ENV-ON-PCR-Environmental Emergency Response Plan (E2 Plan) Port Colborne Refinery

PGS-006009, Rev.02-01/01/2025

Issuer Area: Port Colborne Refinery Environment
Technician Responsible: Name: Gary Remington, Registration: IO955276, Area: Environment Department
Target Audience: Site Operators, Site Supervisors, Site Manager, PCR Environmental personnel
Need of training: (X)YES ( )NO

Expected results:

- ✓ To define roles and responsibilities, resources, equipment, and training requirements related to the emergency response plan.
- ✓ To summarize the site risk analysis by defining specific risk factors, including risk analysis, preparedness, prevention, and response.
- ✓ To define emergency response equipment and alerting/notification procedures.

This document applies to the following Vale facilities and jurisdictions:

Ontario: Port Colborne Refinery

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1 PURPOSE

In 2003, the Environmental Emergency (E2) Regulations came into force under the authorities of the *Canadian Environmental Protection Act*, 1999 (CEPA 1999). The regulations were first amended in 2011.

The Environmental Emergency Regulation, 2019 requires a company to have an environmental emergency plan (E2 Plan) to demonstrate that it is prepared to react in the event of an accidental release of a regulated hazardous substance.

An Environmental Emergency Plan, commonly referred to as an E2 Plan, helps facilities to better prevent, prepare for, respond to and recover from an environmental emergency. The plan is used, in unexpected releases of the regulated substances, establish specific training requirements, and conduct exercises to test the plan to make sure the environment and human life and health are protected.

These plans may be prepared in accordance with existing emergency response documents and systems (i.e. Emergency Preparedness or Crisis Management Plans) if they meet the requirements of subsection (2) of the Regulation or have been amended so that they meet all requirements.

A key pillar in E2 planning is the consideration of the risks present in the overall management of hazardous substances from movement, storage and disposal perspectives. Addressing key risks contributes to the overall reduction of risk severity through the implementation of critical controls and is an effective way to minimize potential catastrophic events.

2 FACILITY DESCRIPTION

Vale Canada Limited – Port Colborne Refinery (PCR) focuses on the production of electrocobalt, the processing of precious metals and the packaging and distribution of finished nickel products to market. These three product lines are processed at three distinct production areas at PCR: the Cobalt Refinery, the Precious Metals Refinery and Nickel Processing. There are also support services and utilities throughout PCR in support of the production areas. Products and intermediates of PCR are shipped to other Vale Refineries or to market.

An administration office building, Process Technology office and workspace, and a Change house are also located onsite at PCR.

This following information provides a brief overview of the PCR operations.

2.1 Cobalt Refinery

Slurry feed is received from Vale Canada Limited – Copper Cliff Nickel Refinery containing nickel and cobalt carbonates and other impurities. This slurry is first dissolved with sulphuric acid and then pH adjusted with soda ash. The mixture is then filtered to remove calcium and iron along with other metals, such as copper, nickel, and cobalt, co-precipitated. The solid phase is rejected, and liquid phase is sent through

several other purification steps including zinc ion exchange and copper removal using ion exchange. The remaining liquid containing purified cobalt and nickel is treated with sodium hypochloride (bleach) to separate the cobalt from the nickel. The remaining nickel solution is treated with soda ash producing a nickel carbonate precipitate which is reverted in slurry form to the Copper Cliff Nickel Refinery. Cobalt hydrate is precipitated, filtered, and sent to the Electro Cobalt Refinery (ECR) building.

In the ECR, the cobalt hydrate feed is subjected to additional purification through ion exchange, settling and filtering. Soluble cobalt contained in acidic liquor is pumped into plating cells containing cathodes and a sacrificial lead anode. Passing an electric current through the cells, metallic cobalt is electrolytically deposited onto mandrels. Several hundred cobalt disks form on each mandrel to a size of about three centimeters in diameter. Once removed from the mandrel, the rounds are polished, degassed in an electrically heated kiln and packaged for market in 250 kg drums.

The process for the maintenance and refinishing of the mandrels that are used in the ECR involves a series of treatments including acid cleaning with both nitric acid and sulphuric acid and grit blasting with aluminum oxide. The mandrels are then coated with epoxy ink in a pattern specific for rounds formation, and dried.

2.2 Precious Metals Refinery

In the PMR, slurry feed shipments of residues or process intermediates are received from Vale's Sudbury Operations, or other toll materials from clients. These feeds undergo batch hydrometallurgical processes to remove impurities and purify targeted metals (i.e. gold) or metallic compounds (i.e. platinum group metals). The feed is either charged to atmospheric leach tanks to be leached in an oxygen atmosphere. The resultant copper-free filter cake is leached to remove lead, fed to a thickener and filtered again, producing a lead carbonate. The leach solution is treated with iron and chlorine to precipitate silver and silver chloride and to dissolve various other precious metals for further upgrading steps. The solids are further processed to separate and concentrate various precious metals. Several metallic compounds are also created as by-products. The PMR produces gold sand, silver sand and platinum group metal cake, which is sent off-site for further refining and processing. By-products such as lead carbonate cake, selenium cake and bismuth sand are sold to other refining operations. An additional process circuit produces a saleable tellurium-containing product.

An analytical laboratory that services all of PCR is also housed in the PMR building. This laboratory provides analytical testing of PCR intermediates and products only.

2.3 Nickel Processing

Nickel products are received from Vale Canada Limited's other operations. Nickel rounds go through a sulphuric acid dip for cleaning followed by screening, a water rinse and polishing. Nickel cathodes are sheared into squares of varying sizes. Nickel pellets and flats are also received in bulk containers for repackaging. The products are packaged into 10 kg bags, 250 kg drums or tonne bulk bags for shipment to market.

2.4 Surrounding Area

Sensitive receptors are places which would be significantly impacted by the adverse effects caused by an emergency at PCR. The sensitive receptors are listed below and have been incorporated in mapping the receptors associated with PCR.

1. Hospitals and Long-Term care facilities;
2. Schools and Child care facilities;
3. Residential, Commercial and Industrial buildings;
4. Highways;
5. Transportation Corridors;
6. Parks;
7. Wildlife habitats;
8. Water sources; and:
9. Water Bodies

The following resources have been used to determine sensitive receptors that must be considered during the implementation of this plan:

- The City of Port Colborne's Official Plan (2006)
- Niagara Peninsula Source Water Protection Area Assessment Report to identify groundwater and surface water intakes, sensitive natural receptors (2010);
- Vale Modelling Plans to identify locations of air monitors, buildings and emission sources (2017);
- Niagara Navigator web tool used to identify sensitive receptors, land uses in the area (2012);
- Natural Heritage Map used to identify ecological, cultural and First Nation values (2008);

Maps depicting the location of the sensitive receptors are located in Appendix A.

Additional information regarding sensitive receptors can be found in the Spill Prevention and Contingency Plans which are located on the Vale Intranet site for reference.

3 SCHEDULE 1 SUBSTANCES

PCR has three Schedule 1 substances that are in quantities greater than the quantity listed in column 4, minimum quantity, that requires a substance specific emergency response plan. The substances are: chlorine, sulphur dioxide, and hydrochloric acid. Safety Data Sheets (SDS) for each substance are attached in Appendix B. A summary of physical and chemical properties for each substance is included in Table 1.

Table 1: Information on basic physical and chemical properties

Physical/Chemical Properties	Chlorine	Sulphur Dioxide	Hydrochloric Acid
CAS Number	7782-50-5	7446-09-5	7647-01-0
UN Number	UN 1017	UN1079	UN1789
Physical State	Gas	Gas	Liquid
Colour	Yellow	Colourless	Clear / colourless
Odour	Sharp	Pungent	Pungent
pH	Not Available	If dissolved in water will effect pH	<1
Melting Point	Not Available	-75.5ºC	-44ºC
Boiling Point	-34. 04ºC	-10ºC	74ºC
Flash Point (close up)	Not Applicable	Not applicable for gases and gas mixtures	Not Applicable
Explosive Limits	Not Applicable	Not Applicable	Not Applicable
Density	1.47 kg/m^3 at 0ºC	2.2697kg/m^3 at 20ºC	1.16
Auto-Ignition Temperature	Not Applicable	Not Applicable	Not Applicable
Soluble in Water?	Not Applicable	soluble	soluble
E2 Hazard Category	Inhalation (I)	Inhalation (I)	Inhalation (I)

3.1 Chlorine

Chlorine is a greenish-yellow gas that is an intense irritant to eyes and mucous membranes. Combining with bodily moisture to liberate nascent oxygen and form HCl, which can cause inflammation of the tissue with which they are in contact with. It is stored and transported in its compressed liquid form but used commonly in its gas state.

3.2 Sulphur Dioxide

Sulphur Dioxide is a highly reactive, colourless gas which can create a suffocating odour. When released, sulphur dioxide can react with other elements in air to form particulate matter or be chemically transformed into acidic pollutants. Inhaling sulphur dioxide can cause severe irritation of the nose and throat and can create a pulmonary edema by accumulating fluids in the lungs. The gas can irritate and burn skin and eyes. It is stored and transported in its compressed liquid form but used most commonly in its gas state.

3.3 Hydrochloric Acid

Hydrochloric acid is the aqueous solution of hydrogen chloride gas. HCl is a clear, colourless liquid with a strong pungent smell. When released to ambient, the liquid can fume and result in gas that can be transported further. Reacting with water, the acid will return to liquid form and can burn and irritate eyes and mucous membranes. It is transported and stored in liquid form.

3.4 Maximum Expected Quantities

3.4.1 Chlorine-Precious Metals Refinery

The Precious Metals Refinery at PCR consumes the reagent chlorine, delivered in 1-tonne cylinders. There is a storage building exterior to the PMR to house cylinders, while two cylinders are on-line within the PMR. The location of the chlorine storage room is 0.189km away from the boundary of the facility and the adjacent public recreational area in Port Colborne. In total there can be 10 tonnes of chlorine with two online cylinders and eight others in storage.

3.4.2 Sulphur Dioxide

Sulphur dioxide is a reagent utilized at the Cobalt Refinery. There is a rail car docking station that serves two 91-tonne cars. The location of the sulphur dioxide rail car dock is 0.13km away from the boundary of the facility and the adjacent residential community of Port Colborne. The maximum expected quantity at the facility is 182 tonnes with the largest container, being any of the rail cars, having a maximum capacity of 91 tonnes.

3.4.3 Hydrochloric Acid

Hydrochloric acid is a reagent utilized at the PMR. The Cobalt Refinery (CoR) reports hydrochloric acid in some exhaust gas, however it is not directly used in the process. The location of the hydrochloric acid storage tanks is at the PMR, and they are 0.22km away from the boundary of the facility and the adjacent public recreational area in Port Colborne. The maximum expected quantity at the facility is 30,000 litres, equivalent to 34.8 tonnes. The twin storage tanks are married with common piping.

3.5 Use at the Facility

Chlorine, Suplhur Dioxide and Hydrochloric acid are each utilized as reagents within Port Colborne Refinery. The tanks and vessels referenced in Sec 3.4, as accounted for under the *Environmental Emergency Regulations 2019* are noted in Table 2. Figure 1 illustrates the respective locations of the materials at Port Colborne Refinery.

Table 2: Location of Chlorine, Sulphur Dioxide and Hydrochloric acid storage at Port Colborne Refinery

Material	Tank Location	Easting*	Northing*	Tank Size (tonnes)
Chlorine	PMR	4748741.2	643914.3	(10) 1
Sulphur Dioxide	Cobalt Refinery	4749061.4	643640.4	(2) 91
Hydrochloric Acid	PMR	4748779.6	643848.8	(2) 17.4

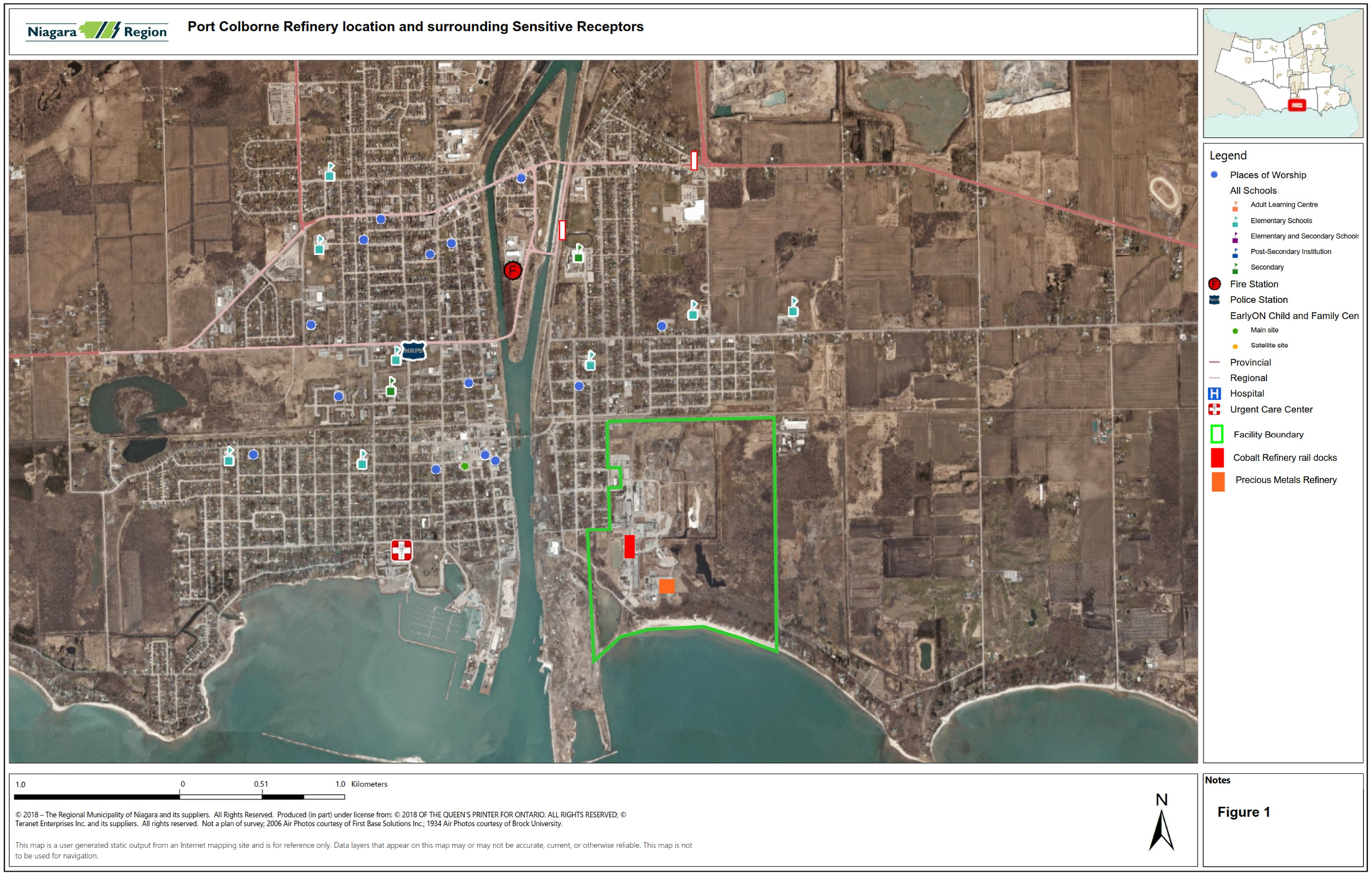
*- UTM coordinates NAD83 Zone 17

Table 3: Sensitive Receptors Identified in area surrounding PCR

Sensitive Receptors	Description / Identifier	Location Relative to PCR (distance, general direction)
Health Care Facility	Port Colborne Urgent Care	1460 m, West
Senior Citizens' residences and Long-term Care facility	Port Colborne Long Term Care, Portal Village Residences, Anglea's Place, Northland Manor	1460 m, West 1950 m, North West 1850 m, North West 3100 m, North Northwest
Child Care Facilities	Catharine/Charlotte Sts., Elm/Charlotte Sts., Port Colborne Highschool, Oakwood Elementary School, DeWitt Carter School	1050 m, West Northwest 1200 m, West Northwest 1700 m, North West 2800 m, North West 1150 m, North
Educational facilities	DeWitt Carter School Ecole St. Joseph St. Therese School Lakeshore Catholic Secondary Steele Street School Port Colborne Highschool McKay School St. Patrick School St. John Bosco School Oakwood Elementary School	1150 meters, North 1500 meters, North 1650 meters, North East 1800 meters, North 1650 meters, West 1700 meters, North West 1800 meters, North West 2500 meters, West 2650 meters, North West 2800 meters, North West
Dwellings	Residential buildings	Within 100 meters, multidirectional
Places of business	Industrial, commercial (stores, shopping centres, etc.)	Within 100 meters, multidirectional
Transportation corridors	Major routes of transportation: Welland Canal	600 meters, West
Vulnerable areas as defined in subsection 2(1) of the Clean Water Act 2006	- Significant ground water recharge area or aquifer - Surface water intake protection zone	Will not be effected in Worst Case scenario, or otherwise
Sensitive ground /surface water feature identified as instrument under the Planning Act	Planning Act, 2006	Evaluated wetlands as represented on Drawing 3.1
Wells and intakes of drinking water systems	Municipal and domestic drinking water wells	Municipal Water Intake and private-owned wells are illustrated on Drawings 3.2, 3.3 and 3.4
Flood plain areas	A level land area subject to periodic flooding from a contiguous body of water	Hazard Land and Flood plains as represented on Drawing 3.1

Fish and wildlife habitat areas	Lakes, rivers, swamps, etc.	Habitat areas as represented on Drawing 3.1

Figure 1 - PCR location and surrounding Sensitive Receptors



4 POTENTIAL ENVIRONMENTAL EMERGENCIES

The materials in use at PCR accounted for under the *Environmental Emergency Regulations 2019,* Chlorine, Sulphur Dioxide and Hydrochloric acid are each Inhalation Hazards. While the risk of each is similar (Inhalation) the method of the release which would create the risk must be considered. Both Chlorine and sulphur dioxide are liquid when contained in their respective pressure vessel and are converted to a gas within PCRs infrastructure. Hydrochloric acid is also an Inhalation Hazard due to the fact that the liquid can vapourize in ambient atmospheric conditions. The potential scenarios of release of chlorine or sulphur dioxide from a rail car are similar and can be assessed in the same manner. There are multiple potential scenarios of a release for each mode, however each scenario that is a risk to the surrounding community is based on a gaseous plume migrating off-site

Table 4 Potential impact to each sensitive receptor, dependent on whether the plume migrates off-site or stays within the PCR airshed.

Sensitive Receptors	A release of chlorine or sulphur dioxide or hydrochloric acid fume that creates a plume that migrates off-site	A release of chlorine or sulphur dioxide or hydrochloric acid fume that does not create a plume capable of migrating off-site
Health care facilities; Long term care facilities; Child care facilities; Educational facilities; Places of business	In worst case scenario the plume would migrate to the receptor in a concentration that could cause fatalities or create cause for emergency treatment, due to inhalation of toxic gas. This scenario is dependent on quantity spilled, rate of release, all the variables of weather and no prevention or mitigation taking place.	No off-site impacts
Dwellings	In worst case scenario the plume would migrate to the receptor in a concentration that could cause fatalities or create cause for emergency treatment, due to inhalation of toxic gas. This scenario is dependent on quantity spilled, rate of release, all the variables of weather and no prevention or mitigation taking place.	No adverse effects to nearby dwellings, although residents may react to in-plant alarms or sirens.
Transportation corridors	In worst case scenario the plume would migrate towards the Welland Canal (a section of the St. Lawrence Seaway), and/or Highways 3, 58 or 140 which connect Port Colborne with neighbouring communities, either in a concentration that could cause fatalities or create cause for emergency treatment, or due to emergency response, block transportation	No off-site impacts

	through the corridor. This scenario is dependent on quantity spilled, rate of release, all the variables of weather and no prevention or mitigation taking place.	
Groundwater and surface water intakes to drinking water systems	Gaseous release will not adversely affect water systems.	Gaseous release will not adversely affect water systems.
Fish and wildlife habitat areas	In worst case scenario the plume would migrate to the receptor in a concentration that could cause mortality of non-aquatic wildlife. This scenario is dependent on quantity spilled, rate of release, and all the variables of weather.	May have minor on-property impact to wetland or woodlot adjacent east of PMR, if release originates at PMR. The topographical relief would prevent migration of a plume to the Fowler's Toad habitat, along the shoreline

4.1 Assessment of Possible Event

The 2016 Emergency Response Guidebook (ERG2016) issued by Transport Canada provides several emergency response guides for numerous hazardous material classes. The guides provide initial isolation distances that are protective of public health and safety in the event of a release. In addition, the guides provide downwind protection distances to consider. Wind speed and ambient air temperature should also be considered when assessing the severity of a release of any toxic substance.

The Port Colborne Refinery has established a system to reference the potential impact of a release of chlorine, sulphur dioxide or hydrochloric acid gas. The system consists of three levels, each associated with a prescribed degree of response. These levels are known plant wide, are included in the contractor orientation program and are advertised in the surrounding community. The Level II gas emergency situation is field-practiced as a minimum, on a once-per year basis with certain parameters measured against the expected/trained response. In the event of a false alarm, the response to the alarm is still measured for efficiency and effectiveness, as all emergency response steps must be taken until the response crew confirms that there was a false alarm.

The gas emergency Levels, as quoted in the controlled document SPI 1 (PCR Toxic Gas Emergency Response Plan) are as follows:

- Level I - An emission of toxic gas confined to a single department area, not likely to affect other areas of the plant, or the public, and which can be controlled and/or contained using the department's facilities and personnel.

- Level II - An emission of toxic gas confined to the plant, not likely to affect the public but could pose a hazard to personnel within the plant, and which can be controlled and/or contained using personnel and equipment from the plant.

- Level III - Any significant, uncontrolled emission of toxic gas that would pose a significant hazard to personnel within the plant, the public, and/or the environment.

To assist in the emergency response to a gas leak, PCR utilizes a contaminant dispersion modelling program named SAFR Real-Time. This software combines meteorological data and release parameters to create a plume dispersion model. The meteorological data is retrieved from an on-site weather station which PCR maintains. The release parameters are either input by the plant protection officer according to information parlayed by the emergency response crew, or data is input from online sensors for that particular gas. The modelled results can then be used by the plant manager or his designate, when determining if a Level III emergency notification is warranted.

4.2 Chlorine

4.2.1 Worst Case Scenario and Resulting Harm

The largest means of containment of chlorine at Port Colborne Refinery are 1 tonne cylinders. The Precious Metals Refinery utilizes chlorine gas as a reagent. There can be up to ten (10) 1 tonne cylinders in storage, all within buildings. Once the liquid chlorine is vaporized, within the cylinder holding room, it is transferred through the Precious Metals Refinery, all indoors. The cylinders in storage are located at a room separated from the Precious Metals Refinery building.

Transport Canada's 2016 Emergency Response Guidebook (ERG2016) identifies isolation distances that are protective of public health and safety in the event of large spills of chlorine (Guide 124) on Table 3. The table below is a summary of ERG2016 chlorine isolations, measured in kilometers, for containers utilized at Port Colborne Refinery.

Transport Container	Initial Isolation	Protection during Day / Night		
		Low Wind (<10 km/h)	Moderate Wind (10-20 km/h)	High wind (>20 km/h)
Multiple tonne cylinders	3.0	2.1 / 4.0	1.3 / 2.4	1.0 / 1.3
Single tonne cylinder	1.5	1.5 / 2.9	0.8 / 1.3	0.5 / 0.6

Figure 3 illustrates the worst case scenario of a single 1-tonne cylinder and multiple tonne cylinders. A release of the contents of multiple cylinders would potentially impact the whole of the City of Port Colborne. As discussed further in Section 7, a measurement of a chlorine concentration of 3ppm or greater will instigate a Level II emergency with the potential to upgrade to Level III emergency if there is risk the community can also be effected.

The potential health hazards in case of a complete release of chlorine from any combination of 1-tonne cylinders, creating a plume that migrates off-site, includes the following:

- Toxic; may be fatal if inhaled
- Fire may produce irritating and/or toxic gases

- Vapors from liquified gas are initially heavier than air and spread along the ground.
- Does not burn but will support combustion
- Strong oxidizer, will react vigorously or explosively with many materials including fuels

Any off-site release of chlorine could have a large impact on the community and environment due to the inhalation hazard and the toxic properties of concentrated gas. At reduced concentrations the odour threshold is such that irritation could cause discourse and panic in the community, prompting complaints to Vale PCR as well as first responders in the community.

Figure 2 Potential Impact Zones for Worst Case release in a Chlorine Emergency

Legend

- Fire Station
- Regional Administration
- Municipal Administration
- Provincial Offences Court
- Police Station
- Provincial
- Regional
- Niagara EMS Facilities
  - EMS Administration
  - Ambulance Base
- Urgent Care Center
- 3 km radius – multiple
- 1.5 km radius - single

2.0 0 1.02 2.0 Kilometers

N

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. This map is not to be used for navigation.

Notes

Niagara Region

4.2.2 Alternate Scenario and Resulting Harm

The potential of the worst-case scenario (complete release of multiple cylinders at Port Colborne Refinery) is extremely low from an operational experience, technical advice, and the preventive measures already in-place (discussed in Sec 7) at PCR. A reasonably anticipated scenario is one where only the on-line cylinder could vent, thereby less harm resulting. Such a scenario will still require several preventive measures to fail, which has not been evident in the 40 year operational history of chlorine use at PCR. However, an alternate scenario of resulting harm has been prepared. Utilizing Transport Canada's ERG2016 Table 3 information equivalent to a single tonne cylinder relates to an alternate scenario with a more reasonable potential. As referenced above and illustrated on Figure 3, the isolation radius for a release of a single cylinder has a radius of 1.5 km during the day and 2.9 km at night. The area of impact would extend to the residential area of the City of Port Colborne and some of the sensitive receptors listed in Figure 1.

The single cylinder release scenario will be included in the planning and communication related to this E2 Plan.

4.3 Sulphur Dioxide

4.3.1 Worst Case Scenario and Resulting Harm

The largest means of containment of sulphur dioxide at Port Colborne Refinery are Rail tank cars. These tank cars supply sulphur dioxide as a reagent to the Cobalt Refinery. Each full tank car has a capacity of 92 tonnes sulphur dioxide. There is potential to have two full cars and one partially loaded tank car onsite. The sulphur dioxide tank car docking station is an open-frame structure. Once the liquid sulphur dioxide is vaporized, at a structure near the docking station, it is transferred to Cobalt operations via an elevated trestle, also open to the environment.
Transport Canada's 2016 Emergency Response Guidebook (ERG2016) identifies isolation distances that are protective of public health and safety in the event of large spills of Sulphur dioxide (Guide 125) on Table 3. The table below is a summary of ERG2016 sulphur dioxide isolations, measured in kilometers, for containers utilized at Port Colborne Refinery.

Transport Container	Initial Isolation	Protection during Day / Night		
		Low Wind (<10 km/h)	Moderate Wind (10-20 km/h)	High wind (>20 km/h)
Rail tank car	1.0	11 / 11	11 / 11	7.0 / 9.8

Figure 4 illustrates the worst-case scenario of a release of sulphur dioxide from a rail tank as well as a more likely scenario. A release of the full contents of the rail tank car would potentially impact the whole of the City of Port Colborne and the southern portion of the City of Welland. As discussed further in Section 7, a measurement of a sulphur dioxide concentration of 3ppm or greater will instigate a Level II emergency with the potential to upgrade to Level III emergency if there is risk the community can also be affected.

The potential health hazards in case of a complete release of Sulphur dioxide from the rail tank car which creates a plume that migrates off-site, includes the following:

- Toxic; may be fatal if inhaled
- Fire will produce irritating, corrosive and/or toxic gases
- Vapors are extremely irritating and corrosive..
- Does not burn but will support combustion

Any off-site release of sulphur dioxide could have a large impact on the community and environment due to the inhalation hazard and the toxic properties of concentrated gas. At reduced concentrations the odour threshold is such that irritation could cause discourse and panic in the community, prompting complaints to Vale PCR as well as first responders in the community.

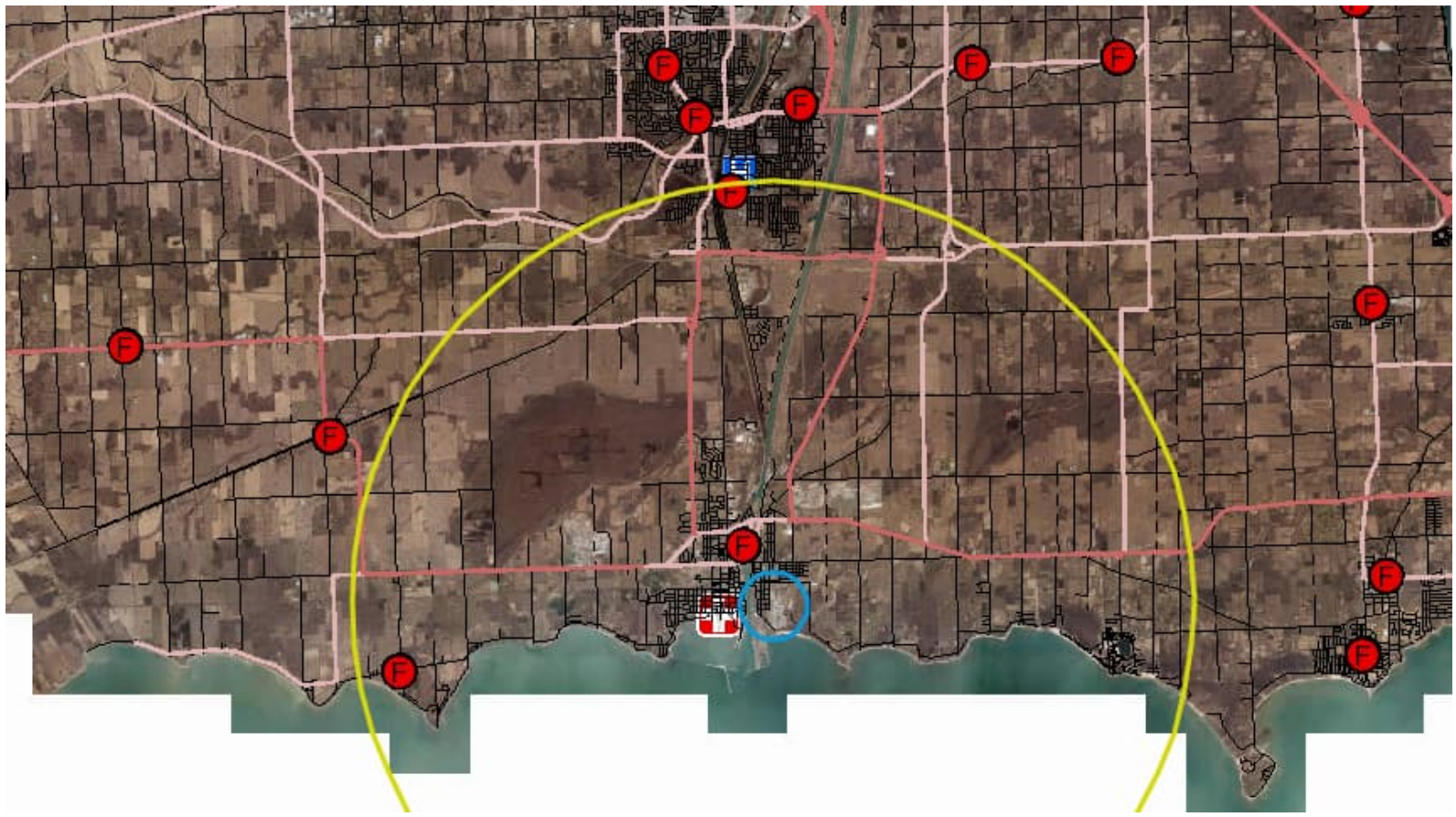
4.3.2 Alternate Scenario and Resulting Harm

The potential of the worst-case scenario (complete release of the rail tank car at Port Colborne Refinery) is extremely low from an operational experience, technical advice, and the preventive measures already in-place (discussed in Sec 7) at PCR. A reasonably anticipated scenario is one where there is not a complete loss of a rail tank car contents, but rather a much less significant release, thereby less harm resulting. Such a scenario will still require several preventive measures to fail, which has not been evident in the 40-year operational history of Sulphur dioxide use at PCR. However, an alternate scenario of resulting harm has been prepared. As referenced above in Sec 4.3.1 the zone of the initial clearance area is 1.0 km. This area seems appropriately reasonable to illustrate the more likely scenario of a release of Sulphur dioxide at PCR. As illustrated on Figure 5, the isolation radius for a release of Sulphur dioxide has a radius of 1.0 km. The area of impact would extend to the residential area of the City of Port Colborne and some of the sensitive receptors listed in Figure 1.

The potential health and physical hazards in the situation of a lesser volume of Sulphur dioxide gas released have the same risks as the larger volume listed above.

The more likely alternate scenario will be included in the planning and communication related to this E2 Plan.

Figure 3 - Potential Impact Zones for Worst Case release of in a Sulphur Dioxide Emergency



Legend
- Fire Station
- Provincial
- Regional
- Municipal Roads
- Hospital
- Urgent Care Center
- 11 km radius – rail tank car
- 1.0 km radius - initial

N

8.1 0 4.06 8.1 Kilometers

4.4 Hydrochloric Acid

4.4.1 Worst Case Scenario and Resulting Harm

The largest single means of containment of hydrochloric acid is a 15,000 litre tank. There are twin tanks of equal size (15,000 l) located outdoors at the Precious Metals Refinery area. The worst-case scenario would result in a complete failure of both tanks, causing a release of 30,000 litres of hydrochloric acid with a concentration of 20 baume. The twin tanks are located within a dyke with a capacity of 35,000 litres and so all of the released liquid contents would be contained. If the acid were to fume, an inhalation hazard could be generated. A release of liquid would be considered a Level I emergency as it would be contained to the site as shown in Figure 1, however if the released liquid were to generate fume an inhalation hazard could result, over a much larger area, reaching off-site.

Transport Canada's 2016 Emergency Response Guidebook (ERG2016) identifies isolation distances that are protective of public health and safety in the event of large spills of Hydrogen Chloride from a highway tank truck (Guide 125) on Table 3. The table below is a summary of ERG2016 hydrogen chloride isolations, measured in kilometers, for containers which are most similar to the tankage utilized at the Precious Metals Refinery at Port Colborne Refinery.

Transport Container	Initial Isolation	Protection during Day / Night		
		Low Wind (<10 km/h)	Moderate Wind (10-20 km/h)	High wind (>20 km/h)
Truck tank	0.2	1.5 / 3.9	0.8/ 1.5	0.6 / 0.8

Figure 5 illustrates the worst-case scenario of a release of hydrogen chloride from a tank. A release of the full contents of the twin tanks would not have a significantly greater potential impact as the tanks are within a dyke and the available surface area for vaporization is reduced similar to a tank truck. If a complete loss of a tank were to occur, the whole of the City of Port Colborne could be impacted in worst case atmospheric conditions. As discussed further in Section 7, failure of one or both tanks with liquid hydrochloric acid contained within secondary containment and volatizing would have the potential to instigate a Level II emergency with the potential to upgrade to Level III emergency if there is risk the community can also be affected.

The potential health hazards in case of a complete release of hydrogen chloride from the storage tanks which creates a plume that migrates off-site, includes the following:

- Toxic; may be fatal if inhaled
- Fire will produce irritating, corrosive and/or toxic gases
- Vapors are extremely irritating and corrosive.
- Does not burn but will support combustion

Any off-site release of volatilized hydrochloric acid could have an impact on the community and environment due to the inhalation hazard and the toxic properties of the vapour. At reduced concentrations the odour threshold is such that irritation could cause discourse and panic in the community, prompting complaints to Vale PCR as well as first responders in the community.

4.4.2 Alternate Scenario and Resulting Harm

A partial release of hydrochloric acid from piping associated with the storage tanks is more likely to occur, than a complete release of the largest single container at Precious Metals Refinery. This is more likely to be considered a Level I, or II emergency potentially only impacting onsite personnel. The meteorological conditions as well as the volume of acid released would need to be factored in. Figure 5 does not demonstrate the impact distances for a level I or II event as such an event would not impact the areas outside of the property boundaries.

There is no modeled SAFER case for a release of hydrochloric acid.

The more likely alternate scenario will be included in the planning and communication.

Figure 4 - Potential Impact Zone for Worst Case release in a Hydrochloric Acid Emergency

Legend

- Fire Station
- Provincial
- Regional
- Municipal Roads
- Urgent Care Centre
- 3.9 km radius - tank

N

4.0 Kilometers 0 2.0 4.0

5 ENVIRONMENTAL EMERGENCY ACTIONS

The following section includes potential causes of environmental emergencies at Port Colborne Refinery involving the release of the three regulated substances at the facility, the preventative measures in place, how the facilities are prepared to deal with such emergency as well as the recovery methods that will take be used in such event.

5.1 Potential Causes of Chlorine Environmental Emergencies

The identified environmental emergency involving the release of multiple tonne cylinders at Vale's Port Colborne Refinery could occur from: valve failure, mobile equipment contacting and rupturing tank, improper maintenance or training, use of improper materials of construction of piping transferring chlorine within the PMR, and failure of a cylinder yolk when in the holding area. Any of these causes are more likely to result in a small release. A large (complete) release of multiple cylinders is only plausible if the storage building holding the full cylinders were destroyed.

5.2 Potential Causes of Sulphur Dioxide Environmental Emergencies

A release from a rail tank car of Sulphur Dioxide at Port Colborne Refinery could occur from: valve failure, large mobile equipment contacting and pushing the tank from the carriage, improper maintenance or training, use of improper materials of construction of piping transferring Sulphur dioxide via the trestle, or within the CHP operational area. Any of these causes would result in a small release, which could in turn result in a large (complete) release of container contents if not addressed.

5.3 Potential Causes of Hydrochloric Acid Environmental Emergencies

Each identified environmental emergency involving Hydrochloric Acid containment systems at Vale's Port Colborne Refinery would stem from various circumstances. A release from one or both of the storage tanks could occur from: over pressurization of the tank during filling, valve failure, failure of the structural integrity of a tank, improper maintenance or training, use of improper materials of construction of piping transferring hydrochloric acid within the PMR operational area. Any of these causes would result in a small release, which could in turn result in a large (complete) release of container contents if not addressed.

6 PREVENTION

To prevent the release of any hazardous substance to the environment, there are several written documents that outline standard operations and the preventative controls in place to reduce the risk of a release and potential harm to people and the environment.

The Port Colborne Refinery has an extensive system of preventive maintenance tasks and responsibilities. The Preventive Maintenance Coordinator tracks, distributes and verifies the completion of the scheduled tasks. A record of each inspection is kept on file and any suggested remedial activity is relayed to the operating authority. The table below references a variety of preventive maintenance tasks performed or organized by each operating area, specifically for tasks regarding spill response and spill prevention. There is also preventive maintenance of personal safety devices for the emergency responders. To determine the full spectrum of tasks related to spill response equipment, the actual job card would need to be reviewed. While some preventive maintenance job cards are associated specifically with spill response equipment (i.e. 7UP191, Cobalt SCBA Testing) the general way some preventive maintenance tasks are written has proper maintenance activities grouped with spill response equipment and materials, or spill prevention (7UP228, PMR Chlorine analyzers). Most of these tasks are performed by trained PCR employees; however, some tasks require contractor participation. The department identified in the list below may be the facilitator and not necessarily the actuator. The listing below was provided by the Preventive Maintenance Coordinator.

	PMR Chlorine Preventive Maintenance List				
Std Job No	Element No.	Standard Job Description	Freq of inspection	Equip No.	Department
7UP228	705701	PMR CL2 area monitors	4 wk	31496	instrumentation
7UP402	705701	PMR CL2/SO2/HYD/O2 analyzers	12 wk	31436	instrumentation
7UP434		PMR Cl2 area monitors	1 wk	31436	instrumentation
7PP053	702181	PMR area 40 Cl2 leaching pumps	16 w	34237	mechanical
7PP128	702181	Chlorine house fans	26 w	36160	mechanical
7PP132	702181	Chlorine hose change out	52 w	31448	mechanical
7UP587	705701	Chlorine Regulator, Replace	52 w		

	COBALT SO2 Preventive Maintenance List				
Std Job No	Element No.	Standard Job Description	Freq of inspection	Equip No.	Department
7CP172	701681	SO2 piping Ultrasonic Inspection	52 w	30926	mechanical
7CP378	701681	SO2 hand valve/PSVh	53 w	30925	mechanical
7CP416	701681	Sulfur Dioxide tank	156 w	30923	mechanical
7UP306	701681	Hyd SO2 heat tracing	52 w	30924	electrical
7UP213		EIT CL2 & SO2 sensor check	4 wk	30925	instrumentation
7UP266	705701	EIT SO2 sensors	12 wk	30925	instrumentation
7UP273	705701	SO2 auto valve/metering	52 wk	30925	instrumentation
7UP401	705701	Cobalt CL2/SO2/HYD analyzers	12 wk	32238	instrumentation
7UP423	705701	Cl2/SO2 Simplex Evac. System	52 wk	30913	instrumentation

	Emergency / Spill Response Preventive Maintenance				
Std Job No	Element No.	Standard Job Description	Freq of inspection	Equip No.	Department
7CP420	701681	Tank berm integrity check	52 wk	31094	mechanical
7PP131	701681	PMR Gas Emergency equipment	4 w	31437	mechanical
7UP092	705803	Gas Emergency Sign, Inspect	4 w		
7UP182	705701	PCR CL2 perimeter sensors	4 wk	36382	instrumentation
7UP185	701681	Cascade System	4 w	31876	mechanical
7UP186	701681	Cobalt Ref cascade system	4 w	33216	mechanical
7UP191	701681	Cobalt SCBA Testing	4 w	33216	mechanical
7UP194		MSA 401 SCBA	4 w	31876	mechanical
7UP201		PMR survive air hydro tests	52 wk	31437	mechanical
7UP325	701681	PCR MSA hip apparatus	4 w	33216	mechanical
7UP470		PMR Survive air flow check	52 wk	31437	mechanical

7 PREPAREDNESS

An emergency resulting from the release of any of the substances included in this Plan may cause substantial harm to people and/or the environment. As such, Vale PCR has deployed a variety of initiatives which would limit the release of chlorine, sulphur dioxide or hydrochloric acid from reaching the degree of release that could pose risk to the community.

Steps already taken to prevent or reduce the risk of a spill from occurring include but are not limited to:

With respect to any release of chlorine gas that could migrate off-site and cause an adverse effect. *Maximum potential volume released from a cylinder (up to 1 tonne):*

- There are three probes monitoring ambient chlorine concentrations in the range 1-5 ppm along the western perimeter of Port Colborne Refinery. There are also gas analyzers and alarm-activating push buttons located within Cobalt Refinery buildings. If a probe within either Cobalt Refinery building measures a concentration of 1 ppm chlorine, a Level I alarm is activated and valves within that particular building will close. The gas emergency response procedures specific to Cobalt operations are described in the controlled document SPI-17 (Cobalt Operations Chlorine Gas Emergency Response Plan) and other documents maintained by the Cobalt unit trainer.

- A number of probes monitor ambient chlorine concentrations within areas of chlorine cylinder storage, on-line cylinders, and in locations that chlorine is utilized within the PMR. The probes will alarm at 1.0 ppm. Activation of an alarm initiates emergency response by trained PMR personnel. The gas emergency response procedures specific to Precious Metals Refinery operations are described in the controlled document SPI-44 (PMR Toxic Gas Emergency Response Plan) and other documents maintained by the PMR unit trainer.

- The on-line chlorine cylinders and the cylinders in storage are all kept in enclosed rooms. In the event of a minor leak, the closed doors will minimize the rate at which chlorine gas would disperse into the ambient environment while the leak is being repaired.

- Port Colborne Refinery Plant protection Officers are all trained regarding gas emergency procedures. Their written procedures are maintained in the PMR security office. The response in accordance to each gas emergency level as described in SPI 1 is documented. As outlined in SPI 1, the Plant Protection Officer will be the liaison between PCR emergency responders, PCR Plant Manager, and Port Colborne Emergency Services. Their duties also include securing the site to prevent non-emergency responders from entering PCR, during an emergency and operating the SAFER Real-Time dispersion modeling software, described later in this section.

- All chlorine handling equipment, analyzing devices and spill response equipment is on a strict preventive maintenance schedule. A listing of the preventive maintenance tasks is referenced in Port Colborne Refineries Spill Prevention and Contingency Plan document in Section 4.8.

With respect to any release of sulphur dioxide gas that could migrate off-site and cause an adverse effect.
Maximum potential volume released from tank car (up to 92 tonnes):

- A probe monitors ambient sulphur dioxide concentrations at the rail docking station. There are also six probes and five alarm activating push buttons located within Cobalt Refinery buildings. Upon measuring a concentration of 3 ppm, a Level I alarm is activated and valves within the Cobalt Refinery will close. If the inter-building valves do not close within 10 seconds, the main valve on the storage tank will close. Upon measuring a concentration of 5 ppm, the alarm will initiate closure of all valves in the sulphur dioxide system. Activation of any alarm initiates emergency response from the Cobalt department. The gas emergency response procedures specific to Cobalt operations is described in the controlled document SPI-18 (Cobalt Refinery Operations SO2 Gas Emergency Response Plan).

- The rail cars are protected from a vehicular impact by traffic bollards on the southeastern approach. A vehicle cannot approach from the north, west or south sides as the asphalt is not continuous.

- The risk of a tank car or the trestle being damaged as a result of an impact from a vehicle has been minimized. The steel frame trestle elevation is 12 meters above ground. It is supported at ground level by robust concrete piers that are 1.5 meters tall. The tank car is protected from vehicle impact by bollards and the rise of the rail track. The asphalt approach from the north has bollards and the approach from the south or east has open rail track which would stop a rolling vehicle.

- Port Colborne Refinery Plant protection Officers are all trained regarding gas emergency procedures. Their written procedures are maintained in the PMR security office. The response in accordance to each gas emergency level as documented in SPI 1. As outlined in SPI 1, the Plant Protection Officer will be the liaison between PCR emergency responders, PCR Plant Manager, and Port Colborne Emergency Services. Their duties also include securing the site to prevent non-emergency responders from entering PCR, during an emergency situation and operating the SAFER Real-Time dispersion modeling software, described later in this section.

- All sulphur dioxide handling equipment, analyzing devices and spill response equipment is on a strict preventive maintenance schedule. A listing of the preventive maintenance tasks is referenced in Port Colborne Refineries Spill Prevention and Contingency Plan document in Section 4.8.

8 RESPONSE

The response that is required in the event of an emergency is outlined in detail in the Port Colborne Refinery Emergency Preparation Manual, the Spill Prevention and Contingency Plans, the EMRG2016 Guide 115 and Guide 170. In addition to the emergency response procedures listed below, the site also maintains several standard job procedures that can be referenced in the event of a site emergency.

Vale's Levels of Emergency
Level I Emergency – confined to a building or operational area, with no effect to other parts of the facility, plant or public. The public is not notified for a Level I Emergency.
Level II Emergency – confined to a plant complex but has no effect to the public. The public is not notified for a Level II Emergency.
Level III Emergency – any situation which could pose a significant hazard to the public. Air horns are activated and the public is notified for a Level III Emergency.

In most cases, PCR will have the necessary resources and equipment to properly address the spill response. In other cases, depending on the pollutant, volume of a release, and/or location of the release, other resources may be required. For each scenario, the plan provides the appropriate level of action necessary, a list of possible spill response equipment which may be needed (where it is located and its purpose) and the suitable contractors, when needed (which must have valid PCR site specific training and WHMIS).

The Standard Operating Procedures at PCR detail the actions for spill response and the additional on-site and off-site resources and equipment which can be used to respond to the various levels of spills at the PCR. If the spill is of a gas, or a liquid that vaporizes such as chlorine and sulphur dioxide, emergency response equipment can only be used to stop the release. Once in a gaseous state in the natural environment, aerial dispersion will occur.

The Precious Metals Refinery has employees trained for spill response to chlorine, while Cobalt Refinery personnel are trained for sulphur dioxide spill response. Responding to a spill of a gas not only requires tools and equipment to stop the leak, but also equipment to support the safety and protection of the responders.

A list of these support supplies for Cobalt personnel responding to a leak of sulphur dioxide was excerpted from SPI-17 and is included below:

- COMMUNICATIONS

The department will make full use of portable radios in emergency situations.
The operator working in the cobalt precipitation area will ensure that the area's radio is taken with him so it is available for use in relaying leak information to the shift foreman.
The foreman will communicate information to plant protection officer and the officer will communicate information to the PCR via the plant public address system, or portable radios.
If no supervision available, the operator's will make full use of portable radios in emergency situations, ensuring that a radio is accessible any time for use in relaying leak information to the plant protection officer.

- LEAK REPAIR CREW TRANSPORTATION

A fully charged electric golf cart is available in the Gas Emergency Equipment Room at all times to ensure that the leak repair crew has a quick, easy means of getting to the leak location, cascade systems, etc.
A Sulphur Dioxide monitor is also mounted on the Emergency Golf Cart to check the concentration in the atmosphere.

- GAS EMERGENCY EQUIPMENT LOCATION

a) M.S.A. Self-Contained Breathing Air Packs
SCBA packs are located at:
- Hydrate area North Entrance (2 packs)
- E.C.R. building entrance (2 packs)
- Gas emergency equipment room (7 packs)
- Foremen's office west wall (outside)(3 packs)
- Cobalt Precipitation Control Room (1 packs)

b) Compressed Breathing Air Cascade Bottle Systems
Breathing air cascade systems are located at:
- SO_2 safety shower building
- ECR gas emergency equipment room
- Inside small door on east side of Main Change house

c) Leak Repair Kits
Leak repair kit for repairing leaks on SO_2 tank cars is located in the equipment locker on the SO_2 tank car platform.
d) Responder Suits
The Gas Emergency Response Suits are located in the Gas Emergency Equipment Room.

A list of the support supplies for PMR personnel responding to a leak of chlorine was excerpted from SPI-44 and is included below:

- GAS EMERGENCY EQUIPMENT LOCATION

a) M.S.A. Self Contained Breathing Air Packs
The packs are located at:
- 1st Floor Reduced Crew Safe Room (3 packs)
- 1st Floor SW Stairwell (1 pack) – Helper's pack
- 3rd Floor Control Room (5 packs)

b) Compressed Breathing Air Cascade Bottle Systems
The cascade system is located in the 1st Floor Reduced Crew Safe Room.

- CHLORINE CYLINDER REPAIR KITS

The repair kits are located in the chlorine house and the chlorine storage building.

- TRAINING AND RESPONDER SUITS

The responder suits are located in the 1st Floor Reduced Crew Safe Room.
Training suits are located in Safety Supply room.

The supplies required in response to other scenarios are often written into the Standard Operating Procedures listed in Appendix D. An illustration of this can be found in ETP-13 Sulphuric Acid Unloading.

Written into this procedure, but not specifically identified as a contingency response is instruction to cover a sewer grate with a rubber mat, and to have a hose running water so that any spilled acid can be flushed to the wastewater collection system.

As per the EMRG2016 Guide 115 a spill of gaseous chlorine or sulphur dioxide should include the following actions;

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk-through spill material.
- Stop leak if you can do it without risk
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use water spray to reduce vapours or divert vapour cloud drift. Avoid allowing water runoff to contact spilled material.
- Do not direct water at spill or source of leak.
- Prevent spreading of vapours through sewers, ventilation systems and confined areas.
- Isolate area until gas has dispersed.

CAUTION: When in contact with refrigerated/cryogenic liquids, many material become brittle and are likely to break without warning.

9 RECOVERY FOR ANY LEVEL OF EMERGENCY

The recovery process for any level of emergency at Port Colborne Refinery is detailed in the Port Colborne Refinery Emergency Response Manual in section 5.11.1. To reach the logical conclusion of any emergency operations Port Colborne Refinery will ensure that the following issues are addressed.

- Damage assessment
- Clean up
- Post-Emergency Response review
- Repair of damaged equipment
- VALE internal investigations
- Government investigations & notifications
- Critical Incident Stress Management
- Business Continuity

10 ROLES AND RESPONSIBILITIES

The following sections outline the general responsibilities of those identified in the emergency organization.

Manager- The Port Colborne Refinery Manager is accountable for PCR during an emergency. The PCR On-Call assumes this accountability outside of regular office hours or in the Manager's absence. The responsibility to manage an emergency has been delegated to the On-scene Emergency Coordinator.

On-scene Emergency Coordinator- The On-Scene Emergency Coordinator is the on-site person designated to manage an emergency event. The role is held by the Area Supervisor; they are backed up by alternate Supervisors on site during the event.

On-scene Coordinator Responsibilities

- Confirm the declared emergency and level classification
- Assumes responsibility over the emergency
- Coordinates on-site emergency response activities
- Directs Emergency Response and/or First Response operations as required
- Summons external assistance and conveys notifications as required
- Liaise with on-site outside emergency agency activities
- Determines changes to the level of emergency as the situation evolves (reductions and escalations). Communicates changes via the Communication Centre.
- Declares the ALL CLEAR for Level I and II Emergencies
- Ensure the workplace is secure for the re-entry

Plant Responders

The Plant Responders are comprised of:

- Operations personnel trained on responding to gas emergencies

Plant Responder Responsibilities:

- Respond to spill scenarios to add
- Provide direction for location of emergency and meeting of emergency responders to #1 First Aid.
- Receive emergency responders at the stipulated location.
- Serve as a knowledgeable guide for external emergency services (fire, police, EMS). Safely guide them to the emergency site and provide information on area potential hazards.
- Ensure that all personnel are accounted for in a Surface Safe Assembly or Evacuation Area.
- Coordinate isolations as required.
- Remain in contact with the On-Scene Coordinator.
- Assist the On-Scene Coordinator in declaring the ALL CLEAR.
- Maintain Associated qualifications in SCBA use.

Protection Services Personnel

In an emergency, Plant Protection Officers (PPOs) provide First Aid and security support for the plant during an emergency (Level I, II, III).

Plant Protection Officers Responsibilities:

- Secure site.
- Prepare to provide first aid, as may be required.
- Coordinate efforts with First Responders.

PMR Office (Alert Call Centre & Communication Centre)

The PSP in the 24hr PMR office runs the Alert Call & Communication Centres.

Alert Call Centre Responsibilities:

- Receives calls advising of an emergency.
- Activates Vale Emergency Notification system advising PCR Operations of emergency.

- Notifies outside emergency services as required.
- Notifies Safety, Environment & Executive On-Call
- Runs SAFER when applicable and provides vital information to emergency responders.
- When necessary, provides on-going communications with outside emergency services.
- On directions from Executive On-Call or the On-Scene Coordinator, advises of the "ALL CLEAR".
- Keeps written records of all events.

Communication Centre Responsibilities:

- Receives calls advising of an emergency.
- Activates Vale Emergency Notification system and EverbridgeTone Alerts.
- Activates PCR Air Horn
- Activates First Responders and On-Scene Coordinator (via Radio "All Call").
- Upgrades or downgrades the Level as per direction from the On-scene Coordinator.
- Keeps written record of all events.

Assembly Area Coordinator

Assembly Area Coordinators take charge of the Assembly Area. It is expected that the first person arriving at the Assembly Area assume responsibility. Instructions are in Emergency Boxes in each Gas Emergency Safe Room.

Gas Emergency Safe Room Coordinator Responsibilities:

- Assume control of the Assembly Area.
- Accounting of personnel by completing attendance sheets.
- Ensures that all visitors sign in books have been retrieved and personnel are being accounted for.
- Delegates personnel to take the required action to secure the Assembly Area (i.e seal room, shutdown H&V's, or use air sampler).
- Receives emergency information during the event (via radio or Emergency Phone). Conveys all information received to personnel assembled.
- Communicates the "ALL CLEAR" when the event is over.
- Completes and returns documentation to the Emergency Management Coordinator for post emergency/drill evaluation: - Personnel accounting lists

PSP Emergency Coordinator

Plant Security Personnel cross-reference the information obtained from Assembly Area Coordinators to determine who may be missing.

- Obtains the names of those who are suspected "missing" and those who are "extra" to the expected occupants (contractors, visitors) of all Assembly Areas:
    - Phones each Assembly Area records the names of missing and extra personnel.
    - Once all areas are contacted, the names are consolidated by reviewing each area to determine if the missing personnel are appearing extra at other locations.
    - If required, each area is contacted again to see if there are any changes to their lists.
    - The status of the accounting process is relayed to the On-Scene Coordinator

Emergency Response Support (Contractor)

Quantum Murray is the primary emergency response responder when assistance is required. They can be contacted 24 hours a day, 7 days a week at 1-877-378-7745.

11 TRAINING

All PCR personnel receive emergency and fire safety training annually (code SA216) so they can recognize the difference between invac and outvac emergencies and any area specific assembly area procedures that they will be required to follow when they enter a department.

Drills and Exercises
A Gas Emergency Drill and a Fire Emergency Drill will be conducted at least once each year for staff and employees. It will test the response of employees to a gas emergency event and the process used in the assembly areas. A debriefing process will be used to identify any deficiencies in response and of the audible alarm systems. The PCR Training Coordinator will facilitate the process to address all deficiencies.

Responsibility for Coordinating Training
The Safety and Training Coordinator is responsible to:
• Establish and maintain the training criteria for key roles within emergency plans.
• Establish and maintain the training criteria for general worker emergency awareness review.

Training Program
First Responders are trained on an annual basis. Training includes:
• First Response Review SSS500
• MSA SCBA Operation SRP 4500
• MSA full face mask fit test

On-Scene Coordinators are trained on an annual basis. Training includes:
• On Scene Coordinator Response Review SSS503
• MSA SCBA Operation SRP 4500
• MSA full face mask fit test

There are annual communication exercises with the City to test/verify the Standard Operation Procedures and well as Everbridge reporting system.

12 NOTIFICATIONS AND ALERTS

12.1 Potential Environmental Emergencies

Vale utilizes several different means of communicating with the public. Examples include, but are not limited to:

- Vale Open Houses (i.e. during Emergency Preparation Week)
- Information Pamphlets
- Posters
- Post Cards to individual households
-

Information on potential environmental emergencies, as defined in the Regulations and applicable to the Port Colborne Refinery will be provided to the community using one of the above means of communication and will specifically address the hazards associated with each substance included in this Plan. In addition, it will identify all scenarios that are most likely to occur at the site and the corresponding potential effects that could be anticipated. The public will be made aware of the emergency response

procedures outlined in this Plan (section 8 Response) and will be advised of how Vale will communicate an emergency should it occur. All information contained in this plan will be communicated by the Corporate and Indigenous Affairs Specialist.

12.2 Actual Environmental Emergencies

The public will be notified in the event of a Level III Emergency involving any of the three substances in this Plan. Once the site has determined that a Level III Emergency has been called, the Communication will notify the Vale Alert Call Centre.

Alerts and notifications will follow from roles and responsibilities listed above and, in the case of emergencies, will follow procedures outlined in the Crisis Management System and in the OMS emergency response plans. Notifications to regulators will be made by the Environment department or a designate including both initial notifications and follow-up written reports or responses to inquiries, as required.

This E2 plan has been included to the Emergency Management intranet site, and any environmental emergency involving the scenarios presented in this Plan that reach a level III emergency will require notifications to be made.

12.3 Consultation with Local Authorities

Vale is prepared for all types of incidents and emergencies through a robust and multi-faceted emergency response program. The E2 plan has been shared with local police, fire and EMT services.

13 REVISION HISTORY

Version Number	Date	Revision Type	Content	Reason for Edit	Name	Approver
v1	2020	Original	E2 Plan	Plan preparation, first draft		
v2	2021	Review	E2 Plan	Annual Review, no changes		
v3	11 Nov 2022	Update	E2 Plan	The preparedness and response sections were reviewed (due to the 2022 full scale drill) with PCR and updates will be incorporated into the 2023 annual update once tasks are complete. Format figures.		
00	4 March 2023	New	New	Integrated into SISPAV format	A.Corson	G. Remington L. Lanteigne
01	1 January 2024	Update	Appendix	Added Annual Test of Plan Template Form	A.Corson	G. Remington L. Lanteigne
02	1 January 2025	Review	E2 plan	Added Quantum Murray as an emergency spill response contractor	A. Corson	G. Remington

APPENDIX A HOW TO ACT IN AN EMERGENCY

How to ACT in an Emergency

If you hear the Vale emergency signal (a repeated blast of the air horn) be sure to ACT accordingly:

A Always go indoors

C Close all doors and windows

T Turn off furnace, air conditioners or other air intakes

Do not use the telephone unless you require immediate emergency assistance.
Stay tuned to your local radio or television for information updates.
Remain inside until an "all clear message" is broadcast and the air horn is stopped.

Vale is committed to the safety of its employees and its neighbours.

APPENDIX B – SDS SHEETS

SAFETY DATA SHEET

1. Identification

Product identifier **CHLORINE NSF**

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	BRENNTAG CANADA INC
Address	43 Jutland Rd. Toronto, ON M8Z 2G6 Canada
Telephone	416-259-8231
Website	http://www.brenntag.com/canada/en/
E-mail	RegulatoryAffairs@Brenntag.ca
Emergency phone number	1-855-273-6824

2. Hazard(s) identification

Physical hazards	Oxidising gases	Category 1
	Gases under pressure	Liquefied gas
Health hazards	Acute toxicity, dermal	Category 1
	Acute toxicity, inhalation	Category 2
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity following single exposure	Category 3 respiratory tract irritation
	Health hazards not otherwise classified	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1

Label elements

Signal word Danger

Hazard statements May cause or intensify fire; oxidiser. Contains gas under pressure; may explode if heated. Fatal in contact with skin. Causes severe skin burns and eye damage. Fatal if inhaled. Causes serious eye damage. May cause respiratory irritation. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects. Presents a health hazard which is not otherwise classified.

Precautionary statement

Prevention Keep away from clothing and other combustible materials. Keep valves and fittings free from oil and grease. Do not breathe gas. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection.

Response	IF SWALLOWED: rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. IF INHALED: Remove person to fresh air and keep comfortable for breathing. 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 CENTRE/doctor. Specific treatment is urgent (see this label). Take off immediately all contaminated clothing and wash it before reuse. In case of fire: Stop leak if safe to do so. Collect spillage.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up. Protect from sunlight. Store in a well-ventilated place.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Other hazards	None known.
Supplemental information	100 % of the mixture consists of component(s) of unknown acute oral toxicity.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
Chlorine		7782-50-5	100

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

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call a physician or poison control centre immediately.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control centre immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
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. Call a physician or poison control centre immediately.
Ingestion	Not likely, due to the form of the product. Call a physician or poison control centre immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
Most important symptoms/effects, acute and delayed	Headache. Dizziness. Nausea, vomiting. Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. May cause respiratory irritation. Coughing.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and 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. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Take off immediately all contaminated clothing. If you feel unwell, seek medical advice (show the label where possible). 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. Discard any shoes or clothing items that cannot be decontaminated.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	Greatly increases the burning rate of combustible materials. Containers may explode when heated. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions	Allow gas to burn if flow cannot be shut off immediately. Apply water from safe distance to cool container and protect surrounding area. In case of fire: Stop leak if safe to do so. Do not move cargo or vehicle if cargo has been exposed to heat. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also consider initial evacuation for 800 meters (1/2 mile) in all directions. ALWAYS stay away from tanks engulfed in flame. Move containers from fire area if you can do so without risk. Do not direct water at source of leak or safety devices as icing may occur. Use water spray to cool unopened containers. Withdraw immediately in case of rising sound from venting safety device or any discolouration of tanks due to fire. For massive fire in cargo area, use unmanned hose holder or monitor nozzles, if possible. If not, withdraw and let fire burn out.
Specific methods	Cool containers exposed to flames with water until well after the fire is out.
General fire hazards	Contents under pressure. Pressurised container may explode when exposed to heat or flame. May cause or intensify fire; oxidiser.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep out of low areas. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Wear appropriate protective equipment and clothing during clean-up. Do not breathe gas. Emergency personnel need self-contained breathing equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Stop leak if you can do so without risk. Extinguish all flames in the vicinity. If this gas leaks without igniting, extreme caution must be used; flammable or explosive mixtures with air may be formed. Use water spray to reduce vapours or divert vapour cloud drift. Isolate area until gas has dispersed. Prevent entry into waterways, sewer, basements or confined areas. Following product recovery, flush area with water. Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground. Runoff from fire control or dilution water may cause pollution.

7. Handling and storage

Precautions for safe handling	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Keep away from combustible material. Keep reduction valves free from grease and oil. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Purge air from system before introducing gas. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt. Do not breathe gas. Do not get in eyes, on skin, or on clothing. When using, do not eat, drink or smoke. Use only outdoors or in a well-ventilated area. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Observe good industrial hygiene practices. Wash contaminated clothing before reuse.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Store in a well-ventilated place. Do not store near combustible materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Stored containers should be periodically checked for general condition and leakage. Store away from incompatible materials (see Section 10 of the SDS). Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Recommendations listed in this section indicate the type of equipment, which will provide protection against overexposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

Occupational exposure limits

US. ACGIH Threshold Limit Values

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	1 ppm
	TWA	0.5 ppm

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

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	2.9 mg/m3
		1 ppm
	TWA	1.5 mg/m3
		0.5 ppm

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

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	1 ppm
	TWA	0.5 ppm

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	1 ppm
	TWA	0.5 ppm

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

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	1 ppm
	TWA	0.5 ppm

Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety)

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	2.9 mg/m3
		1 ppm
	TWA	1.5 mg/m3
		0.5 ppm

Consult provincial or territorial exposure values, as may apply.

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

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

The following are recommendations only for the use of PPE. These recommendations cannot anticipate the variety of workplaces where the product will be used, nor how the product will be used in a variety of applications and processes. In determining appropriate PPE and engineering controls, it is the duty of the employer / user to evaluate their use of this product in accordance with the requirements of the local jurisdiction, and, if necessary, in conjunction with a professional industrial hygienist.

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

Skin protection

Hand protection Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.

Other Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.

Respiratory protection Wear positive pressure self-contained breathing apparatus (SCBA).

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations	When using, do not eat, drink or smoke. 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.

9. Physical and chemical properties

Appearance	
Physical state	Gas.
Form	Liquefied gas.
Colour	GREENISH YELLOW
Odour	SHARP, IRRITATING, CHARACTERISTIC
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	-101.11 °C (-150 °F)
Initial boiling point and boiling range	-34.04 °C (-29.27 °F)
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.
Explosive limit - lower (%)	Not available.
Explosive limit – upper (%)	Not available.
Vapour pressure	Not available.
Vapour density	2.5
Relative density	Not available.
Solubility(ies)	
Solubility (water)	7 g/l
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	11.88 lbs/gal
Explosive properties	Not explosive.
Molecular formula	Cl2
Molecular weight	70.91 g/mol
Oxidising properties	May cause or intensify fire; oxidiser.
Specific gravity	1.42
Surface tension	18.4 mN/m (20 °C (68 °F))

10. Stability and reactivity

Reactivity	Greatly increases the burning rate of combustible materials.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerisation does not occur.
Conditions to avoid	Keep away from combustible material. Heat. Contact with incompatible materials.

Incompatible materials Combustible material. Reducing Agents. Ammonia.

Hazardous decomposition products No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation Fatal if inhaled.

Skin contact Fatal in contact with skin. Causes severe skin burns.

Eye contact Causes serious eye damage.

Ingestion Causes digestive tract burns.

Symptoms related to the physical, chemical and toxicological characteristics Headache. Dizziness. Nausea, vomiting. Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. May cause respiratory irritation. Coughing.

Information on toxicological effects

Acute toxicity Fatal if inhaled. Fatal in contact with skin.

Product	Species	Test results
Chlorine (CAS 7782-50-5)		
Acute		
Inhalation		
LC50	Rat	293 ppm, 1 Hours

Skin corrosion/irritation Causes severe skin burns and eye damage.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitisation

Canada - Alberta OELs: Irritant

Chlorine (CAS 7782-50-5) Irritant

Respiratory sensitisation Not a respiratory sensitizer.

Skin sensitisation This product is not expected to cause skin sensitisation.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity

ACGIH Carcinogens

Chlorine (CAS 7782-50-5) A4 Not classifiable as a human carcinogen.

Canada - Manitoba OELs: carcinogenicity

Chlorine (CAS 7782-50-5) Not classifiable as a human carcinogen.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

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

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not likely, due to the form of the product.

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Product		Species	Test results
Chlorine (CAS 7782-50-5)			
Aquatic			
Fish	LC50	Atlantic silverside (Menidia menidia)	0.037 mg/l, 96 hours

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

Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
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	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

Transportation information on packaging may be different from that listed.

DOT

UN number	UN1017
UN proper shipping name	Chlorine, MARINE POLLUTANT
Transport hazard class(es)	
Class	2.3
Subsidiary risk	5.1, 8
Label(s)	2.3, 5.1, 8
Packing group	Not available.
Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	2, B9, B14, N86, T50, TP19
Packaging exceptions	None
Packaging non bulk	304
Packaging bulk	314, 315

IATA

UN number	UN1017
UN proper shipping name	Chlorine
Transport hazard class(es)	
Class	2.3
Subsidiary risk	5.1, 8
Packing group	Not available.
Environmental hazards	No.
ERG Code	2CP
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Forbidden
Cargo aircraft only	Forbidden

IMDG

UN number	UN1017
UN proper shipping name	CHLORINE, MARINE POLLUTANT
Transport hazard class(es)	
Class	2.3
Subsidiary risk	5.1, 8
Packing group	Not available.

Environmental hazards

Marine pollutant	Yes
EmS	F-C, S-U
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 applicable.

DOT

IATA; IMDG; TDG

Marine pollutant

General information IMDG Regulated Marine Pollutant. Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: Ensure that containers are firmly secured. Ensure cylinder valve is closed and not leaking. Ensure valve outlet cap nut or plug (where provided) is correctly fitted. Ensure valve protection device (where provided) is correctly fitted. Ensure adequate ventilation. Ensure compliance with applicable regulations.

TDG

UN number	UN1017
UN proper shipping name	Chlorine
Transport hazard class(es)	
Class	2.3
Subsidiary risk	5.1, 8
Packing group	Not available.
Environmental hazards	Not available.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

15. Regulatory information

Canadian regulations This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.

Canada DSL Inventory: Registration Status

Chlorine (CAS 7782-50-5) Listed

Canada Environmental Emergency Regulations Schedule 1: Listed Substance

Chlorine (CAS 7782-50-5) Listed

Canada NPRI (Supplier Notification Required): Listed substance

Chlorine (CAS 7782-50-5) Listed

Controlled Drugs and Substances Act

Not regulated.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Ontario. Toxic Substances. Toxic Reduction Act, 2009. Regulation 455/09 (July 1, 2011)

Chlorine (CAS 7782-50-5)

Precursor Control Regulations

Not regulated.

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.

CERCLA Hazardous Substance List (40 CFR 302.4)

Chlorine (CAS 7782-50-5) Listed.

SARA 304 Emergency release notification

Chlorine (CAS 7782-50-5) 10 lbs

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

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)
Chlorine	7782-50-5	10	100		

SARA 311/312 Hazardous chemical Yes

Classified hazard categories
Oxidizer (liquid, solid, or gas)
Gas under pressure
Acute toxicity (any route of exposure)
Skin corrosion or irritation
Serious eye damage or eye irritation
Specific target organ toxicity (single or repeated exposure)

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Chlorine	7782-50-5	100

Clean Air Act (CAA) HAPS list

Other federal regulations

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

Not listed.

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

Not regulated.

DEA Exempt Chemical Mixtures Code Number

Not regulated.

US state regulations

US. California Proposition 65

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Chlorine (CAS 7782-50-5)

California Proposition 65

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Chlorine (CAS 7782-50-5)

International regulations

Stockholm Convention

Not applicable.

Rotterdam Convention

Not applicable.

Kyoto protocol

Not applicable.

Montreal Protocol

Not applicable.

Basel Convention

Not applicable.

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
Taiwan	Taiwan Toxic Chemical Substances (TCS)	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)
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

Issue date	27-May-2018
Version No.	01
Disclaimer	While Brenntag believes the information contained herein to be accurate, Brenntag makes no representation or warranty, express or implied, regarding, and assumes no liability for, the accuracy or completeness of the information. The Buyer assumes all responsibility for handling, using and/or reselling the Product in accordance with applicable federal, state, and local law. This SDS shall not in any way limit or preclude the operation and effect of any of the provisions of Brenntag's terms and conditions of sale.

SAFETY DATA SHEET

1. Identification

Product identifier	**Hydrochloric Acid 28-32%**
Other means of identification	
Synonyms	Aqueous hydrogen chloride, Chlorohydric acid, HCl, Hydrochloric acid, Muriatic acid, Spirits of salt
Recommended use	Industrial Water Treatment
Recommended restrictions	None known.
Manufacturer/Importer/Supplier/Distributor information	
Manufacturer	
Company name	PVS Benson
Address	1012 Gore Road Freelton, ON L0R1K0 Canada
Telephone	1-800-265-0014
e-mail	bensoncs@pvschemicals.com
Emergency phone number	24 hours/7 days: 1-313-921-1200
Supplier	See above.

2. Hazard identification

Physical hazards	Corrosive to metals	Category 1
Health hazards	Acute toxicity, oral	Category 4
	Acute toxicity, dermal	Category 4
	Acute toxicity, inhalation	Category 3
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity following single exposure	Category 3 respiratory tract irritation
Environmental hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	May be corrosive to metals. Causes severe skin burns and eye damage. Harmful if swallowed. Harmful in contact with skin. Toxic if inhaled. May cause respiratory irritation.
Precautionary statement	
Prevention	Keep only in original packaging. Do not breathe mist or vapour. Wash thoroughly after handling. Wear protective gloves, protective clothing, eye protection and face protection. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area.
Response	Absorb spillage to prevent material-damage. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse. IF INHALED: remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor. Specific treatment (see information on this label). IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Storage	Store in a corrosion resistant container with a resistant inner liner. Store locked up. Store in a well-ventilated place.
Disposal	Dispose of container in accordance with local, regional, national and international regulations.
Other hazards	None known.
Supplemental information	68 % of the mixture consists of component(s) of unknown acute dermal toxicity. 68 % of the mixture consists of component(s) of unknown acute inhalation toxicity.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Hydrochloric acid		7647-01-0	28-32

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

Composition comments The concentration ranges are provided due to batch-to-batch variability.

4. First-aid measures

Inhalation IF INHALED: remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTRE or doctor. Specific treatment (see information on this label).

Skin contact IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse. Immediately call a POISON CENTRE or doctor. Specific treatment (see information on this label).

Eye contact 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 CENTRE or doctor.

Ingestion IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTRE or doctor.

Most important symptoms/effects, acute and delayed Burning pain and severe corrosive skin damage.
Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.
May cause respiratory irritation. Coughing.

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

General information If you feel unwell, seek medical advice (show the label where possible). 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. Avoid contact with eyes and skin. Keep out of reach of children.

5. Fire-fighting measures

Suitable extinguishing media Water fog. Foam. Dry chemical powder. Carbon dioxide.

Unsuitable extinguishing media Not available.

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

Hazardous combustion products May include and are not limited to: Hydrogen chloride. Chlorine gas.

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

Fire fighting equipment/instructions Move containers from fire area if you can do so without risk.

Specific methods Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Do not breathe mist or vapour. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Never return spills in original containers for re-use. Clean surface thoroughly to remove residual contamination. Following product recovery, flush area with water. Prevent entry into waterways, sewer, basements or confined areas. For waste disposal, see section 13 of the SDS.

Environmental precautions Do not discharge into lakes, streams, ponds or public waters.

7. Handling and storage

Precautions for safe handling Do not get in eyes, on skin, or on clothing. Wear appropriate personal protective equipment. Do not breathe mist or vapour. Use only outdoors or in a well-ventilated area. Do not taste or swallow. Observe good industrial hygiene practices. Wash thoroughly after handling. When using, do not eat, drink or smoke. Add compound slowly to water, never water to compound.

Conditions for safe storage, including any incompatibilities

FOR DRUM, TOTE, AND BOTTLE STORAGE CONTAINERS: Store in a cool, dry, well-ventilated place. Store only in closed, properly labeled containers. Store locked up. Store in a corrosion resistant container with a resistant inner liner. Store away from incompatible materials (see Section 10 of the SDS).
FOR BULK STORAGE CONTAINERS: Bulk storage tanks should be constructed of corrosion-resistant materials such as rubber- or glass-lined steel, fiberglass, or plastic. Bulk storage tanks should contain a dike sufficiently large enough to contain entire contents.

Keep out of reach of children.

8. Exposure controls/Personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	2 ppm

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

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	3 mg/m3
		2 ppm

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

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	2 ppm

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	2 ppm

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

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	2 ppm

Canada. Quebec OELs. (Ministry of Labour - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	7.5 mg/m3
		5 ppm

Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21)

Components	Type	Value
Hydrochloric acid (CAS 7647-01-0)	Ceiling	2 ppm

Biological limit values

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

Appropriate engineering controls

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

Individual protection measures, such as personal protective equipment

Eye/face protection

Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection

Rubber gloves. Confirm with a reputable supplier first.

Other

As required by employer code.

Respiratory protection

Where exposure guideline levels may be exceeded, use an approved NIOSH respirator. Respirator should be selected by and used under the direction of a trained health and safety professional following requirements found in OSHA's respirator standard (29 CFR 1910.134), CAN/CSA-Z94.4 and ANSI's standard for respiratory protection (Z88.2).

Thermal hazards

Not applicable.

General hygiene considerations

Handle in accordance with good industrial hygiene and safety practices. Wash hands before breaks and immediately after handling the product. When using do not eat or drink.

9. Physical and chemical properties

Appearance	Aqueous solution.
Physical state	Liquid.
Form	Liquid.
Colour	Colourless to pale yellow
Odour	Pungent
Odour threshold	1 - 5 ppm
pH	< 1
Melting point/freezing point	-52.5 °C (-62.5 °F)
Initial boiling point and boiling range	85 °C (185 °F)
Flash point	None
Evaporation rate	Not available
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not applicable
Flammability limit - upper (%)	Not applicable
Explosive limit - lower (%)	Not available.
Explosive limit – upper (%)	Not available.
Vapour pressure	35 mmHg @ 25°C
Vapour density	1.267 (Air=1)
Relative density	1.161 - 1.190 g/cm3
Solubility(ies)	
Solubility (Water)	Complete
Partition coefficient (n-octanol/water)	Not available
Auto-ignition temperature	Not applicable
Decomposition temperature	Not available.
Viscosity	1.75 cPs @ 20°C
Other information	
Explosive properties	Not explosive.
Oxidising properties	Not oxidising.
Percent volatile	100 %
Specific gravity	1.16

10. Stability and reactivity

Reactivity	May react with incompatible materials.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerisation does not occur.
Conditions to avoid	Do not mix with other chemicals.
Incompatible materials	Bases. Strong oxidising agents. Reducing Agents. Metals. Amines.
Hazardous decomposition products	May include and are not limited to: Hydrogen chloride. Chlorine gas.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Toxic if inhaled.
Skin contact	Harmful in contact with skin. Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Harmful if swallowed. May cause stomach distress, nausea or vomiting.

Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. May cause respiratory irritation. Coughing.

Information on toxicological effects

Acute toxicity Toxic if inhaled. Harmful in contact with skin. Harmful if swallowed. May cause respiratory irritation.

Components	**Species**	**Test results**
Hydrochloric acid (CAS 7647-01-0)		
Acute		
Dermal		
LD50	Mouse	1449 mg/kg, HSDB
Inhalation		
LC50	Mouse	13745 ppm, 5 Minutes, ECHA
		2644 ppm, 5 Minutes, ECHA
		1108 ppm, 1 Hours, RTECS
		16.5 mg/L, 5 Minutes, ECHA
		3.2 mg/L, 5 Minutes, ECHA
	Rat	40989 ppm, 5 Minutes, ECHA
		4701 ppm, 5 Minutes, ECHA
		3124 ppm, 1 Hours, HSDB
		2810 ppm, 1 Hours
		1405 ppm, 4 Hours
		45.6 mg/L, 5 Minutes, ECHA
		8.3 mg/L, 5 Minutes, ECHA
		0.4 mg/L, OECD SIDS (2002)
Oral		
LD50	Rabbit	900 mg/kg, HSDB
	Rat	238 - 277 mg/kg, HSDB

Skin corrosion/irritation	Causes severe skin burns and eye damage.
Exposure minutes	Not available.
Erythema value	Not available.
Oedema value	Not available.
Serious eye damage/eye irritation	Causes serious eye damage.
Corneal opacity value	Not available.
Iris lesion value	Not available.
Conjunctival reddening value	Not available.
Conjunctival oedema value	Not available.
Recover days	Not available.

Respiratory or skin sensitisation

Canada - Alberta OELs: Irritant

Hydrochloric acid (CAS 7647-01-0)	Irritant

Respiratory sensitisation	Not a respiratory sensitizer.
Skin sensitisation	This product is not expected to cause skin sensitisation.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	See below.

ACGIH Carcinogens

Hydrochloric acid (CAS 7647-01-0)	A4 Not classifiable as a human carcinogen.

Canada - Manitoba OELs: carcinogenicity

Hydrochloric acid (CAS 7647-01-0)	Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Hydrochloric acid (CAS 7647-01-0) Volume 54 - 3 Not classifiable as to carcinogenicity to humans.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

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

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

Chronic effects Prolonged inhalation may be harmful.

Further information Not available.

12. Ecological information

Ecotoxicity See below

Ecotoxicological data

Components		Species	Test results
Hydrochloric acid (CAS 7647-01-0)			
Aquatic			
Fish	LC50	Western mosquitofish (Gambusia affinis)	282 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.

Mobility in general Not available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

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

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 Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

General Canada: TDG Proof of Classification: Classification Method: Classified as per Part 2, Sections 2.1 – 2.8 of the Transportation of Dangerous Goods Regulations. If applicable, the technical name and the classification of the product will appear below.

Transportation of Dangerous Goods (TDG - Canada)

Basic shipping requirements:

UN number UN1789

Proper shipping name HYDROCHLORIC ACID

Hazard class 8

Packing group II

TDG

15. Regulatory information

Canadian federal regulations This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Precursor Control Regulations

Hydrochloric acid (CAS 7647-01-0) Class B

WHMIS status Controlled

International regulations

Inventory status

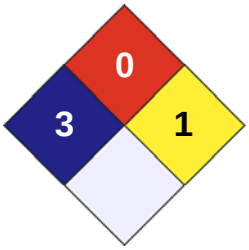
Country(s) or region	Inventory Name	On Inventory (Yes/No)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No

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

16. Other information

LEGEND	
Severe	4
Serious	3
Moderate	2
Slight	1
Minimal	0

HEALTH	/ 3
FLAMMABILITY	0
PHYSICAL HAZARD	1
PERSONAL PROTECTION	X



Issue date 18-April-2019

Revision date 18-April-2019

Effective date 07-April-2017

Version No. 02

Other information For an updated SDS, please contact the supplier/manufacturer listed on the first page of the document.

Disclaimer Information contained herein was obtained from sources considered technically accurate and reliable. While every effort has been made to ensure full disclosure of product hazards, in some cases data is not available and is so stated. Since conditions of actual product use are beyond control of the supplier, it is assumed that users of this material have been fully trained according to the requirements of all applicable legislation and regulatory instruments. No warranty, expressed or implied, is made and supplier will not be liable for any losses, injuries or consequential damages which may result from the use of or reliance on any information contained in this document.

Prepared by Dell Tech Laboratories Ltd. Phone: (519) 858-5021

Sulfur Dioxide

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Revision Date: 05/01/15 Date of issue: 05/01/15 Version: 1.0

SECTION 1: IDENTIFICATION

Product Identifier

Product Form: Substance

Product Name: Sulfur Dioxide

Product Name: SO_2

CAS No: 7446-09-5

Synonyms: Sulfurous anhydride, Sulfurous acid anhydride; Sulfurous Oxide

Intended Use of the Product

Used as a bleaching agent, refrigerant,solvent and in processing food products.

Name, Address, and Telephone of the Responsible Party

Manufacturer

CHEMTRADE LOGISTICS INC.
155 Gordon Baker Road
Suite 300
Toronto, Ontario M2H 3N5
For MSDS Info: (416) 496-5856
www.chemtradelogistics.com

Emergency Telephone Number

Emergency number : Canada: CANUTEC +1-613-996-6666 / US: CHEMTREC +1-800-424-9300
Chemtrade Emergency Contact: (866) 416-4404
For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident, call CHEMTREC – Day or Night

SECTION 2: HAZARDS IDENTIFICATION

Classification of the Substance or Mixture

Classification (GHS-US)

Liquefied gas	H280
Acute Tox. 3 (Inhalation:gas)	H331
Skin Corr. 1B	H314
Eye Dam. 1	H318

Label Elements

GHS-US Labeling

Hazard Pictograms (GHS-US) :

GHS04 GHS05 GHS06

Signal Word (GHS-US) : Danger

Hazard Statements (GHS-US) : H280 - Contains gas under pressure; may explode if heated
H314 - Causes severe skin burns and eye damage
H318 - Causes serious eye damage
H331 - Toxic if inhaled

Precautionary Statements (GHS-US) : P260 - Do not breathe vapors, mist, spray, gas
P264 - Wash hands, forearms, and other exposed areas thoroughly after handling
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear gloves, protective clothing, eye protection, face protection, respiratory protection
P301+P330+P331 - IF SWALLOWED: rinse mouth. Do NOT induce vomiting
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove

contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/physician
P311 - Call a POISON CENTER or doctor/physician
P321 - Specific treatment (see section 4)
P363 - Wash contaminated clothing before reuse
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
P501 - Dispose of contents/container to local, regional, national, and international regulations

Other Hazards

Other Hazards Not Contributing to the Classification: Exposure may aggravate those with pre-existing eye, skin, or respiratory conditions. Prolonged exposure to gas or overexposure to concentrated gas may cause loss of conciousness, possible damage to lung tissue, a decrease of lung function, vocal chord spasms, chemical pneuomia, inflammation of the throat (bronchitis), and breathing paralysis. Contact with the product may cause cold burns or frostbite.

Unknown Acute Toxicity (GHS-US) Not available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Substances

Name	Product identifier	% (w/w)	Classification (GHS-US)
Sulfur dioxide	(CAS No) 7446-09-5	99 - 100	Compressed gas, H280 Acute Tox. 3 (Inhalation:gas), H331 Skin Corr. 1B, H314 Eye Dam. 1, H318

Full text of H-phrases: see section 16

Mixture

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible). If frostbite or freezing occurs, immediately flush with plenty of lukewarm water to GENTLY warm the affected area. Do not use hot water. Do not rub affected area. Get immediate medical attention.

Inhalation: When symptoms occur: go into open air and ventilate suspected area. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.

Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or doctor/physician. Thaw frosted parts with lukewarm water. Do not rub affected area.

Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician. If frostbite or freezing occurs, immediately flush with plenty of lukewarm water to GENTLY warm the affected area. Do not use hot water. Do not rub affected area. Get immediate medical attention.

Ingestion: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor/physician.

Most Important Symptoms and Effects Both Acute and Delayed

General: Causes severe skin burns and eye damage. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Toxic if inhaled. May cause frostbite.

Inhalation: Toxic if inhaled. Irritating to mouth, nose, throat, and lungs, may cause difficulty in breathing.

Skin Contact: Corrosive. Causes burns. May cause frostbite on contact with the liquefied gas.

Eye Contact: Causes serious eye damage. Contact with the liquefied gas causes frostbite. Can cause blindness.

Ingestion: Not expected to be a route of exposure, but gas is extremely irritating to mucous membranes.

Chronic Symptoms: Prolonged exposure to gas or overexposure to concentrated gas may cause loss of conciousness, possible damage to lung tissue, a decrease of lung function, vocal chord spasms, chemical pneuomia, inflammation of the throat (bronchitis), and breathing paralysis.

Indication of Any Immediate Medical Attention and Special Treatment Needed

If medical advice is needed, have product container or label at hand.

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media: Use extinguishing media appropriate for surrounding fire.

Unsuitable Extinguishing Media: Do not use a heavy water stream. Use of heavy stream of water may spread fire.

Special Hazards Arising From the Substance or Mixture

Fire Hazard: Not considered flammable but may burn at high temperatures.

Explosion Hazard: Heating may cause an explosion. Heat may build pressure, rupturing closed containers, spreading fire and increasing risk of burns and injuries.

Reactivity: Thermal decomposition generates : Corrosive vapors.

Advice for Firefighters

Precautionary Measures Fire: Exercise caution when fighting any chemical fire.

Firefighting Instructions: Use water spray or fog for cooling exposed containers.

Protection During Firefighting: Do not enter fire area without proper protective equipment, including respiratory protection.

Hazardous Combustion Products:Not available

Other information: Do not allow run-off from fire fighting to enter drains or water courses.

Reference to Other Sections

Refer to section 9 for flammability properties.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Ruptured cylinders may rocket. Avoid all contact with skin, eyes, or clothing. Do NOT breathe (dust, vapor, mist, gas). Handle in accordance with good industrial hygiene and safety practice.

For Non-Emergency Personnel

Protective Equipment: Use appropriate personal protection equipment (PPE).

Emergency Procedures: Evacuate unnecessary personnel.

For Emergency Personnel

Protective Equipment: Equip cleanup crew with proper protection.

Emergency Procedures: Ventilate area.

Environmental Precautions

Prevent entry to sewers and public waters.

Methods and Material for Containment and Cleaning Up

For Containment: Stop leak without risks if possible. As an immediate precautionary measure, isolate spill or leak area in all directions.

Methods for Cleaning Up: Clear up spills immediately and dispose of waste safely. Isolate area until gas has dispersed.

Reference to Other Sections

See heading 8, Exposure Controls and Personal Protection.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling

Additional Hazards When Processed: Ruptured cylinders may rocket. Dissolves in water to form sulfurous acid, a corrosive liquid. Do not pressurize, cut, or weld containers. Contact with the liquefied gas may cause frostbite.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work. Do no eat, drink or smoke when using this product. Wash contaminated clothing before reuse.

Conditions for Safe Storage, Including Any Incompatibilities

Technical Measures: Comply with applicable regulations.

Storage Conditions: Store in a dry, cool and well-ventilated place. Keep container closed when not in use. Keep/Store away from combustible materials, ignition sources, incompatible materials, direct sunlight, extremely high or low temperatures, water, moisture, humidity.

Storage Area: Store locked up. Store in a well-ventilated place.

Specific End Use(s) Used as a bleaching agent, refrigerant,solvent and in processing food products.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Sulfur dioxide (7446-09-5)		
USA ACGIH	ACGIH STEL (ppm)	0.25 ppm
USA OSHA	OSHA PEL (TWA) (mg/m³)	13 mg/m³
USA OSHA	OSHA PEL (TWA) (ppm)	5 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m³)	5 mg/m³
USA NIOSH	NIOSH REL (TWA) (ppm)	2 ppm
USA NIOSH	NIOSH REL (STEL) (mg/m³)	13 mg/m³
USA NIOSH	NIOSH REL (STEL) (ppm)	5 ppm
USA IDLH	US IDLH (ppm)	100 ppm
Alberta	OEL STEL (mg/m³)	13 mg/m³
Alberta	OEL STEL (ppm)	5 ppm
Alberta	OEL TWA (mg/m³)	5.2 mg/m³
Alberta	OEL TWA (ppm)	2 ppm
British Columbia	OEL STEL (ppm)	5 ppm
British Columbia	OEL TWA (ppm)	2 ppm
Manitoba	OEL STEL (ppm)	0.25 ppm
New Brunswick	OEL STEL (mg/m³)	13 mg/m³
New Brunswick	OEL STEL (ppm)	5 ppm
New Brunswick	OEL TWA (mg/m³)	5.2 mg/m³
New Brunswick	OEL TWA (ppm)	2 ppm
Newfoundland & Labrador	OEL STEL (ppm)	0.25 ppm
Nova Scotia	OEL STEL (ppm)	0.25 ppm
Nunavut	OEL STEL (mg/m³)	13 mg/m³
Nunavut	OEL STEL (ppm)	5 ppm
Nunavut	OEL TWA (mg/m³)	5 mg/m³
Nunavut	OEL TWA (ppm)	2 ppm
Northwest Territories	OEL STEL (mg/m³)	13 mg/m³
Northwest Territories	OEL STEL (ppm)	5 ppm
Northwest Territories	OEL TWA (mg/m³)	5 mg/m³
Northwest Territories	OEL TWA (ppm)	2 ppm
Ontario	OEL STEL (mg/m³)	10.4 mg/m³
Ontario	OEL STEL (ppm)	5 ppm
Ontario	OEL TWA (mg/m³)	5.2 mg/m³
Ontario	OEL TWA (ppm)	2 ppm
Prince Edward Island	OEL STEL (ppm)	0.25 ppm
Québec	VECD (mg/m³)	13 mg/m³
Québec	VECD (ppm)	5 ppm
Québec	VEMP (mg/m³)	5.2 mg/m³
Québec	VEMP (ppm)	2 ppm
Saskatchewan	OEL STEL (ppm)	5 ppm
Saskatchewan	OEL TWA (ppm)	2 ppm
Yukon	OEL STEL (mg/m³)	13 mg/m³
Yukon	OEL STEL (ppm)	5 ppm
Yukon	OEL TWA (mg/m³)	13 mg/m³
Yukon	OEL TWA (ppm)	5 ppm

Exposure Controls

Appropriate Engineering Controls: Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation, especially in confined areas. Ensure all national/local regulations are observed.

Personal Protective Equipment: Protective goggles. Insufficient ventilation: wear respiratory protection. Protective clothing. Gloves.

Materials for Protective Clothing: Chemically resistant materials and fabrics. Corrosionproof clothing.

Hand Protection: Wear chemically resistant protective gloves. Acid-resistant protective gloves.

Eye Protection: Chemical safety goggles.

Skin and Body Protection: Wear suitable protective clothing.

Respiratory Protection: If exposure limits are exceeded or irritation is experienced, NIOSH approved respiratory protection should be worn.

Other Information: When using, do not eat, drink or smoke.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Information on Basic Physical and Chemical Properties

Physical State	:	Gas
Appearance	:	Colorless gas
Odor	:	Pungent. Strong.
Odor Threshold	:	Not available
pH	:	Not applicable. In water, sulfur dioxide is rapidly converted to sulfurous acid (pH less than 3).
Relative Evaporation Rate (butylacetate=1)	:	243.2
Melting Point	:	Not applicable
Freezing Point	:	-75.55 °C (-104°F)
Boiling Point	:	-9.99 °C (14°F)
Flash Point	:	Not applicable
Critical temperature	:	156.9 °C (314.4°F)
Auto-ignition Temperature	:	Not available
Decomposition Temperature	:	Not available
Flammability (solid, gas)	:	Not available
Lower Flammable Limit	:	Not available
Upper Flammable Limit	:	Not available
Vapor Pressure	:	Not available
Relative Vapor Density at 20 °C	:	2.2 [Air = 1]
Relative Density	:	Not available
Specific Gravity	:	1.45
Solubility	:	Water: 11.9% by wt. in water at 15°C (60°F) and 760 mmHg. Organic solvent: Soluble in alcohol, chloroform, ether, acetic acid.
Partition coefficient: n-octanol/water	:	Not available
Viscosity	:	Not available
Explosion Data – Sensitivity to Mechanical Impact	:	Not expected to present an explosion hazard due to mechanical impact.
Explosion Data – Sensitivity to Static Discharge	:	Not expected to present an explosion hazard due to static discharge.

SECTION 10: STABILITY AND REACTIVITY

Reactivity: Thermal decomposition generates : Corrosive vapors.

Chemical Stability: Stable at standard temperature and pressure.

Possibility of Hazardous Reactions: Hazardous polymerization will not occur.

Conditions to Avoid: Direct sunlight. Extremely high or low temperatures. Ignition sources. Incompatible materials. Water. Moisture.

Incompatible Materials: Strong acids. Strong bases. Strong oxidizers. Water. Humidity. Chlorates, acrolein, active metals such as: aluminum, iron, iron oxide.

Hazardous Decomposition Products: Thermal decomposition generates : Corrosive vapors. Sulfur compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

Information on Toxicological Effects - Product

Acute Toxicity: Toxic if inhaled.

LD50 and LC50 Data:

Sulfur Dioxide (\f)7446-09-5	
ATE (gases)	700.000 ppmV/4h

Skin Corrosion/Irritation: Causes severe skin burns and eye damage.
pH: Not applicable. Not applicable. In water, sulfur dioxide is rapidly converted to sulfurous acid (pH less
Serious Eye Damage/Irritation: Causes serious eye damage.
pH: Not applicable. Not applicable. In water, sulfur dioxide is rapidly converted to sulfurous acid (pH less
Respiratory or Skin Sensitization: Not classified
Germ Cell Mutagenicity: Not classified
Teratogenicity: Not available
Carcinogenicity: Not classified
Specific Target Organ Toxicity (Repeated Exposure): Not classified
Reproductive Toxicity: Not classified
Specific Target Organ Toxicity (Single Exposure): Not classified
Aspiration Hazard: Not classified
Potential Adverse Human Health Effects and Symptoms: Toxic if inhaled.
Symptoms/Injuries After Inhalation: Toxic if inhaled. Irritating to mouth, nose, throat, and lungs, may cause difficulty in breathing.
Symptoms/Injuries After Skin Contact: Corrosive. Causes burns. May cause frostbite on contact with the liquefied gas.
Symptoms/Injuries After Eye Contact: Causes serious eye damage. Contact with the liquefied gas causes frostbite. Can cause blindness.
Symptoms/Injuries After Ingestion: Not expected to be a route of exposure, but gas is extremely irritating to mucous membranes.
Chronic Symptoms: Prolonged exposure to gas or overexposure to concentrated gas may cause loss of conciousness, possible damage to lung tissue, a decrease of lung function, vocal chord spasms, chemical pneuomia, inflammation of the throat (bronchitis), and breathing paralysis.

Information on Toxicological Effects - Ingredient(s)

LD50 and LC50 Data:

Sulfur dioxide (7446-09-5)	
LC50 Inhalation Rat (ppm)	2500 ppm/1h

Sulfur dioxide (7446-09-5)	
IARC Group	3

SECTION 12: ECOLOGICAL INFORMATION

Toxicity

Ecology - General: Report spills to the competent authority as this material forms an acidic solution when dissolved in water.

Persistence and Degradability

Sulfur Dioxide (7446-09-5)	
Persistence and Degradability	Not established.

Bioaccumulative Potential

Sulfur Dioxide (7446-09-5)	
Bioaccumulative Potential	Not established.

Sulfur dioxide (7446-09-5)	
BCF fish 1	(no bioaccumulation expected)

Mobility in Soil Not available

Other Adverse Effects

Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Recommendations: Dispose of waste material in accordance with all local, regional, national, provincial, territorial and international regulations.
Additional Information: Empty gas cylinders should be returned to the vendor for recycling or refilling.
Ecology – Waste Materials: Avoid release to the environment.

SECTION 14: TRANSPORT INFORMATION

14.1 In Accordance with DOT

Proper Shipping Name : SULFUR DIOXIDE
Hazard Class : 2.3
Identification Number : UN1079
Label Codes : 2.3,8
ERG Number : 125

14.2 In Accordance with IMDG

Proper Shipping Name : SULPHUR DIOXIDE
Hazard Class : 2.3
Identification Number : UN1079
Label Codes : 2.3,8
EmS-No. (Fire) : F-C
EmS-No. (Spillage) : S-U
MFAG Number : 125

14.3 In Accordance with IATA

Proper Shipping Name : SULPHUR DIOXIDE
Identification Number : UN1079
Hazard Class : 2
Label Codes : 2.3,8
ERG Code (IATA) : 2CP

14.4 In Accordance with TDG

Proper Shipping Name : SULPHUR DIOXIDE
Hazard Class : 2.3
Identification Number : UN1079
Label Codes : 2.3,8

SECTION 15: REGULATORY INFORMATION

US Federal Regulations

Sulfur Dioxide (7446-09-5)	
SARA Section 311/312 Hazard Classes	Delayed (chronic) health hazard Immediate (acute) health hazard Sudden release of pressure hazard

Sulfur dioxide (7446-09-5)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Listed on SARA Section 302 (Specific toxic chemical listings)	
SARA Section 302 Threshold Planning Quantity (TPQ)	500

US State Regulations

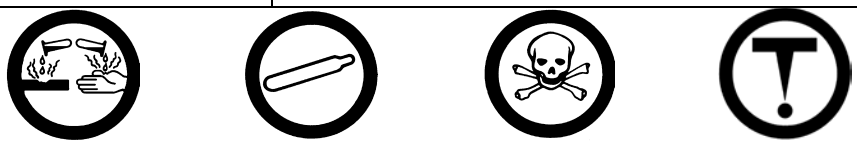
Sulfur dioxide (7446-09-5)	
U.S. - California - Proposition 65 - Developmental Toxicity	WARNING: This product contains chemicals known to the State of California to cause birth defects.

Sulfur dioxide (7446-09-5)
U.S. - Massachusetts - Right To Know List
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) List

Canadian Regulations

Sulfur Dioxide (7446-09-5)	
WHMIS Classification	Class E - Corrosive Material Class A - Compressed Gas

	Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects



Sulfur dioxide (7446-09-5)	
Listed on the Canadian DSL (Domestic Substances List) inventory. Listed on the Canadian Ingredient Disclosure List	
WHMIS Classification	Class A - Compressed Gas Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects Class E - Corrosive Material

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all of the information required by CPR.

SECTION 16: OTHER INFORMATION, INCLUDING DATE OF PREPARATION OR LAST REVISION

Revision date : 05/01/15

Other Information : This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200.

GHS Full Text Phrases:

Acute Tox. 3 (Inhalation:gas)	Acute toxicity (inhalation:gas) Category 3
Compressed gas	Gases under pressure Compressed gas
Eye Dam. 1	Serious eye damage/eye irritation Category 1
Liquefied gas	Gases under pressure Liquefied gas
Skin Corr. 1B	Skin corrosion/irritation Category 1B
H280	Contains gas under pressure; may explode if heated
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H331	Toxic if inhaled

Party Responsible for the Preparation of This Document

CHEMTRADE LOGISTICS, INC.

For MSDS Info: (416) 496-5856

Handle product with due care and avoid unnecessary contact. This information is supplied under U.S. OSHA'S "Right to Know" (29 CFR 1910.1200) and Canada's WHMIS regulations. Although certain hazards are described herein, we cannot guarantee these are the only hazards that exist. The information contained herein is based on data available to us and is believed to be true and accurate but it is not offered as a product specification. No warranty, expressed or implied, regarding the accuracy of this data, the hazards connected with the use of the product, or the results to be obtained from the use thereof, is made and Chemtrade and its affiliates assume no responsibility. Chemtrade is a member of the CIAC (Chemistry Industry Association of Canada) and adheres to the codes and principles of Responsible Care™.

Responsible Care® Our commitment to sustainability. Gestion responsable™ Notre engagement envers le développement durable.

North America GHS US 2012 & WHMIS 2

APPENDIX C – Annual Test of Plan Template Form

Annual Test of Environmental Emergencies Plan (E2)

Site	

Location	
Test Type	
Participants	
Test Coordinator	
Test Date	
Who Prepared the Test?	
Date of Most Recent Revision to Plan	

Context and Purpose of the Test
Under the Environmental Emergency Regulations, 2019 (SOR/2019-51) section 7, each year, beginning on the day on which the plan is brought into effect, a simulation exercise in respect of one substance from each of the hazard categories will be tested. Every five years, beginning on the day on which the plan is brought into effect, a full-scale simulation exercise in respect of any one substance, using an environmental emergency (in paragraph 4(2)(e) or (f) of the regulation) as the emergency being simulated. The purpose of this exercise is to determine reaction time of operator/ maintenance personnel and if notification procedures are consistent with plan. Also, any changes to the plan can be identified and plan revisions made as a result. If at any time during the exercise you observe that an activity is not safe, advise test coordinators and emergency personnel immediately to stop the unsafe activity or the full exercise. SAFETY FIRST!

EXERCISE PREPARATION

	YES	NO
Was the exercise a surprise to participants?		
Did participants know when and where the exercise was going to take place?		
Were participants aware of the scenario in advance?		
Was pre-exercise training provided for exercise participants?		
Are participants familiar with the location of Emergency Safe Assembly Areas?		
Will any facilities/sites be set up in advance? Please summarize what set-up activities will take place and what will be left up to the exercise participants.		
Were necessary site personnel advised of time and location of live test? If so, please identify them.		
Has a cancellation procedure/message been prepared in the event of a real emergency?		
The exercise will be terminated in the event that notification is received of an actual emergency. All test participants will proceed to assembly areas and respond appropriately in the even that an emergency is discovered.		

EXERCISE EXECUTION

Scenario

Summary of Responses

EXERCISE EVALUATION

	YES	NO
Was an informal debriefing held immediately after the exercise?		
If NO, has a formal debriefing been scheduled?		
Date:		

Effectiveness of the Plan (Identify problems with plan, procedures, equipment, facility and training)

Follow Up Items

	YES	NO
Did this exercise result in a need to update the E2 Plan?		
Did this exercise result in an NC or OFI under ISO 14001?		
If YES, was this documented in the NC/OFI tracker?		