



August 20, 2021

To: Ben McPherson, NYSDEC
From: John Yensan, John Black, Roxanne Birx, Keith Adderley
CC: Dan Flanagan, Kirsten Colligan, and Matt Reardon

RE: Bench Scale Testing – Coke Oven Gas Pipe Residuals
Riverview Innovation & Technology Campus
3875 River Road
Tonawanda, New York

The August 10th fire at the RITC site at 3875 River Road, Tonawanda, New York revealed that residuals in the Coke Oven Gas Piping west of the compressor building pipe sections may contain iron compounds that are capable of exothermic reactions causing spontaneous combustion of the combustible materials in the pipes. The most probable cause is ferric iron oxide or ferric iron sulfide which generate heat as they oxidize. The increase in temperature combined with the hydrocarbon (fuel) in the residual and oxygen available outside the pipe complete the fire triangle and can result in a fire:



The characteristics of the material (Photograph No. 1) that were noted prior to, and after, the fire:

- While contained in the piping, the pipe and materials can be moved on the property. The materials in the pipe lack oxygen and heat;
- The subject materials were staged in cut piping for no less than 13 days;
- The material suspected¹ to produce the reaction had a gray to black (some “shiny”) appearance;
- The material was solid, not liquid or a viscous tar like fluid;
- The material in the pipe sections managed could be physically removed from the COG pipe without the use of liquids or solvents;

¹ While there are several observations of the materials suspected of producing the reaction, it must be assumed that all materials in the COG pipe are capable of producing an exothermic reaction until confirmed to be stable.

- The exothermic properties are either not uniformly distributed through the material, or require a critical value to produce sufficient heat for combustion. Photograph No. 1 shows relatively small amounts of material exposed to the atmosphere that did not ignite;
- The material reaction while likely initiated at first exposure to the atmosphere, does not raise the material temperature immediately. The pile of material was observed for more than 15-minutes and exhibited no signs of combustion;
- The material continued to burn if not saturated to extinguish the combustion; and
- After buring and submersive quenching in water, the material did not exhibit exothermic properties.



Photograph No. 1
Coke Oven Gas Pipe and Residual

The materials that will be tested in accordance with this work plan are those that can produce sufficient heat to spontaneously combust. The materials must be treated to eliminate the characteristic of ignitability prior to ultimate management as a product² or waste. Three potential treatment protocols are being evaluated:

² The FQE treatment results in a product that is typically used in fuel blending.



1. Water quenching and underwater oxidation;
2. Sodium³ permanganate treatment (CARUS), and
3. FQE Chemical Pyrophoric treatment (solvent and iron reduction).

Bench-scale testing of the above recommendations to eliminate the characteristic of ignitability⁴ from the COG residual will be performed at the site. No untreated samples of the pipe residual will be shipped by air freight. The bench-scale residual will be tested to quantify disposal parameters for waste profile use.

Treatment Alternatives

1. Water Quenching
The material appeared to change state in a submerged environment. The resulting material recovered from the pipe in the quench sump was stable and was not exothermic. The elimination of the characteristic in materials directly from the COG piping must be confirmed.
2. Carus CAIROX[®] Sodium Permanganate
Permanganate oxidizes without burning. It oxidizes pyrophoric iron sulfide to iron sulfate, which eliminates the potential for exothermic reactions in the material. A secondary benefit from this process is toxic odor control since the resultant sulfates are odorless. The bench-scale testing will allow an evaluation of the ability to create effective contact between the permanganate and the iron. Sodium and Potassium Permanganate react the same and potassium is available for the test. Sodium is available in liquid form and would be used for full scale if that is the selected method.
3. FQE Chemical Pyrophoric Treatment
FQE chemical pyrophoric treatment provides two processes, one that uses a solvent (Appendix B) to separate the iron and coke oven gas residuals (removing the fuel), or treatment of the iron to eliminate the oxidation reaction that produces the heat. The bench-scale testing will evaluate the ability of the solvent to eliminate the fuel and the effectiveness of the iron treatment and the characteristics of the resulting two phases of materials (both liquids and sludges are produced). The liquids are typically used in fuel blending for recovery of the Btu value.

Preparation

The preparation for the testing includes the testing materials and equipment (Appendix A) and the required fire prevention materials and equipment.

Testing

All work on the BCP Site, including the bench-scale testing, will be conducted in accordance with the Health and Safety Plan (HASP, see Appendix B for the PPE requirements in accordance with Activity Hazard Analysis[AHA]) and the Community Air Monitoring Plan (CAMP).

The test setup must be in place prior to the collection of the sample. The test station will be on the upwind end of the former bag house slab (Photograph No. 2).

³ For purposes of the bench-scale test, potassium permanganate may be used.

⁴ 261.21 "It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard."















Photograph No. 2
Former Bag House Slab – Test Site

The information available indicates there is a nominal 15-minute period available before the reaction proceeds past the threshold of ignition.

1. The test station must allow separation of the five sample groups; control, quench, permanganate, and FQE (Solvent and Pyrophoric).
2. Five stations (tables/steel plate of non-combustible materials) shall be available. No wooden or plastic tables shall be used.
3. The test station area will be equipped with:
 - a. A Class D or Multi-purpose Fire Extinguisher:



		Ordinary Combustibles	Wood, Paper, Cloth, Etc.
		Flammable Liquids	Grease, Oil, Paint, Solvents
		Live Electrical Equipment	Electrical Panel, Motor, Wiring, Etc.
		Combustible Metal	Magnesium, Aluminum, Etc.
		Commercial Cooking Equipment	Cooking Oils, Animal Fats, Vegetable Oils

- b. A Fire Suppression Blanket.
- c. Five 5-gallon buckets filled with 4 gallons of potable water;
- d. Scale and instant read thermometer
- e. Two sets⁵ of disposable, BPA Free Aluminum Oven Pans (8-¹/₂- by 6- by 2-inches [Min]). Metals with non-stick coating shall not be used;
- f. Measuring cups, stainless steel mixing spoons;
- g. A cooler with a full set of pre-labeled sample bottles and 5-pounds of double bagged ice;
 - i. Control Station – Sample Number – SD-COGCTRL-date
 - ii. Aqueous Station – Sample Number – SD-COGAQ-date and AQ-COGAQ-date
 - iii. Permanganate Station – Sample Number – SD-COGPerm-date
 - iv. FQE Solvent Station – Sample Numbers – SD-COGFQES-date and LQ-COGFQES-date
 - v. FQE Pyrophoric Station – Sample Numbers – SD-COGFQEP-date and LQ-COGFQEP-date
- h. The appropriate reagents;
 - i. On the quench station six 1-liter bottles of potable water;
 - ii. On the permanganate station six 1-liter bottles, two each of 0.1-, 0.5- and 1-percent aqueous solution of Sodium or Potassium permanganate;
 - iii. On the FQE Stations six 1-liter bottles, two each of aqueous solution of FQE Solvent and Pyrophoric at a rate of 3- 5- and 10-percent by volume; and
 - iv. Weigh all bottles and liquid before and after testing.

Combustion Management

Access to material that will spontaneously combust is required to conduct a valid test. The site crew must open and expose materials for the testing. The removal of pipe will be limited to the amount needed to collect enough reactive residual for testing (estimated between 10- and 40-feet of pipe). The suspension of additional COG Pipe removal will remain in place until a COG Pipe Removal IRM Work Plan is approved by the New York State Department of Environmental Conservation (DEC) and New York State Department of Health (DOH) following the bench-scale testing.

⁵ Two sets of test equipment and materials are required in the event that the first control sample does not produce an exothermic reaction. Due to the reaction rate, they may not be time to wait to observe the reaction before the testing is started.



The section of COG pipe that lead to the west flare is a possible source of combustible material (Photograph No. 3). This pipe is north of the process area immediately north of the green warehouse.



Photograph No. 3
West Flare Piping

The next section of pipe to be removed for the site management/demolition is from the east end of the pump house to the eastern crossover pipe (see Photographs Nos. 4 and 5):





Photograph No. 4
Location of COG Pipe Between the Crossover Pipes
(All COG Pipe East of the Crossover Pipe has been removed)





Photograph No. 5
COG Pipe at Pump House Looking South

The next section of COG to be removed is on a pipe structure with multiple other pipes (Photograph No. 5, Appendix D). COG piping on and in the Boiler House that formerly fed the Boilers may contain the required residual:





Photograph No. 6
COG Pipe Penetrating the South Boiler House Wall (Looking North)





Photograph No. 7

COG Piping on Ground Floor of Boiler House (Looking West)

The residual in the Boiler House Piping is the closest to the pipe that produced the reactive materials and will be sampled first. If the materials within the Boiler House pipe produce an exothermic reaction, that material will be used for the bench-scale test. If the Boiler House pipe materials do not produce an exothermic reaction, samples will be extracted from the section of COG that lead to the west flare (Photograph No. 3), if no reaction the sample will be collected from between the crossover pipes (Photograph No. 4) using steel pipe inserted from the open end of the remaining section of pipe (Photograph No. 5). The equipment staged for combustion management will include:

1. The containment area will be on the former bag house slab (Photograph No. 2) will be cleared of all combustible materials and will have concrete barriers and silt sock around the perimeter;
2. The water truck will be onsite and full;
3. A pump and hose capable of quenching the COG line after sampling, will be set in the coke wharf;
4. Fire extinguishers will be staged at the test station;
5. Inert materials, hydraulic cement, will be mixed and will be used to seal the remaining section of COG pipe;



6. Two open-top fractionation tanks, lined roll off boxes, or the quench sump will be staged/available at the pipe management location. Each will be $\frac{3}{4}$ filled with potable water;
7. An excavator with a grapple and a front end loader (or skip steer) capable of collecting and placing all residuals in the fractionation tank will be available;
8. A shear capable of cutting the pipe and moving it to the former bag house slab will be used to remove the pipe and empty the contents on the slab; and
9. A downwind air monitoring station will be operating within 50 feet of the downwind side of the slab.

Bench-scale Testing

The bench-scale testing is time-sensitive due to the fact it will result in materials being exposed to the atmosphere that have been in an oxygen free environment for decades. In addition to the OSC Staff removing the sample from the COG pipe, dedicated staff will be at each station. Each step of the test will be documented with photographs.

1. Don PPE (See AHA Appendix B).
2. Remove sample from piping:
 - a. Alternative No. 1
 - i. Remove section of pipe between 10- and 40-foot long (as required to produce a representative sample) from the boiler house (exterior first, if empty, interior);
 - ii. Simultaneously seal the remaining end of the pipe and bring the section of pipe and residual to the containment area;
 - iii. Empty no less than 5-gallons equivalent onto a dry section of the containment pad covered with polyethylene sheeting, or directly into a clean loader bucket;
 - iv. Place the pipe and residual into the fractionation tank water.
 - b. Alternative No. 2
 - i. Using a personnel lift, access the cut end of the COG pipe on Broadway.
 - ii. Using a nominal 10-foot long section of pipe, collect a 5-gallon sample from beyond the end of the pipe that had been previously cut.
3. Reseal the COG line with hydraulic cement or other non-combustible material and monitor the temperature and any off gassing.
4. As soon as the equipment is clear:
 - a. Place approximately three cups of material in each of 15 sample trays. Record time.
 - i. Note: Trays should be selected in sequence;
 1. Control 1, 6, and 11
 2. Quench 2, 7, and 12
 3. Permanganate 3, 8, and 13
 4. FQE Stations 4, 5, 9, 10, 14 and 15.
 - b. Move trays to the five stations.
5. Control
 - a. Monitor time from the filling of the tray.
 - b. The residual will be placed as it comes out of the composite sample. No crushing or breaking to simulate the actual full scale management of the materials.
 - c. Observe the material to ensure it produces an exothermic reaction. Temperature shall be measured and recorded for each control sample each minute for 30 minutes. Note:



If the control samples do not burn, the sampling from the alternate COG piping will be used.

- d. If combustion occurs, allow samples to burn unless there is visible smoke leaving the area of the slab or an exceedance of the CAMP Action Levels at the Air Monitoring Station, note time at end of combustion.
 - e. The materials not required for testing will be placed in a 5-gallon steel pail and quenched with water.
6. Quench
- a. The residual will be placed as it comes out of the composite sample. No crushing or breaking to simulate the actual full scale management of the materials.
 - b. Quench each with sufficient water to saturate all samples (limited mixing),
 - c. Drain samples at 5-minutes, 15-minutes and 30-minutes from introduction of water. Collect a sample of the water from the 30-minute quench. The trays will be drained into steel 5-gallon pails with lids.
 - d. Any test sample that ignites will be immediately quenched with water and placed in a 5-gallon bucket of water.
 - e. After no less than one hour, move samples to the hazardous waste storage area⁶. The hazardous waste storage area will be segregated to ensure the samples are no closer than 6-feet to any other waste. The samples will be placed on a non-combustible table or bench, not on polyethylene or other combustible materials.
 - f. Allow to air dry⁷ in the hazardous waste storage area and observe for an exothermic reaction hourly for no less than 4 hours. After the testing day, the samples will be checked twice daily until dry⁸.
 - g. The materials not required for testing will be placed in a 5-gallon steel bucket and quenched with water. The bucket will be retained in the hazardous waste storage area until the results of testing are received.
 - h.
7. Permanganate station.
- a. The residual will be placed as it comes out of the composite sample. No crushing or breaking to simulate the actual full scale management of the materials.
 - b. In each tray add one of the concentrations of solution while gently stirring the material until the color changes from purple to brown as the permanganate is consumed in the reaction.
 - c. Weight the bottles to determine the amount of each used.
 - d. Any test sample that ignites will be immediately quenched with water and placed in a 5-gallon bucket of water.
 - e. After no less than one hour, move samples to the hazardous waste storage area. The hazardous waste storage area will be segregated to ensure the samples are no closer than 6-feet to any other waste. The samples will be placed on a non-combustible table or bench, not on polyethylene or other combustible materials.

⁶ The Hazardous Waste Storage Area is equipped with a fire extinguisher.

⁷ Samples may require several days to air dry. After any danger of combustion has passed, move samples to the hazardous waste storage area to dry.

⁸ "Dry" shall be defined as no free liquid after a teaspoon of residual is placed on a paper towel.



- f. Allow to dry and observe for an exothermic reaction hourly for no less than 4 hours. After the testing day, the samples will be checked twice daily until dry⁹.
 - g. The materials not required for laboratory testing will be placed in a 5-gallon steel bucket and quenched with water. The bucket will be retained in the hazardous waste storage area until the results of testing are received.
8. FQE stations.
- a. The residual will be placed as it comes out of the composite sample. No crushing or breaking to simulate the actual full scale management of the materials.
 - b. In each tray add one of the concentrations of the FQE solution (Solvent or Pyrophoric) until the material begins to liquify or it is saturated.
 - c. Weight the bottles to determine the amount of each used.
 - d. Any test sample that ignites will be immediately quenched with water and placed in a 5-gallon bucket of water.
 - e. After no less than one hour, move samples to the hazardous waste storage area. The hazardous waste storage area will be segregated to ensure the samples are no closer than 6-feet to any other waste. The samples will be placed on a non-combustible table or bench, not on polyethylene or other combustible materials.
 - f. Observe for an exothermic reaction while the quench sample dries hourly for no less than 4 hours. After the testing day, the samples will be checked twice daily until dry¹⁰.
 - g. The materials not required for laboratory testing will be placed in a 5-gallon steel bucket and quenched with water. The bucket will be retained in the hazardous waste storage area until the results of testing are received.
9. Sample collection
- a. Collect a composite sample from the control trays - Sample Number – SD-COGCTRL-date
 - b. Collect a sample of the dried solids from the tray from the aqueous station that did not burn following the shortest quench time (e.g. 5-, 15- or 30-minutes) – Sample Number – SD-COGAQ-date and the water sample from the 30-minute quench – AQ-COGAQ-date
 - i. Collect a solid sample of the dried solids from the tray from the permanganate station that did not burn with the lowest concentration of permanganate – Sample Number – SD-COGPerm-date
 - j. Collect a sample of the liquid and of the solids from the FQE stations from the lowest concentration that produced a dried sample that did not produce an exothermic reaction – Sample Numbers – SD-COGFQES-date, LQ-COGFQES-date SD-COGFQEP-date and LQ-COGFQEP-date.

Analysis

On the Chain of Custody clearly note what has been added, attach SDS for each (Appendix B). The samples shall be tested as shown on the attached Bottle order (Appendix C).

⁹ "Dry" shall be defined as no free liquid after a teaspoon of residual is placed on a paper towel.

¹⁰ "Dry" shall be defined as no free liquid after a teaspoon of residual is placed on a paper towel.



Reporting

The results of the testing will be incorporated into an IRM Work Plan for the management of COG Piping at the site. Part of the predemolition survey will be identifying and segregating the activities associated with each type of piping at the site. See Appendix D for the inspection and identification of pipe on the outside pipe structure that is the next scheduled for removal.



Appendix A Supplies Needed

- Pipe removal equipment
- Fractionation Tank, rolloff, or Quench Pit filled with water
- PPE (see AHA Appendix B)
 - Nitril gloves
 - Safety Glasses
 - Splash Shields
 - Fire reststant Tyvex
 - Heat Resistant Gloves
- Fire supression blanket
- LEL/O₂ Meter
- pH Meter
- Instant read thermometer
- 18 - 1 liter reagent jars
- 6 - 5-Gallon Buckets (filled with potable water)
- Fire extingushers
- 3 - 5-gallon steel buckets with lids
- Scale
- 24 - Disposable alluminum trays
- 18- Stainless steel sampling and mixing Spoons
- Sample Bottles
- 4 Measuring Cups (one for each station)
- Sodium Permanganate
- FQE Reagents
- 4 metal tables or a non-combustable work table
- Air Monitoring station



Appendix B
AHA and SDS Sheets





Activity Hazard Analysis
Project: Tonawanda Coke

Bench Study – Ignitable residuals COG lines

Note: All printed copies of this document are uncontrolled. It is the responsibility of the user to assure that he has the latest revision by checking the electronic version in the HSE Document Library

Activity: Bench Study – Ignitable residuals COG lines		Date: August 18, 2021
Description of the Work: This AHA outlines the activities, hazards and associated hazard control with respect completing a bench scale test on residual scale and materials present in the coke oven gas lines.		OSC Site Supervisors: Matt Reardon OSC HSE Director: Shawn Johnston OSC HSO: Kirsten Colligan
Project: Tonawanda Coke		Review for Latest Use: Prior to beginning field work.
PLAN 1. Initial ground clearing / Creating access 1.1. Set up of work stations 1.2. Verification of fire prevention systems 2. Pipe removal activities 2.1. Comply with Heavy Equipment AHA 2.2. Comply with Aerial Lift AHA 2.3. Use spotter during all work 3. Bench Study 3.1. Comply with Bench Study IRM		
Work Activity Sequence	Potential Health, Safety and Environment Hazards	Hazard Controls
Pre task inspection of work area and crew review/ walk through/General Site Conditions.	<ul style="list-style-type: none"> ▪ Slips, Trips, and Falls ▪ Struck by ▪ Skin ▪ Eye Protection ▪ Hand injuries/cuts/bruises 	<ul style="list-style-type: none"> ▪ Trained personnel (HASP). ▪ Minimum PPE includes hard hat; safety glasses, safety toed boots, high visibility vest/ Leather or cut resistant gloves when handling materials. ▪ Inspect all PPE, tools, and equipment each shift prior to use. ▪ Any sign of thunder, lightning, rain, high winds (>20 mph) immediately terminate all outside work activity, seek shelter and wait for 30 Minutes and for further instruction. ▪ Locate nearest shelter in place facility, eye wash, safety showers, alarm boxes, and point out windsock.

		<ul style="list-style-type: none"> ▪ Dress appropriately for conditions. Know the signs and symptoms of heat stress and cold stress. Stay hydrated and take breaks as needed in a cooled or heated area. ▪ Wear hearing protection (earplugs or muffs) if you have to shout to be heard at a distance of 3 feet or less.
<p>Equipment setup, inspection and operation</p>	<ul style="list-style-type: none"> ▪ Slips, Trips, and Falls ▪ Struck by ▪ Skin ▪ Eye Hazards ▪ Lacerations ▪ Equipment Failure ▪ Working at height ▪ Electrocutation/Shock 	<ul style="list-style-type: none"> ▪ Equipment operator to review traffic path of equipment within site to setup area. Inspect for traffic hazards, obstructions, overhead hazards, electric lines, chemical lines, gas lines, and surface hazards (potholes, voids, uneven surfaces, and unstable ground). ▪ Adequate clearance shall be maintained between the equipment and any obstructions. ▪ If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the lift or touch any person who may be in contact with the electrical current. ▪ Conduct a 360 degree walk around inspection of all equipment and vehicles before moving equipment/vehicles. ▪ Minimum of one spotter is required when driving equipment to setup area. Spotter will be engaged at all times while working near coke over gas lines and the building. Spotter will be designated by onsite supervision. ▪ Only one person shall signal the equipment operator. This person shall be thoroughly familiar with all of the equipment's operation and shall be able to communicate with the equipment operator with the appropriate hand signals. ▪ No personnel shall be permitted on or under the load lifted by equipment or hoist at any time. ▪ A competent person shall inspect equipment, hoists, and rigging prior to each use. Frequency and method of inspection shall be completed according to manufacturer's specifications. Inspections should also occur after any particularly stressful lifts to all involved components. ▪ Only the operator may be on the equipment during operation. ▪ Always maintain three points of contact when inspecting equipment components or entering and exiting the equipment. Utilize safety steps and grab bars. Inspect steps and grab bars prior to use. ▪ Equipment operations shall end when wind speed is greater than 20 mph, or less as dictated by the equipment set up and operating conditions/manufacturer's recommendations. ▪ No cell phone use while operating any equipment. ▪ No eating, drinking, or use of tobacco products in equipment or machines. ▪ Inspect all PPE, tools, and equipment each shift prior to use and in accordance with manufacturing guidelines.
<p>Set up staging/work stations</p>	<ul style="list-style-type: none"> ▪ Slips, Trips, and Falls ▪ Struck by ▪ Skin 	<ul style="list-style-type: none"> ▪ Perform housekeeping in area of work. ▪ Keep all work areas free of debris and trip hazards.

	<ul style="list-style-type: none"> ▪ Eye Hazards ▪ Fire ▪ Heat Stress ▪ Lacerations 	<ul style="list-style-type: none"> ▪ Controlled work zone designed to keep personnel away from work equipment and other overhead hazards. No unauthorized personnel to be near work station. ▪ Work stations to be placed upwind from staging area. ▪ Use temporary lighting as necessary to properly illuminate work area. ▪ Utilize proper lifting procedures. Use mechanical means when available to lift material, and if you cannot lift the material mechanically ask for help from another co-worker. If you are unsure ask your supervisor for explanation. ▪ Ensure Fire Extinguishers in place.
Removal of residuals from pipe	<ul style="list-style-type: none"> ▪ Fire ▪ Struck by ▪ Skin ▪ Eye Hazards 	<ul style="list-style-type: none"> ▪ Use of machines to empty material. ▪ No personnel within swing radius or under boom during process. ▪ Spotter engaged while pipe is removed from building and while material is removed from pipe. Only spotter may direct operator. ▪ Material will be staged in previously delineated staging area on concrete.
Bench Study	<ul style="list-style-type: none"> ▪ Fire ▪ Skin ▪ Eye Hazards 	<ul style="list-style-type: none"> ▪ Comply with procedure outlined in “Bench Scale Testing – Coke Oven Gas Residual” ▪ Conduct pre-job brief and dry run of activities. ▪ Notify local fire department (prior to study). ▪ PPE requirements: safety glasses, hardhat, face shield, fire/cut resistant gloves, fire resistant Tyvek, and steel toe boots. Voluntary use of respirators is permitted. ▪ Use of spotter to continually watch residual material pile for signs of smoke or fire. ▪ Follow manufacturer’s guidelines for chemical handling and management.
Equipment to be used (Equipment to be used in the work activity)	Inspection Requirements (Inspection requirements for the work activity)	Training Requirements (Training requirements including hazard communication)
Hydraulic Excavators	<ul style="list-style-type: none"> ▪ Daily (before each use) by certified, competent operator. ▪ Document daily 	OSC Equipment Operator training documentation
Aerial Lift (optional)	<ul style="list-style-type: none"> ▪ Daily inspection (before each use) by trained and authorized boom lift operator. ▪ Document daily inspections. 	OSC Aerial lift training documentation or designation as competent person by site supervision
Spotter		Spotter to be trained in recognition of hazards, hand signals, and requirements for working with heavy equipment operator.
Hand tools	<ul style="list-style-type: none"> ▪ Daily inspection (before each use) by superintendent, supervisor, and workers. 	
	<ul style="list-style-type: none"> ▪ Jobsite inspection by superintendent / SHSO 	Employee jobsite safety training is done through orientation, daily toolbox safety meetings, STAC cards and as needed on the jobsite

PRINT

SIGNATURE

Site Superintendent:

Date/Time: _____

Site HSE Officer:

Date/Time: _____

Employee Name(s):

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____

Date/Time: _____



CARUSOL® liquid permanganate is an effective oxidant recommended for industrial applications that require a concentrated permanganate solution. Applications include organic synthesis, pharmaceutical productions and other industrial applications.

PRODUCT SPECIFICATIONS

Assay	19.5 - 21.5% as NaMnO₄
pH	5.0 - 8.0
Solubility in Water	Miscible with water in all proportions

CHEMICAL/PHYSICAL DATA

Formula	NaMnO ₄
Appearance	Dark Purple Solution
Specific Gravity	1.15 - 1.17
Freezing Point	21° F (-6° C)

APPLICATIONS

- Iron/Manganese Oxidation
- Phenol Oxidation
- Mercaptan Oxidation
- Hydrogen Sulfide Control
- Color Reduction
- Printed Circuit Boards

BENEFITS

- Concentrated liquid oxidant
- More precise dosing of chemical
- Feed equipment is simplified
- Consistent concentration

SHIPPING CONTAINERS

5-gallon (20-L) Jerrican

(UN Specification: UN3H1/Y1.8/100) Made of high density polyethylene (HDPE). Weighs 3.5 lb (1.6 kg). The net weight is 48.5 lb (22 kg). The jerrican stands approximately 13.4 in. tall, 9.4 in. wide, and 13.0 in. deep (33.9 cm high, 23.8 cm wide, and 33.0 cm. deep).

55-gallon (208.2L) Closed Head HDPE Drum

(UN Specifications: UN1H1/Y1.9/150) Made of high density polyethylene (HDPE). Weighs 20.5 lb (9.3kg). The net weight is 533.5 lb (241.9 kg). The drum stands approximately 35.1 in. tall and has an outside diameter of 23.4 in. (89.1 cm tall, OD 59.4 cm).

275-gallon (1041 L) IBC (Intermediate Bulk Container)

(UN Specification: UN31HA1/Y1.9/100) They are also marked "MX" for multi-trip IBC. Weighs 139 lb (65 kg). The net weight is 2550 lb (1160 kg). The IBC contains 263 gallons of product. The IBC dimensions are 45.4 in. high, 48 in. long, and 40 in. wide. The IBC has a 2 in. butterfly valve with NPT threads in bottom sump.

Bulk Shipping Quantities from 3000-4200 gallons are available.

HANDLING, STORAGE, AND INCOMPATIBILITY

Like any strong oxidant, CARUSOL liquid permanganate should be handled with care. Protective equipment during handling should include face shields and/or goggles, rubber or plastic gloves, and rubber or plastic apron. If clothing becomes spotted, wash off immediately; spontaneous ignition can occur with cloth or paper. In cases where significant exposure exists, use of the appropriate NIOSH-MSHA dust or mist respirator is recommended.

Store in accordance with NFPA (National Fire Protection Association) Code 430 requirements for Class II Oxidizers. The product should be stored in a cool, dry area in closed containers. Concrete floors are preferred. Avoid wooden decks. Spillage should be collected and disposed of properly. Contain and dilute spillage to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite, or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Deposit sludge in an approved landfill or, where permitted, drain into sewer with large quantities of water.

Hazard Communication Safety Data Sheets

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products. The HCS requires new SDSs to be in a uniform format, and include the section numbers, the headings, and associated information under the headings below:

Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.

(Continued on other side)

For more information:



U.S. Department of Labor

OSHA[®] Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

Hazard Communication Safety Data Sheets

Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); ACGIH Threshold Limit Values (TLVs); and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the SDS where available as well as appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties lists the chemical's characteristics.

Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information*

Section 13, Disposal considerations*

Section 14, Transport information*

Section 15, Regulatory information*

Section 16, Other information, includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)).

Employers must ensure that SDSs are readily accessible to employees.

See Appendix D of 29 CFR 1910.1200 for a detailed description of SDS contents.

For more information:



U.S. Department of Labor

The OSHA logo, consisting of a stylized blue and white circular graphic followed by the word "OSHA" in a large, bold, black serif font. To the right of "OSHA" is a registered trademark symbol (®). Below "OSHA" are the words "Occupational Safety and Health Administration" in a smaller, black, sans-serif font.

www.osha.gov (800) 321-OSHA (6742)



FQE Solvent ME

1 PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: FQE Solvent ME
SDS Number: FQE Solvent ME
Product Code: FQE230
Revision Date: 1/28/2020
Version: 3
Product Use: Heavy Oil Solvent
Supplier Details: FQE Chemicals
 4820 Railroad St
 Deer Park, TX 77536
Phone: 281-476-9249
Emergency: CHEMTREC 800-424-9300

2 HAZARDS IDENTIFICATION

Classification of the Substance or Mixture

GHS Classification in Accordance with 29 CFR 1910 (OSHA HCS):

Health, Skin corrosion/irritation, 3
 Health, Eye Irritation, 2 B

GHS Label Elements, Including Precautionary Statements

GHS Signal Word: **WARNING**

GHS Hazard Pictograms:

No GHS pictograms indicated for this product

GHS Hazard Statements:

H316 - Causes mild skin irritation
 H320 - Causes eye irritation

GHS Precautionary Statements:

P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
 P332 + P313 - If skin irritation occurs: Get medical advice/ attention.
 P337 + P313 - If eye irritation persists: Get medical advice/ attention.

3 COMPOSITION/INFORMATION OF INGREDIENTS

Chemical Ingredients:		
CAS#	%	Chemical Name:
64742-94-5	>60%	Solvent naphtha, petroleum, heavy arom.
7732-18-5	5-25%	Water

The chemical composition consists of non-hazardous components that do not require disclosure according to applicable regulations.

The specific identity and percentage of chemicals used in this product have been withheld as a trade secret.

4 FIRST AID MEASURES

Inhalation: If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Contact: If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Launder clothing before reuse. Seek medical attention if irritation persists. Wash with soap and water.

Eye Contact: Flush eyes with plenty of water and get medical attention if irritation persists. Hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poison Information Center, a doctor, or for at least 15 minutes.



FQE Solvent ME

Ingestion: If swallowed, do not induce vomiting. Rinse mouth out with water. Drink plenty of water. Seek medical advise immediately by calling a Poison Control Center or a doctor.

5 FIRE FIGHTING MEASURES

Flammability: Non-combustible
Flash Point: >200 degF
Autoignition Temp: >800 degF

Extinguishing Media:
 Use appropriate material for surrounding area

Specific Chemical Hazard:
 None

Special Firefighting Procedures:
 Fire fighters should wear self-contained breathing apparatus and full protection clothing when fighting chemical fires. Cool exposed containers with water spray.

Hazardous Combustion Products:
 See Hazardous Decomposition Products. (See Section #10)

Hazardous Polymerization:
 Will not occur

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions
 Wear specified protective equipment. (See Section #8)

Environmental Precautions
 Prevent from entering sewers or waterways. If environmental release does occur, inform the appropriate supervisory personnel. If safe to do so, prevent further release.

Methods for clean up
 For small spills - Cover spill with absorbent material. Scoop absorbed material into a suitable container for disposal. Recover product to suitable containers or vessel for reuse, if possible, or for disposal.
 For large spills - Immediately stop the flow of material if safe to do so. Dike the spill to prevent spreading. Use appropriate absorbent material and move into a suitable container. Wash the contaminated area.

7 HANDLING AND STORAGE

Handling Precautions: Wear specified protective equipment. (See Section #8) Use only in a well-ventilated area. Before use carefully read the product label. Use safe work practices to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking, and smoking in contaminated areas.

Storage Requirements: Keep container tightly closed. Store in cool, dry, well-ventilated area removed from incompatible substances, heat, or ignition sources, and foodstuffs. Ensure containers are adequately labeled, protected from physical damage and sealed when not in use.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Use only in a well-ventilated area.

Personal Protective Equipment:
 Eye/face protection: Wear chemical safety goggles. If any inhalation hazards exist, a full-face respirator may be required instead.
 Hand protection: Wear chemical-resistant gloves.
 Skin protection: Wear long sleeves and chemical resistant apron to prevent repeated or prolonged skin contact.
 Respiratory protection: If a risk assessment deems necessary, use a properly fitted supplied air respirator complying with an approved standard.

Occupational Exposure Limits
 Exposure limits are not available for this product.



FQE Solvent ME

Biological Limits:
No biological limits have been entered for this product.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Pale yellow to amber
Physical State:	Liquid
Odor:	Mild Aromatic
Odor Threshold:	No data available
Solubility:	Dispersible in water
Spec Grav./Density:	0.94-1.04
Viscosity:	Thin liquid
Boiling Point:	>400 degF
Freezing/Melting Pt.:	No data available
Flammability:	Non-combustible
Flash Point:	>200 degF
Partition Coefficient:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
pH:	8-10
Evap. Rate:	No data available
Auto-Ignition Temp:	>800 degF
Decomp Temp:	>800 degF
UFL/LFL:	No data available

10 STABILITY AND REACTIVITY

Reactivity:	None known
Chemical Stability:	Stable under normal conditions of use.
Conditions to Avoid:	Strong oxidizers
Materials to Avoid:	Strong oxidizers
Hazardous Decomposition:	Carbon monoxide. Carbon Dioxide
Hazardous Polymerization:	None known

11 TOXICOLOGICAL INFORMATION

Acute toxicity estimates:
Oral - >2000 mg/kg
Dermal - >2000 mg/kg
Inhalation (vapors) - >20 mg/kg

Skin corrosion/irritation:
May cause dermatitis

Serious eye damage/irritation:
May cause mild irritation

Sensitization:
May cause mild skin or respiratory irritation

Mutagenicity:
No applicable toxicity data



FQE Solvent ME

Carcinogenicity:

None of the components of this product have been listed as carcinogenic by IARC, NTP, or OSHA. (IARC - International Agency for Research on Cancer) (NTP - National Toxicology Program) (OSHA - Occupational Safety & Health Administration (US))

Reproductive toxicity:

No applicable toxicity data

Specific target organ toxicity (single exposure):

No applicable toxicity data

Specific target organ toxicity (repeated exposure):

No applicable toxicity data

Aspiration hazard:

Not available

Likely routes of entry anticipated:

Eye and skin contact

Toxicological symptoms related to the physical, chemical, and characteristics:

Information is not available

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

Information is not available

12 ECOLOGICAL INFORMATION

Ecotoxicity data:

No information available for this product

Persistence and degradability

This product is readily biodegradable

Bioaccumulative potential

Not expected to bioaccumulate

Mobility in soil

Expected to be mobile in soils

Other adverse effects

None known

13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product: Burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging: Dispose of as unused product.

14 TRANSPORT INFORMATION

Land transport ADR/RID and GGVS/GGVE:

Not regulated

Sea transport IMDG/GGVSee:



FQE Solvent ME

Not regulated

Air Transport ICAO-TI and IATA-DGR:

Not regulated

Transport/Further information:



15 REGULATORY INFORMATION

[%] RQ (CAS#) Substance - Reg Codes

[>60%] Solvent naphtha, petroleum, heavy arom. (64742-94-5) TSCA

[5-25%] Water (7732-18-5) TSCA

This product does not contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Regulatory Code Legend

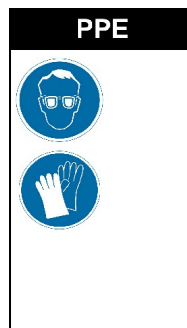
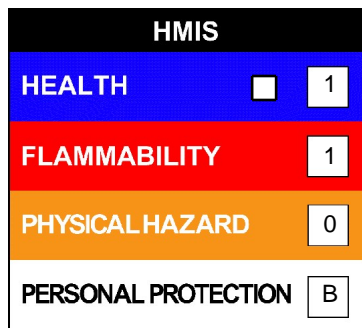
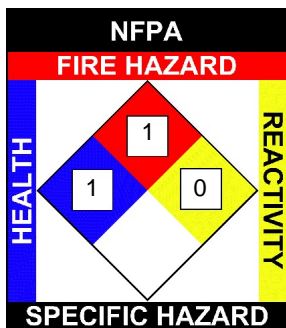
TSCA = Toxic Substances Control Act

16 OTHER INFORMATION

NFPA: Health = 1, Fire = 1, Reactivity = 0, Specific Hazard = n/a

HMIS III: Health = 1, Fire = 1, Physical Hazard = 0

HMIS PPE: B - Safety Glasses, Gloves



The information contained herein is based on data considered accurate, however, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes risk in his use of the material.

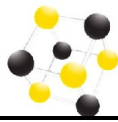
Revision:
1
2
3

Section Changed:
N/A
Sec 14
Sec 2 & 3

Changes Made:
Initial issue of document
Transport info updated
Formulation updated

Date:
10-24-2019
11-22-2019
1-28-2020

Revision Date: 1/28/2020



FQE Pyrophoric

1 PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: FQE Pyrophoric
 SDS Number: FQE Pyrophoric
 Product Code: FQE180
 Revision Date: 1/27/2020
 Version: 3
 Product Use: Pyrophoric Iron Control
 Supplier Details: FQE Chemicals
 4820 Railroad St
 Deer Park, TX 77536
 Phone: 281-476-9249
 Emergency: CHEMTREC 800-424-9300

2 HAZARDS IDENTIFICATION

Classification of the Substance or Mixture
 GHS Classification in Accordance with 29 CFR 1910 (OSHA HCS):
 No GHS Classifications Indicated
GHS Label Elements, Including Precautionary Statements
 GHS Signal Word: **NONE**
 GHS Hazard Pictograms:
 No GHS pictograms indicated for this product
 GHS Hazard Statements:
 No GHS hazards statements indicated
 GHS Precautionary Statements:
 No GHS precautionary statements indicated

3 COMPOSITION/INFORMATION OF INGREDIENTS

Chemical Ingredients:		
CAS#	%	Chemical Name:
7732-18-5	>50%	water

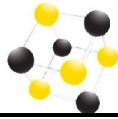
The chemical composition consists of non-hazardous components that do not require disclosure according to applicable regulations.
 The specific identity and percentage of chemicals used in this product have been withheld as a trade secret.

4 FIRST AID MEASURES

Inhalation: If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Skin Contact: If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Launder clothing before reuse. Seek medical attention if irritation persists. Wash with soap and water.
Eye Contact: Flush eyes with plenty of water and get medical attention if irritation persists. Hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poison Information Center, a doctor, or for at least 15 minutes.
Ingestion: If swallowed, do not induce vomiting. Rinse mouth out with water. Drink plenty of water. Seek medical advise immediately by calling a Poison Control Center or a doctor.

5 FIRE FIGHTING MEASURES

Flammability: Non-combustible



FQE Pyrophoric

Flash Point: >200 degF

Autoignition Temp: >600 degF

Extinguishing Media:
Use appropriate material for surrounding area

Specific Chemical Hazard:
None

Special Firefighting Procedures:
Fire fighters should wear self-contained breathing apparatus and full protection clothing when fighting chemical fires. Cool exposed containers with water spray.

Hazardous Combustion Products:
See Hazardous Decomposition Products. (See Section #10)

Hazardous Polymerization:
Will not occur

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions

Wear specified protective equipment. (See Section #8)

Environmental Precautions

Prevent from entering sewers or waterways. If environmental release does occur, inform the appropriate supervisory personnel. If safe to do so, prevent further release.

Methods for clean up

For small spills - Cover spill with absorbent material. Scoop absorbed material into a suitable container for disposal. Recover product to suitable containers or vessel for reuse, if possible, or for disposal.

For large spills - Immediately stop the flow of material if safe to do so. Dike the spill to prevent spreading. Use appropriate absorbent material and move into a suitable container. Wash the contaminated area.

7 HANDLING AND STORAGE

Handling Precautions: Wear specified protective equipment. (See Section #8) Use only in a well-ventilated area. Before use carefully read the product label. Use safe work practices to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking, and smoking in contaminated areas.

Storage Requirements: Keep container tightly closed. Store in cool, dry, well-ventilated area removed from incompatible substances, heat, or ignition sources and foodstuffs. Ensure containers are adequately labeled, protected from physical damage and sealed when not in use.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Use only in a well-ventilated area.

Personal Protective Equipment: Eye/face protection: Wear chemical safety goggles.
Hand protection: Wear chemical-resistant gloves.
Skin protection: Wear long sleeves and chemical resistant apron to prevent repeated or prolonged skin contact.

Occupational Exposure Limits
Exposure limits are not available for this product.

Biological Limits:
No biological limits have been entered for this product.

9 PHYSICAL AND CHEMICAL PROPERTIES



FQE Pyrophoric

Appearance:	dark, amber
Physical State:	Liquid
Odor:	Mild, slight odor
Odor Threshold:	No data available
Solubility:	Complete in water
Spec Grav./Density:	1.15-1.25
Viscosity:	Thin liquid
Boiling Point:	>200 degF
Freezing/Melting Pt.:	No data available
Flammability:	Non-combustible
Flash Point:	>200 degF
Partition Coefficient:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
pH:	7.5-8.5
Evap. Rate:	No data available
Auto-Ignition Temp:	>600 degF
Decomp Temp:	>450 degF
UFL/LFL:	No data available

10 STABILITY AND REACTIVITY

Reactivity:	None known
Chemical Stability:	Stable under normal conditions of use.
Conditions to Avoid:	Strong oxidizers
Materials to Avoid:	Strong oxidizers and acids
Hazardous Decomposition:	Carbon monoxide. Carbon Dioxide
Hazardous Polymerization:	None known

11 TOXICOLOGICAL INFORMATION

Acute toxicity estimates:
 Oral - >2500 mg/kg
 Dermal - >5000 mg/kg
 Inhalation (vapors) - No data

Skin corrosion/irritation:
 May cause dermatitis

Serious eye damage/irritation:
 May cause mild irritation

Sensitization:
 May cause mild skin or respiratory irritation

Mutagenicity:
 No applicable toxicity data

Carcinogenicity:
 None of the components of this product have been listed as carcinogenic by IARC, NTP, or OSHA. (IARC - International Agency for Research on Cancer) (NTP - National Toxicology Program) (OSHA - Occupational Safety & Health Administration (US))

Reproductive toxicity:



FQE Pyrophoric

No applicable toxicity data

Specific target organ toxicity (single exposure):
No applicable toxicity data

Specific target organ toxicity (repeated exposure):
No applicable toxicity data

Aspiration hazard:
Not available

Likely routes of entry anticipated:
Eye and skin contact

Toxicological symptoms related to the physical, chemical, and characteristics:
Information is not available

Delayed and immediate effects and also chronic effects from short and long term exposure:
Information is not available

12	ECOLOGICAL INFORMATION
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Ecotoxicity data:
No information available for this product

Persistence and degradability
This product is readily biodegradable

Bioaccumulative potential
Not expected to bioaccumulate

Mobility in soil
Expected to be mobile in soils

Other adverse effects
None known

13	DISPOSAL CONSIDERATIONS
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Waste treatment methods

Product: Burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging: Dispose of as unused product.

14	TRANSPORT INFORMATION
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Land transport ADR/RID and GGVS/GGVE:

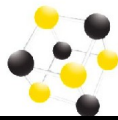
Not regulated

Sea transport IMDG/GGVSee:

Not regulated

Air Transport ICAO-TI and IATA-DGR:

Not regulated



FQE Pyrophoric

Transport/Further information:



15 REGULATORY INFORMATION

[%] RQ (CAS#) Substance - Reg Codes

[>50%] Water (7732-18-5) TSCA

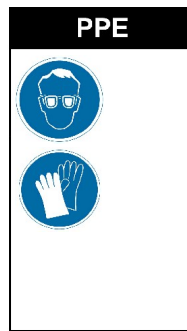
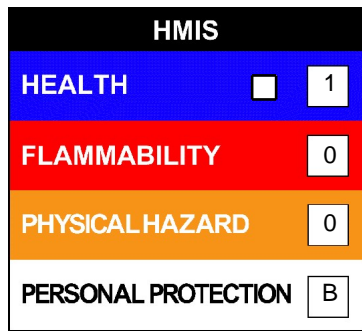
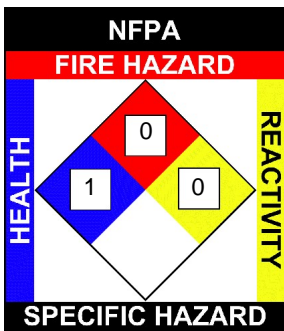
This product does not contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Regulatory Code Legend

TSCA = Toxic Substances Control Act

16 OTHER INFORMATION

NFPA: Health = 1, Fire = 0, Reactivity = 0, Specific Hazard = n/a
 HMIS III: Health = 1, Fire = 0, Physical Hazard = 0
 HMIS PPE: B - Safety Glasses, Gloves



The information contained herein is based on data considered accurate, however, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes risk in his use of the material.

Revision:	Section Changed:	Changes Made:	Date:
1	N/A	Initial issue of document	10-24-2019
2	Sec 14	Transport info updated	11-22-2019
3	Sec 2 & 3	Formulation updated	1-27-2020

Revision Date: 1/27/2020

Appendix C
Bottle Order



INVENTUM ENGINEERING - LABORATORY BOTTLE REQUEST		
Project Name:	Riverview Innovation & Technology Campus	
PO/Reference:	COG Bench Test	
Inventum Contact:	John Black 481 Carlisle Drive; Suite 202 Herndon, VA 20170 571.217.6761 john.black@inventumeng.com	
Shipping or Courier:	Inventum Engineering - Roxanne Birx 3875 River Road Tonawanda, NY 14150 585.734.5255 Roxanne.Birx@inventumeng.com	
BOTTLEWARE REQUIRED BY:		<u>TUESDAY PM (08/17/2021)</u>
Turn-Around-Time:		3-day
Deliverable Requirements:		NYSDEC Cat B w/EQuIS EDD and HONEYWELL EDD
Analysis [Method]	Matrix	No. of Samples
VOCs (5035A/8260C) (Treated Solids, SDS's will be provided)	Solid	5
SVOCs (8270D)	Solid	5
Cyanide (SM 4500 CN E-2011)	Solid	5
TAL Metals (6010C)	Solid	5
Mercury (7470A)	Solid	5
PCBs (8270D)	Solid	5
Pesticides/Herbicides (8081B/8151A)	Solid	5
1,4-Dioxane (8270 SIM)	Solid	5
PFAS (ASTM D7968)	Solid	5
TCLP (Full List)	Solid	5
Paint Filter	Solid	5
Reactivity, Corrosivity, Flamability	Solid	5
BTU Content	Solid	5
Flashpoint	Solid	5
Total Sulfur	Solid	5
TCLP(Boron, cyanides, fluoride, nitrates & nitrites, Uranium)	Solid	5

INVENTUM ENGINEERING - LABORATORY BOTTLE REQUEST		
Project Name:	Riverview Innovation & Technology Campus	
PO/Reference:	COG Bench Test	
Inventum Contact:	John Black 481 Carlisle Drive; Suite 202 Herndon, VA 20170 571.217.6761 john.black@inventumeng.com	
Shipping or Courier:	Inventum Engineering - Roxanne Birx 3875 River Road Tonawanda, NY 14150 585.734.5255 Roxanne.Birx@inventumeng.com	
BOTTLEWARE REQUIRED BY:	<u>TUESDAY PM (08/17/2021)</u>	
Turn-Around-Time:	3-day	
Deliverable Requirements:	NYSDEC Cat B w/EQUS EDD and HONEYWELL EDD	
Analysis [Method]	Matrix	No. of Samples
VOCs (8260) (FQE Solvent, SDS will be provided)	Non-Aqueous Liquid	2
SVOCs (8270)	Non-Aqueous Liquid	2
Cyanide (9012)	Non-Aqueous Liquid	2
TAL Metals (6010)	Non-Aqueous Liquid	2
Mercury (7470) - Low Level if possible	Non-Aqueous Liquid	2
PCBs (8082)	Non-Aqueous Liquid	2
Pesticides/Herbicides (8081/8151)	Non-Aqueous Liquid	2
1,4-Dioxane (8270 SIM)	Non-Aqueous Liquid	2
PFAS (537 MOD)	Non-Aqueous Liquid	2
TCLP (Full List)	Non-Aqueous Liquid	2
Reactivity, Corrosivity, Flamability	Non-Aqueous Liquid	2
BTU Content	Non-Aqueous Liquid	2
Flashpoint	Non-Aqueous Liquid	2
Total Sulfur	Non-Aqueous Liquid	2
TCLP (Boron, cyanides, fluoride, nitrates & nitrites, Uranium)	Non-Aqueous Liquid	2

INVENTUM ENGINEERING - LABORATORY BOTTLE REQUEST		
Project Name:	Riverview Innovation & Technology Campus	
PO/Reference:	COG Bench Test	
Inventum Contact:	John Black 481 Carlisle Drive; Suite 202 Herndon, VA 20170 571.217.6761 john.black@inventumeng.com	
Shipping or Courier:	Inventum Engineering - Roxanne Birx 3875 River Road Tonawanda, NY 14150 585.734.5255 Roxanne.Birx@inventumeng.com	
BOTTLEWARE REQUIRED BY:		<u>TUESDAY PM (08/17/2021)</u>
Turn-Around-Time:		3-day
Deliverable Requirements:		NYSDEC Cat B w/EQuIS EDD and HONEYWELL EDD
Analysis [Method]	Matrix	No. of Samples
VOCs (8260) Quench Sample Water	Aqueous Liquid	1
SVOCs (8270)	Aqueous Liquid	1
Cyanide (9012)	Aqueous Liquid	1
TAL Metals (6010)	Aqueous Liquid	1
Mercury (7470) - Low Level if possible	Aqueous Liquid	1
PCBs (8082)	Aqueous Liquid	1
Pesticides/Herbicides (8081/8151)	Aqueous Liquid	0
1,4-Dioxane (8270 SIM)	Aqueous Liquid	1
PFAS (537 MOD)	Aqueous Liquid	1
pH	Aqueous Liquid	1

Appendix D
Pipe Inspection Notes



As of 8/13/2021 the Broadway pipe rack has been removed up to the east crossover pipe to the Battery. A field assessment was done to gauge distances and number of pipes in the area adjacent to the Pump House. A brief assessment was also conducted in the Boiler House along the southern wall of the ground floor.

The total distance between the east and west crossover pipes is approximately 120 ft.

Heading west along Broadway, the distances between pipe rack supports is as follows: 32ft, 30ft, 23ft, 6ft, 20ft, 16ft. Measurements were taken at the east side of the supports where pipe would be cut. There are a total of 12 pipes and 3 electrical conduits supported by the rack.



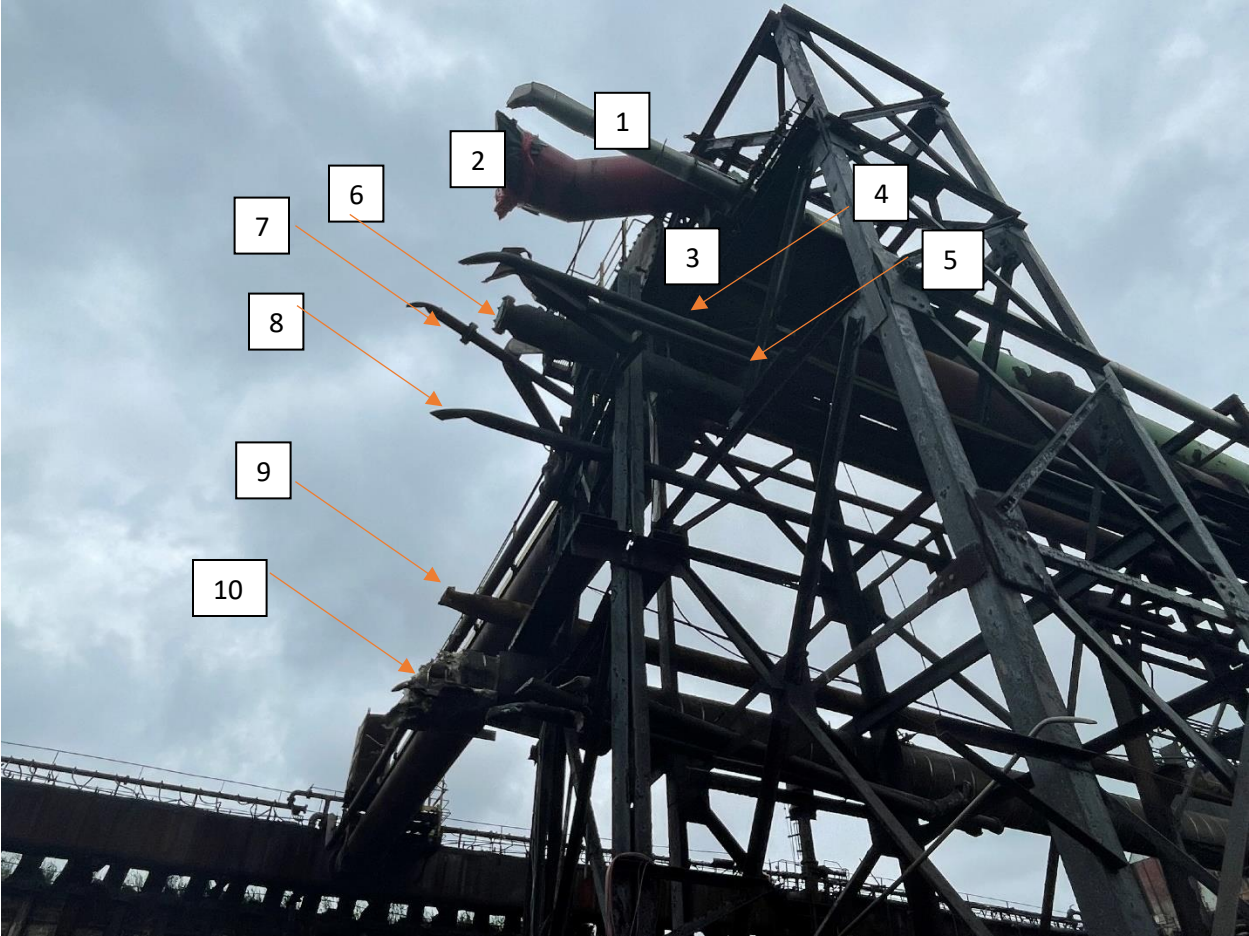
Photograph D 1: Pipe rack supporting the east crossover pipe to Battery.





Photograph D 2: Section of pipe rack evaluated. Note west crossover pipe on left side of image.





Photograph D 3: 10 of the 12 pipes.





Photograph D 4: Pipe 11 out of 12. It comes from the Pump House and continues down the rack.





Photograph D 5: The 12th pipe starts approximately halfway down (heading west) the rack.





Photograph D 6: The COG line inside the Boiler House is approximately 92ft in length.





Photograph D 7: The bolted flange is the end of the COG line it is capped at this hole.





Photograph D 8: Taken to illustrate surrounding piping.



¹ G:\My Drive\Inventum\Project Files\Tonawanda\Work Plans And Site Management Plans\BCP Task
Wps\Demolition Work Plans\Coke Oven Gas Piping\Bench Scale Testing - Coke Oven Gas Residual _ MASTER.Docx

