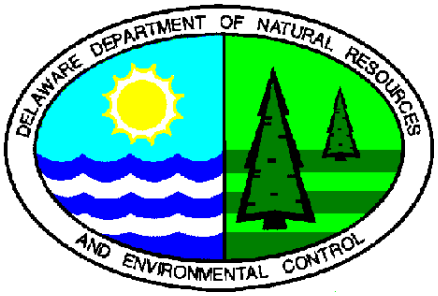

APPLICATION FOR A COASTAL ZONE ACT PERMIT

State of Delaware
Department of Natural Resources & Environmental Control
Office of the Secretary

Revision
March 25, 2019

Veolia Red Lion Plant
Veolia North America Regeneration Services, LLC

Table of Contents

Permit Application Instructions

1. Complete all parts of the application. For sections which are not applicable to your project, do not leave blank; present a statement that clearly states why the section is not applicable to your project.

2. Because all applicants' projects are different, this word document template will provide you flexibility for needed space to answer the questions. Please insert additional lines for text where needed for your application. If appropriate, attach extra pages referencing each answer by the corresponding section and question number.

3. Submit eight complete hard copies of the permit application to:

   Office of the Secretary
   Department of Natural Resources & Environmental Control
   State of Delaware
   89 Kings Highway
   Dover, DE 19901

   In addition to the eight hard copies, submit a complete electronic "pdf" copy of the permit application and a copy of the Offset Matrix in Microsoft Word format on cd-rom.

4. Comply, if required, or as requested by the DNREC Secretary, with 7 Delaware Code, Chapter 79, Section 7902. If requested, but not completed, your application will not be considered administratively complete until this form is reviewed.

5. Be sure to include your permit application fee of $3,000; otherwise the application will not be considered administratively complete. Make checks payable to the "State of Delaware."

6. Be advised that the application for a Delaware Coastal Zone Act Permit is a public document, which may be displayed at DNREC offices, public libraries, and the web, among others. If this application requires you to place confidential information or data in the application to make it administratively complete, note the Delaware Freedom of Information Act (29 Delaware Code, Chapter 100) and DNREC's Freedom of Information Act Regulation, Section 6 (Requests for Confidentiality), for the proper procedure in requesting confidentiality.

Note: This application template was last revised by DNREC on January 30, 2008. Please discard any previous versions.

PART 1

CERTIFICATION BY APPLICANT

Under the penalty of perjury pursuant to 11 Delaware Code §1221-1235, I hereby certify that all the information contained in this Delaware Coastal Zone Act Permit Application and in any attachments is true and complete to the best of my belief.

I hereby acknowledge that any falsification or withholding of information will be grounds for denial of a Coastal Zone Permit.

I also hereby acknowledge that all information in this application will be public information subject to the Delaware Freedom of Information Act, except for clearly identified proprietary information agreed to by the Secretary of the Department of Natural Resources & Environmental Control.

Daniel Frattarelli

Print Name of Applicant

Daniel Frattarelli

Signature of Applicant

Plant Manager

Title

March 25, 2019

Date

PART 2

APPLICANT INFORMATION AND SITE IDENTIFICATION

2.1 Identification of the applicant:

Company Name: Veolia North America Regeneration Services, LLC
Address: 4760 World Houston Parkway, Suite 100
Houston, TX 77032
Telephone: 832-300-5708
Fax:

2.2 Primary contact: Please list the name, phone number and email of a preferred contact within your company in case the DNREC needs to contact you regarding this permit application.

Daniel Frattarelli
302-834-5901
daniel.frattarelli@veolia.com

2.3 Authorized agent (if any):

Name: Dr. Marjorie L. Zeff, AECOM
Address: 625 West Ridge Pike, Suite E-100, Conshohocken, PA 19428
Telephone: 610-832-3588
Fax: 610-832-3501 (email: marjorie.zeff@aecom.com)

If you have an authorized agent for this permit application process, provide written authorization from client for being the authorized agent.

See Attachment A

2.4 Project property location (street address):

Veolia Red Lion Plant
766 Governor Lea Road, New Castle, DE 19720

2.5 In a separate attachment, provide a general map of appropriate scale to clearly show the project site.

See Attachment B

2.6 Is the applicant claiming confidentiality in any section of their application?
No

If yes, see instructions on page 3.

PART 3

PROJECT SUMMARY

Provide a one-page summary describing the proposed project. Include a brief quantitative description of the anticipated environmental impacts, and how the Environmental Offset Proposal will "clearly and demonstrably" more than offset any negative impacts.

Veolia North America Regeneration Services, LLC (Veolia) operates the Red Lion Plant (Red Lion) on a leased parcel of the Delaware City Refinery in Delaware City, DE in accordance with Delaware Department of Natural Resources and Environmental Control (DNREC) Coastal Zone Act (CZA) Permit #406 and Title V Operating Permit #AQM-003/00673 (Revision 3).

Red Lion is a sulfuric acid regeneration (SAR) facility. The applicant is proposing to make more efficient use of Red Lion's regeneration capability through a daily production limit increase from 550 tons to 750 tons (Project). Red Lion is already designed for and capable of accommodating that increase, and emissions would fall well within existing air permit limits. Nevertheless, an actual increase in facility total annual air emissions would be possible if the proposed 200 ton per day increase in production limit is approved. The following Table 1 shows the estimated increase of Red Lion's annual air emissions would be approximately 32 tons per year of a mix of pollutants based on the difference between past actual emissions and forecast future emissions.

Table 1 – Project Air Emission Increases

Air Pollutant	Estimated Project Increase in Annual Facility Air Emissions (Tons)
SO_2	25.8
H_2SO_4 mist	2.1
NO_x	3.1
CO	0.28
PM_{10}	0.023
$PM_{2.5}$*	0.019
VOC	0.34
Total*	31.643

*Note: PM2.5 is not included in the Total because PM2.5 is part of PM10.

Veolia is proposing to provide offsetting emission reductions to more than offset the 32 tons per year increase in air emissions. The proposed offsetting emission reductions (offsets) are the result of the September 2018 shutdown of the Formosa Plastics plant in Delaware City. The offsets will be applied for and reviewed by DNREC Division of Air Quality to assure the offsets are real, surplus, enforceable, permanent, and quantifiable in relation to the definitions and procedures of 7 DE Admin. Code 1134 Emission Banking and Trading Program. If needed, a portion of the offsets may also be purchased from the Emission Reduction Credit (ERC) Bank operated by the Division of Small Business, Development, and Tourism.

PART 4

PROJECT PROPERTY RECORD AND EVIDENCE OF LOCAL ZONING AND PLANNING APPROVAL

PROJECT PROPERTY RECORD

4.1 Name and address of project premises owner(s) of record:

Delaware City Refining Company, LLC
4550 Wrangle Hill Road
Delaware City, DE 19706

4.2 Name and address of project premises equitable owner(s):

Delaware City Refining Company, LLC
4550 Wrangle Hill Road
Delaware City, DE 19706

4.3 Name and address of lessee(s):

Veolia North America Regeneration Services, LLC
53 State Street, 14th Floor
Boston, MA 02109

4.4 Is the project premises under option by permit applicant?

No

4.5 What is the present zoning of the land for this entire project site?

HI (Heavy Industrial)

EVIDENCE OF LOCAL ZONING AND PLANNING APPROVAL

I, _____, **for** New Castle County

(Name of County, City of Town)

do hereby affirm that the project proposed by Veolia North America Regeneration Services, LLC located at 766 Governor Lea Road, New Castle, DE 19720, in the HI (Heavy Industrial) zoning district is in full compliance with the zoning code as it applies to this project.

The above named applicant's project is in compliance with the adopted comprehensive development plan for the geographic area within which the project will be located.

See Attachment D

(Signature)

_____

(Title)

_____

(Date)

This part is essential for a complete Coastal Zone Act Permit Application. No application will be considered administratively complete without it. While the applicant is strongly advised to use this form, the local zoning jurisdiction may utilize a different form or document to demonstrate "evidence of local zoning approval," provided such documents are signed and dated by the proper official.

PART 5

PROJECT OPERATIONS

5.1 Describe the characteristics of the manufactured product and all the process and/or assembly operations utilized by the proposed project. Include in the description (use attachments if necessary):

a. the raw materials, intermediate products, by-products and final products and characteristics of each. Review any materials' risk of carcinogenicity, toxicity, mutagenicity and/or the potential to contribute to the formation of smog. Provide material safety data sheets (MSDS) if available;

The raw materials consist of: i) spent sulfuric acid received from the Delaware City Refinery Alkylation Unit and other similar offsite sources; ii) hydrogen sulfide (H_2S) gas; iii) molten sulfur; iv) vanadium based salts on a silica substrate; v) refinery fuel gas; and vi) process water. The final product is Red Lion non-fuming sulfuric acid ranging from 93% to 99.4% (Final Product) - a colorless and highly corrosive liquid. It is used as a catalyst in the manufacture of petroleum products, as an absorbent, dehydrating agent, active reactant in chemical processes, for pH control in water treatment systems, and as a pickling agent in the manufacture of steel.

The major constituent of the Delaware City Refinery spent acid and other similar offsite sources is sulfuric acid (88-92%). Minor constituents include naphtha (6-8%), diethyl sulfate (<0.2%), and dimethyl sulfate (<0.2%).

The vanadium catalyst (impregnated with cesium) is supported on a silica substrate that facilitates the conversion of the sulfur dioxide (SO_2) generated at the combustion chamber to sulfur trioxide (SO_3). The SO_3 is then absorbed in sulfuric acid to produce acid of the desired strength.

Intermediate products during the regeneration process include SO_2 gas, SO_3 gas and weak sulfuric acid. Byproducts of the regeneration process include various inorganic salts that are removed from the process through wastewater. Products of combustion include carbon dioxide (CO_2), carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NO_x), and SO_2.

Naphtha is not a known carcinogen. It is listed by the International Agency for Research on Cancer (IARC) as IARC-3 (not classified as to its carcinogenicity in humans). Diethyl sulfate and dimethyl sulfate may cause cancer in humans. They both are classified IARC-2A (probably carcinogenic to humans). IARC-1 classification (carcinogenic to humans) has been issued for exposure to strong inorganic acid mists containing sulfuric acid. Data on the carcinogenicity of CO is not available. Sulfur, CO_2, and NO_2 are not considered carcinogens.

Material Safety Data Sheets (MSDS) for raw materials, intermediates, additives and finished products used on-site are provided in Attachment E.

b. the step-by-step procedures or processes for manufacturing and/or assembling the product(s). Provide a flow diagram to illustrate procedures;

A process flow diagram is provided in Attachment F.

Spent sulfuric acid and/or molten sulfur are fed to a horizontal brick-lined combustion chamber for thermal decomposition to SO_2 at a temperature of approximately 1200°C. To achieve and maintain this temperature, refinery gas and H_2S are used as fuels. H_2S is particularly desirable as a fuel as its high heat of combustion allows it to replace organic fuels while its sulfur content produces additional SO_2 that is converted to saleable product. Process gas leaving the decomposition furnace is cooled in a waste heat boiler to approximately 320°C to produce 600 pounds per square inch, gauge (psig) steam. Cooled gas is then sent to the gas-cleaning portion of the plant.

In the gas-cleaning portion of the plant, process gas is cleaned and further cooled. Gas leaves the scrubbing/cooling equipment saturated with water at about 35°C. As part of the gas-cleaning process, water condenses and is removed via weak acid purge stream. The weak acid purge stream is neutralized through elementary neutralization using a dilute sodium hydroxide solution.

Red Lion's preferred technology for cleaning and cooling the gas is reverse jet scrubbing technology, invented by DuPont and later licensed to Monsanto Enviro-Chem. Monsanto Enviro-Chem's trade name for this technology is DynaWave®

Wet gas from the DynaWave® is dried with a circulating stream of acid in a packed tower. The dry process gas must be heated to about 420°C before it enters the converter (SO_2 oxidation reactor). This is done with gas-to-gas heat exchangers using waste heat from the converter. The converter is a multi-pass vessel containing a vanadium-based catalyst supported on silica.

In the converter, the SO_2 is oxidized to SO_3. This reaction produces a large amount of heat which raises the temperature of the process gas and catalyst mass. High temperature slows the oxidation reaction by increasing the decomposition of SO_3 back to SO_2. To restore the overall reaction rate, the process gas is removed from the converter and cooled. To enhance energy recovery, the hot process gas is used to heat the converter inlet gas in gas-to-gas heat exchangers. Thus, the converter gas is cooled and the incoming gas is heated without consuming additional utilities.

Emission standards require conversion of SO_2 to SO_3 to be >99.7%. However, the large amount of SO_3 in the process gas limits conversion in the first three converter passes to about 95-97% due to equilibrium considerations. To achieve additional conversion the SO_2 <-> SO_3 equilibrium is shifted by removing the SO_3 from the process gas in an interpass absorbing tower.

Process gas from the converter enters the interpass absorption tower where the SO_3 is absorbed in a circulating stream of approximately 98%-99% sulfuric acid. The acid strength is maintained in the tower system by adding water and exchanging sulfuric acid between the towers. Product acid is withdrawn from the towers to maintain tower level.

To further increase conversion of SO_2 to SO_3, process gas leaving the interpass tower is re-heated using heat from the converter and sent to the final converter pass. SO_3 produced in this converter pass is absorbed in a final absorbing tower which operates nearly identical to the interpass absorbing tower. Process gas leaving the final absorbing tower is discharged to the atmosphere via stack (designated as EP1, Emission Point 1, or the Main Stack). The Final Product is sulfuric acid ranging from 93% to 99.4%

c. the nature of the materials mentioned above in 5.1(a) as to whether or not the materials require special means of storage or handling;

The existing spent acid tanks will be used to receive and store spent acid. Fumes from these tanks are controlled by a scrubber and/or sent directly to the regeneration process. The tanks are inerted with a nitrogen blanket.

d. list the machinery (new and/or existing) to be utilized by this project;

New machinery will not be needed.

Existing machinery includes:

- Fuel gas-fired burner for heating process gas
- Main Combustion Chamber (where the spent acid is burned with fuel)
- Heat Recovery and Gas Cooling Equipment
- Dynawave® Scrubbers
- Weak Acid Purge Neutralization System
- Gas Dryers
- Gas Compression
- Primary and Final Converters
- Acid (SO_3) Absorption
- Final (SO_3) Absorption
- Plant Support Facilities
- Pumps
- Pump Tanks
- Process Analyzers

e. list any new buildings or other facilities to be utilized;

There are no new buildings, facilities or changes required to the method of the operation of the facility or the current operating procedures. The new rate of production will be 750 tons per day. The Red Lion facility is currently designed to operate at this rate of production. In order to achieve the desired rate, the feed of raw materials into the process will be increased by opening valves and adjusting existing controls to allow additional flow through the existing piping and equipment. No new equipment will be required. Additional catalyst will be installed inside the existing converter and this will be accomplished by adding catalyst through the current access ports, or man-ways. The man-ways are used in the current operation to add catalyst as the addition and replacement of catalyst is a routine activity.

f. list the size and contents of any anticipated aboveground or underground storage tank systems that may be constructed or utilized in support of facility operations;

New tanks are not required.
Existing permitted aboveground storage tanks will be used.

g. if this project represents an increase or decrease in production at an already existing facility, what will be the new rate of maximum production?

Throughput capacity will increase to 750 tons per day.

h. if this project represents a totally new facility at a new or existing site, what will be the maximum production rate?

N/A

5.2 Describe daily hours of plant operations and the number of operating shifts.

Red Lion is a continuous manufacturing process operating 365 days a year. Plant maintains two 12-hour shifts per day.

5.3 Provide a site plan of this project with:

See Attachment G

a. a north arrow; √

b. a scale of not less than one inch to 200 feet; √

c. identity of the person responsible for the plan, including any licenses and their numbers; √

d. the acreage of the applicant's entire property and acreage of the proposed project; √

e. property lines of entire property; √

f. lines designating the proposed project area for which application is being made, clearly distinguished from present facilities and operating areas (if any); N/A

g. existing and proposed roads, railroads, parking and loading areas, piers, wharfs, and other transportation facilities; √

h. existing water bodies and wetlands and proposed dredge and fill areas, N/A and;

i. existing and proposed drainage ways, gas, electric, sewer, water, roads, and other rights-of-way. √

5.4 How many acres of land in total are required for this proposed project?

Existing/ currently utilized/ developed land: 7.48 acres.

New land: 0 acres.

5.5 Has the property been involved with a state or federal site cleanup program such as Superfund, Brownfields, HSCA Voluntary Cleanup Program, RCRA Corrective Action, Aboveground or Underground Storage Tank Cleanup Programs? If so please specify which program.

From 2003 through 2015 DuPont (Former Facility Owner) operated Red Lion and, from 2015 to July 2016, Chemours operated Red Lion. Since August 2016 Veolia North America Regeneration Services, LLC has operated Red Lion, and occupied the property pursuant to a Lease with Delaware City Refining Company commencement date January 1, 2003. The termination date is December 31, 2027.

The property has not been involved with any site cleanup program since the commencement of Veolia's lease, and upon information and belief the property was not involved with any site cleanup program during or prior to Chemours' operation.

5.6 With regards to environmental cleanup actions, has a Uniform Environmental Covenant, Final Plan of Remedial Action, or no further action letter been issued by the Department? If so are the planned construction activities consistent with the requirements or conditions stated in these documents?

N/A

PART 6A

ENVIRONMENTAL IMPACTS

Air Quality

6.1 Describe project emissions (new, as well as any increase or decrease over current emissions) by type and amount under maximum operating conditions:

The proposed project will comply with all of the existing emission limits contained in the Red Lion air permit issued by DNREC Division of Air Quality (DAQ). This includes short term and long term emission rates for the applicable regulated air contaminates emitted by the existing facility emission sources. No new or modified air emission sources are proposed for the project.

Nevertheless, on the basis of considering predicted future actual emissions relative to past actual emissions (for calendar year 2017), the proposed increase in the daily acid production limit from 550 tons per day to 750 tons per day will increase emissions of various air pollutants is summarized in the following table.

Table 2 - Comparisons of Annual Permit Limits, Past Actuals and Future Actuals in Tons Per Year (TPY)

A Pollutant	C Past Actuals based on 2017 reported Emissions	D Forecast Future Actual Emissions with Revised CZA Permit at 750 TPD[2]	F Future Actual Minus Past Actual (Actual to Actual Increase)	B Title V Permit Limits[1]
SO_2	55.9	81.74	25.8	95.55
H_2SO_4 mist	5.02	7.2	2.1	10
NO_x	18.91	22.0	3.1	22
CO	0.62	0.89	0.28	12
PM_{10}	0.043	0.067	0.023	4.3
$PM_{2.5}$	0.036	0.055	0.019	N/A
VOC	0.73	1.07	0.34	2

Table Notes:

1. Total Plant 12-month rolling emission limits. These can be considered the Potential to Emit (PTE) because facility has the potential, because it is so permitted, to emit up to these limits.
2. A conservatively high estimate of predicted future actual emissions based on operation at 750 tons per day (TPD) production of sulfuric acid for 365 days per year.

6.2 Describe how the above emissions change in the event of a mechanical malfunction or human error.

Coastal Zone Permit #406 requires the site to develop a detailed Process Safety Management (PSM) program. Multiple Process Hazard Analyses have been done on the site to identify and control major equipment malfunctions. Emissions scenario has been evaluated as part of the most recent Process Hazards Analysis, which was revalidated in 2016, per OSHA requirements. The emissions change in the event of a failure as compared to 6.1 is an increase of approximately one ton for SO2. A management of change safety review has been performed for this Project and it has been determined that the process controls already in place are adequate to minimize the impact from a catastrophic event.

The site also has operating procedures, safe work practice procedures and emergency response plans for various types of emergencies that do not change as a result of this Project. The site also complies with all conditions of a Risk Management Plan which establishes requirements and responsibilities for responding to fires, fume releases, natural disasters, emergencies at nearby facilities, bomb threats, malicious mischief, civil disorder and sabotage.

The following existing systems are designed into the facility to prevent a release due to human error or equipment failure:

- Follow Red Lion Sulfuric Acid Operating Standards
- Level alarms and transfer pump shutoffs
- Remote emergency shutoff valves
- Emergency shutoff button in the control room
- CCTV to monitor all transfers at the facility
- Motion detector/shutoff during loading
- Scrubber and Vapor Combustion systems which manage releases from the Storage Tanks

In addition, Red Lion continuously monitors and audits safe operations of the plant and implements improvements as needed. The monitoring and audits are part of the Process Hazards Analysis done as a component of the PSM program. Elements of the PSM program are given below:

- Process Technology
- Management of Change
- Quality Assurance
- Mechanical Integrity
- Training and Performance
- Incident Investigating
- Operating Procedures
- Process Hazards Analysis
- Pre-Startup Safety Reviews
- Management of Subtle Change
- Contractor Safety
- Emergency Planning and Response

The PSM program requires the evaluation of various scenarios involving equipment malfunction or human error, and implementation of systems to prevent their occurrence.

The established training and safety procedures and process safety management analyses remain applicable. The facility employs state-of-the-art technology to operate the process safely and efficiently – thereby minimizing environmental impacts.

6.3 Describe any pollution control measures to be utilized to control emissions to the levels cited above in 6.1.

The air pollution control technologies included in the current facility design and documented in the Title V permit will continue to be operated. These control technologies include the following:

- Mist eliminator on Emission Point EP1 for sulfuric acid mist control (99% control efficiency);
- Caustic scrubber, vapor combustion unit on Emission Point EP3, shutdown vent (95% SO_2 control by scrubber, 98% hydrocarbon control by vapor combustion unit); and
- Particulate matter emissions will be controlled by burning gaseous feedstock and by employing good combustion control practices.

These are the air pollution control measures utilized to control air emissions to the levels cited above in 6.1. These are the current measures, and are the same measures that will be used in the future with the Projects' increased production rate.

6.4 Show evidence that applicant has, or will have, the ability to maintain and utilize this equipment listed in 6.3 in a consistently proper and efficient manner. (For example, provide college transcripts and/or records of training courses and summary of experience with this pollution control equipment of person(s) responsible for pollution control equipment, and/or provide copies of contracts with pollution control firms to be responsible for maintaining and utilizing this equipment.)

Red Lion is an existing production facility that has a proven track record and has experience operating and maintaining the equipment. The operators are trained on equipment operation. A formal review of the operating procedures for the equipment is conducted on a three year cycle. Records of this training are maintained on-site at Red Lion and are included in Attachment H.

Red Lion has performed ongoing routine maintenance of this equipment since its original installation. Maintenance on this equipment is performed by trained maintenance technicians. Records of this training are maintained on-site at Red Lion and are included in Attachment H. Equipment history and records of maintenance work performed on the equipment are kept on-site at Red Lion. A summary of experience

with this equipment and a description of the current maintenance program for the equipment listed in 6.3 is outlined below.

Mist Eliminator – Pressure drop is monitored continuously to determine when internal elements need replacement. An internal visual inspection for vessel integrity is performed every two years. Several valves associated with this unit are replaced on a two year cycle as a preventative maintenance task. As a direct result of this maintenance program and as part of normal operations, the internal elements have been replaced several times over the life of the equipment to ensure ongoing safe operations and emissions control.

Caustic Scrubber – Pressure drop is monitored continuously to ensure proper operating performance and emissions control. One valve associated with this unit is replaced on a two year cycle as a preventative maintenance task. Our ongoing maintenance program has resulted in several upgrades to the scrubber system over the life of the unit, including upgraded automation and instrumentation for improved reliability.

VCU – The following maintenance functions are performed on an annual basis by the on-site Maintenance team - visual stack inspection, combustion system safeguard checks, flame arrestor inspection, testing and inspection of the emergency stop.

No modifications or changes are required to the existing equipment as a result of this project. Therefore, no new training is necessary for the operations or maintenance personnel.

Water Quality

6.5 Describe wastewater discharge (new, as well as any increase or decrease over current discharge levels) due to project operations:

There will be no new wastewater discharges as a result of the Project.

The Red Lion process wastewater discharge rate depends on the raw materials being processed, which vary by business conditions. Raw materials include a mix of spent sulfuric acid, hydrogen sulfide gas and/or molten sulfur. Based on the mix of these raw material inputs, the instantaneous wastewater discharge rates decrease and increase around an average that is approximately 29 gallons per minute.

Process engineering estimates of the potential future wastewater discharge rates for the proposed Project forecast that instantaneous wastewater discharge rates could decrease by approximately 5 gallons per minute, or increase by approximately 11 gallons per minute.

On an average annual basis, the process wastewater discharge volume is not expected to increase from the current facility operations. All of Red Lion wastewater will continue to be neutralized to a 6-9 pH range before being transferred to the Delaware City Refinery for further wastewater treatment.

Pollutant	Current Discharge Concentration (ppm)	New or Changed Discharge Concentration (ppm)	Current Discharge		Net Increase/Decrease		New Total Emissions	
			Lbs/day	*Tons/year*	*Lbs/day*	*Tons/year*	*Lbs/day*	*Tons/year*

6.6 Describe the current method of employee sanitary wastewater disposal and any proposed changes to that system due to this proposed project.

Employee sanitary wastewater disposal is managed at the Delaware City Refinery wastewater treatment facility. No proposed changes due to this Project.

6.7 Identify the number, location, and name of receiving water outfall(s) of any and all process wastewater discharge (new or current) affected by this proposed project. Provide NPDES Permit Numbers for each discharge affected.

The wastewater generated at the facility is discharged to the wastewater treatment plant of the Delaware City Refinery for further wastewater treatment. All process wastewater and stormwater are transferred to the Refinery's conveyance systems and

wastewater treatment plant (WWTP) for treatment prior to discharge to the Delaware River. Red Lion does not have a NPDES permit, and has no outfalls.

As a matter of public record, the Delaware City Refinery NPDES Permit Number is DE0000256 (effective August 1, 2018, expires July 31, 2023). The Refinery's wastewater effluent is designated as Outfall 601. The 601 WWTP effluent is combined with other Refinery discharges and released as the combined total discharge to the Delaware River in Outfall 001.

6.8 If any effluent is discharged into a public sewer system, is there any pretreatment program? If so, describe the program.

No effluent water is charged into any public sewer systems.

6.9 Stormwater:

a. Identify the number, location, and name of receiving waters of stormwater discharges. Provide permit number for each discharge.

Stormwater flows are discharged to the Delaware City Refinery WWTP for treatment. The WWTP effluent (Outfall 601) is then discharged via their primary Outfall 001 to the Delaware River.

b. Describe the sources of stormwater run-off (roofs, storage piles, parking lots, etc).

Runoff is generated from the roofs of buildings, operating areas, operating process tanks, vessels, tank cars of fresh and spent acid, continuous boiler blow down and outside storage areas.

c. Describe the amount of stormwater run-off increase over current levels that will result from the proposed project.

There will be no changes in the quantity of stormwater runoff due to this Project.

d. Describe any pollutants likely to be in the stormwater.

Potential pollutants in stormwater may include trace amounts of sulfuric acid, sodium hydroxide, oils and grease, and organics. On this Project we will not change the current stormwater exposure.

e. Describe any pollution control device(s) or management technique(s) to be used to reduce the amount of stormwater generated, and devices to improve the quality of the stormwater run-off prior to discharge.

Secondary containment is implemented for fresh and spent acid storage facilities and process areas to reduce pollutant loading to runoff. The employee parking lot is covered to minimize contact of rainwater with automobile-related pollutants. The facility

implements a Stormwater Pollution Prevention Plan to prevent and mitigate stormwater pollution.

No changes will occur to current devices or techniques due to this Project.

f. Describe any new or improved stormwater drainage system required to safely carry off stormwater without flooding project site or neighboring areas down gradient.

None. The existing stormwater management system safely carries off stormwater without flooding the Project site or neighboring areas down gradient.

6.10 Will this project use a new water intake device, or increase the use (flow) from an existing intake device?

This Project will not require a new water intake device or result in an increase in the flow from an existing intake device. The Delaware City Refinery provides the cooling water. The site will continue to be supplied by Delaware City Refinery's existing water withdrawal allocation.

If yes, state:

a. the volume of water to be withdrawn, and;

b. describe what will be done to prevent entrainment and/or entrapment of aquatic life by the intake device.

6.11 Will this proposed project result in a thermal discharge of water, or an increase in the flow or temperature of a current thermal discharge?

No.

If yes, state:

a. the volume of the new flow or increase from the existing thermal discharge, both in flow and amount of heat;

b. how warm will the water be when it is discharged into a receiving waterway, discharge canal, or ditch, and what will be the difference in discharge temperature and ambient temperature (delta T) at various seasons of the year after all cooling water mechanisms have been applied to the hot water?

c. the equipment and/or management techniques that will be used to reduce the thermal load of the discharge water.

6.12 Will any proposed new discharge or change in existing discharge cause, or have potential to cause, or contribute to, the exceedance of applicable criteria appearing in the "State of Delaware Surface Water Quality Standards"?

No.

If yes, explain:

6.13 Describe any oils discharged to surface waters due to this proposed project.

No oils will be discharged to surface waters due to this Project.

6.14 Describe any settleable or floating solid wastes discharged to surface waters due to this project.

No settleable or floating solid wastes will be discharged to surface waters due to this Project.

6.15 Show evidence that the applicant has, or will have, the ability to maintain and utilize any water pollution control equipment listed in questions 6.5 through 6.14 in a consistently proper and efficient manner. (For example, provide operator license numbers, college transcripts and/or training courses and summary of prior experience with this pollution control equipment of person(s) responsible for pollution control equipment, and/or provide copies of contracts with pollution control firms.)

The Delaware City Refinery manages the wastewater and stormwater generated from this Project. The Refinery has licensed and trained staff to operate their wastewater and stormwater management system.

6.16 Estimate the amount of water to be used for each specified purpose including cooling water. State daily and maximum water use in the unit of gallons per day or each purpose and source of water. State if water use will vary with the seasons, time of day, or other factors.

- Cooling water - varies with seasons, least used in winter, most used in summer. Average use: approximately 10,800,000 gallons per day (GPD). Maximum use: approximately 13,000,000 GPD. No change from current conditions.

- Process water - used for diluting product. Current Average use: approximately 18,000 GPD. Current Maximum use: approximately 23,000 GPD. New average use: approximately 25,000 GPD. New Maximum use: approximately 31,000 GPD. Usage remains significantly less than the estimate in the original Coastal Zone application.

- Utility water - feeds maintenance hoses used for washing. Average use: 1,200 GPD. Maximum use: approximately 1,500 GPD. No change from current conditions.

- Boiler feed water - varies with production rate. Current Average use: approximately 114,000 GPD. Current Maximum use: approximately 133,600 GPD. New average use: approximately 144,000 GPD. New maximum use: approximately 163,000 GPD.

- Safety Shower water - approximately 50 GPD. No change from current conditions.

- Building water (toilets, sinks, etc.) - approximately 400 GPD. No change from current conditions.

6.17 Identify the source of water needed for the proposed project, including potable water supplies.

No change to current source, Delaware City Refinery, is needed.

6.18 Are wells going to be used?

No

If yes:

a. Identify the aquifer to be pumped and the depth, size and pumping capacity of the wells.

b. Has a permit been applied for to do this?

c. How close is the proposed well(s) to any well(s) on adjacent lands?

Solid Waste

6.19 Will this project result in the generation of any solid waste?

No new solid waste will be generated.

The solid waste currently generated is described below.

If yes, describe each type and volume of any solid waste (including biowastes) generated by this project, and the means used to transport, store, and dispose of the waste(s).

The solid waste generated is the same solid waste that is currently being generated at the site. Volumes vary depending on circumstances such as plant outages and capital projects. The waste will continue to be transported, stored and disposed of by following current site procedures. Current site procedures include using permitted waste haulers, storing per Delaware/Federal requirements and disposing of per Delaware/Federal regulations.

Neutralized wastewater	≈ 42,000 GPD
Scrap metal	≈ 15,000 lbs/year
Catalyst	≈ 20,000 lbs/shutdown
Universal waste	≈ 500 lbs/year
Used Oil	≈ 500 lbs/year

6.20 Will there be any on-site recycling, re-use, or reclamation of solid wastes generated by this project?

This Project will not offer an opportunity for on-site recycling, re-use, or reclamation of solid wastes.

If yes, describe:

6.21 Will any waste material generated by this project be destroyed on-site?

Yes. However, there will be no change in the site's current practices. Current practices are described below.

If yes, how will that be done?

Acidic wastewater will be treated on-site by elementary neutralization using a dilute sodium hydroxide solution. This is done under the elementary neutralization exemption allowed by RCRA rules. The waste is then pipelined to Delaware City Refinery Waste Water Treatment Plant. The process described is the current practice which will not be modified.

Hazardous Waste

6.22 Will this proposed project result in the generation of any hazardous waste as defined by the "Delaware Regulations Governing Hazardous Waste"?

No new hazardous waste will be generated. Volumes vary depending on circumstances such as plant outages and capital projects. The hazardous waste currently generated is described below.

If yes, identify each hazardous waste, its amount, and how it is generated:

- Corrosive waste – The site can generate corrosive wastes (D002) as the result of equipment cleanout (≈ 7,500 lbs/year).
- Flammables – The site generates waste from solvents and various maintenance activities that can carry multiple D codes (≈ 500 lbs/year).
- Lab waste – The site removes expired lab chemicals that can carry multiple D codes as a lab pack once per year (≈ 100 lbs/year).
- Other characteristic waste – The site generates characteristic waste (D007) during the clean out of the decomposition furnace (≈ 10,000 lbs/shutdown).

6.23 Describe the transport of any hazardous waste and list the permitted hazardous waste haulers that will be utilized.

The site has utilized the following permitted transporters:

- Safety Kleen – TXR000081205
- Clean Harbors – MAD030322250
- US Environmental – PAR000524041
- SJ Transporters – NJD071629976

6.24 Will the proposed project cause the applicant to store, treat, and/or dispose of hazardous waste?

Yes. However no change to current site practices will occur due to this Project. Current practices are described below.

If yes, describe:

Acidic wastewater will be treated on-site by elementary neutralization using a dilute sodium hydroxide solution. This is done under the elementary neutralization exemption allowed by RCRA rules. The waste is then pipelined to Delaware City Refinery Waste Water Treatment Plant. The process described is the current practice which will not be modified.

Hazardous waste is currently stored per the Delaware Regulations Governing Hazardous Waste and no hazardous waste disposal is performed on-site

6.25 Does the applicant currently generate any hazardous waste at this site?

Yes

If yes, describe:

See Section 6.22.

Habitat Protection

6.26 What is the current use of the land that is to be used for the proposed project?

Heavy Industrial – Chemical manufacturing

6.27 Will the proposed project result in the loss of any wetland habitat?

No

If yes, describe:

6.28 Will any wastewater and/or stormwater be discharged into a wetland?

No

If yes, will the discharge water be of the same salinity as the receiving wetlands?

6.29 Will the proposed project result in the loss of any undisturbed natural habitat or public use of tidal waters?

No

If yes, how many acres?

6.30 Do threatened or endangered species (as defined by the DNREC and/or the Federal Endangered Species Act) exist at the site of the proposed project, or immediately adjacent to it?

No.

If yes, list each species:

6.31 Will this proposed project have any effect on these threatened or endangered species (as defined by the DNREC and/or the Federal Endangered Species Act).

No.

If yes, explain:

6.32 What assurances can be made that no threatened or endangered species exist on the proposed project site?

This site has been in operation for 14 years and constantly monitored; no threatened or endangered species have been observed.

6.33 Describe any filling, dredging, or draining that may affect nearby wetlands or waterways.

There will be no filling, dredging, or draining associated with the proposed Project.

6.34 If dredging is proposed, how much will occur and where will the dredged materials go for disposal?

N/A

Other Environmental Effects

6.35 Describe any noticeable effects of the proposed project site including: heat, glare, noise, vibration, radiation, electromagnetic interference, odors, and other effects.

Operational equipment is the same as the past and none of the listed effects are anticipated to change.

6.36 Describe what will be done to minimize and monitor such effects.

The noticeable effects described in 6.35 are monitored through various Process Safety Management (PSM) and Occupational Health processes and addressed accordingly.

6.37 Describe any effect this proposed project will have on public access to tidal waters.

The proposed Project will have no effect on public access to tidal waters.

6.38 Provide a thorough scenario of the proposed project's potential to pollute should a major equipment malfunction or human error occur, including a description of backup controls, backup power, and safety provisions planned for this project to minimize any such accidents.

Coastal Zone Permit #406 requires the site to develop a detailed PSM program. Multiple Process Hazard Analyses have been done on the site to identify and control major equipment malfunctions. A management of change review was done and this Project will not impact the process controls already in place to minimize accidents.

The site also has operating procedures, safe work practice procedures and emergency response for various types of emergencies that do not change as a result of this Project. The site is also complies with all conditions of a Risk Management Plan.

Based on the many years of experience in handling non-fuming sulfuric acid, the most probable event that could occur at the facility due to human error is a spill of sulfuric acid. Given below are systems that are designed into the SAR to prevent the release of acid to the ground or groundwater at the site.

The following systems are designed into the SAR facility to prevent a release due to human error or equipment failure.

- Follow Red Lion Sulfuric Acid Operating Standards
- Level alarms and transfer pump shutoffs
- Remote emergency shutoff valves
- CCTV to monitor all transfers at the facility
- Motion detector/shutoff during loading
- Scrubber and Vapor Combustion systems to manage releases from the Storage Tanks

- Secondary containment (designed for 100% of tank contents) for the storage tank and an allowance for rainfall (24-hour 25-year storm event)

In addition, Red Lion continuously monitors and audits safe operations of the plant and implements improvements as needed. The monitoring and audits are part of the Process Hazards Analysis done as a component of the PSM program. Elements of the PSM program are given below:

- Process Technology
- Management of Change
- Quality Assurance
- Mechanical Integrity
- Training and Performance
- Incident Investigating
- Operating Procedures
- Process Hazards Analysis
- Pre-Startup Safety Reviews
- Management of Subtle Change
- Contractor Safety
- Emergency Planning and Response

The PSM program requires the evaluation of various scenarios involving equipment malfunction or human error, and implementation of systems to prevent their occurrence.

6.39 Describe how the air, water, solid and hazardous waste streams, emissions, or discharge change in the event of a major mechanical malfunction or human error.

The air, water, solid and hazardous waste streams, emissions or discharges may change in numerous ways in the unlikely event of a major mechanical malfunction or human error. The nature of the change would depend on the nature of the malfunction or error. The anticipated discharges are not expected to cause substantial adverse environmental effects.

PART 6B

ENVIRONMENTAL OFFSET PROPOSAL REDUCTION CLAIM

Is applicant claiming the right to have a reduced offset proposal due to past voluntary improvements as defined in the "Regulations Governing Delaware's Coastal Zone"?

No

If yes, provide an attachment to the application presenting sufficient tangible documentation to support your claim.

PART 6C

ENVIRONMENTAL OFFSET PROPOSAL

Offset Matrix follows on page 36.

If the applicant or the Department finds that an Environmental Offset Proposal is required, the proposed offset project shall include all the information needed to clearly establish:

A. A qualitative and quantitative description of how the offset project will "*clearly and demonstrably"* more than offset the negative impacts from the proposed project.

To more than offset the air quality impacts from the proposed project, Veolia is proposing to provide offsetting emission reductions (offsets) resulting from the shutdown of a nearby facility which will more than offset the potential increases in air emissions related to the daily production limit increase from 550 tons to 750 tons. As described in Part 6A, Section 6.1 and Appendix C of this application, the air emission increase that would result from the proposed project is forecast as a total of 31.643 tons per year of a variety of pollutants as shown below in Table 3.

Table 3 – Project Air Emission Increases to be More than Offset in Tons Per Year (TPY)

Pollutant	Future Actual Minus Past Actual (Actual to Actual Increase)	Emissions to be Offset at a Ratio of 1.3 to 1
SO_2	25.8	33.5
H_2SO_4 mist	2.1	2.8
NO_x	3.1	4.0
CO	0.28	0.4
PM_{10}	0.023	0.030
$PM_{2.5*}$	0.019	0.025
VOC	0.34	0.4
Total*	**31.643**	**41.136**

*Note: PM2.5 is not included in the Total because PM2.5 is a subset of PM10 emissions

At a ratio of 1.3 to 1, the amount of ERCs proposed to more than offset the project's air emission increases is 41.136 tons per year. Therefore, Veolia proposes to procure and retire for the purposes of CZA Project Offsets for this project, as summarized in the next paragraph, emission reduction offsets from Formosa Plastics (and the DNREC ERC Bank, if needed) a total of 42 tons per year of air emission offsets according to the policies and procedures of the DNREC CZA Program.

The offsetting emission reductions are the result of the September 2018 shutdown of the Formosa Plastics plant located at 780 School House Road, Delaware City, DE 19706. The offsets will be applied for and reviewed by DNREC Division of Air Quality (DAQ). The DAQ will review the application for the proposed offsets resulting from the Formosa Plastics facility shutdown to assure the emission reductions are real, surplus, enforceable, permanent, and quantifiable as their implementation of the definitions and procedures of the 7 DE Admin. Code 1134 Emission Banking and Trading Program. It is expected that all of the required CZA Project Offsets (approximately 42 tons per year) will be directly obtained from the DAQ approved Formosa Plastics emission reductions. However, if additional offsets are required Veolia will seek to purchase such offsets from the ERC Bank operated by the Division of Small Business, Development, and Tourism.

The quantities described in the last paragraph relating to direct purchase from Formosa and the Division of Small Business (if any) will be confirmed after the DAQ certifies a specific quantity of offsets; however, the total to be provided as CZA Project Offsets to more than mitigate the project air impacts for the proposed project will be 42 tons per year.

B. How and in what period of time the offset project will be carried out.

Veolia expects to proceed with the offset project on an expedited basis in order to obtain the DAQ approval of the offsets at the earliest opportunity and in coordination with consideration of this application. Veolia and Formosa intend to apply for the ERCs in mid-March 2019 with the goal of obtaining the offset application approval in May of 2019, assuming this meets with DAQ's and DNREC's schedule.

C. What the environmental benefits will be and when they will be achieved.

The environmental air quality benefits of the proposed offset plan are based on these factors:

- The proposed offset plan will use emission reductions from a location of very close proximity (less than 1 mile) to the proposed Red Lion air increases.
- The air emission reductions from the plan shutdown occurred within one year of the prosed air emission increases.
- The offset will not have any impact on the Department's attainment of environmental goals for the Coastal Zone and it will not impact the environmental indicators used to assess long-term environmental quality within the Coastal Zone.

D. What scientific evidence there is concerning the efficacy of the offset project in producing its intended results.

The DAQ review and approval of the offset application with the intent and understanding that such offsets can be used to offset air emission increases in the Delaware Coastal Zone is an approved regulatory process that is based in atmospheric science.

E. How the success or failure of the offset project will be measured in both the short and long term.

The DAQ process of offset application approval will confirm and demonstrate that that the emission reductions are real, surplus, enforceable, permanent and quantifiable.

F. What, if any, negative impacts are associated with the offset project.

There are no negative environmental impacts related to the proposed air emissions offset plan.

G. How the offset will impact the attainment of the Department's environmental goals for the Coastal Zone and the environmental indicators used to assess long-term environmental quality within the Coastal Zone.

There are no expected impacts to the attainment of the Department's environmental goals for the Coastal Zone and the environmental indicators used to assess long-term environmental quality within the Coastal Zone related to the proposed air emissions offset plan.

Additional Offset Proposal Information for the Applicant

1. The offset proposals must "*clearly and demonstrably*"[1] more than offset any new pollution from the applicant's proposed project. The applicant can claim (with documentation) evidence of past voluntary environmental investments (as defined in the Regulations) implemented prior to the time of application. Where the Department concurs with the applicant that such has occurred, the positive environmental improvement of the offset proposal against the new negative impact can be somewhat reduced.

2. The applicant must complete the Coastal Zone Environmental Impact Offset Matrix. This matrix can be found on the CZA web page (http://www.dnrec.delaware.gov/Admin/CZA/CZAHome.htm, or by clicking on this link. On page one, the applicant must list all environmental impacts in the column labeled "Describe Environmental Impacts." In the column to the immediate right, the applicant should reference the page number of the application or attachment which documents each impact listed. In the "Describe Environmental Offset Proposal" column, applicant must state what action is offsetting the impact. The offset action shall be referenced by page number in the column to the right to show how the offset will work. The applicant shall not utilize the far right column. *Please ensure the matrix is complete, detailed, and as specific as possible, given the allotted space. Also, thoroughly proof-read to ensure there are no spelling or grammatical errors.* The applicant must submit a completed matrix both in hardcopy and electronic form.

Offset Matrix follows on page 36.

3. Please note: the entire offset proposal, including the matrix, shall be available to the public, as well as the evidence of past voluntary environmental enhancements.

[1] For purposes of this requirement, the DNREC will interpret the phrase "clearly and demonstrably" to mean an offset proposal that is obviously so beneficial without detailed technical argument or debate. The positive environmental benefits must be obviously more beneficial to the environment than the new pollution that minimal technical review is required by the Department and the public to confirm such. The total project must have a positive environmental impact. The burden of proof is on the applicant.

COASTAL ZONE ENVIRONMENTAL IMPACT OFFSET MATRIX

Applicant:
Project:
CZA Offset Review Reference: (DNREC Only)

Application Date:
Amendments:
Offset Review Date: (DNREC Use Only)
Matrix Amended:

ENVIRONMENTAL IMPACTS	(Applicant's Use) DESCRIBE ENVIRONMENTAL IMPACTS	PAGE NO.	(Applicant's Use) DESCRIBE ENVIRONMENTAL OFFSET PROPOSAL[1]	PAGE NO.	OFFSET SUFFICIENCY Yes, No or N/A
Air Quality (Applicant to List Below by Parameter)	TPY = Tons Per Year				
Sulfur dioxide	25.8 TPY increase (Table 1 and Table 2)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Nitrogen oxides	3.1 TPY increase (Table 1 and Table 2)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Carbon monoxide	0.28 TPY increase (Table 1 and Table 2)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Sulfuric acid mist	2.1 TPY increase (Table 1 and Table 2)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Particulate matter (≤ 10 microns)	0.023 TPY increase e (Table 1 and Table 2)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Particulate matter (≤ 2.5 microns)	0.019 TPY increase (Table 1 and Table 2) (Note that PM 2.5 is a subset of PM10)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Volatile organic compounds	0.34 TPY increase (Table 1 and Table 2)	6 & 15	These emission increases will be offset 1.3:1 with certified ERCs.	32 (Table 3)	
Water Quality					
Surface	None	19-23	None	Not Applicable	
Groundwater	None	23	None	Not Applicable	
Water Quantity					
Surface	None	19-23	None	Not Applicable	
Groundwater	None	23	None	Not Applicable	
Water Use For:				Not Applicable	
Processing	None	22-23	None	Not Applicable	
Cooling	None	22-23	None	Not Applicable	
Effluent Removal	None	22-23	None	Not Applicable	
Solid Waste	None	24	None	Not Applicable	
Hazardous Waste	None	25-26	None	Not Applicable	
Habitat					
Wetlands	None	27-28	None	Not Applicable	
Flora Fauna	None	27-28	None	Not Applicable	
Drainage/Flood Control	None	20-21	None	Not Applicable	
Erosion[2]	None	-	None	Not Applicable	
Land Use Effects					
Glare	None	29	None	Not Applicable	
Heat	None	29	None	Not Applicable	
Noise	None	29	None	Not Applicable	
Odors	None	29	None	Not Applicable	
Vibration	None	29	None	Not Applicable	
Radiation	None	29	None	Not Applicable	
Electro-Magnetic Interference	None	29	None	Not Applicable	
Other Effects	None	29-30	None	Not Applicable	
Threatened & Endangered (T&E) Species	None	27	None	Not Applicable	
Impacts From:					
Raw Material	None	10-12; Attachment E	None	Not Applicable	
Intermediate Products	None	10-12; Attachment E	None	Not Applicable	
By-Products	None	10-12; Attachment E	None	Not Applicable	
Final Products	None	10-12; Attachment E	None	Not Applicable	

1 See paragraph I.1.b in "Secretary Assessment"
2 Construction and normal operation

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PART 7

ECONOMIC EFFECTS

Construction

7.1 Estimate the total number of workers for project construction and the number to be hired in Delaware.

No construction will take place as a result of the Project.

7.2 Estimate the weekly construction payroll.

No construction will take place as a result of the Project.

7.3 Estimate the value of construction supplies and services to be purchased in Delaware.

No construction will take place as a result of the Project.

7.4 State the expected dates of construction initiation and completion.

No construction will take place as a result of the Project.

7.5 Estimate the economic impact from the loss of natural habitat, or any adverse economic effects from degraded water or air quality from the project on individuals who are directly or indirectly dependent on that habitat or air or water quality (e.g. commercial fishermen, waterfowl guides, trappers, fishing guides, charter or head boat operators, and bait and tackle dealers).

No impact.

Operations

7.6 State the number of new employees to be hired as a direct result of this proposed project and how many of them will be existing Delaware residents and how many will be transferred in from other states.

There will be no new hires as the result of the Project.

7.7 If employment attributable to the proposed project will vary on a seasonal or periodic basis, explain the variation and estimate the number of employees involved.

There will be no employment attributable to the Project.

7.8 Estimate the percent distribution of annual wages and salaries (based on regular working hours) for employees attributable to this project:

There will be no employment attributable to the Project.

Wage/salary	Percent of employees
<$10,000	
$10,000-14,999	
$15,000-24,999	
$25,000-34,999	
$35,000-49,999	
$50,000-64,999	
$65,000-74,999	
$75,000-99,999	
>$100,000	

7.9 Estimate the annual taxes to be paid in Delaware attributable to this proposed project:

There will be no annual taxes attributable to the Project.

State personal income taxes:	$
State corporate income taxes	$
County and school district taxes:	$
Municipal taxes:	$

PART 8

SUPPORTING FACILITIES REQUIREMENTS

Describe the number and type of new supporting facilities and services that will be required as a result of the proposed project, including, but not limited to:

No new supporting facilities and services are required as a result of the Project.

a. Roads none
b. Bridges none
c. Piers and/or docks none
d. Railroads none
e. Microwave towers none
f. Special fire protection services not now available none
g. Traffic signals none
h. Sewer expansion none
i. Energy related facilities expansion none
j. Pipelines none

PART 9

AESTHETIC EFFECTS

9.1 Describe whether the proposed project will be located on a site readily visible from a public road, residential area, public park, or other public meeting place (such as schools or cultural centers).

The existing site of the Project is not readily visible from a public road, residential area, a public park, or other public meeting place.

9.2 Is the project site location within a half mile of a place of historic or scenic value?

There are no sites of historic or scenic value within ½ mile of the Project site.

9.3 Describe any planned attempt to make the proposed facility aesthetically compatible with its neighboring land uses. Include schematic plans and/or drawings of the proposed project after it is complete, including any landscaping and screening.

The Heavy Industrial land use zoning at the Project site extends about 1-2 miles in each direction. Project activities and aesthetics are aesthetically compatible with the surrounding Heavy Industrial land uses.

PART 10

EFFECTS ON NEIGHBORING LAND USES

10.1 How close is the nearest year-round residence to the site of this proposed project?

The nearest year-round residence is just over one mile from the Project site.

10.2 Will this proposed project interfere with the public's use of existing public or private recreational facilities or resources?

No

10.3 Will the proposed project utilize or interfere with agricultural areas?

No

10.4 Is there any possibility that the proposed project could interfere with a nearby existing business, commercial or manufacturing use?

No

END OF APPLICATION

ATTACHEMENTS TO FOLLOW

ATTACHMENT A

October 31, 2018

Via Electronic Mail: Judith.Jordan@state.de.us

Ms. Judith Jordan
State Coastal Zone Act Manager/Principal Planner
Department of Natural Resources & Environmental Control
100 W. Water Street, Suite 5A
Dover, DE 19904

Re: Veolia Red Lion Plant
Coastal Zone Act Permit Application

Dear Ms. Jordan:

With respect to matters relating to the above-referenced Coastal Zone Act permit application, Veolia North American Regeneration Services, LLC ("Veolia") authorizes the following individuals, in addition to myself, to act on behalf of or as agent for Veolia:

Ned Bartlett, Veolia
James Harman, Veolia
Dr. Marjorie Zeff, AECOM
Sharon Oras Morgan, Fox Rothschild LLP

Sincerely,

Daniel Frattarelli
Plant Manager

Veolia North America
Red Lion Plan
New Castle, DE 19720
tel. +1 302 834 5901 fax +1 302 834 8889

www.veolianorthamerica.com

ATTACHMENT B

Legend

★ Veolia Red Lion Plant

0 1,000 2,000 4,000 Feet

NAD 1983 UTM Zone 18N
Projection: Transverse Mercator

Reference:
USGS 7.5' Topographic Maps:
Delaware City, DE (1971)
Saint George (1972)

AECOM
625 West Ridge Pike, Suite E-100
Conshohocken, PA 19428
Phone: (610) 832-3500 Fax: (610) 832-3501

Job:	60492653.00001
Prepared by:	NAB/DB
Checked by:	EP
Date:	9/1/2016

FIGURE 1
SITE LOCATION MAP
Veolia Red Lion Plant

New Castle County, Delaware

Path: S:\Projects\IMS\CHEMOURS\Maps\Figure 1 USGS Site Location Map.mxd

Legend

StudyArea

0 100 200 400 Feet

NAD 1983 UTM Zone 18N
Projection: Transverse Mercator

References:
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

AECOM
625 West Ridge Pike, Suite E-100
Conshohocken, PA 19428
Phone: (610) 832-3500 Fax: (610) 832-3501

Job: 60492653.00001	
Prepared by: NAB/DB	
Checked by: EP	
Date: 9/1/2016	

FIGURE 2
AERIAL VIEW OF PROJECT SITE
Veolia Red Lion Plant

New Castle County, Delaware

Path: S:\Projects\IMS\CHEMOURS\Maps\Figure 2 - Aerial Site Location Map.mxd

ATTACHMENT C

Attachment C

Emission Estimation Tables and Analysis

Table

Veolia Red Lion Plant **Coastal Zone Act Application**

Attachment C - Supporting Calculations for Increased Production Limit to 750 Tons per Day

Table 1 - 2017 Actual Operations, Future Operation Forecast and Production Ratio Scale-up Factor

Parameter	Daily Production (tons/day)	Annual Production (tons/year)	Annual Operation (days/year)
Proposed Allowable vs. Current Allowable Production Limits			
Current Production Limit	550	200,750	365
Requested Production Limit	750	273,750	365
Ratio (New/Old Allowable)	1.364	1.364	
Proposed Future Actual vs. 2017 Actual Production			
2017 Actual Average Production	518.8	187,291	361
Forecast Actual Production*	750.0	273,750	365
**Forecast Actual are maximum case: 750 tons/day and annual is 750 tons/day times 365.*			
Scale-up Factor, Production Ratio (Future Actual/2017 Actual)			**1.462**

A 1.462 Production Ratio will be used to estimate future emissions in Tables 2 and 5.

Veolia Red Lion Plant **Coastal Zone Act Application**

Attachment C - Supporting Calculations for Increased Production Limit to 750 Tons per Day

Table 2 - Emission Point EP1 (Main Stack) Emissions

KEY ASSUMPTION: Annual (12-month rolling) TPY emission will increase according to the New/Old Production Ratio

Future Emissions are calculated with a Scaling Factor of: 1.462 This is the Production Ratio of Proposed to Past Actual Acid Production (see Table 1)

	2017 Emissions			Emissions Based on Scaling to 750 tpd limit			
				Net Increase		New Total	
Pollutant	**(lb/d avg)**	**(tons)**	**Basis**	**(lb/d, avg)**	**(tpy)**	**(lb/d, avg)**	**(tpy)**
H2SO4	15.6	2.8	lb/ton	7.11	1.30	22.51	4.11
CO	2.6	0.47	lb/hr	1.19	0.22	3.77	0.69
NOx*	96.1	17.34	CEMS	43.90	*8.01*	138.91	*25.35*
PM10	0.0052	0.00094	lb/MMcf	0.0024	0.00044	0.008	0.001
PM2.5	0.0043	0.00078	lb/MMcf	0.0020	0.00036	0.006	0.00114
VOC	2.6	0.475	lb/MMcf	1.20	0.22	3.81	0.69
SO2	305.4	55.12	CEMS	139.54	25.47	441.56	80.59

*Note the calculated 750 TPD, 365 day per year NOx emissions are calculated to exceed 22 tons per year,however, Red Lion will limit NOx to 22 tons.
The *italic* calculation results for tpy of NOx are for information only and will not occur due to complaince with the applicable permit limit.

Pollutant	**Potential to Emit Basis**
H2SO4	Title V permit Condition 3 Table 1 a.2.ii.A (0.12 lb/ton); Title V permit Condition 3 Table 1 a.2.ii.B (8.5 tpy)
CO	Title V permit Condition 3 Table 1 a.4.ii (1.26 lb/hr); 12 tpy facility-wide limit per Condition 3 Table 1 f.1.ii.D
NOx	Title V permit Condition 3 Table 1 a.3.ii (6.3 lb/hr), truncated to 22.0 tpy facility-wide limit per Condition 3 Table 1 f.1.ii.C
PM10	DNREC advised factors in lb/MMscf (per 2016/2017 emissions calculations); 4.3 tpy facility-wide limit per Condition 3 Table 1 f.1.ii.E (ex. H2SO4)
PM2.5	DNREC advised factors in lb/MMscf (per 2016/2017 emissions calculations);
SO2	Title V permit Condition 3 Table 1 a.1.ii.A (1.35 lb/ton excluding startup) and a.1.ii.B (92.25 tpy)
VOC	5.5 lb/MMscf (per 2017 emissions calculations); 2.0 tpy facility-wide limit per Condition 3 Table 1 f.1.ii.F

2017 Emissions Basis
Emission values in tons per year as reported to DNREC, except for PM10
lb/ton = stack-test-based emission factor, throughput basis
lb/hr = stack-test-based emission factor, hours basis
CEMS = CEMS basis
lb/MMcf = fuel-consumption basis, DNREC Emission Factors

Units
lb/d = pounds per day
tpd = tons per day
tpy = tons per year
PTE = potential to emit

Pollutants
H2SO4 = sulfuric acid mist
CO = carbon monoxide
NOx = oxides of nitrogen
PM10 = respirable particulate matter
SO2 = sulfur dioxide
VOC = volatile organic compounds

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Table 3 - Emission Point EP2 (Process Air Heater) Emissions

KEY ASSUMPTIONS: Future daily rates are Past Actual (2017) average daily emissions times the Ratio of Production.
Future Actual Annual Emissions are 2017 Actual plus the daily increase times future days per year.

EP2 Operation in 2017	
5,563	Operating Hours in 2017
246	Operating Days in 2017
63.9	MMscf, Annual Fuel Gas Use
EP2 Operation Scaled by Production Ratio	
1.462	Ratio of Acid Production (Forecast Actual at 750 tpd limit / 2017 Actual, Table 1)
365	Forecast Future Annual Operating Days for the Process Air Heater

Pollutant	2017 Emissions (lb/d avg)	2017 Emissions (tons)	Future Forecast Daily Total (lb/d, avg)	Net Daily Increase (lb/d, avg)	Net Annual Increase (tpy)	Scaled to 750 tpd (tpy)	Title V 12-Month Permit Limits (tpy)	
							Source-Specific	Plant-Wide
H2SO4	9.72	1.20	14.22	4.49	0.82	2.02	None	N/A
CO	0.71	0.088	1.04	0.33	0.06	0.15	None	12
NOx	10.85	1.34	15.87	5.01	0.92	2.25	None	22
PM10	0.14	0.017	0.20	0.062	0.01	0.03	None	4.3
PM2.5	0.11	0.014	0.16	0.052	0.01	0.02	None	N/A
VOC	0.73	0.090	1.06	0.34	0.06	0.15	None	2.0
SO2	3.30	0.41	4.83	1.53	0.28	0.68	None	3.3

Units
lb/d = pounds per day
tpd = tons per day
tpy = tons per year

Pollutants
H2SO4 = sulfuric acid mist
CO = carbon monoxide
NOx = oxides of nitrogen
PM10 = respirable particulate matter
SO2 = sulfur dioxide
VOC = volatile organic compounds

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Table 4 - Emission Point EP3 Sulfur Dioxide Scrubber and Vapor Combustion Unit

KEY ASSUMPTIONS: This source only operates when the SAR Process is **not** operating; therefore the Scaling Factor is set to 1.0 for this Table. In other words, for purposes of this analysis, it is assumed that Past Actual emissions will equal the Future Actual Emissions.

EP3 Operation in 2017	
358	Operating Hours in 2017
0.434	MMSCF of Fuel gas/year
13	Operating Days in 2017
EP3 Operation Scaled by Production Ratio	
1.000	No Scale-up for this source, see Key Assumption
358	Assumed Annual Operating Hours (same as 2017)
13	Assumed Annual Operating Days (same as 2017)

Pollutant	2017 Emissions (lb/d avg)	2017 Emissions (tons)	Basis Emission Factor		Scaled to 750 tpd (tpy)	New Total (lb/d, avg)	Net Daily Increase** (lb/d, avg)	Net Annual Increase** (tpy)	Title V 12-Month Permit Limits (tpy)	
									Source-Specific	Plant-Wide
H2SO4*	0.00	0.00	0	2017 Report	0.0000	0.00	0.00000	0.00000	None	N/A
CO	1.16	0.0075	35	lb/MMscf2	0.01	1.16	0.00000	0.0000	None	12
NOx	4.63	0.0301	140	lb/MMscf1	0.03	4.63	0.00000	0.000	None	22
PM10	0.02	0.00011	0.52	lb/MMscf2	0.00011	0.02	0.00000	0.00000	None	4.3
PM2.5	0.01	0.000092	0.43	lb/MMscf2	0.00009	0.01	0.00000	0.00000	None	N/A
VOC	0.93	0.006020	2.8	lb/MMscf2	0.0060	0.93	0.0000	0.0000	None	2.0
SO2	0.50	0.00327	15.2	2017 Report	0.00	0.50	0.00	0.0000	None	3.3

*No H2SO4 emissions reported in 2017

**There is no daily or annual increase in emissions from this source due to Key Assumptions.

Pollutants/Limits from the Permit (Permit only has NOx and PM10 limits for this source)

Pollutant	Value	Units	TPY	Comment
NOx	0.04	lb/MMBtu	22	tpy facility-wide limit
PM10	0.3	lb/MMBtu	4.3	tpy facility-wide limit

2017 Emissions Basis

lb/ton = stack-test-based emission factor, throughput basis
lb/hr = stack-test-based emission factor, hours basis
CEMS = CEMS basis
lb/MMscf1 = fuel-consumption basis, AP-42 factor
lb/MMscf2 = emission value reported in 2017 emission report

Units

lb/d = pounds per day
tpd = tons per day
tpy = tons per year
PTE = potential to emit

Pollutants

H2SO4 = sulfuric acid mist
CO = carbon monoxide
NOx = oxides of nitrogen
PM10 = respirable particulate matter
SO2 = sulfur dioxide
VOC = volatile organic compounds

Attachment C - Supporting Calculations for Increased Production Limit to 750 Tons per Day

Table 5 - Project Summary

Table 5.1 Actual Emissions Reported in 2018 for 2017 Operating Year

Pollutant	Plant Total (tpy)	Main Stack EP1 (tpy)	Balance of Plant* (tpy)	Air Heater EP2 (tpy)	Scrubber/VCU EP3 (tpy)	Start Up Furnace EP4 (tpy)	Fugitive Emissions (tpy)	Other Sources Reported (Tanks, Combustion Chamber) (tpy)
Values From:	*Sum*	*Table 2*	*Sum*	*Table 3*	*Table 4*	*2017 Emiss Rpt*	*2017 Emiss Rpt*	*2017 Emiss Rpt*
H2SO4	5.02	2.81	2.21	1.20	0.0000	Not Reported	1.01	0.00071
CO	0.617	0.47	0.15	0.088	0.0075	0.051	N/A	N/A
NOx	18.91	17.34	1.57	1.34	0.0301	0.206	N/A	N/A
PM10	0.0433	0.00094	0.04	0.017	0.00011	0.000764	N/A	0.025
PM2.5	0.0358	0.00078	0.04	0.014	0.00009	0.000631	N/A	0.021
VOC	0.728	0.475	0.25	0.090	0.0060	0.0042	0.019	0.134
SO2	55.94	55.12	0.82	0.406	0.0033	0.022	0.29	0.101

*Balance of Plant includes EP2, EP3, EP4, Fugitive Emissions, and Other Sources

Table 5.2 Forecast Future Actual Emissions with Revised CZA Permit at 750 TPD

Pollutant	Plant Total (tpy)	Main Stack EP1 (tpy)	Balance of Plant (tpy)	Air Heater EP2 (tpy)	Scrubber/VCU EP3 (tpy)	Start Up Furnace** EP4 (tpy)	Fugitive Emissions (tpy)	Other Sources (Scaled by Annual Acid Production Ratio) (tpy)
Values From:	*Sum*	*Table 2*	*Sum*	*Table 3*	*Table 4*	*2017 Emiss Rpt*	*8760 hr/yr PTE*	*2017 Emiss Rpt*
H2SO4	7.15	4.11	3.04	2.02	0.0000	Not Reported	1.03	0.00104
CO	0.89	0.69	0.21	0.15	0.01	0.051	0	N/A
NOx*	22.00	25.35	2.49	2.25	0.03	0.206	0	N/A
PM10	0.067	0.00	0.07	0.03	0.00011	0.001	0	0.036
PM2.5	0.055	0.0011	0.05	0.02	0.00009	0.001	0	0.030
VOC	1.07	0.69	0.38	0.15	0.0060	0.004	0.020	0.196
SO2	81.74	80.59	1.15	0.68	0.00	0.022	0.30	0.148

*Note the calculated 750 TPD, 365 day per year total is 28 tons per year of NOx; however, Red Lion will limit NOx to 22 tons per rolling 12-month period, as required by the current DNREC Title V air permit.

** No forecastable increase in Start-Up Furnace Emissions are expected as Red Lion does not anticipate Start-up frequencies to change. Therefore, the actual 2017 emissions from Table 5.1 are considered in this table for EP4.

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Attachment C - Supporting Calculations for Increased Production Limit to 750 Tons per Day

Table 5.3 Proposed Project Future Air Emissions Compared to CZA Original Project Permit Air Quality Impacts

Pollutant	CZA Permit Section 5.1 Daily Emissions for Veolia Plant lb/day	2003 CZA Permit Project Emissions (Annualized for 365 days from Section 5.1 lb/day) (T/yr)	Actuals based on 2017 reported Emissions (T/yr)	Forecast Future Actual Emissions with Revised CZA Permit at 750 TPD (T/yr)	Do the Proposed CZA Permit Forecast Actuals Emission Exceed the 2003 CZA Application Annualized Emissions?	Title V Permit Limits (T/yr)	Increased Future Actual to 2017 Past Actual (T/yr)	PTE (Permit Limit) Minus Future Actual (Remaining Permit Limit) (T/yr)
SO2	500	91.3	55.9	81.74	No	95.55	25.8	13.8
H2SO4 mist	60	11.0	5.02	7.2	No	10	2.1	2.8
NOx	68	12.4	18.91	22.0	Yes; see Note 1.	22	3.1	0.0
CO	145	26.5	0.62	0.89	No	12	0.28	11.1
PM10	N/A	None	0.043	0.067	N/A	4.3	0.023	4.2
PM2.5	N/A	None	0.036	0.055	N/A	N/A	0.019	N/A
VOC	N/A	None	0.73	1.07	N/A	2	0.34	0.93

Notes:

1. The increase in NOx emissions from 12.4 to the 22 TPY limit in the DNREC Air permit has been offset and the CZA Program has acknowledged this increase, and confirmed that this increase did not trigger CZA permitting, and was not a significant impact to Coastal Zone. See CZA Application Attachment H.

Table 6 Estimate of Air Emission Offsets Needed to More than Mitigate Project Air Impact

Pollutant	Increased Future Actual to 2017 Past Actual* (T/yr)	Emissions to Offset at 1.3 Ratio (T/yr)
SO2	25.8	33.5
H2SO4 mist	2.1	2.8
NOx	3.1	4.0
CO	0.3	0.4
PM10	0.023	0.030
PM2.5	0.019	0.025
VOC	0.3	0.4
Total Air Emissions	**31.7**	**41.2**

*Estimated Total Project Air Emission Increases (From Table 5.3)

Offset Raio: 1.3

Table 7 Preliminary Estimate of Formosa Plastics Emission Reductions and Application as CZA Project Offsets

	A	B	C	D	E	F	G	H	I	J	K	J
	Past[1] Formosa Reported Emissions		Past[1] Formosa Reported Emissions Average	Proposed Potential[2] DNREC Approved ERC/Offset TPY	CZA Project "Increase" (Tables 5.3 and 6)	CZA Increase with 1.3 Factor (Table 6)	CZA Project Increases Offset with the same pollutant from Formosa Emission Reductions	Balance of Formosa Emission Reductions	Remaining Emission to be Offset	Proposed Offsets for balance of SO2 and H2SO4 mist	Total CZA Offsets applied	Remaining Formosa Reductions after All CZA Mitigation
Pollutant	2016	2017	2016-2017	50%		1.3	As much of F as possible from D	(D - E)	(F - G)	From Column H	(G + J)	(D - K)
NOx[3]	27.907	29.234	28.571	14.3	3.10	4.03	4.89	9.39			4.89	9.39
VOC	47.195	46.663	46.929	23.5	0.34	0.44	0.44	23.02		16.16	16.60	6.87
CO	19.261	19.949	19.605	9.8	0.28	0.36	0.36	9.44		9.44	9.80	
NH_3	1.376	2.459	1.918	0.96	N/A	N/A	N/A	0.96		0.96	0.96	
PM10 PRI[4]	15.08	23.5	19.290	9.65	0.02	0.03	0.03	9.62		9.62	9.65	
SO_2	0.203	0.198	0.201	0.10	25.80	33.54	0.10	0.00	33.44		0.10	
H_2SO_4 mist	Not Reported by Formosa			0.00	2.10	2.73	0.00	0.00	2.73		0.00	
Total All	111.0	122.0	116.5	58.3	31.643	41.14	5.83	52.43	36.17	36.17	42.00	
				Total Applied Offsets			5.83			36.17	42.00	
				Total Remaining Formosa Offsets remaining After Mitigation								16.26

Notes:

1. The Emission Reductions proposed as Shutdown Emission Reductions for use as CZA Project Offsets are based on a two-year Baseline of Formosa Plastics for Operating Years 2016 and 2017.

2. Potential Estimate considers the DNREC 50% reduction of emission reductions requested and demonstrated as real, surplus, enforceable, permanent and quantifiable. It is assumed that the DNREC Division of Air Quality will review the application for offsets and confirm the quantities available for CZA offsetting.

3. The NOx Offsets proposed in Column G are higher than Column F in order to achieve the total 42 TPY of offsets proposed.

4. The PM10 PRI pollutant name means PM10 Primary, or Particulate Matter with diameter 10 micron and smaller that includes the total of Filterable and Condensable Particles (Primary = Filterable + Condensable)

ATTACHMENT D

Thomas P. Gordon
County Executive

DEPARTMENT OF LAND USE

Zoning Certification

I, John Troy, on behalf of the New Castle County Department of Land Use, certify that tax parcel number 12-008.00-012 located at 766 Governor Lea Road in New Castle, Delaware, the "Property," is located in the HI (Heavy Industrial) Zoning District. The applicant, Veolia North America Regeneration Services, LLC, proposes a continuance of a use related to chemical manufacturing. This type of use is categorized as Heavy Industry and is allowable in the HI Zoning District pursuant to Chapter 40 of the New Castle County Code, also known as the Unified Development Code.

This certification shall not be construed as approval of the proposed use by New Castle County. Approval may only be granted after review of a land development application, if applicable, for compliance with the provisions of the Unified Development Code.

The Property is located in the Delaware Coastal Zone, and state law contains additional restrictions on uses allowable therein. This certification does not certify that the proposed use is in compliance with the Delaware Coastal Zone Act ("Act"), *7 Del. C. 7001 et seq* or the regulations and administrative codes adopted pursuant to the Act. Furthermore this zoning certification does not supersede any applicable state or federal law.

John Troy
Assistant Land Use Administrator
New Castle County Department of Land Use

Dated: October 25, 2016

ATTACHMENT E

SAFETY DATA SHEET

1. Identification

Product identifier	**Spent Sulfuric Acid**
Other means of identification	
SDS number	613
Recommended use	Industrial byproduct stream typically used as a feed stock for acid regeneration process.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer	Delaware City Refining Company LLC
Address	4550 Wrangle Hill Road, Delaware City, DE 19706
General Assistance	302-834-6271
Emergency Telephone	Chemtrec: 800-424-9300 (24 hr. Transportation Emergency) Delaware City Refining Company: 302-834-6271 (24 hr. Number)

2. Hazard(s) identification

Physical hazards	Corrosive to metals	Category 1
Health hazards	Skin corrosion/irritation	Category 1A
	Serious eye damage/eye irritation	Category 1
	Sensitization, skin	Category 1
	Germ cell mutagenicity	Category 1B
	Carcinogenicity	Category 1B
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 3
	Hazardous to the aquatic environment, long-term hazard	Category 3
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	May be corrosive to metals. Causes severe skin burns and eye damage. May cause an allergic skin reaction. May cause genetic defects. May cause cancer. May cause respiratory irritation. Harmful to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use only outdoors or in a well-ventilated area. Do not breathe mist/vapors/spray. Wear protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace. Keep only in original container. Avoid release to the environment.
Response	If exposed or concerned: Get medical advice/attention. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. If swallowed: Rinse mouth. Do NOT induce vomiting. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. If skin irritation or rash occurs: Get medical advice/attention. Absorb spillage to prevent material damage.
Storage	Store in corrosive resistant container with a resistant inner liner. Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Sulfuric acid	7664-93-9	88 - 92
Naphtha (petroleum), full-range alkylate	64741-64-6	6 - 8
Diethyl sulfate	64-67-5	< 0.2
Dimethyl sulfate	77-78-1	< 0.2

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation Move injured person into fresh air and keep person calm under observation. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim inhaled the substance. If breathing is difficult, give oxygen. Call a physician or poison control center immediately.

Skin contact Remove contaminated clothes and rinse skin thoroughly with water for at least 15 minutes. Get medical attention immediately.

Eye contact Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention immediately.

Ingestion Rinse mouth thoroughly with water and give large amounts of milk or water, if person is conscious. Get medical attention if any discomfort continues.

Most important symptoms/effects, acute and delayed Causes skin, eye and digestive tract burns.

Indication of immediate medical attention and special treatment needed Treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital.

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media Do not use water as an extinguisher. May react with water.

Specific hazards arising from the chemical This material reacts with water to produce a violent chemical reaction. Spent sulfuric acid may contain small amounts of entrained insoluble hydrocarbons that can float to the surface, resulting in a free hydrocarbon layer on the top of the spent sulfuric acid. The vapor space of the storage container would then contain hydrocarbon vapor that is flammable. One method to prevent ignition of the hydrocarbon vapor, if present, is to displace the oxygen in the vapor space of the storage container with an inert gas.

Special protective equipment and precautions for firefighters Firefighters must use full bunker gear including NIOSH-approved (or equal), full-face, self-contained breathing apparatus (SCBA) operated in positive pressure mode. Firefighters' protective clothing will provide only limited protection against liquid contact.

Fire-fighting equipment/instructions Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. Water spray should be used to cool structures and vessels. Use compatible foam to minimize vapor generation as needed. Withdraw immediately in case of rising sound from venting safety devices or any discoloration of tanks due to fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Water runoff can cause environmental damage.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep upwind. Keep out of low areas. Ventilate closed spaces before entering. In case of spills, beware of slippery floors and surfaces. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. See Section 8 of the SDS for Personal Protective Equipment.

Methods and materials for containment and cleaning up

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Vapors may be controlled using a water fog. Remove with vacuum trucks or pump to storage/salvage vessels.

Small Spills: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Use clean non-sparking tools to collect absorbed material.

Clean surface thoroughly to remove residual contamination. Retain all contaminated water for removal and treatment.

Environmental precautions

Contain spillages with sand, earth or any suitable adsorbent material. Prevent entry into waterways, sewer, basements or confined areas. Do not allow material to contaminate ground water system. Reporting of releases to appropriate regulatory agencies may be required.

7. Handling and storage

Precautions for safe handling

Do not handle until all safety precautions have been read and understood.

Before entering storage tanks and commencing any operation in a confined area, check the atmosphere for oxygen content and flammability. Do not breathe mist or vapor. Wear personal protective equipment. Avoid prolonged exposure. When using, do not eat, drink or smoke. Avoid release to the environment.

Conditions for safe storage, including any incompatibilities

Keep away from incompatible materials, open flames and high temperatures. Keep away from food, drink and animal feedingstuffs.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Dimethyl sulfate (CAS 77-78-1)	PEL	5 mg/m3
		1 ppm
Sulfuric acid (CAS 7664-93-9)	PEL	1 mg/m3

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Dimethyl sulfate (CAS 77-78-1)	TWA	0.1 ppm	
Sulfuric acid (CAS 7664-93-9)	TWA	0.2 mg/m3	Thoracic fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Dimethyl sulfate (CAS 77-78-1)	TWA	0.5 mg/m3
		0.1 ppm
Sulfuric acid (CAS 7664-93-9)	TWA	1 mg/m3

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

US - California OELs: Skin designation

Dimethyl sulfate (CAS 77-78-1) Can be absorbed through the skin.

US - Minnesota Haz Subs: Skin designation applies

Dimethyl sulfate (CAS 77-78-1) Skin designation applies.

US - Tennesse OELs: Skin designation

Dimethyl sulfate (CAS 77-78-1) Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

Dimethyl sulfate (CAS 77-78-1) Can be absorbed through the skin.

US. NIOSH: Pocket Guide to Chemical Hazards

Dimethyl sulfate (CAS 77-78-1) Can be absorbed through the skin.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Dimethyl sulfate (CAS 77-78-1)	Can be absorbed through the skin.

Appropriate engineering controls Observe occupational exposure limits and minimize the risk of inhalation of vapors and mist. Provide adequate general and local exhaust ventilation. Provide eyewash station and safety shower.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses. If splash potential exists, wear full face shield or chemical goggles.

Skin protection

Hand protection Chemical resistant gloves are recommended. Be aware that the liquid may penetrate the gloves. Frequent change is advisable. Suitable gloves can be recommended by the glove supplier.

Other Wear chemical-resistant gloves, footwear and protective clothing appropriate for risk of exposure. Contact chemical protective clothing manufacturer for specific information. Flame retardant protective clothing is recommended.

Respiratory protection Use a NIOSH/MSHA approved air purifying respirator as needed to control exposure. Consult with respirator manufacturer to determine respirator selection, use, and limitations. Use positive pressure, air-supplied respirator for uncontrolled releases or when air purifying respirator limitations may be exceeded. Follow respirator protection program requirements (OSHA 1910.134 and ANSI Z88.2) for all respirator use.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Oily liquid.

Color Colorless to dark brown.

Odor Hydrocarbon.

Odor threshold Not available.

pH 1.1 - 1.2 estimated

Melting point/freezing point 51.01 °F (10.56 °C)

Initial boiling point and boiling range 554 °F (290 °C)

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Vapor pressure Not available.

Vapor density Not available.

Relative density 1.84

Solubility(ies)

Solubility (water) Soluble.

Partition coefficient (n-octanol/water) Not available.

Auto-ignition temperature Not available.

Decomposition temperature Not available.

Viscosity Not available.

10. Stability and reactivity

Reactivity May be corrosive to metals.

Chemical stability	This product is stable under expected conditions of use.
Possibility of hazardous reactions	Hazardous polymerization does not occur. Reacts with water with release of heat.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents. Reducing agents.
Hazardous decomposition products	Thermal decomposition or combustion may liberate toxic and/or corrosive gases or fumes. Sulfur oxides.

11. Toxicological information

Information on likely routes of exposure

Ingestion	May cause burns of the gastrointestinal tract if swallowed.
Inhalation	May cause respiratory irritation.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Symptoms related to the physical, chemical and toxicological characteristics	Causes severe skin burns and eye damage.

Information on toxicological effects

Acute toxicity

Components	Species	Test Results
Diethyl sulfate (CAS 64-67-5)		
Acute		
Oral		
LD50	Mouse	647 mg/kg
	Rat	0.88 g/kg
Other		
LD50	Mouse	150 mg/kg
	Rabbit	600 mg/kg
	Rat	350 mg/kg
Dimethyl sulfate (CAS 77-78-1)		
Acute		
Inhalation		
LC50	Guinea pig	0.167 mg/l, 60 Minutes
	Mouse	0.513 mg/l, 60 Minutes
		0.28 mg/l, 4 Hours
	Rat	0.335 mg/l, 60 Minutes
		0.045 mg/l, 4 Hours
Oral		
LD50	Mouse	140 mg/kg
	Rat	205 mg/kg
Other		
LD50	Mouse	61 mg/kg
	Rat	90 mg/kg
Naphtha (petroleum), full-range alkylate (CAS 64741-64-6)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Inhalation		
LC50	Rat	> 5610 mg/m3
Oral		
LD50	Rat	> 5000 mg/kg

Components	Species	Test Results
Sulfuric acid (CAS 7664-93-9)		
Acute		
Oral		
LD50	Rat	2140 mg/kg

Skin corrosion/irritation Causes severe skin burns.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization Based on available data, the classification criteria are not met.

Skin sensitization May cause an allergic skin reaction.

Germ cell mutagenicity May cause genetic defects.

Carcinogenicity May cause cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Diethyl sulfate (CAS 64-67-5)	2A Probably carcinogenic to humans.
Dimethyl sulfate (CAS 77-78-1)	2A Probably carcinogenic to humans.

NTP Report on Carcinogens

Diethyl sulfate (CAS 64-67-5)	Reasonably Anticipated to be a Human Carcinogen.
Dimethyl sulfate (CAS 77-78-1)	Reasonably Anticipated to be a Human Carcinogen.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity Based on available data, the classification criteria are not met.

Specific target organ toxicity - single exposure May cause irritation of respiratory tract.

Specific target organ toxicity - repeated exposure No data available.

Aspiration hazard Not classified.

Chronic effects Occupational exposure to strong inorganic acid mists containing sulfuric acid is recognized as causing cancer to humans. Sulfuric acid fumes: Prolonged, repeated exposure to acid fumes/mists may cause chronic bronchitis, irritation of skin, mucous membranes and gastrointestinal tract and erosion of the teeth.

Further information No other specific acute or chronic health impact noted.

12. Ecological information

Ecotoxicity Harmful to aquatic life with long lasting effects.

Components		Species	Test Results
Dimethyl sulfate (CAS 77-78-1)			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	7.5 mg/l, 96 hours
Naphtha (petroleum), full-range alkylate (CAS 64741-64-6)			
Aquatic			
Algae	EC50	Pseudokirchneriella subcapitata	3.1 mg/l, 72 Hours
Crustacea	EC50	Daphnia magna	4.5 mg/l, 48 Hours
Fish	LC50	Oncorhynchus mykiss	10 mg/l, 96 Hours
		Pimephales promelas	8.2 mg/l, 96 Hours
Sulfuric acid (CAS 7664-93-9)			
Aquatic			
Fish	LC50	Western mosquitofish (Gambusia affinis)	42 mg/l, 96 hours

Persistence and degradability No data available.

Bioaccumulative potential No data available.

Partition coefficient n-octanol / water (log Kow)

Diethyl sulfate (CAS 64-67-5)	1.14

Mobility in soil No data available.

Mobility in general	No data available.
Other adverse effects	The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions	Do not allow this material to drain into sewers/water supplies.
Local disposal regulations	Dispose of in accordance with local regulations.
Hazardous waste code	D002: Waste Corrosive material [pH <=2 or =>12.5, or corrosive to steel]
Waste from residues / unused products	Recover and recycle, if practical.
Contaminated packaging	Not applicable.

14. Transport information

DOT

UN number	UN1832
UN proper shipping name	Sulfuric acid, spent
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Label(s)	8
Packing group	II
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	A3, A7, B2, B83, B84, IB2, N34, T8, TP2, TP12
Packaging exceptions	None
Packaging non bulk	202
Packaging bulk	242

IATA

UN number	UN1832
UN proper shipping name	Sulphuric acid, spent
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	No.
ERG Code	8L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1832
UN proper shipping name	SULPHURIC ACID, SPENT
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-B
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

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

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Diethyl sulfate (CAS 64-67-5) LISTED

Dimethyl sulfate (CAS 77-78-1) LISTED
Sulfuric acid (CAS 7664-93-9) LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Chemical name	CAS number	Reportable quantity	Threshold planning quantity	Threshold planning quantity, lower value	Threshold planning quantity, upper value
Sulfuric acid	7664-93-9	1000	1000 lbs		
Dimethyl sulfate	77-78-1	100	500 lbs		

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Sulfuric acid	7664-93-9	88 - 92
Diethyl sulfate	64-67-5	< 0.2
Dimethyl sulfate	77-78-1	< 0.2

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Diethyl sulfate (CAS 64-67-5)
Dimethyl sulfate (CAS 77-78-1)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Sulfuric acid (CAS 7664-93-9)

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

Sulfuric acid (CAS 7664-93-9) 6552

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Sulfuric acid (CAS 7664-93-9) 20 %WV

DEA Exempt Chemical Mixtures Code Number

Sulfuric acid (CAS 7664-93-9) 6552

US state regulations

US. Massachusetts RTK - Substance List

Diethyl sulfate (CAS 64-67-5)
Dimethyl sulfate (CAS 77-78-1)
Sulfuric acid (CAS 7664-93-9)

US. New Jersey Worker and Community Right-to-Know Act

Diethyl sulfate (CAS 64-67-5)
Dimethyl sulfate (CAS 77-78-1)
Sulfuric acid (CAS 7664-93-9)

US. Pennsylvania Worker and Community Right-to-Know Law

Diethyl sulfate (CAS 64-67-5)
Dimethyl sulfate (CAS 77-78-1)
Sulfuric acid (CAS 7664-93-9)

US. Rhode Island RTK

Diethyl sulfate (CAS 64-67-5)
Dimethyl sulfate (CAS 77-78-1)
Sulfuric acid (CAS 7664-93-9)

US. California Proposition 65

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Diethyl sulfate (CAS 64-67-5)

Dimethyl sulfate (CAS 77-78-1)
Sulfuric acid (CAS 7664-93-9)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 31-July-2014

Revision date -

Version # 01

NFPA ratings

Disclaimer

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SAFETY DATA SHEET

1. Identification

Product identifier **Sulfur**

Other means of identification

SDS number 547

Recommended use Industrial use. Process intermediate

Recommended restrictions None known.

Manufacturer / Importer / Supplier / Distributor information

Manufacturer Delaware City Refining Company LLC

Address 4550 Wrangle Hill Road, Delaware City, DE 19706

General Assistance 302-834-6271

Emergency Telephone Chemtrec: 800-424-9300 (24 hr. Transportation Emergency)
Delaware City Refining Company: 302-834-6271 (24 hr. Number)

2. Hazard(s) identification

Physical hazards	Flammable solids	Category 2
Health hazards	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2B

OSHA defined hazards Not classified.

Label elements

Signal word Warning

Hazard statement Flammable solid. Causes skin irritation. Causes eye irritation.

Precautionary statement

Prevention Wash hands thoroughly after handling. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Wear protective gloves/eye protection/face protection.

Response If on skin: Wash with plenty of water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. In case of fire: Use dry chemical, water, foam, sand to extinguish.

Storage Store away from incompatible materials.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) Not classified.

Supplemental information

Liquid sulfur may evolve sulfur dioxide (SO2) and toxic and flammable hydrogen sulfide (H2S).
Contact with molten material may cause thermal burns.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
Sulfur		7704-34-9	100

Constituents

Chemical name	CAS number	%
Hydrogen sulfide	7783-06-4	trace
Sulfur dioxide	7446-09-5	trace

Composition comments	All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation	Move to fresh air. Get medical attention if any discomfort continues.
Skin contact	Immediately remove contaminated clothing. Wash with soap and water. Continue to rinse for at least 15 minutes. Get medical attention if irritation develops or persists. For thermal burns, cool affected areas as quickly as possible by drenching or immersing in water until material solidifies. Cover with sterile bandages. Do not remove solidified material from the skin.
Eye contact	Do not rub eyes. Remove any contact lenses. Flush eyes thoroughly with water, taking care to rinse under eyelids. If irritation persists, continue flushing for 15 minutes, rinsing from time to time under eyelids. If discomfort continues, consult a physician.
Ingestion	Immediately rinse mouth and drink plenty of water. Do not induce vomiting. Get medical attention if irritation develops and persists.
Most important symptoms/effects, acute and delayed	Skin and eye irritation. Molten material will produce thermal burns. Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract. Inhalation of vapors/fumes generated by heating this product may cause respiratory irritation with throat discomfort, coughing or difficulty breathing. Exposure to high concentrations of hydrogen sulfide may result in respiratory paralysis and death.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Dry chemical, foam, water, sand.
Unsuitable extinguishing media	No restrictions known.
Specific hazards arising from the chemical	Flames may not be visible. Combustion products include sulfur dioxide/sulfur oxides.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus, operated in positive pressure mode and full protective clothing must be worn in case of fire.
Fire-fighting equipment/instructions	Move containers from fire area if you can do it without risk. Use water spray to keep fire-exposed containers cool.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Eliminate all sources of ignition. Ensure adequate ventilation. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Wear protective clothing as described in Section 8 of this safety data sheet.
Methods and materials for containment and cleaning up	Clean up in accordance with all applicable regulations. Should not be released into the environment. Small Spills: Allow spilled material to solidify and scrape up with shovels into a suitable container for recycle or disposal. Clean contaminated surface thoroughly. Large Spills: Keep unnecessary personnel away. Isolate hazard area and deny entry to unauthorized and/or unprotected personnel. Dike far ahead of larger spills for later disposal. Dampen spillage with water. Allow to solidify, use mechanical handling equipment. Retain all contaminated water for removal and treatment.
Environmental precautions	Prevent further leakage or spillage if safe to do so. Do not contaminate water. Prevent entry into drains.

7. Handling and storage

Precautions for safe handling	Do not handle until all safety precautions have been read and understood. Avoid heat, sparks, open flames and other ignition sources. Ground container and transfer equipment to eliminate static electric sparks. Gases may form explosive mixtures with air. Before entering storage tanks and commencing any operation in a confined area, check the atmosphere for oxygen content, hydrogen sulfide (H2S) and flammability. The inherent toxic and olfactory (sense of smell) fatiguing properties of hydrogen sulfide require that air monitoring alarms be used if concentrations are expected to reach harmful levels, such as in enclosed spaces, heated transport vessels and spill or leak situations. If the air concentration exceeds 10 ppm TLV, the area should be evacuated unless respiratory protection is in use. Do not breathe gas. Use personal protection as recommended in Section 8 of the SDS. When using, do not eat, drink or smoke. Avoid release to the environment.

Conditions for safe storage, including any incompatibilities Store in accordance with local/regional/national/international regulation. Do not handle or store near an open flame, heat or other sources of ignition. Provide adequate ventilation. Keep away from incompatible material.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Constituents	Type	Value
Sulfur dioxide (CAS 7446-09-5)	PEL	13 mg/m3
		5 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Constituents	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	20 ppm

US. ACGIH Threshold Limit Values

Constituents	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	STEL	5 ppm
	TWA	1 ppm
Sulfur dioxide (CAS 7446-09-5)	STEL	0.25 ppm

US NIOSH Pocket Guide to Chemical Hazards: Ceiling Limit Value and Time Period (if specified)

Constituents	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	15 mg/m3
		10 ppm

US NIOSH Pocket Guide to Chemical Hazards: Recommended exposure limit (REL)

Constituents	Type	Value
Sulfur dioxide (CAS 7446-09-5)	TWA	5 mg/m3
		2 ppm

US NIOSH Pocket Guide to Chemical Hazards: Short Term Exposure Limit (STEL)

Constituents	Type	Value
Sulfur dioxide (CAS 7446-09-5)	STEL	13 mg/m3
		5 ppm

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines No exposure standards allocated.

Appropriate engineering controls Provide adequate ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation of vapors. Use explosion-proof ventilation equipment. Enclosed or confined spaces should be monitored for hydrogen sulfide to ensure adequate ventilation.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear goggles/face shield.

Skin protection

Hand protection Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

Other Wear suitable protective clothing.

Respiratory protection When respiratory protection is required, wear a NIOSH/MSHA approved self-contained breathing apparatus with full facepiece operated in a positive-pressure mode. A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever work place conditions warrant a respirator's use.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Handle in accordance with good industrial hygiene and safety practice. Wash hands after handling. Routinely wash work clothing and protective equipment to remove contaminants. Observe any medical surveillance requirements.

9. Physical and chemical properties

Appearance Amber for molten liquid. Yellow for solid.

Physical state Liquid.

Form	Molten liquid or solid.
Color	Liquid: Amber. Solid: Yellow.
Odor	Sulfurous.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	235 °F (112.78 °C)
Initial boiling point and boiling range	832 °F (444.44 °C)
Flash point	405.0 °F (207.2 °C) Closed Cup
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	35 g/m3
Flammability limit - upper (%)	1400 g/m3
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor density	Not available.
Relative density	1.8 (248°F) 2.1 (solid material)
Solubility(ies)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	450 °F (232.22 °C)
Decomposition temperature	Not available.
Viscosity	Not available.

10. Stability and reactivity

Reactivity	The product is non-reactive under normal conditions of use, storage and transport.
Chemical stability	Stable at normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents. Fluoride. Chlorine.
Hazardous decomposition products	Hydrogen sulfide. Sulfur oxides (SOx.).

11. Toxicological information

Information on likely routes of exposure

Ingestion	May cause discomfort if swallowed.
Inhalation	In high concentrations, vapors may be irritating to the respiratory system.
Skin contact	Causes skin irritation. Molten material will produce thermal burns.
Eye contact	Causes eye irritation. Contact with hot material can cause thermal burns which may result in permanent damage or blindness.
Symptoms related to the physical, chemical and toxicological characteristics	Skin and eye irritation. Contact with molten material may cause thermal burns. Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract. Inhalation of vapors/fumes generated by heating this product may cause respiratory irritation with throat discomfort, coughing or difficulty breathing. Exposure to high concentrations of hydrogen sulfide may result in respiratory paralysis and death.

Information on toxicological effects

Acute toxicity	May contain hydrogen sulfide: May rapidly cause irritation, breathing failure, coma, and death without necessarily any warning odor being sensed.

Product	Species	Test Results
Sulfur (CAS 7704-34-9)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Inhalation		
LC50	Rat	> 9.23 mg/l, 4 hours
Oral		
LD50	Rat	> 3000 mg/kg

Skin corrosion/irritation Causes skin irritation.

Serious eye damage/eye irritation Causes eye irritation. Molten material will produce thermal burns. Risk of serious damage to eyes.

Respiratory sensitization No data available.

Skin sensitization No data available.

Germ cell mutagenicity No data available.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

Reproductive toxicity No data available.

Specific target organ toxicity - single exposure No data available.

Specific target organ toxicity - repeated exposure No data available.

Aspiration hazard No data available.

Chronic effects Prolonged skin contact may cause dermatitis.

12. Ecological information

Ecotoxicity The product is not expected to be hazardous to the environment.

Persistence and degradability The product is not biodegradable.

Bioaccumulative potential The product is not bioaccumulating.

Mobility in soil No data available.

Mobility in general The product is insoluble in water.

Other adverse effects Not established.

13. Disposal considerations

Disposal instructions Dispose in accordance with all applicable regulations. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container.

Hazardous waste code The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose in accordance with all applicable regulations.

Contaminated packaging Not applicable.

14. Transport information

DOT

UN number UN2448

UN proper shipping name Sulfur, molten

Transport hazard class(es) 4.1

Subsidiary class(es) -

Packing group III

Environmental hazards

Marine pollutant No

Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

Special provisions 30, IB1, T1, TP3

Packaging exceptions None

Packaging non bulk 213

Packaging bulk 247

IATA

UN number UN2448

UN proper shipping name Sulphur, molten

Transport hazard class(es)	4.1
Subsidiary class(es)	-
Packaging group	III
Environmental hazards	No
Labels required	4.1
ERG Code	3L
Special precautions for user	Passenger and Cargo Aircraft Quantity limitation: Forbidden.

IMDG

UN number	UN2448
UN proper shipping name	SULPHUR, MOLTEN
Transport hazard class(es)	4.1
Subsidiary class(es)	-
Packaging group	III
Environmental hazards	
Marine pollutant	No
Labels required	4.1
EmS	F-A, S-H
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

This product is a liquid and when transported in bulk is covered under MARPOL 73/78 Annex II.
This product is listed in the IBC Code.
Product name: Sulfur (Molten).
The product hazard category is: S
Pollution category: Z
Ship type: 3

15. Regulatory information

US federal regulations

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

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - Yes Pressure Hazard - No Reactivity Hazard - No
SARA 302 Extremely hazardous substance	No
SARA 311/312 Hazardous chemical	Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.
Food and Drug Administration (FDA)	Not regulated.

US state regulations

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

US. Massachusetts RTK - Substance List

Sulfur (CAS 7704-34-9)

US. New Jersey Worker and Community Right-to-Know Act

Not regulated.

US. Pennsylvania RTK - Hazardous Substances

Sulfur (CAS 7704-34-9)

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

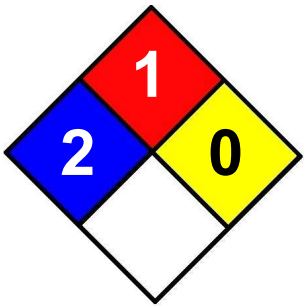
16. Other information, including date of preparation or last revision

Issue date 22-November-2013

Revision date -

Version # 01

NFPA Ratings



References IARC Monographs. Overall Evaluation of Carcinogenicity (Volumes 1-106)
HSDB® - Hazardous Substances Data Bank

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SAFETY DATA SHEET

1. Identification

Product identifier	**Refinery Acid Gas**
Other means of identification	
SDS number	3642
Recommended use	Intermediate process stream from various refinery processes; can be used as a feed to a sulfur recovery process or a sulfuric acid regeneration process.
Recommended restrictions	None known.
Manufacturer/Importer/Supplier/Distributor information	
Manufacturer	Delaware City Refining Company LLC
Address	4550 Wrangle Hill Road, Delaware City, DE 19706
General Assistance	302-834-6271
Emergency Telephone	Chemtrec: 800-424-9300 (24 hr. Transportation Emergency) Delaware City Refining Company: 302-834-6271 (24 hr. Number)

2. Hazard(s) identification

Physical hazards	Flammable gases	Category 1
	Gases under pressure	Liquefied gas
Health hazards	Acute toxicity, inhalation	Category 3
	Serious eye damage/eye irritation	Category 2
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1

OSHA defined hazards Simple asphyxiant

Label elements

Signal word	Danger
Hazard statement	Extremely flammable gas. Contains gas under pressure; may explode if heated. Toxic if inhaled. Causes serious eye irritation. May cause respiratory irritation. Very toxic to aquatic life.
Precautionary statement	
Prevention	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Avoid breathing gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wash thoroughly after handling. Wear eye protection/face protection. Avoid release to the environment.
Response	Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leakage, eliminate all ignition sources. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. Collect spillage.
Storage	Protect from sunlight. Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	Hydrogen sulfide (H2S) can accumulate in the headspace of storage tanks and reach potentially hazardous concentrations. Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn").
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Carbon dioxide	124-38-9	15 to 25 (approx)
Hydrogen sulfide	7783-06-4	70 to 80 (approx)
Water	7732-18-5	5 to 10 (approx)

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation Move to fresh air. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Provide oxygen, if available, or artificial respiration, if needed. Do not use mouth-to-mouth method if victim inhaled the substance.

Skin contact Remove contaminated clothing and shoes. Wash off immediately with soap and plenty of water. Get medical attention. Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes.

If frostbite occurs, immerse affected area in warm water (not exceeding 105°F/41°C). Keep immersed for 20 to 40 minutes. Get medical attention immediately.

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops or persists.

If frostbite occurs, immediately flush eyes with plenty of warm water (not exceeding 105°F/41°C) for at least 20 minutes. If easy to do, remove contact lenses.

Ingestion This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Most important symptoms/effects, acute and delayed Convulsions. Headache. Dizziness. Fatigue. Nausea, vomiting. Very high exposure can cause suffocation from lack of oxygen. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Asphyxiation may bring about unconsciousness without warning and so rapidly that victim may be unable to protect themself. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. May cause respiratory irritation.

Indication of immediate medical attention and special treatment needed Treat symptomatically.

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media Dry chemical powder. Carbon dioxide (CO2). Water may be an ineffective extinguishing medium.

Unsuitable extinguishing media Not available.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters Firefighters must use full bunker gear including NIOSH-approved (or equal), full-face, self-contained breathing apparatus (SCBA) operated in positive pressure mode. Firefighters' protective clothing will provide only limited protection against liquid contact.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED. In case of fire: Stop leak if safe to do so. Move containers from fire area if you can do so without risk. Water spray should be used to cool structures and vessels. Do not direct water at source of leak or safety devices as icing may occur. ALWAYS stay away from tanks engulfed in flame. Use compatible foam to minimize vapor generation as needed. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Water runoff can cause environmental damage.

General fire hazards Extremely flammable gas. Contents under pressure. Pressurized container may explode when exposed to heat or flame.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). In the event of a leak evacuate all personnel until ventilation can restore oxygen concentrations to safe levels. Keep unnecessary personnel away. Keep upwind. Keep out of low areas. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. See Section 8 of the SDS for Personal Protective Equipment.

Methods and materials for containment and cleaning up

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Extinguish all flames in the vicinity. Keep combustibles (wood, paper, oil, etc.) away from spilled material.

Large Spills: Isolate area until gas has dispersed. Stop the flow of material, if this is without risk. If possible, turn leaking containers so that gas escapes rather than liquid. Remove with vacuum trucks or pump to storage/salvage vessels. Use explosion proof electric equipment.

Small Spills: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Use clean non-sparking tools to collect absorbed material.

Clean surface thoroughly to remove residual contamination. Retain all contaminated water for removal and treatment.

Environmental precautions

Contain spillages with sand, earth or any suitable adsorbent material. Prevent entry into waterways, sewer, basements or confined areas. Reporting of releases to appropriate regulatory agencies may be required.

7. Handling and storage

Precautions for safe handling

Do not handle until all safety precautions have been read and understood.

Before entering storage tanks and commencing any operation in a confined area, check the atmosphere for oxygen content, hydrogen sulfide (H2S) and flammability. The inherent toxic and olfactory (sense of smell) fatiguing properties of hydrogen sulfide require that air monitoring alarms be used if concentrations are expected to reach harmful levels, such as in enclosed spaces, heated transport vessels and spill or leak situations. If the air concentration exceeds 10 ppm TLV, the area should be evacuated unless respiratory protection is in use. Use only with adequate ventilation. Wear personal protective equipment. Avoid breathing dust/fume/gas/mist/vapors/spray. Avoid contact with eyes, skin, and clothing. Do not taste or swallow. Avoid prolonged exposure. When using, do not eat, drink or smoke. Wash thoroughly after handling. Avoid release to the environment.

The product is extremely flammable, and explosive vapor/air mixtures may be formed even at normal room temperatures. Keep away from all ignition sources including heat, sparks and flame. Use non-sparking tools and explosion-proof equipment as applicable.

Conditions for safe storage, including any incompatibilities

Flammable compressed gas storage. Do not handle or store near an open flame, heat or other sources of ignition. The pressure in sealed containers can increase under the influence of heat. Keep away from incompatible material. Keep away from food, drink and animal feedingstuffs.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Carbon dioxide (CAS 124-38-9)	PEL	5000 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	20 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
Carbon dioxide (CAS 124-38-9)	STEL	30000 ppm
	TWA	5000 ppm
Hydrogen sulfide (CAS 7783-06-4)	STEL	5 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
	TWA	1 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Carbon dioxide (CAS 124-38-9)	STEL	54000 mg/m3
		30000 ppm
	TWA	9000 mg/m3
		5000 ppm
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	10 ppm

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Provide adequate general and local exhaust ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation of vapors and mists. Use explosion-proof equipment. Provide eyewash station and safety shower.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Chemical resistant gloves are recommended. Be aware that the liquid may penetrate the gloves. Frequent change is advisable. Suitable gloves can be recommended by the glove supplier.

Other Wear chemical-resistant gloves, footwear and protective clothing appropriate for risk of exposure. Contact chemical protective clothing manufacturer for specific information. Flame retardant protective clothing is recommended.

Respiratory protection Use a NIOSH/MSHA approved air purifying respirator as needed to control exposure. Consult with respirator manufacturer to determine respirator selection, use, and limitations. Use positive pressure, air-supplied respirator for uncontrolled releases or when air purifying respirator limitations may be exceeded. Follow respirator protection program requirements (OSHA 1910.134 and ANSI Z88.2) for all respirator use. Protection provided by air-purifying respirators is limited and should not be used in atmospheres deficient in oxygen or where airborne concentrations are immediately dangerous to life or health. Use a positive-pressure air-supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air-purifying respirators may not provide adequate protection.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Appearance

Physical state Gas.

Form Liquid.

Color Colorless.

Odor Rotten egg.

Odor threshold Hydrogen sulfide is considered to have poor warning properties due to the potential to cause olfactory fatigue.

pH Not available.

Melting point/freezing point Not available.

Initial boiling point and boiling range Not determined.

Flash point Not determined. Contains a subtantial amount of hydrogen sulfide which is a flammable gas.

Evaporation rate Not available.

Flammability (solid, gas) Not applicable.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not determined.
Flammability limit - upper (%)	Not determined.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not determined.
Solubility(ies)	
Solubility (water)	10-99% Soluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not determined.
Decomposition temperature	Not available.
Viscosity	Not applicable.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents. Aluminum.
Hazardous decomposition products	Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapors.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Toxic if inhaled. Suffocation (asphyxiant) hazard - if allowed to accumulate to concentrations that reduce oxygen below safe breathing levels.
Skin contact	Contact with compressed gas can cause damage (frostbite) due to rapid evaporative cooling. Prolonged exposure may cause skin irritation.
Eye contact	Causes serious eye irritation. Contact with compressed gas can cause damage (frostbite) due to rapid evaporative cooling.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Convulsions. Headache. Dizziness. Fatigue. Nausea, vomiting. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. May cause respiratory irritation. Very high exposure can cause suffocation from lack of oxygen. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Asphyxiation may bring about unconsciousness without warning and so rapidly that victim may be unable to protect themself.

Information on toxicological effects

Acute toxicity Toxic if inhaled. May cause respiratory irritation.

Hydrogen sulfide, a highly toxic gas is present. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.

Components	Species	Test Results
Hydrogen sulfide (CAS 7783-06-4)		
Acute		
Inhalation		
LC50	Rat	444 ppm, 4 hours

Skin corrosion/irritation Contact with compressed gas can cause damage (frostbite) due to rapid evaporative cooling. Prolonged exposure may cause skin irritation.

Serious eye damage/eye irritation Causes serious eye irritation. Contact with compressed gas can cause damage (frostbite) due to rapid evaporative cooling.

Respiratory or skin sensitization

Respiratory sensitization Based on available data, the classification criteria are not met.

Skin sensitization Not a skin sensitizer.

Germ cell mutagenicity Based on available data, the classification criteria are not met.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity Based on available data, the classification criteria are not met.

Specific target organ toxicity - single exposure May cause respiratory irritation.

Specific target organ toxicity - repeated exposure Based on available data, the classification criteria are not met.

Aspiration hazard Not classified.

Chronic effects Prolonged inhalation may be harmful.

Further information No other specific acute or chronic health impact noted.

12. Ecological information

Ecotoxicity Very toxic to aquatic life.

Components		Species	Test Results
Hydrogen sulfide (CAS 7783-06-4)			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	0.009 mg/l, 96 hours
		Lake whitefish (Coregonus clupeaformis)	0.002 mg/l, 96 hours

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects The product contains volatile organic compounds which have a photochemical ozone creation potential.

13. Disposal considerations

Disposal instructions Recover and recycle, if practical. Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. Do not allow this material to drain into sewers/water supplies.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Recover and recycle, if practical.

Contaminated packaging Not applicable.

14. Transport information

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

General information The product is not intended to be transported. The transport classification has not been evaluated. Transport classification will be dependant upon the physical state in which the gas is packaged.

15. Regulatory information

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

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Hydrogen sulfide (CAS 7783-06-4) LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - Yes
Pressure Hazard - Yes
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Chemical name	CAS number	Reportable quantity (pounds)	Threshold planning quantity (pounds)	Threshold planning quantity, lower value (pounds)	Threshold planning quantity, upper value (pounds)
Hydrogen sulfide	7783-06-4	100	500		

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Hydrogen sulfide	7783-06-4	70 to 80 (approx)

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Hydrogen sulfide (CAS 7783-06-4)

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US. Massachusetts RTK - Substance List

Carbon dioxide (CAS 124-38-9)
Hydrogen sulfide (CAS 7783-06-4)

US. New Jersey Worker and Community Right-to-Know Act

Carbon dioxide (CAS 124-38-9)
Hydrogen sulfide (CAS 7783-06-4)

US. Pennsylvania Worker and Community Right-to-Know Law

Carbon dioxide (CAS 124-38-9)
Hydrogen sulfide (CAS 7783-06-4)

US. Rhode Island RTK

Hydrogen sulfide (CAS 7783-06-4)

US. California Proposition 65

Not Listed.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 17-November-2015

Revision date -

Version # 01

HMIS® ratings Health: 4
Flammability: 4
Physical hazard: 0

NFPA ratings

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MECS, Inc

Material Safety Data

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: SULFURIC ACID CATALYST TYPE SCX-2000 — DATE: September, 2005

CHEMICAL NAME: Mixture of complex inorganic salts (oxosulfato vanadates) containing cesium, potassium and vanadium salts on amorphous silica support

SYNONYMS: None

MECS, INC: 14522 South Outer Forty Road, Chesterfield, MO 63017

FOR CHEMICAL EMERGENCY, SPILL LEAK, FIRE, EXPOSURE, OR ACCIDENT
Call CHEMTREC - Day or Night - 1-800-424-9300 Toll free in the continental U.S., Hawaii, Puerto Rico, Canada, Alaska, or Virgin Islands. For calls originating from international and maritime locations: 703-527-3887 (collect calls accepted)

For additional non-emergency information, call: 314-275-5700

2. COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT	CAS NO.	% BY WEIGHT
Vanadium/cesium/potassium salt complex *	not available	40 - 49
Diatomaceous earth (amorphous silica)	68855-54-9	51 - 60

* Hazardous chemical(s) under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
# National Toxicology Program (NTP) and International Agency for Research on Cancer (IARC) listed carcinogen.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING!
CAUSES EYE, SKIN AND RESPIRATORY TRACT IRRITATION
MAY BE HARMFUL IF SWALLOWED

APPEARANCE AND ODOR: yellow to light pellets or rings

POTENTIAL HEALTH EFFECTS

LIKELY ROUTES OF EXPOSURE: skin contact and inhalation

EYE CONTACT: causes pain, redness and tearing based on toxicity studies on the components. Dust may cause eye irritation as would any foreign material.

SKIN CONTACT: no more than slightly toxic or irritating based on toxicity studies. Dust grittiness may cause slight irritation.

INHALATION: causes coughing, chest pain, runny nose and burning throat based on experience with the components. Repeated and prolonged inhalation can cause delayed lung damage.

INGESTION: no more than slightly toxic. Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: pre-existing lung conditions

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

IF IN EYES, immediately flush with plenty of water for at least 15 minutes. If easy to do, remove any contact lenses. Get medical attention.

IF ON SKIN, immediately flush with plenty of water. Remove contaminated clothing. Get medical attention. Wash clothing before reuse.

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

IF SWALLOWED, rinse mouth thoroughly with water. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. Get medical attention. Contact a Poison Control Center. Do NOT induce vomiting unless directed by medical personnel.

5. FIRE FIGHTING MEASURES

FLASH POINT: not applicable

HAZARDOUS PRODUCTS OF COMBUSTION: Product may evolve small volumes of sulfur trioxide gas if heated above 805 degrees F.

EXTINGUISHING MEDIA: In case of fire, use water, dry chemical, CO2, or foam.

UNUSUAL FIRE AND EXPLOSION HAZARDS: none known

FIRE FIGHTING EQUIPMENT: Fire fighters and others exposed to products of combustion should wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

In case of spill, sweep, scoop or vacuum and remove. Flush residual spill area with water. Keep out of sewers, watersheds and water systems.

Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Avoid contact with eyes, skin and clothing.
Do not taste or swallow.
Avoid breathing dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

STORAGE: Must keep dry to avoid degradation of product.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Where there is significant potential for eye contact, wear chemical goggles and have eye flushing equipment available.

Skin Protection: Wear appropriate chemical resistant gloves and clothing to protect potentially exposed skin. Consult glove manufacturer to determine appropriate type glove for given application. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling.

Respiratory Protection: Avoid breathing dust. Use NIOSH approved respiratory protection equipment when airborne exposure limits are exceeded (see below). Consult respirator manufacturer to determine appropriate type equipment for given application. Observe respirator use limitations specified by NIOSH or the manufacturer. Respiratory protection programs must comply with 29 CFR 1910.134.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). The use local mechanical exhaust ventilation at sources of air contamination such as open process equipment is preferred.

Airborne Exposure Limits:

COMPONENT	OSHA PEL	ACGIH TLV
vanadium salts *	not established	not established
diatomaceous earth ** (amorphous silica)	not established	not established

* OSHA and ACGIH have not established specific exposure limits for this material. OSHA has established the following limits for vanadium pentoxide (V2O5) respirable dust and fume. ACGIH has established the following limits for vanadium pentoxide (V2O5) respirable dust.

OSHA PEL	ACGIH TLV
0.5 mg/m3 (respirable dust) ceiling 0.1 mg/m3 (fume) ceiling	0.05 mg/m3 8-hr (respirable dust or fume)

** OSHA and ACGIH have not established specific exposure limits for this material. However, they have established limits for particulates not otherwise regulated (PNOR) and particulates (insoluble) not otherwise specified (PNOS) respectively, which are the least stringent exposure limits applicable to dusts.

OSHA PEL	ACGIH TLV
15 mg/m3 (total dust) 8-hr TWA 5 mg/m3 (respirable) 8-hr TWA	10 mg/m3 (inhalable) 8-hr TWA 3 mg/m3 (respirable) 8-hr TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: yellow to green ribbed rings
Size is approximately 15/32" O.D. X 9/16" long ribbed rings
Solubility: 65 - 75% SiO2 - insoluble
Solubility in Other Solvents: 25 - 35% inorganic salts - partially soluble in water

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

STABILITY: Product is stable under normal conditions of storage and handling

MATERIALS TO AVOID: none known

HAZARDOUS DECOMPOSITION PRODUCTS: none known

INCOMPATIBILITY: none known

11. TOXICOLOGICAL INFORMATION

Occupational exposure to these catalysts has been reported to cause severe eye, skin and upper respiratory tract irritation. Industrial experience indicates that vanadium compounds, such as vanadates and vanadium oxides, are irritating to the eyes, skin and mucous membranes of the upper respiratory tract. Productive cough, wheezing, difficulty in breathing, chest pains, bronchitis, inflammation of the mucous membranes of the nose, pneumonia, gastrointestinal tract disturbances, kidney and heart effects have also been reported with excessive exposure to dust and fumes of vanadium compounds.

Overexposure to dusts of the diatomaceous earth (silica) component of sulfuric acid catalyst may also cause respiratory tract irritation.

Toxicological Data

MECS has not conducted toxicity studies on these sulfuric acid catalysts. However, the following data were developed on a similar sulfuric acid catalyst and are considered representative of these catalysts.

Single exposure (acute) studies indicate:

Oral - Slightly toxic (rat LD50 - <5,000 mg/kg but > 500 mg/kg)
Dermal - Practically nontoxic (rabbit LD50 - >5,010 mg/kg)
Eye Irritation - Severely irritating (rabbit)
Skin Irritation - Essentially nonirritating (rabbit)

Components

Data from the scientific literature on the components of these sulfuric acid catalysts which have been identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

Vanadium salts

Reduced weight gains, and effects on liver, kidney and lungs have been reported in laboratory animals following

repeated oral administration of vanadates. Vanadium is also reported to interfere with a number of biochemical processes.

Cesium salts

Sulfuric Acid Catalyst contains a mixture of cesium salts (equivalent to 8.5 to 9.5% Cs2SO4).

Toxicity studies in laboratory animals show cesium salts to be practically nontoxic to moderately toxic orally (rats). Most cesium salts are considered to be nonirritating to severely irritating to rabbit eyes and nonirritating to moderately irritating to rabbit skin. Cesium salts have not shown the ability to produce allergic skin reactions in laboratory animals. No birth defects were reported in mice given the chloride salt of cesium in their drinking water during pregnancy, even at levels, which produced toxic effects in the offspring. Cesium chloride produced adverse genetic changes in standard tests with animal cells.

12. ECOLOGICAL INFORMATION

MECS has not conducted environmental toxicity studies with this product.

13. DISPOSAL CONSIDERATIONS

Sulfuric acid catalyst is not a "hazardous waste" as that term is defined in the Resource Conservation and Recovery Act (RCRA), 40 CFR 261, "Identification and Listing of Hazardous Waste". Dispose of in accordance with local, state and federal regulations. Consult your attorney or appropriate regulatory officials for information on such disposal. Metal reclaimers are available to recover vanadium value from disposed material. This product should not be dumped, spilled, rinsed or washed into sewers or public waterways.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

This product is not hazardous under the applicable DOT, ICAO/IATA, or IMDG regulations.

15. REGULATORY INFORMATION

TSCA INVENTORY: All intentional components are listed.

SARA Title III Rules
Section 311/312 Hazard Categories
Immediate; Delayed
Section 302 Extremely Hazardous Substances
Not applicable.
Section 313 Toxic Chemical(s)
Vanadium compounds

CERCLA REPORTABLE QUANTITY: Not applicable

Refer to Section 2 for OSHA Hazardous Chemical(s) and Section 13 for RCRA classification.

16. OTHER INFORMATION

REASON FOR REVISION: Change in company name and contact information

Supersedes MSDS dated: January 17, 2002

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MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**Catalyst**
Version #	01
Revision date	12-22-2010
CAS #	Mixture
Product use	Catalyst for use in Sulfuric Acid Manufacturing.
Synonym(s)	Types: 11, 210, 516, Cs-110, Cs-120, Cs-210, LP-110, LP-120, LP-220, TD-750, XCs-120, XLP-110, XLP-220, WXC-120, WXP-110, WXP-220.
Manufacturer information	MECS INC 14522 South Outer Forty Road Chesterfield MO 63107 CatalystMSDS@mecsglobal.com Telephone: 314-275-5700 Telephone US ER 800-514-1746 Outside United States +1 760-602-8897 Access code 10280

2. Hazards Identification

Physical state	Solid.
Appearance	Yellow green pellets, rings or ribbed rings.
Emergency overview	WARNING Causes skin and respiratory tract irritation. May be harmful if swallowed. Cancer hazard - can cause cancer.
OSHA regulatory status	This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Inhalation. Ingestion. Skin contact. Eye contact.
Eyes	Causes eye irritation. Exposed individuals may experience eye tearing, redness, and discomfort.
Skin	Causes skin irritation. Skin irritation occurs on contact with moist or wet skin.
Inhalation	Causes respiratory tract irritation. Frequent inhalation of fume/dust over a long period of time increases the risk of developing lung diseases.
Ingestion	May be harmful if swallowed.
Target organs	Eyes. Respiratory system. Skin. Lungs.
Chronic effects	Cristobalite and quartz: Crystalline silica (inhaled in the form of cristobalite or quartz) has been classified by IARC, NTP and ACGIH as a known human carcinogen and suspected human carcinogen respectively. The substance (silica) may have an effect on the lungs, resulting in fibrosis (silicosis).
Signs and symptoms	Corneal damage. Conjunctivitis. Irritation of eyes and mucous membranes.
Potential environmental effects	Harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

3. Composition / Information on Ingredients

Components	CAS #	Percent
Diatomaceous earth	61790-53-2	30 - 40%
Vanadium salt complex	-	30 - 40%
Cristobalite	14464-46-1	20 - 30%
Silica, amorphous	7631-86-9	1 - 10%
Quartz	14808-60-7	0.1 - 1%

Composition comments	This product is a mixture that consists of a vanadium salt complex (oxosulfatovanadates) containing potassium and vanadium on a diatomaceous earth support (Group 1) or vanadium salt complex (oxosulfatovanadates) containing cesium, potassium and vanadium on a diatomaceous earth support (Group 2). All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First Aid Measures

First aid procedures

Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Do not rub eye. If irritation occurs, get medical assistance.
Skin contact	Wash off immediately with plenty of water. Take off immediately all contaminated clothing. If irritation occurs, get medical assistance.
Inhalation	Move to fresh air. If not breathing, give artificial respiration.
Ingestion	Rinse mouth thoroughly. Do not induce vomiting. Remove particles from mouth. Never give liquid to an unconscious person. Get medical attention.
Notes to physician	Symptoms may be delayed.
General advice	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

Flammable properties	The product is non-combustible.
Extinguishing media	
Suitable extinguishing media	Use appropriate extinguishing media for any nearby fire.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Protection of firefighters	
Specific hazards arising from the chemical	Product will release sulfur oxides upon heating.
Fire fighting equipment/instructions	Move containers from fire area if you can do it without risk. Use standard firefighting procedures and consider the hazards of other involved materials. Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for fire fighting: follow the general fire precautions indicated in the workplace.
Specific methods	Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for fire fighting: follow the general fire precautions indicated in the workplace.
Hazardous combustion products	Metal oxides. Sulfur oxides.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Wear protective clothing as described in Section 8 of this MSDS. Avoid generation and spreading of dust. Do not breathe dust.
Environmental precautions	Avoid spreading dust or contaminated materials. Avoid discharge into water courses or onto the ground.
Methods for containment	Collect and dispose of spillage as indicated in Section 13 of the MSDS.
Methods for cleaning up	Avoid dust formation. Use a vacuum cleaner. If not possible collect using a shovel, broom or the like. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. For waste disposal, see Section 13 of the MSDS. When wetted the product is corrosive.
Other information	Clean up in accordance with all applicable regulations.

7. Handling and Storage

Handling	Avoid inhalation of dust and contact with skin and eyes. Use only with adequate ventilation. The product, if wetted to the point of creating free liquid, will drip sulfuric acid. Corrosive when wet Only trained personnel should use this product. Work practice should minimize contact. When using, do not eat, drink or smoke. Wash thoroughly after handling. Wash contaminated clothing before reuse. Thoroughly clean equipment after use.
Storage	Keep container dry. Keep this material away from food, drink and animal feed. Keep container tightly closed in a cool, well-ventilated place. Store away from incompatible materials.

8. Exposure Controls / Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.025 mg/m3	Respirable fraction.
Quartz (14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.05 mg/m3	Respirable.
		1.2 mppcf	Respirable.
		0.15 mg/m3	Total dust.
Diatomaceous earth (61790-53-2)	TWA	0.8 mg/m3	
		20 mppcf	
Quartz (14808-60-7)	TWA	0.3 mg/m3	Total dust.
		2.4 mppcf	Respirable.
		0.1 mg/m3	Respirable.
Silica, amorphous (7631-86-9)	TWA	20 mppcf	
		0.8 mg/m3	

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.025 mg/m3	Respirable.
		0.025 mg/m3	Respirable particles.
Quartz (14808-60-7)	TWA	0.025 mg/m3	Respirable particles.

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.025 mg/m3	Respirable fraction.
Diatomaceous earth (61790-53-2)	TWA	1.5 mg/m3	Respirable.
		4 mg/m3	Total
Quartz (14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.
Silica, amorphous (7631-86-9)	TWA	4 mg/m3	Total
		1.5 mg/m3	Respirable.

Canada. Ontario OELs. (Ministry of Labor - Control of Exposure to Biological or Chemical Agents)

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.05 mg/m3	Respirable fraction.
Diatomaceous earth (61790-53-2)	TWA	10 mg/m3	Inhalable
		3 mg/m3	Respirable.
Quartz (14808-60-7)	TWA	0.1 mg/m3	Respirable fraction.
Silica, amorphous (7631-86-9)	TWA	10 mg/m3	

Canada. Quebec OELS. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.05 mg/m3	Total dust.
Diatomaceous earth (61790-53-2)	TWA	6 mg/m3	Total dust.
Quartz (14808-60-7)	TWA	0.1 mg/m3	Respirable dust.
Silica, amorphous (7631-86-9)	TWA	6 mg/m3	Respirable dust.

Mexico. Occupational Exposure Limit Values

Components	Type	Value	Form
Cristobalite (14464-46-1)	TWA	0.05 mg/m3	
Diatomaceous earth (61790-53-2)	TWA	10 mg/m3	Inhalable particulate.
		3 mg/m3	Respirable dust.
Quartz (14808-60-7)	TWA	0.1 mg/m3	

Engineering controls If enclosed handling cannot be guaranteed, ventilation and protective clothing must be used. Observe occupational exposure limits and minimize the risk of inhalation of dust.

Personal protective equipment

Eye / face protection Wear approved safety goggles.

Skin protection Wear appropriate clothing to prevent any possibility of skin contact. Wear suitable gloves.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Personal protective equipment should be kept separate from other clothing. Provide eyewash station and safety shower.

9. Physical & Chemical Properties

Appearance	Yellow green pellets, rings or ribbed rings.
Color	Yellow green
Odor	Odorless.
Odor threshold	Not available.
Physical state	Solid.
Form	Pellets, rings or ribbed rings.
pH	Not applicable
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not Applicable.
Flash point	Not applicable.
Evaporation rate	Not Applicable.
Flammability (Train fire)	Not applicable.
Flammability limits in air, upper, % by volume	Not applicable.
Flammability limits in air, lower, % by volume	Not applicable.
Vapor pressure	Not Applicable.
Vapor density	Not Applicable.
Specific gravity	0.5 - 0.61
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not Applicable.
Auto-ignition temperature	Not applicable.
Decomposition temperature	Not available.
Viscosity	Not applicable.

10. Chemical Stability & Reactivity Information

Chemical stability	Stable under normal temperature conditions and recommended use. When wetted the product is corrosive.
Conditions to avoid	Water, moisture.
Incompatible materials	Water.

Hazardous decomposition products	Metal oxides. Sulfur oxides.
Possibility of hazardous reactions	None known.

11. Toxicological Information

Toxicological data

Product	Test Results
Catalyst (Mixture)	Acute Dermal LD50 Rabbit: > 5000 mg/kg
	Acute Oral LD50 Rat: 1460 mg/kg

Acute effects	Causes skin, eye and respiratory tract irritation. Harmful if inhaled or swallowed.
Local effects	Irritating to eyes, respiratory system and skin.
Sensitization	This product is not expected to cause skin sensitization.
Chronic effects	Vanadium salt complex. May cause damage to the liver and kidneys. May cause lung damage. Crystalline silica: Overexposure to the respirable dust of crystalline silica (quartz or cristobalite, less than or equal to 5 microns in size) may lead to silicosis in humans, which is a progressive and irreversible lung disease.
Carcinogenicity	Contains material which may cause cancer.

ACGIH Carcinogens

Cristobalite (CAS 14464-46-1)	A2 Suspected human carcinogen.
Quartz (CAS 14808-60-7)	A2 Suspected human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Cristobalite (CAS 14464-46-1)	1 Carcinogenic to humans.
Diatomaceous earth (CAS 61790-53-2)	3 Not classifiable as to carcinogenicity to humans.
Quartz (CAS 14808-60-7)	1 Carcinogenic to humans.
Silica, amorphous (CAS 7631-86-9)	3 Not classifiable as to carcinogenicity to humans.

US NTP Report on Carcinogens: Known carcinogen

Cristobalite (CAS 14464-46-1)	Known carcinogen.
Quartz (CAS 14808-60-7)	Known carcinogen.

Mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Neurological effects	No data available.
Reproductive effects	Contains no ingredient listed as toxic to reproduction.
Teratogenicity	No data available.
Symptoms and target organs	Contact may cause irritation with redness, tearing, pain, and/or blurred vision. Dust may irritate throat and respiratory system and cause coughing.

12. Ecological Information

Ecotoxicity	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Aquatic toxicity	May cause long-term adverse effects in the aquatic environment.
Persistence and degradability	No data available.
Bioaccumulation / Accumulation	No data available on bioaccumulation.
Partition coefficient (n-octanol/water)	Not Applicable.
Mobility in environmental media	No data available.

13. Disposal Considerations

Disposal instructions	Do not discharge into drains, water courses or onto the ground. It may be necessary to dispose of this material or its container as a hazardous waste FOLLOW LABEL WARNINGS EVEN AFTER CONTAINER HAS BEEN EMPTIED.
Waste from residues / unused products	Dispose of in accordance with local regulations.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

TDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
CERCLA/SARA Hazardous Substances - Not applicable.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration

Vanadium salt complex (CAS -)	1.0 % N770

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

Vanadium salt complex (CAS -)	N770 Listed.

CERCLA (Superfund) reportable quantity (lbs)

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes

Drug Enforcement Agency (DEA)

Not controlled

Canadian regulations

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS status

Controlled

WHMIS classification

D2A - Other Toxic Effects-VERY TOXIC
D2B - Other Toxic Effects-TOXIC

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

Mexico regulations This product is dangerous according to Mexican regulations.

16. Other Information

Recommended use Catalyst for use in sulfuric acid manufacturing.

Recommended restrictions Use in accordance with supplier's recommendations.

Further information HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings
Health: 2*
Flammability: 0
Physical hazard: 0

NFPA ratings
Health: 2
Flammability: 0
Instability: 0

Disclaimer This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

Issue date 12-22-2010

MATERIAL SAFETY DATA SHEET

Product: FUEL GAS-1, HYDROGEN RICH R1400
DCR Number: 506

Company Data

Company: Premcor Refining Group
1700 EAST PUTNAM AVENUE
SUITE 500
OLD GREENWICH, CT 06780
Emergency Phone: 800-424-9300
Information Phone: 618-254-7301
Fax: 314-854-1580

Manufacturer/Supplier: Premcor Refining Group
1700 East Putnam Avenue, Suite 500
Old Greenwich, CT 06780
Emergency: 877-276-7283
Information: 877-276-7285

Product Data

Manufacturer Product Code : R1400, R1400MT
Revised: 1/4/1999

Component Data

Component: HYDROGEN
Cas No: 1333740
Component Note: May contain
Percent: = 100.0
Limit Note: TLV: ASPHYXIANT

Component: FUEL GASES, C6-8 CATALYTIC REFORMER
Cas No: 68476288
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), C6-8 CATALYTIC REFORMER
Cas No: 68477816
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), REFORMER MAKE-UP, HYDROGEN-RICH
Cas No: 68478013
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), C6-8 CATALYTIC REFORMER RECYCLE
Cas No: 68477805
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), RECYCLE, HYDROGEN-RICH
Cas No: 68478002
Component Note: May contain
Percent: = 100.0

Component: FUEL GASES
Cas No: 68476266
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), REFORMING HYDROTREATER
Cas No: 68478024
Component Note: May contain
Percent: = 100.0

Physical and Chemical Data

Boiling Point: = -259°F
Specific Gravity: (H2O=1) **NOTE:** Not applicable.
Vapor Density: = .6 (Air=1)
Melt/Freeze Point: **NOTE:** Not applicable.
pH: **NOTE:** Not applicable.
Vapor Pressure: (mm Hg) **NOTE:** Not determined.
VOC Content: **NOTE:** Not determined.

Viscosity: (cst) **NOTE:** Not applicable.
Solubility in Water: Not determined.
Appearance/Odor: Colorless gas, Petroleum odor / Other: None
Physical State: Gas
Hazard Rating A: HMIS MFG. Rating: Health = 0 Flammability = 4 Reactivity = 0
Hazard Rating B: NFPA MFG. Rating: Health = 0 Flammability = 4 Reactivity = 0

Fire and DOT Data

Flash Point Closed: **NOTE:** Not applicable.
Flash Point Open: **NOTE:** Not applicable.
Auto Ignition: = 999°F
LEL/LFL: = 4 %
UEL/UFL: = 75 %
Preparer Information: Manager Product Stewardship

UN Number: 1964
DOT Class: 2.1
DOT Label: Flammable gas
Proper Shipping Name: Hydrocarbon gas, compressed, N.O.S.

1. NAME

MATERIAL IDENTITY:

PRODUCT CODE AND NAME: R1400 FUEL GAS-1, HYDROGEN RICH

CHEMICAL NAME AND/OR FAMILY OR DESCRIPTION: Petroleum Hydrocarbon Mixture

LEGEND:

N.D.: NOT DETERMINED
N.A.: NOT APPLICABLE
N.T.: NOT TESTED
<: LESS THAN
>: GREATER THAN

MOTIVA MSDS: R1400MT 01/04/99

TELEPHONE NUMBER:

24 HOUR EMERGENCY ASSISTANCE:

EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300

GENERAL MSDS ASSISTANCE: 877-276-7285

NAME AND ADDRESS:

MOTIVA ENTERPRISES LLC

PRODUCT STEWARDSHIP
P.O. BOX 674414
HOUSTON, TX 77267-4414

2. COMPOSITION/INFORMATION ON INGREDIENTS

SEE COMPONENT PAGE(S) FOR ADDITIONAL INFORMATION.

THE CRITERIA FOR LISTING COMPONENTS IN THE COMPOSITION SECTION IS AS FOLLOWS: CARCINOGENS ARE LISTED WHEN PRESENT AT 0.1 % OR GREATER; COMPONENTS WHICH ARE OTHERWISE HAZARDOUS ACCORDING TO OSHA ARE LISTED WHEN PRESENT AT 1.0 % OR GREATER; NON-HAZARDOUS COMPONENTS ARE LISTED AT 3.0 % OR GREATER. THIS IS NOT INTENDED TO BE A COMPLETE COMPOSITIONAL DISCLOSURE. REFER TO SECTION 14 FOR APPLICABLE STATES' RIGHT TO KNOW AND OTHER REGULATORY INFORMATION.

PRODUCT AND/OR COMPONENT(S) CARCINOGENIC ACCORDING TO:

OSHA	IARC	NTP	OTHER	NONE
				X
-	-	-	-	-

COMPOSITION: (SEQUENCE NUMBER AND CHEMICAL NAME)

SEQ. CHEMICAL NAME

01 * Hydrogen
02 * Fuel gases, C6-8 catalytic reformer
03 * Gases (petroleum), C6-8 catalytic reformer
04 * Gases (petroleum), reformer make-up, hyrogen-rich
05 * Gases (petroleum), C6-8 catalytic reformer recycle
06 * Gases (petroleum), recycle, hyrogen-rich
07 * Fuel gases
08 * Gases (petroleum), reforming hydrotreater

PRODUCT IS HAZARDOUS ACCORDING TO OSHA (1910.1200).
* COMPONENT IS HAZARDOUS ACCORDING TO OSHA.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW:

APPEARANCE: Colorless gas
ODOR: Petroleum odor

WARNING STATEMENT:

DANGER!

FLAMMABLE GAS - MAY CAUSE FLASH FIRE
DELAYED EVAPORATION FROM CONTAMINATED CLOTHING MAY BE A FIRE HAZARD
LIQUID MAY CAUSE FROSTBITE
MAY CAUSE DIZZINESS AND DROWSINESS
GAS REDUCES OXYGEN AVAILABLE FOR BREATHING
GAS MAY ACCUMULATE IN CONFINED SPACES AND CAUSE SUFFOCATION

HMIS:

HEALTH: 0
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

NFPA:

HEALTH: 0
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

POTENTIAL HEALTH EFFECTS:

	EYE	SKIN	INHALATION	INGESTION
PRIMARY ROUTE OF EXPOSURE:	X	X	X	

EFFECTS OF OVEREXPOSURE:

ACUTE:

EYES:

May cause minimal irritation, experienced as temporary discomfort.

Eye contact with liquid product or gas under pressure can cause frostbite (cold burns).

SKIN:

Brief contact is not irritating.
Product is a gas - not expected to be absorbed through the skin.
Skin contact with liquid product can cause frostbite (cold burns).

INHALATION:

Gas may be irritating and cause discomfort in nose and throat, nasal discharge, and coughing. Prolonged overexposure may cause difficulty breathing.

Inhalation may cause dizziness, drowsiness, euphoria, loss of coordination, disorientation, headache, nausea, and vomiting. In poorly ventilated areas or confined spaces, unconsciousness and asphyxiation may result.

INGESTION:

Product is a gas - not expected to cause toxic effects due to ingestion.

This material is a gas. Gas or liquid under pressure may cause frostbite (cold burns).

SENSITIZATION PROPERTIES: Unknown.

CHRONIC: No adverse effects have been documented in humans as a result of chronic exposure. Section 11 may contain applicable animal data.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: There is no evidence that this

product aggravates an existing medical condition.

OTHER REMARKS: None

4. FIRST AID MEASURES

EYES: Flush eyes with plenty of water for several minutes. Get medical attention if eye irritation persists.

SKIN:

Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

In case of cold burn, immediately place affected area in warm water (105 F) and keep at this temperature until circulation returns. Get medical attention.

If clothing becomes wetted, drench individual with water and remove contaminated clothing if possible. Slowly warm affected area of skin.

INGESTION: No emergency care anticipated. This material is a gas at standard temperature and pressure.

INHALATION: If inhaled, remove to fresh air. If not breathing, clear person's airway and give artificial respiration. If breathing is difficult, qualified medical personnel may administer oxygen. Get medical attention immediately.

OTHER INSTRUCTIONS:

Overexposure to this material may sensitize the heart to catecholamine-induced arrhythmias. Do not administer catecholamines to overexposed individuals. Contact a Poison Control Center for further treatment information.

This material is an asphyxiant which may have anesthetic properties at high concentrations. If present in sufficient concentrations to reduce the oxygen level below 18% in inhaled air, rapid respiration, mental dullness, incoordination, poor judgement, nausea, and unconsciousness may result. Oxygen deficiency may occur without warning in areas where this gas may displace air.

5. FIRE-FIGHTING MEASURES

IGNITION TEMPERATURE - AIT (DEGREES F): 999

FLASH POINT (DEGREES F): Not applicable.

FLAMMABLE LIMITS (%):

LOWER: 4
UPPER: 75

RECOMMENDED FIRE EXTINGUISHING AGENTS AND SPECIAL PROCEDURES: Fight fire from protected location or maximum possible distance. Stop flow of gas before attempting to extinguish flames. Use water spray to cool fire-exposed

containers and to protect persons attempting to stop the flow of gas. Use flooding quantities of water as fog or spray. Use dry chemical or carbon dioxide to extinguish flames.

UNUSUAL OR EXPLOSIVE HAZARDS:

Explosive air-vapor mixtures may form.

Danger! Readily forms explosive air-vapor mixtures; may release explosive vapors that travel, be ignited at remote locations, and flash back. Containers may explode in fire. Do not expose to heat, sparks, flame, static, or other sources of ignition. When handling, use non-sparking tool, ground and bond all containers.

EXTINGUISHING MEDIA WHICH MUST NOT BE USED: Not determined.

SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS: Other than normal protective fire-fighting equipment, no special equipment or procedures required.

6. ACCIDENTAL RELEASE MEASURES

(TRANSPORTATION SPILLS: CHEMTREC (800)424-9300)

PROCEDURES IN CASE OF ACCIDENTAL RELEASE, BREAKAGE OR LEAKAGE: Eliminate all ignition sources including internal combustion engines and power tools. Ventilate area. Keep people away. Stay upwind and warn of possible downwind explosion hazard. Avoid breathing vapor. Avoid contact with eyes, skin, or clothing. Pressure demand air supplied respirators should always be worn when the airborne concentration of the contaminant or oxygen is unknown. Otherwise, wear respiratory protection and other personal protective equipment as appropriate for the potential exposure hazard.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN:

HANDLING: Use spark-proof tools. Material may be at elevated temperatures and/or pressures. Exercise care when opening bleeders and sampling ports.

STORAGE: Ground and bond shipping container, transfer line, and receiving container. Keep away from heat, sparks, flame, and other sources of ignition. Periods of exposure to high temperatures should be minimized.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

PROTECTIVE EQUIPMENT (TYPE):

EYE/FACE PROTECTION: Safety glasses, chemical type goggles, or face shield recommended to prevent eye contact.

SKIN PROTECTION: Protective clothing such as coveralls or lab coats should be worn. Launder or dry-clean when soiled. Gloves and boots resistant to chemicals and petroleum distillates required. Insulated gloves also required

if contact with liquid-cooled product or equipment is expected.

RESPIRATORY PROTECTION: Airborne concentrations should be kept to lowest levels possible. If vapor, mist or dust is generated and the occupational exposure limit of the product, or any component of the product, is exceeded, use appropriate NIOSH or MSHA approved air purifying or air supplied respirator after determining the airborne concentration of the contaminant. Air supplied respirators should always be worn when airborne concentration of the contaminant or oxygen content is unknown.

VENTILATION: Use explosion-proof equipment to maintain adequate ventilation to meet occupational exposure limits, if applicable (see below), prevent accumulation of explosive air-gas mixtures, and avoid significant oxygen displacement. Oxygen levels should be at least 19.5% in confined spaces or other work areas (OSHA value).

EXPOSURE LIMIT FOR TOTAL PRODUCT:

None established; considered to be a simple asphyxiant.

Simple asphyxiant - has poor warning properties and can displace air causing an oxygen deficiency. Maintain 19.5% oxygen (by volume) in confined spaces.

9. PHYSICAL AND CHEMICAL PROPERTIES

SEE DATA PAGES FOR ADDITIONAL INFORMATION.

10. STABILITY AND REACTIVITY

THIS MATERIAL REACTS VIOLENTLY WITH: (If Others is checked below, see comments for details)

Air	Water	Heat	Strong Oxidizers	Others	None of These
		X	X		
–	–	–	–	–	–

COMMENTS: None

PRODUCTS EVOLVED WHEN SUBJECTED TO HEAT OR COMBUSTION: Toxic levels of carbon monoxide, carbon dioxide, irritating aldehydes and ketones.

HAZARDOUS POLYMERIZATIONS: DO NOT OCCUR

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION(ANIMAL TOXICITY DATA):

Median Lethal Dose:

ORAL: Not applicable; material is a gas.
INHALATION: Not determined.

DERMAL: Not applicable.

IRRITATION INDEX, ESTIMATION OF IRRITATION (SPECIES):

SKIN: (Draize) Believed to be < .50 /8.0 (rabbit) no appreciable effect
EYES: (Draize) Believed to be < 15.00 /110 (rabbit) no appreciable effect
SENSITIZATION: Not determined.
OTHER: None

12. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHODS: This product (as presently constituted) has the RCRA characteristics of ignitability, and, if discarded in its present form, would have the hazardous waste number of D001. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc. may change the classification to non-hazardous, or hazardous for reasons other than, or in addition to ignitability.

REMARKS: Do not allow to enter drains or sewers. Can cause explosion.

13. TRANSPORT INFORMATION

TRANSPORTATION:

DOT:

PROPER SHIPPING NAME: Hydrocarbon gas, compressed, N.O.S
HAZARD CLASS: 2.1
IDENTIFICATION NUMBER: UN 1964
PACKING GROUP:
LABEL REQUIRED: Flammable gas

IMDG:

PROPER SHIPPING NAME: Not evaluated

ICAO:

PROPER SHIPPING NAME: Not evaluated

TDG:

PROPER SHIPPING NAME: Not evaluated

14. REGULATORY INFORMATION

FEDERAL REGULATIONS:

SARA TITLE III:

SECTION 302/304 EXTREMELY HAZARDOUS SUBSTANCES:

Seq.	Chemical Name	CAS Number	Range in %	TPQ	RQ
None					

SECTION 311 HAZARDOUS CATEGORIZATION:

Acute	Chronic	Fire	Pressure	Reactive	N/A
		X			
-	-	-	-	-	-

SECTION 313 TOXIC CHEMICAL:

Chemical Name	CAS Number	Concentration
None		

CERCLA 102(a)/DOT HAZARDOUS SUBSTANCES: (+ INDICATES DOT HAZARDOUS SUBSTANCE)

Seq.	Chemical Name	CAS Number	Range in %
None			

CERCLA/DOT HAZARDOUS SUBSTANCES (SEQUENCE NUMBERS AND RQ'S):

Seq.	RQ
None	

TSCA INVENTORY STATUS: This product, or its components, are listed on or are exempt from the Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

OTHER: None.

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65: The following detectable components of this product are substances, or belong to classes of substances, known to the State of California to cause cancer and/or reproductive toxicity.

Chemical Name	CAS Number
None	

INTERNATIONAL REGULATIONS:

WHMIS CLASSIFICATION: Not determined
CANADA INVENTORY STATUS: Not determined.
EINECS INVENTORY STATUS: Not determined.
AUSTRALIA INVENTORY STATUS: Not determined.
JAPAN INVENTORY STATUS: Not determined.

15. ENVIRONMENTAL INFORMATION

AQUATIC TOXICITY: Not determined.

MOBILITY: Not determined.

PERSISTENCE AND BIODEGRADABILITY: Not determined.

POTENTIAL TO BIOACCUMULATE: Not determined.

REMARKS: None

16. OTHER INFORMATION

Dispose of as a vapor, venting to suitable combustion chamber.

The information below is given to call attention to the issue of "naturally occurring radioactive materials". Although radon-222 levels in this product do not present any direct radon exposure, customers should be aware of the potential of radon daughter product buildup within their processing streams whatever the source of their product streams. Radon-222 is a naturally occurring radioactive gas which can be a contaminant in natural gas. During subsequent processing, radon tends to be concentrated in the liquified petroleum gas stream and in product streams having a similar boiling point range. Industry experience has shown that this product may contain small amounts of radon-222 and its radioactive decay products, called radon "daughters". The actual concentration of Radon-222 and radioactive daughters in the process equipment (IE lines, filters, pumps and reactor units) may accumulate significant levels of radioactive daughters and show a gamma radiation reading during operation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon-enriched stream or containing internal deposits of radioactive material, due to the transmission of gamma radiation through its wall.

Field studies in the literature and conducted by company personnel at selected sites, have not shown any conditions that subject workers to cumulative exposures in excess of general population limits. Equipment emitting gamma radiation should be presumed to be internally contaminated with alpha-emitting decay products which may be a hazard if inhaled or ingested. During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow the gamma radiation to drop to background levels. Protective equipment E.G. coveralls, gloves and respirator (NIOSH/MSHA approved for high efficiency particulates and radionuclides, or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination, ingestion or inhalation of any residue containing alpha radiation. Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

THE INFORMATION CONTAINED THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA
AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT DATA. IT IS PROVIDED
INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE, FOR PURPOSE OF HAZARD COMMUNICATION. IT
IS NOT INTENDED TO CONSTITUTE PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF
ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED
HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR
DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF'
THE INFORMATION CONTAINED HEREIN.

TO DETERMINE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT
AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE
USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN
AS A RESULT OF THAT DATA, IS THE PROPERTY OF EQUIVA SERVICES, LLC AND IS NOT TO BE THE SUBJECT OF
SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF EQUIVA SERVICES, LLC.

DATE: 1999-01-04

New
X Revised, Supersedes: 1997-11-12

INQUIRIES REGARDING MSDS SHOULD BE DIRECTED TO:

EQUIVA SERVICES, LLC
Manager, Product Stewardship
P.O. Box 674414
Houston, TX 77267-4414

17. PRODUCT LABEL

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

R1400 FUEL GAS-1, HYDROGEN RICH

WARNING STATEMENT:

DANGER!

FLAMMABLE GAS - MAY CAUSE FLASH FIRE
DELAYED EVAPORATION FROM CONTAMINATED CLOTHING MAY BE A FIRE HAZARD
LIQUID MAY CAUSE FROSTBITE
MAY CAUSE DIZZINESS AND DROWSINESS
GAS REDUCES OXYGEN AVAILABLE FOR BREATHING
GAS MAY ACCUMULATE IN CONFINED SPACES AND CAUSE SUFFOCATION

PRECAUTIONARY MEASURES:

-Keep away from heat, sparks or flame.
-Use only with adequate ventilation.
-Do not enter storage areas or confined spaces unless adequately ventilated.
-Use supplied air respiratory protection for cleaning large spills or upon entry into tanks, vessels, or other confined spaces.
-Avoid breathing vapor, mist, or gas.
-Rescue procedures should be attempted ONLY after notifying others of emergency and ONLY if appropriate personal equipment is available.
-Wear insulated gloves if contact with liquid cooled equipment is expected.
-Keep container closed.
-Workers should wash exposed skin several times daily with soap and water.

FIRST AID:

EYE CONTACT: Flush eyes with plenty of water for several minutes. Get medical attention if eye irritation persists.

SKIN CONTACT:

Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

In case of cold burn, immediately place affected area in warm water (105 F) and keep at this temperature until circulation returns. Get medical attention.

If clothing becomes wetted, drench individual with water and remove contaminated clothing if possible. Slowly warm affected area of skin.

INGESTION: No emergency care anticipated. This material is a gas at standard temperature and pressure.

INHALATION: If inhaled, remove to fresh air. If not breathing, clear person's airway and give artificial respiration. If breathing is difficult, qualified medical personnel may administer oxygen. Get medical attention immediately.

NOTE TO PHYSICIAN:

Overexposure to this material may sensitize the heart to catecholamine-induced arrhythmias. Do not administer catecholamines to overexposed individuals. Contact a Poison Control Center for further treatment information.

This material is an asphyxiant which may have anesthetic properties at high concentrations. If present in sufficient concentrations to reduce the oxygen level below 18% in inhaled air, rapid respiration, mental dullness, incoordination, poor judgement, nausea, and unconsciousness may result. Oxygen deficiency may occur without warning in areas where this gas may displace air.

FIRE: In case of fire, use dry chemical or carbon dioxide to extinguish flames. Use water spray to keep containers cool and protect personnel attempting to stop the flow of gas.

Chemical Name	CAS Number	Range in %
CONTAINS ONE OR MORE OF THE FOLLOWING:		
*Gases (petroleum), reforming hydrotreater	68478-02-4	100.00
*Gases (petroleum),reformer make-up, hydrogen-rich	68478-01-3	100.00
*Gases (petroleum), recycle, hydrogen-rich	68478-00-2	100.00
*Gases (petroleum), C6-8 catalytic reformer	68477-81-6	100.00
*Gases (petroleum), C6-8 catalytic reformer recycle	68477-80-5	100.00
*Fuel gases, C6-8 catalytic reformer	68476-28-8	100.00
*Fuel gases	68476-26-6	100.00
*Hydrogen	1333-74-0	100.00

PRODUCT IS HAZARDOUS ACCORDING TO OSHA (1910.1200).

* COMPONENT IS HAZARDOUS ACCORDING TO OSHA.

Pennsylvania Special Hazardous Substance(s)	CAS Number	Range in %
None		

HMIS:

HEALTH: 0
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

NFPA:

HEALTH: 0
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

TRANSPORTATION:

DOT:

PROPER SHIPPING NAME: Hydrocarbon gas, compressed, N.O.S
HAZARD CLASS: 2.1
IDENTIFICATION NUMBER: UN 1964
PACKING GROUP:
LABEL REQUIRED: Flammable gas

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be

hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

NAME AND ADDRESS:

EQUILON ENTERPRISES LLC
MOTIVA ENTERPRISES LLC
P.O. BOX 674414
HOUSTON, TX 77267-4414

TRANSPORTATION EMERGENCY: (877) 276-7283
CHEMTREC: (800) 424-9300

HEALTH EMERGENCY: (877) 276-7283

HAZMIN Version: 4 / Last Edited on 7/11/2003

Report: 8/17/2011 10:59:50 AM

MATERIAL SAFETY DATA SHEET

Product: FUEL GAS-1, SOUR R1500
HAZMIN: 507

Company Data

Company: Premcor Refining Group
1700 EAST PUTNAM AVENUE
SUITE 500
OLD GREENWICH, CT 06780
Information Phone: 618-254-7301

Manufacturer/Supplier: Premcor Refining Group
1700 East Putnam Avenue, Suite 500
Old Greenwich, CT 06780
Emergency: 877-276-7283
Information: 877-276-7285

Product Data

Manufacturer Product Code : R1500, R1500MT
Revised: 1/4/1999

Component Data

Component: NATURAL GAS, DRIED
Cas No: 68410639
Component Note: May contain
Percent: = 100.0

Component: TAIL GAS (PETROLEUM), GAS RECOVERY PLANT DEPROPANIZER OVERHEADS
Cas No: 68308054
Component Note: May contain
Percent: = 100.0

Component: TAIL GAS (PETROLEUM), CATALYTIC CRACKED DISTILLATE AND CATALYTIC CRACKED...
Cas No: 68307982
Component Note: ... NAPHTHA FRACTION ABSORBER / May contain
Percent: = 100.0
ACGIH TWA (ppm): 800
Limit Note: TLV: AS C4

Component: FUEL GASES, REFINERY
Cas No: 68308270

Component Note: May contain
Percent: = 100.0

Component: FUEL GASES, CRUDE OIL DISTILLATES
Cas No: 68476299
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), DEETHANIZER OVERHEADS
Cas No: 68477861
Component Note: May contain
Percent: = 100.0

Component: TAIL GAS (PETROLEUM), CATALYTIC CRACKER REFRACTIONATION ABSORBER
Cas No: 68478251
Component Note: May contain
Percent: = 100.0

Component: FUEL GASES, HYDROTREATER FRACTIONATION, SCRUBBED
Cas No: 68513111
Component Note: May contain
Percent: = 100.0

Physical and Chemical Data

Boiling Point: = -114°F
Specific Gravity: Between .42 And .58 (H2O=1)
Vapor Density: (Air=1) **NOTE:** Not determined.
Melt/Freeze Point: **NOTE:** Not applicable.
pH: **NOTE:** Not applicable.
Vapor Pressure: (mm Hg) **NOTE:** Not determined.
VOC Content: **NOTE:** Not determined.
Viscosity: **NOTE:** Not applicable.
Solubility in Water: Not determined.
Appearance/Odor: Colorless gas, Rotten egg odor / Other: None
Physical State: Gas
Hazard Rating A: HMIS MFG. Rating: Health = 3 Flammability = 4 Reactivity = 0
Hazard Rating B: NFPA MFG. Rating: Health = 2 Flammability = 4 Reactivity = 0

Fire and DOT Data

Flash Point Closed: **NOTE:** Not applicable.
Flash Point Open: **NOTE:** Not applicable.
Auto Ignition: **NOTE:** Not determined.
LEL/LFL: = 4
UEL/UFL: = 75

Preparer Information: Manager Product Stewardship

UN Number: 1964
DOT Class: 2.1
DOT Label: Flammable Gas
Proper Shipping Name: Hydrocarbon gas, compressed, N.O.S.

1. NAME

MATERIAL IDENTITY:

PRODUCT CODE AND NAME: R1500 FUEL GAS-1, SOUR

CHEMICAL NAME AND/OR FAMILY OR DESCRIPTION: Petroleum Hydrocarbon Mixture

LEGEND:

N.D.: NOT DETERMINED
N.A.: NOT APPLICABLE
N.T.: NOT TESTED
<: LESS THAN
>: GREATER THAN

MOTIVA MSDS: R1500MT 01/04/99

TELEPHONE NUMBER:

24 HOUR EMERGENCY ASSISTANCE:

EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300

GENERAL MSDS ASSISTANCE: 877-276-7285

NAME AND ADDRESS:

MOTIVA ENTERPRISES LLC
PRODUCT STEWARDSHIP
P.O. BOX 674414
HOUSTON, TX 77267-4414

2. COMPOSITION/INFORMATION ON INGREDIENTS

SEE COMPONENT PAGE(S) FOR ADDITIONAL INFORMATION.

THE CRITERIA FOR LISTING COMPONENTS IN THE COMPOSITION SECTION IS AS FOLLOWS: CARCINOGENS ARE LISTED WHEN PRESENT AT 0.1 % OR GREATER; COMPONENTS WHICH ARE OTHERWISE HAZARDOUS ACCORDING TO OSHA ARE LISTED WHEN PRESENT AT 1.0 % OR GREATER; NON-HAZARDOUS COMPONENTS ARE LISTED AT 3.0 % OR GREATER. THIS IS NOT INTENDED TO BE A COMPLETE COMPOSITIONAL DISCLOSURE. REFER TO SECTION 14 FOR APPLICABLE STATES' RIGHT TO KNOW AND OTHER REGULATORY INFORMATION.

PRODUCT AND/OR COMPONENT(S) CARCINOGENIC ACCORDING TO:

OSHA	IARC	NTP	OTHER	NONE
			X	
-	-	-	-	-

COMPOSITION: (SEQUENCE NUMBER AND CHEMICAL NAME)

SEQ. CHEMICAL NAME

CONTAINS ONE OR MORE OF THE FOLLOWING:

01 * Natural Gas, dried
02 * Tail gas (petroleum), gas recovery plant depropanizer overheads
03 * Tail gas (petroleum), catalic cracked distillate and catalytic cracked naphtha fraction absorber
04 * Fuel gases, refinery
05 * Fuel gases, crude oil distillates
06 * Gases (petroleum), deethanizer overheads
07 * Tail gas (petroleum), catalytic cracker refractionation absorber
08 * Fuel gases, hydrotreater fractionation, scrubbed

PRODUCT IS HAZARDOUS ACCORDING TO OSHA (1910.1200).
* COMPONENT IS HAZARDOUS ACCORDING TO OSHA.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW:

APPEARANCE: Colorless gas
ODOR: Rotten egg odor

WARNING STATEMENT:

DANGER!

FLAMMABLE GAS - MAY CAUSE FLASH FIRE
DELAYED EVAPORATION FROM CONTAMINATED CLOTHING MAY BE A FIRE HAZARD
MAY CAUSE DIZZINESS AND DROWSINESS
CONTAINS OR MAY RELEASE HYDROGEN SULFIDE GAS WHEN HEATED
GAS REDUCES OXYGEN AVAILABLE FOR BREATHING
GAS MAY ACCUMULATE IN CONFINED SPACES AND CAUSE SUFFOCATION
CAUSES EYE AND RESPIRATORY TRACT IRRITATION - CAN CAUSE DAMAGE TO RESPIRATORY TRACT

HMIS:

HEALTH: 3
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

NFPA:

HEALTH: 2
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

POTENTIAL HEALTH EFFECTS:

	EYE	SKIN	INHALATION	INGESTION
PRIMARY ROUTE OF EXPOSURE:	X	X	X	

EFFECTS OF OVEREXPOSURE:

ACUTE:

EYES:

Vapor causes irritation, experienced as pain, with excess blinking and tear production, and seen as marked excess redness and swelling of the eye with possible injury to the cornea. Liquid will cause more severe irritation, with chemical burns to the eye.

Eye contact with liquid product or gas under pressure can cause frostbite (cold burns).

SKIN:

Brief contact may cause slight irritation.
Product is a gas - not expected to be absorbed through the skin.
Skin contact with liquid product can cause frostbite (cold burns).

INHALATION:

Gas is irritating and causes nasal discharge, coughing, and discomfort in nose and throat. Prolonged or repeated overexposure may cause lung damage.

Contains or may release hydrogen sulfide (H2S) gas. H2S concentrations above permissible concentrations can cause irritation of the eyes and respiratory tract, headache, dizziness, nausea, vomiting, diarrhea, and pulmonary edema. At concentrations above 300 ppm, respiratory paralysis, causing unconsciousness and death, can occur

INGESTION:

Product is a gas - not expected to cause toxic effects due to ingestion.

This material is a gas. Gas or liquid under pressure may cause frostbite (cold burns).

SENSITIZATION PROPERTIES: Unknown.

CHRONIC: Repeated inhalation may cause lung damage.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Overexposure to vapor, dust or mist may aggravate existing respiratory conditions, such as asthma, bronchitis, and inflammatory or fibrotic respiratory disease.

OTHER REMARKS: None

4. FIRST AID MEASURES

EYES: Immediately flush eyes with large amounts of running water for at least 15 minutes. Hold eyelids apart while flushing to rinse entire surface of eye and lids with water. Do not attempt to neutralize with chemical agents. Obtain medical attention immediately. Continue flushing for an additional 15 minutes if medical attention is not immediately available.

SKIN:

Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

In case of cold burn, immediately place affected area in warm water (105 F) and keep at this temperature until circulation returns. Get medical attention.

If clothing becomes wetted, drench individual with water and remove contaminated clothing if possible. Slowly warm affected area of skin.

INGESTION: No emergency care anticipated. This material is a gas at standard temperature and pressure.

INHALATION: If inhaled, remove to fresh air. If not breathing or in respiratory distress, clear person's airway and start artificial respiration. With a physician's advice, give supplemental oxygen using a bag-valve mask or manually triggered oxygen supply.

OTHER INSTRUCTIONS:

Overexposure to this material may sensitize the heart to catecholamine-induced arrhythmias. Do not administer catecholamines to overexposed individuals. Contact a Poison Control Center for further treatment information.

This material is an asphyxiant which may have anesthetic properties at high concentrations. If present in sufficient concentrations to reduce the oxygen level below 18% in inhaled air, rapid respiration, mental dullness, incoordination, poor judgement, nausea, and unconsciousness may result. Oxygen deficiency may occur without warning in areas where this gas may displace air.

Inhalation exposure may result in respiratory tract injury, the delayed onset of pulmonary edema, and may predispose patient to secondary respiratory infection. Persons exposed to high concentrations should be hospitalized for observation. Contact a Poison Center for additional treatment information.

5. FIRE-FIGHTING MEASURES

IGNITION TEMPERATURE - AIT (DEGREES F): Not determined.

FLASH POINT (DEGREES F): Not applicable.

FLAMMABLE LIMITS (%):

LOWER: 4
UPPER: 75

RECOMMENDED FIRE EXTINGUISHING AGENTS AND SPECIAL PROCEDURES: Fight fire from protected location or maximum possible distance. Stop flow of gas before attempting to extinguish flames. Use water spray to cool fire-exposed containers and to protect persons attempting to stop the flow of gas. Use flooding quantities of water as fog or spray. Use dry chemical or carbon dioxide to extinguish flames.

UNUSUAL OR EXPLOSIVE HAZARDS:

Vapor space in closed container can contain hydrogen sulfide (H_2S) in explosive concentrations. Hydrogen sulfide gas may be released when heated.
Toxic vapors formed on burning.

Danger! Readily forms explosive air-vapor mixtures; may release explosive vapors that travel, be ignited at remote locations, and flash back. Containers may explode in fire. Do not expose to heat, sparks, flame, static, or other sources of ignition. When handling, use non-sparking tool, ground and bond all containers.

EXTINGUISHING MEDIA WHICH MUST NOT BE USED: Not determined.

SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS:

Wear full protective clothing and positive pressure breathing apparatus.

Approach fire from upwind to avoid hazardous vapors and toxic decomposition products.

6. ACCIDENTAL RELEASE MEASURES

(TRANSPORTATION SPILLS: CHEMTREC (800) 424-9300)

PROCEDURES IN CASE OF ACCIDENTAL RELEASE, BREAKAGE OR LEAKAGE: Eliminate all ignition sources including internal combustion engines and power tools. Ventilate area. Keep people away. Stay upwind and warn of possible downwind explosion hazard. Avoid breathing vapor. Avoid contact with eyes, skin, or clothing. Pressure demand air supplied respirators should always be worn when the airborne concentration of the contaminant or oxygen is unknown. Otherwise, wear respiratory protection and other personal protective equipment as appropriate for the potential exposure hazard.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN:

HANDLING: Use spark-proof tools. Material may be at elevated temperatures and/or pressures. Exercise care when opening bleeders and sampling ports. Eye wash and safety shower should be available nearby when this product is handled or used.

STORAGE: Ground and bond shipping container, transfer line, and receiving container. Keep away from heat, sparks, flame, and other sources of ignition.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

PROTECTIVE EQUIPMENT (TYPE):

EYE/FACE PROTECTION: Avoid eye contact. Chemical type goggles with face shield must be worn. Do not wear contact lenses.

SKIN PROTECTION: Protective clothing such as coveralls or lab coats should be worn. Launder or dry-clean when soiled. Gloves and boots resistant to chemicals and petroleum distillates required. Insulated gloves also required if contact with liquid-cooled product or equipment is expected.

RESPIRATORY PROTECTION: When Hydrogen Sulfide (H2S) concentrations are unknown or are equal to or greater than 10 ppm, (as in such activities as: loading; unloading; gauging; cleaning large spills or upon entry into tanks, vessels, or other confined spaces; and during rescue of individuals suspected to be overexposed to H2S), use supplied-air (airline or self-contained breathing apparatus) respiratory protection (NIOSH/MSHA Approved). The respirators must be equipped with pressure-demand regulators and operated in the pressure-demand mode ONLY. If airline units are used, a 5-minute egress bottle MUST also be carried. GAS MASKS OR OTHER AIR-PURIFYING RESPIRATORS MUST NEVER BE USED FOR H2S DUE TO POOR WARNING PROPERTIES OF THE GAS.

VENTILATION: Use explosion-proof equipment to maintain adequate ventilation to meet occupational exposure limits, if applicable (see below), prevent accumulation of explosive air-gas mixtures, and avoid significant oxygen displacement. Oxygen levels should be at least 19.5% in confined spaces or other work areas (OSHA value).

EXPOSURE LIMIT FOR TOTAL PRODUCT: None established for product.

FOR HYDROGEN SULFIDE:

OSHA PEL-TWA 10 ppm; STEL 15 ppm
ACGIH TLV-TWA 10 ppm; STEL 15 ppm

FOR BUTANE:

OSHA PEL-TWA 800 ppm
ACGIH TLV-TWA 800 ppm

9. PHYSICAL AND CHEMICAL PROPERTIES

SEE DATA PAGES FOR ADDITIONAL INFORMATION.

10. STABILITY AND REACTIVITY

THIS MATERIAL REACTS VIOLENTLY WITH: (If Others is checked below, see comments for details)

Air	Water	Heat	Strong Oxidizers	Others	None of These
		X	X		

COMMENTS: None

PRODUCTS EVOLVED WHEN SUBJECTED TO HEAT OR COMBUSTION: Toxic and irritating levels of carbon monoxide, carbon dioxide, nitrogen and sulfur oxides; hydrogen sulfide may also be released.

HAZARDOUS POLYMERIZATIONS: DO NOT OCCUR

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION(ANIMAL TOXICITY DATA):

Median Lethal Dose:

ORAL: Not applicable; material is a gas.
INHALATION: Not determined.
DERMAL: Not applicable.

IRRITATION INDEX, ESTIMATION OF IRRITATION (SPECIES):

SKIN: (Draize) Believed to be > .50 - 3.00 /8.0 (rabbit) slightly irritating

EYES: (Draize) Believed to be > 50.00 - 80.00 /110 (rabbit) severely irritating

SENSITIZATION: Not determined.

OTHER: None

12. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHODS: This product (as presently constituted) has the RCRA characteristics of ignitability, and, if discarded in its present form, would have the hazardous waste number of D001. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc. may change the classification to non-hazardous, or hazardous for reasons other than, or in addition to ignitability.

REMARKS: None

13. TRANSPORT INFORMATION

TRANSPORTATION:

DOT:

PROPER SHIPPING NAME: Hydrocarbon gas, compressed, N.O.S
HAZARD CLASS: 2.1
IDENTIFICATION NUMBER: UN 1964
PACKING GROUP:
LABEL REQUIRED: Flammable gas

IMDG:

PROPER SHIPPING NAME: Not evaluated

ICAO:

PROPER SHIPPING NAME: Not evaluated

TDG:

PROPER SHIPPING NAME: Not evaluated

14. REGULATORY INFORMATION

FEDERAL REGULATIONS:

SARA TITLE III:

SECTION 302/304 EXTREMELY HAZARDOUS SUBSTANCES:

Seq.	Chemical Name	CAS Number	Range in %	TPQ	RQ
None					

SECTION 311 HAZARDOUS CATEGORIZATION:

Acute	Chronic	Fire	Pressure	Reactive	N/A
X		X			

SECTION 313 TOXIC CHEMICAL:

Chemical Name	CAS Number	Concentration
None		

CERCLA 102(a)/DOT HAZARDOUS SUBSTANCES: (+ INDICATES DOT HAZARDOUS SUBSTANCE)

Seq.	Chemical Name	CAS Number	Range in %
None			

CERCLA/DOT HAZARDOUS SUBSTANCES (SEQUENCE NUMBERS AND RQ'S):

Seq.	RQ
None	

TSCA INVENTORY STATUS: This product, or its components, are listed on or are exempt from the Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

OTHER: None.

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65: The following detectable components of this product are substances, or belong to classes of substances, known to the State of California to cause cancer and/or reproductive toxicity.

Chemical Name	CAS Number
None	

INTERNATIONAL REGULATIONS:

WHMIS CLASSIFICATION: Not determined.
CANADA INVENTORY STATUS: Not determined.
EINECS INVENTORY STATUS: Not determined.
AUSTRALIA INVENTORY STATUS: Not determined.
JAPAN INVENTORY STATUS: Not determined.

15. ENVIRONMENTAL INFORMATION

AQUATIC TOXICITY: Not determined.

MOBILITY: Not determined.

PERSISTENCE AND BIODEGRADABILITY: Not determined.

POTENTIAL TO BIOACCUMULATE: Not determined.

REMARKS: None

16. OTHER INFORMATION

Hazardous concentrations of hydrogen sulfide (H2S) gas can accumulate in storage and rundown tanks, marine vessel compartments, sump pits or other confined spaces. When opening valves, hatches and dome covers, stand upwind, keep face as far from the opening as possible and avoid breathing any gases or vapors. When exposure concentrations are unknown and respiratory protection is not used, personal H2S warning devices should be worn. These devices should not be relied on to warn of life threatening concentrations. H2S fatigues the sense of smell rapidly. The rotten egg odor of H2S disappears quickly, even though high concentrations are still present. The ACGIH TLV/TWA for H2S is 10 ppm; the ACGIH STEL is 15 ppm.

Dispose of as a vapor, venting to suitable combustion chamber.

The information below is given to call attention to the issue of "naturally occurring radioactive materials". Although radon-222 levels in this product do not present any direct radon exposure, customers should be aware of the potential of radon daughter product buildup within their processing streams whatever the source of their product streams. Radon-222 is a naturally occurring radioactive gas which can be a contaminant in natural gas. During subsequent processing, radon tends to be concentrated in the liquified petroleum gas stream and in product streams having a similar boiling point range. Industry experience has shown that this product may contain small amounts of radon-222 and its radioactive decay products, called radon "daughters". The actual concentration of Radon-222 and radioactive daughters

in the process equipment (IE lines, filters, pumps and reactor units) may accumulate significant levels of radioactive daughters and show a gamma radiation reading during operation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon-enriched stream or containing internal deposits of radioactive material, due to the transmission of gamma radiation through its wall.

Field studies in the literature and conducted by company personnel at selected sites, have not shown any conditions that subject workers to cumulative exposures in excess of general population limits. Equipment emitting gamma radiation should be presumed to be internally contaminated with alpha-emitting decay products which may be a hazard if inhaled or ingested. During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow the gamma radiation to drop to background levels. Protective equipment E.G. coveralls, gloves and respirator (NIOSH/MSHA approved for high efficiency particulates and radionuclides, or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination, ingestion or inhalation of any residue containing alpha radiation. Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME,
AND IS BELIEVED TO BE ACCURATE BASED UPON THAT DATA. IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF
THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT
PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT
TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN
DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND YOU ARE ENCOURAGED TO
ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY
INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION
PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF EQUIVA SERVICES, LLC AND IS NOT TO BE
THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF EQUIVA SERVICES, LLC.

DATE: 1999-01-04

New
X Revised, Supersedes: 1996-12-19

INQUIRIES REGARDING MSDS SHOULD BE DIRECTED TO:

EQUIVA SERVICES, LLC
Manager, Product Stewardship
P.O. Box 674414
Houston, TX 77267-4414

17. PRODUCT LABEL

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

R1500 FUEL GAS-1, SOUR

WARNING STATEMENT:

DANGER!

FLAMMABLE GAS - MAY CAUSE FLASH FIRE
DELAYED EVAPORATION FROM CONTAMINATED CLOTHING MAY BE A FIRE HAZARD
MAY CAUSE DIZZINESS AND DROWSINESS
CONTAINS OR MAY RELEASE HYDROGEN SULFIDE GAS WHEN HEATED
GAS REDUCES OXYGEN AVAILABLE FOR BREATHING
GAS MAY ACCUMULATE IN CONFINED SPACES AND CAUSE SUFFOCATION
CAUSES EYE AND RESPIRATORY TRACT IRRITATION - CAN CAUSE DAMAGE TO RESPIRATORY TRACT

PRECAUTIONARY MEASURES:

-Keep away from heat, sparks or flame.
-Use only with adequate ventilation.
-H2S gas deadens sense of smell. Do not depend on odor to detect presence of gas.
-Do not enter storage areas or confined spaces unless adequately ventilated.
-Use supplied air respiratory protection for cleaning large spills or upon entry into tanks, vessels, or other confined spaces.
-Avoid breathing vapor, mist, or gas.
-Avoid contact with eyes.
-Rescue procedures should be attempted ONLY after notifying others of emergency and ONLY if appropriate personal equipment is available.
-Keep container closed.
-Wash thoroughly after handling.

FIRST AID:

EYE CONTACT: Immediately flush eyes with large amounts of running water for at least 15 minutes. Hold eyelids apart while flushing to rinse entire surface of eye and lids with water. Do not attempt to neutralize with chemical agents. Obtain medical attention immediately. Continue flushing for an additional 15 minutes if medical attention is not immediately available.

SKIN CONTACT:

Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

In case of cold burn, immediately place affected area in warm water (105 F) and keep at this temperature until circulation returns. Get medical attention.

If clothing becomes wetted, drench individual with water and remove contaminated clothing if possible. Slowly warm affected area of skin.

INGESTION: No emergency care anticipated. This material is a gas at standard temperature and pressure.

INHALATION: If inhaled, remove to fresh air. If not breathing or in respiratory distress, clear person's airway and start artificial respiration.

With a physician's advice, give supplemental oxygen using a bag-valve mask or manually triggered oxygen supply.

NOTE TO PHYSICIAN:

Overexposure to this material may sensitize the heart to catecholamine-induced arrhythmias. Do not administer catecholamines to overexposed individuals. Contact a Poison Control Center for further treatment information.

This material is an asphyxiant which may have anesthetic properties at high concentrations. If present in sufficient concentrations to reduce the oxygen level below 18% in inhaled air, rapid respiration, mental dullness, incoordination, poor judgement, nausea, and unconsciousness may result. Oxygen deficiency may occur without warning in areas where this gas may displace air.

Inhalation exposure may result in respiratory tract injury, the delayed onset of pulmonary edema, and may predispose patient to secondary respiratory infection. Persons exposed to high concentrations should be hospitalized for observation. Contact a Poison Center for additional treatment information.

FIRE: In case of fire, use dry chemical or carbon dioxide to extinguish flames. Use water spray to keep containers cool and protect personnel attempting to stop the flow of gas.

Chemical Name	CAS Number	Range in %
CONTAINS ONE OR MORE OF THE FOLLOWING:		
*Fuel gases, hydrotreater fractionation, scrubbed	68513-11-1	100.00
*Tail gas (petroleum), catalytic cracked refractionation absorber	68478-25-1	100.00
*Gases (petroleum), deethanizer overheads	68477-86-1	100.00
*Fuel gases, crude oil distillates	68476-29-9	100.00
*Natural gas, dried	68410-63-9	100.00
*Fuel gases, refinery	68308-27-0	100.00
*Tail gas (petroleum), gas recovery plant depropanizer overheads	68308-05-4	100.00
*Tail gas (petroleum), catalytic cracked distillate and catalytic cracked naphtha fraction absorber	68307-98-2	100.00

PRODUCT IS HAZARDOUS ACCORDING TO OSHA (1910.1200).

* COMPONENT IS HAZARDOUS ACCORDING TO OSHA.

Pennsylvania Special Hazardous Substance(s)	CAS Number	Range in %
None		

HMIS:

HEALTH: 3
FLAMMABILITY: 4
REACTIVITY: 0

SPECIAL: -

NFPA:

HEALTH: 2
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

TRANSPORTATION:

DOT:

PROPER SHIPPING NAME: Hydrocarbon gas, compressed, N.O.S
HAZARD CLASS: 2.1
IDENTIFICATION NUMBER: UN 1964
PACKING GROUP:
LABEL REQUIRED: Flammable gas

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

NAME AND ADDRESS:

EQUILON ENTERPRISES LLC
MOTIVA ENTERPRISES LLC
P.O. BOX 674414
HOUSTON, TX 77267-4414

TRANSPORTATION EMERGENCY: (877) 276-7283
CHEMTREC: (800) 424-9300

HEALTH EMERGENCY: (877) 276-7283

HAZMIN Version: / Last Edited on 7/11/2003

Report: 9/15/2008 10:15:05 AM

MATERIAL SAFETY DATA SHEET

Product: FUEL GAS-1, SWEET R1600
DCR Number: 508

Company Data

Company: Premcor Refining Group
1700 EAST PUTNAM AVENUE
SUITE 500
OLD GREENWICH, CT 06780
Emergency Phone: 800-424-9300
Information Phone: 618-254-7301
Fax: 314-854-1580

Manufacturer/Supplier: Premcor Refining Group
1700 East Putnam Avenue, Suite 500
Old Greenwich, CT 06780
Emergency: 877-276-7283
Information: 877-276-7285

Product Data

Manufacturer Product Code : R1500, R1500MT
Revised: 1/4/1999

Component Data

Component: FUEL GASES, CRUDE OIL DISTILLATES
Cas No: 68476299
Component Note: May contain
Percent: = 100.0

Component: TAIL GAS (PETROLEUM), PROPANE-PROPYLENE ALKYLATION FEED PREP DEETHANIZER
Cas No: 68308112
Component Note: May contain
Percent: = 100.0

Component: NATURAL GAS, DRIED
Cas No: 68410639

Component Note: May contain
Percent: = 100.0

Component: PETROLEUM PRODUCTS, LIQUEFIED GAS
Cas No: 68476857
Component Note: May contain
Percent: = 100.0
OSHA TWA (ppm): 1000
ACGIH TWA (ppm): 1000

Component: GASES (PETROLEUM), REFORMER EFFLUENT HIGH PRESSURE FLASH DRUM OFF
Cas No: 68513188
Component Note: May contain
Percent: = 100.0

Component: DISTILLATES (PETROLEUM), CATALYTIC REFORMED STRAIGHT RUN
Cas No: 68513633
Component Note: May contain
Percent: = 100.0

Component: GASES (PETROLEUM), C6-8 REFORMER RECYCLE, HYDROGEN-RICH
Cas No: 68477827
Component Note: May contain
Percent: = 100.0

Component: FUEL GASES, REFINERY
Cas No: 68308270
Component Note: May contain
Percent: = 100.0

Physical and Chemical Data

Boiling Point: = 31°F
Specific Gravity: = .58 (H2O=1)
Vapor Density: = 2.1 (Air=1)
Melt/Freeze Point: **NOTE:** Not applicable.
pH: **NOTE:** Not applicable.
Vapor Pressure: = 2 @ 66.0 (mm Hg) **NOTE:** mmHg
VOC Content: **NOTE:** Not determined.
Viscosity: (cst) **NOTE:** Not applicable.
Solubility in Water: .1 - 1%

Appearance/Odor: Colorless gas, Petroleum odor / Other: None
Physical State: Gas
Hazard Rating A: HMIS MFG. Rating: Health = 1 Flammability = 4 Reactivity = 0
Hazard Rating B: NFPA MFG. Rating: Health = 1 Flammability = 4 Reactivity = 0

Fire and DOT Data

Flash Point Closed: NOTE: Not applicable.
Flash Point Open: NOTE: Not applicable.
Auto Ignition: = 550°F
LEL/LFL: = 3 %
UEL/UFL: = 30 %
Preparer Information: Manager Product Stewardship

UN Number: 1964
DOT Class: 2.1
DOT Label: Flammable gas
Proper Shipping Name: Hydrocarbon gas, compressed, N.O.S.

1. NAME

MATERIAL IDENTITY:

PRODUCT CODE AND NAME: R1600 FUEL GAS-1, SWEET

CHEMICAL NAME AND/OR FAMILY OR DESCRIPTION: Petroleum Hydrocarbon Mixture

LEGEND:

N.D.: NOT DETERMINED
N.A.: NOT APPLICABLE
N.T.: NOT TESTED
<: LESS THAN
>: GREATER THAN

MOTIVA MSDS: R1600MT 01/04/99

TELEPHONE NUMBER:

24 HOUR EMERGENCY ASSISTANCE:

EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300

GENERAL MSDS ASSISTANCE: 877-276-7285

NAME AND ADDRESS:

MOTIVA ENTERPRISES LLC
PRODUCT STEWARDSHIP
P.O. BOX 674414
HOUSTON, TX 77267-4414

2. COMPOSITION/INFORMATION ON INGREDIENTS

SEE COMPONENT PAGE(S) FOR ADDITIONAL INFORMATION.

THE CRITERIA FOR LISTING COMPONENTS IN THE COMPOSITION SECTION IS AS FOLLOWS: CARCINOGENS ARE LISTED WHEN PRESENT AT 0.1 % OR GREATER; COMPONENTS WHICH ARE OTHERWISE HAZARDOUS ACCORDING TO OSHA ARE LISTED WHEN PRESENT AT 1.0 % OR GREATER; NON-HAZARDOUS COMPONENTS ARE LISTED AT 3.0 % OR GREATER. THIS IS NOT INTENDED TO BE A COMPLETE COMPOSITIONAL DISCLOSURE. REFER TO SECTION 14 FOR APPLICABLE STATES' RIGHT TO KNOW AND OTHER REGULATORY INFORMATION.

PRODUCT AND/OR COMPONENT(S) CARCINOGENIC ACCORDING TO:

OSHA	IARC	NTP	OTHER	NONE
			X	
—	—	—	—	—

COMPOSITION: (SEQUENCE NUMBER AND CHEMICAL NAME)

SEQ. CHEMICAL NAME

01 * Fuel gases, crude oil distillates
02 * Tail gas (petroleum), propane-propylene alkylation feed prep deethanizer
03 * Natural gas, dried
04 * Petroleum products, liquefied gas
05 * Gases (petroleum), reformer effluent high pressure flash drum off
06 * Distillates (petroleum), catalytic reformed straight run
07 * Gases (petroleum), C6-8 reformer recycle, hydrogen-rich
08 * Fuel gases, refinery

PRODUCT IS HAZARDOUS ACCORDING TO OSHA (1910,1200).
* COMPONENT IS HAZARDOUS ACCORDING TO OSHA.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW:

APPEARANCE: Colorless gas
ODOR: Petroleum odor

WARNING STATEMENT:

DANGER!

FLAMMABLE GAS - MAY CAUSE FLASH FIRE
DELAYED EVAPORATION FROM CONTAMINATED CLOTHING MAY BE A FIRE HAZARD
LIQUID MAY CAUSE FROSTBITE
MAY CAUSE DIZZINESS AND DROWSINESS
GAS REDUCES OXYGEN AVAILABLE FOR BREATHING
GAS MAY ACCUMULATE IN CONFINED SPACES AND CAUSE SUFFOCATION

HMIS:

HEALTH: 1
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

NFPA:

HEALTH: 1
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

POTENTIAL HEALTH EFFECTS:

	EYE	SKIN	INHALATION	INGESTION
PRIMARY ROUTE OF EXPOSURE:	X	X	X	

EFFECTS OF OVEREXPOSURE:

ACUTE:

EYES:

May cause minimal irritation, experienced as temporary discomfort.

Eye contact with liquid product or gas under pressure can cause frostbite (cold burns).

SKIN:

Brief contact is not irritating.
Product is a gas - not expected to be absorbed through the skin.
Skin contact with liquid product can cause frostbite (cold burns).

INHALATION:

Gas may be irritating and cause discomfort in nose and throat, nasal discharge, and coughing. Prolonged overexposure may cause difficulty breathing.

Inhalation may cause dizziness, drowsiness, euphoria, loss of coordination, disorientation, headache, nausea, and vomiting. In poorly ventilated areas or confined spaces, unconsciousness and asphyxiation may result.

INGESTION:

Product is a gas - not expected to cause toxic effects due to ingestion.

This material is a gas. Gas or liquid under pressure may cause frostbite (cold burns).

SENSITIZATION PROPERTIES: Unknown.

CHRONIC: No adverse effects have been documented in humans as a result of chronic exposure. Section 11 may contain applicable animal data.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: There is no evidence that this product aggravates an existing medical condition.

OTHER REMARKS: None

4. FIRST AID MEASURES

EYES: Flush eyes with plenty of water for several minutes. Get medical attention if eye irritation persists.

SKIN:

Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

In case of cold burn, immediately place affected area in warm water (105 F) and keep at this temperature until circulation returns. Get medical attention.

If clothing becomes wetted, drench individual with water and remove contaminated clothing if possible. Slowly warm affected area of skin.

INGESTION: No emergency care anticipated. This material is a gas at standard temperature and pressure.

INHALATION: If inhaled, remove to fresh air. If not breathing, clear person's airway and give artificial respiration. If breathing is difficult, qualified medical personnel may administer oxygen. Get medical attention immediately.

OTHER INSTRUCTIONS:

Overexposure to this material may sensitize the heart to catecholamine-induced arrhythmias. Do not administer catecholamines to overexposed individuals. Contact a Poison Control Center for further treatment information.

This material is an asphyxiant which may have anesthetic properties at high concentrations. If present in sufficient concentrations to reduce the oxygen level below 18% in inhaled air, rapid respiration, mental dullness, incoordination, poor judgement, nausea, and unconsciousness may result. Oxygen deficiency may occur without warning in areas where this gas may displace air.

5. FIRE-FIGHTING MEASURES

IGNITION TEMPERATURE - AIT (DEGREES F): 550

FLASH POINT (DEGREES F): Not applicable.

FLAMMABLE LIMITS (%):

LOWER: 3
UPPER: 30

RECOMMENDED FIRE EXTINGUISHING AGENTS AND SPECIAL PROCEDURES: Fight fire from protected location or maximum possible distance. Stop flow of gas before attempting to extinguish flames. Use water spray to cool fire-exposed containers and to protect persons attempting to stop the flow of gas. Use

flooding quantities of water as fog or spray. Use dry chemical or carbon dioxide to extinguish flames.

UNUSUAL OR EXPLOSIVE HAZARDS: Explosive air-vapor mixtures may form.

Danger! Readily forms explosive air-vapor mixtures; may release explosive vapors that travel, be ignited at remote locations, and flash back. Containers may explode in fire. Do not expose to heat, sparks, flame, static, or other sources of ignition. When handling, use non-sparking tool, ground and bond all containers.

EXTINGUISHING MEDIA WHICH MUST NOT BE USED: Not determined.

SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS: Wear full protective clothing and positive pressure breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

(TRANSPORTATION SPILLS: CHEMTREC (800) 424-9300)

PROCEDURES IN CASE OF ACCIDENTAL RELEASE, BREAKAGE OR LEAKAGE: Eliminate all ignition sources including internal combustion engines and power tools. Ventilate area. Barricade the immediate hazard area. Stay upwind and warn of possible downwind explosion hazard. Avoid breathing vapor. Avoid contact with skin, eyes, or clothing. Pressure demand air supplied respirators should always be worn when the airborne concentration of the contaminant or oxygen is unknown. Otherwise, wear respiratory protection and other personal protective equipment as appropriate for the potential exposure hazard. Contain spill if possible. Remove with inert absorbent. Prevent entry into sewers and waterways.

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN:

HANDLING: Use spark-proof tools. Material may be at elevated temperatures and/or pressures. Exercise care when opening bleeders and sampling ports. Minimum feasible handling temperatures should be maintained. Material can be at elevated temperatures and/or pressures. Exercise care when opening bleeders and sampling ports. Avoid generating mist or dust.

STORAGE: Ground and bond shipping container, transfer line, and receiving container. Keep away from heat, sparks, flame, and other sources of ignition. Periods of exposure to high temperatures should be minimized.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

PROTECTIVE EQUIPMENT (TYPE):

EYE/FACE PROTECTION: Safety glasses, chemical type goggles, or face shield recommended to prevent eye contact.

SKIN PROTECTION: Protective clothing such as coveralls or lab coats should be worn. Launder or dry-clean when soiled. Gloves and boots resistant to chemicals and petroleum distillates required. Insulated gloves also required if contact with liquid-cooled product or equipment is expected.

RESPIRATORY PROTECTION: Airborne concentrations should be kept to lowest levels possible. If vapor, mist or dust is generated and the occupational exposure limit of the product, or any component of the product, is exceeded, use appropriate NIOSH or MSHA approved air purifying or air supplied respirator after determining the airborne concentration of the contaminant. Air supplied respirators should always be worn when airborne concentration of the contaminant or oxygen content is unknown.

VENTILATION: Adequate to meet component occupational exposure limits (see Section 2).

EXPOSURE LIMIT FOR TOTAL PRODUCT:

None established; considered to be a simple asphyxiant.

Simple asphyxiant - has poor warning properties and can displace air causing an oxygen deficiency. Maintain 19.5% oxygen (by volume) in confined spaces.

9. PHYSICAL AND CHEMICAL PROPERTIES

SEE DATA PAGES FOR ADDITIONAL INFORMATION.

10. STABILITY AND REACTIVITY

THIS MATERIAL REACTS VIOLENTLY WITH: (If Others is checked below, see comments for details)

Air	Water	Heat	Strong Oxidizers	Others	None of These
		X	X		

COMMENTS: None

PRODUCTS EVOLVED WHEN SUBJECTED TO HEAT OR COMBUSTION: Toxic levels of carbon monoxide, carbon dioxide, irritating aldehydes and ketones.

HAZARDOUS POLYMERIZATIONS: DO NOT OCCUR

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION(ANIMAL TOXICITY DATA):

Median Lethal Dose:

ORAL: Not applicable; material is a gas.
INHALATION: Not determined.
DERMAL: Not applicable.

IRRITATION INDEX, ESTIMATION OF IRRITATION (SPECIES):

SKIN: (Draize) Believed to be < .50 /8.0 (rabbit) no appreciable effect
EYES: (Draize) Believed to be < 15.00 /110 (rabbit) no appreciable effect
SENSITIZATION: Not determined.

OTHER: None

12. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHODS: This product (as presently constituted) has the RCRA characteristics of ignitability, and, if discarded in its present form, would have the hazardous waste number of D001. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc. may change the classification to non-hazardous, or hazardous for reasons other than, or in addition to ignitability.

REMARKS: Do not allow to enter drains or sewers. Can cause explosion.

13. TRANSPORT INFORMATION

TRANSPORTATION:

DOT:

PROPER SHIPPING NAME: Hydrocarbon gas, compressed, N.O.S
HAZARD CLASS: 2.1
IDENTIFICATION NUMBER: UN 1964
PACKING GROUP:
LABEL REQUIRED: Flammable gas

IMDG:

PROPER SHIPPING NAME: Not evaluated

ICAO:

PROPER SHIPPING NAME: Not evaluated

TDG:

PROPER SHIPPING NAME: Not evaluated

14. REGULATORY INFORMATION

FEDERAL REGULATIONS:

SARA TITLE III:

SECTION 302/304 EXTREMELY HAZARDOUS SUBSTANCES:

Seq.	Chemical Name	CAS Number	Range in %	TPQ	RQ
None					

SECTION 311 HAZARDOUS CATEGORIZATION:

Acute	Chronic	Fire	Pressure	Reactive	N/A
	X	X			

SECTION 313 TOXIC CHEMICAL:

Chemical Name	CAS Number	Concentration
None		

CERCLA 102(a)/DOT HAZARDOUS SUBSTANCES: (+ INDICATES DOT HAZARDOUS SUBSTANCE)

Seq.	Chemical Name	CAS Number	Range in %
None			

CERCLA/DOT HAZARDOUS SUBSTANCES (SEQUENCE NUMBERS AND RQ'S):

Seq.	RQ
None	

TSCA INVENTORY STATUS: This product, or its components, are listed on or are exempt from the Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

OTHER: None.

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65: The following detectable components of this product are substances, or belong to classes of substances, known to the State of California to cause cancer and/or reproductive toxicity.

Chemical Name	CAS Number
None	

INTERNATIONAL REGULATIONS:

WHMIS CLASSIFICATION: Not determined

CANADA INVENTORY STATUS: Not determined.

EINECS INVENTORY STATUS: This product, or its components, are listed on or are exempt from the European Inventory of Existing Chemical Substances (EINECS) or the European List of Notified Chemical Substances (ELINCS).

AUSTRALIA INVENTORY STATUS: This product, or its components, are listed on or are exempt from the Australian Inventory of Chemical Substances (AICS).

JAPAN INVENTORY STATUS: Not determined.

15. ENVIRONMENTAL INFORMATION

AQUATIC TOXICITY: Not determined.

MOBILITY: Not determined.

PERSISTENCE AND BIODEGRADABILITY: Not determined.

POTENTIAL TO BIOACCUMULATE: Not determined.

REMARKS: None

16. OTHER INFORMATION

Dispose of as a vapor, venting to suitable combustion chamber.

The information below is given to call attention to the issue of "naturally occurring radioactive materials". Although radon-222 levels in this product do not present any direct radon exposure, customers should be aware of the potential of radon daughter product buildup within their processing streams whatever the source of their product streams. Radon-222 is a naturally occurring radioactive gas which can be a contaminant in natural gas. During subsequent processing, radon tends to be concentrated in the liquified petroleum gas stream and in product streams having a similar boiling point range. Industry experience has shown that this product may contain small amounts of radon-222 and its radioactive decay products, called radon "daughters". The actual concentration of Radon-222 and radioactive daughters in the process equipment (IE lines, filters, pumps and reactor units) may accumulate significant levels of radioactive daughters and show a gamma radiation reading during operation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon-enriched stream or containing internal deposits of radioactive material, due to the transmission of gamma radiation through its wall.

Field studies in the literature and conducted by company personnel at selected sites, have not shown any conditions that subject workers to cumulative exposures in excess of general population limits. Equipment emitting gamma radiation should be presumed to be internally contaminated with alpha-emitting decay products which may be a hazard if inhaled or ingested. During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow the gamma radiation to drop to background levels. Protective equipment E.G. coveralls, gloves and respirator (NIOSH/MSHA approved for high efficiency particulates and radionuclides, or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination, ingestion or inhalation of any residue containing alpha radiation. Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

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DATE: 1999-01-04

New
X Revised, Supersedes: 1997-03-24

INQUIRIES REGARDING MSDS SHOULD BE DIRECTED TO:

EQUIVA SERVICES, LLC
Manager, Product Stewardship
P.O. Box 674414
Houston, TX 77267-4414

17. PRODUCT LABEL

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

R1600 FUEL GAS-1, SWEET

WARNING STATEMENT:

DANGER!

FLAMMABLE GAS - MAY CAUSE FLASH FIRE
DELAYED EVAPORATION FROM CONTAMINATED CLOTHING MAY BE A FIRE HAZARD
LIQUID MAY CAUSE FROSTBITE
MAY CAUSE DIZZINESS AND DROWSINESS
GAS REDUCES OXYGEN AVAILABLE FOR BREATHING
GAS MAY ACCUMULATE IN CONFINED SPACES AND CAUSE SUFFOCATION

PRECAUTIONARY MEASURES:

-Keep away from heat, sparks or flame.
-Use only with adequate ventilation.
-Do not enter storage areas or confined spaces unless adequately ventilated.
-Use supplied air respiratory protection for cleaning large spills or upon

entry into tanks, vessels, or other confined spaces.
-Avoid breathing vapor, mist, or gas.
-Rescue procedures should be attempted ONLY after notifying others of emergency and ONLY if appropriate personal equipment is available.
-Wear insulated gloves if contact with liquid cooled equipment is expected.
-Keep container closed.
-Workers should wash exposed skin several times daily with soap and water.

FIRST AID:

EYE CONTACT: Flush eyes with plenty of water for several minutes. Get medical attention if eye irritation persists.

SKIN CONTACT:

Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

In case of cold burn, immediately place affected area in warm water (105 F) and keep at this temperature until circulation returns. Get medical attention.

If clothing becomes wetted, drench individual with water and remove contaminated clothing if possible. Slowly warm affected area of skin.

INGESTION: No emergency care anticipated. This material is a gas at standard temperature and pressure.

INHALATION: If inhaled, remove to fresh air. If not breathing, clear person's airway and give artificial respiration. If breathing is difficult, qualified medical personnel may administer oxygen. Get medical attention immediately.

NOTE TO PHYSICIAN:

Overexposure to this material may sensitize the heart to catecholamine-induced arrhythmias. Do not administer catecholamines to overexposed individuals. Contact a Poison Control Center for further treatment information.

This material is an asphyxiant which may have anesthetic properties at high concentrations. If present in sufficient concentrations to reduce the oxygen level below 18% in inhaled air, rapid respiration, mental dullness, incoordination, poor judgement, nausea, and unconsciousness may result. Oxygen deficiency may occur without warning in areas where this gas may displace air.

FIRE: In case of fire, use dry chemical or carbon dioxide to extinguish flames. Use water spray to keep containers cool and protect personnel attempting to stop the flow of gas.

Chemical Name	CAS Number	Range in %
CONTAINS ONE OR MORE OF THE FOLLOWING:		
*Distillates (petroleum), catalytic reformed straight run	68513-63-3	100.00
*Gases (petroleum), reformer effluent high pressure flash drum off	68513-18-8	100.00

*Gases (petroleum), C6-8 reformer recycle, hydrogen-rich	68477-82-7	100.00
*Petroleum products, liquefied gas	68476-85-7	100.00
*Fuel gases, crude oil distillates	68476-29-9	100.00
*Natural gas, dried	68410-63-9	100.00
*Fuel gases, refinery	68308-27-0	100.00
*Tail gas (petroleum),propane-propylene alkylation feed prep deethanizer	68308-11-2	100.00

PRODUCT IS HAZARDOUS ACCORDING TO OSHA (1910.1200).

* COMPONENT IS HAZARDOUS ACCORDING TO OSHA.

Pennsylvania Special Hazardous Substance(s)	CAS Number	Range in %
None		

HMIS:

HEALTH: 1
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

NFPA:

HEALTH: 1
FLAMMABILITY: 4
REACTIVITY: 0
SPECIAL: -

TRANSPORTATION:

DOT:

PROPER SHIPPING NAME: Hydrocarbon gas, compressed, N.O.S
HAZARD CLASS: 2.1
IDENTIFICATION NUMBER: UN 1964
PACKING GROUP:
LABEL REQUIRED: Flammable gas

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

NAME AND ADDRESS:

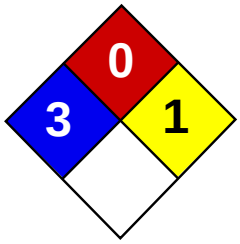
EQUILON ENTERPRISES LLC
MOTIVA ENTERPRISES LLC
P.O. BOX 674414
HOUSTON, TX 77267-4414

TRANSPORTATION EMERGENCY: (877) 276-7283
CHEMTREC: (800) 424-9300

HEALTH EMERGENCY: (877) 276-7283

HAZMIN Version: 4 / Last Edited on 7/11/2003

Report: 8/17/2011 11:00:30 AM



Material Safety Data Sheet
Sodium Hydroxide, 50% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Hydroxide, 50%

Catalog Codes: SLS3127, SLS4549

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Sodium hydroxide; Water

CI#: Not applicable.

Synonym: Sodium Hydroxide, 50% Solution

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hydroxide	1310-73-2	50
Water	7732-18-5	50

Toxicological Data on Ingredients: Sodium hydroxide LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation

leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention immediately. Finish by rinsing thoroughly with running water to avoid a possible infection.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Sodium hydroxide reacts to form explosive products with ammonia + silver nitrate. Benzene extract of allyl benzenesulfonate prepared from allyl alcohol, and benzene sulfonyl chloride in presence of aquesous sodium hydroxide, under vacuum distillation, residue darkened and exploded. Sodium Hydroxde + impure tetrahydrofuran, which can contain peroxides, can cause serious explosions. Dry mixtures of sodium hydroxide and sodium tetrahydroborate liberate hydrogen explosively at 230-270 deg. C. Sodium Hydroxide reacts with sodium salt of trichlorophenol + methyl alcohol + trichlorobenzene + heat to cause an explosion. (Sodium hydroxide)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, metals, acids, alkalis, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Sodium hydroxide STEL: 2 (mg/m3) from ACGIH (TLV) [United States] TWA: 2 CEIL: 2 (mg/m3) from OSHA (PEL) [United States] CEIL: 2 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Odorless.

Taste: Alkaline. Bitter. (Strong.)

Molecular Weight: Not applicable.

Color: Clear Colorless.

pH (1% soln/water): Basic.

Boiling Point: 140°C (284°F)

Melting Point: 12°C (53.6°F)

Critical Temperature: Not available.

Specific Gravity: 1.53 (Water = 1)

Vapor Pressure: The highest known value is 2.3 kPa (@ 20°C) (Water).

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, water/moisture

Incompatibility with various substances:
Reactive with oxidizing agents, reducing agents, metals, acids, alkalis. Slightly reactive with water

Corrosivity:
Extremely corrosive in presence of aluminum, brass. Corrosive in presence of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Hygroscopic. Much heat is evolved when solid material is dissolved in water. Therefore cold water and caution must be used for this process. Generates considerable heat when a sodium hydroxide solution is mixed with an acid Sodium hydroxide solution and octanol + diborane during a work-up of a reaction mixture of oxime and diborane in tetrahyrofuran is very exothermic, a mild explosion being noted on one occassion. Reactive with water, acids (mineral, non-oxidizing, e.g. hydrochloric, hydrofluoric acid, muriatic acid, phosphoric), acids (mineral, oxidizing e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, foraldehyde), carbamates (e.g. carbanolate, carbofuran), esters (e.g. butyl acetate, ethyl acetate, propyl formate), halogenated organics (dibromoethane, hexachlorobenzene, methyl chloride, trichloroethylene), isocyanates (e.g. methyl isocyanate), ketones (acetone, acetophenone, MEK, MIBK), acid chlorides, strong bases, strong oxidizing agents, strong reducing agents, flammable liquids, powdered metals and metals (i.e aluminum, tin, zinc, hafnium, raney nickel), metals (alkali and alkaline e.g. cesium, potassium, sodium), metal compounds (toxic e.g. berylium, lead acetate, nickel carbonyl, tetraethyl lead), mitrides (e.g. potassium nitride, sodium nitride), nitriles (e.g. acetonitrile, methyl cyanide), nitro compounds (organic e.g. nitrobenzene, nitromethane), acetic anhydride, hydroquinone, chlorohydrin, chlorosulfonic acid, ethylene cyanohydrin, glyoxal, hydrosulfuric acid, oleum, propiolactone, acylonitrile, phorosous pentoxide, chloroethanol, chloroform-methanol, tetrahydroborate, cyanogen azide, 1,2,4,5 tetrachlorobenzene, cinnamaldehyde. Reacts with formaldehyde hydroxide to yield formic acid, and hydrogen. (Sodium hydroxide)

Special Remarks on Corrosivity: Very caustic to aluminum and other metals in presence of moisture.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Investigation as a mutagen (cytogenetic analysis), but no data available. (Sodium hydroxide)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May be harmful if absorbed through skin. Causes severe skin irritation and burns. May cause deep penetrating ulcers of the skin. Eyes: Causes severe eye irritation and burns. May cause chemical conjunctivitis and corneal damage. Inhalation: Harmful if inhaled. Causes severe irritation of the respiratory tract and mucous membranes with coughing, burns, breathing difficulty, and possible coma. Irritation may lead the chemical pneumonitis and pulmonary edema. Causes chemical burns to the respiratory tract and mucous membranes. Ingestion: May be fatal if swallowed. May cause severe and permanent damage to the digestive tract. Causes

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Sodium hydroxide, solution (Sodium hydroxide) UNNA: UN1824 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sodium hydroxide Illinois chemical safety act: Sodium hydroxide New York release reporting list: Sodium hydroxide Rhode Island RTK hazardous substances: Sodium hydroxide Pennsylvania RTK: Sodium hydroxide Minnesota: Sodium hydroxide Massachusetts RTK: Sodium hydroxide New Jersey: Sodium hydroxide Louisiana spill reporting: Sodium hydroxide TSCA 8(b) inventory: Sodium hydroxide; Water CERCLA: Hazardous substances.: Sodium hydroxide: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

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

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Material Safety Data Sheet

Sulfur Dioxide

Section 1. Chemical product and company identification

Product name : Sulfur Dioxide

Supplier : AIRGAS INC., on behalf of its subsidiaries
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Product use : Synthetic/Analytical chemistry.

Synonym : Sulfurous acid anhydride; Fermenicide powder; Fermenticide liquid; Sulfur oxide (SO2); Sulfurous anhydride; Sulfurous oxide; SO2; Sulphur dioxide; Fermenicide liquid; Schwefeldioxyd; Siarki dwutlenek; Sulfur oxide; UN 1079; Oxosulfane oxide

MSDS # : 001047

Date of Preparation/Revision : **3/20/2012.**

In case of emergency : 1-866-734-3438

Section 2. Hazards identification

Physical state : Gas. [COLORLESS LIQUEFIED COMPRESSED GAS WITH A SHARP IRRITATING ODOR. [NOTE: A LIQUID BELOW 14 F. SHIPPED AS A LIQUEFIED COMPRESSED GAS.]

Emergency overview : DANGER!

CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

Do not puncture or incinerate container. Do not breathe gas. Do not get on skin or clothing. Use only with adequate ventilation. Keep container closed. Wash thoroughly after handling.

Contact with rapidly expanding gases can cause frostbite.

Target organs : May cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.

Routes of entry : Inhalation Dermal Eyes

Potential acute health effects

Eyes : Severely corrosive to the eyes. Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.

Skin : Severely corrosive to the skin. Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : Severely corrosive to the respiratory system.

Ingestion : Ingestion is not a normal route of exposure for gases

Potential chronic health effects

Target organs : May cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Sulfur Dioxide	7446-09-5	100	**ACGIH TLV (United States, 1/2009).** STEL: 0.25 ppm 15 minute(s). **OSHA PEL 1989 (United States, 3/1989).** TWA: 2 ppm 8 hour(s). TWA: 5 mg/m³ 8 hour(s). STEL: 5 ppm 15 minute(s). STEL: 10 mg/m³ 15 minute(s). **NIOSH REL (United States, 6/2009).** TWA: 2 ppm 10 hour(s). TWA: 5 mg/m³ 10 hour(s). STEL: 5 ppm 15 minute(s). STEL: 13 mg/m³ 15 minute(s). **OSHA PEL (United States, 11/2006).** TWA: 5 ppm 8 hour(s). TWA: 13 mg/m³ 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product : Non-flammable.

Products of combustion : Decomposition products may include the following materials:
sulfur oxides

Fire-fighting media and instructions : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

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

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling : Use only with adequate ventilation. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Storage : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

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

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

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

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

Personal protection in case of a large spill : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name

sulphur dioxide

ACGIH TLV (United States, 1/2009).
STEL: 0.25 ppm 15 minute(s).
OSHA PEL 1989 (United States, 3/1989).
TWA: 2 ppm 8 hour(s).
TWA: 5 mg/m³ 8 hour(s).
STEL: 5 ppm 15 minute(s).
STEL: 10 mg/m³ 15 minute(s).
NIOSH REL (United States, 6/2009).
TWA: 2 ppm 10 hour(s).
TWA: 5 mg/m³ 10 hour(s).
STEL: 5 ppm 15 minute(s).
STEL: 13 mg/m³ 15 minute(s).
OSHA PEL (United States, 11/2006).
TWA: 5 ppm 8 hour(s).
TWA: 13 mg/m³ 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight : 64.06 g/mole

Molecular formula : O2-S

Boiling/condensation point : -10°C (14°F)

Melting/freezing point : -75.6°C (-104.1°F)

Critical temperature : 156.9°C (314.4°F)

Vapor pressure : 34 (psig)

Vapor density : 2.2 (Air = 1)

Specific Volume (ft^3/lb) : 5.9172

Gas Density (lb/ft^3) : 0.169

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: alkalis and moisture. Reactive or incompatible with the following materials: metals.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

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

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
sulphur dioxide	LC50 Inhalation Gas.	Mouse	3000 ppm	0.5 hours
	LC50 Inhalation Gas.	Rat	2520 ppm	1 hours
	LC50 Inhalation Gas.	Rat	2520 ppm	1 hours

IDLH : 100 ppm

Chronic effects on humans : **CARCINOGENIC EFFECTS**: A4 (Not classifiable for humans or animals.) by ACGIH, 3 (Not classifiable for humans.) by IARC.
May cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.

Other toxic effects on humans : Hazardous by the following route of exposure: of skin contact (corrosive), of eye contact (corrosive), of inhalation (lung corrosive).

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation :

Environmental fate : Not available.

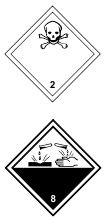
Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1079	SULFUR DIOXIDE	2.3	Not applicable (gas).		**Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: Forbidden. **Special provisions** 3, B14, T50, TP19
TDG Classification	UN1079	SULFUR DIOXIDE; OR SULPHUR DIOXIDE	2.3	Not applicable (gas).		**Explosive Limit and Limited Quantity Index** 0 **ERAP Index** 500 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** Forbidden
Mexico Classification	UN1079	SULFUR DIOXIDE	2.3	Not applicable (gas).		-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States

U.S. Federal regulations :

United States inventory (TSCA 8b): This material is listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: sulphur dioxide
SARA 302/304 emergency planning and notification: sulphur dioxide
SARA 302/304/311/312 hazardous chemicals: sulphur dioxide
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: sulphur dioxide: Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: sulphur dioxide

State regulations :

Connecticut Carcinogen Reporting: This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is listed.
New York Acutely Hazardous Substances: This material is listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada) :

Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements :

CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

Canada

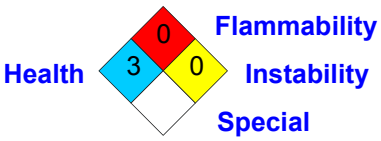
Label requirements :

Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material

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

Health	*	3
Flammability		0
Physical hazards		0

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



Notice to reader

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

The MSDS format adheres to U.S. standards and regulatory requirements and may not meet regulatory requirements in other countries.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience are gained.

SPENT CONDENSATE

7111004 Revised 19-OCT-1996 Printed 6-MAR-2000

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Grade : WASTE

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-441-7515
Transport Emergency : CHEMTREC 1-800-424-9300
Medical Emergency : 1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
SULFURIC ACID	7664-93-9	2-15
DISSOLVED SO2	7446-09-5	NIL
SOLIDS		TRACE
WATER	7732-18-5	BALANCE

HAZARDS IDENTIFICATION

Potential Health Effects

There is no information given on this mixture. Health Hazard information for individual components are given below.

SULFUR DIOXIDE:

Highly toxic by acute inhalation. Human LCLo: 400 ppm,

1 minutes. Human TCLo: 3 ppm, 5 days, pulmonary irritation

Sulfur dioxide is an irritant of the eyes, skin and mucous membranes. Tests in bacterial and mammalian cells indicate mutagenicity. Tests in some animals demonstrate equivocal tumorigenic activity. Animal tests indicate no reproductive toxicity. No test results for embryotoxicity are available.

Human health effects of overexposure by inhalation or skin or eye contact may include irritation of the upper respiratory tract, temporary lung irritation effects with cough, discomfort, difficulty breathing, or shortness of breath; skin irritation with discomfort or rash; eye irritation with discomfort, tearing, or blurred vision. Severe exposure may cause possibly modest initial symptoms, followed in hours by severe shortness of breath requiring prompt medical attention.

Individuals with pre-existing diseases of the lungs or skin may be more susceptible to the effects of excessive exposure

SULFURIC ACID:

Inhalation: 1 Hr. LC50, Rats; 347 ppm
Oral: LD50, Rats; 2140 mg/kg

Corrosive to eyes and skin in animals. Toxic effects of respiration include irritation and corrosion of mucosal surfaces. Toxic effects of ingestion include neurologic and non-specific effects such as weight loss and irritation.

Human health effects of overexposure include eye irritation with discomfort, tearing or blurring of vision, skin irritation with discomfort or rash, irritation of the upper respiratory passages, or erosion of dental surfaces. Higher exposures may lead to eye corrosion with corneal or conjunctival ulceration, skin burns or ulceration, temporary lung irritation effects with cough, discomfort, and difficulty breathing, requiring prompt medical attention. Individuals with preexisting diseases of the lungs may have increased susceptibility to the toxicity of excessive exposure.

The International Agency for Research on Cancer (IARC) classified "strong inorganic acid mists containing sulfuric acid" as a Category 1 carcinogen, a substance that is "carcinogenic to humans". This classification is for inorganic acid mists only and does not apply to sulfuric acid or sulfuric acid solutions. The basis for the IARC classification rests on several epidemiology studies which have several deficiencies. These studies did not account for exposure to other substances, some known to be animal or potential human carcinogens, social influences (smoking or alcohol consumption), and included small numbers of subjects. Based on the overall weight of evidence from all human and chronic animal studies, no definitive causal relationship between sulfuric acid mist exposure and respiratory tract cancer has been shown.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

In case of contact, immediately flush skin with plenty of water for at least 15 minutes, while removing contaminated clothing and shoes. Call a physician. Wash contaminated clothing before reuse.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

If swallowed, do not induce vomiting. Immediately give 2 glasses of water. Never give anything by mouth to an unconscious person. Call a physician.

Notes to Physicians

Activated charcoal mixture may be administered. To prepare activated charcoal mixture, suspend 50 grams activated charcoal in 400 mL water and mix thoroughly. Administer 5 mL/kg, or 350 mL for an average adult.

FIRE FIGHTING MEASURES

Flammable Properties

Will not burn.

Fire and Explosion Hazards:

Will not burn.

Extinguishing Media

Will not burn - use media appropriate for surrounding fire.

Fire Fighting Instructions

None - will not burn.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Spill Clean Up

Neutralize with soda ash.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing vapors or mist. Do not store or consume food, drink or tobacco in areas where they may become contaminated with this material.

Handling (Physical Aspects)

Keep away from heat, sparks and flames.

Storage

Keep container in a cool place.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use a totally enclosed system.

Personal Protective Equipment

Eye/Face	: Coverall chemical splash goggles.
Protective Gloves	: Butyl, Neoprene or PVC.

Exposure Guidelines

Applicable Exposure Limits

SULFURIC ACID		
PEL	(OSHA)	: 1 mg/m3, 8 Hr. TWA
TLV	(ACGIH)	: 1 mg/m3, 8 Hr. TWA, A2 STEL 3 mg/m3, A2 A2 (Sulfuric acid contained in strong inorganic acid mists)
AEL *	(DuPont)	: 1 mg/m3, 8 & 12 Hr. TWA 3 mg/m3, 15 minute TWA
DISSOLVED SO2		
PEL	(OSHA)	: 5 ppm, 13 mg/m3, 8 Hr. TWA
TLV	(ACGIH)	: 2 ppm, 5.2 mg/m3, 8 Hr. TWA, A4 STEL 5 ppm, 13 mg/m3, A4
AEL *	(DuPont)	: 2 ppm, 8 Hr. TWA 5 ppm, 15 minute TWA

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: 100 C (212 F) @ 760 mm Hg
% Volatiles	: 100 WT%
Evaporation Rate	: GT .1 0

Odor	: Pungent and Acrid
Form	: Liquid
Color	: Colorless

Physical Hazards

May cause thermal burns.

STABILITY AND REACTIVITY

Chemical Stability

Stable.

Incompatibility with Other Materials

None reasonably foreseeable.

Decomposition

Decomposition will not occur.

Polymerization

Polymerization will not occur.

DISPOSAL CONSIDERATIONS

Waste Disposal

Incinerate material in accordance with Federal, State/Provincial and Local requirements. Do not incinerate in closed containers. Neutralize chemical with da ash.

Flush to neutralization pond.

OTHER INFORMATION

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS	: H. J. WILCOX
Address	: E. I. DuPONT C & P BURNSIDE, LA.
Telephone	: 504-473-8618

# Indicates updated section.

End of MSDS

Sulfuric Acid (77 to 100%)

Version 4.0

Revision Date 07/28/2016 Ref. 150000002271

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Sulfuric Acid (77 to 100%)
Product Use	:	Raw material, Manufacture of inorganic basic chemicals, Catalyst for oil refining industry, For the manufacturing of pharmaceutical products., Textile products (incl. nonwoven fabric processing) - Bleaching agents, discharging agents, Paper and board products - Bleaching agents, stabilizers for bleaching bath, Chemical plating of metals
Restrictions on use	:	Not to be used as a biocidal product., Not to be used as a drain cleaner., Not to be used as a direct component of a cleaning product., Not to be used for cleaning sludge out of oil tanks.
Manufacturer/Supplier	:	Veolia North America Regeneration Services LLC 4760 World Houston Pkwy, Ste 100 Houston, TX 77032 United States of America The Chemours Company FC, LLC 1007 Market Street Wilmington, DE 19898 United States of America
Product Information	:	1-844-773-CHEM (outside the U.S. 1-302-773-1000)
Medical Emergency	:	1-866-595-1473 (outside the U.S. 1-302-773-2000)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Product hazard category

Acute toxicity (Inhalation)	Category 1
Acute toxicity (Dermal)	Category 4
Skin corrosion	Category 1A
Serious eye damage/eye irritation	Category 1

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Carcinogenicity	Category 2
Specific target organ toxicity - single exposure	Category 1
Specific target organ toxicity - repeated exposure	Category 1

Label content

Pictogram :

Signal word : Danger

Hazardous warnings : Harmful in contact with skin.
Causes severe skin burns and eye damage.
Fatal if inhaled.
Suspected of causing cancer.
Causes damage to organs. (Respiratory system)
Causes damage to organs through prolonged or repeated exposure. (Respiratory system)

Hazardous prevention measures : Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
Use personal protective equipment as required.
Wear respiratory protection.
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF exposed: Call a POISON CENTER or doctor/ physician.
Immediately call a POISON CENTER/doctor.
Wash contaminated clothing before reuse.
Store in a well-ventilated place. Keep container tightly closed.
Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

Other hazards
No applicable data available.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Sulfuric Acid	7664-93-9	77 - 100 %
Water	7732-18-5	0 - 23 %

Sulfuric Acid (77 to 100%)

Version 4.0

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SECTION 4. FIRST AID MEASURES

General advice	:	When symptoms persist or in all cases of doubt seek medical advice.
Inhalation	:	Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Skin contact	:	Wash off with plenty of water. Remove contaminated clothing and shoes. Consult a physician. Wash contaminated clothing before re-use. Discard contaminated shoes.
Eye contact	:	Immediately flush eyes for at least 15 minutes. Get medical attention.
Ingestion	:	Do NOT induce vomiting. Immediately give large quantities of water to drink. Call a physician immediately. Never give anything by mouth to an unconscious person.
Most important symptoms/effects, acute and delayed	:	No applicable data available.
Protection of first-aiders	:	If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Notes to physician	:	No applicable data available.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	The product itself does not burn., Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	None known.
Specific hazards	:	Does not readily burn or support combustion.

Special protective equipment for firefighters	:	No applicable data available.
Further information	:	Do not get water inside any containers.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	:	Use personal protective equipment. Keep people away from and upwind of spill/leak.
Environmental precautions	:	Try to prevent the material from entering drains or water courses.
Spill Cleanup	:	Clean-up methods - small spillage Soak up with sand, oil dry, or other noncombustible absorbent materials. Clean-up methods - large spillage Dam up. Carefully apply fine water mist or mid-expansion foam to slowly dilute to non-fuming sulfuric acid. This process may release sulfuric acid mists into the air. Neutralize with: lime soda ash other alkali material
Accidental Release Measures	:	No applicable data available.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel)	:	Do not get in eyes. Do not get on skin or clothing. Do not breathe vapours or spray mist. Wash hands thoroughly after handling.
Handling (Physical Aspects)	:	No applicable data available.
Dust explosion class	:	No applicable data available.
Storage	:	Keep containers dry and tightly closed to avoid moisture absorption and contamination. Protect containers from damage. Never allow product to get in contact with water during storage. Never allow product to get in contact with water during storage.
Storage period	:	No applicable data available.

Storage temperature : No applicable data available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal protective equipment

Respiratory protection : Wear NIOSH approved respiratory protection as appropriate.

Eye protection : Wear chemical splash goggles in combination with a full-length face shield or an acid hood.

Skin and body protection : Where there is potential for skin contact have available and wear as appropriate:
Full body chemical protective clothing.
Chemical-resistant gloves
Chemical-resistant boots

Protective measures : All Personal Protection Equipment should be checked before use to confirm it is compatible with the chemicals you are handling.

Exposure Guidelines

Exposure Limit Values

Sulfuric Acid

Permissible exposure limit:	(OSHA)	1 mg/m3	8 hr. TWA
TLV	(ACGIH)	0.2 mg/m3	TWA Thoracic fraction.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state : liquid
Form : liquid, oily
Color : colourless, to, light grey

Sulfuric Acid (77 to 100%)

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Odor	:	acrid
Odor threshold	:	No applicable data available.
pH	:	< 1
Melting point/freezing point	:	Freezing point -35 - 11 °C (-31 - 52 °F)
Boiling point/boiling range	:	Boiling point/boiling range 193 - 327 °C (379 - 621 °F) at 760 mm Hg
Flash point	:	does not flash
Evaporation rate	:	< 1 (Butyl Acetate=1.0)
Flammability (solid, gas)	:	No applicable data available.
Upper explosion limit	:	No applicable data available.
Lower explosion limit	:	No applicable data available.
Vapor pressure	:	< 0.3 mm Hg at 25 °C (77 °F) < 0.6 mm Hg at 38 °C (100 °F)
Vapor density	:	3.4 (Air = 1.0)
Specific gravity (Relative density)	:	1.706 - 1.844 at 15.6 °C (60.1 °F)
Water solubility	:	completely soluble, Reacts violently with water liberating sulfuric acid mist cloud.
Solubility(ies)	:	No applicable data available.
Partition coefficient: n-octanol/water	:	No applicable data available.
Auto-ignition temperature	:	No applicable data available.
Decomposition temperature	:	No applicable data available.

Viscosity, kinematic	:	No applicable data available.
Viscosity, dynamic	:	No applicable data available.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Stable under recommended storage conditions.
Chemical stability	:	Stable at normal temperatures and storage conditions.
Possibility of hazardous reactions	:	Reacts violently with water.
Conditions to avoid	:	Avoid excessive heat.
Incompatible materials	:	Water Organic materials, nitrates, chlorates, perchlorates, carbides, picrates, strong oxidizers, Reducing agents, Powdered metals, Cyanides, sulphides
Hazardous decomposition products	:	Hazardous decomposition products: Sulphur dioxide

SECTION 11. TOXICOLOGICAL INFORMATION

Sulfuric Acid

Inhalation 4 h LC50	:	0.375 mg/l , Rat Target Organs: Respiratory system Respiratory effects
Dermal LD50	:	2,000 mg/kg , Rabbit
Oral LD50	:	2,140 mg/kg , Rabbit
Skin irritation	:	Corrosive after 3 minutes or less of exposure, Rabbit
Eye irritation	:	Corrosive, Rabbit
Skin sensitization	:	Does not cause skin sensitisation., Not tested on animals Does not cause respiratory sensitisation., human
Repeated dose toxicity	:	Inhalation

Rat
- 28 dMethod: OECD Test Guideline 412
No toxicologically significant effects were found.

Carcinogenicity : Suspected human carcinogens
An increased risk of cancer in humans has been shown in workplace-based studies.

Mutagenicity : Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
Evidence suggests this substance does not cause genetic damage in animals.

Reproductive toxicity : No toxicity to reproduction
Evidence suggests the substance is not a reproductive toxin in animals.

Teratogenicity : Animal testing showed no developmental toxicity.

Carcinogenicity
The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

Material	IARC	NTP	OSHA
Sulfuric Acid	1	X	

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity
Sulfuric Acid

96 h LC50 : Lepomis macrochirus (Bluegill sunfish) 16 mg/l

72 h ErC50 : Desmodesmus subspicatus (green algae) > 100 mg/l OECD Test Guideline 201

48 h EC50	:	Daphnia magna (Water flea) > 100 mg/l OECD Test Guideline 202
65 d	:	NOEC Fish (unspecified species) 0.025 mg/l

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal methods - Product	:	In accordance with local and national regulations. Discarded material is a RCRA Hazardous Waste.
Contaminated packaging	:	No applicable data available.

SECTION 14. TRANSPORT INFORMATION

DOT	UN number	:	1830
	Proper shipping name	:	Sulfuric acid
	Class	:	8
	Packing group	:	II
	Labelling No.	:	8
IATA_C	UN number	:	1830
	Proper shipping name	:	Sulphuric acid
	Class	:	8
	Packing group	:	II
	Labelling No.	:	8
IMDG	UN number	:	1830
	Proper shipping name	:	SULPHURIC ACID
	Class	:	8
	Packing group	:	II
	Labelling No.	:	8

SECTION 15. REGULATORY INFORMATION

TSCA	:	On the inventory, or in compliance with the inventory

Sulfuric Acid (77 to 100%)

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SARA 313 Regulated Chemical(s)	:	Sulfuric Acid Sulfuric Acid
PA Right to Know Regulated Chemical(s)	:	Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Sulfuric Acid
NJ Right to Know Regulated Chemical(s)	:	Substances on the New Jersey Workplace Hazardous Substance List present at a concentration of 1% or more (0.1% for substances identified as carcinogens, mutagens or teratogens): Sulfuric Acid
SARA Reportable Quantity	:	1000 lbs Based on the percentage composition of this chemical in the product.: Sulphuric acid
California Prop. 65	:	WARNING! This product contains a chemical or chemicals known to the State of California to cause cancer.Sulfuric Acid

SECTION 16. OTHER INFORMATION

Revision Date : 07/28/2016

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.

CARBON DIOXIDE
Safety Data Sheet

1. IDENTIFICATION

Product identifier
Product Name CARBON DIOXIDE

Other means of identification
Safety data sheet number LIND-P023
UN / ID no. UN1013
Synonyms Carbonic Anhydride, Carbonic Acid Gas
Trade name LASER Carbon Dioxide, LASER Carbon Dioxide Ultra, MAPAX® C; Carbon Dioxide Lasershield GR4.5; Carbon Dioxide Lasershield GR5.0

Recommended use of the chemical and restrictions on use
Recommended Use Industrial and professional use. Food and Beverage.
Uses advised against Consumer use

Details of the supplier of the safety data sheet
Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC
200 Somerset Corporate Blvd, Suite 7000
Bridgewater, NJ 08807
Phone: 908-464-8100
www.lindeus.com

Linde Gas Puerto Rico, Inc.
Road 869, Km 1.8
Barrio Palmas, Catano, PR 00962
Phone: 787-641-7445
www.pr.lindegas.com

Linde Canada Limited
5860 Chedworth Way
Mississauga, Ontario L5R 0A2
Phone: 905-501-2500 / 905-501-1700
www.lindecanada.com

* May include subsidiaries or affiliate companies / divisions.

For additional product information contact your local customer service.

Emergency telephone number
Company Phone Number +1 800-232-4726 (Linde National Operations Center, US)
+1 905-501-0802 (Canada)
CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Gases under pressure	Liquefied gas
Simple asphyxiants	Yes

Label elements

Signal word Warning

Hazard Statements
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation
May cause frostbite
May increase respiration and heart rate

Precautionary Statements - Prevention
Do not handle until all safety precautions have been read and understood
Avoid breathing gas
Do not get in eyes, on skin, or on clothing
Use and store only outdoors or in a well ventilated place
Use a backflow preventive device in piping
Use only with equipment rated for cylinder pressure
Close valve after each use and when empty

Precautionary Statements - Response
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Get medical attention / advice.
IF ON SKIN:. Get immediate medical advice / attention. Thaw frosted parts with lukewarm water. Do not rub affected area.

Precautionary Statements - Storage
Protect from sunlight when ambient temperature exceeds 52°C / 125°F

Hazards not otherwise classified (HNOC)
Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Volume %	Chemical Formula
CARBON DIOXIDE	124-38-9	>99	CO_2

4. FIRST AID MEASURES

Description of first aid measures

General advice — Show this safety data sheet to the doctor in attendance.

Inhalation — Remove to fresh air and keep comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Skin contact — For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physican should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.

Eye contact — If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.

Ingestion — Not an expected route of exposure.

Self-protection of the first aider — RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Most important symptoms and effects, both acute and delayed

Symptoms — Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death. Depending on concentration and duration of exposure to carbon dioxide may cause increased respirations, headache, mild narcotic effects, increased blood pressure and pulse, and asphyxiation. Symptoms of overexposure become more apparent when atmospheric oxygen is decreased to 15-17%. Contact with evaporating liquid may cause cold burns / frostbite.

Indication of any immediate medical attention and special treatment needed

Note to physicians — Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media — None.

Specific extinguishing methods

Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.

Specific hazards arising from the chemical

Non-flammable gas. Cylinders may rupture under extreme heat.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas. Monitor oxygen level. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Other Information	Gas / vapor is heavier than air. Prevent from entering sewers, basements and workpits, or any place where accumulation may be dangerous.

Environmental precautions

Environmental precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas.

Methods and material for containment and cleaning up

Methods for containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for cleaning up	Return cylinder to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling

For applications with moist Carbon Dioxide, 316, 309 and 310 stainless steels may be used as well as Hastelloy® A, B, & C and Monel®. Ferrous nickel alloys are slightly suspectible to corrosion. At normal temperatures carbon dioxide is compatible with most plastics and elastomers.

Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Never attempt to lift a cylinder by its valve protection cap. Never insert an object (e.g. wrench, screwdriver, pry bar,etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Use only with adequate ventilation. Use a backflow preventive device in piping. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Ensure the complete gas system has been checked for leaks before use.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

Only experienced and properly instructed persons should handle gases under pressure. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

For additional recommendations consult Compressed Gas Association's (CGA) Safety Bulletin SB-2, Oxygen-Deficient Atmospheres.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Full and empty cylinders should be segregrated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Stored containers should be periodically checked for general condition and leakage.

Incompatible materials: Certain reactive metals, hydrides, moist cesium monoxide, or lithium acetylene carbide diammino may ignite. Passing carbon dioxide over a mixture of sodium peroxide and aluminum or magnesium may explode. Carbon dioxide is incompatible with:.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
CARBON DIOXIDE 124-38-9	STEL: 30000 ppm TWA: 5000 ppm	TWA: 5000 ppm TWA: 9000 mg / m^3 (vacated) TWA: 10000 ppm (vacated) TWA: 18000 mg / m^3 (vacated) STEL: 30000 ppm (vacated) STEL: 54000 mg / m^3	IDLH: 40000 ppm TWA: 5000 ppm TWA: 9000 mg / m^3 STEL: 30000 ppm STEL: 54000 mg / m^3

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

Other Information: Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Appropriate engineering controls

Engineering Controls: Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%. Oxygen detectors should be used when asphyxiating gases may be released. Systems under pressure should be regularly checked for leakages. Showers. Eyewash stations.

Individual protection measures, such as personal protective equipment

Eye / face protection: Wear safety glasses with side shields (or goggles). If splashes are likely to occur, wear:. Goggles. Face-shield.

Skin and body protection: Work gloves and safety shoes are recommended when handling cylinders. Wear cold insulating gloves when handling liquid.

Respiratory protection: Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%). If exposure limits are exceeded or irritation is experienced, NIOSH approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Considerations: Handle in accordance with good industrial hygiene and safety practice. Do not get in eyes, on skin, or on clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Gas
Appearance	Colorless.
Odor	Odorless.
Odor threshold	No information available
pH	Not applicable
Melting / freezing point	-56.6 °C / -69.8 °F
Evaporation rate	Not applicable
Flammability (solid, gas)	See Section 5.
Lower flammability limit:	Not applicable
Upper flammability limit:	Not applicable

Flash point	Not applicable
Autoignition temperature	No data available
Decomposition temperature	No data available
Water solubility	0.145 g / ml @ 25°C
Partition coefficient	No data available
Kinematic viscosity	Not applicable

Component Level Information:

Chemical Name	Molecular weight	Boiling point / range	Vapor Pressure	Vapor density (air =1)	Gas Density kg / m³@20°C	Critical Temperature
CARBON DIOXIDE	44.01	-78.5 °C (Sublimes)	57780 hPa @ 21.1°C	1.522	1.839	31.1 °C

10. STABILITY AND REACTIVITY

Reactivity
Not reactive under normal conditions

Chemical stability
Stable under normal conditions.

Explosion data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Due to the presence of Carbon dioxide, Carbonic acid is formed in the presence of moisture.

Incompatible materials
Certain reactive metals, hydrides, moist cesium monoxide, or lithium acetylene carbide diammino may ignite. Passing carbon dioxide over a mixture of sodium peroxide and aluminum or magnesium may explode. Carbon dioxide is incompatible with:.

Hazardous Decomposition Products
Oxygen. Carbon monoxide.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation	Acidosis, adrenal cortical exhaustion, and other metabolic stresses have resulted from prolonged continuous exposure to 1-2% carbon dioxide (10,000 ppm-20,000 ppm). The ACGIH TLV of 5,000 ppm is expected to provide a good margin of safety from asphyxiation and undue metabolic stress provided sufficient oxygen levels are maintained in the air. Increased physical activity, duration of exposure, and decreased oxygen content can affect systemic and respiratory effects resulting from exposure to carbon dioxide.
Skin contact	Contact with evaporating liquid may cause cold burns / frostbite.
Eye contact	Contact with evaporating liquid may cause cold burns / frostbite.
Ingestion	Not an expected route of exposure.

Information on toxicological effects

Symptoms: Depending on concentration and duration of exposure to carbon dioxide may cause increased respirations, headache, mild narcotic effects, increased blood pressure and pulse, and asphyxiation. Symptoms of overexposure become more apparent when atmospheric oxygen is decreased to 15-17%.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion / irritation	Not classified.
Serious eye damage / eye irritation	Not classified.
Irritation	Not classified.
Sensitization	Not classified.
Germ cell mutagenicity	Not classified.
Carcinogenicity	This product does not contain any carcinogens or potential carcinogens listed by OSHA, IARC or NTP.
Reproductive toxicity	Not classified.
STOT - single exposure	Not classified.
STOT - repeated exposure	Not classified.
Chronic toxicity	Chronic harmful effects are not known from repeated inhalation of concentrations below PEL / TLV.
Target Organ Effects	Central Vascular System (CVS), Respiratory system.
Aspiration hazard	Not applicable.

Numerical measures of toxicity

Component Level Information:

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50	Inhalation LC50 (CGA P-20)
CARBON DIOXIDE 124-38-9	-	-	47,000 ppm (Rat)	-

Product Information

Oral LD50	No information available
Dermal LD50	No information available
Inhalation LC50	TCLo - 10,000 ppm (Rat) 24 hours / 30 days-continuous

12. ECOLOGICAL INFORMATION

Ecotoxicity
No known acute aquatic toxicity.

Persistence and degradability
No information available.

Bioaccumulation
No information available

Global warming potential (GWP) 1

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes: Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Linde for proper disposal.

14. TRANSPORT INFORMATION

DOT

UN / ID no.	UN1013
Proper shipping name	Carbon dioxide
Hazard Class	2.2
Description	UN1013, Carbon dioxide, 2.2
Emergency Response Guide Number	120

TDG

UN / ID no.	UN1013
Proper shipping name	Carbon dioxide
Hazard Class	2.2
Description	UN1013, Carbon dioxide, 2.2

IATA

UN / ID no.	UN1013
Proper shipping name	Carbon dioxide
Hazard Class	2.2
ERG Code	2L
Description	UN1013, Carbon dioxide, 2.2

IMDG

UN / ID no.	UN1013
Proper shipping name	Carbon dioxide
Hazard Class	2.2
EmS-No.	F-C, S-V
Description	UN1013, Carbon dioxide, 2.2

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL / NDSL	Complies
EINECS / ELINCS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL / NDSL - Canadian Domestic Substances List / Non-Domestic Substances List
EINECS / ELINCS - European Inventory of Existing Chemical Substances / European List of Notified Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311 / 312 Hazard Categories

Should this product meet EPCRA 311 / 312 reporting criteria at 40 CFR 370, refer to Section 2 of this SDS for appropriate classifications.

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments

of 1990.

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Risk and Process Safety Management Programs
This material, as supplied, does not contain any regulated substances with specified thresholds under 40 CFR Part 68. This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Carbon dioxide 124-38-9	X	X	X

Chemical Name	Carcinogenicity	Exposure Limits
CARBON DIOXIDE		Mexico: TWA 5000 ppm Mexico: TWA 9000 mg / m^3 Mexico: STEL 15000 ppm Mexico: STEL 27000 mg / m^3

NFPA Health hazards 2 Flammability 0 Instability 0 Physical and Chemical Properties Simple asphyxiant

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

Issue Date	17-Feb-2015
Revision Date	01-Feb-2018
Revision Note	SDS sections updated; 15

LIND-P023

General Disclaimer
For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

End of Safety Data Sheet

MATERIAL SAFETY DATA SHEET

CO [Carbon monoxide]

1. IDENTIFICATION

A. Product name

- Carbon monoxide

B. Recommended use and restriction on use

- General use : Not available
- Restriction on use : Not available

C. Manufacturer / Supplier / Distributor information

○ **Manufacturer information**

- Company name : AIR LIQUIDE KOREA CO.,LTD.
- Address : 11FL BOJUN BLDG, 725 EONJU-RO, GANGNAM-GU, SEOUL, KOREA
- Dept. : HSE Department
- Telephone number : +(82)2.3019.2500

2. HAZARD IDENTIFICATION

A. GHS Classification

- Flammable gases : Category1
- Gases under pressure : Compressed gas
- Acute toxicity (inhalation: gas) : Category3
- Reproductive toxicity : Category1A
- Specific target organ toxicity(Repeated exposure) : Category2

B. GHS label elements

○ **Hazard symbols**

○ **Signal words**

- Danger

○ **Hazard statements**

- H220 Extremely flammable gas
- H280 Compressed gas ; Contains gas under pressure; may explode if heated
- H331 Toxic if inhaled
- H360 May damage fertility or the unborn child
- H373 May cause damage to organs through prolonged or repeated exposure (Refer Section SDS 11)

○ **Precautionary statements**

1) Prevention

- P201 Obtain special instructions before use.
- P202 Do not handle until all safety precautions have been read and understood.
- P210 Keep away from heat/sparks/open flames/hot surfaces. ? No smoking.
- P260 Do not breathe dust/fume/gas/mist/vapours/spray.
- P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
- P271 Use only outdoors or in a well-ventilated area.
- P281 Use personal protective equipment as required.

2) Response

- P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P308+P313 If exposed or concerned: Get medical advice/attention.

- P311 Call a POISON CENTER or doctor/physician.
- P314 Get medical advice/attention if you feel unwell.
- P321 Specific treatment
- P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
- P381 Eliminate all ignition sources if safe to do so.

3) Storage

- P403 Store in a well-ventilated place.
- P403+P233 Store in a well-ventilated place. Keep container tightly closed.
- P405 Store locked up.
- P410+P403 Protect from sunlight. Store in a well-ventilated place.

4) Disposal

- P501 Dispose of contents/container in accordance with local/regional/national/international regulation

C. Other hazards which do not result in classification : (NFPA Classification)

○ **NFPA grade (0 ~ 4 level)**

- Health : 3 , Flammability : 4, Reactivity : 0

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Trade names and Synonyms	CAS No.	Content(%)
Carbon monoxide	Carbonic oxide	630-08-0	100

4. FIRST AID MEASURES

A. Eye contact

- Do not rub your eyes.
- Immediately flush eyes with plenty of water for at least 15minutes and call a doctor/physician.
- Get medical attention immediately.

B. Skin contact

- Flush skin with plenty of wter for at least 15 minutes while removing contaminated clothing and shoes
- Laundering enough contaminated clothing before reuse.
- Get medical attention immediately.
- Remove contaminated clothing, shoes and isolate.
- Wear gloves when washing the patient, and please avoid contact with contaminated clothing.

C. Inhalation contact

- When exposed to large amounts of steam and mist, move to fresh air.
- Take specific treatment if needed.
- Get medical attention immediately.
- If breathing is stopped or irregular, give artificial respiration and supply oxygen.
- Take the doctor's examination.

D. Ingestion contact

- About whether I should induce vomiting Take the advice of a doctor.
- Rinse your mouth with water immediately.
- Get medical attention immediately.

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

- Not available

F. Notes to physician

- Notify medical personnel of contaminated situations and have them take appropriate protective measures.
- If exposed or concerned, get medical attention/advice.

5. FIREFIGHTING MEASURES

A. Suitable (Unsuitable) extinguishing media

- Dry chemical, carbon dioxide, regular foam extinguishing agent, spray

- Avoid use of water jet for extinguishing

B. Specific hazards arising from the chemical

- high-pressure gas; May explode when heated.

C. Special protective actions for firefighters

- Move containers from fire area, if you can do without the risk.
- Cool containers with water until well after fire is out.
- Keep unauthorized personnel out.
- Use appropriate extinguishing measure suitable for surrounding fire.
- Keep containers cool with water spray.
- Leaking gas fire: do not extinguish, unless leak can be stopped safely.
- Remove sources of ignition.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

- Must work against the wind, let the upwind people to evacuate.
- Do not touch spilled material. Stop leak if you can do it without risk.
- Remove all sources of ignition.
- Handling the damaged containers or spilled material after wearing protective equipment.
- Keep unauthorized people away,isolate hazard area and deny entry.

B. Environmental precautions

- Prevent runoff and contact with waterways, drains or sewers.
- If large amounts have been spilled, inform the relevant authorities.

C. Methods and materials for containment and cleaning up

- Large spill : Stay upwind and keep out of low areas. Dike for later disposal.
- Notification to central government, local government. When emissions at least of the standard amount
- Dispose of waste in accordance with local regulation.
- Appropriate container for disposal of spilled material collected.
- Spilled material should be treated as a potential risk of waste collected.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Get the manual before use.
- Refer to Engineering controls and personal protective equipment.
- Dealing only with a well-ventilated place.
- Operators should wear antistatic footwear and clothing.
- Avoid contact with heat, sparks, flame or other ignition sources.
- Contaminated work clothing should not be allowed out of the workplace.
- Handling only authorized person.

B. Conditions for safe storage, including any incompatibilities

- Check regularly for leaks.
- Do not use damaged containers.
- Avoid direct sunlight.
- Keep sealed when not in use.
- Prevent static electricity and keep away from combustible materials or heat sources.
- Collected them in sealed containers.
- Store in well ventilated area.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Exposure limits

○ **ACGIH TLV**

- [Carbon monoxide] : TWA, 25 ppm (29 mg/m3)

B. Engineering controls

- A system of local and/or general exhaust is recommended to keep employee exposures above the Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. The use of local exhaust ventilation is recommended to control emissions near the source.

C. Personal protective equipment

○ **Respiratory protection**

- Under conditions of frequent use or heavy exposure, Respiratory protection may be needed.
- Respiratory protection is ranked in order from minimum to maximum.
- Consider warning properties before use.
- Any chemical cartridge respirator with organic vapor cartridge(s).
- Any chemical cartridge respirator with a full facepiece and organic vaporcartridge(s).
- Any air-purifying respirator with a full facepiece and an organic vapor canister.
- For Unknown Concentration or Immediately Dangerous to Life or Health : Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply. Any self-contained breathing apparatus with a full facepiece.

○ **Eye protection**

- Wear primary eye protection such as splash resistant safety goggles with a secondary protection face shield.
- Provide an emergency eye wash station and quick drench shower in the immediate work area.

○ **Hand protection**

- Wear appropriate chemical resistant glove.

○ **Skin protection**

- Wear appropriate chemical resistant protective clothing.

○ **Others**

- Not available

9. PHYSICAL AND CHEMICAL PROPERTIES

A. Appearance	
- Appearance	Gas
- Color	Colorless Gas
B. Odor	No Odor warning propeties.
C. Odor threshold	Not available
D. pH	Not available
E. Melting point/Freezing point	-205 ℃
F. Initial Boiling Point/Boiling Ranges	-191 ℃
G. Flash point	Not available
H. Evaporation rate	Not available
I. Flammability(solid, gas)	Flammable gas
J. Upper/Lower Flammability or explosive limits	74.2 / 12.5 %
K. Vapour pressure	760 ㎜Hg (-191℃)
L. Solubility	2.3 ml/100 ml (20℃)
M. Vapour density	0.97 (Water=1)
N. Specific gravity(Relative density)	Not available
O. Partition coefficient of n-octanol/water	1.78 (Estimate)
P. Autoignition temperature	630 ℃
Q. Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	28.01

10. STABILITY AND REACTIVITY

A. Chemical Stability and Reactivity

- high-pressure gas; May explode when heated.
- May form explosive mixture.

B. Possibility of hazardous reactions

- Contact with other combustible material may cause fire.
- Cylinders exposed to fire may vent and release flammable gas.

C. Conditions to avoid

- Avoid contact with incompatible materials and condition.
- Avoid : Accumulation of electrostatic charges, Heating, Flames and hot surfaces
- Avoid contact with heat, sparks, flame or other ignition sources.

D. Incompatible materials

- Not available

E. Hazardous decomposition products

- May emit flammable vapour if involved in fire.

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure

○ **(Respiratory tracts)**
- Not available

○ **(Oral)**
- Not available

○ **(Eye·Skin)**
- Not available

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

○ **Acute toxicity**

*** Oral**
- Not available

*** Dermal**
- Not available

*** Inhalation**
- [Carbon monoxide] : gas LC50 1805 ppm 4 hr Rat

○ **Skin corrosion/irritation**
- Not available

○ **Serious eye damage/irritation**
- Not available

○ **Respiratory sensitization**
- Not available

○ **Skin sensitization**
- Not available

○ **Carcinogenicity**

*** IARC**
- Not available

*** OSHA**
- Not available

*** ACGIH**
- Not available

*** NTP**
- Not available

*** EU CLP**
- Not available

○ **Germ cell mutagenicity**
- Not available

○ **Reproductive toxicity**
- May damage fertility or the unborn child

○ **STOT-single exposure**
- Not available

○ **STOT-repeated exposure**
- May cause damage to organs through prolonged or repeated exposure (Refer Section SDS 11)

○ **Aspiration hazard**
- Not available

12. ECOLOGICAL INFORMATION

A. Ecotoxicity

○ **Fish**

- Not available

○ **Crustaceans**

- Not available

○ **Algae**

- Not available

B. Persistence and degradability

○ **Persistence**

- [Carbon monoxide] : log Kow 1.78 (Estimates)

○ **Degradability**

- Not available

C. Bioaccumulative potential

○ **Bioaccumulative potential**

- Not available

○ **Biodegration**

- Not available

D. Mobility in soil

- Not available

E. Other adverse effects

- Not available

13. DISPOSAL CONSIDERATIONS

A. Disposal methods

- Since more than two kinds of designaed waste is mixed, it is difficult to treat seperatly, then can be reduction or stabilization by incineration or similar process.
- If water separation is possible, pre-process with Water separation process.
- Dispose by incineration.

B. Special precautions for disposal

- The user of this product must disposal by oneself or entrust to waste disposer or person who other’s waste recycle and dispose, person who establish and operate waste disposal facilities.
- Dispose of waste in accordance with all applicable laws and regulations.

14. TRANSPORT INFORMATION

A. UN No. (IMDG)

- 1016

B. Proper shipping name

- Carbon monoxide, compressed

C. Hazard Class

- 2.3

D. IMDG Packing group

- Not available

E. Marine pollutant

- Not available

F. Special precautions for user related to transport or transportation measures

- Local transport follows in accordance with Dangerous goods Safety Management Law.
- Package and transport follow in accordance with Department of Transportation (DOT) and other regulatory agency requirements.

- EmS FIRE SCHEDULE : F-D (Flammable gases)
- EmS SPILLAGE SCHEDULE : S-U (Gases (flammable, toxic or corrosive))

15. REGULATORY INFORMATION

A. National and/or international regulatory information

○ **POPs Management Law**

- Not applicable

○ **Information of EU Classification**

*** Classification**

- [Carbon monoxide] : F+; R12 Repr. Cat. 1; R61 T; R23-48/23

*** Risk Phrases**

- [Carbon monoxide] : R61, R12, R23, R48/23

*** Safety Phrase**

- [Carbon monoxide] : S53, S45

○ **U.S. Federal regulations**

*** OSHA PROCESS SAFETY (29CFR1910.119)**

- Not applicable

*** CERCLA Section 103 (40CFR302.4)**

- Not applicable

*** EPCRA Section 302 (40CFR355.30)**

- Not applicable

*** EPCRA Section 304 (40CFR355.40)**

- Not applicable

*** EPCRA Section 313 (40CFR372.65)**

- Not applicable

○ **Rotterdam Convention listed ingredients**

- Not applicable

○ **Stockholm Convention listed ingredients**

- Not applicable

○ **Montreal Protocol listed ingredients**

- Not applicable

16. OTHER INFORMATION

A. Reference

- The information contained herein is believed to be accurate. It is provided independently of any sale of the product for purpose of hazard communication. It is not intended to constitute performance information concerning the product. No express warranty, or implied warranty of merchantability or fitness for a particular purpose is made with respect to the product or the information contained herein.
- This Safety Data Sheet was compiled with data and information from the following sources: KOSHA, NITE, ESIS, NLM, SIDS, IPCS

B. Issue date

- 2005-04-15

C. Revision number and Last date revised

- 3Times, 2015-02-16

D. Other

- This MSDS is prepared according to the Globally Harmonized System (GHS).
- Asphyxiant in high concentrations.
- Keep container in a well-ventilated place.
- Do not breathe the gas
- The hazard of asphyxiation is often overlooked and must be stressed during operator training.
- This safety data sheet has been established in accodance with the applicable European Directives and applies to all countries that have translated the
- Whilst proper care has been taken in the preparation of this documents, no liability for injury or damage resulting from its use can be accepted.
- Details given in this documents are believed to be correct at the time of going to press. Before using this product in any new process or experiment, a thorough materal compatibility and safety study should be carried out.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: NITRIC OXIDE

TRADE NAMES/SYNONYMS:
MTG MSDS 66; NITROGEN OXIDE (NO); NITRIC OXIDE (NO); NITRIC OXIDE TRIMER; NITROGEN MONOXIDE; NITROGEN MONOOXIDE; NITROGEN OXIDE (N4O4); NITROSYL RADICAL; RCRA P076; UN 1660; NO; MAT16560; RTECS QX0525000

CHEMICAL FAMILY: inorganic, gas

CREATION DATE: Jan 24 1989
REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: NITRIC OXIDE
CAS NUMBER: 10102-43-9
PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=4 FIRE=0 REACTIVITY=1

EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: gas
MAJOR HEALTH HAZARDS: harmful if inhaled, respiratory tract irritation, skin irritation, blood damage
PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat. May ignite combustibles. May react on contact with water. May react on contact with air. Releases toxic, corrosive, flammable or explosive gases.

POTENTIAL HEALTH EFFECTS:
INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, vomiting, stomach pain, chest pain, difficulty breathing, headache, dizziness, bluish skin color, lung congestion
LONG TERM EXPOSURE: same as effects reported in short term exposure
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation (possibly severe)
LONG TERM EXPOSURE: no information is available
EYE CONTACT:
SHORT TERM EXPOSURE: irritation (possibly severe)
LONG TERM EXPOSURE: no information is available
INGESTION:
SHORT TERM EXPOSURE: no information is available
LONG TERM EXPOSURE: no information is available

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If a large amount is swallowed, get medical attention.

ANTIDOTE: methylene blue, intravenous; ascorbic acid, intravenous.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials.

EXTINGUISHING MEDIA: water

Do not use dry chemicals, carbon dioxide or halogenated extinguishing agents. Large fires: Flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. For small fires, contain and let burn.

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Stop leak if possible without personal risk. Avoid contact with combustible materials. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. NFPA 430 Code for the Storage of Liquid and Solid Oxidizing Materials. Keep separated from incompatible substances. Notify State Emergency Response Commission for storage or use at amounts greater than or equal to the TPQ (U.S. EPA SARA Section 302). SARA Section 303 requires facilities storing a material with a TPQ to participate in local emergency response planning (U.S. EPA 40 CFR 355 Part B).

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
NITRIC OXIDE:
25 ppm (30 mg/m3) OSHA TWA
25 ppm ACGIH TWA
25 ppm (30 mg/m3) NIOSH recommended TWA 10 hour(s)

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
100 ppm
Any supplied-air respirator operated in a continuous-flow mode.
Any air-purifying respirator with a full facepiece and a canister providing protection against this substance. Only non-oxidizable sorbents are allowed (not charcoal).
Any powered, air-purifying respirator with cartridge(s) providing protection against this substance. Only non-oxidizable sorbents are allowed (not charcoal).

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted canister providing protection against the compound of concern.
Only non-oxidizable sorbents are allowed (not charcoal).
Any supplied-air respirator.
Any self-contained breathing apparatus with a full facepiece.
Emergency or planned entry into unknown concentrations or IDLH conditions -
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Escape -
Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted canister providing protection against the compound of concern.
Only non-oxidizable sorbents are allowed (not charcoal).
Any appropriate escape-type, self-contained breathing apparatus.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: gas
COLOR: colorless
ODOR: Not available
MOLECULAR WEIGHT: 30.01
MOLECULAR FORMULA: N-O
BOILING POINT: -242 F (-152 C)
FREEZING POINT: -263 F (-164 C)
VAPOR PRESSURE: 26000 mmHg @ 20 C
VAPOR DENSITY (air=1): 1.036
SPECIFIC GRAVITY: Not applicable
DENSITY: 1.3402 g/L
WATER SOLUBILITY: 7.3% @ 0 C
PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: 0.3-1.0 ppm
EVAPORATION RATE: Not applicable
VISCOSITY: 0.0188 cP @ 25 C
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable
SOLVENT SOLUBILITY:
Soluble: sulfuric acid, alcohol, ferrous sulfate solutions, carbon disulfide

10. STABILITY AND REACTIVITY

REACTIVITY: May react on contact with air. May react on contact with water. Releases toxic, corrosive, flammable or explosive gases. May explode during distillation or evaporation.

CONDITIONS TO AVOID: Avoid contact with combustible materials. Minimize contact with material. Avoid inhalation of material or combustion by-products. Keep out of water supplies and sewers.

INCOMPATIBILITIES: metals, bases, metal oxides, reducing agents, combustible materials, halo carbons, oxidizing materials, halogens, metal carbide, metal salts

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of nitrogen

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

NITRIC OXIDE:
TOXICITY DATA: 160 mg/m3 inhalation-rat LC50
LOCAL EFFECTS:
Irritant: inhalation, skin
ACUTE TOXICITY LEVEL:
Highly Toxic: inhalation
TARGET ORGANS: blood
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders
MUTAGENIC DATA: Available.

12. ECOLOGICAL INFORMATION

Not available

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. D003.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Nitric oxide, compressed
ID NUMBER: UN1660
HAZARD CLASS OR DIVISION: 2.3
LABELING REQUIREMENTS: 2.3; 5.1; 8
QUANTITY LIMITATIONS:
PASSENGER AIRCRAFT OR RAILCAR: Forbidden

CARGO AIRCRAFT ONLY: Forbidden
ADDITIONAL SHIPPING DESCRIPTION: Toxic-Inhalation Hazard Zone A

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Nitric oxide, compressed
UN NUMBER: UN1660
CLASS: 2.3; 5.1; 8

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
NITRIC OXIDE: 10 LBS RQ (exemption <1000 lbs/24 hr to air of NO resulting from combustion activities)

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B):
NITRIC OXIDE: 100 LBS TPQ

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C):
NITRIC OXIDE: 10 LBS RQ (exemption <1000 lbs/24 hr to air of NO resulting from combustion activities)

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):
ACUTE: Yes
CHRONIC: No
FIRE: No
REACTIVE: No
SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65): Not regulated.

OSHA PROCESS SAFETY (29 CFR 1910.119):
NITRIC OXIDE: 250 LBS TQ

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: ACD1

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

MSDS SUMMARY OF CHANGES
7. HANDLING AND STORAGE
15. REGULATORY INFORMATION

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.

AIR LIQUIDE

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NITROGEN DIOXIDE

SYNONYMS: Dinitrogen Tetroxide; Azote; Nitrogen Peroxide
CHEMICAL FAMILY NAME: Inorganic Oxide
FORMULA: NO_2

	Document Number: 20133
PRODUCT USE:	Catalyst in oxidization reactions; inhibitor to prevent polymerization; nitrating agent; for rocket fuel; flour bleaching agent; added to increase the strength of paper and in manufacture of explosives.
SUPPLIER/MANUFACTURER'S NAME:	AIR LIQUIDE AMERICA CORPORATION
ADDRESS:	2700 Post Oak Drive Houston, TX 77056-8229
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	
General MSDS Information:	1-713/896-2896
Fax on Demand:	1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Nitrogen Dioxide	10102-44-0	> 99.5%	3, A4 (Not Classifiable as a Human Carcinogen)	5	NE	5 C 1 ST (Vacated 1989 PEL)	20	NIOSH REL: 1 ppm ST DFG MAK 5 ppm
Maximum Impurities		< 0.5 %	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalents standards.					

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used.

NOTE: all WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a yellow-brown liquid to red-brown, non-flammable gas with an acidic, suffocating odor. Nitrogen Dioxide is extremely toxic by inhalation and symptoms of overexposure may not become apparent for up to 72 hours. The gas is an oxidizer and will support and enhance combustion. Nitrogen Dioxide is not flammable. Exposure to the rapidly expanding gas can cause frostbite. Emergency Responders must protect themselves from inhalation. A water spray can be used to control and direct a release.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for this product is by inhalation.

INHALATION: Exposure to Nitrogen Dioxide gas in low concentrations produces an irritating effect on the mucous membranes of the eyes, nose, throat, and lungs. Acute exposure through inhalation may result in dryness and irritation of the nose and throat, choking, coughing, and bronchospasm. Severe overexposure may cause death through systemic, delayed pulmonary edema. High concentrations of Nitrogen Dioxide gas may cause an oxygen-deficient atmosphere; however, other health effects will become apparent before the symptoms of oxygen deficiency occur. Exposure to high concentrations may cause unconsciousness, and under some circumstances, death. Typical symptoms of overexposure are:

CONCENTRATION	SYMPTOMS of OVEREXPOSURE
25 ppm:	Delayed (5-72 hours) pulmonary irritation after 8 hour exposure.
100 - 150 ppm:	Delayed (5-48 hours) pulmonary edema after exposure for 30 - 60 minutes.
200 - 700 ppm:	Delayed (5-8 hours) severe pulmonary damage after only a few breaths.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	3
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		D

EYES RESPIRATORY HANDS BODY

See Section 8

For routine industrial applications

A typical overexposure incident follows the course described in the next paragraph:

After inhalation of a few breaths of Nitrogen Dioxide, there is no immediate reaction, or only a very slight respiratory discomfort, headache, dizziness, or lassitude. After 5-8 hours (frequently after the employee has left the workplace and returned home), it is noticed that the victim's lips and ears have a blue (cyanotic) color. There then follows rapidly increasing symptoms of breathing difficulty, irregular respiration, choking, dizziness, headache, increasing cyanosis, tightness in the chest, nausea, vomiting, lassitude, and palpitations. Left untreated, death frequently occurs. Physical examination immediately following overexposure reveals an accelerated respiratory rate, decreased vital capacity, generally suppressed breathing sounds, low blood pressure, and a platelet count elevated by 10-100%.

SKIN and EYE CONTACT: Prolonged exposure may cause potentially harmful amounts of Nitrogen Dioxide to enter the body via absorption through the skin. The gas may be irritating to the skin, especially in a moist environment, for prolonged periods. Symptoms of skin overexposure may include scratchiness, pain, and redness. If Nitrogen Dioxide contaminates the eyes, severe injury and swelling of the eye tissue may occur. Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

SKIN ABSORPTION: Skin absorption is a significant route of exposure for Nitrogen Dioxide following prolonged low-level exposure.

INGESTION: While ingestion is highly unlikely, ingestion of Nitrogen Dioxide can damage the tissues of the mouth, throat, esophagus, and other tissues of the digestive system. Ingestion of Nitrogen Dioxide can be fatal. Additionally, aspiration by inhalation is possible, causing pulmonary edema or death.

3. HAZARD IDENTIFICATION (Continued)

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to Nitrogen Dioxide may cause the following health effects:

ACUTE: This gas is toxic and damaging to the respiratory system, as well as to contaminated skin and eyes. Overexposures can result in severe irritation and burns of eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, delayed pulmonary damage and breathing difficulty may occur. Medical care is essential, as symptoms will rapidly worsen, possibly leading to death. Overexposure to this gas may be fatal. Though unlikely to occur during occupational use, ingestion of large quantities may be fatal. Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with liquid can quickly subside.

CHRONIC: Prolonged or repeated overexposures may cause respiratory problems, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, and alteration in the senses of taste and smell. Repeated overexposures to Nitrogen Dioxide can also result in dental erosion and gum disorders. Nitrogen Dioxide has been shown to cause genetic damage and fetal toxicity in animal or bacterial studies.

TARGET ORGANS: Respiratory system, skin, and eyes.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus should be worn.

Remove victim(s) to fresh air as quickly as possible. If the victim is unconscious, vomiting may occur as the person awakes. In order to prevent aspiration, exposed individuals should be placed on their side with their head at the level of, or slightly lower than, their body. Due to the possibility of the victim developing pulmonary edema, the symptoms of which can be delayed up to 72 hours, the victim should be discouraged from physical exertion during this time period.

SKIN EXPOSURE: If Nitrogen Dioxide contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If irritation of the eye develops after exposure to the gas, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes.

NOTICE! Delayed onset of life-threatening symptoms is very likely to occur. **Victim(s) must be taken for medical attention**. Rescuers should be taken for medical attention if necessary. Take copy of label and MSDS to physician or other health professional with victim(s). Medical care providers should refer to Section 11 (Toxicological Information) of this MSDS for additional information. Rescue personnel should be aware of the extreme fire hazards associated with oxidizer-enriched atmospheres.

5. FIRE-FIGHTING MEASURES

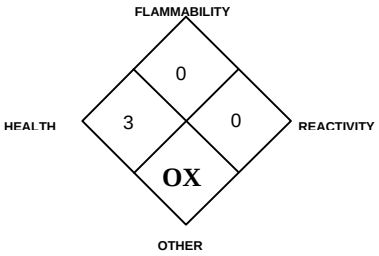
FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

NFPA RATING



FIRE EXTINGUISHING MATERIALS: Non-flammable gas. Use extinguishing media appropriate for surrounding fire. In the event of fire, cool containers of this product with water to prevent failure.

UNUSUAL FIRE AND EXPLOSION HAZARDS: In the event of fire, cool containers of this product with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Do not direct a water spray at the source of a release. Water spray should be used with care. Nitrogen Dioxide can slowly react with water to form a corrosive solution of nitric acid. Nitric acid is corrosive to skin and metal. Corrosive and toxic gases, vapors, and mists may spread from the point of release. Nitrogen Dioxide is a strong oxidizer and can support or enhance combustion.

5. FIRE-FIGHTING MEASURES (Continued)

UNUSUAL FIRE AND EXPLOSION HAZARDS (continued):

Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Fight fires in a protected location. Approach fire from an upwind direction, to prevent overexposure to Nitrogen Dioxide. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. If cylinders are exposed to heat, the cylinder may rupture or burst and release the contents. It may be prudent to remove potentially heat-exposed cylinders from the area surrounding a fire, if it is safe for firefighters to do so.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided.

Minimum Personal Protective Equipment should be **Level B: protective clothing, gloves and Self-Contained Breathing Apparatus**. Locate and seal the source of the leaking gas. Allow the gas to dissipate. Monitor the surrounding area for oxygen level and the level of Nitrogen Dioxide. The atmosphere must have at least 19.5 percent oxygen and the level of Nitrogen Dioxide must be below levels indicated in Section 2 (Composition and Information on Ingredients) before personnel can be allowed in the area without Self-Contained Breathing Apparatus. While starch-iodide paper will respond to the presence of Nitrogen Dioxide, the limit of detection is too high to be of appreciable value, and its use is not recommended. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there. Colorimetric tubes are available for Nitrogen Dioxide.

THIS IS AN EXTREMELY TOXIC GAS. Protection of all personnel and the area must be maintained.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing the gas or sprays or mists generated by Nitrogen Dioxide. Be aware of any signs of dizziness or fatigue. Exposures to fatal concentrations of this product could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases should be protected against extremes of weather and from the dampness of the ground to prevent rusting.

Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition, and direct sunlight. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and production areas, elevators, building and room exits, or main aisles leading to exits.

Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers).

Use a check valve in the discharge line to prevent hazardous backflow. Never tamper with pressure relief valves and cylinders. Use only compatible materials for cylinders, process lines, and other Nitrogen Dioxide-handling equipment. Anhydrous Nitrogen Dioxide is not corrosive to steel and other common structural materials. In the presence of air or moisture, however, corrosive conditions will develop. If piping and accessories cannot be maintained free of air or moisture, stainless steel is recommended. Lines should be purged with dry nitrogen both before and after maintenance activity.

Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition. Nitrogen Dioxide emergency equipment should be available near the point of use.

- Workers who handle Nitrogen Dioxide should wear protective clothing, as listed in Section 8 (Exposure Controls - Personal Protection).

7. HANDLING and USE (Continued)

STORAGE AND HANDLING PRACTICES (continued):

- Instant-acting showers should be available in the event of an emergency.
- Special eye-wash fountains or similar equipment should be available for eye irrigation.
- Proper respiratory protection equipment must be provided and workers using such equipment must be carefully trained in its operation and limitations.
- Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check valve, vacuum break, or trap, since suck-back may cause dangerous pressure changes within the cylinder.
- The cylinder valve should be closed after each use.

Keep the smallest amount necessary on-site at any one time. Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

Before Use: Move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Leak check system with leak detection solution, never with flame. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage the valve, causing a leak to occur. Use an adjustable strap wrench to remove overly tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder part of an electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to Section 16 (Other Information) for additional literature.

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections**,** DO NOT USE ADAPTERS:

THREADED**:**	CGA 660
PIN-INDEXED YOKE:	Not applicable.
ULTRA HIGH INTEGRITY:	Not applicable.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e., nitrogen) before attempting repairs. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents dispersion of this gas into the work place by eliminating it at its source. Eye wash stations/safety showers should be near areas where this product is used or stored. Employee exposure should be monitored and reduced to the lowest practical levels using ventilation or other appropriate engineering controls.

If necessary, Nitrogen Dioxide cylinders should be placed in a ventilated gas cabinet. If appropriate, install automatic monitoring equipment to detect the level of Nitrogen Dioxide and oxygen.

RESPIRATORY PROTECTION: Maintain oxygen level above 19.5% in the workplace. Use supplied air respiratory protection if oxygen level is below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards. Employee exposure should be monitored and reduced to the lowest practical levels using ventilation or other appropriate engineering controls. If exposures in excess of 3 ppm cannot be avoided, employees should be provided with supplied air or powered air purifying respirators.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

If the concentration is above 20 ppm (IDLH) or unknown, Self-Contained Breathing Apparatus (SCBA) or other supplied air respiratory protection must be used. The following NIOSH recommendations for Nitrogen Dioxide concentrations in air are in place.

CONCENTRATION	**RESPIRATORY EQUIPMENT**
Up to 20 ppm:	Supplied Air Respirator (SAR) operated in a continuous-flow mode; or full facepiece SCBA; or full facepiece SAR.
Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:	Positive pressure, full facepiece SCBA or positive pressure, full facepiece SAR with an auxiliary positive pressure SCBA.

The IDLH concentration for Nitrogen Dioxide is 20 ppm.

EYE PROTECTION: Splash goggles or safety glasses and face-shields should be used.

HAND PROTECTION: Wear leather gloves when handling cylinders of this product or specific gloves that are appropriate to the specific operation for which this product is used. Neoprene gloves are recommended.

BODY PROTECTION: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.212 lb/ft^3 (1439 kg/m^3)

BOILING POINT @ 1 atm: 21.2°C (70.1°F)

FREEZING/MELTING POINT @ 1 atm: -11.2°C (11.8°F)

SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F) and 1 atm: 2.62

pH: Not applicable.

VAPOR PRESSURE @ 21.1°C (70°F) psig: 14.66

MOLECULAR WEIGHT: 46.0055

EVAPORATION RATE (nBuAc = 1): Not applicable.

EXPANSION RATIO: Not applicable.

ODOR THRESHOLD: 0.1 - 0.4 ppm (detection)

SPECIFIC VOLUME (ft^3/lb): 4.7

SOLUBILITY IN WATER: Decomposes in water to nitric and nitrous acids.**COEFFICIENT WATER/OIL DISTRIBUTION**: Not applicable.

APPEARANCE AND COLOR: Red-brown gas with an irritating odor

HOW TO DETECT THIS SUBSTANCE (warning properties): Though the odor is strong and irritating, it does not serve as a reliable warning property for Nitrogen Dioxide. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. The dense, red to brown color of the gas is characteristic. Area monitoring should be performed using appropriate equipment.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: Decomposes in water to form nitric and nitrous acids. Above 160°C, the gas decomposes to nitric oxide and oxygen.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Nitrogen Dioxide is not compatible with the following materials: air, oxygen, flammable or combustible materials, powdered aluminum, boron, chlorine monoxide, chromium, fluorine, nitrogen trichloride, ozone, phosphorous, oxidizing agents, halogens, powdered iron, sodium monoxide, magnesium, manganese, uranium, and tungsten carbide.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with air, moisture, and incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Nitrogen Dioxide.

Mutation in Microorganism System (Salmonella typhimurium) 6 ppm
Sister Chromatid Exchange (hamster lung) 5 ppm for 10 minutes
TDLo (inhalation, mouse) 22 ppm, reproductive effects
TCLo (inhalation, rat) 0.85 mg/m^3 for 24 hours, teratogenic effects
LCLo (inhalation, human) 200 ppm for 1 minute
TCLo (inhalation, man) 6.2 ppm for 10 minutes, pulmonary effects
TCLo (inhalation, man) 90 ppm for 40 minutes, pulmonary effects
LC_{50} (inhalation, rat) 88 ppm for 4 hours
LC_{50} (inhalation, mouse) 1000 ppm for 10 minutes
LCLo (inhalation, dog) 123 mg/m^3
LCLo (inhalation, monkey) 123 mg/m^3 for 8 hours
LC_{50} (inhalation, rabbit) 315 ppm for 15 minutes
LC_{50} (inhalation, guinea pig) 30 ppm for 1 hour

SUSPECTED CANCER AGENT: Nitrogen Dioxide is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC therefore it is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: This product is irritating to the eyes and may be irritating to the skin.

SENSITIZATION OF PRODUCT: Nitrogen Dioxide is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Nitrogen Dioxide on the human reproductive system.

Mutagenicity: No mutagenicity effects on humans have been described for Nitrogen Dioxide. Nitrogen Dioxide has been shown to cause genetic damage in bacterial studies.
Embryotoxicity: This product is not expected to cause embryotoxic effects in humans.
Teratogenicity: No teratogenicity effects on humans have been described for Nitrogen Dioxide.
Reproductive Toxicity: No reproductive toxicity effects on humans have been described for Nitrogen Dioxide. Nitrogen Dioxide has been shown to cause fetal toxicity in animal studies.

A mutagen is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical that causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical that causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance that interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions, skin conditions, or eye disorders may be aggravated by overexposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen as soon as possible following exposure. If possible, have victim breathe as deeply and rapidly as possible to help flush gas from the lungs. Enforce bed rest for 24 - 48 hours, whether or not symptoms have appeared. Start oxygen therapy at the first sign of symptoms. Provide medication to reduce anxiety and dyspnea, as needed. Keep respiratory tract clear of mucous and exudate. Atropine, epinephrine, expectorants, emetics, most sedatives, and most cardiac glycosides are usually ineffective and possibly harmful. Surgical intervention to assist breathing may be necessary. Respiratory infection should be controlled as soon as it is detected. Prednisone has been reported to be effective during recovery, in amounts of 3-8 x 10-6 kg daily, in divided doses. If Nitrogen Dioxide contaminates the eye, use an optic anesthetic to reduce pain. The victim should be promptly examined by an ophthalmologist.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for this compound.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. Complex reactions of Nitrogen Dioxide occur in the atmosphere which contribute to air pollution.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen deficient environments, respiratory system damage, and damage to the skin and eyes. Because Nitrogen Dioxide produces corrosive nitric acid upon contact with air or moisture, plants may be damaged or destroyed.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Nitrogen Dioxide hydrolyzes to nitric acid when in contact with water. If a release of this product occurs near a river or other body of water, the release has the potential to kill fish and other aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Dinitrogen tetroxide
HAZARD CLASS NUMBER and DESCRIPTION: 2.3 (Poison Gas)
UN IDENTIFICATION NUMBER: UN 1067
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Poison Gas, Oxidizer, Corrosive
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 124

SPECIAL PROVISION: Nitrogen Dioxide is poisonous by inhalation. Shipments must be properly described as inhalation hazards. ZONE A.

MARINE POLLUTANT: Nitrogen Dioxide is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the following information for the preparation of Canadian Shipments.

SPECIAL PROVISION: 79, 102; (Poison-Inhalation Hazard) Emergency Response Assistance Planning requirements must be met for shipments in excess of 1,000 kg or liters.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Nitrogen Dioxide is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPOUND	SARA 302	SARA 304	SARA 313
Nitrogen Dioxide	YES	YES	NO

U.S. SARA THRESHOLD PLANNING QUANTITY: 100 lb.

U.S. CERCLA REPORTABLE QUANTITY (RQ): 10 lb.

CANADIAN DSL INVENTORY STATUS: Nitrogen Dioxide is listed on the Canadian DSL Inventory.

U.S. TSCA INVENTORY STATUS: Nitrogen Dioxide is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS:

- Nitrogen Dioxide is subject to the reporting requirements of CFR 29 1910.1000. Nitrogen Dioxide is listed on Table Z.1.
- Nitrogen Dioxide does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen Dioxide, Anhydrous is subject to the reporting requirements of Section 112(r) of the Clean Air Act.
- Depending on specific operations involving the use of this product, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Nitrogen Dioxide is listed in Appendix A. The threshold quantity for Nitrogen Dioxide under this regulation is 250 lbs.
- Nitrogen Dioxide is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Release Prevention.

CALIFORNIA PROPOSITION 65: Nitrogen Dioxide is not on the California Proposition 65 lists.

15. REGULATORY INFORMATION (Continued)

STATE REGULATORY INFORMATION: Nitrogen Dioxide is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Nitrogen Dioxide.
California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen Dioxide.
Florida - Substance List: Nitrogen Dioxide.
Illinois - Toxic Substance List: Nitrogen Dioxide.
Kansas - Section 302/313 List: Nitrogen Dioxide.
Massachusetts - Substance List: Nitrogen Dioxide.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: Nitrogen Dioxide.
Missouri - Employer Information/Toxic Substance List: Nitrogen Dioxide.
New Jersey - Right to Know Hazardous Substance List: Nitrogen Dioxide.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: Nitrogen Dioxide.
Pennsylvania - Hazardous Substance List: Nitrogen Dioxide.
Rhode Island - Hazardous Substance List: Nitrogen Dioxide.
Texas - Hazardous Substance List: Nitrogen Dioxide.
West Virginia - Hazardous Substance List: Nitrogen Dioxide.
Wisconsin - Toxic and Hazardous Substances: Nitrogen Dioxide.

OTHER CANADIAN REGULATIONS: Nitrogen Dioxide is categorized as a Controlled Product, Hazard Classes A, C, D1B, D2A, and E as per the Controlled Product Regulations.

16. OTHER INFORMATION

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about Nitrogen Dioxide can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 *"Safe Handling of Compressed Gases in Containers"*
AV-1 *"Safe Handling and Storage of Compressed Gases"*

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

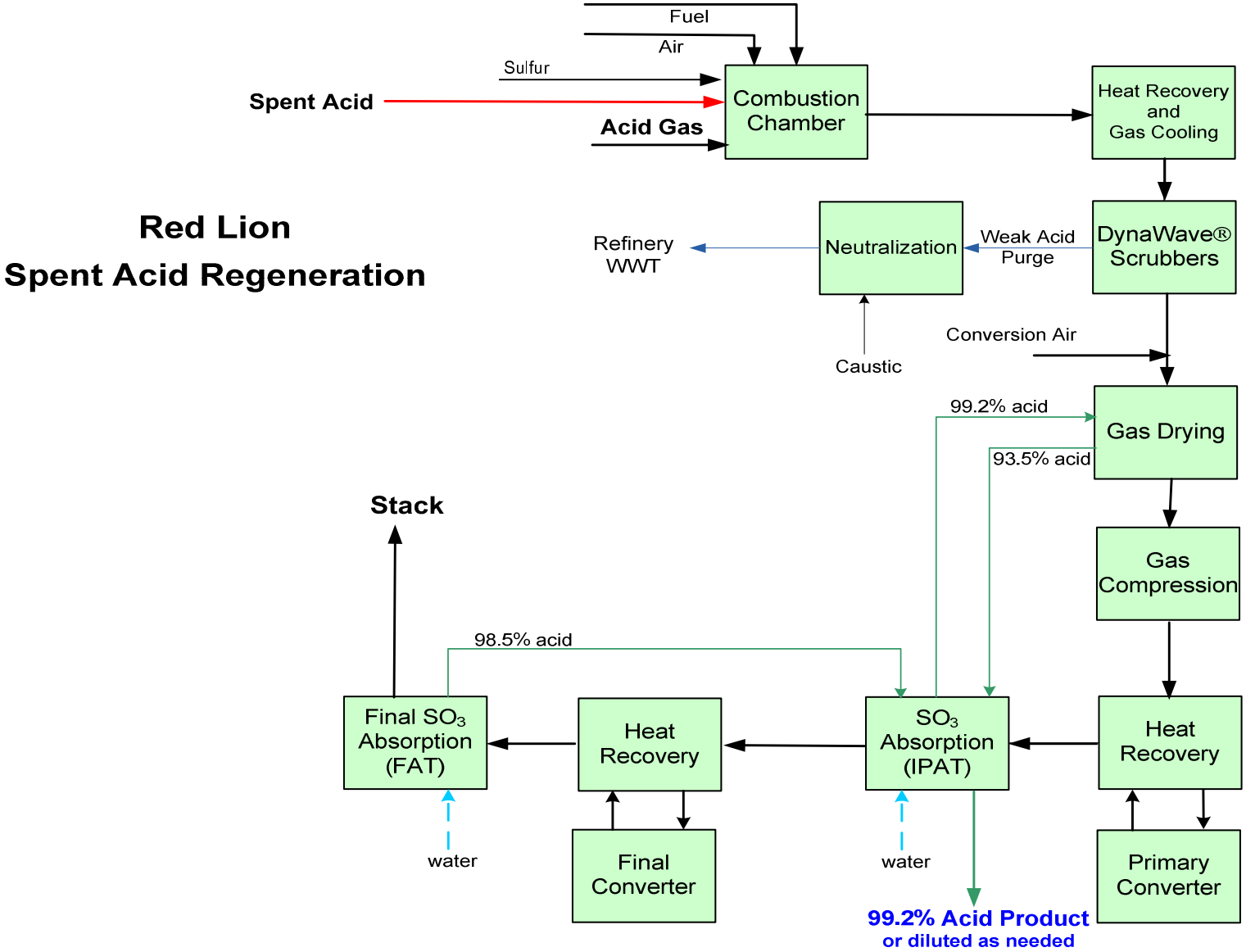
Fax on Demand: 1-800/231-1366

AIR LIQUIDE™

ATTACHMENT F

Attachment F

Veolia Red Lion Process Overview - Acid



ATTACHMENT G

ZONING INFORMATION

THE PLANNING AND ZONING RESOURCE COMPANY

100 NORTHEAST 5TH STREET
OKLAHOMA CITY, OKLAHOMA 73104
(405) 840-4344
FAX (405) 840-2808

ZONING AND SITE REQUIREMENTS SUMMARY

I. Existing Land Use and Zoning

1. Jurisdiction:	*New Castle County, DE*
2. Existing Zoning Designation:	*"IH" Heavy Industry District*
Abutting Zones:	*Surrounded by "HI"*
3. Existing Land Use:	*Manufacturing Facility*
Is The Existing Use In Conformance?	*Yes, Heavy Industry Uses are Permitted by Right*

(See Zoning Code Table 40.03.110B for reference)

II. Property Specification

1. Building Set-Back Lines	
a. Street:	*40 Feet*
b. Side/Rear:	*None Required*

(See Zoning Code Table 40.04.110B and 40.04111A for reference)

2. Building Size	
a. Maximum Building Height or Stories:	*90 Feet*
b. Building Site Area Requirements:	*Minimum Landscaped Surface Ratio (LSR): 0% (Per Variance No. 01-0442-A)*
	Minimum Site Area: 20 Acres
	Minimum Lot Area: 5 Acres
	Minimum Lot Width: 300 Feet

(See Zoning Code Table 40.04.110A and 40.04.110B for reference)

3. Density	
a. Building Density Formula:	*Maximum Gross Floor Area Ratio (FAR): 0.62*
	Maximum Net FAR: 0.69

(See Zoning Code Table 40.04.110A for reference)

4. Parking	
a. Parking Space Formula:	*Warehouse, Storage Establishment, Wholesaling, Manufacturing or Industrial Establishment: Minimum of 5 Spaces, plus 0.5 Spaces per 1,000 Square Feet of Gross Floor Area*

(See Zoning Code Table 40.03.522 for reference)

III. Site History

1. Was special permitting or condition(s) applied to existing zoning?	*Yes, Variance No. 01-0442-A was approved on May 10, 2001 to change the required 11% Landscaped Surface Ratio from 10% to 0%. (Copy Attached)*
2. Are there any outstanding building or zoning violations on file?	*No, according to Shawn M. Soviak, Planner I, there are no open or pending Zoning or Building Code violations on file for the above-mentioned property. (See Attached Letter)*
3. Is a Certificate of Occupancy available for the site?	*Yes, Copies attached.*

IV. Conclusions

1. Use Conformance Status:	*Legal Conforming*
2. Nonconforming Use Characteristics of the Site:	*None*
3. Recommended Action:	*None*
4. Rebuildability Clause:	*Not Applicable*

Other Comments: ***None***

This report was prepared by Karen Foreman. Questions may be directed to Sheila Lyles at 405.840.4344, Extension 4406 or by email to Sheila.Lyles@pzr.com. Please reference PZR Site Number 92578-1.

Thomas P. Gordon
County Executive

DEPARTMENT OF LAND USE

March 30, 2016

In reply, refer to:
2016-0232
766 Governor Lea Road

PZR: Karen Foreman
100 Northeast Fifth Street
Oklahoma City, Oklahoma 73104

Dear Ms. Foreman:

The New Castle County Department of Land Use is in receipt of your request for a verification of zoning and use for tax parcel number 12-008.00-012, which is located at 766 Governor Lea Road in New Castle, Delaware.

A review of the Official Zoning Map of New Castle County indicates the subject parcels are zoned **HI (Heavy Industrial), HI zoning permits heavy industrial uses**, pursuant to Table 40.03.110 and Section 40.33.270.C of the New Castle County Code. The following uses are permitted by **right in the HI zoning district**: Agriculture, Agricultural Support and other Rural Services, Light and Heavy Industry, Utilities – maintenance facilities, Minor Utilities and Public Service Facilities, pursuant to Table 40.03.110 (General Use Table) and Chapter 40.33 of the *New Castle County Code*.

The following uses **are limited uses in the HI zoning district**, subject to limited use review: Clearing (Section 40.03.301), Farm Markets (40.03.328), Drive-In Facilities (40.03.316), Offices (40.03.321), Low Intensity Recreation (40.33.250C), Compost operations (40.03.336), Extraction (40.03.324), Commercial Communications Towers (40.03.326), Park and Ride Facilities, Temporary Storage Trailers, Concrete/Asphalt Batch Plants (40.03.327), Contractor's Offices and Public Interest & Special Events (40.03.330).

in 2001, the New Castle County Board of Adjustment granted variances for the subject property to permit a reduced landscape surface ratio and impervious cover within a Water Resources Protection Area (2001-0442-A). A copy of the decision is enclosed. No zoning or building violations were found for the subject properties in a search of the tax parcel information system.

A Record Minor Land Development Plan for Coke Barn, Delaware City Refinery (instrument number 20101013005463 1) was recorded on October 13, 2010, in the Office of the Recorder of Deeds for New Castle County. The approval and recordation of this plan indicate compliance with the subdivision and zoning code in effect at the time. A copy of the plan is enclosed for your information.

Any new construction or changes in use to that shown on the record and site plans listed above will require compliance with current UDC regulations.

Please be advised that this letter only verifies whether the type of use that exists or is proposed on the site – to the extent you described it in your zoning verification application – is permitted, not permitted, or permitted under limited circumstances in the zoning district. This letter is not a permit

87 Reads Way, New Castle, DE 19720 www.nccdelaware.org Phone: 302-395-5400 Fax: 302-395-5587

and does not offer any guarantee that any other required plans, applications, certifications, or variances for your project will be approved.

If your project involves an expansion of the existing use, a change in use, alterations to the building or site, demolition, or new construction, one or more permits may be needed before you can initiate the use. The following is a summary of Department of Land Use permits, certificates, and plans that may be required for your project.

Any new use of change of use in an existing building may require:

1. **Limited Use Permit**. If the existing or proposed use is identified as a "limited use" on the first page of this letter you will need to apply for a Limited Use Permit. This application must be accompanied by a site plan, or other supporting documentation, demonstrating that the special standards for that use are met. Refer to Articles 3 and 31 of the Unified Development Code for additional information.
2. **Certificate of Use**. To either institute a new use, or expand an existing use, in an existing building you must obtain a Certificate of Use. The Department will determine whether the building meets the BOCA Code (building code) and parking requirements for such use. Refer to Chapter 6, Article 2 of the New Castle County Code (Building and Property Regulations) for additional information.

Any new construction, or altering or expansion of existing buildings and features on the site may require:

1. **Major or Minor Land Development Plan**. If your project will subdivide land or add more than 1,000 square feet of gross floor area, you must submit a major or minor land development plan. The plan will be reviewed for compliance with the land development criteria outlined in the Unified Development Code. During review of the plan, the Department may hold public hearings and may identify other applications, plans, studies, or permits that need to be submitted before development can commence. Refer to Article 31 of the Unified Development Code for general requirements
2. **Parking Plan**. If your project requires installation, expansion or reconfiguration of a parking lot, you will need to submit a parking plan. Refer to Articles 3 and 31 of the Unified Development Code for general requirements.
3. **Building Permit / Demolition Permit / Sign Permit**. If your project will involve altering or enlarging a building (including mechanical systems), demolishing all or part of a building, or installing new signs, you must obtain permits for those activities. During the review of these applications, the Department may identify other applications, plans, studies, or permits that need to be submitted before development can commence. Before the new or improved building can be inhabited, a **Certificate of Occupancy** must be secured from the Department. Refer to Chapter 6, Article 2 of the New Castle County Code (Building and Property Regulations) for additional information.

This summary of Department of Land Use permit applications is intended only for general informational purposes and is not intended to be inclusive of the comprehensive requirements contained in the New Castle County Doe. Please be advised that some of the review processes described above may also require recommendations or decisions from County boards (Planning Board, Historic Review Board, Board of Adjustment, and Resource Protection Area Technical Advisory Committee) or outside agencies. New Castle County must abide by regulations imposed on it by a variety of State and Federal agencies. Accordingly, any of the County permits described above may be subject to additional review processes that address environmental concerns;

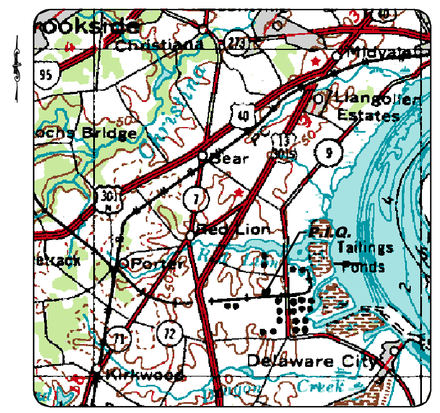
resource protection; public health, safety, and welfare; and a variety of other issues. In some cases, landowners may need to address the requirements of those agencies independently.

Landowners contemplating a change of use, future development, or alterations to buildings and land are encouraged to engage the services of an engineer, land surveyor, and/or attorney for advice on any physical constraints that may limit development of the property, and guidance on what permits may be needed to commence a new use or development.

General questions regarding the plan review process; building, demolition, and sign permits; and Certificates of Use/Occupancy, can be answered by the Department at (302) 395-5400. Copies of documents such as certificates of occupancy or code violations may be obtained, where applicable and available, by submitting an Information Request Form (FOIA). The form is available on-line at http://www.nccde.org/375/Freedom-of-Information-Act. Thank you for your attention to this matter.

Sincerely,

Shawn M. Soviak
Planner I



VICINITY MAP

GENERAL SURVEY NOTES:

1. This survey was made in accordance with laws and/or Minimum Standards of the State of Delaware.
2. The basis of bearing for this survey is DE.S.P.C.S. NAD 83 (2011), as shown hereon.
3. Said described property is located within an area having a Zone Designation Other Areas Zone X (Areas determined to be outside the 0.2% annual chance floodplain) by the Federal Emergency Management Agency (FEMA), on Flood Insurance Rate Map No. 10003C0234K, with an effective date of April 17, 1996 and map revised date of February 4, 2015, for New Castle County, Community No. 105085, in the State of Delaware, which is the current Flood Insurance Rate Map for the community in which said premises is situated.
4. The Property has indirect access to Governor Lea Road (A.K.A. Upper Twin Lane), a dedicated public street or highway.
5. The total number of striped parking spaces on the subject property is 40, including 2 designated handicap spaces.
6. There is no observed evidence of current earth moving work, building construction or building additions.
7. Proposed changes in street right of way lines were not provided. There is no observed evidence of recent street or sidewalk construction or repairs.
8. There is no observed evidence of site use as a solid waste dump, sump or sanitary landfill.
9. Utility Note: Observed evidence of utilities has been shown pursuant to Section 5 Paragraph E (iv) of the ALTA/NSPS Minimum Standard Detail Requirements. The surveyor makes no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The surveyor further does not warrant that the underground utilities shown are in the exact location indicated although he does certify that they are located as accurately as possible from information available. The surveyor has not physically located the underground utilities.
10. *No apparent* wetlands are located on the subject property according to the U.S. Fish and Wildlife Service National Wetlands Inventory located at www.fws.gov/wetlands.
11. The building height, shown hereon, was measured between the highest point of the building and the finished floor elevation in the approximate location as depicted on the drawing.
12. This survey is based in part on a commitment for title insurance by The Fidelity National Title Insurance Company, Commitment No. 4701622, with an effective date of 12/21/2015, and is subject to the following record instruments contained therein:

    Item numbers refer to Schedule B-2 of the title report

    4 AFFIDAVIT AND ASSIGNMENT OF RIGHTS-OF-WAY AND PERMITS between Shell Pipeline Company LP, a Delaware limited partnership and The Premcor Pipeline Co., a Delaware corporation dated April 16, 2009 and recorded in the Office aforesaid on July 29, 2009 in Document No. 20090729005022. - Not Plottable

    5 EASEMENT FOR GAS PIPELINE between Getty Refining and marketing Company and Getty Pipeline, Inc., dated March 8, 1983 and recorded in the Office aforesaid on March 11, 1983 in deed record L, Volume 121, Page 165. - Does not affect the subject property

    6 EASEMENT AGREEMENT FOR UNDERGROUND GAS MAIN between Tidewater oil Company, a corporation of the State of Delaware and Delaware Power & Light Company, a Delaware corporation, dated July 22, 1965 and recorded in the Office aforesaid on August 16, 1965 in Deed Record R, Volume 75, Page 39. - Does not affect the subject property

    7 GRANT OF EASEMENT AND RIGHT OF WAY from Getty Oil Company, a Delaware corporation to Eastern Shore Natural Gas Company, a Delaware corporation to construct a pipeline dated September 9, 1971 and recorded in the Office aforesaid on September 17, 1975 in Deed Record X, Volume 90, Page 593. - Not Plottable, Appendix A not attached

    8 PERMANENT GAS EASEMENT AGREEMENT between Motiva Enterprises LLC, a Delaware limited liability company and Eastern Shore National Gas Company, a Delaware corporation dated February 1, 1999 and recorded in the Office aforesaid on February 3, 2000 in Deed Record 2779, Page 238. - Not Plottable, no supporting plan to illustrate the location of the Eastern Shore Pipeline and meter station

    9 LAND DEVELOPMENT IMPROVEMENT AGREEMENT between Premcor Refining Group, Inc. and New Castle County dated August 19, 2005 and recorded in the office aforesaid on August 26, 2005 in Document No. 20050826-0086258. - Not Plottable, plan not provided

    10 PIPELINE RIGHT OF WAY GRANTS between Getty Refining and Marketing Company and Getty Pipeline, Inc., dated March 6, 1984 and recorded in the Office aforesaid on January 10, 1985 in Deed Record 194, Page 229; Deed Record 194, Page 240 and Deed Record 194, Page 245. - Does not affect the subject property

    11 RIGHT OF WAY AGREEMENT FOR RAILROAD SPUR between Tidewater oil Company, a corporation of the State of Delaware and The Philadelphia, Baltimore and Washington Railroad Company, a Delaware corporation dated November 22, 1966 and recorded in the office aforesaid on February 3, 1967 in deed Record M, Volume 78, Page 156. - Does not affect the subject property

    12 RIGHT OF WAY AGREEMENT TO CONNECT TO RAILROAD LINE between Tidewater Oil Company, a corporation of the State of Delaware and Standard Chlorine of Delaware, Incorporated, a corporation of the State of Delaware, dated December 21, 1965 and recorded in the Office aforesaid on March 1, 1966 in Deed record S, Volume 76, Page 137 - Does not affect the subject property

    13 RESERVATIONS contained in Deed from Star Enterprise, a New York general partnership to Motiva Enterprises LLC, a Delaware limited liability company, dated October 1, 1998, and recorded in the Office aforesaid in Deed Record 2567, Page 286. - Not Plottable

    14 TEN FEET WIDE RIGHT OF WAY as shown on a survey by Dixie Line Surveys, Inc., for those portions of the Insured premises Identified as parcels 1 and 2, set forth in Deed between Tidewater Oil Company and Stauffer Chemical Company, dated December 6, 1960 and recorded December 9, 1960 in the Office aforesaid in Deed Record D, Volume 67, Page 453. - Does not affect the subject property

    15 SURFACE LEASE between Getty Refining and Marketing Company, a Delaware corporation and Getty Pipeline, Inc., a Delaware corporation dated March 6, 1984 and recorded in the Office aforesaid on January 10, 1985 in Deed Record 194, Page 255. - Does not affect the subject property

    16 TERMS, CONDITIONS, RESTRICTIONS, COVENANTS, EASEMENTS AND RIGHTS OF WAY as set forth on Boundary Survey for Lands of Star Enterprises, dated May 11, 1998, May 14, 1998, May 20, 1998 and October 20, 1998 for various parcels, prepared by Dixie Line Surveys, Inc., as listed below:

    a. Parcel 4B: exceptions include those portions within the right-of-way of Governor Lea Road - Does not affect the subject property
    b. Parcel 4A: exceptions include those portions within the rights-of-way of Schoolhouse Road and Governor Lea Road; the permanent drainage easement on the northeasterly side of Road 406 and the utility poles along Delaware Route 1 - Does not affect the subject property
    c. Parcel 2: exceptions include 6 feet wide right-of-way for sewers to Stauffer Chemical (not recorded) along northerly boundary and the 40 feet wide Delmarva Power & Light Co. easement along with River Road right-of-way (including reference in Deed Record S, Volume 69, page 592) - Does not affect the subject property
    d. Parcel 1: exceptions include the waters of Dragon Run Creek, the North Drain of Dragon run Creek Water, a 10 feet wide right-of-way for Stauffer Chemical along the northerly boundary of the parcel, a 40 feet wide Delmarva Power & Light Co. easement along the St. George's Clerks Corner Road (including reference Deed Record S, Volume 69, page 592) and the Bridge No. 308 Taking (reference Deed Record B, Volume 106, Page 7) - Does not affect the subject property
    e. Parcel 6: exceptions include the waters of Doll Run - Does not affect the subject property
    f. Parcel 3B: exceptions include the area leased to Getty Pipeline Inc., 5 feet wide right-of-way for sewers to Stauffer Chemical Co. and the 40 feet DPI & L right-of-way; rights of others to an alley running northerly from Williams Street west of Jefferson Street and 20 feet wide easement for walkway in southeasterly area of the property. - Does not affect the subject property

    17 UTILITY AGREEMENT regarding electrical easement by and between Tidewater Oil Company, a corporation of the State of Delaware and Delmarva Power & Light Company, a Delaware corporation dated July 3, 1967 and recorded in the Office of the Recorder of Deeds in and for New Castle County, State of Delaware on March 15, 1972, at Deed Record A, Volume 86, Page 503. - Not Plottable, plan referenced in deed not provided

    18 AGREEMENT FOR UNDERGROUND POWER LINES between Getty Refining and Marketing Company, a corporation of the State of Delaware and Delmarva Power & Light Company, a Delaware corporation, dated January 2, 1979 and recorded in the Office aforesaid on January 26, 1979 in deed record L, Volume 104, Page 97. this Agreement supercedes and cancels prior Agreement between Getty Oil Company (Eastern Operations), Inc., a corporation of the State of Delaware and Delmarva Power & Light Company, a Delaware corporation, dated March 19, 1976 and recorded on April 9, 1976 in Deed Record U, Volume 92, Page 34. - Not Plottable, plan referenced in deed not provided

    19 AGREEMENT TO CONSTRUCT OVERHEAD POWER LINES between Getty Oil Company, a corporation of the State of Delaware and Delmarva Power & Light Company, a Delaware corporation dated May 15, 1970 and recorded in the Office aforesaid on January 11, 1971 in Deed Record M, Volume 84, Page 523. - Not Plottable, plan referenced in deed not provided

    20 AGREEMENT TO CONSTRUCT OVERHEAD POWER LINES between Tidewater Oil Company, a corporation of the State of Delaware and Delmarva Power & Light Company, a Delaware corporation dated July 16, 1964and recorded in the Office aforesaid on August 25, 1964 in Deed Record P, Volume 73, Page 314. - Not Plottable, plan referenced in deed not provided

    21 EASEMENT FOR INSTALLATION OF ELECTRIC LINES between Getty Refining and Marketing Company, a corporation of the State of Delaware and Delmarva Power & Light Company, a corporation of the State of Delaware and the Commonwealth of Virginia dated January 10, 1983 and recorded in the Office aforesaid on August 31, 1983 in deed Record P, Volume 123, Page 280. - Does not affect the subject property

    22 AGREEMENT TO INSTALL OVERHEAD ELECTRIC POWER LINES between Getty Oil Company (Eastern Operations), Inc., a corporation of the State of Delaware and Delmarva Power & Light Company, a corporation of the State of Delaware dated April 23, 1973 and recorded in the Office aforesaid on May 21, 1973 in Deed Record T, Volume 87, Page 442. - Does not affect the subject property

    23 AGREEMENT TO INSTALL OVERHEAD ELECTRICAL LINE AND GAS MAIN between Tidewater Oil Company, a corporation of the State of Delaware and Delaware Power & Light Company, a Delaware corporation dated July 22, 1965 and recorded September 29, 1965 in Deed Record W, Volume 75, Page 397. This Agreement supersedes and cancels prior Agreements between Tidewater Oil Company, a corporation of the State of Delaware and Delaware Power & Light Company, a Delaware corporation dated December 24, 1964 and recorded on January 28, 1965 in Deed Record M, Volume 74, Page 255 and Agreement dated June 22, 1962 and recorded July 30, 1962 in Deed Record S, Volume 69, Page 592. - Does not affect the subject property

    24 AGREEMENT REGARDING GRANTING OF RIGHTS OF WAY AND EASEMENTS between Tidewater Oil Company, a corporation of the State of Delaware and Delaware Power & Light Company, a corporation of the State of Delaware dated October 21, 1965 and recorded in the Office aforesaid on October 24, 1966 in Deed Record Y, Volume 77, page 519; as amended by Agreement between Getty Oil Company, a Delaware corporation and Delmarva Power & Light Company, a Delaware corporation dated April 29, 1970 and recorded in the Office aforesaid on July 24, 1970 in deed Record X, Volume 83, Page 90 and as further amended by Agreement between Getty Oil Company (Eastern Operations), Inc., a Delaware corporation and Delmarva Power & Light Company, a Delaware corporation dated June 8, 1973 and recorded in the Office aforesaid on August 22, 1973 in Deed Record E, Volume 88, Page 349. - Does not affect the subject property

    25 EASEMENT AGREEMENT (ELECTRIC POWER LINE) between Tidewater Oil Company, a Delaware corporation and Diamond Alkali Company, a Delaware corporation dated March 14, 1966 and recorded in the Office aforesaid on February 7, 1969 in Deed Record Z, Volume 81, Page 10. - Does not affect the subject property

    26 EXCEPTIONS AS CONTAINED IN SPECIAL WARRANTY DEED from Texaco Refining and Marketing, Inc., a Delaware corporation to Star Enterprise, a New York general partnership, dated December 31, 1988 and recorded in the Office aforesaid in Deed Record 814, Page 314. - Not Plottable

    27 EASEMENT FOR WATER LINES between Texaco Refining and marketing, Inc. and Wilmington Suburban Water Corporation dated September 23, 1987 and recorded in the Office aforesaid on November 3, 1987 in Deed Record 620, Page 246. - Not Plottable, plan referenced in deed not attached

    28 AGREEMENT TO CONSTRUCT AND MAINTAIN MONITORING WELLS between Getty refining and Marketing Company, a corporation of the State of Delaware and Delmarva Power & Light Company, a corporation of the State of Delaware and the Commonwealth of Virginia, dated February 18, 1982 and recorded in the Office aforesaid on March 3, 1982 in Deed Record T, Volume 117, Page 113. - Not Plottable, plan referenced in deed not attached

    29 GRANT OF EASEMENT from Star Enterprise, a general partnership, to Eastern Shore Natural Gas Company, a Delaware Corporation, dated March 27, 1992, recorded April 9,1992 in Deed Record 1314, Page 87. - Does not affect the subject property

    30 RECORD MINOR SUBDIVISION PLAN Delmarva Power, as recorded in the office aforesaid on December 9, 1997 in Microfilm No. 4672. Exceptions include: Building Setback Line (no depth given) along River Road. - Does not affect the subject property

    31 RECORD MINOR LAND DEVELOPMENT AND SUBDIVISION PLAN for Star Enterprise - Repowering Project as recorded in the Office aforesaid on August 18, 1997 in Microfilm No. 13276. Exceptions include: Extinguishment of a portion of 30 feet wide access easement; building restriction line of 40 feet in depth; existing 30 feet wide access easements; utilities lines as shown on the plan; General Notes. - Does not affect the subject property

    32 RECORD MINOR LAND DEVELOPMENT PLAN for Star Enterprise as recorded in the Office aforesaid on November 4, 1997 in Microfilm No. 13347. Exceptions include: Notes and utilities as shown on the plan. - Does not affect the subject property

    33 RECORD MINOR LAND DEVELOPMENT PLAN for Star Enterprise - Repowering Project as recorded in the Office aforesaid on May 15, 1998 in Microfilm #13506. Exceptions include: General Notes: General Data paragraph on restoration of impervious cover; utilities as shown on the plan; proposed access drive; proposed access easement for Parcel 4E; building restriction lien of 40 feet in depth; dedication of Governor Lea Road right-of-way; storm water management easement on east side of Route 9. - Does not affect the subject property

    34 RECORD UTILITY PLAN for Conectiv Power Delivery on Lands of Motiva Enterprises -Parcels 1 & 2 as recorded in the Office aforesaid on November 24, 1998 in Microfilm No. 13710. Exceptions include: Ten foot wide easement (1); ten foot wide easement (2A); 35 foot wide easement from Schoolhouse Road and parallel to Wrangle Hill Road; utilities as shown on the plan; Notes. - Does not affect the subject property

    35 EXPLORATORY RECORD MINOR LAND DEVELOPMENT PLAN, Motiva Enterprises, L.L.C., as recorded in the Office aforesaid at Document No. 20011003-0082111. Exceptions include: Utilities as shown on the plan; General Notes. - Does not affect the subject property

    36 RECORD MINOR LAND DEVELOPMENT PLAN - SHOP MODULAR BUILDING ADDITION - MOTIVA ENTERPRISES, L.L.C. as recorded in the office aforesaid on April 11, 2003 in Document No. 200304110044537. Exceptions include: General Notes; utilities as shown on the plan. - Does not affect the subject property

    37 RECORD MINOR LAND DEVELOPMENT PLAN - PROPOSED UNIT NO. 22 - SO2 SCRUBBER COMPLEX FOR MOTIVA ENTERPRISES L.L.C. as recorded in the Office aforesaid on May 30, 2003 in Document No. 20030530-0065709. Exceptions include: General Notes; utilities as shown on the plan. - Does not affect the subject property

    38 RECORD RESUBDIVISION PLAN - SHOP MODULAR BUILDING ADDITION MOTIVA ENTERPRISES, L.L.C., recorded in Document No. 20031010-0130681. - Does not affect the subject property

    39 RECORD MINOR SUBDIVISION PLAN Delmarva Power, as recorded In the office aforesaid on January 24, 1978 in Microfilm No. 4717. Exceptions include: Building Restriction Line of 40 feet in depth along River Road. - Does not affect the subject property

    40 RECORD MINOR SUBDIVISION PLAN Getty Refining & Marketing Co. as recorded in the Office aforesaid on May 3, 1979 in Microfilm No. 5151. - Does not affect the subject property

    41 RECORD MINOR LAND DEVELOPMENT PLAN - School House Road - County Road #406 as recorded in the Office aforesaid on April 10, 1985 in Microfilm No. 7535. Exceptions include: notes, General Notes, Fire Lane Note, 60 feet wide Conrail right-of-way, 40 feet wide DP & L easement and right-of-way. - Does not affect the subject property

    42 RECORD MINOR LAND DEVELOPMENT PLAN - Instrument Repair Facility for Star Enterprise as recorded in the Office aforesaid on October 24, 1990 in Microfilm No. 10634. Exceptions include: Notes and utility lines as shown on the plan. - Does not affect the subject property

    43 RECORD MINOR SUBDIVISION PLAN Lands of Delmarva Power & Light Company to be conveyed to Star Enterprise, as recorded in the Office aforesaid on July 26, 1991 in Microfilm No. 10956. Exceptions include: 30 feet wide access easement to Parcel 4C; access easement to Parcels 2 and 3; 30 feet wide access easement to Parcel 2; building restriction line of 40 feet in depth; notes. - Does not affect the subject property

    44 RECORD MINOR SUBDIVISION PLAN Lands of to be Star Enterprise to be conveyed to Delmarva Power & Light Company, as recorded in the Office aforesaid on August 16, 1993 in Microfilm No. 11774. Exceptions include: Proposed 30 feet wide access easement to Parcel 4 east of Parcel 3; proposed 30 feet wide access easement to Parcel 4 north of Parcels 4 and 5; three existing 30 feet wide access easements; Notes; building restriction line of 40 feet in depth. - Does not affect the subject property

    45 RECORD MINOR LAND DEVELOPMENT PLAN of Star Enterprise as recorded in the Office aforesaid on March 24, 1992 in Microfilm No. 11175. Exceptions include: Notes, utility lines as shown on the plan and existing railroad tracks. - Blanket in nature

    46 RECORD MINOR LAND DEVELOPMENT/RESUBDIVISION PLAN for Parcels 4A & 4B DuPont Red Lion Plant as recorded in the Office aforesaid on July, 14, 2004 in Document No. 200407140077518. - Blanket in nature

    47 RECORD MINOR REDEVELOPMENT PLAN for Premcor Petroleum Coke Warehouse as recorded in the Office aforesaid on July 20, 2006 in Document No. 200607200069256. - Blanket In nature

    48 RECORD RESUBDIVISION PLANE for Parcels 4A & 4B Dupont Red Lion Plant as recorded in the Office aforesaid on September 1, 2006 in Document No. 200609010084363. - Blanket in nature

    49 RECORD MINOR LAND DEVELOPMENT PLAN for Valero SO2 Scrubber Project as recorded in the Office aforesaid on March 28, 2007 in Document No. 200703280028868. - Blanket in nature

    50 RECORD RESUBDIVISION PLAN for Parcels 4A & 4B DuPont Red Lion Plant as recorded in the Office aforesaid on October 3, 2008 in Document No. 200810030066570. - Blanket in nature

    51 LAND DEVELOPMENT IMPROVEMENT AGREEMENT by and between E.I. duPont de Nemours & Co. and New Castle County recorded July 14, 2004 in Document No. 200407140077517. - Not Plottable

    52 AMENDMENT TO LAND DEVELOPMENT IMPROVEMENT AGREEMENT as set forth in Document No. 20111222-0076579. - Not Plottable, Document Not Provided

    53 ELECTRICAL LINE EASEMENT as set forth in Document No. 20130731-0049846. - Does not affect the subject property

    54 EASEMENT as set forth in Document No. 20110419-0020515. - Does not affect the subject property

    55 EASEMENTS and condiltions as shown on Microfilm No. 20101013-0054631;Document No. 20120905-0050431. - Easements do not affect the subject property; conditions Not Plottable

13. This Survey Was Prepared In Accordance With The Following Sources Of Information

    A An actual field survey performed by Spartan Engineering / Land Surveying P.C.

    B Plan set titled "ALTA/ACSM LAND TITLE SURVEY, PREPARED FOR DELAWARE CITY REFINING COMPANY LLC, FOR PROPERTY KNOWN AS PARCEL No. 4C, SITUATE IN RED LION HUNDRED, NEW CASTLE COUNTY - STATE OF DELAWARE," last revised 6/9/11, prepared by Meretone Consultants, Inc., sheets 1 & 2 of 4.

    C Plan set titled "ALTA/ACSM LAND TITLE SURVEY, PREPARED FOR DELAWARE CITY REFINING COMPANY LLC, FOR PROPERTY KNOWN AS PARCEL No. 4B, SITUATE IN RED LION HUNDRED, NEW CASTLE COUNTY - STATE OF DELAWARE," last revised 6/9/11, prepared by Meretone Consultants, Inc., sheets 1 & 2 of 4.

    D Plan set titled "RECORD MINOR LAND DEVELOPMENT / RESUBDIVISION PLAN FOR PARCELS 4A & 4B, DUPONT RED LION PLANT, RED LION HUNDRED - NEW CASTLE COUNTY, DELAWARE," last revised 6-17-04, prepared by Landmark Engineering, sheets 1 - 3 of 3.

LIST OF POSSIBLE ENCROACHMENTS

The following list of encroachments is only the opinion of this surveyor and should not be interpreted as complete listing.

-Chain Link Fence on western side of Lease Parcel
-Basin
-(Five) Utility Poles

LAND AREA:

5.748 ACRES OR 250,388 S.F

RECORD LEGAL DESCRIPTION

ALL that certain lot, piece or parcel of land, being a leased portion of parcel known as 766 Governor Lea Road, and also known as current Tax Parcel No. 12-008.00-012, situate in Red Lion Hundred, New Castle County, Delaware, in accordance with the "Minor Land Development/Resubdivision Plan for Parcels 4A & 4B, Dupont Red Lion Plant", prepared by Landmark Engineering, Inc., dated July 14, 2004, and recorded in the Office of the Recorder of Deeds in and for New Castle County, State of Delaware, in Microfilm/ Instrument No. 20040714-0077518, and also as per recorded plans with Instrument #20101013005463 1, #20060720069256, and Microfilm #13506, and more particularly described according to the following metes and bounds:

COMMENCING from a point on the line of lands now or formerly of Star Enterprise, said point being the northwesterly end of a corner-cut (having a bearing/distance of: N 42° 12' 53" W, 60.88'), joining the westerly right-of-way line of River Road (Delaware Route No.9 at 70 feet wide), with the southerly right-of-way line of Governor Lea Road (Road No. 405 at 45 feet wide); Thence, along the said southerly right-of-way line of Governor Lea Road, N 86° 34' 10" W, 2091.74'+/-, to a point; Thence, Leaving said side of Governor Lea Road and along the dividing line between Parcel 4B and Parcel 4A (being other lands now or formerly of Delaware City Refining Company LLC), S 00° 00' 00" E, 1866.34', to the True Point of Beginning;

FROM the True Point of BEGINNING, along an existing fence-line and sidewalk, Thence, N 90° 00' 00" E, 224.89', to a point of curvature;

THENCE, by an arc of a circle, curving to the left, having a radius of 39.00', an arc distance of 61.26', a chord bearing of N 45° 00' 00" E, and a chord length of 55.15', to a point of tangent;

THENCE, along an existing fenced parking area for the following (4) courses;
1. N 00° 00' 00" E, 177.04', to a point;
2. N 90° 00' 00" E, 94.11', to a point;
3. S 00° 00' 00" E, 216.04', to a point;
4. S 05° 53' 17" W, 37.32', to a point, crossing Street "T"(a private street),;

THENCE, along a curving line that falls approximately between an existing fence-line and an existing railroad spur, by an arc of a circle, curving to the right, having a radius of 425.00', an arc distance of 318.58', a chord bearing of S 27° 21' 46" W, and a chord length of 311.18', to a point of a compound (non-tangental) curve;

THENCE, along a curving line that follows said existing fence-line, by an arc of a circle, curving to the right, having a radius of 1822.00', an arc distance of 236.72', a chord bearing of S 63° 12' 02" W, and a chord length of 236.56', to a point,

THENCE, S 00° 00' 00" E, 16.98', to a point, along lands now or formerly of Norfolk and Southern Railroad, being an existing railroad right-of-way at 60' wide;

THENCE, along the northerly side of said right of way ~~and said fence-line~~, S 82° 44' 10" W, 267.25', to a point at the common corner of Parcel 4B and Parcel 4A;

THENCE, leaving said right-of-way, along ~~said fence~~-line dividing Parcel 4B and 4A, and crossing Street "T"(a private street), N 00° 00' 00" E, 470.91 ', to a point;

THENCE, N 90° 00' 00" E, 265.11 ', to the True Point and Place of Beginning; Containing herein 5.75+/- acres of land.

No.	REVISIONS	Date

COORDINATED BY:
SMITH-ROBERTS
NATIONAL CORPORATION
100 NE 5th Street
OKLAHOMA CITY, OK 73104
800.411.2010
www.smith-roberts.com

ALTA/NSPS LAND TITLE SURVEY

RED LION PLANT - LEASE PARCEL
766 GOVERNOR LEA ROAD
PART OF PARCEL 4B
RED LION HUNDRED
NEW CASTLE COUNTY, DELAWARE

SURVEYOR'S CERTIFICATE

To THE CHEMOURS COMPANY FC, LLC, A DELAWARE LIMITED LIABILITY COMPANY, ITS SUCCESSORS AND ASSIGNS, FIDELITY NATIONAL TITLE INSURANCE COMPANY :

This is to certify that this map or plat and the survey on which it is based were made in accordance with the 2016 Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys, jointly established and adopted by ALTA and NSPS, and includes Items 1, 2, 3, 4, 6a, 6b, 7a, 7b1, 7c, 8, 9, 13, 14, 16, 17, and 20 of Table A thereof.

The field work was completed on 4/6/2016.

Date of Plat or Map 4/7/2016.

PRELIMINARY

ROBERT W. TELSCHOW JR.
DE LICENSED LAND SURVEYOR
NO. - S6-0000802

Spartan®
SPARTAN ENGINEERING / LAND SURVEYING P.C.
132 WEST 31st STREET, SUITE 301
NEW YORK, NY 10001-3406
PHONE: (646) 760-0269 FAX: (646) 571-0269
rtelschow@spartanengineers-surveyors.com
DE CERT. OF AUTH: S8-0000121

LEGEND OF SYMBOLS:

- PROPERTY LINE - PIQ
- PROPERTY LINE - INTERIOR
- PROPERTY LINE - ADJACENT (NOT SURVEYED)
- RIGHT-OF-WAY LINE
- EDGE OF PAVEMENT
- FENCE - STEEL (CHAIN LINK, WIRE, ETC.)
- RAILROAD TRACK
- APPROXIMATE LOCATION OF UNDERGROUND NATURAL GAS LINE PER UTILITY MARKOUT & OBSERVABLE EVIDENCE
- APPROXIMATE LOCATION OF STORM SEWER PIPE
- OVERHEAD WIRES - UNIDENTIFIED / UNVERIFIED UTILITY
- B. BOLLARD
- C.L.F. CHAIN LINK FENCE
- C/O CLEAN OUT
- FH FIRE HYDRANT
- GW GUY WIRE
- INLET
- JBX JUNCTION BOX
- LIGHT POST
- MF MONUMENT FOUND
- MHU MANHOLE UNIDENTIFIED UTILITY
- MNS MAG NAIL SET
- MW MONITORING WELL
- RBCS REBAR WITH CAP SET
- SIGN SIGN
- UP UTILITY POLE
- UPL UTILITY POLE WITH LIGHT
- WS WATER SERVICE
- WV WATER VALVE
- 21 NUMBER OF STRIPED PARKING STALLS
- 2 NUMBER OF DESIGNATED HANDICAPPED PARKING STALLS
- ASPHALT PAVEMENT AREA
- CONCRETE AREA
- BUILDING

GOVERNOR LEA ROAD
(ROAD NO. 405 AT 45 FEET WIDE)
[RECORD DESCRIPTION]

N 86°34'10" W 2091.74'±
[RECORD DESCRIPTION]

P.O.C.
[RECORD DESCRIPTION]

N 42°12'23" W 69.88'
[RECORD DESCRIPTION]

LANDS N/F OF STAR ENTERPRISE
[RECORD DESCRIPTION]

RIVER ROAD
(DELAWARE ROUTE NO. 9 AT 70 FEET WIDE)
[RECORD DESCRIPTION]

MATCHLINE 'A'

MATCHLINE 'B'

MATCHLINE 'C'

PARCEL 4A
S 00°00'00" E 1866.34'
[RECORD DESCRIPTION]
PARCEL 4B

PARCEL 4B
N 90°00'00" E 94.11'

PARCEL 4B
LANDS N/F OF DELAWARE CITY REFINING COPMANY, LLC
T.P. #12-008.00-012
INSTRUMENT #20081003-0066570

PARCEL 4B
N 00°00'00" E 177.04'

PARCEL 4B
S 00°00'00" E 216.04'

A=61.26'
R=39.00'
CH=55.15'
CHD=N 45°00'00" E

PARCEL 4A
LANDS N/F OF DELAWARE CITY REFINING COPMANY, LLC
T.P. #12-002.00-025
INSTRUMENT #20081003-0066570

P.O.B.
N:592246.60
E:593767.05

PARCEL 4A
N 90°00'00" E 490.00'

265.11'

224.89'

S 05°53'17" W 37.32'

"T" STREET
(A PRIVATE STREET)

PARCEL 4A
N 00°00'00" E 470.91'

PARCEL 4B

LEASE PARCEL
5.748 ACRES OR 250,388 S.F.

A=318.58'
R=425.00'
CH=311.18'
CHD=S 27°21'46" W

A=236.72'
R=1822.00'
CH=236.56'
CHD=S 63°12'02" W

S 00°00'00" E 16.98'

N/F NORFOLK SOUTHERN RAILWAY COMPANY
(F.K.A. CONRAIL – NEWARK TO DELAWARE CITY BRANCH)
REYBOLD INDUSTRIAL TRACK
60' WIDE

S 82°44'10" W 267.25'

GOVERNOR LEA ROAD
(A.K.A. UPPER TWIN LANE)
(VARIABLE WIDTH)

DE.S.P.C.S. NAD 83 (2011)

SCALE: 1" = 40'
0 40 80 120

No.	REVISIONS	Date

COORDINATED BY:
SMITH-ROBERTS NATIONAL CORPORATION
100 NE 5th Street
OKLAHOMA CITY, OK 73104
800.411.2010
www.smith-roberts.com

ALTA/NSPS LAND TITLE SURVEY

RED LION PLANT - LEASE PARCEL
766 GOVERNOR LEA ROAD
PART OF PARCEL 4B
RED LION HUNDRED
NEW CASTLE COUNTY, DELAWARE

SURVEYOR'S CERTIFICATE

To THE CHEMOURS COMPANY FC, LLC, A DELAWARE LIMITED LIABILITY COMPANY, ITS SUCCESSORS AND ASSIGNS, FIDELITY NATIONAL TITLE INSURANCE COMPANY :

This is to certify that this map or plat and the survey on which it is based were made in accordance with the 2016 Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys, jointly established and adopted by ALTA and NSPS, and includes Items 1, 2, 3, 4, 6a, 6b, 7a, 7b1, 7c, 8, 9, 13, 14, 16, 17, and 20 of Table A thereof.

The field work was completed on 4/6/2016.

Date of Plat or Map 4/7/2016.

PRELIMINARY

ROBERT W. TELSCHOW JR.
DE LICENSED LAND SURVEYOR
NO. - S6-0000802

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rtelschow@spartanengineers-surveyors.com

DE CERT. OF AUTH: S8-0000121

2/13/15

DE.S.P.C.S.
MAD 83 (2011)

SCALE: 1" = 40'

0 40 80 120

No.	REVISIONS	Date

COORDINATED BY:

SMITH-ROBERTS
NATIONAL CORPORATION

100 NE 5th Street
OKLAHOMA CITY, OK 73104
800.411.2010
www.smith-roberts.com

ALTA/NSPS LAND TITLE SURVEY

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2/13/15

ATTACHMENT H

#	Maintenance Procedure Title	Red Lion Maintenance Procedure Training Status-Completion Dates							
	Training required upon hire	Mechanic 1	Mechanic 2	Mechanic 3	Mechanic 4	Mechanic 5	Mechanic 6	Mechanic 7	Mechanic 8
200-151	Static Electricty and Grounding	2/26/18	6/23/16	2/21/18	6/23/16	2/19/15	2/26/18	4/22/15	3/17/15
200-217	Common Fasteners and Bolts	2/22/2018	5/30/16	2/22/18	5/24/16	4/28/15	2/16/18	5/4/15	4/24/15
201-105	Electrical Circuit Analysis-No test	Not Required	Not Required	Not Required	Not Required	4/23/2015	Not Required	4/23/2015	4/23/2015
201-108	Electrical Equipment Installation	Not Required	Not Required	Not Required	Not Required	6/12/15	Not Required	6/22/15	6/16/15
201-110	Emergency Alarms Maintenance and Testing	Not Required	Not Required	Not Required	Not Required	5/5/15	Not Required	5/13/15	5/5/15
201-112	Electrical Grounding and Bonding	Not Required	Not Required	Not Required	Not Required	6/12/15	Not Required	6/22/15	6/19/15
201-125	UPS Maintenance	Not Required	Not Required	Not Required	Not Required	6/23/15	Not Required	6/24/15	6/23/15
204-106	Communication Equipment Maintenance	Not Required	Not Required	Not Required	Not Required	6/26/15	Not Required	7/1/15	6/23/15
206-101	Safety Interlocks and Alarm Testing and Maintenance	Not Required	Not Required	Not Required	Not Required	6/19/15	Not Required	6/22/15	6/22/15
206-113	Instrument Inspection and Calibration	Not Required	Not Required	Not Required	Not Required	4/28/15	Not Required	5/4/15	4/24/15
206-122	Safety Interlocks and Alarm Testing and Maintenance	Not Required	Not Required	Not Required	Not Required	6/12/15	Not Required	6/23/15	6/16/16
206-132	Pneumatic Control Valve Maintenance	Not Required	Not Required	Not Required	Not Required	6/26/15	Not Required	7/1/15	6/23/15
207-208	Emergency and Conservation Vent Maintenance	2/16/2018	5/6/16	2/22/18	5/6/16	Not Required	2/22/18	Not Required	Not Required
207-213	Bellows Expansion Joints	2/16/2018	5/6/16	2/26/18	5/6/16	Not Required	2/26/18	Not Required	Not Required
207-216	Flame Arrestor Inspection	3/5/2018	7/11/16	3/5/2018	7/12/16	Not Required	3/5/2018	Not Required	Not Required
207-221	Heat Exchanger Maintenance	3/5/2018	7/11/16	3/5/2018	7/12/16	Not Required	3/5/2018	Not Required	Not Required
207-222	Hose Inspection and Replacement	3/5/2018	5/16/16	3/5/2018	5/6/16	Not Required	3/5/2018	Not Required	Not Required
207-228	Piping Systems, Metallic, Repair and Replacement	4/27/2018	6/23/16	4/27/18	6/23/16	Not Required	5/15/18	Not Required	Not Required
207-230	Piping System and Thermoplastic Repair and Replacement	4/27/2018	5/27/16	4/27/18	5/27/16	Not Required	5/15/18	Not Required	Not Required
207-231	Piping Systems, Nonmetallic, In-Service Visual Inspection	4/27/2018	7/12/16	4/27/2018	7/11/16	Not Required	4/27/2018	Not Required	Not Required
207-232	Vessels and Piping Systems, Metallic Lined/Unlined In-Service Casual Visual Inspection	4/27/2018	7/12/16	4/27/2018	7/11/16	Not Required	4/27/2018	Not Required	Not Required
207-233	Inspection	4/27/2018	5/27/16	4/27/2018	5/27/16	Not Required	4/27/2018	Not Required	Not Required
207-235	Pipe Support Inspection	5/18/2018	7/12/16	5/18/18	7/11/16	Not Required	5/18/18	Not Required	Not Required
207-243	Rupture Disk Maintenance	5/18/2018	7/12/16	5/18/2018	7/11/16	Not Required	5/18/2018	Not Required	Not Required
207-248	Sightglass Installation, Inspection and Maintenance	5/18/2018	7/15/16	5/18/18	7/15/16	Not Required	5/18/18	Not Required	Not Required
207-254	Hydrostatic Testing of Vessels and Piping Systems	5/18/2018	7/15/16	5/18/18	7/15/16	4/28/15	5/18/18	5/4/15	4/24/15
207-257	Tubing System Maintenance	Not Required	Not Required	Not Required	Not Required	6/30/15	Not Required	7/10/15	6/30/15
207-259	Valve in Service Inspection	6/20/2018	5/30/16	6/20/2018	5/30/16	2/27/15	6/20/2018	4/2/15	3/16/15

207-261	Valve Removal and Replacement	6/20/2018	7/15/16	6/20/2018	7/15/16	4/28/15	6/20/2018	5/4/15	4/24/15
207-267	Back Flow Prevention Systems	6/20/2018	6/23/16	6/20/2018	6/23/16	2/27/15	6/20/2018	4/2/15	3/16/15
208-240	Mechanical Seals	11/2/2018	Not Required	11/2/2018	10/6/15	Not Required	11/2/2018	Not Required	Not Required
208-242	Pump System Inspection and Troubleshooting	3/20/2019	Not Required	3/20/19	7/15/16	6/30/15	Not Required	6/30/15	6/24/15
212-201	General Material and Equipment Rigging	6/20/2018	5/6/16	6/20/2018	5/6/16	4/23/15	6/20/2018	4/23/15	4/23/15
221-001	Corrosion Under Insulation	11/2/2018	7/15/16	11/2/18	7/15/16	8/25/15	11/2/18	3/19/19	3/19/19
		Training required upon hire and every three years thereafter.							
	Process Overview	12/20/2018	12/20/2018	12/20/2018	12/20/2018	12/20/2018	12/20/2018	12/20/2018	12/20/2018
100	Maintaining Maintenance Procedure	11/21/2016	11/21/2016	6/13/2017	11/21/2016	12/9/2016	6/13/2017	12/12/2016	12/8/2016
101	Using Herbicides	10/21/2016	11/21/2016	6/13/2017	10/21/2016	12/9/2016	6/13/2017	12/12/2016	12/8/2016
102	Preheater Tune-up	Not Required	Not Required	Not Required	Not Required	11/16/2017	Not Required	2/12/2015	11/17/2017
103	Combustion Chamber BMS K6R Inspection	Not Required	Not Required	Not Required	Not Required	1/9/2018	Not Required	8/22/2017	2/13/2018
104	Receiving and Maintaining Gas Cylinders	Not Required	10/16/2015	Not Required	Not Required	2/19/2015	6/13/2017	2/12/2015	2/10/2015
108	Acid Valve Decomissioning	10/21/2016	11/21/2016	6/13/2017	10/21/2016	12/9/2016	6/13/2017	12/12/2016	12/8/2016
110	Maintenance and Testing	Not Required	Not Required	Not Required	Not Required	6/11/2018	Not Required	5/8/2018	5/2/2018
111	Inspecting and Testing Hoses	10/16/2017	10/16/2017	10/16/2017	10/16/2015	Not Required	10/16/2017	Not Required	Not Required
112	Grinding Wheel Replacement and Inspection	3/8/2017	3/8/2017	3/8/2017	3/8/2017	6/19/2018	3/8/2017	3/10/2017	3/9/2017
114	Rigging and Hoisting Equipment Inspections	3/8/2017	3/8/2017	3/8/2017	3/8/2017	6/19/2018	3/8/2017	3/10/2017	3/9/2017
115	MCC Bucket Removal and Installation	Not Required	Not Required	Not Required	Not Required	11/13/2017	Not Required	11/13/2017	10/11/2017
116	Cutting Metal with a Torch	3/15/2017	3/15/2017	3/15/2017	3/15/2017	6/19/2018	3/15/2017	3/16/2017	3/16/2017
117	FRP Vessel Closure	7/12/2017	7/12/2017	7/12/2017	7/12/2017	7/28/2017	7/12/2017	7/28/2017	7/21/2017
118	Maintenance on Horiba Nox CEMS	Not Required	Not Required	Not Required	Not Required	7/13/2015	Not Required	7/10/2015	7/7/2017
119	Main Compressor Lube Oil Change	10/16/2017	Not Required	10/16/2017	10/16/2017	Not Required	Not Required	Not Required	Not Required
120	Stack Nox and SO2 Cylinder Gas Audit	Not Required	Not Required	Not Required	Not Required	6/11/2018	Not Required	5/18/2018	5/2/2018
121	Calibration of Field H2S and SO2 Area Monitors	Not Required	Not Required	Not Required	Not Required	6/11/2018	Not Required	6/4/2018	5/22/2018
122	Ametec SO2 Analyzer	Not Required	Not Required	Not Required	Not Required	6/11/2018	Not Required	5/22/2018	5/21/2018
124	Steam Trap Inspections and Cleaning	9/25/2017	4/12/2016	9/26/2017	4/14/2016	Not Required	9/25/2017	Not Required	Not Required
125	Main Compressor PM	5/16/2018	Not Required	5/16/2018	5/16/2018	Not Required	Not Required	Not Required	Not Required
127	Railroad Grounding Inspection	Not Required	Not Required	Not Required	Not Required	6/15/2015	Not Required	6/15/2015	6/12/2015
128	Acid Cooler Anodic Protection PM	Not Required	Not Required	Not Required	Not Required	8/15/2018	Not Required	7/2/2018	6/26/2018
129	Pump and Motor Repair	5/16/2018	Not Required	5/16/2018	5/16/2018	Not Required	5/16/2018	Not Required	Not Required
131	Nox and SO2 Drift Test	Not Required	Not Required	Not Required	Not Required	8/15/2018	Not Required	7/2/2018	6/26/2018
132	Plant Lubrication Program	7/11/2018	Not Required	7/11/2018	7/11/2018	Not Required	7/11/2018	Not Required	Not Required
133	Portable Water Filter Maintenance	8/4/2016	8/11/2016	10/16/2017	8/4/2016	Not Required	10/16/2017	Not Required	Not Required
134	Plant Process Fans Maintenance	8/4/2016	Not Required	10/16/2017	8/4/2016	Not Required	10/16/2017	Not Required	Not Required
136	Spent Acid Gun PM	9/16/2016	4/12/2016	3/19/2019	9/16/2016	Not Required	3/19/2019	Not Required	Not Required
137	Boiler Tube Lancing	4/19/2017	4/19/2017	4/19/2017	4/19/2017	Not Required	4/19/2017	Not Required	Not Required
138	Using Rags and Universal Waste Disposal	2/16/2018	2/16/2018	2/16/2018	4/14/2016	2/22/2018	2/16/2018	2/22/2018	2/22/2018
141	Performing Calibration Checks on Site PH Probes	Not Required	Not Required	Not Required	Not Required	8/15/2018	Not Required	7/2/2018	6/27/2018
143	Welding in Maintenance Shop	9/16/2016	4/16/2016	Not Required	9/16/2016	Not Required	Not Required	Not Required	Not Required
145	Annual Storage Tank D/P Level Calibration	Not Required	Not Required	Not Required	Not Required	9/6/2016	Not Required	9/1/2016	9/1/2016
146	MCC Fuse Clip and Starter Torque Inspections	Not Required	Not Required	Not Required	Not Required	6/22/2018	Not Required	6/22/2018	12/9/2016
147	SIT Procedure Safety Seal	Not Required	Not Required	Not Required	Not Required	9/26/2016	Not Required	9/26/2016	9/23/2016
148	SIT Procedure Boiler Drum Level Interlock Test	Not Required	Not Required	Not Required	Not Required	11/2/2018	Not Required	10/16/2018	11/2/2018
149	SIT Procedure FAT	Not Required	Not Required	Not Required	Not Required	6/19/2018	Not Required	3/27/2017	3/27/2017
150	SIT Procedure IPAT	Not Required	Not Required	Not Required	Not Required	1/17/2018	Not Required	1/17/2018	9/23/2015
151	SIT Procedure PRJS	Not Required	Not Required	Not Required	Not Required	1/17/2018	Not Required	1/17/2018	9/23/2015

152	Voltage Rated Glove Inspection	Not Required	Not Required	Not Required	Not Required	9/22/2016	Not Required	9/1/2016	9/1/2016
153	IPAT	Not Required	Not Required	Not Required	Not Required	6/19/2018	Not Required	4/6/2017	4/6/2017
154	Prevention Check	Not Required	Not Required	Not Required	Not Required	2/9/2018	Not Required	2/6/2018	2/2/2018
156	Disks	2/16/2018	2/16/2018	2/16/2018	2/21/2018	Not Required	2/16/2018	Not Required	Not Required
157	Training Procedure	11/2/2018	11/2/2018	11/2/2018	11/2/2018	11/5/2018	11/2/2018	11/5/2018	11/5/2018
158	Preventive Maintenance to Switchgear Batteries	Not Required	Not Required	Not Required	Not Required	8/15/2018	Not Required	7/2/2018	6/26/2018
200-384	Safety Line Breaks	1/12/2018	1/12/2018	1/12/2018	1/25/18	1/26/18	1/25/18	1/29/18	1/26/18
201-104	Electrical Checkout	Not Required	Not Required	Not Required	Not Required	5/8/18	Not Required	5/8/18	3/20/18
206-134	Safety Interlock Bypassing	Not Required	Not Required	Not Required	Not Required	5/16/18	Not Required	5/18/18	5/22/18
207-223	Flange Joint Make up	1/12/2018	1/12/2018	1/12/2018	1/25/18	1/26/18	1/25/18	1/29/18	1/26/18
207-245	Pressure Relief Valve Removal and Replacement	1/12/2018	1/12/2018	1/12/2018	1/25/18	Not Required	1/25/18	Not Required	Not Required
208-233	Gaskets and Packing	2/28/2018	2/26/18	2/26/18	2/22/18	3/12/18	2/26/18	3/6/18	3/13/18
208-235	Pump Removal and Reinstallation	7/24/2018	Not Required	7/24/2018	6/10/16	Not Required	7/24/2018	Not Required	Not Required
208-237	Pump, ANSI and Chemical Repair	11/2/2018	Not Required	11/2/18	10/7/15	Not Required	11/2/18	Not Required	Not Required

VEOLIA

RED LION
TRAINING ATTENDANCE SHEET

COURSE TITLE: OPP 119.14 VCU SYSTEM OPERATION INCLUDING SCRUBBER OPERATION	**DATE TRAINING STARTED** 10/13/2017
OBJECTIVE(S): Review Procedure Updates	

Regulation (if applicable): N/A

Description of Personnel Requiring Training: Red Lion Operators

Frequency of training : ONE TIME

Method of instruction: PROCEDURE REVIEW

Trainer's name and signature: Mike Gross

Trainer's Qualifications: Ops Mgr.

	Name of Student	Signature	DATE		NOTES
1.			10/26/17		
2.		N/A	N/A		
3.			10/25/17		
4.			10/27/17		
5.			12/14/17		
6.			10/16/17		
7.			10/23/17		
8.			10/19/17		
9.			10.26.17		
10.			10-18-17		
11.					
12.			10.18.17		
13.			11/15/17		
14.			10-17-17		
15.			10/23/17		

VEOLIA

RED LION
TRAINING ATTENDANCE SHEET

COURSE TITLE: OPP100.34 Plant Startup		DATE TRAINING STARTED 5-23-18
OBJECTIVE(S): train all Ops on changes		
Regulation (if applicable): N/A		
Description of Personnel Requiring Training: Red Lion Operators		
Frequency of training : when changes to procedure apply		
Method of instruction:		
Trainer's name and signature: Trainer's Qualifications: Operator		

Name of Student	Signature	DATE		NOTES
1.		5-29-18		
2.		8-27-18		
3.		6/2/18		
4.		5-26-18		
5.		5-23-18		
6.		5.23.18		
7.		6/13/18		
8.		6/26/18		
9.		6/12/18		
10.		6-12-18		
11.		5-23-18		
12.	N/A	N/A		
13.		6-19-18		
14		5-25-18		

THIS PROCEDURE INCLUDES THE OPERATING PROCEDURE FOR THE MIST ELIMINATOR