of light oil on the rubber element will facilitate assembly. Care must be taken to keep oil, grease and dirt off face areas of seal. Be sure the seal faces are not damaged during assembly or the seal will leak during operation.

Check dimension from face of ceramic seat to shaft shoulder. This distance should be within a tolerance of ±1/64. Install rotating element of seal on shaft. Be sure the lapped sealing surface is toward seal seat and assemble impeller. Check diameter of impeller against motor horsepower rating to ensure proper performance.

Secure impeller using key, impeller retainer washer, 5/16 stainless steel helical spring lockwasher and socket head cap screw, 1" long. Then rotate pump shaft with fingers, making sure there is uniform drag of the seal faces.

Centri-Thrift Centrifugal Pump Parts List

		1-1/2" Suction – 1-1/4" Discharge		2" Suction – 1-1/2" Discharge		
Pump Nameplate Catalog Number Horsepower		**125M-2 2**	**125M-3 3**	**150M-2 2**	**150M-3 3**	**150M-5 5**
Description	**No. Req.**	**Part No.**	**Part No.**	**Part No.**	**Part No.**	**Part No.**
Motor – See Chart Below.	1					
Pump Shaft Assembly – See Chart Below	1					
Bracket – See Chart Below	1					
Set Screw for Shaft Assembly, Single Phase Motor	2	05013A015	06024A001	05013A015	06024A001	06024A001
Set Screw for Shaft Assembly, Three Phase Motor	2	05013A015	05013A015	05013A015	05013A015	05013A015
Cap Screw – Bracket to Motor, 3/8"-16NC x 1-1/8"	4	19101A016	19101A016	19101A016	19101A016	–
Cap Screw – Bracket to Motor, 1/2"-13NC x 1-1/4"	4	–	19103A004	–	–	19103A004
Cap Screw – Bracket to Motor, 3/8"-16 NC x 1"	4	–	19101A013	–	19101A013	–
Cap Screw – Bracket to Case, 3/8"-16NC x 1-1/8"	8	19101A016	19101A016	19101A016	19101A016	19101A016
Lockwasher – 3/8"	12	05454A007	05454A007	05454A007	05454A007	05454A007
Lockwasher – 3/8"	8	–	–	–	–	05454A007
Lockwasher – 1/2"	4	–	05454A004	–	05454A004	05454A004
Shaft Seal	1	11716A001K	11716A001K	RTF	RTF	RTF
Impeller	1	11725B002	11725B003	12935B003	12935B001	12935B003
Key for Impeller	1	05818A025	05818A025	05818A025	05818A025	05818A025
Washer – Special	1	11718A000	11718A000	12933A000	12933A000	12933A000
Lockwasher – 5/16"	1	05454A014	05454A014	05454A014	05454A014	05454A014
Cap Screw – Stainless Steel	1	19100A004	19100A004	06106A008	06106A008	06106A008
Gasket – Case to Bracket	1	05863A013	05863A013	–	–	–
Volute Case	1	11726D001	11726D001	12937D001	12937D001	12937D001
Wearing Ring – For Units w/Wearing Ring	1	–	–	12934A000	12934A000	12934A000
Pipe Plug – 1/8"	4	05022A004	05022A004	05022A004	05022A004	05022A004
Pipe Plug – 1/4"	1	05022A009	05022A009	05022A009	05022A009	05022A009
Deflector – Rubber, for 5/8" Shaft	1	05059A318	05059A318	05059A318	–	–
Deflector – Rubber, for 7/8" Shaft	1	05059A320	05059A320	–	05059A320	–
Deflector – Rubber, for 1-1/8" Shaft	1	–	05059A321	–	05059A321	05059A321

Motor Horsepower	2	2	2	2	2	2	3	3	3
Pump Serial Number	654	654	756	756	1056	1056	654	654	157
Motor Number	–	–	13229A000	20051A000	13229A000	20051A000	RTF	–	RTF
Voltage	115/230	220/440	115/230	220/440	115/230	220/440	230	220/440	220/440
Phase	Single	Three	Single	Three	Single	Three	Single	Three	Three
Motor Bolt Circle	5-7/8"	5-7/8"	5-7/8"	5-7/8"	5-7/8"	5-7/8"	7-1/4"	7-1/4"	5-7/8"
Motor Shaft Diameter	7/8"	7/8"	5/8"	5/8"	5/8"	5/8"	1-1/8"	7/8"	7/8"
Shaft – Rotary Seal	11723B001	11723B001	11714B001	11714B001	11714B001	11714B001	11914B001	RTF	RTF
Bracket – Rotary Seal	11715D000	11715D000	11715D000	11715D000	11715D000	11715D000	11912D000	11912D000	RTF

Motor Horsepower	3	3	3	3	5	5
Pump Serial Number	974	974	1056	1056	1056	1056
Motor Number	21206A000	21207A000	RTF	–	18939A000	18941A000
Voltage	208/230	230/460	230	220/440	230	220/440
Phase	Single	Three	Single	Three	Single	Three
Motor Bolt Circle	5-7/8"	5-7/8"	7-1/4"	7-1/4"	7-1/4"	7-1/4"
Motor Shaft Diameter	5/8"	5/8"	1-1/8"	7/8"	1-1/8"	1-1/8"
Shaft – Rotary Seal	11714B001	11714B001	11914B001	RTF	11914B001	11914B001
Bracket – Rotary Seal	11715D000	11715D000	11912D000	11912D000	11912D000	11912D000

Centri-Thrift Centrifugal Pump Parts List

2-1/2" Suction -2" Discharge

Pump Nameplate Catalog Number Horsepower		200M-3 3	200M-5 5	200M-7-1/2 7-1/2
Description	**No. Req.**	**Part No.**	**Part No.**	**Part No.**
Motor – See Chart Below.	1			
Pump Shaft Assembly – See Chart Below	1			
Bracket – See Chart Below	1			
Set Screw for Shaft Assembly, Single Phase Motor	2	06024A001	06024A001	06024A001
Set Screw for Shaft Assembly, Three Phase Motor	2	05013A015	06024A001	06024A001
Cap Screw – Bracket to Motor, 3/8"-16NC x 1-1/8"	4	19101A016	–	–
Cap Screw – Bracket to Motor, 1/2"-13NC x 1-1/4"	4	19103A004	19103A004	19103A004
Cap Screw – Bracket to Motor, 3/8"-16 NC x 1"	4	19101A003	–	–
Cap Screw – Bracket to Case, 3/8"-16NC x 1-1/8"	8	19101A016	19101A016	19101A016
Lockwasher – 3/8"	12	05454A007	–	–
Lockwasher – 3/8"	8	–	05454A007	05454A007
Lockwasher – 1/2"	4	05454A004	05454A004	05454A004
Impeller	1	12936B002	12936B001	12936B003
Key for Impeller	1	05818A025	05818A025	05818A025
Washer – Special	1	12933A000	12933A000	12933A000
Lockwasher – 5/16"	1	05454A014	05454A014	05454A014
Gasket – Case to Bracket	1	05863A013	05863A013	05863A013
Volute Case	1	12938D001	12938D001	12938D001
Wearing Ring – For Units w/Wearing Ring	1	12934A000	12934A000	12934A000
Pipe Plug – 1/8"	4	05022A004	05022A004	05022A004
Pipe Plug – 1/4"	1	05022A009	05022A009	05022A009
Deflector – Rubber, for 5/8" Shaft	1	05059A318	–	–
Deflector – Rubber, for 7/8" Shaft	1	05059A320	–	–
Deflector – Rubber, for 1-1/8" Shaft	1	05059A321	05059A321	05059A321

Motor Horsepower	3	3	3	3	3	5	5	7-1/2
Pump Serial Number	974	974	1056	1056	157	1056	1056	1056
Motor Number	21206A000	21207A000	RTF	–	RTF	18939A000	18941A000	18944A000
Voltage	208/230	230/460	230	220/440	220/440	230	220/440	220/440
Phase	Single	Three	Single	Three	Three	Single	Three	Three
Motor Bolt Circle	5-7/8"	5-7/8"	7-1/4"	7-1/4"	5-7/8"	7-1/4"	7-1/4"	7-1/4"
Motor Shaft Diameter	5/8"	5/8"	1-1/8"	7/8"	7/8"	1-1/8"	1-1/8"	1-1/8"
Shaft – Rotary Seal	11714B001	11714B001	11914B001	RTF	RTF	11914B001	11914B001	11914B001
Bracket – Rotary Seal	11715D000	11715D000	11912D000	11912D000	RTF	11912D000	11912D000	11912D000

Part Number	Description
16837A002	Kit – Cat. No. 125M-2FA
16837A014	Kit – Cat. No. 125M-3FA
16837A005	Kit – Cat. No. 150M-2FA
16837A015	Kit – Cat. No. 150M-3FA

Part Number	Description
16837A008	Kit – Cat. No. 150M-5FA
16837A016	Kit – Cat. No. 200M-3FA
16837A011	Kit – Cat. No. 200M-5FA
16837A012	Kit – Cat. No. 200M-7-1/2FA

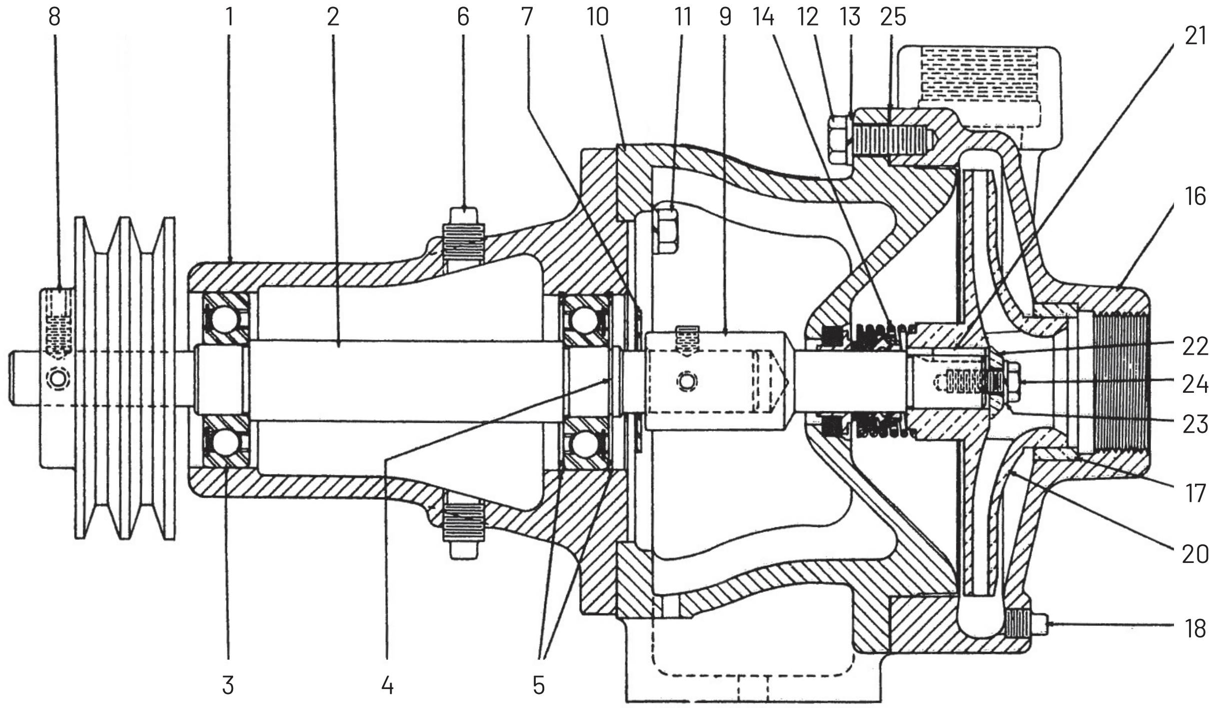
150M 5 hp 3 ph =
182TC 3450 rpm

200M = 184TC

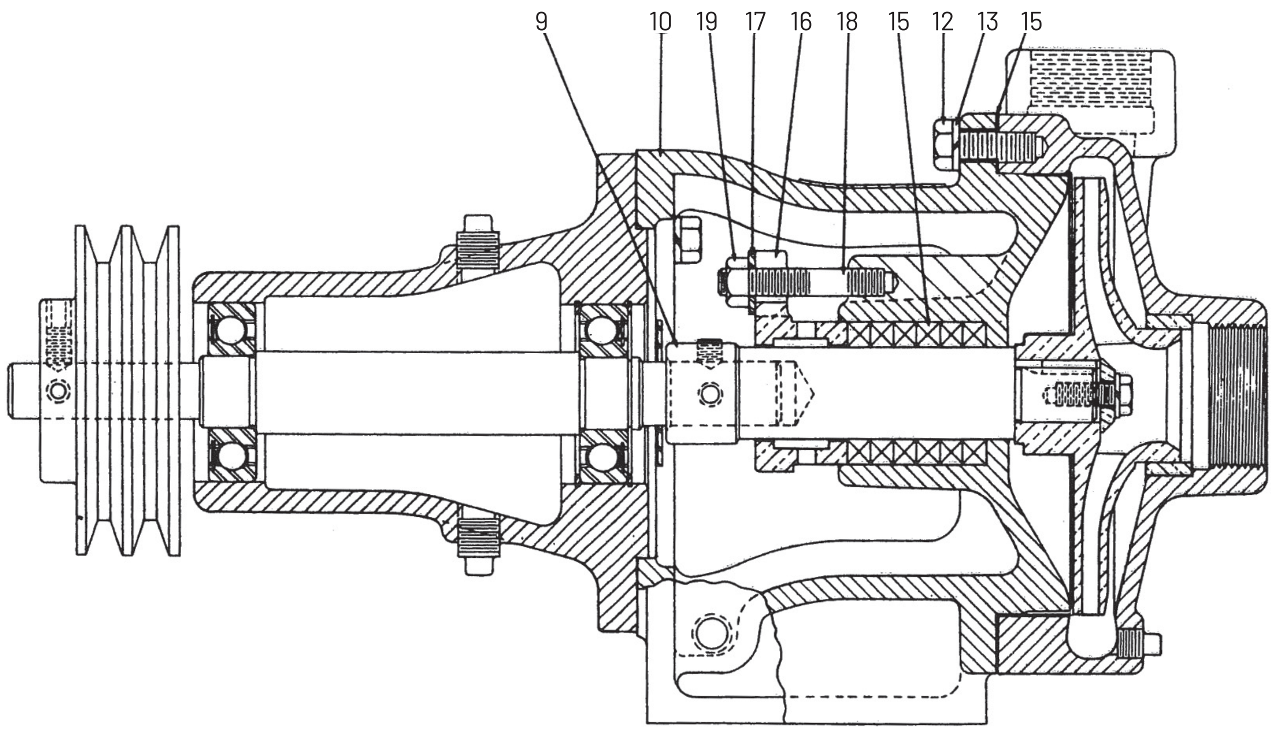
Centri-Thrift Centrifugal Pump Parts List

Belt Driven

Pump Name and Plate Catalog Number			125B	125B	150B	200B
Pump Nameplate Serial Number			654 Plus Year Made	856 Plus Year Made	1056 Plus Year Made	1056 Plus Year Made
Suction			1-1/2"	1-1/2"	2"	2-1/2"
Discharge			1-1/4"	1-1/4"	1-1/2"	2"
Ref. No.	Name of Part	No. Req.	Part No.		Part No.	Part No.
1	Bearing Housing Only	1	11727C000	11727C000	11727C000	11727C000
2	Shaft for Belt Driven Head	1	RTF	11728B001	11728B001	11728B001
3	Bearing for Housing – Belt Driven Head	2	11729A001	11729A001	11729A001	11729A001
4	Snap Ring – Belt Driven Head	1	10848A003	10848A003	10848A003	10848A003
5	Snap Ring – Belt Driven Head	2	10848A004	10848A004	10848A004	10848A004
6	Pipe Plug – 1/4", Belt Driven Head	3	05022A060	05022A060	05022A060	05022A060
7	Deflector – Rubber, for 7/8" Shaft	1	05059A320	05059A320	05059A320	05059A320
8	Set Screw – 5/16"-18NC, 5/8" Long, Headless	2	05013A007	05013A007	05013A007	05013A007
–	Key for Pulley – 3/16" x 3/16" x 1-3/4" Long	1	–	05818A015	05818A015	05818A015
9	Pump Shaft Assembly – Rotary Seal	1	11723B001	11723B001	11723B001	11723B001
–	Set Screw for Shaft Assembly– 5/16"-18NC, 5/16" Long	2	05013A015	05013A015	05013A015	05013A015
10	Bracket for Use with Rotary Seal	1	11715D000	11715D000	11715D000	11715D000
11	Cap Screw – 3/8"-16NC, 1-1/8" Long, Bracket to Bearing Housing	4	19101A016	19101A016	19101A016	19101A016
12	Cap Screw – 3/8"-16NC, 1-1/8" Long, Bracket to Case	8	19101A016	19101A016	19101A016	19101A016
13	Lockwasher – 3/8"	12	05454A007	05454A007	05454A007	05454A007
14	Shaft Seal	1	RTF	RTF	RTF	RTF
15	Gasket – Case to Bracket	1	05863A013	05863A013	05863A013	05863A013
16	Volute Case with Wearing Ring	1	11726D001	11726D001	12937D001	12938D001
17	Wearing Ring Only	1	RTF	RTF	12934A000	12934A000
18	Pipe Plug – 1/8"	4	05022A004	05022A004	05022A004	05022A004
19	Nut for Studs	2	19109A021	19109A021	19109A021	19109A021
20	Impeller	1	11725B003	11725B003	12935B003	12936B003
21	Key for Impeller – 3/16" x 3/16" x 3/4" Long	1	05818A025	05818A025	05818A025	05818A025
22	Washer – Special	1	11718A000	11718A000	12933A000	12933A000
23	Lockwasher – 5/16"	1	05454A014	05454A014	05454A014	05454A014
24	Cap Screw – Stainless Steel	1	19100A004	19100A004	06106A008	06106A008



Belt Driven Head with Rotary Seal



Belt Driven Head with Stuffing Box

Limited Warranty

Myers® warrants to the original consumer purchaser ("Purchaser" or "You") of the products listed below, that they will be free from defects in material and workmanship for the Warranty Period shown below.

Product	**Warranty Period** whichever occurs first:
Jet pumps, small centrifugal pumps, submersible pumps and related accessories	12 months from date of original installation, or 18 months from date of manufacture
Fibrewound Tanks	5 years from date of original installation
Steel Pressure Tanks	5 years from date of original installation
Sump/Sewage/Effluent Products	12 months from date of original installation, or 36 months from date of manufacture
Battery Backup Units	
MBSP-2, MBSP-2C	12 months from date of original installation, or 18 months from date of manufacture
MBSP-3, MBSP-3C	24 months from date of original installation, or 30 months from date of manufacture
Wastewater Solids Handling Pumps	12 months from date of shipment from factory or 18 months from date of manufacture

Our warranty applies only where such products are used in compliance with the requirements of the applicable product catalog and/or manuals. For additional information, please refer to the applicable standard limited warranty featured in the product manual.

Our warranty will not apply to any product that, in our sole judgement, has been subject to negligence, misapplication, improper installation, or improper maintenance. Without limiting the foregoing, operating a three phase motor with single phase power through a phase converter will void the warranty. Note also that three phase motors must be protected by three-leg, ambient compensated, extra-quick trip overload relays of the recommended size or the warranty is void.

Your only remedy, and MYERS's only duty, is that MYERS repair or replace defective products (at MYERS's choice). You must pay all labor and shipping charges associated with this warranty and must request warranty service through the installing dealer as soon as a problem is discovered. No request for service will be accepted if received after the Warranty Period has expired. This warranty is not transferable.

MYERS SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING LIMITED WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE FOREGOING LIMITED WARRANTIES SHALL NOT EXTEND BEYOND THE DURATION PROVIDED HEREIN.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on the duration of an implied warranty, so the above limitations or exclusions may not apply to You. This warranty gives You specific legal rights and You may also have other rights which vary from state to state.

This Limited Warranty is effective April 1, 2014 and replaces all undated warranties and warranties dated before April 1, 2014.

F.E. MYERS
293 Wright Street, Delavan, WI 53115
Phone: 888-987-8677 • Fax: 800-426-9446 • www.femyers.com
In Canada: 490 Pinebush Road, Unit 4, Cambridge, Ontario N1T 0A5
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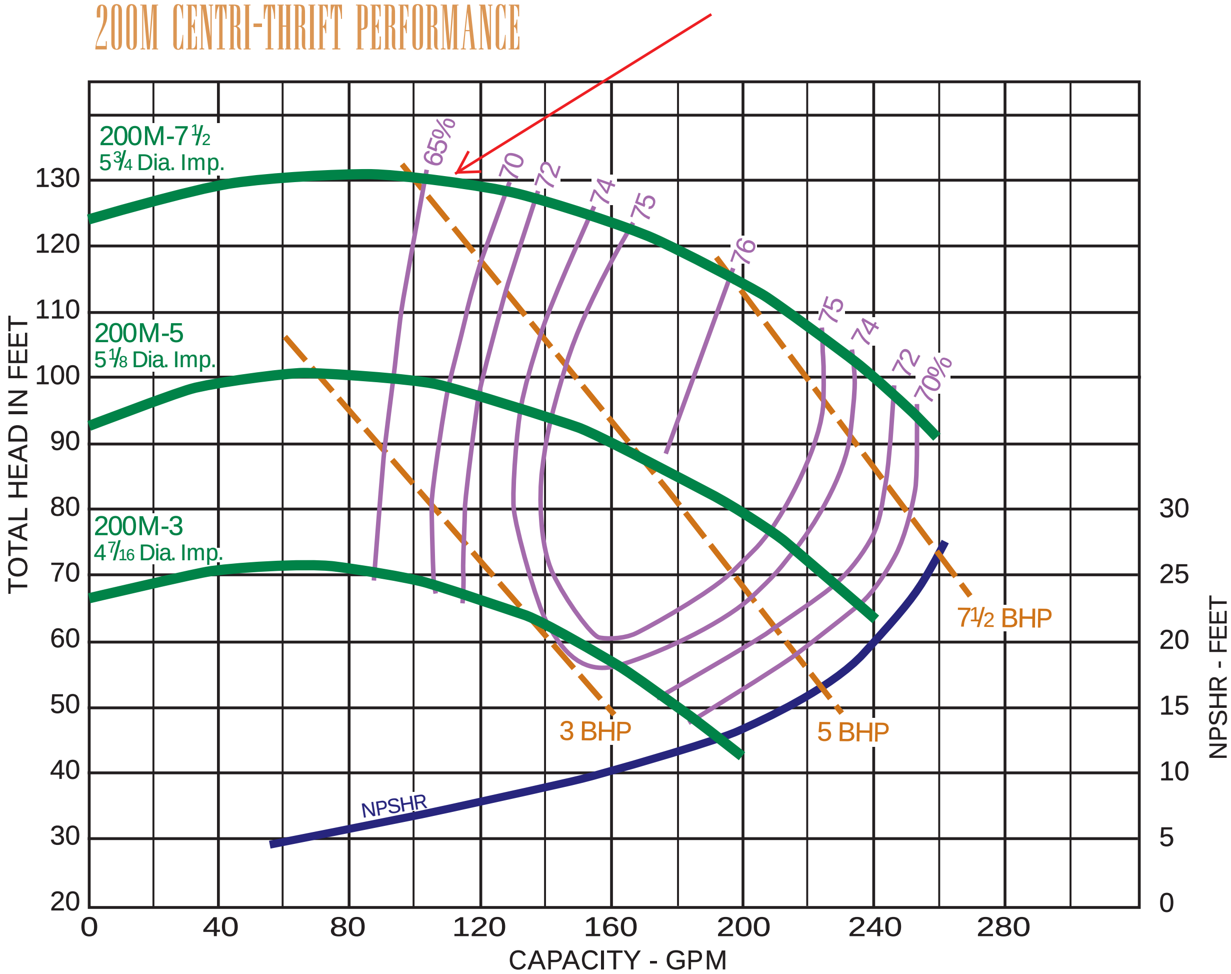
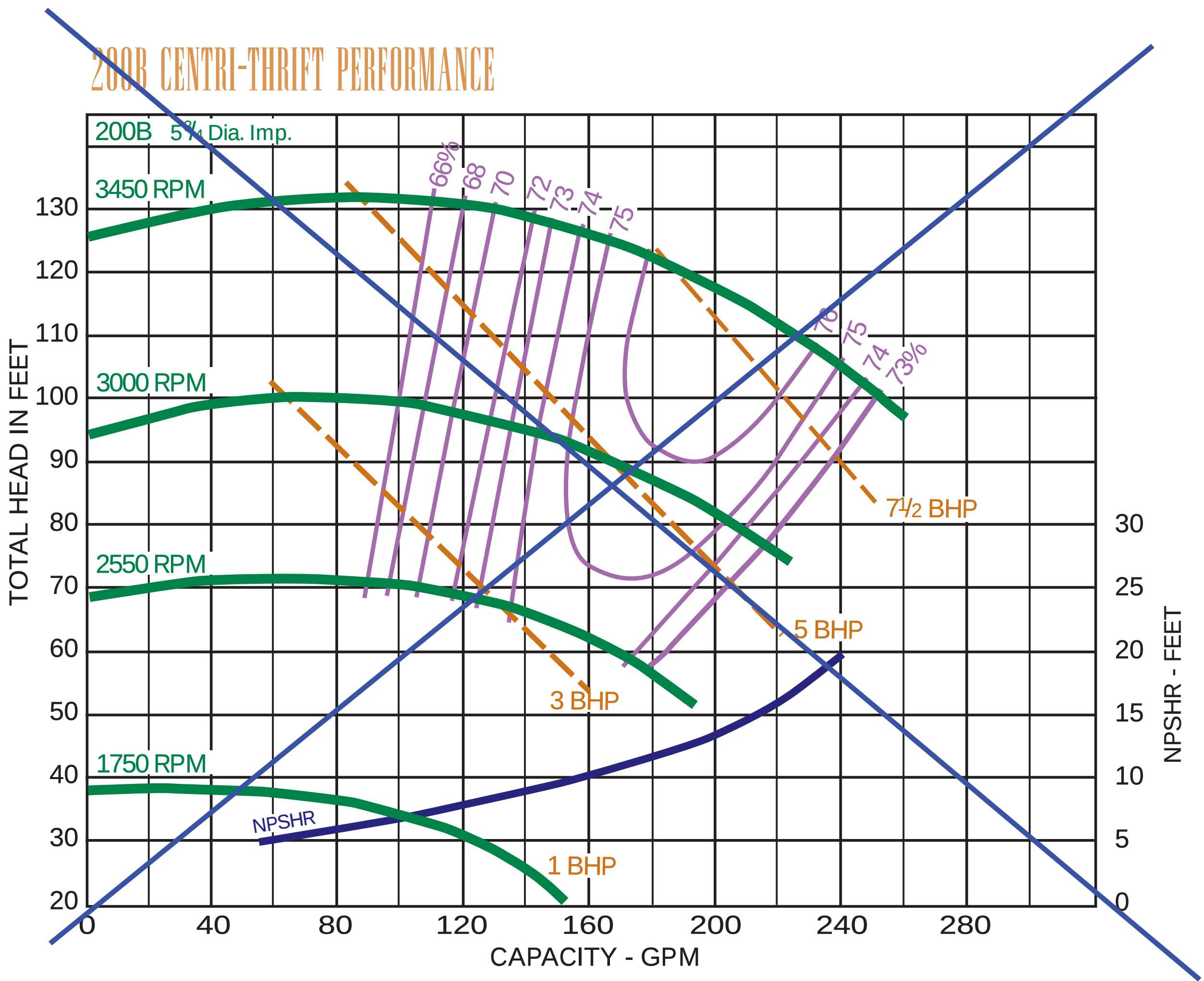
200M CENTRI-THRIFT PERFORMANCE



200B CENTRI-THRIFT PERFORMANCE



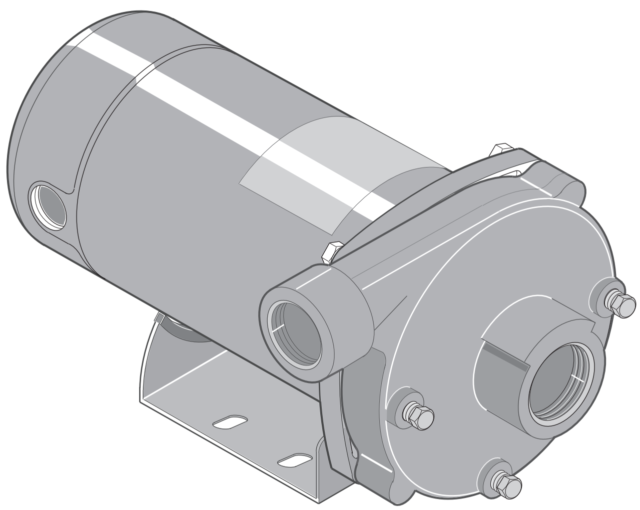
PENTAIR

OWNER'S MANUAL

60 Cycle CT Series Centrifugal Pump

MYERS®

INSTALLATION AND OPERATING INSTRUCTIONS
REPAIR PARTS LIST



HP	MODELS			
1/2	CTJ05B	CTJ05B3	CTJ05	CTJ053
3/4	CTJ07B	CTJ07B3	CTJ07	CTJ073
1	CTJ10B	CTJ10B3	CTJ10	CTJ103
1-1/2	CTJ15B	CTJ15B3	CTJ15	CTJ153
2	CTJ20B	CTJ20B3	CTJ20	CTJ203
2-1/2	CTJ25B	CTJ25B3	CTJ25	CTJ253

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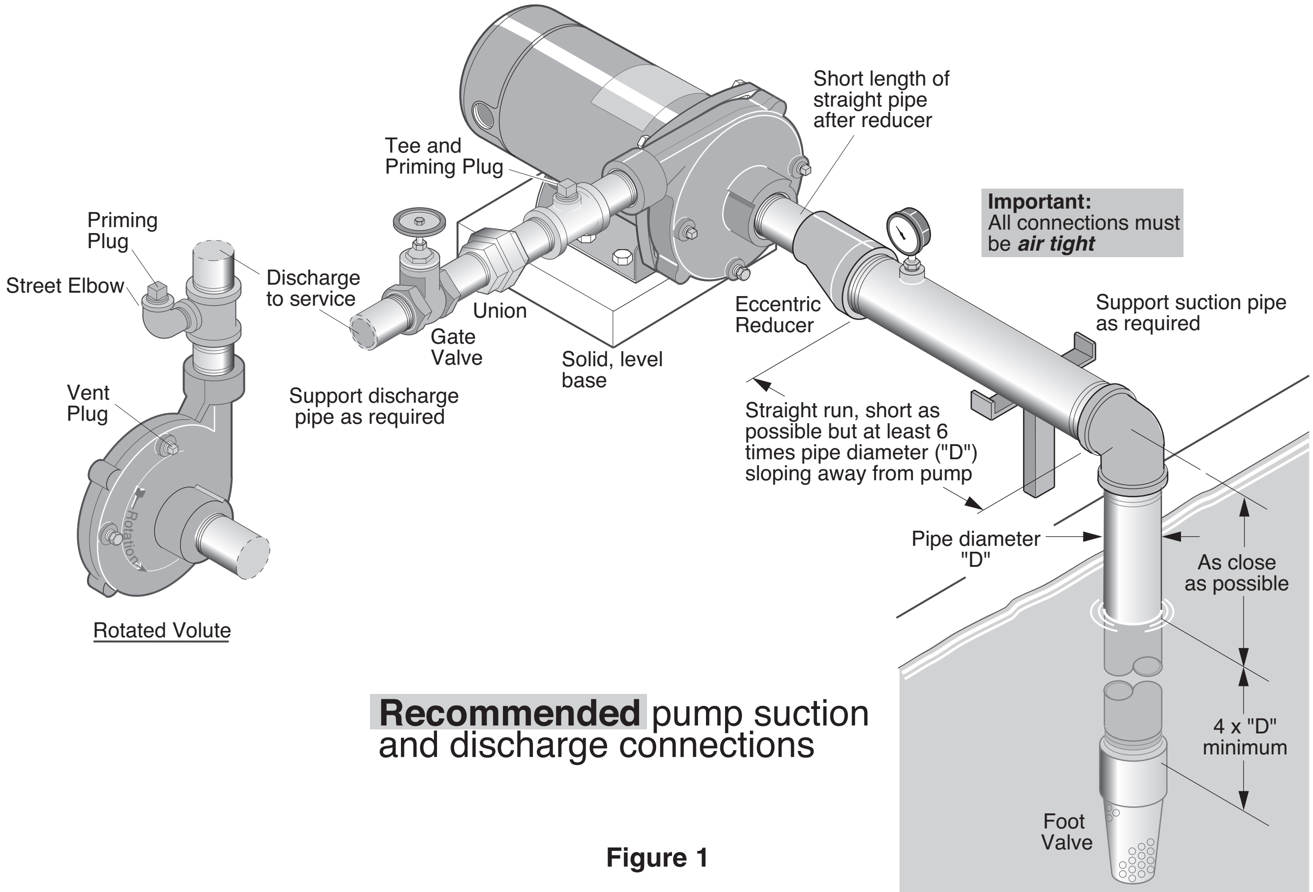


Figure 1

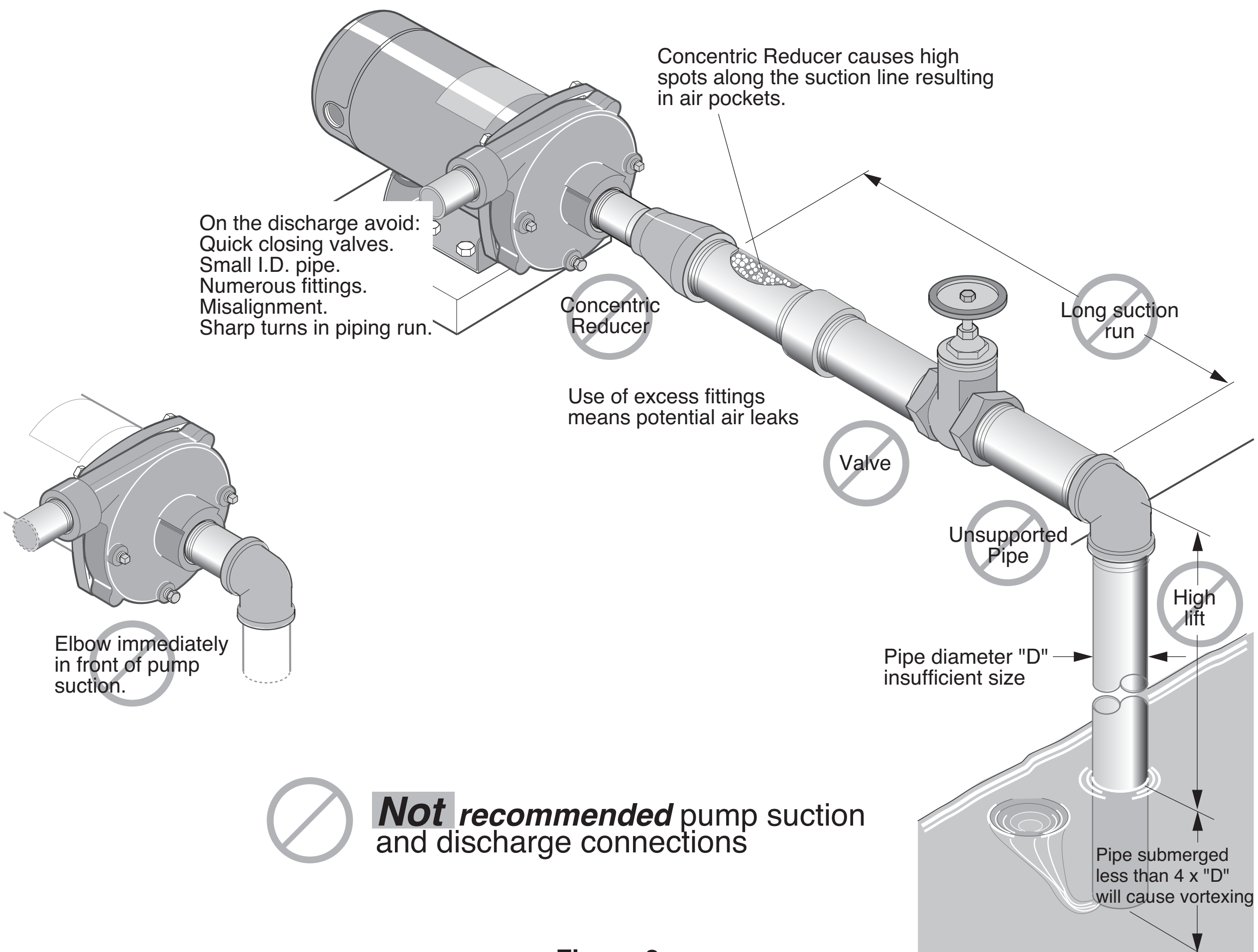


Figure 2

California Proposition 65 Warning

⚠ WARNING This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

PIPING - GENERAL

Support both suction and discharge piping independently at a point near the pump to avoid putting a strain on the pump housing. Start all piping **AT THE PUMP.**

Increase pipe diameter at both the suction and discharge by one (1) standard pipe size (minimum) to obtain desired performance and flow rate. Refer to Table I when sizing pipe for your pumping system.

NOTICE: Do not use pipe with **smaller** diameter on the suction side of pump.

TABLE I

Pipe Tapping Size On Pump		Recommended Pipe Size	
Suction	Discharge	Suction	Discharge
1-1/4	1	1-1/2	1-1/4
1-1/2	1-1/4	2	1-1/2
2	1-1/2	3	2

SUCTION PIPE

Increase pipe size from pump tapping as shown in Table I.

Figure 1 (Page 2) depicts a recommended run of pipe and fittings for the suction side of a centrifugal pump. Please refer to this illustration when choosing pipe and fittings for your suction connection.

IMPORTANT: All connections must be air tight!

Figure 2 (Page 2) depicts conditions that are **NOT DESIRABLE** on the suction side of a centrifugal pump and may cause problems in flow rate and priming. Please look this illustration over carefully before choosing pipe and fittings for your suction connection.

DISCHARGE PIPING

Increase pipe size from pump tapping as show in Table I. Figure 1 (Page 2) depicts a recommended run of pipe and fittings for the discharge. Install tee with priming plug as close to pump as possible. Figure 2 (Page 2) notes conditions that should be avoided. Please read over carefully before making discharge connection.

PRIMING THE PUMP

A pump is primed when all air in the suction line and pump volute has been evacuated and replaced with water.

To Prime:

1. Close valve in discharge line.
2. Remove priming plug from tee and fill pump and suction line with water until water is flowing back out of tee.
3. Replace priming plug.
4. Start pump and slowly open valve until desired water flow is achieved.
   NOTICE: If water is not being pumped, turn off pump, close valve, and repeat steps 1 thru 4.

If pump volute is rotated as shown in Figure 1 (Page 2), loosen vent plug when priming to evacuate air trapped inside volute and tighten when volute is completely filled with water.

⚠ WARNING **Risk of explosion and scalding**. Never run pump against closed discharge. To do so can boil water inside pump, causing hazardous pressure buildup and possible explosion.

⚠ CAUTION **Risk of flooding**. Do not run the pump dry. This will damage mechanical seal and void warranty. It may cause burns to person handling pump.

⚠ CAUTION **Motor normally operates at high temperature and will be too hot to touch.** It is protected from heat damage during operation by an automatic internal cutoff switch. Before handling pump or motor, stop motor and allow it to cool for 20 minutes.

TABLE II - RECOMMENDED FUSING AND WIRING DATA - 60 CYCLE MOTORS

MOTOR HP	MAX. LOAD AMPERES	BRANCH FUSE* RATING AMPS	DIAMETER IN FEET FROM MOTOR TO METER					
			0' TO 50'	51' TO 100'	101' TO 200'	201' TO 300'	301' TO 400'	401' TO 500'
			WIRE SIZE					
SINGLE PHASE - 115/230 VOLT								
1/3	9.4/4.7	15/15	14/14	14/14	10/14	10/14	6/14	6/12
1/2	9.4/4.7	15/15	14/14	14/14	10/14	10/14	6/14	6/12
3/4	12.2/6.1	20/15	12/14	12/14	10/14	8/14	6/12	6/12
1	14.8/7.4	20/15	12/14	12/14	8/14	6/14	6/12	4/10
1-1/2	19.9/9.95	25/15	10/14	10/14	8/14	6/12	4/10	4/10
2	24.0/12.0	30/15	12/14	10/14	6/14	6/12	4/10	4/10
2-1/2	21.0/10.5	15/15	14/14	14/14	14/14	12/12	12/12	10/10
THREE PHASE - 230/460 VOLT								
1/2	2.3/1.15	15/15	14/14	14/14	14/14	14/14	14/14	14/14
3/4	3.1/1.55	15/15	14/14	14/14	14/14	14/14	14/14	14/14
1	3.6/1.8	15/15	14/14	14/14	14/14	14/14	14/14	14/14
1-1/2	4.7/2.35	15/15	14/14	14/14	14/14	14/14	14/14	14/14
2	6.8/3.4	15/15	14/14	14/14	14/14	14/14	12/14	12/14
2-1/2	8.5/4.25	15/15	14/14	14/14	14/14	14/14	12/14	10/14

* Time delay fuse or circuit breakers are recommended in any motor circuit.

ELECTRICAL

Connection diagram for dual voltage, single-phase motors. Your dual-voltage motor's terminal board (under the motor end cover) will match one of the diagrams below. Follow that diagram if necessary to convert motor to 115 Volt power.

Connect power supply wires to L1 and L2. For 3-phase motors, or if motor does not match these pictures, follow the connection diagram on the motor nameplate.

THE MOTOR IS SET FOR 230 VOLTS WHEN SHIPPED.

To change the motor to use 115 volts:

1. Turn off power
2. Remove the back motor cover.
3. Use a 1/2" wrench and turn the voltage selector dial counterclockwise until 115 shows in the dial opening.
4. Reinstall the motor cover.

⚠ WARNING **Hazardous voltage.** Can shock, burn, or cause death. Disconnect power to motor before working on pump or motor. Ground motor before connecting to power supply.

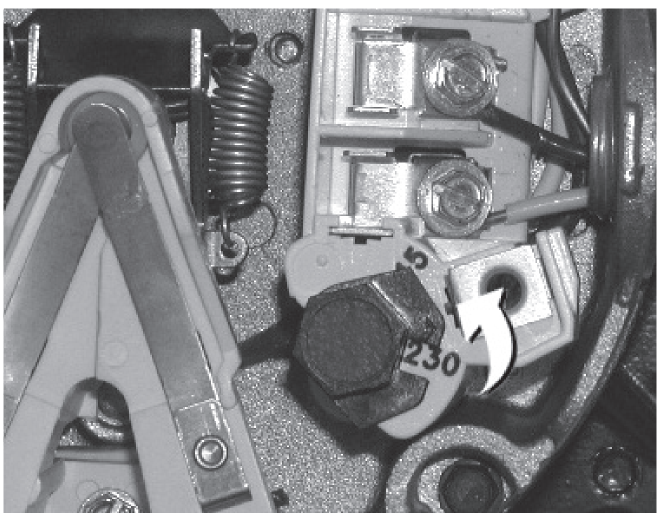


Figure 3: Changing the Voltage Setting

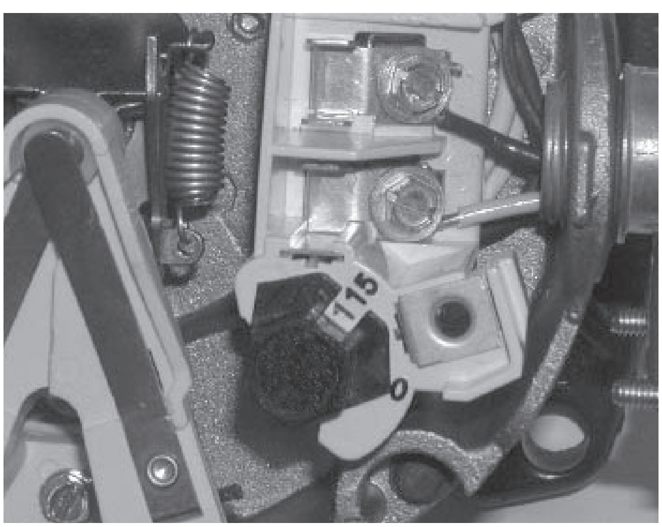


Figure 4: Motor Set for 115 Volt Operation

WIRING

⚠ **Ground motor before connecting to electrical power supply. Failure to ground motor can cause severe or fatal electrical shock hazard.**

⚠ **Do not ground to a gas supply line.**

⚠ **To avoid dangerous or fatal electrical shock, turn OFF power to motor before working on electrical connections.**

⚠ **Supply voltage must be within ±10% of nameplate voltage. Incorrect voltage can cause fire or damage motor and voids warranty. If in doubt consult a licensed electrician.**

⚠ **Use wire size specified in Wiring Chart (Page 3). If possible, connect pump to a separate branch circuit with no other appliances on it.**

⚠ **Wire motor according to diagram on motor nameplate. If nameplate diagram differs from diagrams above, follow nameplate diagram.**

1. Install, ground, wire and maintain your pump in compliance with the National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable, and with all local codes and ordinances that apply. Consult your local building inspector for code information.
2. Provide a correctly fused disconnect switch for protection while working on motor. For switch requirements, consult your local building inspector for information about codes.
3. Disconnect power before servicing motor or pump. If the disconnect switch is out of sight of pump, lock it open and tag it to prevent unexpected power application.
4. Ground the pump permanently using a wire of the same size as that specified in wiring chart (Page 3). Make ground connection to green grounding terminal under motor canopy marked GRD. or ⏚.
5. Connect ground wire to a grounded lead in the service panel or to a metal underground water pipe or well casing at least 10 feet long. Do not connect to plastic pipe or insulated fittings.
6. Protect current carrying and grounding conductors from cuts, grease, heat, oil, and chemicals.
7. Connect current carrying conductors to terminals L1 and L2 under motor canopy. When replacing motor, check wiring diagram on motor nameplate. If the motor wiring diagram does not match either diagram in Figure 3, follow the diagram on the motor.

IMPORTANT: 115/230 Volt single phase models are shipped from factory with motor wired for 230 volts. If power supply is 115 volts, remove motor canopy and reconnect motor as shown in Figure 3. Do not try to run motor as received on 115 volt current.

8. Motor has automatic internal thermal overload protection. If motor has stopped for unknown reasons, thermal overload may restart it unexpectedly, which could cause injury or property damage. Disconnect power before servicing motor.
9. If this procedure or the wiring diagrams are confusing, consult a licensed electrician.

SERVICE

PUMP SERVICE

This centrifugal pump requires little or no service other than reasonable care and periodic cleaning. Occasionally, however, a shaft seal may become damaged and must be replaced. The procedure as outlined below will enable you to replace the seal.

NOTICE: Pumps use mechanical seals with a rubber seat ring or a sealing O-Ring. THESE SEALS ARE COMPLETELY INTERCHANGEABLE.

NOTICE: The highly polished and lapped faces of this seal are easily damaged. Read instructions and handle the seal with care.

Some models are equipped with an impeller screw, which has a left hand thread. Before unscrewing the impeller, remove the impeller screw.

REMOVAL OF OLD SEAL

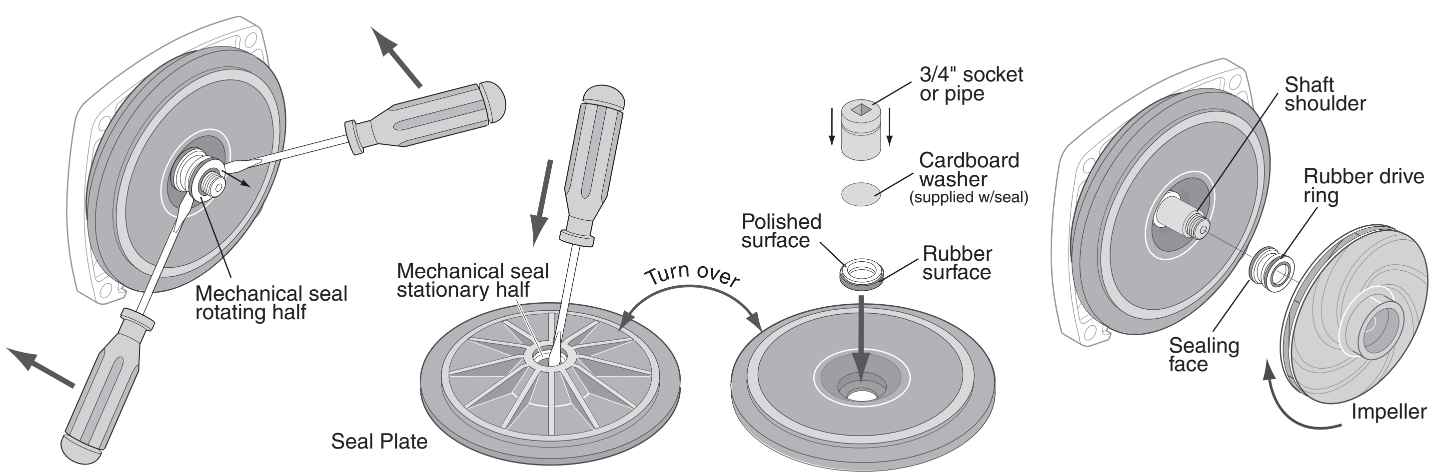
1. After unscrewing impeller, carefully remove rotating part of seal by prying up on sealing washer, using two screwdrivers (see Figure 5A). Use care not to scratch motor shaft.
2. Remove seal plate from motor and place on flat surface, face down. Use a screwdriver to push ceramic seat out from seal cavity (see Figure 5B).

INSTALLATION OF FLOATING SEAT (Figure 5C)

1. Clean polished surface of floating seat with clean cloth.
2. Turn seal plate over so seal cavity is up, clean cavity thoroughly.
3. Lubricate outside rubber surface of ceramic seat with soapy water and press firmly into seal cavity with finger pressure. If seat will not locate properly in this manner, place cardboard washer over polished face of seat and press into seal cavity using a 3/4” socket or 3/4” piece of standard pipe.
4. **DISPOSE OF CARDBOARD WASHER**. Be sure polished surface of seat is free of dirt and has not been damaged by insertion. Remove excess soapy water.

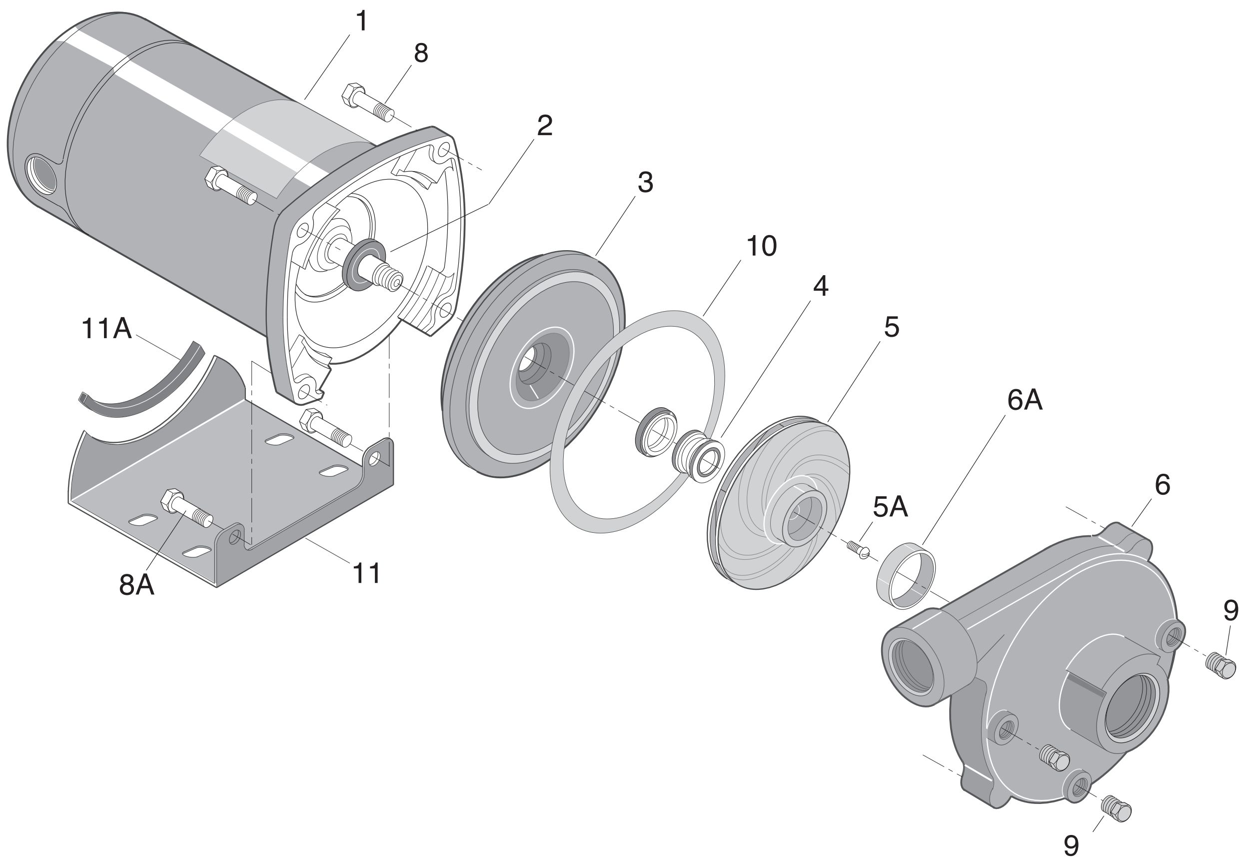
INSTALLATION OF ROTATING PART OF SEAL UNIT (Figure 5D)

1. Reinstall seal plate using extreme caution not to hit ceramic portion of seal on motor shaft.
2. Inspect shaft to make sure that it is clean.
3. Clean face of sealing washer with clean cloth.
4. Lubricate inside diameter and outer face of rubber drive ring with soapy water and slide assembly on motor shaft (sealing face first) until rubber drive ring hits shaft shoulder.
5. Screw impeller on shaft until impeller hub hits shaft shoulder. This will automatically locate seal in place and move the sealing washer face up against seat facing. Reinstall impeller screw (if used).



A-Seal removal-rotating half **B**-Seal removal-stationary half **C**-Stationary half installation **D**-Rotating half installation

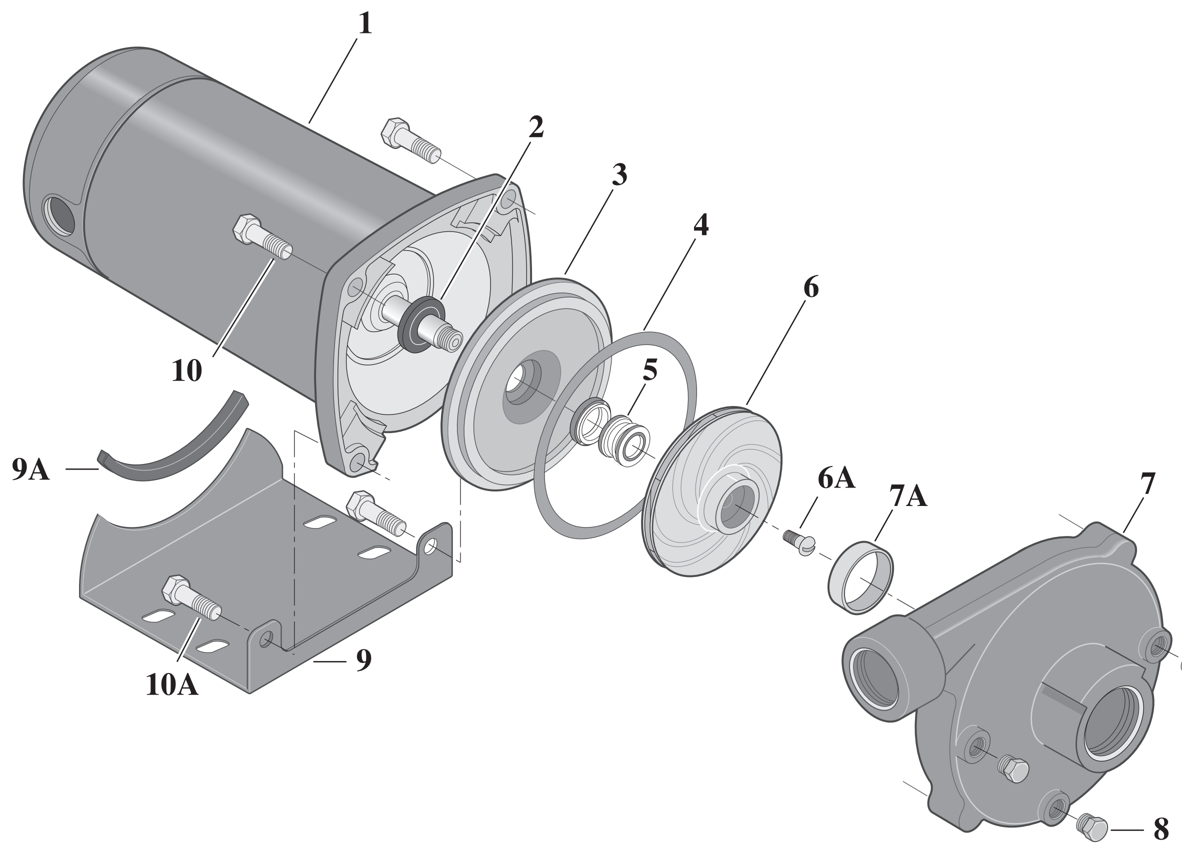
FIGURE 5



REPAIR PARTS LIST – CT SERIES

Key No.	Part Description	No. Used	MOTOR AND HORSEPOWER					
			CTJ05 CTJ053 1/2 HP	CTJ07 CTJ073 3/4 HP	CTJ10 CTJ103 1 HP	CTJ15 CTJ153 1-1/2 HP	CTJ20 CTJ203 2 HP	CTJ25 CTJ253 2-1/2 HP
1*	Motor, 115/230V, Single Phase	1	J218-582APKG	J218-590PKG	J218-596PKG	J218-601PKG	J218-883APKG	J218-628APKG
1*	Motor, 230/460V, Three Phase	1	AP100CL	AP100DL	AP100EL	AP100FL	AP100GL	AP100G5L
†2	Water Slinger	1	17351-0009	17351-0009	17351-0009	17351-0009	17351-0009	17351-0009
3	Seal Plate	1	C3-178	C3-178	C3-178	C3-178	C3-181	C3-181
†4	Shaft Seal	1	U109-6A	U109-6A	U109-6A	U109-6A	U109-6A	U109-6A
5	Impeller - Single Phase	1	C105-92PN	C105-92PM	C105-92PL	C105-92PB	–	C105-92PAB
5	Impeller - Three Phase	1	C105-95PNA	C105-95PMA	C105-95PLA	C105-95PBA	C105-95PCAB	C105-95PAB
5A	Impeller Screw - Three Phase	1	C30-14SS	C30-14SS	C30-14SS	C30-14SS	C30-14SS	C30-14SS
6	Volute Assembly with Wear Ring	1	C101-284E	C101-284E	C101-284E	C101-284E	C101-264E	C101-264EB
6A	Wear Ring	1	C23-27	C23-27	C23-27	C23-27	C23-19	C23-19
8	Hex capscrew - 3/8 - 16 x 1” Lg.	2	U30-74ZP	U30-74ZP	U30-74ZP	U30-74ZP	U30-74ZP	U30-74ZP
8A	Hex capscrew - 3/8 - 16 x 1-1/4” Lg.	2	U30-75ZP	U30-75ZP	U30-75ZP	U30-75ZP	U30-75ZP	U30-75ZP
9	Pipe Plug - 1/4” NPT	3	U78-941ZPV	U78-941ZPV	U78-941ZPV	U78-941ZPV	U78-941ZPV	U78-941ZPV
†10	Gasket - Volute	1	C20-121C	C20-121C	C20-121C	C20-121C	C20-122C	C20-122C
11	Base	1	J104-9F	J104-9F	J104-9F	J104-9F	J104-9F	J104-9F
11A	Motor Pad	1	C35-5S	C35-5S	C35-5S	C35-5S	C35-5S	C35-5S
	SERVICE KIT							
	Seal and Gasket Kit	1	PP1700	PP1700	PP1700	PP1700	PP1700	PP1700
	NOTE: † Included in Seal and Gasket Kit.							

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.



REPAIR PARTS LIST – CTB SERIES

Key No.	Part Description	No. Used	MOTOR AND HORSEPOWER					
			CTJ05B CTJ05B3 1/2 HP	CTJ07B CTJ07B3 3/4 HP	CTJ10B CTJ10B3 1 HP	CTJ15B CTJ15B3 1-1/2 HP	CTJ20B CTJ20B3 2 HP	CTJ25B CTJ25B3 2-1/2 HP
1	Motor, 115/230V, 1 Phase	1	J218-582APKG	J218-590PKG	J218-596PKG	J218-601PKG	J218-883APKG	J218-628APKG
1	Motor, , 230/460V, 3 Phase	1	AP100CL	AP100DL	AP100EL	AP100FL	AP100GL	AP100G5L
†2	Water Slinger	1	17351-0009	17351-0009	17351-0009	17351-0009	17351-0009	17351-0009
3	Seal Plate	1	C3-178	C3-178	C3-178	C3-178	C3-181	C3-181
†4	Gasket, Seal Plate	1	C20-121C	C20-121C	C20-121C	C20-121C	C20-122C	C20-122C
†5	Shaft Seal	1	U109-6A	U109-6A	U109-6A	U109-6A	U109-6A	U109-6A
6	Impeller, Single Phase	1	C5-256BA	C5-256BAA	C5-254BA	C5-254BC	C5-257BB	C5-257B
6	Impeller, Three Phase	1	C5-256BA	C5-256BAA	C5-254BA	C5-254BC	C5-257BB	C5-257B
6A	Impeller Screw, Three Phase	1	C30-14SS	C30-14SS	C30-14SS	C30-14SS	C30-14SS	C30-14SS
7	Volute Assembly with Wear Ring	1	C101-284E	C101-284E	C101-284E	C101-284E	C101-264E	C101-264EB
7A	Wear Ring	1	C23-27	C23-27	C23-27	C23-27	C23-27	C23-27
8	Pipe Plug, 1/4” NPT Hex Hd.	3	U78-941ZPV	U78-941ZPV	U78-941ZPV	U78-941ZPV	U78-941ZPV	U78-941ZPV
9	Base	1	J104-9F	J104-9F	J104-9F	J104-9F	J104-9F	J104-9F
9A	Motor Pad	1	C35-5S	C35-5S	C35-5S	C35-5S	C35-5S	C35-5S
10	Hex Capscrew, 3/8” - 16 x 1” Lg.	2	U30-74ZP	U30-74ZP	U30-74ZP	U30-74ZP	U30-74ZP	U30-74ZP
10A	Hex Capscrew, 3/8” - 16 x 1-1/4” Lg.	2	U30-75ZP	U30-75ZP	U30-75ZP	U30-75ZP	U30-75ZP	U30-75ZP
			SERVICE KIT					
	Seal and Gasket Kit	1	PP1700	PP1700	PP1700	PP1700	PP1700	PP1700
	NOTE: † Included in Seal and Gasket Kit.							

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.

TROUBLESHOOTING

TROUBLE AND CAUSE	REMEDY
FAILURE TO PUMP	
1. Pump not properly primed.	1. Make sure pump casing and suction line are full of water. See priming instructions.
REDUCED CAPACITY AND/OR HEAD	
1. Air pockets or leaks in suction line. 2. Clogged impeller.	1. Check suction piping. 2. Remove and clean.
PUMP LOSES PRIME	
1. Air leaks in suction line. 2. Excessive suction lift and operating too near shut-off point. 3. Water level drops while pumping, uncovering suction piping.	1. Check suction piping 2. Move pump nearer to water level. 3. Check water supply. Add length of pipe to suction to keep submerged end under water.
MECHANICAL TROUBLES AND NOISE	
1. Bent shaft and/or damaged bearings. 2. Suction and/or discharge piping not properly supported and anchored.	1. Take motor to authorized motor repair shop. 2. See that all piping is supported to relieve strain on pump assembly.

Limited Warranty

Myers® warrants to the original consumer purchaser ("Purchaser" or "You") of the products listed below, that they will be free from defects in material and workmanship for the Warranty Period shown below.

Product	Warranty Period whichever occurs first:
Jet pumps, small centrifugal pumps, submersible pumps and related accessories	12 months from date of original installation, or 18 months from date of manufacture
Fibrewound Tanks	5 years from date of original installation
Steel Pressure Tanks	5 years from date of original installation
Sump/Sewage/Effluent Products	12 months from date of original installation, or 36 months from date of manufacture
Battery Backup Units	
MBSP-2, MBSP-2C	12 months from date of original installation, or 18 months from date of manufacture
MBSP-3, MBSP-3C	24 months from date of original installation, or 30 months from date of manufacture
Wastewater Solids Handling Pumps	12 months from date of shipment from factory or 18 months from date of manufacture

Our warranty applies only where such products are used in compliance with the requirements of the applicable product catalog and/or manuals. For additional information, please refer to the applicable standard limited warranty featured in the product manual.

Our warranty will not apply to any product that, in our sole judgement, has been subject to negligence, misapplication, improper installation, or improper maintenance. Without limiting the foregoing, operating a three phase motor with single phase power through a phase converter will void the warranty. Note also that three phase motors must be protected by three-leg, ambient compensated, extra-quick trip overload relays of the recommended size or the warranty is void.

Your only remedy, and MYERS's only duty, is that MYERS repair or replace defective products (at MYERS's choice). You must pay all labor and shipping charges associated with this warranty and must request warranty service through the installing dealer as soon as a problem is discovered. No request for service will be accepted if received after the Warranty Period has expired. This warranty is not transferable.

MYERS SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING LIMITED WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE FOREGOING LIMITED WARRANTIES SHALL NOT EXTEND BEYOND THE DURATION PROVIDED HEREIN.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on the duration of an implied warranty, so the above limitations or exclusions may not apply to You. This warranty gives You specific legal rights and You may also have other rights which vary from state to state.

This Limited Warranty is effective April 1, 2014 and replaces all undated warranties and warranties dated before April 1, 2014.

F.E. MYERS
293 Wright Street, Delavan, WI 53115
Phone: 888-987-8677 • Fax: 800-426-9446 • www.femyers.com
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Phone: 800-363-7867 • Fax: 888-606-5484

CT Series

High Pressure Centrifugal Pumps
½ - 2½ HP
Heads to 140 Feet
Capacities to 95 GPM

MYERS CT SERIES LINE OF HIGH PRESSURE CENTRIFUGAL PUMPS PROVIDES QUALITY AT A COMPETITIVE PRICE. The complete line of ½ to 2½ HP units provide strong pressures up to 140 feet and flows up to 95 gpm.

The rugged cast iron body construction is available with either a corrosion resistant composite or brass impeller. The brass impeller unit is equipped with a high temperature, viton seal for more demanding applications. The heavy duty motor features a double ball bearing, 50° C ambient, dual voltage design for dependable service. The compact, back pullout design provides easy installation and serviceability.

The quality features of the CT series will provide dependable service for a wide variety of applications.

SPECIFICATIONS

HP	Catalog No. Composite Impeller	Catalog No. Brass Impeller	Pipe Tapping Sizes Suction (NPT)	Pipe Tapping Sizes Discharge (NPT)	Motor Voltage	Phase	Approx. Wt. Lbs.
½	CT05	CT05B	1¼"	1"	115/230	1	30
	CT053	CT05B3	1¼"	1"	208/230/460	3	30
¾	CT07	CT07B	1¼"	1"	115/230	1	32
	CT073	CT07B3	1¼"	1"	208/230/460	3	32
1	CT10	CT10B	1¼"	1"	115/230	1	35
	CT103	CT10B3	1¼"	1"	208/230/460	3	35
1½	CT15	CT15B	1¼"	1"	115/230	1	40
	CT153	CT15B3	1¼"	1"	208/230/460	3	40
2	CT20	CT20B	1½"	1¼"	115/230	1	57
	CT203	CT20B3	1½"	1¼"	208/230/460	3	57
2½	CT25	CT25B	2"	1½"	115/230	1	62
	CT253	CT25B3	2"	1½"	208/230/460	3	62

ADVANTAGES BY DESIGN

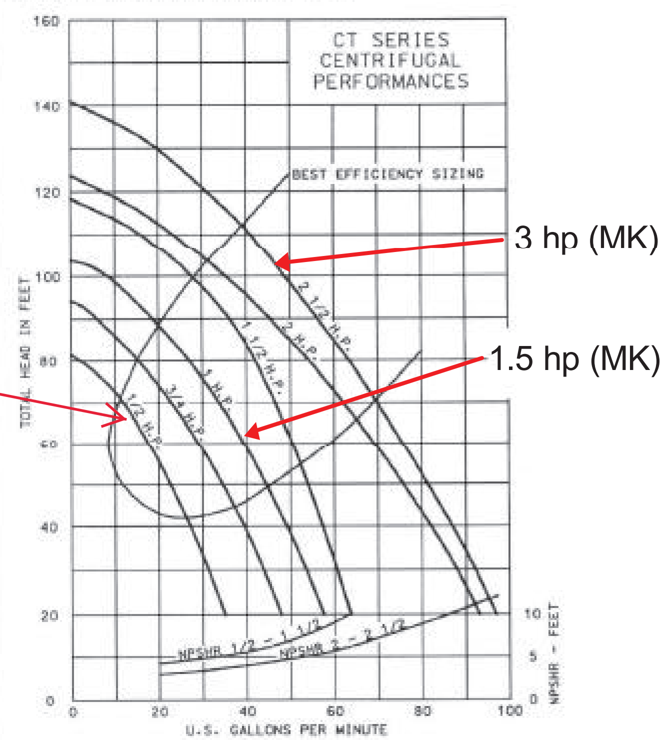
- Heavy duty cast iron construction.
- Back pull-out design.
- Dependable double ball bearing motor
- Continuous duty rating motor.
- Choice of brass or composite impeller.
- Brass impeller pumps rated 212° F.
- Composite impeller pumps rated 140° F.
- Maximum working pressure of 125 psi.
- CSA listed.

Applications

- Booster service
- Irrigation
- Circulating
- Cooling towers
- Air conditioning
- Liquid transfer
- Sprinkling systems
- General industrial service

Note: MK Environmental uses oversized pump motors. See below

PUMP PERFORMANCE



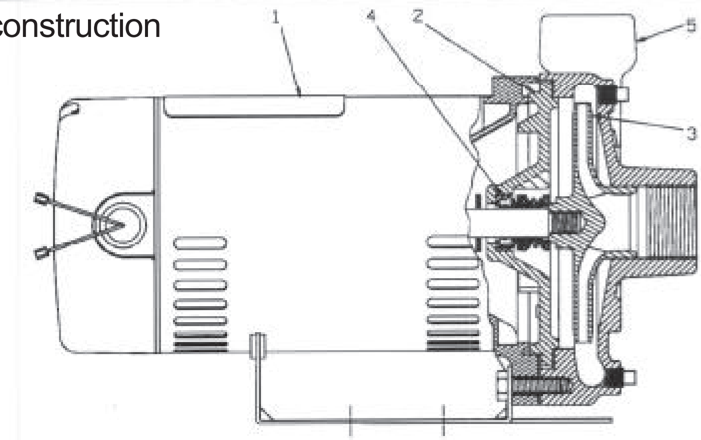
WHERE INNOVATION MEETS TRADITION

Myers
ISO 9001 Certified Company

CT Series

High Pressure Centrifugal Pumps
½ - 2½ HP
Heads to 140 Feet
Capacities to 95 GPM

1. MOTOR MK standard is TEFC construction
- NEMA standard
- Double ball bearing
- Open drip proof
- 60 Hz, 3450 rpm
- Stainless steel shaft
- Single phase with built-in overload protection
- Three phase require overload protection in starter unit
- Non-overloading
- Continuous duty
- Strong capacitor start design

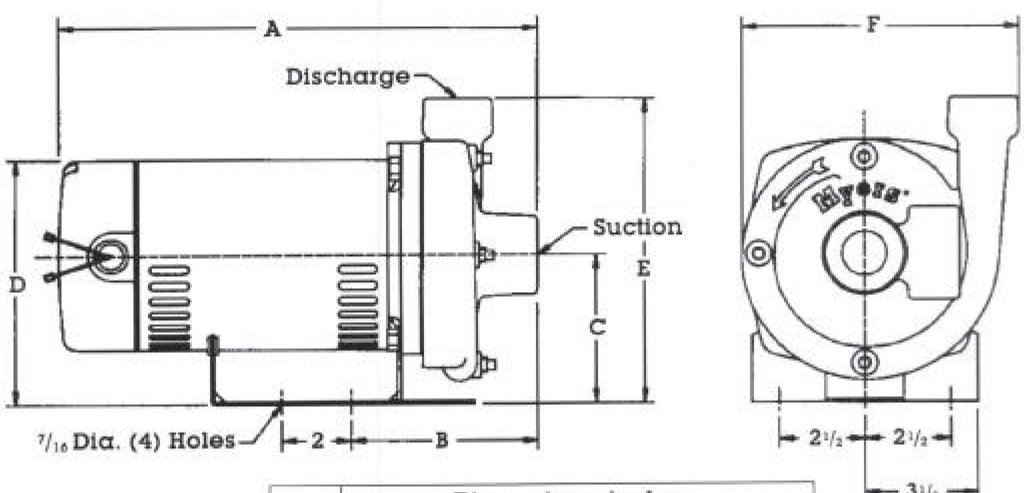


2. SEAL PLATE
- Heavy duty cast iron for dependable service and long life

3. IMPELLER
- Reinforced composite for applications to 140° F.
- Threaded SST insert on composite impellers
- Brass for applications to 212° F.
- Enclosed design for high efficiencies
- Balanced for smooth operation

4. MECHANICAL SEAL
- Standard carbon/ceramic faces, Buna elastomers, 300 series SST components (standard for pumps with composite impellers)
- High temperature carbon/ceramic faces, viton elastomers, 300 series SST components (standard for pumps with brass impellers)

5. CASING
- Heavy duty cast iron construction
- Back pull-out design
- Discharge can be rotated in four positions
- Tapped openings for priming, venting and draining.
- Vertical discharge standard



HP	Dimensions, inches							
	A	B	C	D	E	F	Suct.	Disch.
1/2	13 7/8	5 1/2	4 3/8	7 1/4	9	8	1 1/4	1
3/4	14 3/8	5 1/2	4 3/8	7 1/4	9	8	1 1/4	1
1	15 1/8	5 1/2	4 3/8	7 1/4	9	8	1 1/4	1
1 1/2	15 1/8	5 1/2	4 3/8	7 1/4	9	8	1 1/4	1
2	16 1/2	6 1/4	4 1/2	7 1/2	9 1/2	8 7/8	1 1/2	1 1/4
2 1/2	16 1/2	6 1/4	4 1/2	7 1/2	9 1/2	8 7/8	2	1 1/2

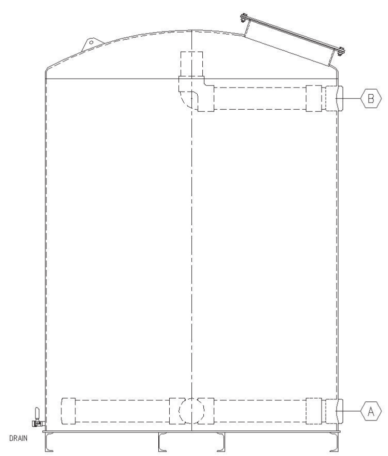
PRODUCT DATA

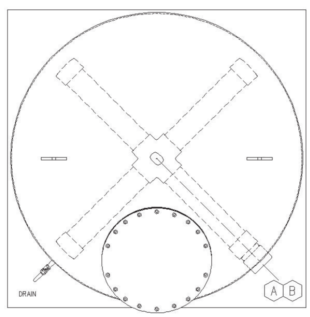
tetraSOLV FILTRATION

with MK Modifications

VFV SERIES FILTERS

VFV series filters are designed to treat vapor streams in a wide variety of adsorption applications. The modular design enables the units to easily fit into a wide variety of installations. Standard features include steel construction with epoxy internal coating, efficient internal distributor array, forklift skid and lifting eyes.





A - Process Inlet
B - Process Outlet
C - Drain
Manway standard size 18" Round

Standard Model Shown - Detailed Submittal Drawings Available

VFV SERIES STANDARD SPECIFICATIONS

Model Number	VFV-250	VFV-500	VFV-1000	VFV-2000	VFV-3000	VFV-5000	VFV-10000
Overall Height	3'11"	5'3"	6'5"	7'7"	7'10"	9'0"	9'4"
Diameter	24"	30"	36"	48"	60"	72"	96"
Process Connection	2" FNPT	2" FNPT	3" FNPT	4" FNPT	8" flange	6" FNPT	6" FNPT
Typical GAC Fill (28#/FT³)	250 Lbs	500 Lbs	1,000 Lbs	2,000 Lbs	3,000 Lbs	5,000 Lbs	10,000 Lbs
Shipping Weight (empty)	165 Lbs	375 Lbs	500 Lbs	925 Lbs	1,375 Lbs	2,300 Lbs	3,150 Lbs
Operational Weight	500 Lbs	1,050 Lbs	1,800 Lbs	3,500 Lbs	5,250 Lbs	8,750 Lbs	15,800 Lbs
Air flows for standard conditions	30 to 180 CFM	50 to 300 CFM	70 to 420 CFM	125 to 750 CFM	200 to 1200 CFM	280 to 1680 CFM	500 to 3000 CFM
Available Bed Volume	9 FT^3	19.5 FT^3	35 FT^3	75 FT^3	117 FT^3	196 FT^3	400 FT^3
Maximum Pressure	10 PSIG	10 PSIG	10 PSIG	10 PSIG	5 PSIG	10 PSIG	10 PSIG
Maximum Vacuum	28" Hg	28" Hg	28" Hg	28" Hg	15" Hg	28" Hg	28" Hg

Vent-Scrub® Vapor Phase Adsorbers

Applications

The Vent-Scrub® adsorbers have been proven to be the simplest and most cost effective way to treat malodorous and VOC emission problems. Sturdy steel construction and specially formulated corrosion resistant internal coating ensures long service life and low maintenance. Applications for Vent-Scrub® adsorbers include:

- API separator vents
- VOC control from soil vapor extraction (SVE) systems and airstrippers
- Wastewater and product storage tank vents
- Process vents
- Refinery and chemical plant wastewater sewer vents
- Laboratory hood exhausts

Installation, Startup and Operation

Siemens can provide a total service package that includes utilizing OSHA trained personnel providing on-site carbon changeouts, packaging and transportation of spent carbon for recycling at our reactivation facilities, where the contaminants are thermally destroyed.

We provide instructions on sampling the spent carbon and completion of our spent carbon profile form. Spent carbon acceptance testing can be performed at our certified laboratory.

When requested, a certificate of reactivation will be issued.

Benefits and Design Features

- Durable, carbon steel construction.
- Abrasion and corrosion resistant baked epoxy lining; urethane exterior finish (Vent-Scrub® 1000, 2000, 3000, 8000 adsorbers).
- Ready-to-use systems: simple installation and operation.
- Applications to 3750 SCFM.
- The Vent-Scrub® 1000, 2000, 3000 and 8000 adsorbers have forklift channels for easy handling.
- The Vent-Scrub® 200, 400, 1000 and 2000 adsorbers are UN/DOT approved transportation containers for RCRA hazardous spent carbon.
- Hose kit and pipe manifold options are available to simplify installation and operation.

Piping Manifold (Optional)

- 2"/3" sch 80 PVC piping and valves (optional carbon steel and stainless steel piping).
- Series or parallel operation.
- Sampling ports and pressure gauges.
- Flexible hoses with Kamlock fittings allow easy installation and removal during service exchange operations (Vent-Scrub® 200, 400, 1000 and 2000 adsorbers).

Specification					
Vent-Scrub® Adsorber Model No.	200	400	1000/2000	3000	8000
Dimensions, diameter x overall height	22” x 34”	32” x 43”	48” x 59”/48” x 95”	60” x 112”	96” x 131”
Inlet Connection	2” FNPT	4” FNPT	4” FNPT	10” Flange	16” Flange
Outlet Connection	2” MPT	4” FNPT	4” FNPT	10” Flange	16” Flange
Manway	Top	Top	18” Top	16” Top	20” Top/Side
Internal Distribution[1]	PVC	PVC	PVC	FRP/PPL	FRP/PPL
Interior Coating	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Exterior Coating	Enamel	Enamel	Epoxy/Urethane	Epoxy/Urethane	Epoxy/Urethane
Carbon Fill Volume (Cu.ft.)	6.8	14	34/68	107	273
Cross Sectional Area (sq.ft.)	2.8	4.9	12.3	19.6	50.2
Approx. Carbon Weight (lbs)	200	400	1000/2000	3000	8000
Empty Vessel Weight (lbs)	50	80	890/1190	2500	5500
Flow, CFM (max.)	100	300	500	1500	3750
Pressure, psig (max.)	3	3	14.9	5	5
Temperature, deg. F (max)[4]	140	140	140	140	140
Vacuum, in. Hg (max.)	N/A	N/A	12/12[2]	6[3]	12[3]

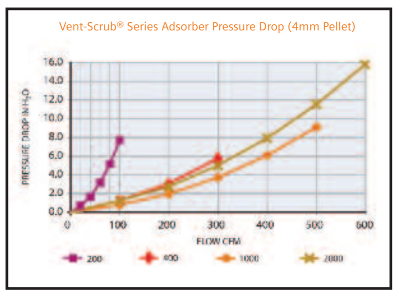
1Carbon steel and stainless steel internals are also available.
2For vacuum greater than 12 in. Hg on Vent-Scrub® 2000 Adsorber, contact your Siemens representative.
3For vacuum service on Vent-Scrub® 3000 and 8000 Adsorber, contact your Siemens representative.
4For higher temperatures, stainless and carbon steel internals are available.
For detailed dimensional information or drawings, contact your local Siemens sales representative.

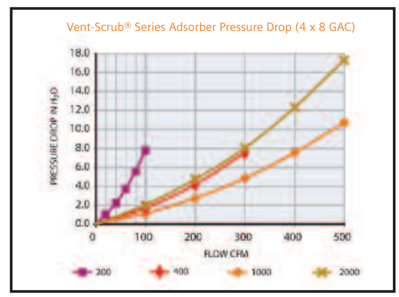
Warning

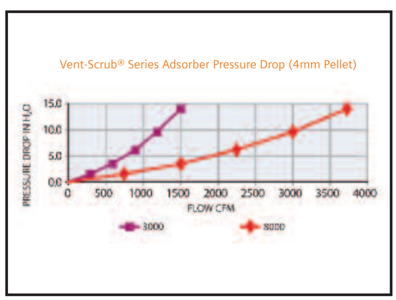
The adsorption of organic compounds onto activated carbon generates heat. In rare instances, adsorbed compounds may also react on the carbon surface to generate additional heat. If these heat sources are not properly dissipated, the carbon bed temperature may rise to the point where the carbon can ignite, leading to a fire or other hazardous condition. A description of industry-accepted engineering practices to assure the dissipation of heat and safe operation of the carbon bed can be provided upon request. In certain applications where the risk of ignition is significant, activated carbon may not be a recommended treatment technology. Please contact your Technical Sales Representative for more details.

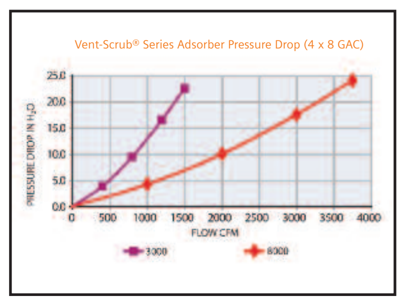
Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

All information presented herein is believed reliable and in accordance with accepted engineering practices. Siemens makes no warranties as to the completeness of this information. Users are responsible for evaluating individual product suitability for specific applications. Siemens assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.









Siemens
Water Technologies
866.613.5620 phone

WS-VSCdr-DS-0910
Subject to change without prior notice.

NORIT® VAPURE™ REACT GRANULAR ACTIVATED CARBON

WHY CABOT

Cabot Norit Activated Carbon is a premier activated carbon manufacturer respected for experienced people, diverse products and strong customer relationships. Cabot's history of innovation, product performance, technical expertise and customer focus ensure that you receive the right products and solutions for your specific purification needs.

BSI
ISO 9001
FM 39843

NORIT VAPURE REACT is a granular reactivated carbon produced under closely controlled operating conditions in our state-of-the-art facility. Quality and screen size are designed to provide high performance levels in the removal of odors, toxic vapors, and irritants from various gas streams. This product is a recycled activated carbon and not for food grade or potable water applications.

PRODUCT SPECIFICATIONS

Iodine number	850 min.	mg/g
Hardness number (ASTM)	95 min.	
Moisture	3 max.	% as packed
Mesh size (U.S. Sieve Series)		
Greater than 4 mesh (4.75 mm)	5 max.	%
Less than 10 mesh (2.00 mm)	5 max.	%

TYPICAL PROPERTIES*

Butane activity, (ASTM)	23**	%
Apparent density, vibrating feed	0.50	g/mL
	31	lb/ft^3

*For general information only, not to be used as purchase specifications.
**This butane activity value is equivalent to a carbon tetrachloride adsorption value of 62%.

PACKAGING/TRANSPORTATION

Standard package is woven polypropylene bulk bags, 800 lb net.
Activated carbon (NOT REGULATED)
Exempt from DOT, IATA, and IMDG regulations
Import/Export classification: 3802.10.0000 (HS Tariff Classification)
Domestic Freight Classification: NMFC 040560
CAS # 7440-44-0

NORIT® VAPURE™ REACT

MATERIAL HANDLING

Wet activated carbon depletes oxygen from air and, therefore, dangerously low levels of oxygen may be encountered. Whenever workers enter a vessel containing activated carbon, the vessel's oxygen content should be determined and work procedures for potentially low oxygen areas should be followed. Appropriate protective equipment should be worn. Avoid inhalation of excessive carbon dust. No problems are known to be associated in handling this material. Please see the product Material Safety Data Sheet for details. Long-term inhalation of high dust concentrations can lead to respiratory impairment. Use forced ventilation or a dust mask when necessary for protection against airborne dust exposure (see Code of Federal Regulations - Title 29, Subpart Z, par. 1910.1000, Table Z-3).

CABOT
NORIT ACTIVATED CARBON

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Elgin, IL 60120

REACTION FOR THE REMOVAL OF VINYL CHLORIDE USING POTASSIUM PERMANGANATE

The reaction of permanganate ion with vinyl chloride monomer is outlined in Figure 1. The reaction produces 1,2 dihydroxy, chloroethane, an addition product, and a precipitate of manganese dioxide. A short description of the reaction is also included below. The typical oxidation reaction for an alkene by permanganate ion may be found in any general organic chemistry text.

The oxidation of an alkene leads to the formation of a compound with hydroxyl groups on the carbon atoms that were involved in the double bond, a 1,2 diol. Manganese (VII) in permanganate ion is ultimately reduced to manganese (IV) in manganaese dioxide. The carbon atoms of the double bond are oxidized. Even if no base is added at first, the solution becomes progressively more basic as the reaction proceeds.

In this oxidation reaction, the two hydroxyl groups become attached to the same face of the double bonds. The permanganate ion is believed to add to the double bond to give a cyclic intermediate, a manganate ester. The first step of this reaction is the syn (same side) addition of permanganate ion to the double bond. This intermediate breaks down in the presence of water to give the cis-1,2 diol. Thus, there are no appreciable quantities of chlorine gas or formaldehyde formed in the reaction.

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Reaction Mechanism of Permanganate Ion with VCM (Vinyl Chloride Monomer)

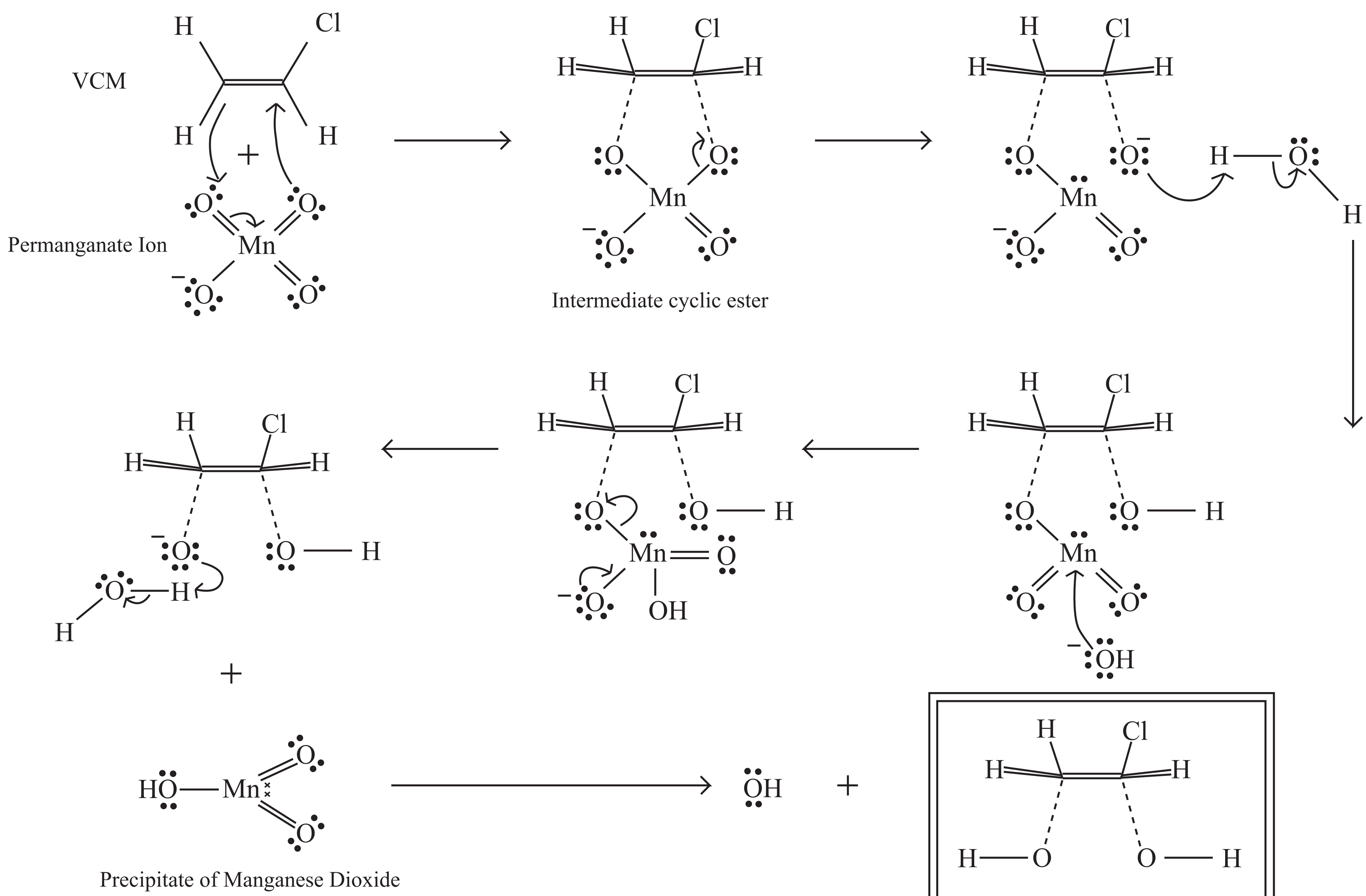

FIGURE 1

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➢ HS-600 provides a significantly longer service life than potassium hydroxide impregnated carbon.

Hydrosil HS-600 has 3.6 pounds of active ingredient as compared to 1.6 pounds of active ingredient (32 pounds per cubic foot times 5.0%). Mathematically, the service life of HS-600 is 125% greater.

➢ HS-600 is effective on a broader spectrum of gaseous pollutants.

Potassium permanganate used in the Hydrosil HS-600 production process chemically produces manganese dioxide (MnO_2) and manganese tetraoxide (MnO_4), in addition to potassium hydroxide (KOH). Manganese dioxide/tetraoxide is effective in removing sulfur dioxide, nitrogen dioxide, chlorine dioxide and mercaptans. These chemicals are not present in potassium hydroxide impregnated carbon. Typically corrosive pollution in a plant environment is caused by a broad group of chemicals and potassium hydroxide impregnated carbon is too focused to handle this broad spectrum.

➢ HS-600 does not support combustion.

Potassium hydroxide impregnated carbon will support combustion.

➢ HS-600 provides a visual indicator when the media is spent.

The manganese dioxide/tetraoxide produces a purple color, which evolves to a dull brown as the media is spent. Testing is the only reliable way of knowing the remaining productive service life of the media. Visual indications are useful in prioritizing the need to test.

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Effectiveness of Chemisorption on Chlorinated Solvents

> ➢ Mechanism of removing vinyl chloride in air with potassium permanganate

Activated carbon is used to remove many chlorinated solvents in air streams. If the isotherm (adsorption capacity) is good this is the best method. In the case of low molecular weight chlorinated solvents this isotherm is not very good. In these cases we must use other mechanisms for the removal of the pollutant gas. The alternative to adsorption/absorption is to have the gas adsorbed into a substrate and have a chemical reaction to neutralize or oxidize the pollutant. This mechanism is understood to be chemisorption.

Potassium permanganate is a very good chemical to perform both the neutralization and oxidization process in air. When potassium permanganate is hydrated it will form three compounds. These compounds are potassium hydroxide, manganese tetraoxide and manganese dioxide. The in the case of vinyl chloride the manganese tetraoxide will oxidize the vinyl chloride into potassium chloride and carbon dioxide. The potassium chloride will remain in the pore structure of the substrate that contains the hydrated potassium permanganate.

Hydrosil impregnates a molecular sieve of zeolite with 6% by weight potassium permanganate. This media is called HS-600. Field applications of this media in removing vinyl chloride from air streams have been proven to be efficient and economically better than that of activated carbon. In field studies, the spent media was tested and determined that it did not pose a hazardous waste. The spent material was disposed in a landfill. In using this media, a representative sample should be tested for hazardous materials prior to disposal in a landfill as a non-hazardous waste.

It should be noted that if other higher molecular weight chlorinated substances are present in the air stream it is advisable to place activated carbon scrubber systems prior to the potassium permanganate system. This will increase the efficiency of the systems and result in decreased operating costs.

1180 St. Charles Street, Elgin, IL 60120 1.847.741.1600 Fax 1.847.741.1616 1.800.PURPLE.1
www.hydrosilintl.com

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Remaining Service Life

The percentage of available potassium permanganate and the density of the gas phase media can be correlated to the active service life left in the product. If the media in the adsorber is Hydrosil HS-600 or an activated alumina based product, the following schedule can be followed:

Hydrosil HS-600 Percentage of Potassium Permanganate (% by weight)		Activated Alumina Percentage of Potassium Permanganate (% by weight)
2.2 to 6.0	**SAFE**	2.6 to 4.0
1.6 to 2.2	**BORDERLINE**	1.9 to 2.6
1.2 to 1.6	**CHANGE**	1.4 to 1.9
0.0 to 1.2	**CHANGE IMMEDIATELY**	0.0 to 1.4

The comments are intended to mean the following:

SAFE	- Reanalyze in 90 days
BORDERLINE	- Change in 30-60 days
CHANGE	- Change in 30 days, breakthrough could occur quickly under plant "spill" conditions
CHANGE IMMEDIATELY	- Change Immediately

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Hydrosil HS-600

Hydrosil vigorously controls the production process. Data is reviewed and maintained on each batch as it is being produced through and including the moisture content of the HS-600 being delivered to our customer.

- **HS-600 Specifications**

The potassium permanganate impregnated media shall have no less than 3.6 pounds of potassium permanganate per cubic foot, a bulk density of no less than 60 pounds per cubic foot, a moisture content of 12-15% by weight and shall not dust. The media shall have an irregular particle size of 4 x 8 mesh.

The performance characteristics of the air filtration media shall meet or exceed a service life of no less than 72 hours for breakthrough of hydrogen sulfide at the following test conditions:

Media Bed Volume: 76.00 cubic centimeters
Bed Configuration: 2.54 cm (id) x 15.00 cm
Flow Rate: 3000 (+/- 100) ml/minute
Relative Humidity: 70%
Challenge Gas: hydrogen sulfide
Challenge Gas Concentration: 10 (+/- 0.25) PPM

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Elgin, IL 60120

Phone: 1-800-787-7531
Emergency Phone: 1-847-741-1600
Telex*: 1-847-741-1616

Hydrosil HS-600
Identity (Trade Name As Used On Label)

MSDS Number*

CAS Number*

January 1, 2011 to December 31, 2011
Date Prepared

William J. Waldschmidt
Prepared By*

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

COMPONENTS - Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%*	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
hydrated potassium permanganate forming ionic	6-8%	5 mg/m^3	5 mg/m^3	None
potassium hydroxide (CAS # 1310-58-3) and				
ionic manganese tetraoxide (CAS # 1317-35-7)				
Non-Hazardous Ingredients molecular sieve/moisture	92-94%			
TOTAL	**100**			

SECTION 2 - PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point	N/A	Specfic Gravity (H_2O = 1)	Density 59-61 $\#/ft^3$
Vapor Pressure (mm Hg and Temperature)	N/A	Melting Point	N/A
Vapor Density (Air = 1)	N/A	Evaporation Rate (________ = 1)	N/A
Solubility in Water	$KMnO_4$ - yes, molecular sieve - no	Water Reactive	N/A

Appearance and Odor: purple granules, odorless

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

Flash Point and Method Used	Auto-Ignition Temperature	Flammability Limits in Air % by Volume	LEL	UEL
N/A	N/A	N/A	N/A	N/A

Extinguisher Media: None

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None

SECTION 4 - REACTIVITY HAZARD DATA

STABILITY
- ■ Stable
- ☐ Unstable

Conditions To Avoid: Protect in containers against puncture and physical damage, keep in a dry area, avoid exposure to water

Incompatability (Materials to Avoid): None

Hazardous Decomposition Products: None

HAZARDOUS POLYMERIZATION
- ☐ May Occur
- ■ Will Not Occur

Conditions To Avoid: None

SECTION 5 - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY: ☐ Inhalation ☐ Ingestion ☐ Skin Absorption ■ Not Hazardous

CARCINOGEN LISTED IN: ☐ NTP ☐ OSHA ☐ IARC Monograph ■ Not Listed

HEALTH HAZARDS
- Acute: May be irritating to body tissue upon contact
- Chronic: None

Signs and Symptoms of Exposure: May stain body tissue

Medical Conditions Generally Aggravated by Exposure: Open wounds, burns, and mucous membranes

EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary

Eye Contact: Immediately flush with large amounts of water for 15 minutes

Skin Contact: Immediately flush with soap and water

Inhalation: Leave contaminated area

Ingestion: Drink several glasses of water or milk. Seek medical attention.

SECTION 6 - CONTROL AND PROTECTIVE MEASURES

Respiratory Protection (Specify Type): Treat as low level nuisance dust, Use NIOSH/MSA #TC-21C-132

Protective Gloves: Rubber or plastic gloves

Eye Protection: Safety glasses

VENTILATION TO BE USED: ☐ Local Exhaust ■ Mechanical (general) ☐ Special ☐ Other (specify)

Other Protective Clothing and Equipment: Regular work clothing

Hygienic Work Practices: Wash your hands before eating. Wash contaminated clothing.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE/ LEAK PROCEDURES

Steps to be Taken If Material is Spilled Or Released: Sweep up granules and dispose of in accordance with local, state, and federal regulations.

Waste Disposal Methods: Reduce potassium permanganate with hypo (10% sodium thiosulfate) solution and deposit in permitted landfill.

Precautions to be Taken in Handling and Storage: Protect containers against physical damage. Store in a cool dry area in closed containers.

Other Precautions and/or Special Hazards: Avoid exposure to water and contaminated air, otherwise the media is rendered useless

NFPA Rating* Health _______ Flammability _______ Reactivity _______ Special _______

HMIS Rating* Health _______ Flammability _______ Reactivity _______ Special _______

* Optional

tetraSOLV FILTRATION

Tetrasolv Filtration Inc
Vapor Phase Adsorption Model

System Conditions	
System Temperature (oF)	90.000
Flow Rate (acfm)	600.000
System Pressure (mmHg)	760.000
System Operation (hrs/day)	24.000

Rev 13

45036.447

Project

Component	Inlet Concentration	Inlet Concentration	Activated carbon 55 CTC		
			Capacity	Usage	
	ppm	lb/day	% (w/w)	lb/day	
ACETALDEHYDE	0.000	0.000	0.000	0.000	
ACETONE	0.230	0.029	0.464	6.196	
ACETIC ACID	0.000	0.000	0.000	0.000	
ACRYLONITRILE	0.000	0.000	0.000	0.000	
ALLYLCHLORIDE	0.000	0.000	0.000	0.000	
ANILINE	0.000	0.000	0.000	0.000	
BENZENE	0.015	0.003	2.900	0.087	
BUTANE-n	0.000	0.000	0.000	0.000	
BUTANOL-n	0.000	0.000	0.000	0.000	
BUTOXY ETHANOL-2	0.000	0.000	0.000	0.000	
BUTYL ACETATE-n	0.000	0.000	0.000	0.000	
BTEX	15.680	5.592	53.444	10.463	*
CARBON TETRACHLORIDE	0.000	0.000	0.000	0.000	
CHLOROBENZENE	0.000	0.000	0.000	0.000	
CHLOROFORM	0.000	0.000	0.000	0.000	
CUMENE	0.009	0.002	16.244	0.014	
CYCLOHEXANE	0.050	0.009	4.621	0.196	*
DICHLOROBENZENE	0.000	0.000	0.000	0.000	
DICHLOROETHANE-1,2	0.000	0.000	0.000	0.000	
DICHLOROETHYLENE-1,1	0.000	0.000	0.000	0.000	
DICHLOROMETHANE	0.000	0.000	0.000	0.000	
DIETHYLENE GLYCOL MONOBUTYL ETHER	0.000	0.000	0.000	0.000	
DIETHYL ANILINE	0.000	0.000	0.000	0.000	
DIMETHYLPENTANE-2,2	0.000	0.000	0.000	0.000	
ETHANOL	57.890	5.735	7.208	79.572	
ETHYL ACETATE	0.000	0.000	0.000	0.000	
ETHYLBENZENE	0.014	0.003	12.491	0.026	
ETHYL CHLORIDE	0.000	0.000	0.000	0.000	
ETHYLENE GLYCOL MONOPROPYL ETHER	0.000	0.000	0.000	0.000	
HEPTANE-n	0.000	0.000	0.000	0.000	
HEXANE-n	0.000	0.000	0.000	0.000	
ISOPRENE	0.000	0.000	0.000	0.000	

ISOPROPANOL	0.000	0.000	0.000	0.000	
ISOPROPYL ACETATE	0.000	0.000	0.000	0.000	
ISOPENTYL ACETATE	7.080	1.982	34.954	5.671	*
METHANOL	0.000	0.000	0.000	0.000	
METHYL-2-PYROLIDONE	0.000	0.000	0.000	0.000	
METHYL ACRYLATE	0.000	0.000	0.000	0.000	
METHYL CHLORIDE	0.000	0.000	0.000	0.000	
METHYL ETHYL KETONE	0.018	0.003	0.883	0.316	
METHYL ISOBUTYL KETONE	0.000	0.000	0.000	0.000	
METHYL METHACRYLATE	0.000	0.000	0.000	0.000	
METHYL TERT BUTYL ETHER	0.000	0.000	0.000	0.000	
METHYLENE CHLORIDE	0.000	0.000	0.000	0.000	
NAPTHALENE	0.000	0.000	0.000	0.000	
PENTANE-n	0.000	0.000	0.000	0.000	
PHENOL	0.000	0.000	0.000	0.000	
PROPANE	0.000	0.000	0.000	0.000	
PROPANOL	0.000	0.000	0.000	0.000	
PROPYLENE GLYCOL-1,2	0.780	0.128	30.427	0.420	*
STYRENE	0.064	0.014	19.034	0.075	
TPH-GRP	0.000	0.000	0.000	0.000	
TETRACHLOROETHYLENE	0.010	0.004	12.778	0.028	
TETRACHLOROETHANE	0.000	0.000	0.000	0.000	
TETRAHYDROFURAN	0.000	0.000	0.000	0.000	
TOLUENE	0.015	0.003	7.222	0.041	
TRI-O-CRESYL PHOSPHATE	0.000	0.000	0.000	0.000	
TRICHLOROETHANE-1,1,1	0.000	0.000	0.000	0.000	
TRICHLOROETHYLENE (TCE)	0.000	0.000	0.000	0.000	
TRICHLOROTRIFLUOROETHANE-1,1,2	0.000	0.000	0.000	0.000	
TRIMETHYLAMINE	0.000	0.000	0.000	0.000	
VINYLCHLORIDE	0.124	0.017	0.042	39.800	
XYLENE	0.043	0.010	16.166	0.061	*
Total Usage	82.022	13.533		142.966	
Average Adsorption Capacity (% w/w)			0.095		

The Adsorption Capacity Is Estimated Using The Polanyi Adsorption Theory And Toluene

Note: estimated based on models, results not guaranteed.

* Compound	Surrogate used
2-Ethylhexyl acrylate	PROPYLENE GLYCOL-1,2
n-Butyl acrylate	ISOPENTYL ACETATE
Methylcyclohexane	CYCLOHEXANE. Added to cyclohexane
Diesel Range Organics (C10)-(C28)	BTEX
o-xylene	included in total xylenes

Note: Surrogate are used for compounds where isotherms were not available for carbon modeling. Surrogates were chosen based on similar chemical characteristics (i.e. chemical structure, MW, etc.).

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Hydrosil HS-600 Product Usage on Vapors

Contaminant	CAS	HAP	Input Concentration	HS-600 Usage
			lb/day	lb/day
2-Ethylhexyl acrylate	103-11-7		0.01	0
Acetone	67-64-1		0.001	0
Ethanol	64-17-5		0.29	0
n-Butyl acrylate	141-32-2		0.10	0
Vinyl chloride	75-01-4	HAP	0.02	1.2
Styrene	100-42-5	HAP	0.001	0
Toluene	108-88-3	HAP	0.0001	0
Benzene	71-43-2	HAP	0.0001	0
o-xylene	95-47-6	HAP	0.0002	0
xylenes, total	1330-20-7	HAP	0.0005	0
2-Butanone (MEK)	78-93-3		0.0002	0.009
Tetrachloroethene	127-18-4	HAP	0.0002	0.008
Ethylbenzene	100-41-4	HAP	0.0002	0
Cyclohexane	110-82-7		0.0001	0
Isopropylbenzene (cumene)	98-82-8	HAP	0.0001	0
Methylcyclohexane	108-87-2		0.0004	0
Diesel Range Organics (C10)-(C28)	n/a		0.29	0
			Total	1.2

Note: Influent vapor concentrations assume 0% of Vinyl Chloride mass in air stripper effluent is removed by carbon and 95% of remaining VOC mass is removed by carbon.

Modular Tank Summary Sheet

Harpoon Tanks

- Two (2) tanks will be used to store water collected across the Site during response activities.
- Both tanks are 70-foot diameter by 36-foot tall with an individual maximum capacity of 24,675 barrels (bbls; 1,036,350 gallons) when completely full (i.e., at zero freeboard).
- The tanks are expected to be filled to a maximum usable capacity of 22,619 bbls (950,000 gallons) reserving approximately 3 feet of freeboard.
- Both tanks have been plumbed such that the volume of stored water will equalize between the tanks. At each tank, a valve was installed on the connecting pipe between the tanks. Each valve is kept closed and locked/tagged-out to reduce the potential for a release from both tanks at one time.
- Equalization will be conducted periodically by a valve operator manually opening the valves on each tank. The tanks will be monitored throughout the equalization process by the valve operator and other on-site personnel, staffed 24/7. The valves are shut and locked/tagged-out as soon as equalization is complete.
- Tank levels will be monitored by transducers. A display is mounted on the exterior of each tank.

Secondary Containment

- Both tanks were installed within a single secondary containment consisting of an impermeable liner, steel sheet piles, and earthen berms.
- The impermeable liner consists of a 120 mil Linear Low-Density Polyethylene (LLDPE) liner manufactured by ATARFIL.
- The total volume of available secondary containment is: 27,870 bbls (1,170,500 gallons), which provides for approximately 8 inches of freeboard when containing 113% of the volume of the largest tank 24,675 bbls (1,036,350 gallons).
  - The containment was designed to meet the requirements of 40 CFR Subpart J 265.193(e)(1) whereby the capacity is sufficient to contain precipitation from a 25-year, 24-hour rainfall event, which is 3.96 inches (reference: NOAA Atlas 14, Volume 2, Version 3, East Palestine, Ohio)
  - The containment calculation also accounts for the following:
    - Displacement of one tank
    - Displacement of the pumping equipment
- Stormwater that accumulates within the secondary containment area is collected by two sumps and will be pumped into the tanks.
- The tanks will be visually inspected daily by on-site personnel, staffed 24/7 to monitor for leaks into the secondary containment.
- The truck unloading/loading area will be paved with a 9-inch-thick asphalt pavement section and a 12-inch-tall asphalt curb to provide secondary containment. This area will also be sloped to a catch basin inlet that will be piped to the collection sumps located within the tank secondary containment area. From this point any water will be pumped back into the tanks.

Tank Loading Operations

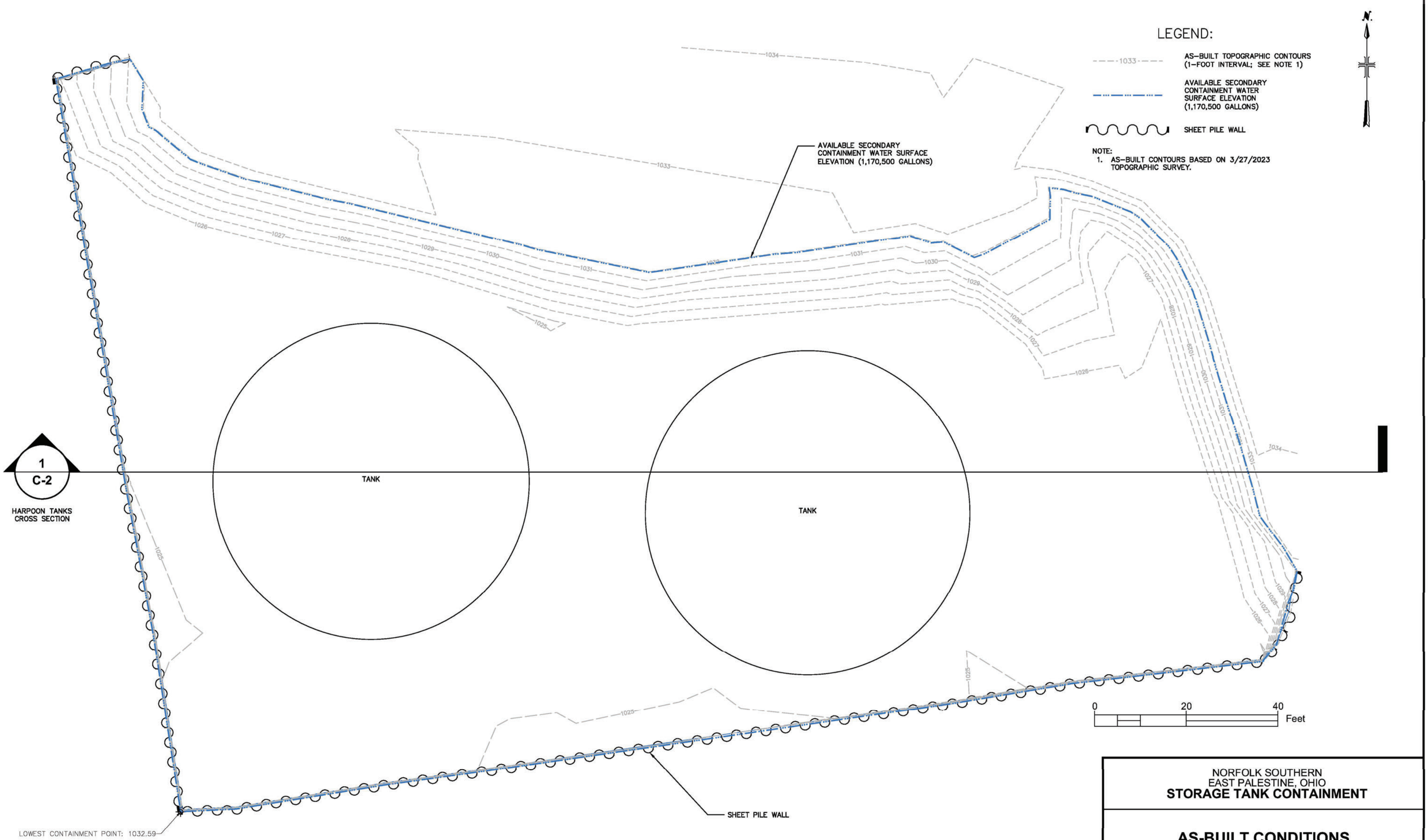
- Industrial vacuum trucks will offload into the tanks using a manifold system that gravity feeds to a pump within the containment area. The pump will convey water up into the tanks. There will be one manifold installed with the ability to scale-up the system to accommodate more loading points if needed.
- Air monitoring will occur during loading operations at all connections in accordance with the procedures and action levels in the HASP by trained CTEH personnel
- Water from the North Ditch will be pumped directly into the tanks.
- Flow meters will be installed on the manifold to monitor input into the tanks. Flow meters will also be installed on the piping from North Ditch pump.

Tank Offloading Operations

- An offload pumping system will be installed to the north of the tanks with the ability to simultaneously load two tanker trucks directly from the tanks.
- Plumbing will be installed to connect a third loading platform for use as a backup offloading area, if needed.
- Flow meters will be installed on the load-out pipes to meter truck filling.
- Air monitoring will occur during offloading operations using the same procedures as loading operations.

Emergency Procedures

- Visual and audible high-level alarms will be installed on each tank. The first level alarm will be set at 3 feet of freeboard in the tank (i.e., maximum usable capacity). The second alarm level will be set to the manufacturer's recommended minimum freeboard of 1.5 feet.
- All tank inflow pumps will be programmed to automatically shut down when the tank level reaches the maximum usable capacity as indicated by the first level alarm.
- In the event of a first alarm or direct spill, the Operations Section Chief, Deputy Operations Section Chiefs, and Wastewater Transfer Group Supervisor will be notified immediately of discovery by on-site personnel. by on-site personnel.
- The Operations Section Chief will notify Unified Command within 30 minutes of notification.
- Refer to Incident Action Plan ICS 204 Wastewater Transfer Group and ICS 205a Communication List for contact information.



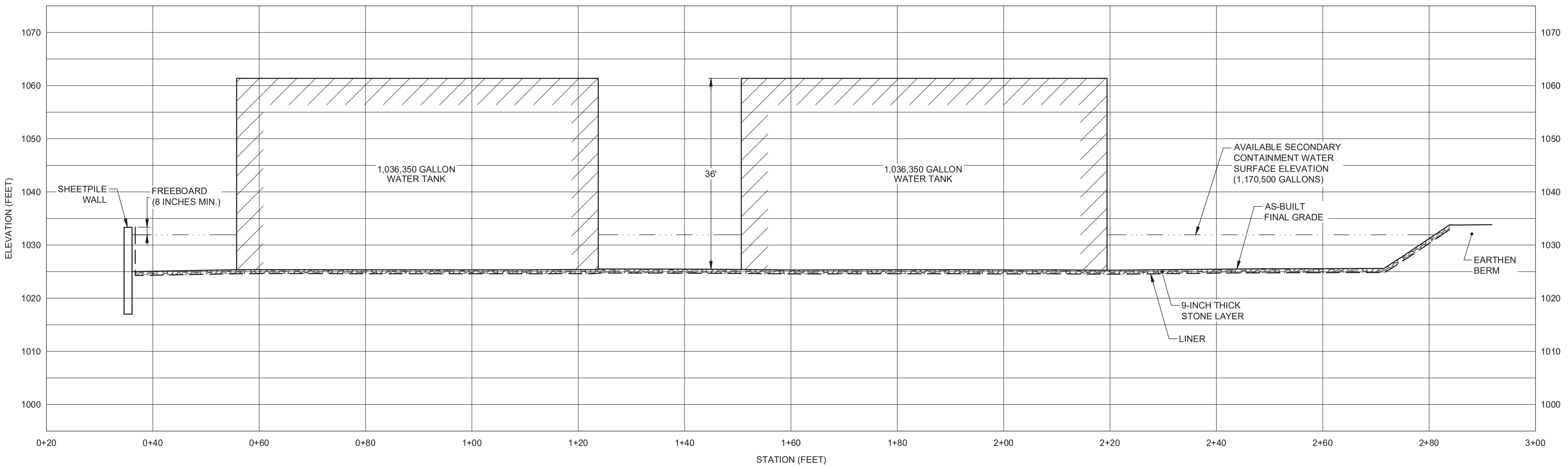
NORFOLK SOUTHERN
EAST PALESTINE, OHIO
STORAGE TANK CONTAINMENT

AS-BUILT CONDITIONS

ARCADIS

FIGURE
C-1

C:\Users\VDavis\ARCADIS\NS East Palestine - General\11 Engineering & Design\01 Stormwater Management\Tank Farm Containment Calcs\TANK FARM CONTAINMENT AS-BUILT.dwg LAYOUT: C-1 SAVED: 4/6/2023 3:34 PM ACADVER: 24.2S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ----
PLOTTED: 4/6/2023 3:34 PM BY: DAVIS, VANCE
XREFS: NS_E_PALESTINE-X-Border
IMAGES: DJI_20230327161415_0470.jpg



HARPOON TANKS CROSS SECTION

(NO VERTICAL EXAGGERATION)

0 10' 20'
GRAPHIC SCALE

NORFOLK SOUTHERN
EAST PALESTINE, OHIO
STORAGE TANK CONTAINMENT

CROSS SECTION

ARCADIS

FIGURE
C-2

T: (720) 690-6989

HYDRERA WATER SERVICES

DOC #00157

*Harpoon Install Report

H20p-05 & 06 East Palestine OH 2 25k

Sent By

Cody Phillips 005

Sent At

26 March 2023 at
11:21 PM

Submitted By:

Cody

Weather:

Nice/sunny

Report #:

J1

Customer:

Rain For Rent

Field Contact:

Phone #:

(___) ___-____

Supervisor Name:

Cody

Groundwork Supervisor:

Cody

Lease Name:

East Palestine Train Derailment

State/Province:

Oh

Directions to Location:

Tank Size:

25k

Start Time:

Fluid Composition:

NonPot/Vinyl Chloride/fire suppression

Finish Time:

Equipment Type:

Lifting Implements Serial #:

09 & 12

Lifting Implements Visually Inspected?:

- [x] Yes
- [ ] No

Groundwork Details:

Description:

Flat

Pad Grade Within Spec:

- [x] Yes
- [ ] No

Pad Compaction Sufficient:

- [x] Yes
- [ ] No

Photos of Pad:

Equipment Used:

Tank Panels Serial #:

H20p-06

Tank Panels Visually Inspected?:

(•) Yes ( ) No

Tank Panels Properly Installed?:

(•) Yes ( ) No

Comments:

Liner Type:

TPU

Liner Serial #:

HL25k-09

Liner Visually Inspected?:

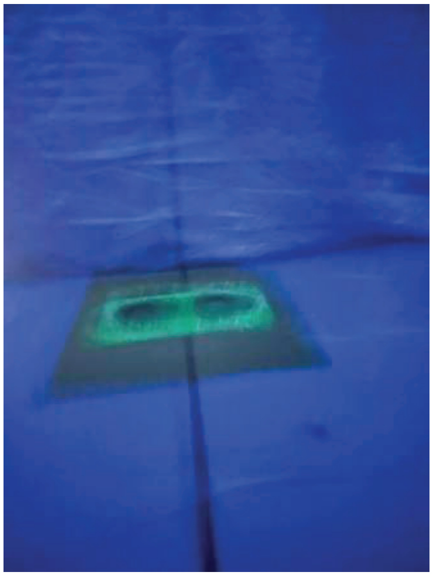
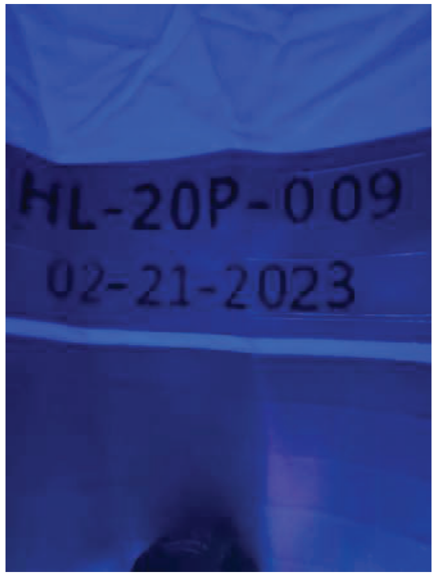
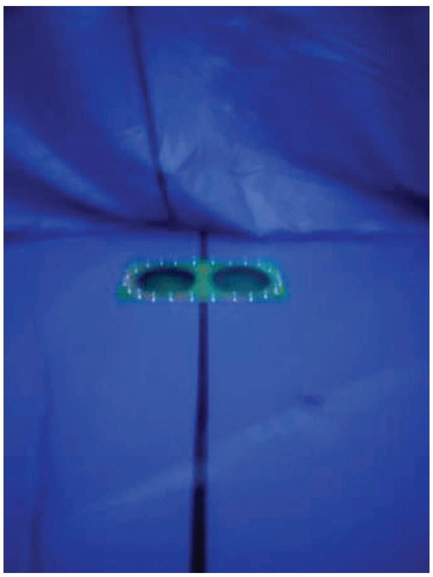
(•) Yes ( ) No

Liner Properly Installed?:

(•) Yes ( ) No

Liner Installed By:

C2



HL-20P-009
02-21-2023



Comments:

Groundcloth Visually Inspected?:

(•) Yes ( ) No

Groundcloth Properly Installed?:

(•) Yes ( ) No

Manifold Set Serial #:

29

Manifold Set Visually Inspected?:

(•) Yes ( ) No

Manifold Set Properly Installed?:

(•) Yes ( ) No

Additional Items Installed or Left On Location:

Hydrm23

Additional Items Installed Not Listed:

All Liner Connections Double Checked?

Yes

- [x] Fill Manifold Connection
- [x] Suction Manifold Connection
- [x] Inner Manway Connection

☑ Outer Manway Connection

Third Party Vendors:

○ Yes ◉ No

General Project Comments:

Tank install complete

Signed on Corfix

X Cody Phillips

Cody Phillips 005

(cody@hydrera.com)

Signed 11:21:52 PM Sun Mar 26 2023

From IP 76.76.73.224, 172.31.20.230

FIELD COMPACTION TEST DATA
R. D. ZANDE ASSOCIATES, INC.

Project: NS East Palestine Derailment
Project Number: 172607922

Density/Moisture Gauge Information

Tested By: Matthew Macielewicz Date: 03/16/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Standard Density Count: 1716 % Change: 0
Standard Moisture Count: 635 % Change: 0

TEST NUMBER	1	2	3	4
LOCATION	Eastern tank pad, Northern half	Eastern tank pad, Southern half	Western tank pad, Northern half	Western tank pad, Southern half
LIFT NUMBER	1	1	1	1
NUMBER OF PASSES	5	5	5	5
LIFT THICKNESS (INCHES)	12	12	12	12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	6	6	6	6
WET DENSITY (PCF)	140.6	136.4	143.3	141.2
DRY DENSITY (PCF)	136.4	132.4	139.3	136.7
MOISTURE (PCF)	4.2	4	4	4.6
MOISTURE (%)	3.1	3	2.9	3.3
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	98.41	95.53	100.51	98.63
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier
Drainage Layer
Test Pad (Recompacted Soil)

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

[3] Pass/Noncompliance Key
P: Passed - test results comply with specs
NC1: Noncompliance - Low Density
NC2: Noncompliance - Low Moisture
NC3: Noncompliance - High Moisture

Project: NS East Palestine Derailment
Project Number: 172607922

Tested By: Matthew Macielewicz Date: 03/16/2023
Checked By:______________________Date:____________
Material Tested [1]: ODOT #304 Limestone

Density/Moisture Gauge Information
Model No.:________________________
Serial No.:________________________
Standard Density Count: 1716 — % Change: 0
Standard Moisture Count: 635 — % Change: 0

TEST NUMBER	5	6	7	8
LOCATION	Eastern tank pad, Southern half	Eastern tank pad, Northern half	Western tank pad, Northern half	Western tank pad, Southern half
LIFT NUMBER	2	2	2	2
NUMBER OF PASSES	4	4	4	4
LIFT THICKNESS (INCHES)	12	12	12	12
GAUGE READINGS				
PROBE DEPTH [2] (IN)	6	6	6	6
WET DENSITY (PCF)	137	139.5	140.6	140.8
DRY DENSITY (PCF)	133.7	135.3	136	135.4
MOISTURE (PCF)	3.3	4.2	4.6	5.4
MOISTURE (%)	2.4	3.1	3.3	4
LABORATORY DATA				
PROCTOR CURVE NUMBER				
MAX. DRY DENSITY (PCF)	138.6	138.6	138.6	138.6
OPTIMUM MOISTURE (%)	8	8	8	8
RESULTS				
% COMPACTION	96.46	97.62	98.12	97.69
PASS/NONCOMPLIANCE [3]	PASS	PASS	PASS	PASS
RETESTED NUMBER/DATE				

Remarks: ODOT #304 Limestone was compacted with a vibratory smooth drum roller

[1] Material Types
Structural Fill
Subbase
Recompacted Soil Liner/Barrier
Drainage Layer
Test Pad (Recompacted Soil)

[2] Probe Depth
Depths choices are in two inch increments
(2 through 12) and backscatter (BS)

[3] Pass/Noncompliance Key
P: Passed - test results comply with specs
NC1: Noncompliance - Low Density
NC2: Noncompliance - Low Moisture
NC3: Noncompliance - High Moisture

T: (720) 690-6989

HYDRERA WATER SERVICES

DOC #00156

*Harpoon Install Report

H20p-05 & 06 East Palestine OH 2 25k

Sent By

Cody Phillips 005

Sent At

26 March 2023 at 11:11 PM

Submitted By:

Cody

Weather:

Rain/snow

Report #:

J1

Customer:

Rain For Rent

Field Contact:

Phone #:

(___) ___-____

Supervisor Name:

Cody

Groundwork Supervisor:

Cody

Lease Name:

NS East Palestine Train Derailment

State/Province:

Oh

Directions to Location:

East Palestine OH

Tank Size:

25k

Start Time:

Fluid Composition:

NonPot water/vinyl chloride/fire suppression

Finish Time:

Equipment Type:

Lifting Implements Serial #:

09&12

Lifting Implements Visually Inspected?:

(•) Yes ( ) No

Groundwork Details:

Description:

Flat

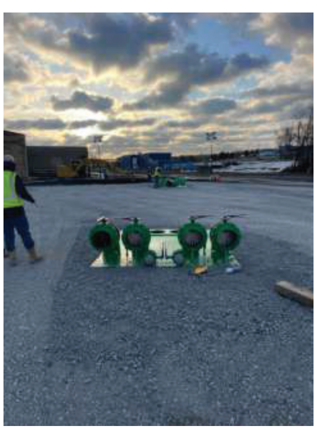
Pad Grade Within Spec:

(•) Yes ( ) No

Pad Compaction Sufficient:

(•) Yes ( ) No

Photos of Pad:



Equipment Used:

Tank Panels Serial #:

H20p-05

Tank Panels Visually Inspected?:

◉ Yes ○ No

Tank Panels Properly Installed?:

◉ Yes ○ No

Comments:

Liner Type:

TPU

Liner Serial #:

HL25k-008

Liner Visually Inspected?:

- [x] Yes
- [ ] No

Liner Properly Installed?:

- [x] Yes
- [ ] No

Liner Installed By:

C2

Comments:

Groundcloth Visually Inspected?:

(●) Yes ( ) No

Groundcloth Properly Installed?:

(●) Yes ( ) No

Manifold Set Serial #:

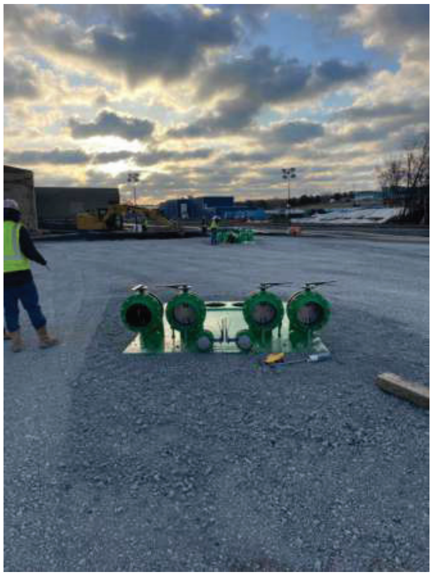
28

Manifold Set Visually Inspected?:

(●) Yes ( ) No

Manifold Set Properly Installed?:

- [x] Yes
- [ ] No



Additional Items Installed or Left On Location:

Hydrm24

Additional Items Installed Not Listed:

All Liner Connections Double Checked?

Yes

- [x] Fill Manifold Connection

- [x] Suction Manifold Connection
- [x] Inner Manway Connection
- [x] Outer Manway Connection

Third Party Vendors:

( ) Yes (•) No

General Project Comments:

Tank completed, sone plates were randomly hard to get on

Signed on Corfix

X Cody Phillips

Cody Phillips 005

(cody@hydrera.com)

Signed 11:11:46 PM Sun Mar 26 2023

From IP 76.76.73.224, 172.31.1.95

5101 Office Park Drive, Suite 100
Bakersfield, CA 93309

Mr. Bryan Martin
VP - Midwest
Hepaco
2647 Hamilton Ln
Hamilton, OH

Rain for Rent has verified with Cody Phillips, owner of C2 Services LLC, and Partner and Field Supervisor for Hydrera Water, he has certified that H20P-05 & H20P-06, located at the East Palestine OH derailment pad site, have been set up in accordance to Hydrera Harpoon Installation SOP, both tanks we set on a 95% compacted and leveled pad per spec. Tanks 05 & 06 were setup consecutively on March 19th & 20th. Both tanks had 1' of fresh water put in to seat liner. Tanks have been inspected since install on 3/29 via aerial manlift after secondary containment was completed. Tanks are in appropriate working order ready for operational use.

We are submitting for your review the install reports from C2 Services based on the set up and conditions of the 2 – 25k Harpoon Tanks that are onsite were installed correctly per manufacturers SOP.

Sincerely,

Steve Bayda

Steve Bayda
Midwest Regional Vice President
Rain for Rent

Cc: Rich Speidel Midwest Regional Sales Manager

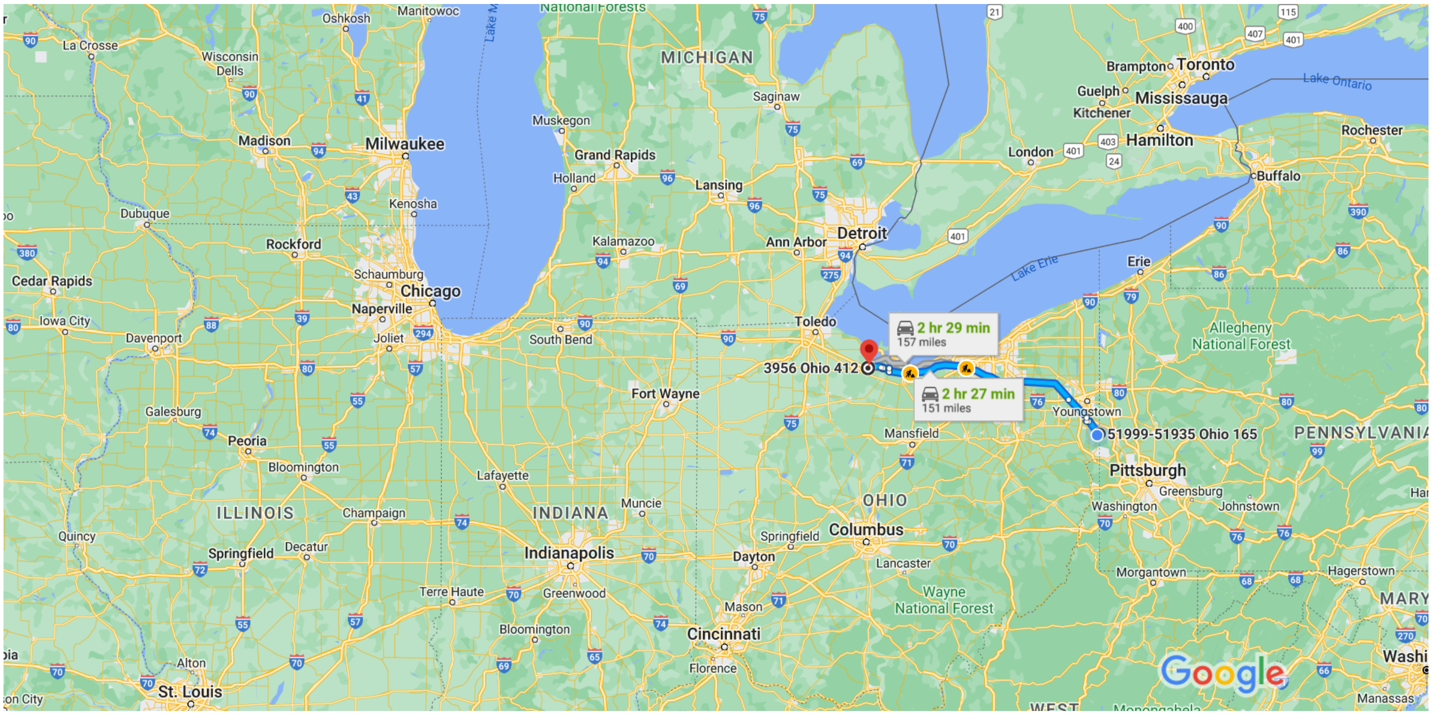
Attachment 7

Offsite Disposal Facility Transportation Routes

51999-51935 OH-165, East Palestine, OH 44413 to 3956 OH-412, Fremont, OH 43420

Drive 152 miles, 2 hr 26 min

Vickery Disposal Facility



Map data ©2023 Google 50 mi

51999-51935 OH-165
East Palestine, OH 44413

⚠ This route has tolls.

Get on I-76 W/Ohio Turnpike in Beaver Township from OH-14 W and OH-165 W

23 min (15.6 mi)

1. Head east on OH-165 E
   Entering Pennsylvania

1.4 mi

2. Turn left onto PA-51 N
   Entering Ohio

1.7 mi

3. Continue onto OH-14 W

2.4 mi

4. Turn right onto OH-165 W

6.9 mi

5. Turn left onto OH-165 W/S Range Rd

1.2 mi

6. Turn right onto OH-7 N/Market St

1.4 mi

7. Slight right onto the I-76 ramp to Ohio Turnpike
   Toll road

   0.3 mi

8. Use the left lane to take the ramp to I-76 W/Ohio Turnpike
   Toll road

   69 ft

9. Keep left at the fork, follow signs for I-76 W/Cleveland and merge onto I-76 W/Ohio Turnpike
   Toll road

   0.4 mi

Take I-80 W to OH-4 N in Groton Township. Take exit 110 from I-80 W

1 hr 48 min (123 mi)

10. Merge onto I-76 W/Ohio Turnpike
    Toll road

    13.9 mi

11. Continue onto Ohio Turnpike
    Toll road

    0.5 mi

12. Ohio Turnpike turns slightly left and becomes I-80 W/Ohio Turnpike
    Toll road

    108 mi

13. Take exit 110 for OH-4 toward Sandusky/Bellevue
    Toll road

    0.6 mi

Take W Mason Rd to OH-412 W in Vickery

18 min (14.0 mi)

14. Turn left onto OH-4 N

    0.8 mi

15. Turn left onto Skadden Rd

    0.7 mi

16. Turn left onto W Mason Rd

    3.6 mi

17. Turn right onto OH-269 N

    0.7 mi

18. Turn left onto Rogers Rd

    1.1 mi

19. Turn right onto Co Hwy 1/Co Rd 312

    108 ft

20. Turn left onto OH-101 W

    0.2 mi

21. Turn right onto OH-412 W

Destination will be on the right

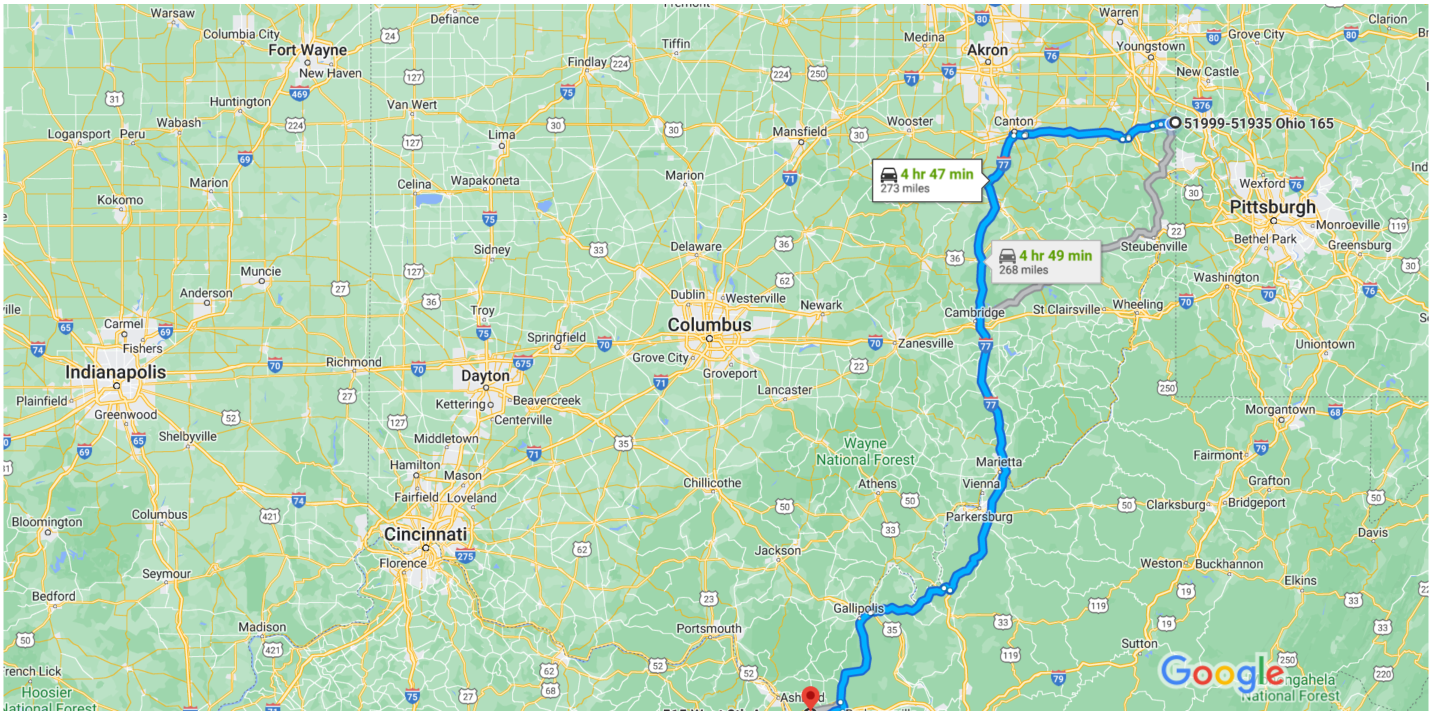
7.0 mi

Google Maps

51999-51935 OH-165, East Palestine, OH 44413 to 515 W 8th Ave, Huntington, WV 25701

Drive 273 miles, 4 hr 47 min

Valicor Environmental Disposal Facility



Map data ©2023 Google 20 mi

51999-51935 OH-165
East Palestine, OH 44413

Get on US-30 W in Canton Township from OH-558 W, OH-517 W and OH-172 W/State Hwy 172

1 hr 5 min (46.1 mi)

1. Head west on OH-165 W/E Taggart St

0.4 mi

2. Turn left onto N Pleasant Dr

0.1 mi

3. Turn right onto E Main St

1.0 mi

4. Continue onto OH-46/OH-558 W/Bacon Ave
   Continue to follow OH-46/OH-558 W

2.8 mi

5. Turn left onto OH-558 W

2.4 mi

6. Slight left onto OH-517 W

7.8 mi

7. Continue straight

436 ft

8. Turn left onto N Beaver St

0.4 mi

9. Turn right onto US-30 W/W Lincoln Way

1.9 mi

10. Slight right onto OH-172 W/State Hwy 172
Pass by Subway (on the left in 26.7 mi)

28.6 mi

11. Use the left 2 lanes to turn left onto US-30 W

0.3 mi

12. Turn right onto the US-30 W ramp to Massillon

0.3 mi

Follow I-77 S to US-33 W in Jackson County. Take exit 146 from I-77 S

2 hr 8 min (149 mi)

13. Continue onto US-30 W

2.9 mi

14. Use the right 2 lanes to merge onto I-77 S toward Marietta
Entering West Virginia

146 mi

15. Take exit 146 toward Silverton/Ravenswood

0.2 mi

Get on I-64 W in Barboursville from WV-2 S

1 hr 16 min (66.0 mi)

16. Merge onto US-33 W

2.2 mi

17. Continue straight onto WV-2 S

26.9 mi

18. Turn left onto 3rd St

0.3 mi

19. Turn left onto Viand St

0.2 mi

20. Continue onto WV-2 S/Bartow Jones Bridge
Continue to follow WV-2 S

0.3 mi

21. Keep left to stay on WV-2 S

32.6 mi

22. Turn left onto WV-193 S

3.2 mi

23. Turn right to merge onto I-64 W toward Huntington

0.2 mi

Follow I-64 W to WV-527 N/5th Street Rd. Take exit 8 from I-64 W

10 min (9.6 mi)

24. Merge onto I-64 W

9.4 mi

25. Take exit 8 for WV-152 S/WV-527 N/5th St E

0.2 mi

26. Keep right at the fork, follow signs for Huntington/VA Reg'l Office and merge onto WV-527 N/5th Street Rd

299 ft

Continue on WV-527 N/5th Street Rd to your destination

5 min (1.9 mi)

27. Merge onto WV-527 N/5th Street Rd

0.7 mi

28. Turn left onto W Whitaker Blvd

0.7 mi

29. Continue onto 5th St W

0.3 mi

30. Turn left onto W 8th Ave

0.1 mi

31. Turn left

157 ft