Climax Molybdenum
A Freeport-McMoRan Company

COLORADO OPERATIONS
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March 5, 2021

Submitted Via ePermitting and Email

Mr. Peter Hays
Division of Reclamation Mining and Safety
1313 Sherman St., Rm. 215
Denver, CO 80203

RE: Climax Molybdenum Company, Henderson Mill, Permit No. M-1977-342, Technical Revision No. 34, Environmental Protection Plan Revision

Dear Mr. Hays:

Climax Molybdenum Company (CMC) is submitting this request for a Technical Revision to the Henderson Reclamation Permit Environmental Protection Plan (EPP). The EPP has been prepared pursuant to Rule 6.1.4 and Rule 6.4.21 of the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal, and Designated Mining Operations and is being formally submitted as Technical Revision 34 (TR-34) to the Henderson Mine and Mill Reclamation Permit No. M-1977-342. This revised EPP supersedes the 2012 EPP submitted to the Division of Reclamation, Mining and Safety (DRMS) as TR-18. Key updates to the enclosed EPP include:

- Incorporation of URAD WTP as an Environmental Protection Facility (EPF), consistent with our approved Amendment 7 that includes the URAD WTP in the affected land boundary.
- Incorporation of our planned Mill WTP as an EPF. A separate TR for the Mill WTP will be submitted with design drawings when those are available.
- Inclusion of Tailing Storage Facility inspection and reporting requirements as requested by DRMS.
- Addition of EPFs that have been permitted as separate TRs since the last version of the EPP was submitted in 2012:
    - TR-23 Phase I Ute Park Extraction Wellfield (1 well)
    - TR-25 Phase II Ute Park Extraction Wellfield (2 wells)
    - TR-28 Phase III Ute Park Extraction Wellfield (2 wells)
    - TR-30 Seep Water Road Raise
- Expansion of Seep Water Collection and Return System EPF to include the Seep Spoils Collection Area as permitted in TR-33.
- Inclusion of 1.2 Pond at the Mine as an EPF, since that was permitted as an EPF in TR-08 in 1995.
- Updates to designated chemicals to include lime and remove P_2S_5 (we no longer mix Nokes) and Coherex (not used for metallurgical processing).
- Revised storage volumes for designated chemicals where necessary.
- Incorporation of secondary containment for tailings delivery line as a part of the corresponding EPF.
- Updated and consolidated figures.

If you have any questions regarding this submittal, please contact me at (720) 942-3255.

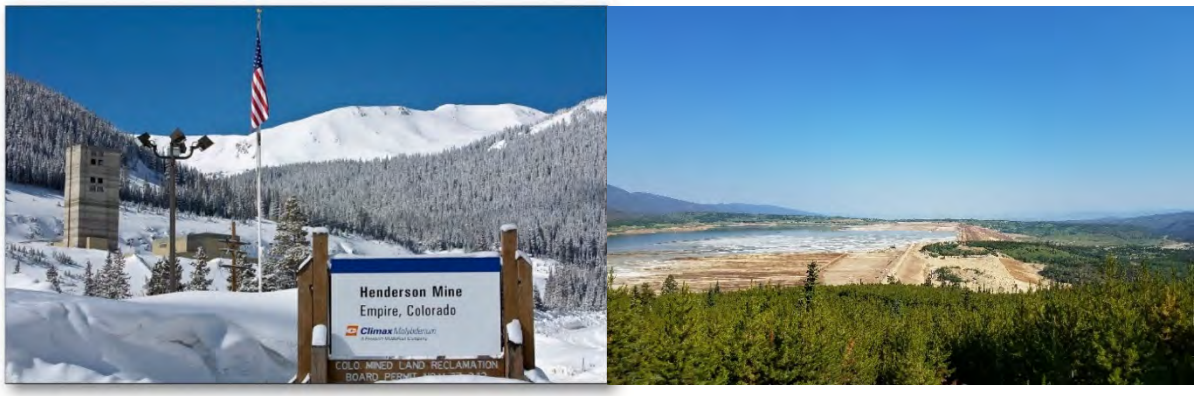
Sincerely,

Miguel Hamarat
Environmental Manager
Climax Molybdenum Company
Henderson Operations

Enclosures:
1. Environmental Protection Plan

cc (via email)
G. Niggeler, Climax

CLIMAX MOLYBDENUM COMPANY
HENDERSON OPERATIONS



Technical Revision 34 (TR-34) to Permit M-77-342
Environmental Protection Plan

March, 2021

Submitted To:

Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, Colorado 80203

Prepared by:

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List of Acronyms and Abbreviations

AM – Amendment
AMSL – Above Mean Sea Level
ARD – Acid Rock Drainage
BMP – Best Management Practice
CDOW – Colorado Division of Wildlife
CDPHE – Colorado Department of Public Health and Environment
CDPS - Colorado Discharge Permit System
CPW – Colorado Parks and Wildlife
DMO – Designated Mining Operation
DRMS – Division of Reclamation, Mining and Safety
DWR – Division of Water Resources
EBR – East Branch Reservoir
ECO – Emergency Cut-out
EPA – U.S. Environmental Protection Agency
EPF – Environmental Protection Facility
EPP – Environmental Protection Plan
GWMP – Groundwater Management Plan
HDPE – High Density Polyethylene
HDS – High-density sludge
IRM – Incident Response Manual
MLRB – Mined Land Reclamation Board
NPL – Numeric Protection Limit
NRCS – Natural Resources Conservation Service
RCP – Reinforced Concrete Pipe
SDS – Safety Data Sheet
SPCC – Spill Prevention Control and Countermeasures Plan
SWMP – Stormwater Management Plan
TDL – Tailing Delivery Line
TR – Technical Revision
TSF - Tailing Storage Facility
USDOT – United States Department of Transportation
WQCD – Water Quality Control Division
WRCC – Western Regional Climate Center
WTP – Water Treatment Plant

1. INTRODUCTION

1.1. Purpose and Objectives

The Mineral Rules and Regulations (Rule) of the Colorado Mined Land Reclamation Board (MLRB) for Hard Rock, Metal and Designated Mining Operations defines a Designated Mining Operation (DMO) as a mining operation where designated chemicals used in metallurgical processing are present on-site; toxic or acid-forming materials will be exposed or disturbed as a result of mining operations; or acid mine drainage occurs or has the potential to occur due to mining or reclamation activities.

Climax Molybdenum Company, Henderson Operations (Henderson) is classified as a DMO, and as such must follow the requirements for a DMO Environmental Protection Plan (EPP) under Rule 6.4.21, Exhibit U. The purpose of this EPP is to provide a description of environmental protection facilities (EPFs) for those areas that potentially could be affected or impacted by designated chemicals, toxic or acid-forming materials or acid mine drainage.

The original Henderson EPP was submitted as Technical Revision 04 (TR-04) to the existing Regular (112) Mining and Reclamation Permit, Number M-1977-342 (the "Reclamation Permit"). A revision to the original EPP was submitted as Technical Revision 18 (TR-18) in 2012, which then superseded the EPP submitted under TR-04. This Technical Revision (TR-34) now supersedes TR-18 and, once approved, will become part of the Reclamation Permit. The objective of this revision is to update the current EPP to reflect existing conditions at the site.

1.1.1. Reference and Indexing

Since Henderson is an existing active operation with an approved Reclamation Permit, much of the information and data required for the EPP has been developed previously. Where such information is already part of the public record and official Reclamation Permit files (modifications to the Reclamation Permit via Amendment (AM) or Technical Revision (TR), correspondence with DRMS, etc.), that information is referenced but not included herein. Only information that presently is not part of the public record or is required specifically under the Rule is included.

1.1.2. Changes in Referenced Information and Documents

Changes in the reclamation plan or EPP can trigger the need for submittal of a formal Amendment, Technical Revision, or Modification depending upon the type of change as defined in Rule 1.

Facility improvements have occurred since the last EPP revision. Please refer to Appendix A for a List of DRMS Permit Amendments and Technical Revisions.

1.1.3. Emergency Response Plan

An Emergency Response Plan is required as a component of the EPP to comply with Rule 8.3 for designated chemicals. Henderson maintains Incident Response Manuals (IRMs) for both the Mine and Mill, which are included in Appendix B. Henderson also maintains Spill Prevention, Control and Countermeasure (SPCC) Plans at the Mine and Mill. These documents describe procedures to protect, prevent, control, and mitigate releases of chemicals to the environment in the unlikely

event of a spill or release of designated chemicals or toxic or acid-forming materials. Material revisions to the IRMs will be submitted to DRMS in a timely fashion as required in Rule 8.3. The SPCC Plans are maintained at the site and are available upon request.

It should be noted that these documents include descriptions of emergency procedures for chemicals and fuels not regulated by or under the jurisdiction of the DRMS.

2. DESCRIPTION OF SITE AND SITE FIGURES

2.1. Henderson Mine & URAD Water Treatment Plant

The Henderson Mine is an underground mining operation that extracts molybdenite ore from beneath the base of Red Mountain and transports it via conveyor through a 9.6 mile tunnel and 5 mile overland conveyor to the Henderson Mill for milling and flotation concentrating. The final product is molybdenum disulfide (MoS_2) concentrate that is transported out of the state for final processing.

The Mine is located on the north side of Red Mountain near the confluence of Butler Gulch and the West Fork of Clear Creek. It is 9 miles west of Empire, Colorado, in Clear Creek County on the eastern slope of the Continental Divide. The elevation at the mine site is 10,400 feet above mean sea level (AMSL). Facilities at the mine site include shafts, support facilities, storage yards, the subsidence area on Red Mountain, the water conveyance pipeline between the Mine and URAD, and the URAD Industrial Water Treatment Plant (WTP).

2.2. Henderson Mill

The Mill is located in Grand County, Colorado in the upper Williams Fork River valley approximately 22 miles south of Parshall, Colorado. The Mill site and all facilities are on the western side of the Continental Divide in the upper Colorado River drainage basin. Facilities include the portal and conveyor, mill complex, and the tailing storage facility (TSF). An industrial WTP at the Mill (the Mill WTP) is currently in the design phase, and construction is planned between 2022 and 2024, depending on climatic conditions and water balance.

Physical and environmental descriptions of the Mine and Mill site including location maps are found in the Reclamation Permit (Sections 2 and 6) as modified. Section B of the Reclamation Permit shows the general location of the Henderson Mine and Mill.

2.3. Site Figures

- **Figure 1**: **Henderson Mine General Site Layout and EPFs 1.1, 1.2 and 1.3 -** Illustrates the general site layout of the Mine and the location of surrounding water bodies; and the location of the EPFs associated with the mine water and URAD WTP, stormwater diversion system and Pond 1.2. Note that there are no designated chemicals at the mine site.

- **Figure 2**: **Henderson Mill General Site Layout -** Illustrates the general site layout of the Mill and the locations of surrounding water bodies.

- **Figure 3**: **Henderson Mill EPFs 1.1, 1.2 and 2.1 – 2.10 – East Branch Reservoir System, Mill Process Water Storage Tanks and Designated Chemical Storage -** Illustrates the locations of the Henderson Mill EPFs associated with the East Branch Reservoir system, the process water storage tanks, and designated chemical storage.

- **Figure 4**: **Henderson Mill EPFs 1.3, 1.4, 1.5, 1.6, 1.7, 1.8 and 3.1 – Tailing Delivery System, Tailing Storage Facility, Seep Water Collection/Return, Groundwater Extraction System, Ute Park Pump Station, Stormwater Diversion System and Mill WTP -** Illustrates the

locations of the Henderson Mill EPFs associated with the tailing system, seep/groundwater collection and return system, stormwater diversion system and the Mill WTP.

3. OTHER AGENCY ENVIRONMENTAL PROTECTION MEASURES AND MONITORING

3.1. General Information

The Henderson Mine and Mill has implemented environmental protection measures and monitoring required by statute, regulation or permit by other agencies or jurisdictions, which is summarized in Table 3-1 below.

Table 3-1: Environmental Protection Measures and Monitoring Required by Other Agencies

Statute, Regulation or Permit	Summary of Environmental Protection Measures and Monitoring
CDPS Permit No. CO-0000230 (Mill)	State permit that includes provisions for process water handling, treatment, monitoring and reporting.
CDPS Permit No. CO-0041467 (Mine)	State permit that includes provisions for process water handling, treatment, monitoring and reporting.
Stormwater Permit No. COR-040079 (Mine and Mill)	State permit that includes provisions for stormwater management, best practice, pollution prevention and monitoring.
Stormwater Permit No. COR-040080 (URAD)	State permit that includes provisions for stormwater management, best practice, pollution prevention and monitoring.
AQ Permit No. 95CC899.CP4 (Mine)	State air quality permit that includes provision for air emission management, control, related equipment operation and maintenance, monitoring and reporting.
AQ Permit No. 02GR0546.CP5 (Mill)	State air quality permit that includes provision for air emission management, control, related equipment operation and maintenance, monitoring and reporting.
Hazardous Materials Certificate of Registration No. 070218550011AC	Federal registration and related regulatory requirements that includes provisions for the safe shipping of hazardous materials.
EPA Identification Number COD041517343 (Mine)	Federal waste management authorization and related regulatory requirements includes provisions for waste management, profiling, testing, disposal and tracking.
EPA Identification Number COD000695064 (Mill)	Federal waste management authorization and related regulatory requirements that includes provisions for waste management, profiling, testing, disposal and tracking.

4. OTHER PERMITS AND LICENSES

4.1. Other Permits and Licenses

The Henderson Mine and Mill operate under numerous specific regulatory permits, licenses and authorizations. Table 4-1 provides a list of air, water quality, solid and hazardous waste, and other federal and state permits or local licenses, or other formal authorizations which Henderson holds or will be seeking that are applicable to the use, handling, storage, or disposal of designated chemicals and acid mine drainage-forming materials within the permit area. These permits and authorizations pertaining to environmental controls are regulated by state and federal programs and are public information. The most current versions of these permits and authorizations are available at the environmental offices at both the Henderson Mine and Henderson Mill and at the agencies listed.

Table 4-1: Other Permits and Licenses

Agency	Permit	Permitted Area
DRMS	M-1977-342, Mining and Reclamation Permit	Henderson Mine and Mill
	Various Amendments and Technical Revisions.	Henderson Mine and Mill
CDPHE, Water Quality Control Division	CDPS Permit No. CO-0000230	Henderson Mill
	CDPS Permit No. CO-0041467	Henderson Mine and URAD
	Stormwater Permit No. COR-040079	Henderson Mine and Mill
	Public Water Supply System ID #CO0210001	Henderson Mine
	Public Water Supply System ID #CO0225116	Henderson Mill
CDPHE, Air Pollution Control Division	AQ Permit No. 95CC899.CP4	Henderson Mine
	AQ Permit No. 02GR0546.CP5	Henderson Mill
United States Department of Transportation (USDOT)	Hazardous Materials Certificate of Registration No. 070218550011AC	Henderson Mill
CDPHE Hazardous Materials and Waste Management Division	EPA Identification Number COD041517343	Henderson Mine
	EPA Identification Number COD000695064	Henderson Mill

Local permits or authorizations that may be required for certain facilities under County land use or building codes (including 1041 permits for Activities of State Interest) are not listed in the table above as they are not specifically applicable to the use, handling, storage, or disposal of designated chemicals and acid mine drainage-forming materials.

5. DESIGNATED CHEMICAL EVALUATION

Designated chemicals are defined in the Rule as toxic or acidic chemicals used within the Reclamation Permit area in extractive metallurgical processing, the use of which, at certain concentrations, represents a potential threat to human health, property or the environment. The designated chemicals discussed in this EPP are exclusive to the extractive metallurgical processing of molybdenite ore to produce MoS_2 and are thus only located at the Mill. The Henderson Mine does not use designated chemicals as a part of mining activities.

The designated chemicals, listed quantities, and use concentrations are presented as the best information available at the time of the submittal of this EPP. These chemicals, quantities, and concentrations may vary based upon production needs and processes. For example, brand name chemicals such as (but not limited to) Syntex, Dowfroth 250-C Frother or Naxolate may be changed out for different brands of similar chemicals based on factors such as effectiveness, cost and availability. Changes in brands and reagent usage are a part of the production process and are not considered to be grounds for notification to the DRMS. However, notification to the DRMS will be made in the event that:

- New types of designated chemicals, not discussed herein, are added to the process;
- The storage location of a designated chemical is changed; or
- The containment facility for a designated chemical must be modified.

5.1. List of Chemicals and Specific Locations

Designated Chemicals Used at the Henderson Mill are included in Table 5-1 below, which provides a summary of the estimated quantity, locations and fate of the designated chemicals used in processing at Henderson. Note that there are no designated chemicals used at the Mine.

Table 5-1: Designated Chemicals[1] Used at the Henderson Mill

NAME	FUNCTION	MAXIMUM QUANTITY	STORAGE LOCATION	APPROX. USE	FATE
#2 Diesel Fuel	Collector and Heating Fuel	32,000 gal	Mill	0.5 lbs/ton	Product and tailings
Collector Oil[2]	Collector	32,000 gal	Mill	0.5 lbs/ton	Product and tailings
Hydrochloric Acid	Lead Leach Circuit	50,000 gal	Mill	0.4 gal/ton	Neutralized
Nokes	Lead, Copper Depression	21,800 gal	Mill	0.2 lbs/ton	Tailings
Dowfroth 250-C Frother	Frother	2,750 gal	Mill	0.01 lbs/ton	Product and tailings
Orfom D8 Depressant	Depressant	5,400 gal	Mill	0.2 lbs/ton	Product and tailings
Pine Oil	Frother	16,121 gal	Mill	0.03 lbs/ton	Product and tailings
Quicklime	Neutralization	31,760 gal	Mill	3 lbs/ton	Tailings
Sodium Hydroxide	Lead Leach Circuit	25,100 gal	Mill	0.5 lbs/ton	Neutralized
Sodium Lauryl Sulfate (Naxolate)	Frother, Soap	26,400 lbs	Mill	0.003 lbs/ton	Product and Tailings
Syntex	Frother, Soap	17,000 gal (Mix Tank) 33,000 gal (Storage Tank)	Mill	0.01 lbs/ton	Product and tailings
Tergitol NP-9/9N9 Surfactant	Surfactant in Lead Leach	9,900 gal	Mill	0.01 lbs/ton	Product and tailings

[1] The designated chemicals, listed quantities, and use concentrations are presented as the best information available at the time of the submittal of this EPP. These chemicals, quantities, and concentrations may vary based upon production needs and processes. For example, brand name chemicals such as (but not limited to) Syntex, Naxolate, Dowfroth 250-C Frother or Orfom D8 Depressant may be changed out for different brands of similar chemicals based on factors such as cost and availability. Changes in brands and reagent usage are a part of the production process and are not considered to be grounds for notification to the DRMS.

[2] Mainly use Vapor Oil (Hydrocal 60), but Diesel #2 may be used as a backup.

5.2. Known Potential to Affect Human Health and the Environment

The following is a brief narrative description of the known potential to affect human health, property or the environment for the designated chemicals at Henderson.

#2 Diesel Fuel is a combustible petroleum distillate commonly used as a heating fuel. At the Mill, it may be used as a collector reagent in the milling process in place of vapor oil. Aside from being combustible, #2 diesel is an aspiration hazard and a skin irritant. In the environment, #2 diesel reacts similar to other petroleum fuels and can cause short-term damage to terrestrial and aquatic ecosystems.

Collector Oil (Vapor Oil - Calumet Hydrocal 60 or equivalent; Diesel #2 may be used as a backup) is a light naphthenic petroleum oil which is used in the mill circuit as a collector/rougher reagent. It is non-hazardous and practically non-toxic through dermal or ingestion pathways. In the environment, this reagent is stable. It should be treated similar to any petroleum product should spills or releases occur.

Hydrochloric acid is used in the mill circuit in the lead leaching process. It is an acidic corrosive that can affect the human body through inhalation, ingestion, and dermal contact. It is corrosive to any tissue with which it contacts. Effects can vary from mild irritations to severe burns (internally or externally) depending upon the type, degree, and length of exposure. Repeated chronic exposure to dilute solutions may cause dermal irritations, whereas similar exposure to vapors or mists may cause erosion of teeth and inflammation of the eyes and mucus membranes of the nose, throat, and lungs.

Hydrochloric acid is acid forming in aquatic and terrestrial environments. It can be neutralized with the application of alkaline materials.

Nokes Reagent is used in the mill circuit to selectively depress sulfides of lead and other metals during the flotation process. It is a highly basic liquid that can affect the human body through inhalation, ingestion and dermal contact. Effects can vary from mild irritations to destructive burns (internally or externally) depending upon the type, degree, and length of exposure. Severe exposures, particularly those resulting from ingestion, can be fatal.

Nokes is incompatible with acids which will cause the release of highly toxic hydrogen sulfide gas, and small spills should be cleaned up with inert absorbents or sand.

Dowfroth 250-C Frother (or equivalent) is utilized in the mill circuit as a flotation frother. It is a non-hazardous mixed polyglycol. Direct contact with this material may cause mild eye and skin irritation. Dowfroth 250-C Frother is a stable product that is completely miscible with water. It is not considered an environmental hazard. It does not contain OSHA regulated (hazardous) components.

Orfom D8 Depressant (or equivalent) is a mineral processing aide that is used in the mill circuit to suppress other metals in the flotation process. This is a corrosive material that causes eye and skin damage. The vapor is combustible and may cause respiratory tract irritation if inhaled. The material can be harmful or fatal if swallowed.

Pine Oil is composed of terpene alcohols and hydrocarbons and is used in the mill circuit as a frother reagent. In humans, it may cause skin and eye irritation and may be harmful if ingested

or inhaled. However, it is neither characteristically hazardous nor listed as hazardous under federal regulations. Pine oil is stable and non-persistent in the environment.

Quicklime is used for neutralization in the mill process water circuit. Henderson receives as stored dry quicklime, also known as dry lime, burnt lime or calcium oxide (CaO). The quicklime is subsequently hydrated or "slaked" to form calcium hydroxide ($Ca(OH)_2$). The slaked lime is then used to neutralize the tailing slurry as it is piped to the TSF. This helps to neutralize the mill process water circuit as a whole as well as allow for the precipitation of some metals within the TSF. Contact can cause irritation to eyes, skin, respiratory system, and gastrointestinal tract. Quicklime reacts violently with water, releasing heat which may ignite combustible materials in certain instances. Contact with eyes can cause severe irritation or burning, including permanent damage.

In the presence of acidic conditions such as acid rock drainage or acid mine drainage, quicklime reacts as an acid neutralizer and buffer. It can be used to raise the pH of acidic waters. Should quicklime be delivered directly into a non-process water or a non-acidic water environment, it would cause short-term impacts to aquatic communities by raising the system pH. Direct long-term impacts would be negligible to non-existent since calcium hydroxide would neutralize in the natural system and does not bio-accumulate.

Sodium hydroxide is used in the mill circuit to neutralize waters in the lead leach process. It is a strong corrosive alkali that can affect the human body through inhalation, ingestion, and dermal contact. Effects can vary from mild irritations to destructive burns (internally or externally) depending upon the type, degree, and length of exposure. Severe exposures, particularly those resulting from ingestion, can be fatal.

In the presence of acidic conditions such as acid rock drainage or acid mine drainage, sodium hydroxide reacts as an acid neutralizer and buffer. It can be used to raise the pH of acidic waters and soils. Should sodium hydroxide be delivered directly into a non-process water or a non-acidic water environment, it would cause short-term impacts to aquatic communities by raising the system pH. Direct long-term impacts would be negligible to non-existent since sodium hydroxide would neutralize in the natural system and does not bio-accumulate.

Sodium Lauryl Sulfate (Naxolate or equivalent) is a solid, flake-form, non-hazardous particulate surfactant used in the Mill circuit as a frother/soap. It is a frothing agent that is mixed with hot water to form Syntex in the mill process. It is non-reactive, slightly flammable, and a slight human health hazard. Eye protection and gloves should be worn when in contact with the product. Decomposition products from burning are carbon monoxide and carbon dioxide. In the environment, Naxolate is stable and non-hazardous.

Syntex (or equivalent) is a non-hazardous particulate surfactant used in the mill circuit as a frother/soap. Syntex is Sodium Lauryl Sulfate mixed with hot water. In humans, it may lead to possible irritation of the gastrointestinal tract if ingested in quantity. It is stable and non-hazardous in the environment.

Tergitol NP-9/9N9 or N95 Surfactant (or equivalent) is a nonylphenol polyethylene glycol ether used as a nonionic surfactant in the lead leach circuit in the Mill. This reagent is stable, and essentially is non-hazardous to humans, but it can cause skin and eye irritation with prolonged

contact. In the environment, NP-9/9N9 or N95 may be toxic to aquatic organisms and has a tendency to bioaccumulate.

5.3. Safety Data Sheets for Designated Chemicals

SDSs for designated chemicals are included in Appendix C. SDSs are maintained at the Mine and Mill and can be accessed by employees should information be required for emergency response procedures.

6. DESIGNATED CHEMICALS AND MATERIALS HANDLING

6.1. Disposal, Decommissioning, Detoxification or Stabilization

6.1.1. Designated Chemicals Handling

Mine: No designated chemical are used in processing at the Mine.

Mill: Designated chemicals used during active mining operations are handled in accordance with procedures that have been developed and implemented as a part of Henderson's over-arching environmental and health and safety management systems. In the unlikely event of a release of a designated chemical from its storage area or area of use, it would be contained by the TSF.

6.1.1.1. Temporary Cessation

Mine: No designated chemicals used in processing at the Mine.

Mill: Under the scenario of Temporary Cessation, those designated chemicals at the Mill site would be used, removed from, or stored at the site. Mixed chemicals such as Syntex (sodium lauryl sulfate and water) would be used in the milling process until depletion of the supplies. The manufacturer would be contacted to assume possession of any unmixed and uncontaminated chemicals, and the material would be transported off-site in the same manner that it was received at the site. As an alternative, the materials, such as (but not limited to) pine oil would be stored on site until operations resumed.

If any unmixed chemicals were contaminated or the manufacturers were to decline possession, then detoxification, stabilization or shipment offsite would be performed in compliance with federal, state, and local regulations using a licensed and experienced professional contractor and transporter to remove the chemicals from the site.

6.1.1.2. Final Closure

Mine: No Designated Chemicals used in processing at the Mine.

Mill: Upon final closure at the conclusion of Mill operations, removal and disposal would be performed in the same manner as for temporary cessation with the exception that no designated chemicals would be stored for future use.

6.1.2. Acid-Forming Materials and Acid Mine Drainage Handling

Mine - The Henderson ore body contains sulfides that, in the presence of oxygen, water and bacteria, have the potential to become an acid-forming material as defined in Rule 1, Section 1.1 (1). In addition, water which accumulates in the mine contacts this sulfide bearing material and, in turn, has the potential to become acidified, thus, meeting the definition of "Acid Mine Drainage" in Rule 1, Section 1.1 (2).

Impacted underground water at the Mine is diverted, conveyed to, and treated at the URAD WTP.

The structures and facilities at the Mine site are constructed on a fill base of barren development rock extracted during construction and development of the underground mine and its associated access and ventilation shafts (see Figure 1). Samples of this material were characterized, and the results were presented to DRMS in TR-04 related documents. The results of those analyses

indicate that the material is non-acid forming. Further, water quality monitoring data collected, including monitoring requirements of the Henderson Groundwater Management Plan (GWMP), comparing metal concentrations above and below the Henderson Mine provide demonstration that, after over 40 years, the fill materials at the Mine is not causing adverse impacts to downstream water quality.

Henderson maintains adequate controls in place to detect acid forming conditions and/or elevated concentrations of key parameters through routine surface and groundwater monitoring (refer to the GWMP, approved as TR-16).

Mill - The tailing delivery line (TDL) gravity transports slurry, a mixture of tailing material and process water consisting of approximately 40 percent solids, to the TSF (see Figure 4). Tailing material deposited into the TSF has the potential to be acid-forming. Adequate controls and protection facilities are in place related to these systems and are discussed in detail in Section 7.2 below.

6.1.2.1. Temporary Cessation

Mine - During temporary cessation, mine water will continue to be conveyed to the URAD WTP for treatment.

Mill - At the Mill site, process waters, including seep water from the TSF, are impounded and recycled. Should Mill operations temporarily cease, tailing seep water would continue to be pumped back to the process circuit and the East Branch Reservoir (EBR). Prior to construction of the Mill WTP there would be no discharge from the TSF during periods of temporary cessation except for potential emergency situations as allowed pursuant to the CDPS permit. After construction of the Mill WTP, impacted water would be treated and discharged under a CDPS permit.

Handling of the acid-forming tailing material during temporary cessation would be the same as under active operations. Seep water would be pumped back to the process circuit, the water pool would be maintained, and wind-blown particulates from the TSF would be controlled through utilization of dust suppressants.

6.1.2.2. Final Closure

Upon final closure and reclamation of the Henderson Mine and Mill, acidic water will be managed as described in Section 9.0 of the approved Reclamation Permit, as amended and revised.

The mine site, portal area, surface conveyor, mill yard, access roads, reservoirs, TSF, associated mill buildings and protection facilities will be closed, stabilized, and/or reclaimed as specified in Section 9.11 of the Reclamation Permit, as amended and revised.

7. ENVIRONMENTAL PROTECTION FACILITIES

An EPF is defined in the Rules as "...a structure...for control or containment of designated chemicals, acid mine drainage, or toxic or acid-forming materials...". EPFs, as defined, are present and operational at both the Mine site and the Mill site and are discussed below.

Routine water quality monitoring to assess the overall effectiveness of many of the EPFs discussed in this section is performed in accordance with the approved GWMP. The GWMP includes narratives and maps to describe site locations, sample designators, sample parameters, sampling frequency, media being sampled, method of sampling and analysis applied, and reporting date, as required per Rule 6.4.21(7)(d).

7.1. Mine Environmental Protection Facilities

EPFs at the Henderson Mine site involve the conveyance of impacted underground mine water, which is treated at the URAD WTP, the stormwater diversion system and a pond approved for high-density sludge (HDS) storage.

The related EPFs (Mine EPF 1.1 - 1.3) are defined and evaluated below. Surface features of these EPFs are shown on Figure 1.

Leaks, spills, or any other accidental or unauthorized releases are immediately addressed and reported as described in the Henderson Mine IRM (Appendix B). In addition, Henderson has contracted with a spill response contractor to provide third party emergency services who is available to assist in the event of an accidental release.

Mine EPF 1.1 – Mine Water & URAD Water Treatment System: Mine water is collected underground and pumped to various settlers for solids removal. A non-toxic flocculant may be added into the settlers to aid precipitation, if necessary. A non-toxic scale inhibitor is added at various sites to keep piping clear.

Mine water is pumped to the surface through the #2 shaft. Once at the surface, the Mine water is pumped to a holding tank which is subsequently conveyed to the URAD WTP via 12" and 14" high density polyethylene (HDPE) pipelines and appurtenances. Solids from the settlers are generally sent to the Mill for processing. Some solids have been stored in mine drifts in the past; however, this material is of similar composition to the native ore and may be mined out in the future.

Water conveyed from the Mine to the URAD WTP is delivered to the Buffer Pond (1 Pond) where it is held until it is pumped into the treatment system. The URAD WTP utilizes a lime based HDS process. This process treats incoming water using lime to raise the pH, followed by oxidation, settling and final pH adjustment. The HDS process recirculates sludge to improve coagulation and settling, and minimize reagent use. As the pH is raised with lime to alkaline conditions, metals are oxidized and precipitated. A flocculant is also added to promote precipitation. The resulting precipitate or sludge is thickened and removed from the HDS effluent using a clarifier. Clarifier overflow, or effluent, undergoes pH neutralization using sulfuric acid and is discharged under CDPS permit #CO-0041467 (see Tables 3-1 and 4-1 above). Solids (or sludge) consisting of the metals removed in the treatment process are piped to sludge

cells immediately east of the WTP. The dry solids are characterized before being transported to an approved solid waste landfill for final disposal.

The URAD WTP utilizes other ponds in addition to the Buffer Pond and Sludge Cells. 2 Pond is utilized as a holding cell for solids that are dredged annually from the Buffer Pond. J Pond is used to capture and hold potentially impacted water which has contacted historic URAD tailing material. Both the 2 Pond and J Pond can also be used for emergency overflow storage.

Effectiveness: Utilizing the monitoring and maintenance routines detailed below, the Mine water settlers, conveyance system and appurtenances have been demonstrated to be effective for the conveyance and treatment of Mine water.

Monitoring: The Mine water system is routinely inspected by Mine personnel to assess effectiveness and integrity. Scheduled preventative maintenance, including pigging (cleaning) of the pipelines, is performed to mitigate the build-up of scale inside the pipelines. Further maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases. Effluent from the URAD WTP is routinely monitored as required by its CDPS discharge permit.

Mine EPF 1.2 – Stormwater Diversion System:

A stormwater diversion system has been constructed on the south side of the Mine office and surface operations to divert un-impacted stormwater around industrial activities to the east end of the property. See Section 10.2 for additional information on stormwater.

Effectiveness: The stormwater diversion system has been effective in preventing the amount of stormwater that can come into contact with disturbed land and potentially toxic or acid forming materials. As a result, the volume, or quantity of potentially impacted stormwater is greatly reduced.

Monitoring: The stormwater diversion system is inspected twice per year in accordance with Henderson's Stormwater Management Plan (SWMP). See Section 10.2 for additional information.

Mine EPF 1.3 – Pond 1.2

Pond 1.2 is a 26 acre-foot, subgrade lined pond located southeast of the Mine entrance gate that was originally designed as a mine water sedimentation pond. The pond was subsequently repurposed and approved in TR-08 (approved 9/7/1999) for the storage of HDS generated at the URAD WTP. The pond has been maintained in an inactive state since that time.

Effectiveness: Pond 1.2 and has been designed and operated with appropriate engineering controls and redundancies as stipulated in the original TR.

Monitoring: Periodic visual inspections are conducted by Mine personnel to assess integrity.

7.2. Mill Environmental Protection Facilities

EPFs at the Henderson Mill site involve three main areas/categories:

- Process Water and Tailing Circuit;
- Designated Chemical Storage Facilities; and
- Stormwater Diversion System.

The EPFs in these areas are defined and evaluated in Sections 7.2.1, 7.2.2 and 7.3, respectively. Figures 3 and 4 identify the locations of the EPFs at the Mill site.

Leaks, spills, or any other accidental or unauthorized releases are immediately addressed and reported as described in the Henderson Mill IRM (Appendix B). In addition, Henderson has contracted with a contractor to provide third party emergency services who is available to assist in the event of an accidental release.

7.2.1. Process Water and Tailing Circuit

Currently, the Henderson Mill employs a zero-discharge process water circuit. There is no active discharge of process waters, although a CDPS permit for Henderson Mill allows for the discharge of process waters if needed. Design of the Mill WTP is in progress and construction is anticipated between 2022 and 2024, depending on climatic conditions and site water balance. The water management system at the Mill includes the following components:

Mill-EPF 1.1 - East Branch Reservoir System: This EPF includes the reservoir, dam, pump station below the dam, and the process water line between the East Branch pump station and the Mill process water tanks. The EBR is the principal storage area for mill process water. Its capacity is 2,000 acre-feet stored behind an earthen dam with a spillway which was constructed in 1970-71 from local cut and fill material and certified by W.W. Wheeler and Associates, Inc. The outlet pipe from the reservoir runs to the pump house located just below the dam. Water from the reservoir is pumped from this station to the Mill process water tanks, and from there to the Mill on an as needed basis.

***Effectiveness*:** The reservoir is located such that any water escaping during a catastrophic failure would drain toward the tailing system storage where it would be contained.

Monitoring: The EBR dam is regulated by the Division of Water Resources (DWR), and all monitoring and maintenance is performed according to requirements by the DWR. The reservoir is routinely inspected by Mill personnel to assess effectiveness and integrity. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 1.2 - Mill Process Water Storage Tanks: This EPF includes two (2) 1.5 million gallon steel tanks that are located east of and upgradient of the Mill buildings. Water from these tanks is gravity fed to the Mill system and 500,000 gallons in each tank is reserved for firefighting purposes.

***Effectiveness*:** The tanks are located such that any water escaping during a catastrophic failure would drain toward the EBR or to the TSF, where it would be contained.

Monitoring: The tanks are routinely inspected by Mill personnel to assess effectiveness and integrity of the EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill-EPF 1.3 – Tailing Delivery System: The TDL conveys tailing slurry, which is a mixture of tailing material and process water consisting of approximately 40 percent solids, via gravity to the TSF. This line is constructed of 42" HDPE pipe on a nominal grade of 1.2% from the mill building to 3-Dam. At the south abutment of 3-Dam, the line transitions to 30" HDPE pipe. Where grades are in excess of 1.2%, concrete drop structures and reinforced concrete pipe (RCP) have been installed. The original RCP between drop towers in this steeper section has been slip-lined with HDPE pipe. The tailing slurry is delivered to the tailing dam via 24" diameter lead-off pipes used predominantly during winter months, and via a higher quantity of smaller, 8" diameter spigots during the summer months.

Where the TDL daylights outside the Mill building there is a diversion box which can route the tailings through an Emergency Cutout (ECO) line. This is a RCP which parallels the upper portion of the TDL, passes underneath County Road 3 and discharges tailings into the southernmost area of the TSF. The ECO is utilized during periods of TDL pipeline and drop structure inspections and during emergency conditions. Emergency Cutout No. 1 is the primary location where tailing slurry is diverted from the TDL when there is an upset condition within the delivery or distribution system. This cutout is also used during regular mill shutdowns as the discharge point for process water that continues to flow through the TDL when the mill is not in operation.

Bear Paw pipeline routes process water from the wet scrubbers for dust control and the mill site surface drainage to the TSF. The Bear Paw pipeline discharges in the same approximate location as the No. 1 cutout.

An engineered drainage channel runs along the alignment of the ECO and TDL and is a part of this EPF. This channel serves as secondary containment to convey slurry and process solution leaks from the pipeline and valves under the county road to the TSF.

Effectiveness: Process water and slurry is contained within the enclosed Mill building during processing. Any spills within the Mill building will be transported via floor launders, sumps and pumps to either the thickener or the TDL. Slurry or process water escaping from the TDL or ECO would drain towards the TSF, where it would be fully contained.

Monitoring: The tailing delivery system is routinely inspected by Mill personnel to assess effectiveness and integrity. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed, to be protective of the environment and to prevent releases.

Mill EPF 1.4 - Tailing Storage Facility: The TSF, dams (1-Dam and 3-Dam), barge pump, and barge return pipeline are located in the Ute Creek drainage basin, north-northwest of the Mill site. The TSF contains tailings, process water and seepage water returned from the seepage collection system. This impoundment and its final configuration of approximately 1,500 acres is described in Section 9 of the Reclamation Permit, as modified.

Tailing slurry is deposited across 1-Dam and 3-Dam by multiple spigots in the spring and summer months, transitioning to lead-off deposition during the winter months. Process water is reclaimed from the TSF for reuse in the Mill through a barge pump system, which conveys decant water from the TSF to the EBR.

Effectiveness: As discussed in TR-14, the TSF has been designed, engineered, and constructed to contain the flow from a probable maximum storm event without compromising dam stability. TR-14 also addresses operational plans which are now in place to manage post storm event operations including maintaining at least 3,582 acre-feet of storage. Under emergency situations, where the stability of the dam may be threatened, stormwater can be pumped from the TSF to the EBR and diverted to the Williams Fork River via the Upper Bypass line.

The TSF has been designed, and is being operated, with effective engineering controls and redundancies, including seep water collection and return, a groundwater interceptor system, and regular internal and external monitoring and inspections.

Monitoring: Routine monitoring associated with the TSF includes the following:

- Inspections are performed on a daily, monthly, and annual basis by Henderson Tailing personnel and include visual observations of the tailing dam and impoundment, benches, starter dams, 3-Dam step-back, access roads, and diversion ditches for the appearance of structural weakness and other hazardous conditions.
- Weekly piezometer monitoring and data assessment.
- Completion of a detailed monthly inspection of the TSF and the Seep Water Collection and Return System.
- Annual inspection by a qualified registered professional engineer or other qualified professional specialist under the direction of a professional engineer.

Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases. Additionally, the Henderson Annual Reclamation Permit Report to DRMS includes both a flood storage evaluation report, documenting that a minimum of 3,582 acre-feet of flood capacity is maintained throughout the year, and an annual TSF evaluation report, which summarizes the results of operation, maintenance, and inspection activities for the previous year.

Mill-EPF 1.5 – Seep Water Collection and Return System: Seepage water from the base of 1-Dam and 3-Dam is collected and returned to the process water circuit. The TSF contains a series of abutment, foundation and horizontal drains that manage the phreatic level in the tailing embankment and maintain dam stability. Subterranean seepage at 3-Dam is captured using a wick-drain system. The seepage collection system conveys seep water from the base of 1-Dam and 3-Dam to the Ute Park pump station via the seep water collection canals, where it is returned to the TSF and back into the process water circuit. When needed, sediment is excavated from the seep water collection canals and placed within the seepage collection boundary, drained and moved to the dam face.

Effectiveness: This EPF is one of several engineering controls and redundancies to prevent releases of acidic waters and has been effectively operated (as amended and improved) since

the beginning of Mill operations in 1976. As described in TR-30, the seep water road, which provides the initial capture barrier at 1-Dam, was raised to increase the storage capacity to approximately 78 acre-feet. This allows for the 1-Dam seep water collection system to contain a 100-year snowmelt event under life of mine conditions.

Monitoring: Routine monitoring associated with the Seep Water Collection and Return System includes the following:

- Routine inspections are performed on a daily, monthly, and annual basis by Henderson Tailing personnel and include visual observations of the 3-Dam Seepage Collection System, 1-Dam Seepage Collection System, Underdrain System, Emergency Seep Water Pump System, Decant Barge, and Pipeline.
- Completion of a detailed monthly inspection of the TSF and the Seep Water Collection and Return Systems.
- Annual leakdown, or static pressure test is performed on the pipeline that conveys seep water from 3-Dam to the Ute Park pump station.

Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases. The results of the annual leakdown test are submitted with Henderson's Annual Reclamation Permit Report.

Mill EPF 1.6 – Groundwater Extraction System: Henderson operates a series of five extraction wells along the north seep water collection canal to prevent potential process water influences on groundwater quality; the wells are labelled MLEX-1 through MLEX-5, from northwest to southeast. Based on previous characterization studies, the alluvial and glacial drift deposits were reported to be the primary water-bearing unit underlying and downgradient of the TSF. Seepage from the 1-Dam tailing facility that is not captured in the seepage collection canals reports to the underlying alluvium. The MLEX extraction wells are installed parallel to the toe of 1-Dam in the alluvial and glacial drift deposits and range in depth from 76 to 95 feet. Flows from wells MLEX-1 through MLEX-4 are combined into a single underground header that discharges to the 1-Dam seepage collection area. The discharge from MLEX-5 is piped separately into the Ute Park pump station inlet channel. All water pumped from the extraction system is pumped back to the tailing pond for reuse in the milling circuit.

***Effectiveness*:** This EPF is one of several engineering controls and redundancies to prevent releases of acidic waters. All the MLEX well pumps are submersible VFD electric pumps and can be controlled either to maintain a certain water level in the well or a specific pumping rate, ensuring capture performance under a variety of conditions.

Monitoring: Flow rates and volumes are continuously measured and recorded with the use of electronic recording devices. Monitoring of ground and surface water quality downstream of the Groundwater Intercept System is conducted on a routine basis as part of the GWMP (see Sections 8-11 below).

Mill EPF 1.7 – Ute Park Pump Station: The Ute Park pump station is an important component in the process water management. Collected seepage is pumped back from the Ute Park pump station to the water pool on the TSF by turbine pumps with a total capacity of 5,000 gpm. A

total of approximately 134 acre-feet of storage capacity exists in the areas which feed the Ute Park pump station (as discussed in EPF 1.5). This is comprised of 78 acre-feet in the 1-Dam Primary Seepage Detention area and 56 acre-feet in the 3-Dam Primary Seepage Detention area. The storage capacity of these combined areas based on a conservative maximum rate of 3,000 gpm (during the wet spring runoff period) and a nominal seepage rate of 1,000 gpm would provide between approximately 10-30 days of storage; sufficient time to place backup pumps into operation.

Effectiveness: If the pump and alarm systems lose power, there is a solar and battery powered fail-safe system that closes the seep water feed channels to the pump house. An emergency diesel pump is located in the seepage detention area which is capable of pumping seepage water directly from the 1-Dam detention area back into the TSF.

Monitoring: The Ute Park pumping system includes numerous instruments and control equipment, including a programmable logic controller, display screen for instrumentation monitoring and control, and radio telemetry system that includes provisions for, among other things, pump rates, high level alarms and pump power failures. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 1.8 – Mill Water Treatment Plant: The Mill facility has operated as a zero-discharge facility since the beginning of operations in 1976, however, under forecasted operating and climate conditions, a water scenario is possible which results in surplus water that must be stored in the TSF or EBR. The new Mill WTP will provide treatment of excess process water to provide operational flexibility and allow appropriate management of stored water volumes under a variety of conditions.

The treatment process to be used at the WTP will consist of a lime-based single-stage HDS process capable of treating surplus water at a design flow rate of 600 GPM (0.86 MGD) year-round. The HDS process recirculates sludge to improve coagulation and settling, and minimize reagent use. As the pH is raised to alkaline conditions, metals are oxidized and precipitated. A flocculant is added to promote precipitation. The resulting precipitate or sludge is thickened and removed from the HDS effluent using a clarifier. Ultimately, waste sludge will be pumped to the TSF for disposal using existing pipelines. Clarifier overflow, or effluent, will be filtered and undergo pH neutralization using carbon dioxide. This treated water will be conveyed through an existing pipeline that runs between the Mill complex and the Williams Fork Pump Station. Treated water will be discharged through the existing Williams Fork Pump Station outlet structure to the Williams Fork River.

The WTP will consist of a metal building with concrete floor and foundation to house the process area tanks, piping, pumps, control equipment, and chemical storage, as well as a control room, lab, break room, restrooms, electrical, maintenance, and mechanical rooms. The plant will be constructed with a sealed concrete floor sloped to a central trench drain system that flows to sumps for collection of spills and water from floor cleaning in the process area such that all spills will be collected within this system and recycled to the HDS reactor tanks.

***Effectiveness*:** As stated in Sections 2.2 and 15.2, the Mill WTP is currently in the design stage, with construction anticipated to commence between 2022 and 2024. The treated effluent will

be regulated under CDPS Permit # CO-0000230. A renewal application for this permit has been submitted to the WQCD with modifications to include the WTP discharge.

Monitoring: Monitoring will be performed to meet the requirements of the CDPS permit.

7.2.2. Designated Chemical Storage Facilities

EPFs for designated chemicals at the Henderson Mill site include enclosed buildings, trailers, tanks, bins and berms, individually or in combination. The ultimate emergency EPF for all designated chemicals is the TSF/seep water collection and containment system discussed in Section 7.2.1. As stated previously, the Mill site and its ancillary facilities are located within the Ute Creek drainage. Therefore, accidental release of a designated chemical or process water at the Mill which is not captured by primary, secondary, and (in some cases) tertiary containment at the release site ultimately would be contained in the TSF. The specific EPFs for designated chemicals at the Mill are discussed below.

Mill EPF 2.1 – Sodium Hydroxide Storage: Located directly adjacent and north of the Mill building, this facility was used to make liquid Nokes reagent prior to 2019. As Nokes is no longer mixed onsite, the Nokes mixing tank has been cleaned and emptied. However, liquid sodium hydroxide continues to be stored in two 12,300 gallon tanks located in this building as well as a 500 gallon head tank inside the Mill building.

Effectiveness: The tank room within the storage building is designed with floors sloping toward a sump and secondary containment with the capacity to contain 110 percent of a release from one tank. Spilled sodium hydroxide would be pumped from the sump directly to the concentrate thickener.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC by Mill personnel to assess effectiveness and integrity of each EPF system. The tanks are equipped with sonic level detectors and local alarms that warn of high tank levels. The Nokes building sump also contains a high-level alarm to provide warning in the event of a large release.

Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.2 - Hydrochloric Acid Storage: Hydrochloric acid is stored in one 50,000 gallon tank located in the acid storage yard outside and just north of the Mill building. Although there are two tanks at this location, one has been decommissioned. Hydrochloric acid is introduced into the lead-leach circuit within the Mill building.

Effectiveness: The area is fenced, and the tanks are surrounded by an earthen berm that has a containment capacity of 100,000 gallons. The containment is lined with a limestone bedding material that acts to absorb and neutralize spills. A collection sump captures any free liquid that might be spilled.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.3.a – Frother Chemical Storage – Dowfroth 250-C Frother (or substantially similar chemical), a frothing agent used in the flotation process, is stored in 250 gallon totes in the Mill building with a maximum storage of approximately 2,750 gallons.

Effectiveness: Releases of this chemical would be contained directly by the Mill sump system. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.3.b – Depressant Chemical Storage - Orfom D8 Depressant, a suppressant used in the flotation process, is stored in 275 gallon totes in the Mill building with a maximum storage of approximately 5,400 gallons.

Effectiveness: Releases of this chemical would be contained directly by the Mill sump system. The Mill sump also contains a high level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases

Mill EPF 2.4 - Pine Oil Storage: Pine oil, used in the flotation process, is stored in a 16,121 gallon steel tank located and contained in the oil room inside the Mill building.

Effectiveness: Releases in the oil room are contained by a concrete-walled secondary containment that is sloped to a system that channels the material to the mill sump system for either return to the mill circuit, or for routing to the TDL. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.5 - Collector Oil Storage: Collector oil is a product used in the flotation process within the Mill. Vapor oil (also known as Hydrocal 60 or Calumet) is generally used for this product, but Diesel #2 may be used as a backup. Vapor oil is stored in a 32,000 gallon steel tank contained within the oil room inside the Mill building. Diesel #2 is also stored in a 32,000 gallon steel tank in the oil room located within the Mill building.

Effectiveness: Releases in the oil room are contained by a concrete-walled secondary containment that is sloped to a system that channels the material to the Mill sump system for either return to the Mill circuit, or for routing to the TDL. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.6 – Syntex Storage: Syntex is a frothing agent used in the Mill process. Syntex is a mixture of sodium lauryl sulfate (current product is called Naxolate) and hot water. It is mixed in a 17,000 gallon tank behind the regrind mills, then transferred to a 33,000 gallon storage tank.

Effectiveness: Releases of this chemical would be contained directly by the Mill sump system. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.7 - Sodium Lauryl Sulfate Storage: Sodium Lauryl Sulfate (current product is called Naxolate) is a precursor to the frothing agent Syntex that is mixed with hot water in the Mill process. It is stored inside the Mill building in 220 pound drums. Maximum storage quantity at the Henderson Mill is 120 drums (26,400 pounds).

Effectiveness: Releases of this chemical would be contained directly by the Mill sump system. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.8 - Tergitol NP-9/9N9 Surfactant Storage: NP-9/9N9 is a surfactant used in the leach circuit in the mill process to prevent "lumping" of concentrate. It is stored as a liquid in a storage tank with a capacity of 9,400 gallons. Prior to its addition into the Mill circuit, NP-9/9N9 is pumped to a gravity feed tank with a 500 gallon capacity.

Effectiveness: Releases of this chemical would be contained directly by the Mill sump system. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.9 - Quicklime Storage: Quicklime (dry lime, burnt lime or calcium oxide (CaO)) is used for neutralization in the mill circuit. Henderson receives and stores the solid quicklime in a storage tank with a capacity of 31,760 gallons. The quicklime is subsequently hydrated or "slaked" to form calcium hydroxide ($Ca(OH)_{2)}$ and dosed into the tailing slurry. The slaker building is constructed with a 2 foot high foundation wall and drains that will direct any overflow to the tailing discharge line.

Effectiveness: Releases of this chemical would be directed to the tailing delivery line.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

Mill EPF 2.10 - Nokes Storage: Nokes is used in the mill circuit to selectively depress sulfides of lead and other metals during the flotation process. Pre-mixed liquid Nokes reagent is stored in a 21,800 gallon tank within the Mill building.

Effectiveness: Releases of this chemical would be contained directly by the Mill sump system. The Mill sump also contains a high-level alarm to provide warning in the event of a large release.

Monitoring: Chemical storage containers are routinely inspected in accordance with the SPCC Plan by Mill personnel to assess effectiveness and integrity of each EPF system. Maintenance and/or updates to facilities, systems, equipment, or procedures are performed as needed to be protective of the environment and to prevent releases.

7.3. Stormwater Diversion System

Mill EPF 3.1 – Stormwater Diversion System: The following stormwater diversion systems intercept clean water and divert it around the Mill facilities:

- The Ultimate Canal on the west and north ends of the TSF diverts un-impacted stormwater around the north end of the property to the Williams Fork River; and
- The Upper Bypass Pipeline on the southwest portion of the Mill property diverts water through an underground diversion pipe to the Williams Fork River.

See Section 10.2 and the Henderson SWMP for additional information on stormwater diversion systems.

Effectiveness: The stormwater diversion canals and pipelines have been effective in preventing the amount of stormwater that can come into contact with disturbed land, designated chemicals and toxic or acid forming materials. As a result, the potential pollution of stormwater is greatly reduced.

Monitoring: The stormwater system is inspected twice per year in accordance with Henderson's SWMP (see Section 10.2 for additional information).

8. GROUNDWATER

Groundwater at hard rock mine sites is regulated through the DRMS under authority of Senate Bill 89-181. Henderson has prepared and submitted a GWMP, Technical Revision 16 (TR-16) to the DRMS which outlines practices and procedures to protect groundwater quality pursuant to Rule 3.1.7. The GWMP establishes permit conditions, including numeric protection levels (NPLs) for groundwater and is an important component of this EPP.

The following section provide a general summary of the water bodies, site geology and site hydrogeology in and around the mine and mill sites as it relates to groundwater. More detailed information and related references have been developed and submitted as a part of Henderson's Reclamation Permit, as revised and amended, including the GWMP.

8.1. Water Maps

Figures 1 and 2 depict major surface water bodies within the vicinity of the Mine and Mill.

8.2. Site Geology

8.2.1. Mine

Bedrock in the vicinity of the Henderson Mine surface facilities is shallow, generally less than 30 feet, and is composed primarily of Precambrian Silver Plume Granite and Tertiary-age stock and dike granitic intrusions. Bedrock in the vicinity of the Henderson Mine property is, in places, hydrothermally altered and mineralized, and therefore, has the potential to naturally generate acidic conditions when contacted by meteoric water. Shallow colluvial and glacial deposits consisting of poorly sorted and unconsolidated sand, gravel, and cobbles, overlie the bedrock surface in drainage areas, such as near the West Fork of Clear Creek. Colluvial sediments east of the mine facilities is approximately 20 to 25 feet thick and consists of boulders, cobbles, gravels and sands with varying amounts of clay. Granite bedrock underlies the sediments (Ajax/Clear Creek Associates, 2013).

8.2.2. Mill

The Henderson Mill and TSF are located in the Ute Creek Basin of the Williams Fork River drainage basin. The Ute Creek Basin is bounded on the west by the Vasquez Mountain Range and bounded on the north, south and east by northwest trending Williams Fork Mountains. The Ute Creek Basin basement rocks consist of weathered and unweathered Precambrian gneiss and schist of the Idaho Springs Formation and Silver Plume Granite. In some areas of the basin, the Miocene-aged Troublesome Formation consists mostly of unconsolidated and semi-consolidated lensed clays, silts, sands, gravels and volcanic ash grading to consolidated siltstone, sandstone, conglomerate and claystone derived from the weathering of the Williams Fork Mountain Range. Pleistocene-aged glacial end-moraines, lake sediments and outwash material encroach on the Ute Creek Basin and overlie the Troublesome Formation. End-moraines are a conglomeration of boulders, cobbles, gravels, sands, silts and clays. Glacial lake sediments cover low flat sections while glacial outwash was deposited in braided stream beds. Glacial outwash consists of gravels, cobbles and sands. The Troublesome Formation is generally blanketed by a 2 to 10-foot thick layer of recent slopewash and residual soils. Alluvial material generally lies within the present stream valleys.

The Henderson Mill and adjacent facilities are constructed on the Idaho Springs Formation and Silver Plume Granite. The TSF is located on the western slope of the Williams Fork River Valley and is constructed primarily on the Troublesome Formation although some areas overlay glacial and alluvial deposits.

8.3. Site Hydrogeology

8.3.1. Mine

Groundwater in the vicinity of the Henderson Mine surface facilities occurs within colluvial deposits near and adjacent to the West Fork of Clear Creek. Groundwater flow is generally from west to east from the upper end of the drainage to the lower end. Upgradient of the confluence with Woods Creek, the colluvium pinches out and groundwater is forced to surface into the West Fork of Clear Creek (Climax Molybdenum Company, 2012). The Precambrian Silver Plume Granite is generally impermeable and non-water bearing (Ajax/Clear Creek Associates, 2013).

8.3.2. Mill

Three primary hydrostratigraphic units have been identified at the Henderson Mill site: 1) unconsolidated glacial and alluvial deposits, 2) the Troublesome Formation, and 3) the Idaho Springs Formation and Silver Plume Granite. The following sections summarize the hydraulic characteristics of each hydrostratigraphic unit. Within and downgradient of the TSF, groundwater primarily occurs within the glacial and alluvial deposits, while little groundwater flow is present in the Troublesome Formation, Idaho Springs Formation and Silver Plume Granite. The primary groundwater flow path is generally from southwest and towards the Williams Fork River to the northeast.

Glacial and Alluvial Materials

Field data from test pits and borings advanced prior to and after tailing deposition (Woodward-Clyde, 1983, Hydrokenetics, 1993) show that the groundwater levels within the glacial and alluvial materials are hydraulically connected. Since both the glacial and alluvial materials consist of gravels, sands and clay deposits, and are hydraulically connected, these materials are considered a single hydrostratigraphic unit.

The groundwater levels measured within the glacial and alluvial materials vary considerably across the site. When correlated to geologic data, it is evident that the variability of the groundwater levels can be attributed to multiple perched water zones present within pervious layers which overlay impervious layers. Therefore, the groundwater levels and hydraulic properties of this hydrostratigraphic unit are expected to be highly variable.

Troublesome Formation

The Troublesome Formation has been documented to contain discontinuous sands, gravels, lensed clays, and silts underlain by semi-consolidated siltstones, sandstones, conglomerates and claystones. Data from test pits and borings within the Troublesome indicate that the presence of groundwater within this unit is highly variable. A site study conducted by Woodward-Clyde (1983) concluded that this formation is not considered to be a continuous aquifer because of the limited extent of the sand layers in the formation which would preclude significant groundwater flow.

Idaho Springs Formation and Silver Plume Granite

The weathered and unweathered Precambrian Idaho Springs Formation and Silver Plume Granite are considered to be relatively impermeable compared to the overlying glacial, alluvial and Troublesome Formation deposits. The low permeability nature of the Idaho Springs Formation and the Silver Plume Granite have been documented through packer and geophysical testing in the Precambrian bedrock. These data indicate that the Precambrian bedrock is not capable of transmitting significant quantities of groundwater as compared to the overlying glacial and alluvial deposits and show a defined decrease in hydraulic conductivity with depth.

9. GROUNDWATER QUALITY DATA

9.1. Local Groundwater Uses

Mine: As discussed above, groundwater at the Mine is limited to a thin lens of alluvium that is bounded on all sides by low permeability, Precambrian Silver Plume Granite. Therefore, the current and future groundwater use at the site is limited to recharge of the West Fork of Clear Creek. The site hydrogeologic conditions cannot support development of groundwater resources for any other beneficial use.

Mill: Current and future groundwater use at the Henderson Mill is limited. Groundwater within the Henderson Mill property boundary occurs primarily in the areas downstream of the TSF. Within these areas, current and future domestic and agricultural development of groundwater would not be likely, given the remote site location and harsh climate conditions. The primary use of groundwater at the Mill site is recharge to the Williams Fork River.

9.2. Groundwater Monitoring

Groundwater monitoring is conducted on a regular basis in accordance with the GWMP. Groundwater collection and analyses procedures at the Mine and Mill sites are described in the GWMP, including sampling parameters, monitoring locations, sampling and analytical procedures, detection limits, and frequency.

9.3. Groundwater Quality Data

A large database of groundwater quality data exists in the record and is on file as part of the Reclamation Permit. As discussed in this document and at more length in the GWMP, due to Henderson's geology, groundwater is forced to the surface in close proximity to Henderson operations. Surface water quality data upstream and downstream of potentially impacted groundwater indicates that Mine and Mill operations are not adversely impacting surface water quality downstream of the sites.

The GWMP describes surface and groundwater monitoring and reporting of water quality data to the DRMS. The ongoing collection of this data provides a basis for the evaluation of reclamation performance standards and the adequacy of EPF design, maintenance and operation.

10. SURFACE WATER CONTROL AND CONTAINMENT FACILITIES

10.1. Surface Water Control

As discussed earlier related to Mill EPF 3.1 and Mine EPF 1.2, a key strategy utilized by Henderson to prevent potential stormwater pollution is to minimize the amount of stormwater that can come into contact with disturbed land and other industrial activities. The Mine and Mill have installed the following diversion systems:

- The Ultimate Canal has been constructed around the west and north ends of the TSF and routes un-impacted stormwater around the north end of the property to the Williams Fork River;
- The Upper Bypass Pipeline has been constructed to divert stormwater from drainages southwest of the Mill property through an underground diversion pipe to the Williams Fork River; and
- Diversion ditches have been constructed on the south side of the Mine office and surface operations to divert water around industrial activities to the east end of the property.

Design specifications and final certification for EPFs associated with surface water conveyance, capture and storage are submitted to the DRMS each time a modification to the Reclamation Permit is proposed, as required.

10.2. Stormwater Management Plan

The Henderson Mine and Mill SWMPs have been prepared for the purpose of identifying potential sources of pollution reasonably expected to affect the quality of stormwater discharges associated with operation of the Henderson Mine and Mill sites, including the conveyor that connects the sites. The plans describe and provide guidelines for the implementation of both general best management practices (BMPs) and site-specific or activity specific BMPs. These BMPs are designed to minimize the likelihood of pollutants being carried off-site through stormwater discharges.

The SWMPs also provide information regarding the management of stormwater that falls within the boundaries of the Mill process water and tailing circuit and the URAD WTP. This stormwater comingles with process waters that are either managed on-site or treated and discharged under the provisions of CDPS Permit No. CO-0041467 and CO-0000230.

The stormwater boundaries, BMPs, and outfall locations discussed in the SWMP are based on surface discharges resulting from stormwater.

The SWMPs were developed to achieve the following objectives and goals:

1. Provide a simple format for inspection, control, prevention, and mitigation of potential pollution sources that may affect the quality of stormwater discharge.
2. Provide a simple format for educating and training site personnel in methods and practices for stormwater management and pollution prevention.
3. Provide assurance that the provisions of CDPS General Permit for Stormwater Discharges Associated with Metal Mining Operations and ancillary activities are met.

Two formal site inspections (one in the spring and one in the fall) are performed and documented to satisfy annual reporting requirements. These inspections are conducted by site personnel and include a review of:

- All disturbed areas;
- Areas used for material storage or handling that are exposed to precipitation; and
- Other areas with potential sources of pollution.

The inspections:

- Look for evidence of, or the potential for, pollutants entering the drainage system; and
- Review the adequacy and upkeep of stormwater management measures, sediment and erosion control measures, and other BMPs identified in the SWMP.

Spill response equipment is regularly inspected and maintained as a part of the Mine and Mill SPCC Plans.

Conditions not conforming to the SWMP are proactively managed and corrected. If a revision of the SWMP is required, such revisions are made and implemented promptly. A copy of the current SWMPs can be provided upon request.

11. SURFACE WATER QUALITY DATA

11.1. Local Water Uses and Standards

Mine: Adjacent to the Henderson Mine, Segment 4 of Clear Creek (COSPCL04) runs from the source of the West Fork of Clear Creek to the confluence with Woods Creek and is classified as Agriculture, Aquatic Life (cold) Class 1, Recreation E, and Water Supply. Downstream of the Henderson Mine, Segment 5 of Clear Creek (COSPCL05) runs from the confluence with Woods Creek to the confluence with Clear Creek and is classified as Agriculture, Aquatic Life (cold) Class 1, Recreation E and Water Supply.

URAD WTP: Adjacent to the URAD WTP, Segment 7a of Clear Creek (COSPCL07A), which is the mainstem of Woods Creek from the outlet of Upper URAD Reservoir to the confluence with the West Fork of Clear Creek is classified as Aquatic Life (cold) Class 2 and Recreation N. Located just below the URAD WTP is Lower URAD Reservoir which is Segment 7b of Clear Creek (COSPCL07B) and is also classified as Aquatic Life (cold) Class 2 and Recreation N.

Mill: Adjacent to the Henderson Mill, the Williams Fork River, from the source to the confluence with the Colorado River, is Segment 8 of the Upper Colorado River basin. This segment is classified as Aquatic Life (cold) Class 1, Recreation E, Water Supply, and Agriculture.

11.2. Surface Water Monitoring

Surface water monitoring is conducted on a regular basis in accordance with the GWMP. Surface water collection and analyses procedures at the Mine and Mill sites are described in the GWMP, including sampling parameters, monitoring locations, sampling and analytical procedures, detection limits, and frequency.

11.3. Surface Water Quality Data

A large database of surface water quality data exists in the public record and on file as part of the Reclamation Permit. Surface water quality data upstream and downstream indicates that Mine and Mill operations are not adversely impacting water quality downstream of the sites.

The GWMP describes surface and groundwater monitoring, including upstream and downstream of the mine and mill sites, and reporting of water quality data to the DRMS. The ongoing collection of this data provides a basis for the evaluation of reclamation performance standards and the adequacy of EPF design, maintenance and operation.

12. WATER QUALITY MONITORING PLAN

The Henderson Mine and Mill surface water and groundwater sampling locations that are currently monitored under the Reclamation Permit are summarized in the GWMP.

The water treatment and discharge systems are permitted under CDPS Permit CO-0041467 for the Mine and Permit CO-0000230 for the Mill. Detailed information regarding the types of monitoring, parameters, frequency, reporting requirements, methods and analyses are found in these permits.

These monitoring programs help to ensure that EPFs designed to protect water quality are functioning as designed and that Henderson continues to comply with applicable surface and groundwater standards and Reclamation Permit conditions.

13. CLIMATE

Information regarding climate was developed during the planning and early construction phases of the Henderson Project. This data is found in Section 3.1 of the Reclamation Permit. A more detailed description of baseline climatic data in the vicinity of the Mine and Mill, based on records from stations located near these facilities, is described below.

The climate in the Henderson Mine and Mill area includes long, snowy, cold winters and short, cool summers. Snow is possible throughout the year, with the heaviest snowfall occurring between the months of November and April.

Recent climatic data for the vicinity of the Mine, Mill and URAD WTP were obtained from meteorological monitoring stations located onsite. Appendix D provides a summary of the data and includes:

- Precipitation data for the Mine for the most recent five-year period and monthly precipitation for the wettest year on record (2017);
- Precipitation data for the Mill for the most recent five-year period and monthly precipitation for the wettest year on record (1936). Note that the 1936 data was collected at the Williams Fork Dam WRCC meteorological station (#059096);
- Temperature data for the Mine, Mill and URAD including the monthly mean, maximum and minimum for the most recent five-year period; and
- Wind data for the Mine, Mill and URAD including annual and monthly average wind speed and direction. Generally, winds exhibit typical mountain flow patterns, and vary significantly from location to location because of the rugged topography.

14. GEOCHEMICAL DATA AND ANALYSIS

14.1. Evaluation of Ore and Tailing Storage Facility

The Henderson ore body contains unoxidized sulfides that, in the presence of oxygen, water and bacteria, have the potential to become an acid-forming material as defined in Rule 1, Section 1.1 (1). Henderson concurred with this fact when it accepted the DRMS determination that the Henderson Mine was a DMO under the amended rules. Thus, based upon discussions with DRMS personnel, development of specific geochemical data are not necessary for mill tailing material.

14.2. Evaluation of Development Rock Properties

Water quality monitoring data collected and on file with the DRMS comparing metal concentrations above and below the Henderson Mine demonstrates that, after 40 years, the fill materials at the Mine is not causing adverse impacts to downstream water quality. Henderson maintains adequate controls in place to detect acid forming conditions and/or elevated concentrations of key parameters through routine surface and groundwater monitoring (see Sections 8-11).

Furthermore, related to the development of the GWMP (TR-16), Henderson performed a geochemical evaluation of the Mine site fill materials in June, 2010 in order to identify key parameters that have a reasonable potential of being transported from mining materials to surface and groundwater systems and incorporating these parameters in the scope of ongoing surface and groundwater monitoring.

The upper portion of the old railroad haulage route at the Mill, running from the portal for approximately the first 2 miles, is constructed of rock excavated during construction of the haulage tunnel. This material was tested for the potential to be acid producing. Acid-base accounting analyses were used to test six (6) grab samples collected from this stretch of railroad in June of 1995, and are presented in Appendix E. The data indicate that this fill material is non-acid producing.

15. CONSTRUCTION SCHEDULE INFORMATION

15.1 Existing EPFs

Construction schedules are determined whenever an EPF is changed or updated (see Appendix A List of DRMS Permit Amendments and Technical Revisions). Henderson will continue to follow this method of updating and modifying EPFs when observations, changing operational requirements or environmental conditions warrant.

15.2 New EPFs

Mill WTP

As discussed in Section Sections 2.2, 7.2.1 and 15.2, the final design of the Mill WTP is underway and is expected to be completed in 2021. Construction timing will be dependent on water balance and operational needs, with start date anticipated in 2022 or 2023, and operations beginning between 2022-2024.

16. QA/QC PROGRAM

The QA/QC program, and measures to be employed during construction of EPFs, are determined whenever an EPF is changed or updated (see Appendix A List of DRMS Permit Amendments and Technical Revisions). This targets the QA/QC program to be specific to the facility in question, ensuring QA/QC efficacy. Henderson will continue to follow this method of updating and modifying EPFs when observations, changing operational requirements or environmental conditions warrant.

17. PLANT GROWTH MEDIA AND REVEGETATION

The Henderson Mine and Mill site closure and reclamation plan are detailed in Section 9.0 of the Reclamation Permit. The Reclamation Permit has been modified as site conditions warrant and reclamation technology advances. Generally, revegetation plays an important role in this approved plan. While topsoil material (growth media) is not widely available to cover the Mine site, it will be available to cover the TSF at the Mill site. Detailed soils information and maps are found in Section 6.2 of the Reclamation Permit as modified.

In addition, significant research relative to soils and revegetation has been conducted at Henderson since the mid-1970s (Section 8.0 of the Reclamation Permit). Much of this research, including soil/vegetation test plots, is revisited periodically to determine long-term trends.

Recommendations on soil and revegetation material from the local Natural Resources Conservation Service (NRCS) have been taken in to account as modifications to the Reclamation Permit were compiled and reviewed.

18. WILDLIFE PROTECTION

Since the initial planning process for the Henderson Project in the late 1960s, wildlife resources have been recognized by Henderson. Colorado Division of Wildlife (CDOW), now Colorado Parks and Wildlife (CPW), personnel were involved in all early planning stages, and this relationship has continued.

Information and data developed during planning is included in Section 6.3 of the Reclamation Permit. Comments and input into this Reclamation Permit application were solicited from the CDOW by Henderson prior to the initial filing. Although wildlife issues at Henderson have never been significant, Henderson has maintained excellent communications throughout the years with both Regional Office personnel and the local District Wildlife Managers.

In addition, AM-03 to the Reclamation Permit includes plans for wetland mitigation and forest management strategies that Henderson is continuing to pursue. These practices will improve habitat on Mine and Mill property, and have a positive influence on area wildlife.

19. DISPOSAL OF TAILING AND SLUDGES IN MINE WORKINGS

Tailings are not disposed of in mine workings. Water treatment sludge from the URAD WTP is hauled off site for disposal. Sediments collected at the Mine water settlers underground are hauled or pumped to the conveyor and transferred to the Mill with other ore where it is processed for molybdenum recovery. In past years, some of these sediments have intermittently been stored in underground drifts. These sediments will either be processed as the drifts are mined out in the future or will remain in place. Since the sediments are of the same mineral composition as the ore body, no discrete impacts or management is anticipated.

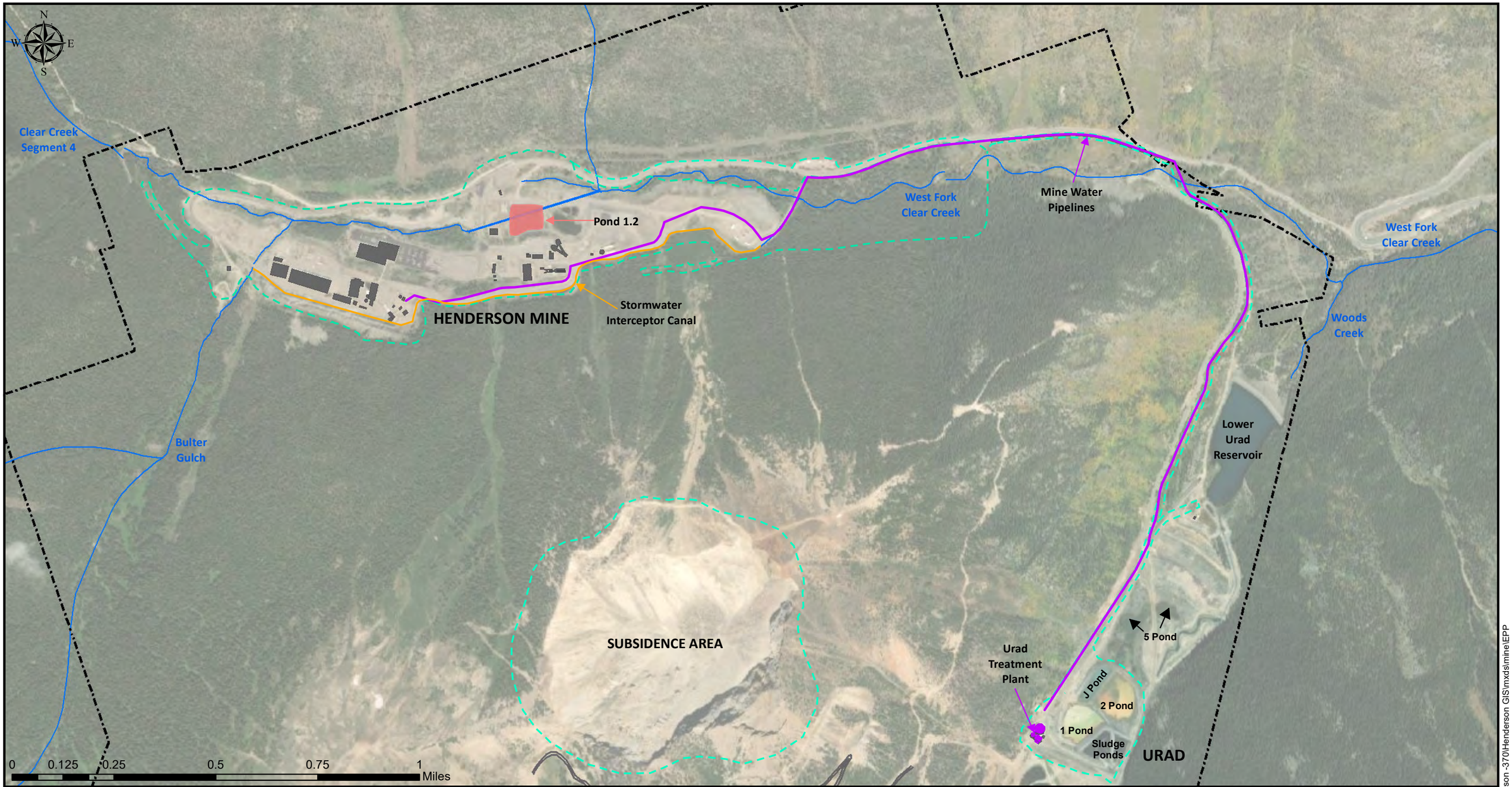
20. REFERENCES

Ajax/Clear Creek Associates, 2013, Groundwater Quality Assessment Technical Memorandum Henderson Mine.

Climax Molybdenum Company Henderson Operations, 2012. Technical Revision (TR-16) to Permit M-1977-342 Groundwater Management Plan.

Hydrokinetics, 1993, Well Construction and Flow Analysis – Troublesome Formation and Alluvial Materials.

Woodward Clyde, 1983, Henderson Tailing Area Geohydrology, Report No. 20997-9407 to Amax, Inc.



MAP FEATURES

- PROPERTY BOUNDARY
- SITE FACILITIES
- AFFECTED LAND BOUNDARY
- MINE EPF 1.1
- MINE EPF 1.2
- MINE EPF 1.3

MINE EPF DETAILS

EPF 1.1: Mine Water and URAD Water Treatment System

EPF 1.2: Stormwater Diversion System

EPF 1.3: Pond 1.2

REVISION	DATE
Updated labels and feature characteristics	02/17/2021

Climax Molybdenum
A Freeport-McMoRan Company
HENDERSON OPERATIONS
1746 County Road
Empire, Colorado 80438

FIGURE 1: Henderson Mine General Site Layout and EPFs 1.1, 1.2 and 1.3

Aquionix
EHS Services
5545 W.56th Ave, Unit E
Arvada, CO 80002
303-289-7520 (Office)
www.aquionix.com

DESIGNED BY: MT (Aquionix)
DRAWN BY: MT
DATE DRAWN: 7/6/2015
SCALE: 1:14,000

S:\ArcGIS and AutoCAD files\CMC - Henderson -370\Henderson GIS\mxds\mineEPP

N
W
E
S

Ultimate Canal

Tailings Impoundment

Ultimate Canal

Upper Colorado River Segment 8 (Williams Fork River)

Property Boundary (Approx.)

Ultimate Canal

HENDERSON MILL

East Branch Reservoir

Property Boundary (Approx.)

Ute Creek Reservoir

Ute Creek

0 0.375 0.75 1.5 2.25 3 Miles

LOCATION MAP

Denver

Colorado

MAP FEATURES

- PROPERTY BOUNDARY
- CREEKS / STREAMS
- ULTIMATE CANAL
- FRESH WATER
- PROCESS WATER

REVISION	DATE
Label updates	05/09/2012
Updated well locations	6/28/2015
Updated features; Added MLGW-15 and MLGW-17	11/17/2020
Removed sampling locations	1/26/2021

Climax Molybdenum
A Freeport-McMoRan Company
HENDERSON OPERATIONS
19302 County Road
Parshall, CO 80468

FIGURE 2: HENDERSON MILL GENERAL SITE LAYOUT

Aquionix
EHS Services
5545 W. 56th Avenue
Arvada, CO 80002
303-289-7520 (Office)
303-289-7521 (Fax)

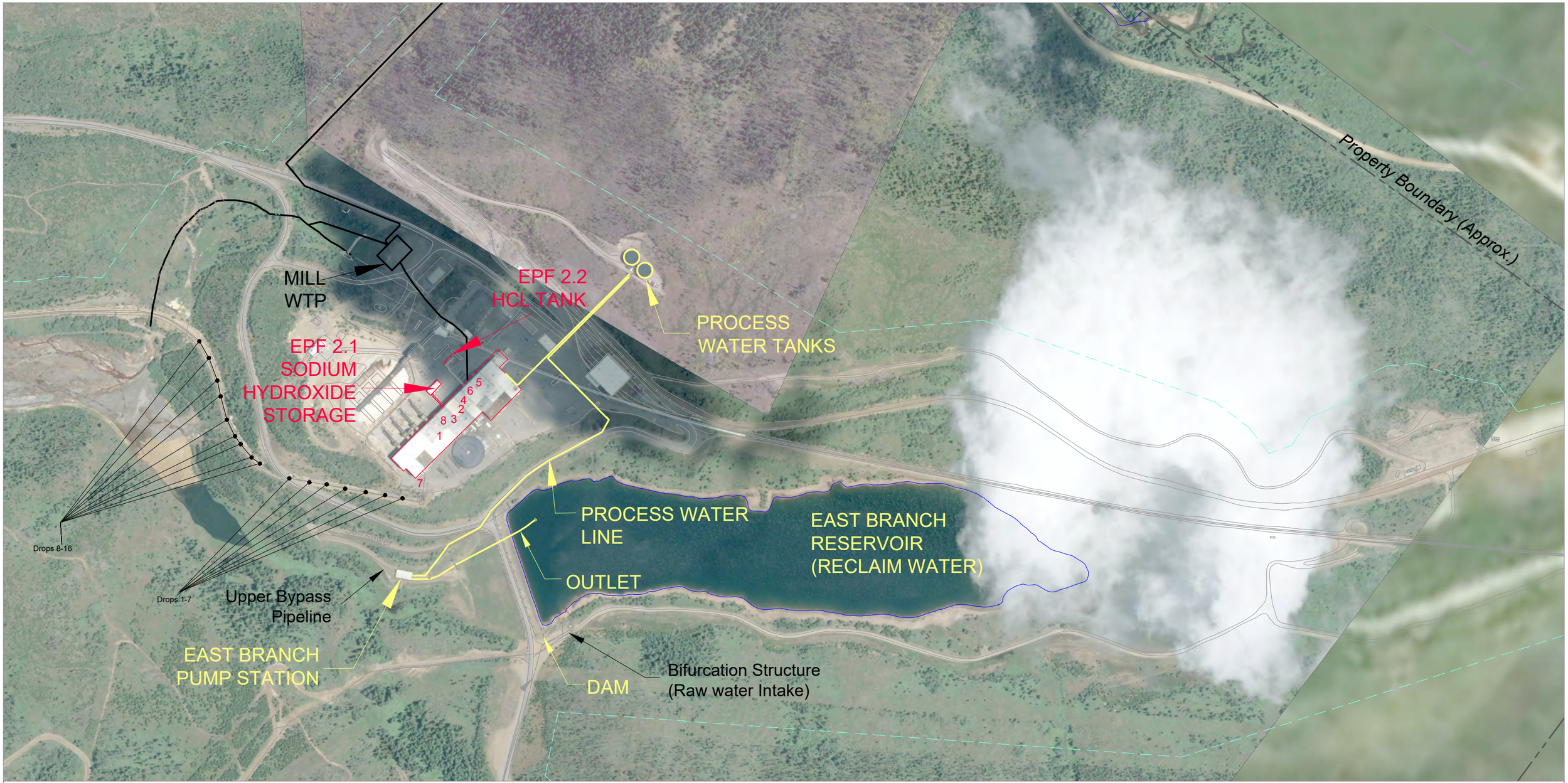
DESIGNED BY: MT (Aquionix)

DRAWN BY: MT

DATE DRAWN: 3/7/2011

SCALE: AS NOTED

FILE: S:\ArcGIS\Henderson GIS\mxds\mill\EPP



MAP FEATURES

- PROPERTY BOUNDARY
- AFFECTED LAND BOUNDARY
- ENVIRONMENTAL PROTECTION FACILITIES 1.1 and 1.2
- ENVIRONMENTAL PROTECTION FACILITIES 2.1 – 2.10
- SITE FACILITIES

PLAN

SCALE
300 0 300 600 FEET
CONTOUR INTERVAL = NA

MILL EPF DETAILS

EPF 1.1: East Branch Reservoir System	
EPF 1.2: Mill Process Water Storage Tanks	
EPF 2.1 - 2.10: Designated Chemical Storage	

MILL BUILDING

1	EPF 2.3a - Frother Chemical Storage (Dowfroth 250-C or similiar)
	EPF 2.3b - Depressant Chemical Storage (Orform D8 Depressant)
2	EPF 2.4 - Pine Oil Storage
3	EPF 2.5 - Collector Oil Storage
4	EPF 2.6 - Syntex Storage
5	EPF 2.7 - Sodium Lauryl Sulfate Storage
6	EPF 2.8 - Tergitol NP-9/9N9 Storage
7	EPF 2.9 - Quiklime Storage
8	EPF 2.10 - Nokes Storage

ISSUE / REV	DESCRIPTION	DATE	DWN	CHK'D
a	Updated locations and labels.	08/11	MT	TC
b	Updated feature characteristics. Added Affected Land Boundary	03/21	MT	AH

DRAWING REFERENCE(S):

FROM DRAWING PROVIDED BY MWH TITLE "HENDERSON MINE LAYOUT AND ENVIRONMENTAL PROTECTION FACILITIES".

DESIGNED BY	Not Available	
DRAWN BY	Not Available	
DATE DRAWN	Not Available	
APPROVED BY	T. Cardwell	
PROJECT MANAGER	T. Cardwell	
CLIENT APPROVAL	Miguel Harmarat	
CLIENT REFERENCE NO.	370	

PROJECT LOCATION: Parshall, Colorado

PROJECT: Environmental Protection Plan

TITLE: Figure 3: Henderson Mill EPFs 1.1, 1.2 and 2.1 - 2.10 - East Branch Reservoir System, and Mill Process Water Storage Tanks and Designated Chemical Storage

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Arvada, CO 80002
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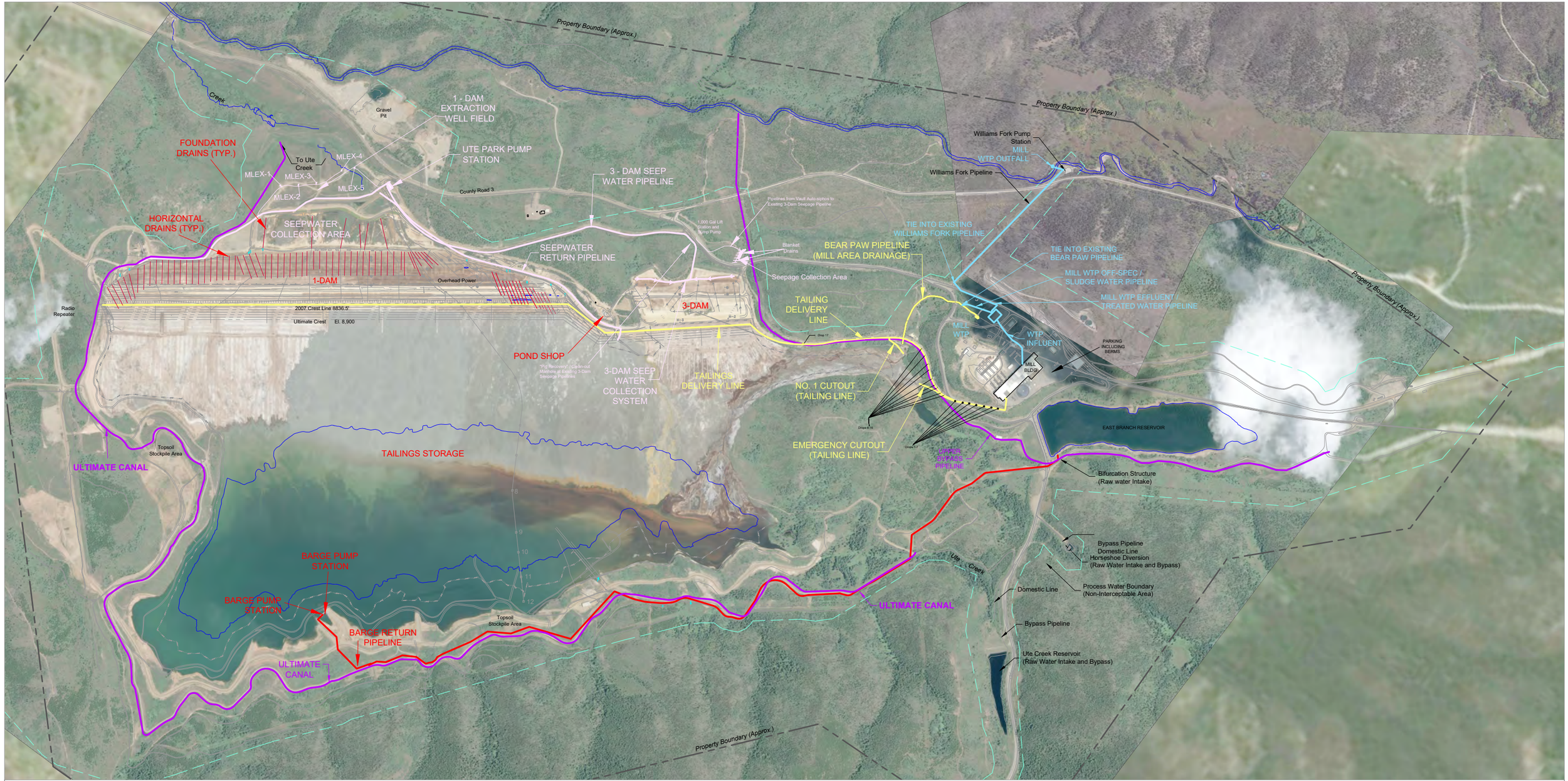
FIGURE: 3

REVISION:

FILE NAME: EPF MILL MASTER



MAP FEATURES

- PROPERTY BOUNDARY
- AFFECTED LAND BOUNDARY
- ENVIRONMENTAL PROTECTION FACILITY 1.3
- ENVIRONMENTAL PROTECTION FACILITY 1.4
- ENVIRONMENTAL PROTECTION FACILITIES 1.5, 1.6 and 1.7
- ENVIRONMENTAL PROTECTION FACILITY 1.8
- ENVIRONMENTAL PROTECTION FACILITY 3.1
- SITE FACILITIES

PLAN

SCALE
750 0 750 1500 FEET
CONTOUR INTERVAL = NA

MILL EPF DETAILS

- EPF 1.3: Tailing Delivery System
- EPF 1.4: Tailing Storage Facility
- EPF 1.5: Seep Water Collection and Return System
- EPF 1.6: Groundwater Extraction System
- EPF 1.7: Ute Park Pump Station
- EPF 1.8: Mill Water Treatment Plant
- EPF 3.1: Stormwater Diversion System

ISSUE / REV	DESCRIPTION	DATE	DWN	CHK'D
a	Updated locations and labels.	08/11	MT	TC
b	Updated feature characteristics. Added Affected Land Boundary	03/21	MT	AH

DRAWING REFERENCE(S):

FROM DRAWING PROVIDED BY MWH TITLE "HENDERSON MINE LAYOUT AND ENVIRONMENTAL PROTECTION FACILITIES".

DESIGNED BY	Not Available	
DRAWN BY	Not Available	
DATE DRAWN	Not Available	
APPROVED BY	T. Cardwell	
PROJECT MANAGER	T. Cardwell	
CLIENT APPROVAL	Miguel Harmarat	
CLIENT REFERENCE NO.	370	

PROJECT LOCATION: Parshall, Colorado

PROJECT: Environmental Protection Plan

TITLE: Figure 4: Henderson Mill EPFs 1.3, 1.4, 1.5, 1.6, 1.7 and 3.1 - Tailing Delivery System, Tailing Storage Facility, Seep Water Collection/Return, Groundwater Extraction System, Ute Park Pump Station, Stormwater Diversion System and Mill WTP

FIGURE: 4

REVISION:

FILE NAME: EPF MILL MASTER

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Section Break

Appendix A

List of DRMS Permit Amendments and Technical Revisions

Permit Action	Purpose of Permit Action	Date Submitted (Approximate)
AM-01	Addition of acreage of affected land due to future operational requirements.	1/27/1981
AM-02	Add Water Treatment Facility to include Urad water treatment	3/13/1996
AM-03	Replace ore train by adding conveyor; Increase affected land by 53.36 acres for conveyor route.	1/19/1998
AM-04	Change post-mining land uses. Reduce permitted acres. Modify operations to reduce bond.	1/14/2003
AM-05	Redefine permitted acreage; Include better maps for permit definition; Modify USFS access/legal right of entry; Include DUSEL as a post-mining land use; Construction of ultimate interceptor canal around tailing impoundment.	5/12/2006
AM-06	Redefine permitted acreage; Include better maps for permit definition; Modify USFS access/legal right of entry.	2/20/2007
AM-07	URAD WWTP and Glory Hole	5/8/2019
TR-Historic (aka HR-01)	Change the timetable for reclamation of Area 10 of Henderson Mine from 1979 to 1983 for 5 acres and 2006 for remaining 6 acres.	---
TR-Historic (aka HR-02)	Exchange 50 acres of disturbed area from Area 21 for 50 acres northwest of the tailing dam outside of the present affected land boundary.	---
TR-Historic (aka HR-03)	Exchange 13 acres of disturbed area from the southwest end of Area 23 for 13 acres adjacent to Area 9 outside present affected land boundary.	3/25/1983
TR-Historic (aka HR-04)	Clarify statements in permit application that will be considered as commitments.	10/26/1983
TR-01	Institute an alternate form of bonding and establish a reclamation trust fund; Revised requirement for soil cover on tailing; Revise the soil stockpile plan.	4/4/1988
TR-02	Proposed soil stockpile plan meeting requirement to cover tailing deposition area with an average 12 inch soil depth.	4/4/1988
TR-03	Place affected area boundary markers in response to 1990 MLRD regulation change.	6/28/1991
TR-04	Add lined mine water treatment pond near #1-Shaft hoist house to replace 9 16,000 frac tanks.	8/30/1995
TR-04	Proposal for Temporary Interceptor Canal Crossings	9/24/2002
TR-04	Ultimate Interceptor Canal	6/27/2006
TR-04	Use of D8 Oroform	4/22/2008
TR-04	Extension of seepwater return line	7/8/2009
TR-04	East Branch Pipeline Replacement	6/23/2010
TR-04	Construction of tailings cyclones	7/7/2010
TR-04	Lower flood bypass closure	7/20/2010
TR-04	Lime Slaker Construction	7/30/2010
TR-05	Groundwater Management Plan	10/2/2005
TR-06	Water Treatment Facility for Bonding Purposes	8/29/1996
TR-08	Use Pond 1.2 for water treatment sludge disposal from offsite Urad wastewater treatment plant.	6/30/1990
TR-08	Methods to protect the geosynthetic liner in Pond 1.2.	4/20/2001
TR-09	Grouting a portion of the abandoned 2-Dam Decant System and the installation of parallel gravity lines to route No. 3-Dam seepage to the No. 1-Dam seep water collection system.	4/12/2000
TR-09	Grouting a portion of the abandoned 2-Dam Decant System and the installation of parallel gravity lines to route No. 3-Dam seepage to the No. 1-Dam seep water collection system.	4/12/2000
TR-09	Grouting a portion of the abandoned 2-Dam Decant System and the installation of parallel gravity lines to route No. 3-Dam seepage to the No. 1-Dam seep water collection system.	4/12/2000
TR-09	Grouting a portion of the abandoned 2-Dam Decant System and the installation of parallel gravity lines to route No. 3-Dam seepage to the No. 1-Dam seep water collection system.	4/12/2000
TR-09	Relocation of the 3-Dam seep water line discharge.	4/11/2002
TR-09	Relocation of the 3-Dam seep water line discharge.	4/11/2002
TR-09	3-Dam Seep Collection Addition	9/7/2010
TR-10	Install 1-Dam GW interception field to protect groundwater.	5/15/2001
TR-11	Change to topsoil salvage methods - doze and windrow method vs. shovel and truck haul method.	8/28/2001
TR-13	1. Haul road construction 2. Topsoil salvage change 3. Relocate topsoil storage piles 4. Temporary upland interception ditch crossings	5/22/2003
TR-14	Installation of a new mill water return pipeline; this pipeline is the first step toward the replacement of the tailing impoundment decant system with a barge pump system.	2/12/2004

Permit Action	Purpose of Permit Action	Date Submitted (Approximate)
TR-14	Installation of a new mill water return pipeline; this pipeline is the first step toward the replacement of the tailing impoundment decant system with a barge pump system.	2/12/2004
TR-14	Barge System As-Builts	1/26/2006
TR-15	Disposal of dewatered high-density water treatment sludge from the URAD wastewater treatment plant into the #1 Dam Tailing Impoundment at the Henderson Mill.	6/16/2004
TR-16	Groundwater Management Plan	4/26/2012
TR-17	Topsoil Stockpile	6/27/2012
TR-18	Environmental Protection Plan	10/30/2012
TR-19	Barge Relocation	4/2/2013
TR-20	Drop Tower 17 Removal	8/23/2013
TR-21	Seed Mix Modification	10/24/2013
TR-22	TDL Refurbishment and Removal of Drop Towers 15 and 16	3/20/2014
TR-23	Phase I Ute Park Extraction Wellfield (1 well)	5/20/2014
TR-24	Removal of Drop Towers 13 and 14 and replacement of 2,500 feet of 36" RCP with 42" HDPE.	8/28/2014
TR-25	Phase II Ute Park Extraction Wellfield (2 wells)	4/29/2015
TR-26	Tailing Storage Facility - Sand Seam Project	4/29/2015
TR-27	3-Dam Regrade	3/1/2017
TR-28	Phase III Ute Park Extraction Wellfield (2 wells)	6/8/2017
TR-29	3-Dam Buttress	1/26/2018
TR-30	Seepwater Road Raise	9/19/2018
TR-31	3-Dam Clean-Out Ports	7/2/2019
TR-32	3 Dam Buttress Phase II	6/8/2020
TR-33	Seep Spoil Collection Area	2/9/2021

Section Break

Appendix B

Incident Response Manuals

Environmental Incident Response Manual (IRM)

HENDERSON MILL

March 2021

Climax Molybdenum
A Freeport-McMoRan Company

Prepared by:

Aquionix

Aquionix. Inc
3700 E. 41st Ave
Denver, CO 80216
303-289-7520
www.aquionix.com

FACILITY INFORMATION

MILL FACILITY	
Facility Name	Henderson Mill
Facility Owner	Climax Molybdenum Company
Facility Type	Molybdenum milling and associated operations
Physical Address	19302 County Road 3, Parshall, Colorado 80468
Mailing Address	19302 County Road 3, Parshall, Colorado 80468
Phone Number	303-942-3452
Fax Number	970-725-0038
Facility Contact	Miguel Hamarat, Environmental Manager 720-942-3255

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LIST OF APPENDICES

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It is important that this document be updated to reflect changes in operations, as well as responsible people at the site. Such revisions will be made in accordance with related compliance calendars, document control and other applicable procedures specified in Henderson's Environmental Management System (EMS). Revisions to this document are summarized in the Revision History log.

Timely updates to this document are a key component in maintaining effective incident response procedures. As specified in Section 1.1 of this Plan, this Plan is also relied upon to fulfill specific regulatory requirements.

Revision Date	Completed By:	Summary of Revisions or Record of Review
May 2011	Aquionix, Inc.	IRM Update: Separated Hazardous Waste LQG Requirements into a distinct document; Added reference to the Henderson Operations Spill Management Procedure.
August 2012	Tim Haynes	Annual review: Revised various outdated references
April 2013	Tim Haynes	Annual review. Primarily contact updates, minimal plan edits.
November 2013	Lori Elliott	Update Phone Numbers
December 2014	Tim Haynes	Annual review
November 2015	Tim Haynes	Annual review
December 2017	Amber Parmet	Annual review
December 2017	Amber Parmet	Annual review, update contact information. Will revise and distribute in January upon pending updates to Crisis Management Plan.
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December 2019	Amber Parmet	Annual review, update contact information.
November 2020	Kasey Martin	Annual Review, Update contact information
March 2021	Kasey Maritn	Annual Review, Updated errors in text

1.0 GENERAL INFORMATION

1.1 Introduction (Purpose and Scope)

This manual is an Environmental Management System (EMS) tool to be used in the event of an environmental incident involving the spill or release of potentially toxic chemicals including those referenced in section 1.2 at the Henderson Mill site. The Henderson Mill IRM is intended to be a standalone document in the case of an environmental incident or as a supplement to the site Crisis Management Plan in the case of a large-scale emergency involving an environmental incident. This plan has been written to meet the emergency response requirements associated with the following plans, permits, procedures, and underlying regulations.

- Spill Prevention Control and Countermeasures (SPCC) Requirement to update emergency contacts and reporting procedures.
- Henderson Stormwater Management Plan
- Henderson Waste Management Program
- Environmental Protection Plan

1.2 What is an Environmental Incident?

An environmental incident includes the following:

1. Petroleum product or other chemical release (hazardous or non-hazardous) that could contact surface water;
2. Petroleum product or other chemical and non-petroleum product that spills on the ground or other surface area;
3. Hazardous waste that spills on the ground or other surface area;
4. Water treatment upsets (potable, domestic or industrial);
5. A release of waters outside of the domestic treatment or process-related systems;
6. Imminent or actual failure of any surface impoundment or other environmental protection facility (environmental protection facility or "EPF" is terminology from the Colorado Division of Reclamation, Mining and Safety for process related engineered structures or controls); and
7. Air monitoring equipment or control upset or failure.

If you are unsure whether a situation is an environmental incident, treat it as such until you are informed otherwise by the Environmental staff.

2.0 OVERVIEW OF FACILITY OPERATIONS

2.1 Operations

The scope of the Henderson operation can best be understood by separately discussing its four major components: (1) Henderson Mine, (2) Urad Minesite, (3) Henderson Mill, and (4) the Overland Conveyor System. This Plan focuses on the Henderson Mill and Overland Conveyor System.

2.1.1 Henderson Mine

The Henderson Mine is located on the North side of Red Mountain near the confluence of Butler Gulch and the West Fork of Clear Creek. It is nine miles west of Empire, CO, in Clear Creek County on the Eastern Slope of the Continental Divide. The elevation at the mine site is 10,400 feet. Access to the mine is gained by a 28 foot diameter vertical shaft which is 3,100 feet deep. Four other shafts service the ventilation requirements for intake and discharge air. Horizontal drifts (tunnels) at the bottom of the shafts provide access to the ore body. A highly mechanized panel-cave system of mining is being employed with a nominal capacity of 40,000 tons per day

2.1.2 Urad Mine Site

The Urad Mine Site is a reclaimed mine located southeast of the Henderson Mine in Woods Creek Valley. This site consists of two reclaimed tailing impoundments, two plugged portals, water treatment collection ponds, and a water treatment plant.

2.1.3 Overland Conveyor System

A conveyor belt system is used to haul the mined ore from the Henderson Mine to the Henderson Mill. The conveyor system begins in a tunnel below the ore body at an elevation of 7000 feet. The tunnel runs west for 9.6 miles, surfacing at an elevation of 9,000 feet. After surfacing, the Overland Conveyor System continues west and north for another 4.8 miles to the Henderson Mill Site.

2.1.4 Henderson Mill

The Henderson Mill is approximately 22 miles south of Parshall, CO, just off of Grand County Road No. 3. The ore processing facilities (concentrator and tailing impoundment) are located on the western slope of the ridge between the Williams Fork River and the East Branch of Ute Creek, Grand County, CO.

2.2 Hazardous Waste Activities

Much of the waste generated at Henderson is from mineral processing and is thus excluded from hazardous waste regulation under the mineral processing exclusion found in 6 CCR 1007-3 261.4(b)(7). However, periodically some potentially regulated hazardous waste is generated at Henderson, such as unusable products and various other maintenance related wastes. As such,

the Henderson Mill may become an episodic Large Quantity Generator (LQG) of hazardous waste.

A LQG of hazardous waste is required to document very specific emergency preparedness and response information, which is not included within the scope of this IRM. As such, during a month where the site surpasses the LQG threshold, the *Henderson Mill Hazardous Waste Contingency Plan* will be used in conjunction with this IRM to ensure that required solid and hazard waste protocols are addressed and implemented (see Appendix D).

2.3 Petroleum and Other Chemicals

Henderson also manages petroleum products, petroleum containing equipment, chemicals, and waste oils/lubricants. Storage and other technical features of these items are discussed in the facility's SPCC Plan. Refer to Appendix B for the locations of SPCC bulk storage chemicals at Henderson Mill.

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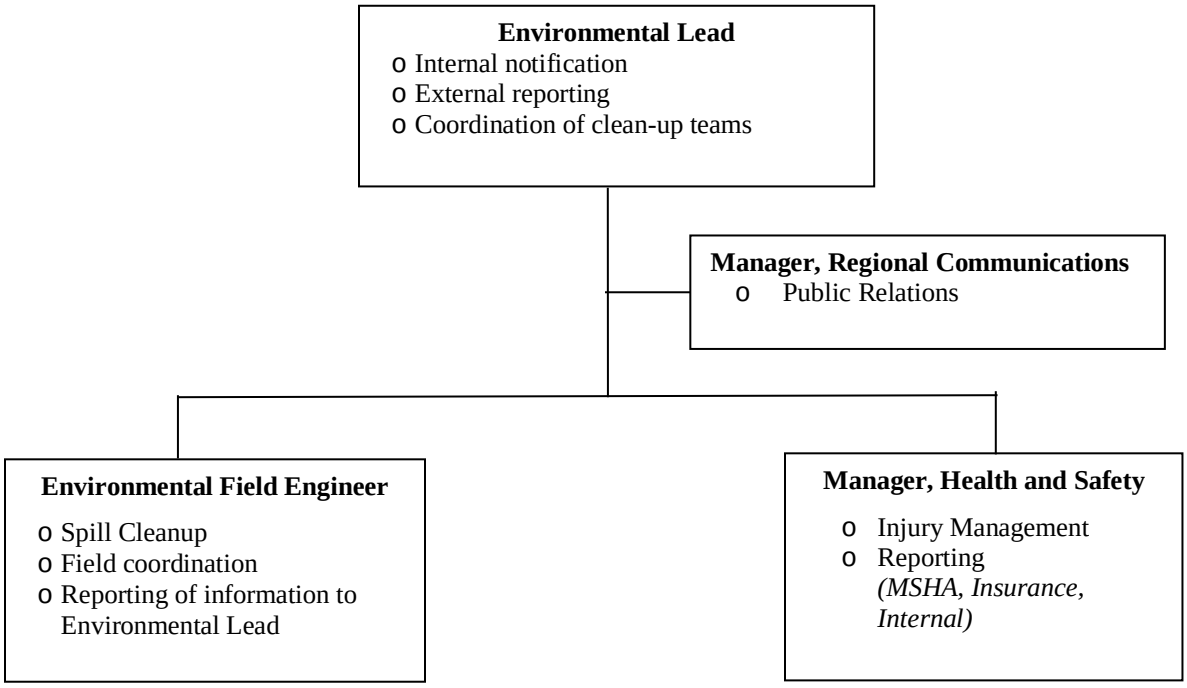
3.0 ORGANIZATION RESPONSIBILITY AND DUTIES

3.1 Organizational Structure

The following flowchart summarizes the organizational structure for an environmental emergency response at the Henderson Mill. If the incident goes beyond a strictly environmental response, then site management must be notified. The names and contact information for all listed positions is provided on the *Incident Response Flowchart* found in Appendix A. The *crisis management team organizational chart* and contact information can also be found in appendix A or on the *Crisis Management SharePoint*. The responsibilities of each function are further discussed below in the flowchart.



3.2 Environmental Field Engineer

The Environmental Field Engineer shall:

- Work with operations to ensure appropriate environmental response at the scene
- Gather appropriate information for government agencies and report it to environmental lead
- Advises Environmental Lead and Operations Technical Lead of potential environmental issues and provides options for mitigation

3.3 Communications lead

The Communications Lead shall:

- Control the release of information within and outside the organization
- Advises CMT Lead on information dissemination and media relations
- Assesses incident and collects information as required

- Drafts initial internal/external messages
- Facilitates review and approval process with Corporate Communications for the intial set of messages
- Prepares the designated spokesperson, if needed
- Monitors crisis events and updates messages as needed
- Communicates updated messages to internal and external audiences according to predetermined process and procedures
- Advises the community and media if authorized by Corporate Communication

3.4 Environmental Lead

Upon being notified of an incident, the Environmental Lead (or representative) shall:

- Advises CMT Lead on issues regarding environmental impacts of the incident
- Coordinates emergency clean-up teams as needed based on input from the Environmental Field Engineer
- Notifies relevant government agencies according to the immediate reporting criteria
- Notifies Corporate Regional Environmental Manager
- Keeps CMT Lead notified of incident progression

3.5 Safety Lead:

The Safety Lead shall:

- Advise CMT Lead on issues regardin safety incident
- Axtivates emergency teams as needed based on input from Operations Technical Lead
- Notifies relevant government agencies according to the immediate reporting criteria
- Notifies Corporate Health and Safety as appropriate based on incident
- Keep CMT lead notified of incident progression
- Conducts or assists in investigation of safety related incidents

3.6 Boiler Operator / Mill Control

Upon being notified of an emergency incident, the Boiler Operator or Mill Control shall be responsible for:

- Contacting the Crisis Management Team
- Ensuring that the Facility Emergency Response Coordinator or one of the alternates has been notified; and
- Notifying the on-call safety and environmental representative.

3.7 Area Supervisors and Superintendents

Area Supervisors and Superintendents (or their designees) shall be responsible for assisting the Emergency Coordinator in understanding the systems involved and, as is appropriate and safe to do so, coordinating the shut-down of impacted processes and monitoring of operating systems for leaks, pressure build-ups, gas generation, etc. The Area Supervisor or Superintendent shall also be responsible for notifying their immediate supervisor of the incident.

3.8 Employees and Contractors

Employees and contractors are to report hazardous waste spills, releases, fires or explosions to their supervisors and to the Boiler Operator / Mill Control via the emergency telephone numbers or radio Mayday procedures. Employees and contractors may also participate in emergency response activities as directed by the emergency coordinator and as appropriate to their level of training.

4.0 EMERGENCY PREPAREDNESS

4.1 Emergency Response Equipment

Emergency equipment is located throughout the facility and in close proximity to areas that have an increased risk for potentially harmful releases and incidents.

4.2 Emergency Response and Communication Equipment Maintenance and Testing

Emergency response and preparedness equipment is inspected by the personnel staffing the area in which it is located, with the exception of annual fire extinguisher inspections which are contracted to a private company for the mill site. Spill response equipment is regularly inspected and maintained as a part of the Mine and Mill SPCC Plans. Preventive maintenance of other critical equipment is managed through Henderson's Preventive Maintenance System (SAP).

4.3 Emergency Response Training

Henderson employees receive emergency incident training during initial MSHA training and annually thereafter through the MSHA refresher course. Personnel receive training on the proper management of hazardous wastes and materials during an annual environmental training class (this class is commonly held in conjunction with the annual MSHA refresher training).

Each person must maintain a record indicating that they have completed their MSHA training and/or annual refresher. Records of annual MSHA training are maintained by the safety department. Records of annual environmental training are maintained by the environmental department.

Contractors and visitors must receive site-specific MSHA training prior to being allowed outside of the office complex. This training covers incident reporting and evacuation requirements.

Henderson's emergency responders receive extensive training on responding to emergency incidents. Standard training for personnel who are authorized to respond to and direct work at an emergency includes 24-hour or 40-hour of initial emergency response training combined with an 8-hour refresher course.

4.4 Emergency Response Drills

Periodic environmental incident drills are conducted for training purposes and to verify the effectiveness of Henderson's environmental incident response systems. These drills serve the primary purposes of ensuring that:

- Site personnel are thoroughly familiar with the applicable incident response procedures;
- Henderson incident response procedures are followed in the event of an environmental incident;
- Henderson incident response procedures are effective; and
- Necessary revisions to Henderson's incident response procedures are identified and implemented.

These drills are not subject to any set schedule, but are conducted at least once every two years.

4.5 Coordination with Local Emergency Response Agencies

When possible, Henderson works with local emergency response organizations and teams to:

- Familiarize their personnel with our facility;
- Verify they are capable of providing the resources that may be required in the event of an emergency; and
- Verify that response procedures are compatible and able to be effectively implemented during an emergency.

5.0 RESPONSE AND REPORTING PROCEDURES

The emergency response and reporting procedures to be followed in the event of an environmental incident OR any other spill, injury, fire or explosion are located on the Mill Incident Response Flowchart found in Appendix A of this Plan. The sections below expand on the procedures and requirements listed on this flowchart.

5.1 Initial Notification and Evacuation

Upon observing an incident, employees, contractors and visitors are to immediately evacuate the vicinity and call mill control, if they have a radio, call on **Channel 3, 5 or 7.**

Upon hearing the emergency call, all employees, visitors, and contractors are immediately required to stop what they are doing and listen for further instructions, observing radio silence in the meantime.

It is highly unlikely that an evacuation of all Henderson facilities would be required. However, individual evacuation routes and assembly areas have been developed for each area of the Henderson Mill Site. These assembly areas are conveyed in initial and site specific training.

If instructed to evacuate, personnel must immediately evacuate the area and immediately proceed to a designated assembly area via the safest route possible.

5.2 Emergency Assistance from Outside Organizations

In the event of an emergency incident that is outside the response capabilities of Henderson personnel, assistance from the appropriate resources identified on the Incident Response Flowchart will be requested. Phone numbers for each of these organizations are provided on the Flowchart, which is located in Appendix A of this IRM.

Personnel from the emergency service providers (i.e., hospital, local ambulance services, etc.) will be advised of materials involved and their likely hazards. Material Safety Data Sheets and other technical references pertaining to hazardous materials will be provided for use by hospital and emergency service providers' personnel as necessary or requested.

5.3 Internal Facility Reporting

The Incident Response Flowchart found in Appendix A lays out the steps for *immediate* internal notification procedures in the case of an environmental spill, injury, fire or explosion. It is **critical** that the incident is reported to the Environmental Department to ensure that:

- Any release is properly cleaned up;
- Any resulting waste is properly characterized, managed and disposed of; and
- Any applicable reporting of the incident is made to company officials and government agencies.

As indicated on the flowchart, the area supervisor for which a spill or release has occurred shall fill out the *Release Report Form* (located on Sharepoint within the Henderson Mill SPCC/MCP) and submit it to the Environmental Department as soon as possible.

5.4 Internal Corporate Reporting

Required reporting to the Freeport-McMoRan corporate environmental group is managed through the Incident Management System (IMS) database. The Environmental Department is responsible for adding all relevant information to this database related to any environmental incident occurring at Henderson.

Verbal reports of environmental incidents are also required to be made to appropriate corporate environmental/legal contacts. As with the preceding electronic reporting, the Environmental Department is responsible for making these verbal reports. The Incident Response Flowchart in Appendix A contains the required contact information.

5.5 External Reporting

Depending on the situation, it may be necessary to report the environmental incident to government or other non-Henderson contacts. The decision to make such a report will be made by the Environmental Department. The Incident Response Flowchart located in Appendix A contains information for potential external contacts to whom an incident may need to be reported. **Unless otherwise instructed, communication with these contacts will only be made by the Environmental Department.**

5.6 Government Agency Reporting

Certain environmental incidents are required to be reported to specified government agencies. These requirements are time sensitive and typically based on:

- Time and duration of the release/spill;
- Type of material released/spilled;
- Quantity of material released/spilled;
- Rate of release/spill of material; and
- Location of release/spill and affected media (i.e. soil, water, air, etc.).

The determination of whether a release/spill is subject to government reporting requirements is often based on complex factors that require special environmental and legal analyses. Additionally, noncompliance with these reporting requirements can result in significant corporate, as well as personal liability. As such, reporting to government agencies will always be coordinated by the Environmental Department.

5.7 Other Reporting (SPCC, SWMP, EPP)

Henderson is required under certain regulatory requirements to maintain environmental plans that contain additional emergency response and reporting requirements. Refer to the Incident Response Flowchart in Appendix A for guidance as to which document should be used in an incident situation.

5.8 Follow-up

Following an initial emergency response, the Emergency Coordinator must work with the appropriate Henderson personnel and departments to ensure that cleanup and other recovery activities are completed expediently.

If Henderson personnel cannot safely cleanup a release, a qualified third-party cleanup company will be hired. To reduce liability, wastes must be disposed of in strict accordance with Federal and State regulations. As such, it is essential that environmental personnel be involved in cleanup and disposal activities.

Following the emergency incident, all employees involved in the response should participate in a debriefing which will evaluate:

1. Response;
2. Equipment problems;
3. Training requirements;
4. Root cause, including who, what, when and why; and/or
5. Applicable SOPs, infrastructure, and surveillance.

6.0RECORDKEEPING

Records are maintained per the appropriate plan and procedure and in accordance with the Company's Records Retention Program.

Appendices - IRM Appendices available upon request

Section Break

Environmental Incident Response Manual (IRM)

HENDERSON MINE

March 2021

Climax Molybdenum
A Freeport-McMoRan Company

Prepared by:

Aquionix

Aquionix. Inc
3700 E. 41st Ave
Denver, CO 80216
303-289-7520
www.aquionix.com

FACILITY INFORMATION

MINE FACILITY	
Facility Name	Henderson Mine
Facility Owner	Climax Molybdenum Company
Facility Type	Underground molybdenum mining and associated operations
Physical Address	1746 County Road 202, Empire, Colorado 80438
Mailing Address	PO Box 68, Empire, CO 80438
Phone Number	720-942-3394
Fax Number	303-569-2829
Facility Contact	Miguel Hamarat, Environmental Manager 720-942-3255

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Revision Date	Completed By:	Summary of Revisions or Record of Review
April 2011	Geoff Clothier	Added reference to SPCC Bulk Chemical Inventory list to Appendix E with select MSDSs, edited contacts, edited and updated flowchart (Appendix A)
May 2011	Aquionix, Inc.	IRM Update: Separated Hazardous Waste LQG Requirements into a distinct document; Added reference to the Henderson Operations Spill Management Procedure.
May 2013	Geoff Clothier, Whitney Koester	Annual Review and Update
November 2013	Lori Elliott	Updated Phone Numbers due to new Phone System
February 2014	Whitney Koester	Annual Review and Update
September 2015	Lori Elliott/Whitney Koester	Updated titles, phone number, and contacts
January 2016	Whitney Koester	Updated Section 1.2
March 2017	Whitney Koester	Annual Review
December 2017	F	Annual review, update contact information. Will revise and distribute in January upon pending updates to Crisis Management Plan.
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4. Water treatment upsets (potable, domestic or industrial);
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2.1 Operations

The scope of the Henderson operation can best be understood by separately discussing its four major components: (1) Henderson Mine; (2) URAD Mine Site; (3) Henderson Mill; and (4) the Overland Conveyor System.

2.1.1 Henderson Mine

The Henderson Mine is located on the North side of Red Mountain near the confluence of Butler Gulch and the West Fork of Clear Creek. It is nine miles west of Empire, CO in Clear Creek County on the Eastern Slope of the Continental Divide. The elevation at the mine site is 10,400 feet. Access to the mine is gained by a 28 foot diameter vertical shaft which is 3,100 feet deep. Four other shafts service the ventilation requirements for intake and discharge air. Horizontal drifts (tunnels) at the bottom of the shafts provide access to the ore body. A highly mechanized panel-cave system of mining is being employed with a nominal capacity of 40,000 tons per day

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2.1.3 Overland Conveyor System

A conveyor belt system is used to haul the mined ore from the Henderson Mine to the Henderson Mill. The conveyor system begins as a tunnel below the ore body at an elevation of 7000 feet. The tunnel runs west for 9.6 miles, surfacing at an elevation of 9,000 feet. After surfacing, the Overland Conveyor System continues west and north for another 4.8 miles to the Henderson Mill Site.

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2.2 Hazardous Waste Activities

Much of the waste generated at Henderson is from mineral processing and is thus excluded from hazardous waste regulation under the mineral processing exclusion found in 6 CCR 1007-3 261.4(b)(7). However, periodically some potentially regulated hazardous waste is generated at Henderson, such as unusable products and various other maintenance related wastes. As such,

the Henderson Mine may become an episodic Large Quantity Generator (LQG) of hazardous waste.

A LQG of hazardous waste is required to document very specific emergency preparedness and response information, which is not included within the scope of this IRM. As such, during a month where the site surpasses the LQG threshold, the *Henderson Mine Hazardous Waste Contingency Plan* will be used in conjunction with this IRM to ensure that required solid and hazard waste protocols are addressed and implemented (see Appendix D).

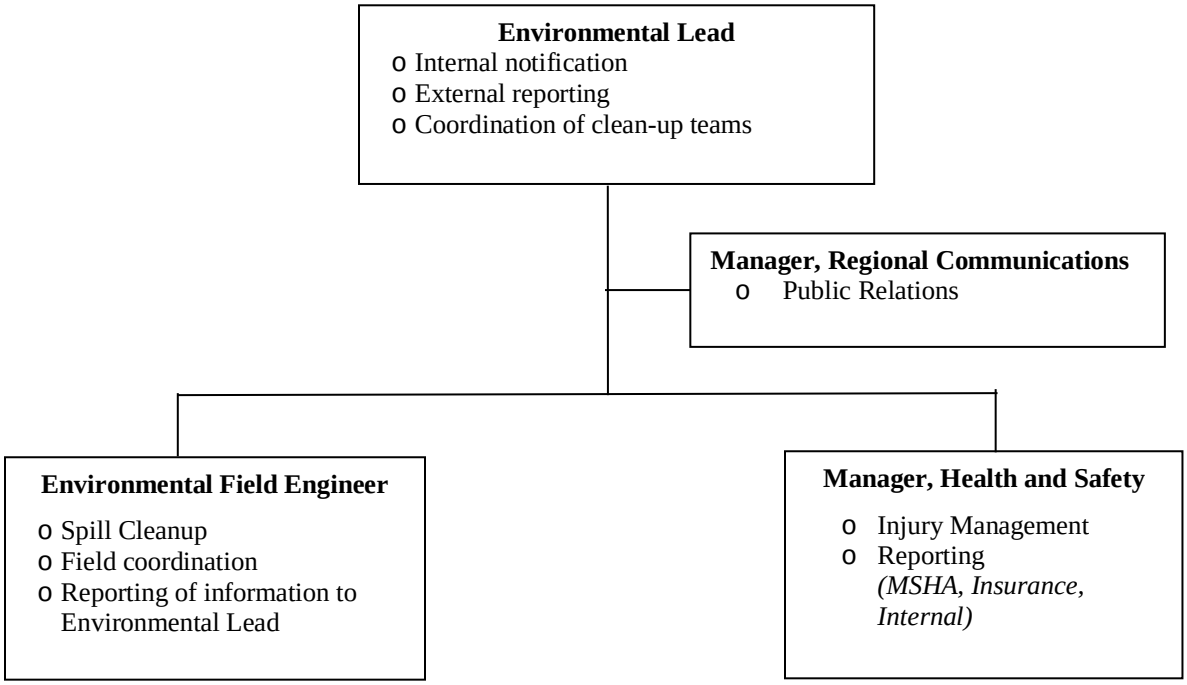
2.3 Petroleum and Other Chemicals

Henderson also manages petroleum products, petroleum containing equipment, chemicals, and waste oils/lubricants. Storage and other technical features of these items are discussed in the facility's SPCC Plan. Refer to Appendix B for the locations of SPCC bulk storage chemicals at Henderson Mine.

3.0 ORGANIZATION RESPONSIBILITY AND DUTIES

3.1 Organizational Structure

The following flowchart summarizes the organizational structure for an environmental emergency response at the Henderson Mill. The names and contact information for all listed positions is provided on the *Incident Response Flowchart* found in Appendix A. The *crisis management team organizational chart* and contact information can also be found in appendix A or on the *Crisis Management SharePoint*. The responsibilities of each function are further discussed below in the flowchart.



3.2 Emergency Field Engineer

The Environmental Field Engineer shall:

- Work with operations to ensure appropriate environmental response at the scene
- Gather appropriate information for government agencies and report it to environmental lead
- Advises Environmental Lead and Operations Technical Lead of potential environmental issues and provides options for mitigation

3.3 Communications lead

The Communications Lead shall:

- Control the release of information within and outside the organization
- Advises CMT Lead on information dissemination and media relations
- Assesses incident and collects information as required
- Drafts initial internal/external messages

- Facilitates review and approval process with Corporate Communications for the intial set of messages
- Prepares the designated spokesperson, if needed
- Monitors crisis events and updates messages as needed
- Communicates updated messages to internal and external audiences according to predetermined process and procedures
- Advises the community and media if authorized by Corporate Communication

3.4 Environmental Lead

Upon being notified of an incident, the Environmental Lead (or representative) shall:

- Advises CMT Lead on issues regarding environmental impacts of the incident
- Coordinates emergency clean-up teams as needed based on input from the Environmental Field Engineer
- Notifies relevant government agencies according to the immediate reporting criteria
- Notifies Corporate Regional Environmental Manager
- Keeps CMT Lead notified of incident progression

3.5 Safety Lead:

The Safety Lead shall:

- Advise CMT Lead on issues regardin safety incident
- Axtivates emergency teams as needed based on input from Operations Technical Lead
- Notifies relevant government agencies according to the immediate reporting criteria
- Notifies Corporate Health and Safety as appropriate based on incident
- Keep CMT lead notified of incident progression
- Conducts or assists in investigation of safety related incidents

3.6 Hoistman and Dispatch

Upon being notified of an emergency incident, the Hoistman shall be responsible for:

- Contacting the Command Center

Upon being notified of an emergency incident, the dispatchers shall be responsible for:

- Contacting the Crisis Management Team
- Ensuring that the Facility Emergency Response Coordinator or one of the alternates has been notified; and
- Notifying the on call safety and environmental representative.

3.7 Area Supervisors and Superintendents

Area Supervisors and Superintendents (or their designees) shall be responsible for assisting the Emergency Coordinator in understanding the systems involved and, as is appropriate and safe to

do so, coordinating the shut-down of impacted processes and monitoring of operating systems for leaks, pressure build-ups, gas generation, etc. The Area Supervisor or Superintendent shall also be responsible for notifying their immediate supervisor of the occurrence of any incidents.

3.8 Employees and Contractors

Employees and contractors are to report hazardous waste spills, releases, fires or explosions to their supervisors and to the Hoistman via the emergency telephone numbers or radio procedures. Employees and contractors may also participate in emergency response activities as directed by the emergency coordinator and as appropriate to their level of training.

4.0 EMERGENCY PREPAREDNESS

4.1 Emergency Response Equipment

Emergency equipment is located throughout the facility and in close proximity to areas that have an increased risk for potentially harmful releases and incidents.

4.2 Emergency Response and Communication Equipment Maintenance and Testing

Emergency response and preparedness equipment is inspected by the personnel staffing the area in which it is located, with the exception of annual fire extinguisher inspections, which are contracted to a private company for the mine site. Spill response equipment is regularly inspected and maintained as a part of the Mine and Mill SPCC Plans. Preventive maintenance of other critical equipment is managed through Henderson's Preventive Maintenance System (SAP).

4.3 Emergency Response Training

Henderson employees receive emergency incident training during initial MSHA training and annually thereafter through their MSHA refresher course. Personnel receive training on the proper management of hazardous wastes and materials during an annual environmental training class (this class is commonly held in conjunction with the annual MSHA refresher training).

Records of annual environmental training are maintained, on site, by the Henderson Environmental Department.

Contractors and visitors must receive site-specific MSHA training prior to being allowed outside of the office complex. This training covers incident reporting and evacuation requirements.

Henderson's emergency responders receive extensive training on responding to emergency incidents. Standard training for personnel who are authorized to respond to and direct work at an emergency includes 24-hour or 40-hour of initial emergency response training combined with an 8-hour refresher course.

4.4 Emergency Response Drills

Periodic environmental incident drills are conducted for training purposes and to verify the effectiveness of Henderson's environmental incident response systems. These drills serve the primary purposes of ensuring that:

- Site personnel are thoroughly familiar with the applicable incident response procedures;
- Henderson incident response procedures are followed in the event of an environmental incident;
- Henderson incident response procedures are effective; and
- Necessary revisions to Henderson's incident response procedures are identified and implemented.

These drills are not subject to any set schedule, but are conducted at least once every two years.

4.5 Coordination with Local Emergency Response Agencies

When possible, Henderson works with local emergency response organizations and teams to:

- Familiarize their personnel with our facility;
- Verify they are capable of providing the resources that may be required in the event of an emergency; and
- Verify that response procedures are compatible and able to be effectively implemented during an emergency.

5.0 RESPONSE AND REPORTING PROCEDURES

The emergency response and reporting procedures to be followed in the event of an environmental incident OR any other spill, injury, fire or explosion are located on the Mine Incident Response Flowchart found in Appendix A of this Plan. This flowchart is also posted throughout the Henderson Mine Site. The sections below expand on the procedures and requirements listed on this flowchart.

5.1 Initial Notification and Evacuation

Immediately upon observing an incident, employees, contractors and visitors are to evacuate the immediate vicinity and call the Hoistman, if they have a radio, dial any channel **1 through 8** and follow reporting procedures appropriate for the incident area. Immediately upon hearing the procedural call, all employees, visitors, and contractors are required to stop what they are doing and listen for further instructions, observing radio silence in the meantime.

It is highly unlikely that an evacuation of all Henderson facilities would be required. However, individual evacuation routes and assembly areas have been developed and posted for each area of the Henderson Mine Site. These assembly areas will be added to the Incident Response Flowcharts as they are posted in areas of the facility.

If instructed to evacuate, personnel must immediately evacuate the area and immediately proceed to a designated assembly area via the safest route possible.

5.2 Emergency Assistance from Outside Organizations

In the event of an emergency incident that is outside the response capabilities of Henderson personnel, assistance from the appropriate resources identified on the Incident Response Flowchart will be requested. Phone numbers for each of these organizations are provided on the Flowchart, which is located in Appendix A of this IRM.

Personnel from the emergency service providers (i.e., hospital, local ambulance services, etc.) will be advised of materials involved and their likely hazards. Safety Data Sheets and other technical references pertaining to hazardous materials will be provided for use by hospital and emergency service providers' personnel as necessary or requested.

5.3 Internal Facility Reporting

The Incident Response Flowchart found in Appendix A lays out the steps for *immediate* internal notification procedures in the case of an environmental spill, injury, fire or explosion. It is **critical** that the incident is reported to the Environmental Department to ensure that:

- Any release is properly cleaned up;
- Any resulting waste is properly characterized, managed and disposed of; and
- Any applicable reporting of the incident is made to company officials and government agencies.

As indicated on the flowchart, the area supervisor for which a spill or release has occurred shall fill out the *Release Report Form* (located on Sharepoint within the Henderson Mine SPCC/MCP) and submit it to the Environmental Department as soon as possible.

5.4 Internal Corporate Reporting

Required reporting to the Freeport-McMoRan corporate environmental group is managed through the Corporate Incident Management System (IMS) database. The Environmental Department is responsible for adding all relevant information to this database related to any environmental incident occurring at Henderson.

Verbal reports of environmental incidents are also required to be made to appropriate corporate environmental/legal contacts. As with the preceding electronic reporting, the Environmental Department is responsible for making these verbal reports. The Incident Response Flowchart in Appendix A contains the required contact information.

5.5 External Reporting

Depending on the situation, it may be necessary to report the environmental incident to government or other non-Henderson contacts. The decision to make such a report will be made by the Environmental Department. The Incident Response Flowchart located in Appendix A contains information for potential external contacts to whom an incident may need to be reported. **Unless otherwise instructed, communication with these contacts will only be made by the Environmental Department.**

5.6 Government Agency Reporting

Certain environmental incidents are required to be reported to specified government agencies. These requirements are time sensitive and typically based on:

- Time and duration of the release/spill;
- Type of material released/spilled;
- Quantity of material released/spilled;
- Rate of release/spill of material; and
- Location of release/spill and affected media (i.e. soil, water, air, etc.).

The determination of whether a release/spill is subject to government reporting requirements is often based on complex factors that require special environmental and legal analyses. Additionally, noncompliance with these reporting requirements can result in significant corporate, as well as personal liability. As such, reporting to government agencies will always be coordinated by the Environmental Department.

5.7 Reporting to Downstream Water Users

Downstream water users must also be notified if a spill might affect them. The Water User Advisory Procedure can be found in Appendix E. In the event a spill is in jeopardy of reaching

Clear Creek this procedure needs to be followed. As with the other external contacts, the Environmental Department will make these notifications if necessary.

5.8 Other Reporting (SPCC, SWMP, EPP)

Henderson is required under certain regulatory requirements to maintain environmental plans that contain additional emergency response and reporting requirements. Refer to the Incident Response Flowchart in Appendix A for guidance as to which document should be used in an incident situation.

5.9 Follow-up

Following an initial emergency response, the Emergency Response Coordinator must work with the appropriate Henderson personnel and departments to ensure that cleanup and other recovery activities are completed expediently.

If Henderson personnel cannot safely cleanup a release, a qualified private cleanup company will be hired. To reduce liability, wastes must be disposed of in strict accordance with Federal and State Regulations. As such, it is essential that environmental personnel be involved in cleanup and disposal activities.

Following the emergency incident, all employees involved in the response should participate in a critique which will evaluate:

1. Response;
2. Equipment problems;
3. Training requirements;
4. Root cause, including who, what, when and why; and/or
5. Applicable SOPs, infrastructure, and surveillance.

6.0 RECORDKEEPING

Records are maintained per the appropriate plan and procedure and in accordance with the Company's Records Retention Program.

Appendices - IRM Appendices available upon request

Section Break

Appendix C

SDS Sheets for Designated Chemicals

SDS List – Designated Chemicals

#2 Diesel Fuel
Dowfroth 250-C Frother
Hydrocal 60 Collector Oil
Hydrochloric Acid
Naxolate (Sodium Lauryl Sulfate)
Nokes
Orfom D8 Depressant
Pine Oil
Quicklime
Sodium Hydroxide
Tergitol NP-9/9N9 Surfactant

Section Break

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DIESEL FUEL
Synonyms	:	Seasonal Diesel, #1 Diesel, #2 Heating Oil, #1 Heating Oil, D50, Arctic Diesel, Farm Diesel, Marine Diesel, Low Sulphur Diesel, LSD, Ultra Low Sulphur Diesel, ULSD, Mining Diesel, Naval Distillate, Dyed Diesel, Marked Diesel, Coloured Diesel, Furnace special, Biodiesel blend, B1, B2, B5, Diesel Low Cloud (LC). Marine Gas Oil
Product code	:	101802, 100107, 100668, 100658, 100911, 100663, 100652, 100460, 100065, 101796, 101793, 101795, 101792, 101794, 101791, 100768, 100643, 100642, 100103, 101798, 101800, 101797, 101788, 101789, 101787, 102531, 100734, 100733, 100640, 100997, 100995, 100732, 100731, 100994

Manufacturer or supplier's details

Petro-Canada
P.O. Box 2844, 150 - 6th Avenue South-West
Calgary Alberta T2P 3E3
Canada

Emergency telephone number		Suncor Energy: +1 403-296-3000; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type. Mining diesels, marine diesels, MDO and naval distillates may have a higher flash point requirement.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	Bright oily liquid.
Colour	Clear to yellow (This product may be dyed red for taxation purposes).
Odour	Mild petroleum oil like.

GHS Classification

Flammable liquids	:	Category 3
Acute toxicity (Inhalation)	:	Category 4

Skin irritation	:	Category 2
Carcinogenicity	:	Category 2
Specific target organ toxicity - single exposure	:	Category 3 (Central nervous system)
Specific target organ toxicity - repeated exposure	:	Category 2 (Liver, thymus, Bone)
Aspiration hazard	:	Category 1

GHS Label element

Hazard pictograms :

Signal word : Danger

Hazard statements : H226 Flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.
H332 Harmful if inhaled.
H336 May cause drowsiness or dizziness.
H351 Suspected of causing cancer.
H373 May cause damage to organs (Liver, thymus, Bone) through prolonged or repeated exposure.

Precautionary statements : **Prevention:**
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/ eye protection/ face protection.
P281 Use personal protective equipment as required.
Response:
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.

P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Storage:
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact Skin Absorption
Target Organs	:	Skin Eyes Respiratory Tract
Inhalation	:	May cause respiratory tract irritation. Inhalation may cause central nervous system effects. Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness.
Skin	:	Causes skin irritation.
Eyes	:	Causes eye irritation.
Ingestion	:	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Aspiration hazard if swallowed - can enter lungs and cause damage.
Aggravated Medical Condition	:	None known.

Carcinogenicity:

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
OSHA	No component of this product present at levels greater than or

equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

NTP No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
kerosine (petroleum), hydrodesulfurized	64742-81-0	70 - 100 %
kerosine (petroleum)	8008-20-6	
fuels, diesel	68334-30-5	
fuel oil no. 2	68476-30-2	
Alkanes, C10-20-branched and linear	928771-01-1	0 - 25 %
Soybean oil, Methyl ester	67784-80-9	0 - 5 %
Rape oil, Methyl ester	73891-99-3	
Fatty acids, tallow, Methyl esters	61788-61-2	

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.
Seek medical advice.

Most important symptoms : First aider needs to protect himself.

and effects, both acute and delayed

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Dry chemical Carbon dioxide (CO2) Water fog. Foam
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), sulphur compounds (H2S), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid spark promoters. Ground/bond container and

equipment. These alone may be insufficient to remove static electricity.
Avoid contact with skin, eyes and clothing.
Do not ingest.
Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
kerosine (petroleum), hydrodesulfurized	64742-81-0	TWA	200 mg/m3	ACGIH
kerosine (petroleum)	8008-20-6	TWA	100 mg/m3	NIOSH REL

Engineering measures : Use only in well-ventilated areas.
Ensure that eyewash station and safety shower are proximal to the work-station location.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstances where air-purifying respirators may not provide adequate protection.

Hand protection
Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R). Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for

		wear and tear. At the first signs of hardening and cracks, they should be changed.
Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Bright oily liquid.
Colour	:	Clear to yellow (This product may be dyed red for taxation purposes).
Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	No data available
Boiling point/boiling range	:	150 - 371 °C (302 - 700 °F)
Flash point	:	> 40 °C (104 °F) Method: closed cup
Auto-Ignition Temperature	:	225 °C (437 °F)
Evaporation rate	:	No data available
Flammability	:	Flammable in presence of open flames, sparks and heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. This product can accumulate static charge and ignite.
Upper explosion limit	:	6 %(V)
Lower explosion limit	:	0.7 %(V)
Vapour pressure	:	7.5 mmHg (20 °C / 68 °F)

Relative vapour density	:	4.5
Relative density	:	0.8 - 0.88
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	1.3 - 4.1 cSt (40 °C / 104 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Runoff to sewer may create fire or explosion hazard.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents and acids.
Hazardous decomposition products	:	May release COx, NOx, SOx, H2S, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Eye contact
Ingestion
Inhalation
Skin contact
Skin Absorption

Acute toxicity

Product:

Acute oral toxicity	Remarks: No data available
Acute inhalation toxicity	Remarks: No data available
Acute dermal toxicity	Remarks: No data available

Components:

kerosine (petroleum), hydrodesulfurized:

Acute oral toxicity	LD50 (Rat): > 5,000 mg/kg

Acute inhalation toxicity	LC50 (Rat): > 5.2 mg/l Exposure time: 4 hrs Test atmosphere: dust/mist
Acute dermal toxicity	LD50 (Rabbit): > 2,000 mg/kg

kerosine (petroleum):

Acute oral toxicity	LD50 (Rat): > 5,000 mg/kg
Acute inhalation toxicity	LC50 (Rat): > 5 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	LD50 (Rabbit): > 2,000 mg/kg

fuels, diesel:

Acute oral toxicity	LD50 (Rat): 7,500 mg/kg
Acute dermal toxicity	LD50 (Mouse): 24,500 mg/kg

fuel oil no. 2:

Acute oral toxicity	LD50 (Rat): 12,000 mg/kg
Acute inhalation toxicity	LC50 (Rat): 4.1 mg/l Exposure time: 4 h Test atmosphere: dust/mist

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.
Contaminated packaging	:	Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR

UN/ID No.	:	1202
Proper shipping name	:	Diesel fuel
Class	:	3
Packing group	:	III
Labels	:	3
Packing instruction (cargo aircraft)	:	366

IMDG-Code

UN number	:	1202
Proper shipping name	:	DIESEL FUEL
Class	:	3
Packing group	:	III
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

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

Not applicable for product as supplied.

49 CFR

UN/ID/NA number	:	1202
Proper shipping name	:	Diesel fuel
Class	:	3
Packing group	:	III
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

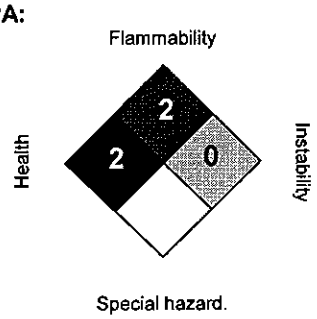
The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
EINECS	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	2
FLAMMABILITY	2
PHYSICAL HAZARD	0
PERSONAL PROTECTION	H

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Section Break

DowFroth 250-C

UNIVAR®

Univar USA Inc Safety Data Sheet

HENDERSON MILL
NOKES BLDG
19302 COUNTY ROAD 3
PARSHALL
CO 80468

SDS No:
Version No: 003 04/19/19
Order No: DV717083

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

SAFETY DATA SHEET

THE DOW CHEMICAL COMPANY

Product name: DOWFROTH™ 250-C Flotation Frother

Issue Date: 06/07/2018
Print Date: 06/11/2018

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

1. IDENTIFICATION

Product name: DOWFROTH™ 250-C Flotation Frother

Recommended use of the chemical and restrictions on use
Identified uses: Flotation frother.

COMPANY IDENTIFICATION
THE DOW CHEMICAL COMPANY
2030 DOW CENTER
MIDLAND MI 48674-0000
UNITED STATES

Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: CHEMTREC +1 800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification
GHS classification in accordance with 29 CFR 1910.1200
Acute toxicity - Category 4 - Oral
Eye irritation - Category 2B

Label elements
Hazard pictograms

Signal word: **WARNING!**

Hazards
Harmful if swallowed.
Causes eye irritation.

Precautionary statements

Prevention
Wash skin thoroughly after handling.
Do not eat, drink or smoke when using this product.

Response
IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/ attention.

Disposal
Dispose of contents/ container to an approved waste disposal plant.

Other hazards
No data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: Glycol ether
This product is a substance.

Component	CASRN	Concentration
Polypropylene glycol monomethyl ether	37286-64-9	>= 92.0 - <= 100.0 %
Propylene glycol monomethyl ether	107-98-2	< 3.0 %
Dipropylene glycol monomethyl ether	34590-94-8	< 8.0 %

4. FIRST AID MEASURES

Description of first aid measures
General advice:
First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air. If not breathing, give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask, etc). If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

Skin contact: Wash off with plenty of water.

Eye contact: Immediately flush eyes with water; remove contact lenses, if present, after the first 5 minutes, then continue flushing eyes for at least 15 minutes. Obtain medical attention without delay, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.

Ingestion: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.

Most important symptoms and effects, both acute and delayed:
Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed
Notes to physician: Maintain adequate ventilation and oxygenation of the patient. Attempt seizure control with diazepam 5-10 mg (adults) intravenous over 2-3 minutes. Repeat every 5-10 minutes as needed. Monitor for hypotension, respiratory depression, and need for intubation. Consider second agent if seizures persist after 30 mg. If seizures persist or recur administer phenobarbital 600-1200 mg (adults) intravenous diluted in 60 ml 0.9% saline given at 25-50 mg/minute. Evaluate for hypoxia, dysrhythmia, electrolyte disturbance, hypoglycemia (treat adults with dextrose 100 mg intravenous). No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Skin contact may aggravate preexisting dermatitis.

5. FIREFIGHTING MEASURES

Suitable extinguishing media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Unsuitable extinguishing media: No data available

Special hazards arising from the substance or mixture
Hazardous combustion products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.

Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters
Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers,

boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Isolate area. Keep unnecessary and unprotected personnel from entering the area. Refer to section 7, Handling, for additional precautionary measures. Keep upwind of spill. Ventilate area of leak or spill. No smoking in area. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

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

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

7. HANDLING AND STORAGE

Precautions for safe handling: Avoid contact with eyes. Wash thoroughly after handling. Do not swallow. Avoid breathing vapor. Use with adequate ventilation. Keep container closed. Containers, even those that have been emptied, can contain vapors. Do not cut, drill, grind, weld, or perform similar operations on or near empty containers. Keep away from heat, sparks and flame. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.
Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

Conditions for safe storage: Store in the following material(s): Carbon steel. Stainless steel. Phenolic lined steel drums. Do not store in: Aluminum. Copper. Galvanized iron. Galvanized steel. See Section 10 for more specific information.

Storage stability

Storage Period:
Steel drums.
24 Month
Bulk
6 Month

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
If exposure limits exist, they are listed below. If no exposure limits are displayed, then no values are applicable.

Component	Regulation	Type of listing	Value/Notation
Propylene glycol monomethyl ether	ACGIH	TWA	50 ppm
	ACGIH	STEL	100 ppm

Dipropylene glycol monomethyl ether	Dow IHG	TWA		10 ppm
	Dow IHG	TWA		SKIN
	Dow IHG	STEL		30 ppm
	Dow IHG	STEL		SKIN
	ACGIH	TWA		100 ppm
	ACGIH	STEL		150 ppm
	ACGIH	TWA		SKIN
	OSHA Z-1	TWA	600 mg/m3	100 ppm
	ACGIH	STEL		SKIN
	OSHA Z-1	TWA		SKIN

Biological occupational exposure limits

Components	CAS-No.	Control parameters	Biological specimen	Sampling time	Permissible concentration	Basis
Propylene glycol monomethyl ether	107-98-2				100 mg/g	
					100 mg/g	
					100 mg/g	
					100 mg/g	

Exposure controls

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

Individual protection measures

Eye/face protection: Use chemical goggles.

Skin protection

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

Other protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. For most conditions, no respiratory protection should be needed; however, if material is heated or sprayed, use an approved air-purifying respirator.
The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	Liquid.
Color	Colorless
Odor	Mild
Odor Threshold	No test data available
pH	Not applicable
Melting point/range	No test data available
Freezing point	No test data available
Boiling point (760 mmHg)	> 175 °C (> 347 °F) *Literature*
Flash point	**closed cup** > 93 °C (> 199 °F) *ASTM D3828*
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammability (solid, gas)	Not expected to form explosive dust-air mixtures.
Lower explosion limit	No test data available
Upper explosion limit	No test data available
Vapor Pressure	0.001 mmHg at 25 °C (77 °F) *Literature*
Relative Vapor Density (air = 1)	low volatile
Relative Density (water = 1)	0.971 - 0.986 at 25 °C (77 °F) / 25 °C *Literature*
Water solubility	100 % *Literature*
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	No test data available
Decomposition temperature	No test data available
Kinematic Viscosity	6 - 12 mm2/s at 37.8 °C (100.0 °F) *Literature*
Explosive properties	No
Oxidizing properties	No
Molecular weight	No data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: No data available

Chemical stability: Thermally stable at typical use temperatures.

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Do not distill to dryness. Product can oxidize at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.

Incompatible materials: Avoid contact with: Strong acids. Strong oxidizers.

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

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity
Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Observations in animals include: Convulsions. Tremors.

As product: Single dose oral LD50 has not been determined.

For similar material(s):
LD50, Rat, 1,260 mg/kg

Acute dermal toxicity
Prolonged skin contact is unlikely to result in absorption of harmful amounts. Prolonged skin contact with very large amounts may cause dizziness or drowsiness.
As product: The dermal LD50 has not been determined.

Acute inhalation toxicity
At room temperature, exposure to vapor is minimal due to low volatility; single exposure is not likely to be hazardous. If material is heated or aerosol/mist is produced, concentrations may be attained that are sufficient to cause respiratory irritation and other effects. Symptoms of excessive exposure may be anesthetic or narcotic effects; dizziness and drowsiness may be observed.
As product: The LC50 has not been determined.

Skin corrosion/irritation
Brief contact is essentially nonirritating to skin.
Prolonged contact may cause moderate skin irritation with local redness.
May cause more severe response if skin is abraded (scratched or cut).
May cause more severe response on covered skin (under clothing, gloves).
May cause drying and flaking of the skin.

Serious eye damage/eye irritation
May cause moderate eye irritation.
May cause moderate corneal injury.
Effects may be slow to heal.

Sensitization
For skin sensitization:
No relevant data found.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Symptoms of excessive exposure may be anesthetic or narcotic effects; dizziness and drowsiness may be observed.
Contains component(s) which have been reported to cause effects on the following organs in animals:
Kidney.
Liver.

Carcinogenicity
No relevant data found.

Teratogenicity
Contains component(s) which, in laboratory animals, have been toxic to the fetus only at doses toxic to the mother. Contains component(s) which did not cause birth defects in laboratory animals.

Reproductive toxicity
In animal studies on component(s), effects on reproduction were seen only at doses that produced significant toxicity to the parent animals.

Mutagenicity
In vitro genetic toxicity studies were negative for component(s) tested.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

COMPONENTS INFLUENCING TOXICOLOGY:

Polypropylene glycol monomethyl ether

Acute dermal toxicity
The dermal LD50 has not been determined. Prolonged skin contact with very large amounts may cause dizziness or drowsiness.

Acute inhalation toxicity
At room temperature, exposure to vapor is minimal due to low volatility; single exposure is not likely to be hazardous. If material is heated or aerosol/mist is produced, concentrations may be attained that are sufficient to cause respiratory irritation and other effects. Symptoms of excessive exposure may be anesthetic or narcotic effects; dizziness and drowsiness may be observed.

As product: The LC50 has not been determined.

Propylene glycol monomethyl ether

Acute dermal toxicity
LD50, Rabbit, > 2,000 mg/kg No deaths occurred at this concentration.

Acute inhalation toxicity
Brief exposure (minutes) is not likely to cause adverse effects. The odor is objectionable at 100 ppm; higher levels produce eye, nose, and throat irritation and are intolerable at 1000 ppm. Anesthetic effects are seen at or above 1000 ppm.

LC50, Rat, 6 Hour, vapour, > 25.8 mg/l

Dipropylene glycol monomethyl ether

Acute dermal toxicity
LD50, Rabbit, 9,510 mg/kg

Acute inhalation toxicity
LC50, Rat, 7 Hour, vapour, 3.35 mg/l No deaths occurred at this concentration.

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity

Acute toxicity to fish
Based on information for a similar material:
Material is practically non-toxic to fish on an acute basis (LC50 > 100 mg/L).

Based on information for a similar material:
LC50, emerald shiner (Notropis atherinoides), static test, 96 Hour, > 100 mg/l, Method Not Specified.

Persistence and degradability

Biodegradability: Based on information for a similar material: Biodegradation under aerobic static laboratory conditions is low (BOD20 or BOD28/ThOD between 2.5 and 10%).

Theoretical Oxygen Demand: 2.12 mg/mg

Chemical Oxygen Demand: 2.07 mg/mg

Biological oxygen demand (BOD)

Incubation Time	BOD
5 d	0 %
10 d	0 %
20 d	8.5 %

Bioaccumulative potential

Bioaccumulation: Based on information for a similar material: No bioconcentration is expected because of the relatively high water solubility.

Mobility in soil

Based on information for a similar material:
Potential for mobility in soil is very high (Koc between 0 and 50).

13. DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and

compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device.

14. TRANSPORT INFORMATION

DOT

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Not regulated for transport

Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code: Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312
Acute toxicity (any route of exposure)
Serious eye damage or eye irritation

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Pennsylvania Worker and Community Right-To-Know Act:
The following chemicals are listed because of the additional requirements of Pennsylvania law:

Components	CASRN
Propylene glycol monomethyl ether	107-98-2
Dipropylene glycol monomethyl ether	34590-94-8

California Prop. 65
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

United States TSCA Inventory (TSCA)
All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

16. OTHER INFORMATION

Product Literature
Additional information on this product may be obtained by calling your sales or customer service contact.

Hazard Rating System
NFPA

Health	Flammability	Instability
2	1	0

Revision
Identification Number: 38870 / A001 / Issue Date: 06/07/2018 / Version: 6.1
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

ACGIH	USA. ACGIH Threshold Limit Values (TLV)
Dow IHG	Dow Industrial Hygiene Guideline
OSHA Z-1	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
SKIN	Absorbed via skin
STEL	Short term exposure limit
TWA	Time weighted average

Full text of other abbreviations
AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of

Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Information Source and References
This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

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

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

Univar USA Inc. ("Univar") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this SDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

Section Break

SAFETY DATA SHEET

Hydrocal 60

Section 1. Identification

GHS product identifier : Hydrocal 60

Product code : 1080-00-C

Chemical name : Distillates (petroleum), hydrotreated light naphthenic

Other means of identification : Baseoil - unspecified; Hydrotreated light naphthenic distillate solvent extract (petroleum); Distillates, petroleum, hydrotreated light naphthenic; Hydrotreated light naphthenic distillate, solvent extract, petroleum; Distillates (petroleum), hydrotreated light naphthenic.; Mineral oil, petroleum distillates, hydrotreated light naphthenic; Mineral oil, petroleum distillates, hydrotreated (severe) light naphthenic

Product type : Liquid.

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

Identified uses
Petrochemical industry: Petroleum refining. Naphthenic Lubricant.

Uses advised against	Reason
Not available.	

Supplier's details : Calumet Specialty Products Partners, L.P.
2780 Waterfront Pkwy E. Dr.
Suite 200
Indianapolis, Indiana 46214 USA
Technical Services: 317-328-5660

Calumet Sales Company Incorporated
Pa Monument Chemical BVBA
Haven 1972, Ketenislaan 3
B-9130 Kallo (Kieldrecht)
Belgium
+32 3 570 25 20

Emergency telephone number (with hours of operation) : 24 hr. CHEMTREC 1-800-424-9300 / International 1-703-527-3887

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : May be fatal if swallowed and enters airways.

Precautionary statements

Prevention : Not applicable.

Section 2. Hazards identification

Response : IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : Distillates (petroleum), hydrotreated light naphthenic

Other means of identification : Baseoil - unspecified; Hydrotreated light naphthenic distillate solvent extract (petroleum); Distillates, petroleum, hydrotreated light naphthenic; Hydrotreated light naphthenic distillate, solvent extract, petroleum; Distillates (petroleum), hydrotreated light naphthenic.; Mineral oil, petroleum distillates, hydrotreated light naphthenic; Mineral oil, petroleum distillates, hydrotreated (severe) light naphthenic

CAS number/other identifiers

CAS number : 64742-53-6

Ingredient name	%	CAS number
Distillates (petroleum), hydrotreated light naphthenic	100	64742-53-6

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

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

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

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

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Section 4. First aid measures

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : May be fatal if swallowed and enters airways.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : Adverse symptoms may include the following:
nausea or vomiting

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

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

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

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

Unsuitable extinguishing media : Do not use water jet.

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

Hazardous thermal decomposition products : No specific data.

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

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

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

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

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

Section 6. Accidental release measures

Methods and materials for containment and cleaning up

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

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

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not swallow. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

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

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

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Distillates (petroleum), hydrotreated light naphthenic	**ACGIH TLV (United States, 4/2014).** TWA: 5 mg/m³ 8 hours. Form: Inhalable fraction **NIOSH REL (United States, 10/2013).** TWA: 5 mg/m³ 10 hours. Form: Mist STEL: 10 mg/m³ 15 minutes. Form: Mist **OSHA PEL (United States, 2/2013).** TWA: 5 mg/m³ 8 hours.

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

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

Individual protection measures

Section 8. Exposure controls/personal protection

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

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

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

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

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

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

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Mobile liquid.]

Color : Clear. Colorless to light yellow.

Odor : Mild. Hydrocarbon.

Odor threshold : Not available.

pH : Not available.

Melting point : 0°C (32°F)

Boiling point : 270.56 to 371.11°C (519 to 700°F)

Flash point : Open cup: 146.11°C (295°F) [Cleveland.]

Evaporation rate : <0.038 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

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

Vapor pressure : 0.00069 kPa (0.0052 mm Hg) [room temperature]

Vapor density : Not available.

Relative density : 0.895

Solubility : Insoluble in the following materials: cold water and hot water.

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

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C (104°F)): 0.0995 cm^2/s (9.95 cSt)

Section 10. Stability and reactivity

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

Chemical stability : The product is stable.

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

Conditions to avoid : No specific data.

Incompatible materials : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Distillates (petroleum), hydrotreated light naphthenic	LC50 Inhalation Dusts and mists	Rat	5.7 mg/l	4 hours
	LD50 Oral	Rat	>5000 mg/kg	-

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Conclusion/Summary : The classification as a carcinogen need not apply if it can be shown that the substance contains less than 3 % DMSO extract as measured by IP 346.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Name	Result
Distillates (petroleum), hydrotreated light naphthenic	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure : Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Section 11. Toxicological information

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : Adverse symptoms may include the following: nausea or vomiting

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

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

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

Section 12. Ecological information

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

Section 13. Disposal considerations

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

RCRA classification : Not Regulated

Section 14. Transport information

	DOT Classification	TDG Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.

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

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

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: This material is listed or exempted.
This material is listed or exempted.

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

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Section 15. Regulatory information

Composition/information on ingredients

No products were found.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is not listed.

California Prop. 65

This product is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International lists

National inventory

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : This material is listed or exempted.

Malaysia : This material is listed or exempted.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Taiwan : This material is listed or exempted.

Section 16. Other information

Procedure used to derive the classification

Classification	Justification
Asp. Tox. 1, H304	On basis of test data

History

Date of issue/Date of revision : 02/25/2015

Version : 1

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

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

Section Break

Univar USA Inc Safety Data Sheet

SDS No:	
Version No:	001 2017-10-17
Order No:	

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

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HYDROCHLORIC ACID SOLUTIONS

Version 3.0

Revision Date 12/10/2015 Ref. 150000000889

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	HYDROCHLORIC ACID SOLUTIONS
Product Grade/Type	:	HCL, HCL 20 DEG, HCL 23 DEG
Product Use	:	Industrial applications, For industrial use only.
Restrictions on use	:	Do not use product for anything outside of the above specified uses
Manufacturer/Supplier	:	The Chemours Company FC, LLC 1007 Market Street Wilmington, DE 19899 United States of America
Product Information	:	1-844-773-CHEM (outside the U.S. 1-302-773-1000)
Medical Emergency	:	1-866-595-1473 (outside the U.S. 1-302-773-2000)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Product hazard category

Corrosive to metals	Category 1
Acute toxicity (Inhalation)	Category 4
Skin corrosion	Category 1
Serious eye damage/eye irritation	Category 1
Aspiration hazard	Category 1

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Label content

Pictogram :

Signal word : Danger

Hazardous warnings : May be corrosive to metals.
May be fatal if swallowed and enters airways.
Causes severe skin burns and eye damage.
Causes serious eye damage.
Harmful if inhaled.

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Hazardous prevention measures : Keep only in original container.
Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
Wash contaminated clothing before reuse.
Absorb spillage to prevent material damage.
Store locked up.
Store in corrosive resistant stainless steel container with a resistant inner liner.
Dispose of contents/ container to an approved waste disposal plant.

Other hazards
No applicable data available.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Water	7732-18-5	60 - 70 %
Hydrochloric acid	7647-01-0	30 - 40 %

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SECTION 4. FIRST AID MEASURES

General advice	:	Remove from exposure, lie down. Never give anything by mouth to an unconscious person. When symptoms persist or in all cases of doubt seek medical advice.
Inhalation	:	Move to fresh air. Keep patient warm and at rest. Artificial respiration and/or oxygen may be necessary. Call a physician immediately.
Skin contact	:	*Take off contaminated clothing and shoes immediately. Wash off immediately* with plenty of water. Call a physician immediately.
Eye contact	:	Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention. Remove contact lenses, if present and easy to do. Continue rinsing.
Ingestion	:	Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. If possible drink milk afterwards. Call a physician immediately.
Most important symptoms/effects, acute and delayed	:	Lachrymation Shortness of breath Pain sweating Erythema Skin disorders corrosive effects
Protection of first-aiders	:	No applicable data available.
Notes to physician	:	Risk of product entering the lungs on vomiting after ingestion. Do not give adrenaline or similar drugs. Administer repeated doses of glucocorticoid aerosol and ensure that they are deeply inhaled. Later control for pneumonia and lung oedema.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	The product itself does not burn., Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No applicable data available.

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Specific hazards	:	Hazardous decomposition products formed under fire conditions. Hazardous decomposition products may include: Hydrogen chloride gas
Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment. Exposure to decomposition products may be a hazard to health.
Further information	:	Will react with most metals, releasing potentially explosive hydrogen gas. Cool containers/tanks with water spray. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	:	Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Ventilate the area. Refer to protective measures listed in sections 7 and 8.
Environmental precautions	:	Prevent further leakage or spillage. Try to prevent the material from entering drains or water courses. Prevent spreading over a wide area (e.g. by containment or oil barriers). Prevent material from entering sewers, waterways, or low areas. Should not be released into the environment.
Spill Cleanup	:	Suppress (knock down) gases/vapours/mists with a water spray jet. Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Dispose of in an approved container. Dispose of in accordance with local regulations. Small amounts: Neutralize with lime milk or soda and flush with plenty of water.
Accidental Release Measures	:	No applicable data available.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel) : Avoid contact with skin, eyes and clothing. Avoid breathing mist. Handle

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product only in closed system or provide appropriate exhaust ventilation at machinery. For personal protection see section 8.
Handle in accordance with good industrial hygiene and safety practice. When using do not eat, drink or smoke. Do not breathe vapours or spray mist. Avoid contact with skin, eyes and clothing.

Handling (Physical Aspects) : The product is not flammable. Contact with metals may lead to the formation of hydrogen and nitrous gases - explosion hazard.

Dust explosion class : No applicable data available.

Storage : Keep container tightly closed in a dry and well-ventilated place. Store in original container. Protect from contamination. Store in corrosive resistant polyethylene container with a resistant inner liner. Store in corrosive resistant polypropylene container with a resistant inner liner. Store only in approved containers.
Alkali metals Oxidizing agents Keep away from oxidizing agents, strongly alkaline and strongly acid materials in order to avoid exothermic reactions.
No decomposition if stored and applied as directed.

Storage period : No applicable data available.

Storage temperature : No applicable data available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls : Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Respiratory protection : For rescue and maintenance work in storage tanks use self-contained breathing apparatus. In case of mist or aerosol exposure wear suitable personal respiratory protection.

Hand protection : Material: Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374.
Glove thickness: 0.11 mm
Wearing time: 8 h
Additional protection: Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is

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used, such as the danger of cuts, abrasion, and the contact time.

Eye protection : Safety glasses with side-shields Additionally wear a face shield where the possibility exists for face contact due to splashing, spraying or airborne contact with this material.

Skin and body protection : Complete suit protecting against chemicals.

Exposure Guidelines
Exposure Limit Values

Hydrochloric acid				
Permissible exposure limit:	(OSHA)	5 ppm	7 mg/m3	TLV-C
TLV	(ACGIH)	2 ppm	TLV-C	

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance
Physical state : liquid
Form : liquid
Color : colourless

Odor : stinging

Odor threshold : No applicable data available.

pH : < 1

Melting point/freezing point : Melting point/range
ca. -40 - -35 °C (-40 - -31 °F)

Boiling point/boiling range : Boiling point/boiling range
ca. 57 °C (135 °F)

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Flash point	:	does not flash
Evaporation rate	:	No applicable data available.
Flammability (solid, gas)	:	No applicable data available.
Upper explosion limit	:	Not applicable
Lower explosion limit	:	No applicable data available.
Vapor pressure	:	13 - 22 hPa at 20 °C (68 °F)
Vapour density	:	No applicable data available.
Density	:	ca. 1.1 - 1.3 g/cm3 at 20 °C (68 °F)
Specific gravity (Relative density)	:	No applicable data available.
Water solubility	:	completely miscible
Solubility(ies)	:	No applicable data available.
Partition coefficient: n-octanol/water	:	No applicable data available.
Auto-ignition temperature	:	No applicable data available.
Decomposition temperature	:	No applicable data available.
Viscosity, kinematic	:	No applicable data available.
Viscosity, dynamic	:	No applicable data available.
Phys-chem data	:	No other data to be specially mentioned.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Exothermic reaction with bases.

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Chemical stability	:	The product is chemically stable under recommended conditions of storage, use and temperature.
Possibility of hazardous reactions	:	Corrosive in contact with metals Gives off hydrogen by reaction with metals. Exothermic reaction with bases. Heating can release hazardous gases. corrosive and irritating fumes Hydrogen chloride Chlorine
Conditions to avoid	:	Will react with most metals, releasing potentially explosive hydrogen gas.
Incompatible materials	:	Ammonia Amines Alkaline earth metals Bases Powdered metals Cyanides Light and/or alkaline metals Powdered metal salts strong oxidants Reacts with oxidizing agents, generating chlorine.
Hazardous decomposition products	:	Hazardous decomposition products: Hydrogen, by reaction with metals, Hazardous thermal decomposition products may include:, Hydrogen chloride gas, Chlorine, Heating or fire can release toxic gas.

SECTION 11. TOXICOLOGICAL INFORMATION

HYDROCHLORIC ACID SOLUTIONS

Further information	:	Vapours may cause irritation to the eyes, respiratory system and the skin.Inhalation of vapours in high concentration may cause shortness of breath (lung oedema).Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation.

Hydrochloric acid

Inhalation 4 h LC50	:	1 mg/l , Rat Target Organs: Respiratory Tract Respiratory tract irritation
Skin irritation	:	Causes severe burns., Rabbit
Eye irritation	:	Risk of serious damage to eyes., Rabbit

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Carcinogenicity : Not classifiable as a human carcinogen.

Carcinogenicity

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity
Hydrochloric acid

96 h LC50	:	Lepomis macrochirus (Bluegill sunfish) 3.25 mg/l
72 h ErC50	:	Chlorella vulgaris (Fresh water algae) 4.7 mg/l OECD Test Guideline 201
48 h EC50	:	Daphnia magna (Water flea) 4.92 mg/l OECD Test Guideline 202

Environmental Fate

Hydrochloric acid

Bioaccumulation	:	Does not bioaccumulate.
Additional ecological information	:	Ecotoxic effect due to strong pH shift.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal methods - Product	:	Can be disposed as waste water, when in compliance with local regulations.
Contaminated packaging	:	If recycling is not practicable, dispose of in compliance with local regulations.

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SECTION 14. TRANSPORT INFORMATION

DOT	UN number	: 1789
	Proper shipping name	: Hydrochloric acid
	Class	: 8
	Packing group	: II
	Labelling No.	: 8
	Reportable Quantity	: 5000 lbs Hydrogen chloride
IATA_C	UN number	: 1789
	Proper shipping name	: Hydrochloric acid
	Class	: 8
	Packing group	: II
	Labelling No.	: 8
IMDG	UN number	: 1789
	Proper shipping name	: HYDROCHLORIC ACID
	Class	: 8
	Packing group	: II
	Labelling No.	: 8

SECTION 15. REGULATORY INFORMATION

TSCA	: Listed
SARA 313 Regulated Chemical(s)	: Hydrochloric acid
PA Right to Know Regulated Chemical(s)	: Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Hydrochloric acid...%

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NJ Right to Know Regulated Chemical(s)	:	Substances on the New Jersey Workplace Hazardous Substance List present at a concentration of 1% or more (0.1% for substances identified as carcinogens, mutagens or teratogens): Hydrochloric acid...%
CERCLA Reportable Quantity	:	15152 lbs Based on the percentage composition of this chemical in the product.: Hydrochloric acid...%
SARA Reportable Quantity	:	15152 lbs Based on the percentage composition of this chemical in the product.: Hydrochloric acid...%
California Prop. 65	:	Chemicals known to the State of California to cause cancer, birth defects or any other harm: none known

SECTION 16. OTHER INFORMATION

Before use read Chemours safety information. For further information contact the local Chemours office or nominated distributors.

Revision Date : 12/10/2015

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

Notice

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Do not use ingredient information and/or ingredient percentages in this SDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein.

This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

Section Break

NAXOLATE® AS-LG95

SAFETY DATA SHEET

OSHA HCS (29 CFR 1910.1200)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product identifier

Chemical Name	Mixture
Trade name	NAXOLATE® AS-LG95
CAS No.	68585-47-7 (ALT: 151-21-3)

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

Identified use(s)	Surfactant
Uses advised against	None

Details of the supplier of the safety data sheet

Company Identification	Nease Co. LLC 10740 Paddys Run Road Harrison, OH 45030
Telephone	(513) 738-1255
Telephone (Product Information)	(888) 762-7373
Fax	(513) 587-2828
E-Mail (competent person)	techservice@neaseco.com

Emergency telephone number

Emergency Phone No.	(513) 738-1255 CHEMTREC 24 hr. (800) 424-9300

SECTION 2: HAZARDS IDENTIFICATION

Classification of the substance or mixture

OSHA HCS (29 CFR 1910.1200) — Eye Dam. 1; Skin Irrit. 2; May form combustible dust concentrations in air.

Label elements

Signal word(s): **DANGER**

Hazard statement(s):
Causes serious eye damage.
Causes skin irritation.
May form combustible dust concentrations in air

Precautionary statement(s):

Wear protective gloves/protective clothing/eye protection/face protection.

Keep work areas free of dust accumulation. Enclosed material handling equipment (conveyors, ventilation, precipitators, etc.) must be designed and maintained so as not to be a source of ignition Wear protective gloves/protective clothing/eye protection/face protection.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical attention.

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. If irritation (redness, rash, blistering) develops, get medical attention.

IF SWALLOWED: rinse mouth. Do NOT induce vomiting.

Other hazards Harmful to aquatic life with long lasting effects. Not classified as PBT or vPvB.

Additional Information: None.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Composition/information on ingredients	%W/W	CAS No.	Hazard statement(s)
Sulfuric acid, mono-C10-C16 alkyl esters, sodium salts	>90%	68585-47-7 (ALT: 151-21-3	Harmful if swallowed. Harmful if inhaled. Causes skin irritation. Causes serious eye damage. May cause respiratory irritation. Harmful to aquatic life with long lasting effects.
Dodecyl alcohol	<3%	112-53-8	Causes eye irritation. Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.
Sodium sulfate	<6%	7757-82-6	None
Water	<4%	7732-18-5	None

Additional Information- None

SECTION 4: FIRST AID MEASURES

Description of first aid measures

Inhalation — Remove to fresh air and keep at rest in a position comfortable for breathing. If breathing is laboured, administer oxygen. If breathing has stopped, apply artificial respiration.

Skin Contact — Wash affected skin with plenty of water. Continue to wash the affected area for at least 15 minutes. Remove contaminated clothing and wash clothing before reuse.

Eye Contact — Immediately flush eyes for at least 15 minutes. Hold eye open and rinse slowly and gently with water. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical attention.

Ingestion — If ingested, rinse mouth. Do not induce vomiting. Seek medical treatment.

Most important symptoms and effects, both acute and delayed None

Indication of any immediate medical attention and special treatment needed None

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing media

-Suitable Extinguishing Media — Extinguish with waterspray, dry chemical, sand or carbon dioxide or foam. Do not use water jet on a leak from the tank. Water spray should be used to cool containers.

-Unsuitable Extinguishing Media — None anticipated.

Special hazards arising from the substance or mixture None anticipated.

Advice for fire-fighters Fire fighters should wear complete protective clothing including self-contained breathing apparatus. Water spray should be used to cool containers.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures — Remove all ignition sources. Avoid breathing dust. Put on protective equipment before entering danger area.

Environmental precautions — Do not allow to enter drains, sewers or watercourses.

Methods and material for containment and cleaning up — Contain spillages with sand, earth or any suitable adsorbent material. Transfer to a container for disposal or recovery. Wash the spillage area with water. If possible prevent water running into sewers.

Reference to other sections — None

Additional Information — None

SECTION 7: HANDLING AND STORAGE

Precautions for safe handling — Keep container in a well-ventilated place. Keep container closed. Empty container may contain product residues. Ground/bond container and receiving equipment. Follow precautions for safe handling after container is empty.

Conditions for safe storage, including any incompatibilities

-Storage Temperature — Not specified.

-Incompatible materials — None known.

Specific end use(s) — Surfactant

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Occupational exposure limits

SUBSTANCE.	CAS No.	LTEL (8 hr TWA mg/m³)		STEL (mg/m³)		Note:
		PEL (OSHA)	TLV (ACGIH)	PEL (OSHA)	TLV (ACGIH)	
Particulate Matter	-----	15^ / 10*	10^^ / 3*	-----	-----	See below

- TWA = Time-Weighted Average; STEL: Short Term Exposure Limit;
- ^Total Dust / *Respirable Dust / ^^Inhalable Dust

Recommended monitoring method — NIOSH O500 / 0600, IOM Sampling Method

Exposure controls

Appropriate engineering controls — Not normally required.

Personal protection equipment

Eye/face protection — Wear protective eyewear (goggles, face shield, or safety glasses).

Skin protection (Hand protection/ Other) — The following to be used as necessary: Gloves (Neoprene or Natural rubber). Check with protective equipment manufacturer's data.

Respiratory protection — No personal respiratory protective equipment normally required. Avoid generation of mist. An approved dust mask should be worn if dust/mist is generated during handling.

Thermal hazards — Use gloves with insulation for thermal protection, when needed.

Environmental Exposure Controls — Do not allow to enter drains, sewers or watercourses.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	solid
Colour	White
Odour	Mild, Fatty Odour
Odour Threshold (ppm)	Not available.
pH (Value)	7- 9.5 (1% aqueous solution)
Melting Point (°C) / Freezing Point (°C)	Not available.
Boiling point/boiling range (°C):	Not available.
Flash Point (°C)	Not applicable.
Evaporation rate (butyl acetate=1)	Not available.
Flammability (solid, gas)	May form combustible dust concentrations in air.
Explosive limit ranges	Not available.
Vapour Pressure (Pascal)	Low.
Vapour Density (Air=1)	Not available.
Density (g/ml)	Not available.
Solubility (Water)	Soluble.
Solubility (Other)	Not available.
Partition Coefficient (n-Octanol/water)	Not available.
Auto Ignition Temperature (°C)	Not available.
Decomposition Temperature (°C)	Not available.
Kinematic Viscosity (cSt) @ 40°C	Not available.
Explosive properties	Not available
Oxidising properties	Not oxidising.

Other information Not available.

SECTION 10: STABILITY AND REACTIVITY

Reactivity	Stable under normal conditions.
Chemical stability	Stable.
Possibility of hazardous reactions	None anticipated.
Conditions to avoid	Incompatible materials.
Incompatible materials	None known.
Hazardous Decomposition Product(s)	Carbon monoxide, Carbon dioxide, Sulphur oxides

SECTION 11: TOXICOLOGICAL INFORMATION

Exposure routes: Skin Contact**,** Eye Contact

Substances in preparations / mixtures

Sulfuric acid, mono-C10-a6 alkyl esters, sodium salts (CAS 68585-47-7)

Acute toxicity	Oral: LD50 = 1200 mg/kg bw Dermal: LD50 > 2000 mg/kg (By analogy with similar materials)
Irritation/Corrosivity	Causes serious eye damage. Causes skin irritation.
Sensitization	It is not a skin sensitiser. (By analogy with similar materials)
Repeated dose toxicity	NOAEL: 488 mg/kg/day (13 weeks, feed, Systemic effects) LOAEL: 1016 mg/kg/day (13 weeks, feed, Systemic effects)
Carcinogenicity	It is unlikely to present a carcinogenic hazard to man.

NTP	IARC	ACGIH	OSHA	NIOSH
No.	No.	No.	No.	No.

Mutagenicity	There is no evidence of mutagenic potential.
Toxicity for reproduction	Not to be expected. NOAEL: >300 mg/kg/day (parental) (By analogy with similar materials) NOEL: >300 mg/kg/day (developmental) (By analogy with similar materials)

Dodecyl alcohol (CAS No. 112-53-8)

Acute toxicity	Oral: LD50 > 2000 mg/kg bw Dermal: LD50 = 8000-12000 mg/kg Inhalation: LC50 > 71 mg/l (1 hour, mist, By analogy with similar materials)
Irritation/Corrosivity	Causes eye irritation. Not Irritating to skin.
Sensitization	It is not a skin sensitiser.
Repeated dose toxicity	NOAEL:= 2000 mg/kg/day (14-54 days, feed, Systemic effects) NOEL: <100 mg/kg/day (14-54 days, feed, Systemic effects)
Carcinogenicity	It is unlikely to present a carcinogenic hazard to man.

NTP	IARC	ACGIH	OSHA	NIOSH
No.	No.	No.	No.	No.

Mutagenicity	There is no evidence of mutagenic potential.
Toxicity for reproduction	Not to be expected. NOAEL:= 2000 mg/kg/day (parental)

SECTION 12: ECOLOGICAL INFORMATION

Toxicity - Substances in preparations / mixtures

Sulfuric acid, mono-C10-a6 alkyl esters, sodium salts (CAS 68585-47-7)

Short term	LC50 (96 hour): 29 mg/L *(Pimephales promelas)* LC50 (48 hour): 5.55 mg/l (*Ceriodaphnia dubia,* mortality*)* EC50 (72 hour): >120 mg/l (*Desmodesmus subspicatus*)
Long Term	NOEC (42 days): >1.357 mg/l (*Pimephales promelas, Weight*) NOEC (7 days): 0.88 mg/L (*Ceriodaphnia dubia, reproduction*)
Persistence and degradability	Biodegradable.
Bioaccumulative potential	Not available.
Mobility in soil	The substance has low mobility in soil.
Results of PBT and vPvB assessment	Not classified as PBT or vPvB.
Other adverse effects	None

Dodecyl alcohol (CAS No. 112-53-8)

Short term	LC50 (96 hour): 1.01 mg/L *(Pimephales promelas)* LC50 (48 hour): 0.765 mg/l (*Daphnia magna,* immobilisation*)* EC50 (72 hour): 0.33 mg/l (*Desmodesmus subspicatus*)
Long Term	NOEC (21 days): 14 µg/l (*Daphnia magna,* reproduction)
Persistence and degradability	Readily biodegradable.
Bioaccumulative potential	The substance has low potential for bioaccumulation.
Mobility in soil	The substance has low mobility in soil.
Results of PBT and vPvB assessment	Not classified as PBT or vPvB.
Other adverse effects	None

SECTION 13: DISPOSAL CONSIDERATIONS

Waste treatment methods	Dispose of contents in accordance with local, state or national legislation.
Additional Information	None known.

SECTION 14: TRANSPORT INFORMATION

	Land transport (U.S. DOT)	Sea transport (IMDG)	Air transport (ICAO/IATA)
UN number			
Proper Shipping Name		**Not classified as dangerous for transport**	
Transport hazard class(es)			
Packing group			
Hazard label(s)			
Environmental hazards			
Special precautions for user			

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:

SECTION 15: REGULATORY INFORMATION

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

TSCA (Toxic Substance Control Act) - Inventory Status**:** All components listed or polymer exempt.
Canada Domestic Substance List (DSL) - Listed

Designated Hazardous Substances and Reportable Quantities (40 CFR 302.4):

Chemical Name	CAS No.	Typical %wt.	RQ (Pounds)
None	----	----	----

SARA 311/312 - Hazard Categories:

☐ Fire ☐ Sudden Release ☐ Reactivity ☒ Immediate (acute) ☐ Chronic (delayed)

SARA 313 - Toxic Chemicals (40 CFR 372):

Chemical Name	CAS No.	Typical %wt.
None	------	-----

SARA 302 - Extremely Hazardous Substances(40 CFR 355):

Chemical Name	CAS No.	Typical %wt.
None	------	----

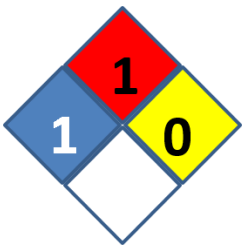
SECTION 16: OTHER INFORMATION

The following sections contain revisions or new statements: 1-16

Date of preparation: May 3, 2016

Additional Information:

HMIS (Hazardous Material Information System)



NFPA (National Fire Protection Association)

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Section Break

Tessenderlo KERLEY

Safety Data Sheet

Liquid Nokes Reagent

SDS Number: 4560 **Revision:** October 25, 2018

Section 1: IDENTIFICATION

1.1 Product Name: **Liquid Nokes Reagent**

1.2 Other Identification:

Chemical Family: Inorganic salt solution, thiophosphates
Formula: Blend of thiophosphates, predominately $Na_3PS_2O_2$

1.3 Recommended Use of Chemical: Mining reagent (depressant)

1.4 Manufacturer: Tessenderlo Kerley, Inc.
2255 N. 44th Street, Suite 300
Phoenix, Arizona 85008-3279
Information: (602) 889-8300

1.5 Emergency Contact: Tessenderlo Kerley, Inc. (800) 877-1737
CHEMTREC (800) 424-9300 (Domestic)
(703) 527-3887 (International)

Section 2: HAZARD(S) IDENTIFICATION

2.1 Hazard Classification:

Health	Acute Toxicity – Oral	Category 4
	Acute Toxicity – Dermal	Category 4
	Acute Toxicity – Inhalation	Category 3
	Skin Corrosion/Irritation	Category 1A
	Eye Damage/Irritation	Category 1
Physical	None	

2.2 Signal Word: **DANGER**

2.3 Hazard Statement(s):
Harmful if swallowed
Harmful in contact with skin
Toxic if inhaled
Causes severe skin burns and eye damage
Causes serious eye damage

2.4 Symbol(s):

2.5 Precautionary Statement(s):

If swallowed: Rinse mouth. Do NOT induce vomiting. Immediately call a poison center/doctor/regional medical center.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Immediately call a poison center/doctor/regional medical center. Wash contaminated clothing before reuse.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor/regional medical center.
If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor/regional medical center.
Wash hands and face thoroughly after handling. Do not eat, drink or smoke when using this product.
Wear neoprene rubber gloves, chemical suit and boots and chemical goggles and full-face shield.
Do not breathe fumes/gas/mist/vapors/spray.
Use only outdoors or in a well-ventilated area. Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Dispose of contents/container to chemical waste facility in accordance with local/state/federal regulations.
Do not allow release to aquatic waterways.

2.6 Unclassified Hazard(s): Aquatic toxicity

2.7 Unknown Toxicity Ingredient: None

Section 3: COMPOSITION/INFORMATION on INGREDIENTS

3.1 Chemical Ingredients: (See Section 8 for exposure guidelines)

Chemical	Synonym Common Name	CAS No.	EINECS No.	% By Wt.
Phosphorus Sulfide (P_2S_5), reaction products with sodium hydroxide		1402156-07-3	Not listed	18 – 25 (Typical)
Water	Water	7732-18-5	231-791-2	Remaining %

Section 4: FIRST AID MEASURES

4.1 Symptoms/Effects:

Acute: Eye contact may result in severe corneal damage. Skin contact may result in corrosion of skin tissue. Ingestion may burn mouth, throat and gastrointestinal tract.

Chronic: No known chronic effects.

4.2 Eyes: Immediately flush with large quantities of water for at least 15 minutes. Hold eyelids apart during irrigation to ensure thorough flushing of the entire area of the eye and lids. Obtain immediate medical attention.

4.3 Skin: Immediately flush with large quantities of water. Remove contaminated clothing under a safety shower. Continue rinsing. Obtain immediate medical attention.

4.4 Ingestion: DO NOT INDUCE VOMITING. If victim is conscious, immediately give 2 to 4 glasses of water. If vomiting does occur, continue to give fluids. Obtain immediate medical attention.

4.5 Inhalation: Remove victim from contaminated atmosphere. If breathing is labored, administer Oxygen. If breathing has ceased, clear airway and start CPR. Obtain immediate medical attention.

Section 5: FIRE FIGHTING MEASURES

5.1 Flammable Properties: (See Section 9, for additional flammable properties)

NFPA: **Health - 3** **Flammability - 0** **Reactivity – 1**

5.2 Extinguishing Media:

5.2.1 Suitable Extinguishing Media: As appropriate for combustibles involved in the fire.

5.2.2 Unsuitable Extinguishing Media: None known

5.3 Protection of Firefighters:

5.3.1 Specific Hazards Arising from the Chemical:

Physical Hazards: Liquid is corrosive to the skin and eyes. Vapors of Hydrogen sulfide exist in the vapor space over the liquid. Heating (flames) of closed or sealed containers may cause violent rupture of the container due to thermal expansion of compressed gases.

Chemical Hazards: Dilution of product with water will increase the evolution of Hydrogen sulfide vapors.

5.3.2 Protective Equipment and Precautions for Firefighters:

Firefighters should wear self-contained breathing apparatus (SCBA) and full firefighting turnout gear. Keep containers/storage vessels in fire area cooled with water spray. Heating the product will evolve highly toxic Hydrogen sulfide.

Section 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions: Use personal protective equipment specified in Section 8. Isolate the hazard area and deny entry to unnecessary, unprotected or untrained personnel.

6.2 Environmental Precautions: Keep out of "waters of the United States" because of potential aquatic toxicity (See Section 12).

6.3 Methods of Containment:

Small Release: Dike spill using inert absorbents or impervious materials such earth, sand or clay.

Large Release: Shut off release if safe to do so. Dike spill area to prevent runoff into surface waterways (aquatic toxicity), sewers or storm drains.

6.4 Methods for Cleanup:

Small Release: Confine and absorb small releases with inert absorbents, earth or sand. Shovel soaked up material and place in suitable container for proper waste disposal.

Large Release: Shut off release if safe to do so. Recover as much of the spilled product as possible with a portable air-operated diaphragm pump and hoses. Use recovered material as originally intended or dispose of as a chemical waste. Treat the remaining material as a small release (above).

Section 7: HANDLING and STORAGE

7.1 Handling: Avoid contact with skin and eyes. Use only in well-ventilated areas. Wash thoroughly after handling. Avoid breathing product vapors.

7.2 Storage: Store in cool, dry well-ventilated areas. Do not store combustibles in the area of storage containers/tanks. Keep away from heat or flames. Store totes and small containers out of direct sunlight at moderate

temperatures. (See Section 10.5 for materials of construction)

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 EXPOSURE GUIDELINES:

Chemical	OSHA PELs		ACGIH TLVs	
	TWA	STEL	TWA	STEL
Hydrogen sulfide	None	20 ppm (Ceiling)	1 ppm	5 ppm
Phosphorus Sulfide (P_2S_5), reaction products with sodium hydroxide	None	None	None	None
water	None	None	None	None

8.2 Engineering Controls: Use adequate exhaust ventilation to prevent inhalation of product vapors. Keep eye wash/safety shower in areas where product is commonly handled.

8.3 Personal Protective Equipment (PPE):

8.3.1 Eye/Face Protection: Chemical goggles and full-face shield.

8.3.2 Skin Protection: Neoprene rubber gloves, boots and chemical suit should be worn to prevent contact with the liquid. Wash contaminated clothing prior to reuse.

8.3.3 Respiratory Protection: Wear SCBA, pressure demand, MSHA/NIOSH approved or equivalent.

8.3.4 Hygiene Considerations: Common good industrial hygiene practices should be followed, such as washing thoroughly after handling or before eating or drinking.

Section 9: PHYSICAL and CHEMICAL PROPERTIES

9.1 Appearance: Tan liquid slurry.
9.2 Odor: Slight rotten egg odor.
9.3 Odor Threshold: 4.7 ppb (hydrogen sulfide).
9.4 pH: 13.5
9.5 Melting Point/Freezing Point: Not determined
9.6 Boiling Point: Not determined
9.7 Flash Point: Not applicable
9.8 Evaporation Rate: Not determined
9.9 Flammability: Not applicable
9.10 Upper/Lower Flammability Limits: 4.3 to 46% in air (hydrogen sulfide).
9.11 Vapor Pressure: Not determined
9.12 Vapor Density: Not determined
9.13 Relative Density: 1.198 to 1.208 (9.99 to 10.07 lbs/gal)
9.14 Solubility: Complete
9.15 Partition Coefficient: Not applicable
9.16 Auto-ignition Temperature: Not determined

9.17 Decomposition Temperature:	300 to 305°C (572 to 581°F).
9.18 Viscosity:	Not determined

Section 10: STABILITY and REACTIVITY

10.1 Reactivity:	Dilution with water will result in increased evolution of Hydrogen sulfide gas.
10.2 Chemical Stability:	This product is stable under normal (ambient) temperature and pressure.
10.3 Possibility of Hazardous Reactions:	Contact with acids or acidic materials.
10.4 Conditions to Avoid:	High temperatures and fire conditions.
10.5 Incompatible Materials:	Acids will cause the release of highly toxic Hydrogen sulfide gas. **Product solution is not compatible with Copper, Zinc, Aluminum or their alloys (i.e. bronze, brass, galvanized metals, etc.)**. These materials should not be used I product handling or storage systems.
10.6 Hazardous Decomposition Products:	(Thermal decomposition) Heating product will evolve H_2S gas. Decomposition will evolve Hydrogen sulfide, Phosphine, and Oxides of Sulfur.

Section 11: TOXICOLOGICAL INFORMATION

11.1 Oral:	Oral Rat, LD_{50}: 389 mg/kg (phosphorus pentasulfide) Oral Mus, LD_{50}: 750 mg/kg (phosphorus pentasulfide)
11.2 Dermal:	Dermal Rabbit, LD_{50}: 1,350 mg/kg (sodium hydroxide) Primary Skin Irritation, Rat Severe (sodium hydroxide) Primary Skin Irritation, Rabbit Moderate (phosphorus pentasulfide)
11.3 Inhalation:	INH-RAT, LC_{50}: 444 ppm, 1 hour exposure (hydrogen sulfide)
11.4 Eye:	Primary Eye Irritation, Rabbit Severe (sodium hydroxide) Primary Skin Irritation, Rabbit Moderate (phosphorus pentasulfide)
11.5 Chronic/Carcinogenicity:	Not listed in NTP, IARC or by OSHA.
11.6 Teratology:	No data available.
11.7 Reproduction:	No data available.
11.8 Mutagenicity:	No data available.

Section 12: ECOLOGICAL INFORMATION

12.1 Ecotoxicity: Fathead Minnow, LC_{50}: 179 mg/L, 96 hours (sodium hydroxide)
Water Flea, EC_{50}: 42 mg/L, 48 hours (sodium hydroxide)
Green Algae, EC_{50}: 41 mg/L, 96 hours (sodium hydroxide)

12.2 Persistence & Degradability: No data available.

12.3 Bioaccumulative Potential: No data available.

12.4 Mobility in Soil: No data available.

12.5 Other Adverse Effects: None

Section 13: DISPOSAL CONSIDERATIONS

Consult federal, state and local regulations for disposal requirements.

Section 14: TRANSPORT INFORMATION

14.1 Basic Shipping Description:

14.1.1 Proper Shipping Name:	Corrosive liquid, basic, inorganic, n.o.s. (sodium dithiophosphate)
14.1.2 Hazard Classes:	8
14.1.3 Identification Number:	UN3266
14.1.4 Packing Group:	II
14.1.5 Hazardous Substance:	No
14.1.6 Marine Pollutant:	No

14.2 Additional Information:

14.2.1 Other DOT Requirements:

14.2.1.1 Reportable Quantity:	No
14.2.1.2 Placard(s):	Corrosive
14.2.1.3 Label(s):	Corrosive

14.2.2 USCG Classification: Not determined

14.2.3 International Transportation:

14.2.3.1 IMO:	Corrosive liquid, basic, inorganic, n.o.s. (sodium dithiophosphate).
14.2.3.2 IATA:	Corrosive liquid, basic, inorganic, n.o.s. (sodium dithiophosphate).
14.2.3.3 TDG (Canada):	Corrosive liquid, basic, inorganic, n.o.s. (sodium dithiophosphate).

14.2.3.4 ADR (Europe):	Corrosive liquid, basic, inorganic, n.o.s. (sodium dithiophosphate).
14.2.3.5 ADG (Australia):	Corrosive liquid, basic, inorganic, n.o.s. (sodium dithiophosphate).
14.2.4 Emergency Response Guide:	154
14.2.5 ERAP - Canada:	Not applicable
14.2.6 Special Precautions:	None

Section 15: REGULATORY INFORMATION

15.1 U.S. Federal Regulations:

15.1.1 OSHA:	This product is considered hazardous under the criteria of the Federal OSHA Hazard Communication Standard (29 CFR 1910.1200).
15.1.2 TSCA:	Product is contained in USEPA Toxic Substance Control Act Inventory.
15.1.3 CERCLA:	Reportable Quantity – No

15.1.4 SARA Title III:

15.1.4.1 Extremely Hazardous Substance (EHS):	No

15.1.4.2 Section 312 (Tier II) Ratings:

Immediate (acute)	Yes
Fire	No
Sudden Release	No
Reactivity	Yes
Delayed (chronic)	No

15.1.4.3 Section 313 (FORM R):	No
15.1.5 RCRA:	Yes, possible D002
15.1.6 CAA (Hazardous Air Pollutant/HAP):	Not applicable

15.2 International Regulations:

15.2.1 Canada:

15.2.1.1 WHMIS:	E, D2B
15.2.1.2: DSL/NDSL:	NDSL

15.3 State Regulations:

15.3.1 CA Proposition 65: Not applicable

Section 16: OTHER INFORMATION

REVISIONS:

Revised Logo, 1/10/2013
Revised ingredients, CAS No., 4/3/2013
Revised Section 3, 10/23/2013.
Revised Section 15, 1/20/2014.
This SDS was reformatted to comply with the new Hazard Communications Standard dated March 26, 2012, by the Regulatory Affairs Department of Tessenderlo Kerley, Inc. 9/26/14.
Revised Section 2 Precautionary Statements also wording and formatting in multiple sections. 6/4/2015.
Revised sections 2, 5, 6, 8-10 and 14. 6/10/2016.
Revised sections 3, 8, 15. 10/25/2018.

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Section Break

SAFETY DATA SHEET

Orfom® D8 Depressant

Version 2.9 Revision Date 2017-09-06

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

Product information

Product Name	:	Orfom® D8 Depressant
Material	:	1119972, 1119971, 1116157, 1108014, 1106095, 1106087, 1095798, 1016855, 1016856
Use	:	Mineral Processing Aide
Company	:	Chevron Phillips Chemical Company LP Mining Chemicals 10001 Six Pines Drive The Woodlands, TX 77380

Emergency telephone:

Health:
866.442.9628 (North America)
1.832.813.4984 (International)
Transport:
CHEMTREC 800.424.9300 or 703.527.3887(int'l)
Asia: CHEMWATCH (+612 9186 1132) China: 0532 8388 9090
EUROPE: BIG +32.14.584545 (phone) or +32.14583516 (telefax)
Mexico CHEMTREC 01-800-681-9531 (24 hours)
South America SOS-Cotec Inside Brazil: 0800.111.767 Outside Brazil: +55.19.3467.1600
Argentina: +(54)-1159839431

Responsible Department	:	Product Safety and Toxicology Group
E-mail address	:	SDS@CPChem.com
Website	:	www.CPChem.com

SECTION 2: Hazards identification

Classification of the substance or mixture
This product has been classified in accordance with the hazard communication standard 29 CFR 1910.1200; the SDS and labels contain all the information as required by the standard.

Classification

: Flammable liquids, Category 4
Corrosive to Metals, Category 1
Skin corrosion, Category 1
Serious eye damage, Category 1

Labeling

Symbol(s) :

Signal Word : Danger

Hazard Statements : H227: Combustible liquid.
H290: May be corrosive to metals.
H314: Causes severe skin burns and eye damage.
H318: Causes serious eye damage.

Precautionary Statements : **Prevention:**
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P234 Keep only in original container.
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
Response:
P301 + P330 + P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P363 Wash contaminated clothing before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P390 Absorb spillage to prevent material damage.
Storage:
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P406 Store in corrosive resistant stainless steel container with a resistant inner liner.
Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Carcinogenicity:

IARC	No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
ACGIH	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3: Composition/information on ingredients

Molecular formula : Mixture

Component	CAS-No.	Weight %
Disodium Carboxymethyltrithiocarbonate	86932-91-4	35 - 45
Sodium Hydroxide	1310-73-2	5

SECTION 4: First aid measures

General advice : Move out of dangerous area. Consult a physician. Show this material safety data sheet to the doctor in attendance. Material may produce a serious, potentially fatal pneumonia if swallowed or vomited.

If inhaled : Move to fresh air. If symptoms persist, call a physician.

In case of skin contact : Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and with difficulty. If on skin, rinse well with water. If on clothes, remove clothes.

In case of eye contact : Small amounts splashed into eyes can cause irreversible tissue damage and blindness. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Continue rinsing eyes during transport to hospital. Remove contact lenses. Protect unharmed eye. Keep eye wide open while rinsing. If eye irritation persists, consult a specialist.

If swallowed : Clean mouth with water and drink afterwards plenty of water. Keep respiratory tract clear. Never give anything by mouth to an unconscious person. Take victim immediately to hospital.

SECTION 5: Firefighting measures

Flash point : > 93 °C (> 199 °F)

Autoignition temperature : > 400 °C (> 752 °F)

Suitable extinguishing media : Carbon dioxide (CO_2).

Unsuitable extinguishing media : High volume water jet.

Specific hazards during fire fighting : Do not allow run-off from fire fighting to enter drains or water courses.

Special protective equipment for fire-fighters : Wear self-contained breathing apparatus for firefighting if necessary.

Further information : Collect contaminated fire extinguishing water separately. This

must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. For safety reasons in case of fire, cans should be stored separately in closed containments. Use a water spray to cool fully closed containers.

Fire and explosion protection	:	Do not spray on an open flame or any other incandescent material. Keep away from open flames, hot surfaces and sources of ignition.
Hazardous decomposition products	:	Carbon oxides. Sulfur oxides.

SECTION 6: Accidental release measures

Personal precautions	:	Use personal protective equipment. Ensure adequate ventilation.
Environmental precautions	:	Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods for cleaning up	:	Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Keep in suitable, closed containers for disposal.
Additional advice	:	No conditions to be specially mentioned.

SECTION 7: Handling and storage

Handling

Advice on safe handling	:	Avoid formation of aerosol. Do not breathe vapors/dust. Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Provide sufficient air exchange and/or exhaust in work rooms. To avoid spills during handling keep bottle on a metal tray. Dispose of rinse water in accordance with local and national regulations.
Advice on protection against fire and explosion	:	Do not spray on an open flame or any other incandescent material. Keep away from open flames, hot surfaces and sources of ignition.

Storage

Requirements for storage areas and containers	:	No smoking. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Observe label precautions. Electrical installations / working materials must comply with the technological safety standards.

SECTION 8: Exposure controls/personal protection

Ingredients with workplace control parameters

US

Ingredients	Basis	Value	Control parameters	Note
Sodium Hydroxide	ACGIH	C	2 mg/m3	URT irr, eye irr, skin irr,
	OSHA Z-1	TWA	2 mg/m3	
	OSHA Z-1-A	C	2 mg/m3	

eye irr Eye irritation
skin irr Skin irritation
URT irr Upper Respiratory Tract irritation

Immediately Dangerous to Life or Health Concentrations (IDLH)

Substance name	CAS-No.	Control parameters	Update
Sodium Hydroxide	1310-73-2	Immediately Dangerous to Life or Health Concentration Value 10 mg/m³	1995-03-01

Engineering measures

Adequate ventilation to control airborned concentrations below the exposure guidelines/limits. Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

Personal protective equipment

Respiratory protection : Wear a NIOSH approved respirator that provides protection when working with this material if exposure to harmful levels of airborne material may occur, such as:. Wear a supplied-air NIOSH approved respirator unless ventilation or other engineering controls are adequate to maintain minimal oxygen content of 19.5% by volume under normal atmospheric pressure. Air-Purifying Respirator for Dusts and Mists / P100. Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.

Hand protection : The suitability for a specific workplace should be discussed with the producers of the protective gloves. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Eye protection : Eye wash bottle with pure water. Wear face-shield and protective suit for abnormal processing problems.

Skin and body protection : Choose body protection according to the amount and concentration of the dangerous substance at the work place. Wear as appropriate:. Complete head face and neck protection. Flame-resistant clothing. Rubber apron. Footwear protecting against chemicals.

Hygiene measures	:	When using do not eat or drink. When using do not smoke. Wash hands before breaks and at the end of workday.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance

Form	:	Liquid
Physical state	:	Liquid
Color	:	clear, orange-red
Odor	:	Mild

Safety data

Flash point	:	> 93 °C (> 199 °F)
Lower explosion limit	:	No data available
Upper explosion limit	:	No data available
Autoignition temperature	:	> 400 °C (> 752 °F)
Molecular formula	:	Mixture
Molecular weight	:	Not applicable
pH	:	12.52
Boiling point/boiling range	:	106.4 °C (223.5 °F)
Vapor pressure	:	
Relative density	:	1.3106 at 16 °C (61 °F)
Density	:	1.3478 g/cm3 at 16 °C (60 °F)
Water solubility	:	260,000 MG/L
Partition coefficient: n-octanol/water	:	Pow: 398 log Pow: 2.6
Viscosity, kinematic	:	5.44 cSt at 21.1 °C (70.0 °F)
Relative vapor density	:	1 (Air = 1.0)
Evaporation rate	:	1
Percent volatile	:	60 %

Other information

Oxidizing potential	:	Note: The substance or mixture is not classified as oxidizing.

SECTION 10: Stability and reactivity

Chemical stability : This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Possibility of hazardous reactions

Conditions to avoid : Heat, flames and sparks.

Materials to avoid : Corrosive to copper and copper bearing alloys. Incompatible with strong acids and oxidizing agents..

Hazardous decomposition products : Carbon oxides
Sulfur oxides

Other data : No decomposition if stored and applied as directed.

SECTION 11: Toxicological information

Orfom® D8 Depressant
Acute oral toxicity : No data available

Orfom® D8 Depressant
Acute inhalation toxicity : No data available

Orfom® D8 Depressant
Acute dermal toxicity : No data available

Orfom® D8 Depressant
Skin irritation : Extremely corrosive and destructive to tissue.

Orfom® D8 Depressant
Eye irritation : May cause irreversible eye damage.

Orfom® D8 Depressant
Sensitization : No data available.

Orfom® D8 Depressant
Repeated dose toxicity : This information is not available.

Orfom® D8 Depressant
Reproductive toxicity : This information is not available.

Orfom® D8 Depressant
Developmental Toxicity : This information is not available.

Orfom® D8 Depressant
Aspiration toxicity : May be harmful if swallowed and enters airways.

Orfom® D8 Depressant
Further information : No data available.

SECTION 12: Ecological information

Ecotoxicity effects

Toxicity to fish : LC50: 64.69 mg/l
Exposure time: 96 h
Species: Danio rerio (Zebra Fish)
semi-static test Method: OECD Test Guideline 203

Toxicity to daphnia and other aquatic invertebrates : EC50: 35.46 mg/l
Exposure time: 48 h
Species: Daphnia magna (Water flea)
semi-static test Method: OECD Test Guideline 202

Elimination information (persistence and degradability)

Mobility : No data available

Biodegradability : No data available

Ecotoxicology Assessment

Additional ecological information : No data available

SECTION 13: Disposal considerations

The information in this SDS pertains only to the product as shipped.

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

Product : Do not dispose of waste into sewer. Do not contaminate ponds, waterways or ditches with chemical or used container. Send to a licensed waste management company.

Contaminated packaging : Empty remaining contents. Dispose of as unused product. Do not re-use empty containers. Do not burn, or use a cutting torch on, the empty drum.

SECTION 14: Transport information

The shipping descriptions shown here are for bulk shipments only, and may not apply to shipments in non-bulk packages (see regulatory definition).

Consult the appropriate domestic or international mode-specific and quantity-specific Dangerous Goods Regulations for additional shipping description requirements (e.g., technical name or names, etc.) Therefore, the information shown here, may not always agree with the bill of lading shipping

description for the material. Flashpoints for the material may vary slightly between the SDS and the bill of lading.

US DOT (UNITED STATES DEPARTMENT OF TRANSPORTATION)
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., (DISODIUM CARBOXYMETHYLTRITHIOCARBONATE, SODIUM HYDROXIDE), 8, II, RQ (SODIUM HYDROXIDE)

IMO / IMDG (INTERNATIONAL MARITIME DANGEROUS GOODS)
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., (DISODIUM CARBOXYMETHYLTRITHIOCARBONATE, SODIUM HYDROXIDE), 8, II, (> 93 °C)

IATA (INTERNATIONAL AIR TRANSPORT ASSOCIATION)
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., (DISODIUM CARBOXYMETHYLTRITHIOCARBONATE, SODIUM HYDROXIDE), 8, II

ADR (AGREEMENT ON DANGEROUS GOODS BY ROAD (EUROPE))
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., (DISODIUM CARBOXYMETHYLTRITHIOCARBONATE, SODIUM HYDROXIDE), 8, II, (E)

RID (REGULATIONS CONCERNING THE INTERNATIONAL TRANSPORT OF DANGEROUS GOODS (EUROPE))
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., (DISODIUM CARBOXYMETHYLTRITHIOCARBONATE, SODIUM HYDROXIDE), 8, II

ADN (EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY INLAND WATERWAYS)
UN3267, CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., (DISODIUM CARBOXYMETHYLTRITHIOCARBONATE, SODIUM HYDROXIDE), 8, II

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

SECTION 15: Regulatory information

National legislation

SARA 311/312 Hazards	:	Fire Hazard Acute Health Hazard
CERCLA Reportable Quantity	:	Calculated RQ exceeds reasonably attainable upper limit. Sodium Hydroxide
SARA 302 Reportable	:	This material does not contain any components with a SARA

Quantity		302 RQ.
SARA 302 Threshold Planning Quantity	:	No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 304 Reportable Quantity	:	This material does not contain any components with a section 304 EHS RQ.
SARA 313 Ingredients	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

Ozone-Depletion Potential	:	This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

US State Regulations

Pennsylvania Right To Know	:	Sodium Hydroxide - 1310-73-2
New Jersey Right To Know	:	Sodium Hydroxide - 1310-73-2
California Prop. 65 Ingredients	:	This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

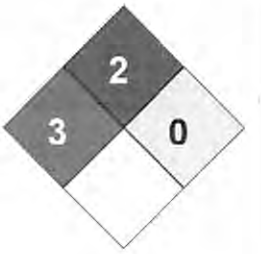
Notification status

Europe REACH	:	On the inventory, or in compliance with the inventory

United States of America (USA) TSCA	:	On the inventory, or in compliance with the inventory
Canada DSL	:	On the inventory, or in compliance with the inventory
Australia AICS	:	On the inventory, or in compliance with the inventory
New Zealand NZIoC	:	Not in compliance with the inventory
Japan ENCS	:	Not in compliance with the inventory
Korea KECI	:	Not in compliance with the inventory
Philippines PICCS	:	Not in compliance with the inventory
China IECSC	:	Not in compliance with the inventory

SECTION 16: Other information

NFPA Classification : Health Hazard: 3
Fire Hazard: 2
Reactivity Hazard: 0



Further information

Legacy SDS Number : 59700

Significant changes since the last version are highlighted in the margin. This version replaces all previous versions.

The information in this SDS pertains only to the product as shipped.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key or legend to abbreviations and acronyms used in the safety data sheet			
ACGIH	American Conference of Government Industrial Hygienists	LD50	Lethal Dose 50%
AICS	Australia, Inventory of Chemical Substances	LOAEL	Lowest Observed Adverse Effect Level
DSL	Canada, Domestic Substances List	NFPA	National Fire Protection Agency
NDSL	Canada, Non-Domestic Substances List	NIOSH	National Institute for Occupational Safety & Health
CNS	Central Nervous System	NTP	National Toxicology Program
CAS	Chemical Abstract Service	NZIoC	New Zealand Inventory of Chemicals
EC50	Effective Concentration	NOAEL	No Observable Adverse Effect Level
EC50	Effective Concentration 50%	NOEC	No Observed Effect Concentration
EGEST	EOSCA Generic Exposure Scenario Tool	OSHA	Occupational Safety & Health Administration
EOSCA	European Oilfield Specialty Chemicals Association	PEL	Permissible Exposure Limit
EINECS	European Inventory of Existing Chemical Substances	PICCS	Philippines Inventory of Commercial Chemical Substances
MAK	Germany Maximum Concentration	PRNT	Presumed Not Toxic

	Values		
GHS	Globally Harmonized System	RCRA	Resource Conservation Recovery Act
>=	Greater Than or Equal To	STEL	Short-term Exposure Limit
IC50	Inhibition Concentration 50%	SARA	Superfund Amendments and Reauthorization Act.
IARC	International Agency for Research on Cancer	TLV	Threshold Limit Value
IECSC	Inventory of Existing Chemical Substances in China	TWA	Time Weighted Average
ENCS	Japan, Inventory of Existing and New Chemical Substances	TSCA	Toxic Substance Control Act
KECI	Korea, Existing Chemical Inventory	UVCB	Unknown or Variable Composition, Complex Reaction Products, and Biological Materials
<=	Less Than or Equal To	WHMIS	Workplace Hazardous Materials Information System
LC50	Lethal Concentration 50%		

Section Break

BRENNTAG

SAFETY DATA SHEET

1. Identification

Product identifier	**PINE OIL**
Other means of identification	None.
Recommended use	ALL PROPER AND LEGAL PURPOSES
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	Brenntag Pacific Inc.	
Address	10747 Patterson Place Santa Fe Springs, CA 90670	
Telephone	562-903-9626	
E-mail	Not available.	
Emergency phone number	800-424-9300	CHEMTREC

2. Hazard(s) identification

Physical hazards	Flammable liquids	Category 3
Health hazards	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2
	Sensitization, skin	Category 1
	Aspiration hazard	Category 1
Environmental hazards	Not classified.	
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Flammable liquid and vapor. May be fatal if swallowed and enters airways. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation.

Precautionary statement

Prevention	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Avoid breathing mist or vapor. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace. Wear protective gloves/eye protection/face protection.
Response	If swallowed: Immediately call a poison center/doctor. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If skin irritation or rash occurs: Get medical advice/attention. If eye irritation persists: Get medical advice/attention. Take off contaminated clothing and wash before reuse. In case of fire: Use appropriate media to extinguish.
Storage	Store in a well-ventilated place. Keep cool. Store locked up.
Disposal	Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
ACEITE DE PINO		8002-09-3	100

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation
Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact
Remove contaminated clothing immediately and wash skin with soap and water. In case of eczema or other skin disorders: Seek medical attention and take along these instructions. 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. Get medical attention if irritation develops and persists.

Ingestion
Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Most important symptoms/effects, acute and delayed
Aspiration may cause pulmonary edema and pneumonitis. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain. May cause an allergic skin reaction. Dermatitis. Rash.

Indication of immediate medical attention and special treatment needed
Provide general supportive measures and treat symptomatically. Thermal 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 under observation. Symptoms may be delayed.

General information
Take off all contaminated clothing immediately. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

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

Unsuitable extinguishing media
Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical
Vapors may form explosive mixtures with air. Vapors may travel considerable distance to a source of ignition and flash back. 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
In case of fire and/or explosion do not breathe fumes. 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.

General fire hazards
Flammable liquid and vapor.

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). Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist or vapor. 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
Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. Take precautionary measures against static discharge. Use only non-sparking tools. Prevent entry into waterways, sewer, basements or confined areas.

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Following product recovery, flush area with water.

Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Wipe up with absorbent material (e.g. cloth, fleece). 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.

Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Do not handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. When using do not smoke. Explosion-proof general and local exhaust ventilation. All equipment used when handling the product must be grounded. Take precautionary measures against static discharges. Use non-sparking tools and explosion-proof equipment. Avoid breathing mist or vapor. Avoid contact with eyes, skin, and clothing. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Keep away from heat, sparks and open flame. Prevent electrostatic charge build-up by using common bonding and grounding techniques. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Store in a well-ventilated place. Keep in an area equipped with sprinklers. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Explosion-proof general and local exhaust ventilation. 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 for Personnel Protective Equipment (PPE). The employer/user of this product must perform a Hazard Assessment of the workplace according to OSHA regulations 29 CFR 1910.132 to determine the appropriate PPE for use while performing any task involving potential exposure to this product.

Eye/face protection	Face shield is recommended. Wear safety glasses with side shields (or goggles).
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	If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	When using do not 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. Contaminated work clothing should not be allowed out of the workplace.

9. Physical and chemical properties

Appearance	
Physical state	Liquid.
Form	Liquid.
Color	CLEAR
Odor	PINE
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	167.0 °F (75.0 °C)
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.

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.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	7.68 lbs/gal
Explosive properties	Not explosive.
Flammability class	Combustible IIIA estimated
Oxidizing properties	Not oxidizing.
Specific gravity	0.92

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure	
Inhalation	No adverse effects due to inhalation are expected.
Skin contact	Causes skin irritation. May cause an allergic skin reaction.
Eye contact	Causes serious eye irritation.
Ingestion	Droplets of the product aspirated into the lungs through ingestion or vomiting may cause a serious chemical pneumonia.
Symptoms related to the physical, chemical and toxicological characteristics	Aspiration may cause pulmonary edema and pneumonitis. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain. May cause an allergic skin reaction. Dermatitis. Rash.
Information on toxicological effects	
Acute toxicity	May be fatal if swallowed and enters airways. May cause an allergic skin reaction.
Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye irritation.
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	May cause an allergic skin reaction.

Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	May be fatal if swallowed and enters airways.

12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	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. 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

DOT

UN number	UN1272
UN proper shipping name	PINE OIL
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Packing group	III
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
ERG number	129

DOT information on packaging may be different from that listed.

IATA

UN number	UN1272
UN proper shipping name	PINE OIL
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Packing group	III
Environmental hazards	No.

ERG Code	129
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1272
UN proper shipping name	PINE OIL, MARINE POLLUTANT
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	Yes
EmS	F-E, S-E
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

DOT

IATA; IMDG

Marine pollutant

General information	IMDG Regulated Marine Pollutant.

15. Regulatory information

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

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

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

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

SARA 302 Extremely hazardous substance
Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)
Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List
Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)
Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)
Not listed.

US. Massachusetts RTK - Substance List
Not regulated.

US. New Jersey Worker and Community Right-to-Know Act
ACEITE DE PINO (CAS 8002-09-3)

US. Pennsylvania Worker and Community Right-to-Know Law
Not listed.

US. Rhode Island RTK
Not regulated.

US. California Proposition 65
California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

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)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates 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, including date of preparation or last revision

Issue date 04-10-2015
Revision date 07-28-2016
Version # 04

HMIS® ratings	Health: 3 Flammability: 3 Physical hazard: 0
NFPA ratings	Health: 2 Flammability: 2 Instability: 0
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.
Revision information	This document has undergone significant changes and should be reviewed in its entirety.

Section Break

Conforms to HazCom 2012/United States

SAFETY DATA SHEET

Quicklime

Section 1. Identification

GHS product identifier	: Quicklime
Other means of identification	: Snowbright Quicklime, Quicklime, High calcium quicklime, Pebble lime, Hi Cal, Unslaked lime, Calcium Oxide, CaO, Type S, Type N, Calcined limestone, Burnt lime, Chemical lime
Identified uses	: Water treatment, Caustic agent, pH adjustment, Neutralization, Acid gas absorption, Construction
Supplier's details	: Pete Lien & Sons, Inc. PO Box 440 Rapid City, SD 57702
Emergency telephone number (hours of operation)	: (605) 342-7224 (Monday-Friday 8am-5pm)

Section 2. Hazards identification

Classification of the substance or mixture : SKIN IRRITATION - Category 2
EYE DAMAGE - Category 1
SPECIFIC TARGET ORGAN TOXICITY SINGLE EXPOSURE [Respiratory System] - Category 3
SPECIFIC TARGET ORGAN TOXICITY REPEAT EXPOSURE [Respiratory System] - Category 1
CARCINOGEN - Category 1A

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Causes skin irritation. Causes serious eye damage. May cause cancer through inhalation. May cause respiratory irritation. Reacts violently with water, releasing heat, which can ignite combustible material. Causes damage to lungs through prolonged and repeated exposure.

Precautionary statements

Prevention : Wear protective gloves/protective clothing/face protection /eye protection. Wash exposed skin thoroughly after handling. Use only outdoors or in a well-ventilated area. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust. Do not eat, drink or smoke when using this product.

Response	: IF ON SKIN: Wash exposed skin with plenty of water. If skin irritation occurs: Get medical attention. Take off contaminated clothing and wash it before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention immediately. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Seek medical attention if you feel unwell IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. If exposed or concerned: Get medical advice
Storage	: Store to minimize dust generation. Store in a well-ventilated place. Keep container tightly closed.
Disposal	: Dispose of contents or containers in accordance with applicable regulations. **Do not use water on material spills.**
Hazards not otherwise classified	: Calcium oxide reacts violently with water, releasing heat which can ignite combustible materials.
Ingredients with unknown toxicity	: Not Applicable

Section 3. Composition/information on ingredients

Substance/mixture : Calcium Oxide (CaO)

CAS number/other identifiers

Component	CAS #	% by weight
Calcium Oxide	1305-78-8	>87
Magnesium Oxide	1309-48-4	<5
Crystalline Silica (Quartz)	14808-60-7	<2.0

Section 4. First aid measures

Description of necessary first aid measures

Eye Contact : Contact can cause severe irritation or burning of eyes, including permanent damage. Immediately flush eyes with generous amounts of water for at least 15 minutes. Pull back the eyelid to ensure that all lime dust has been washed out. Seek medical attention immediately. Do not rub eyes.

Skin Contact : Contact can cause severe irritation or burning of skin, especially in the presence of moisture. Wash exposed area with large amounts of water. Seek medical attention immediately.

Ingestion : This product can cause severe irritation or burning of gastrointestinal tract if swallowed. Do not induce vomiting. Seek medical attention immediately. Never give anything by mouth unless instructed to do so by medical personnel.

Inhalation : This product can cause severe irritation of the respiratory system. Move victim to fresh air. Seek medical attention if necessary. If breathing has stopped, give artificial respiration.

Most important symptoms/effects, acute and delayed : Irritation of skin, eyes, gastrointestinal tract or respiratory tract. Long-term exposure by inhalation may cause permanent damage. This product contains crystalline silica, which has been classified by IARC as (Group I) carcinogenic to humans when inhaled. Inhalation of silica can also cause a chronic lung disorder, silicosis.

Indication of immediate medical attention and special treatment needed, if necessary: See first aid information above. Note to Physicians: Provide general supportive measures and treat symptomatically.

Section 5. Fire-fighting measures

Extinguishing Media : Use dry chemical fire extinguisher. Do not use water or halogenated compounds, except that large amounts of water may be used to deluge small quantities of quicklime.

Fire Hazards : Quicklime is not combustible or flammable. However, quicklime reacts violently with water, and can release heat sufficient to ignite combustible materials. Quicklime is not considered to be an explosion hazard, although reaction with water or other incompatible materials may rupture containers. Hazardous Combustion Products: None.

Special Protective Equipment and Fire Fighting Instructions:

Keep personnel away from and upwind of fire. Wear full fire-fighting turn-out gear (full Bunker gear), and respiratory protection (SCBA)

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Spill/Leak Procedures : Do NOT use water on bulk material spills. Lime reacts violently with water, releasing heat. Use proper protective equipment.

Small Spills : Use dry methods to collect spilled materials. Avoid generating dust. Do not clean up with compressed air. Store collected materials in dry, sealed plastic or metal containers. Residue on surfaces may be water washed.

Large Spills : Use dry methods to collect spilled materials. Evacuate area downwind of clean-up operations to minimize dust exposure. Store spilled materials in dry sealed plastic or metal containers.

Methods and materials for containment and cleaning up

Containment : For large spills, as much as possible, avoid the generation of dusts. Prevent release to sewers or waterways.

Cleanup : Residual amounts of material can be flushed with large amounts of water. Equipment can be washed with either mild vinegar and water solution, or detergent and water.

Section 7. Handling and storage

Precautions for safe handling

Keep in tightly closed containers. Protect containers from physical damage. Avoid direct skin contact with the material.

Conditions for safe storage, including any incompatibilities

Store in a cool, dry, and well-ventilated location. Do not store near incompatible materials (see Section 10 below). Keep away from moisture. Long-term storage in aluminum containers is not recommended, as calcium oxide may corrode aluminum over long periods of time.

Section 8. Exposure controls/personal protection

Exposure limits

Component	CAS #	Exposure limits
Calcium Oxide	1305-78-8	OSHA PEL: 5mg/m^3 ACGIH TLV: 2mg/m^3
Magnesium Oxide	1309-48-4	OSHA PEL: 15mg/m^3 ACGIH TLV: 10mg/m^3
Crystalline Silica	14808-60-7	OSHA PEL: 0.050 mg/m^3 as an 8hr TWA (respirable) ACGIH TLV: 0.025 mg/m^3 (respirable)

US. NIOSH: Pocket Guide to Chemical Hazards

Material	Type	Value
Calcium oxide (CaO) (CAS 1305-78-8)	TWA	2 mg/m3

Impurities	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0.05 mg/m3	Respirable dust.

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

Engineering controls : Provide ventilation adequate to maintain PELs.

Individual Protection Measures

Respiratory Protection :Use NIOSH/MSHA approved respirators if airborne concentration exceeds PEL.

If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Wear NIOSH approved respirator appropriate for airborne exposure at the point of use.

Skin Protection : Use appropriate gloves to prevent skin contact. When there is a risk of skin contact, wear suitable clothing to prevent such contact. Clothing should fully cover arms and legs.

Eye Protection : Use safety glasses with side shields or safety goggles. Contact lenses should not be worn when working with lime products. When working with powders or dusts, wear dust-proof chemical goggles and face shield unless full facepiece respiratory protection is worn.

Other : Eye wash fountain and emergency showers are recommended
: Wear appropriate thermal protective clothing, when necessary.

Section 9. Physical and chemical properties

Physical State	: Solid
Appearance	: White or grayish-white material
Odor	: Odorless
Odor threshold	: Not applicable
pH at 25 degrees C	: 12.45
Melting point	: 4658°F, 2570°C
Initial boiling point	: 5162°F, 2850°C
Flash point	: Not applicable.
Evaporation rate	: Not applicable.
Flammability (solid, gas)	: Not applicable.
Lower and upper explosive (flammable) limits	: Not applicable.
Vapor pressure	: Not applicable.
Vapor density	: Not applicable.
Relative density	: Not applicable.
Solubility in water	: Negligible, but reacts with water to produce calcium hydroxide and heat
Partition coefficient: n octanol/water	: Not applicable.
Auto-ignition temperature	: Not applicable.
Decomposition temperature	: Not applicable.
Viscosity	: Not applicable.

Section 10. Stability and reactivity

Reactivity	: Quicklime reacts violently with water to form calcium hydroxide, releasing heat. See also Incompatibility below
Chemical stability	:Quicklime is chemically stable
Possibility of hazardous reactions	: See above
Conditions to avoid	: Do not allow quicklime to come in contact with incompatible materials. The substance is hygroscopic and will absorb water by contact with the moisture in the air.
Incompatible materials	: Quicklime should not be mixed or stored with the following materials, due to the potential for violent reaction and release of heat: WATER ACIDS REACTIVE FLUORIDATED COMPOUNDS REACTIVE BROMINATED COMPOUNDS REACTIVE POWDERED METALS ALUMINUM POWDER ORGANIC ACID ANHYDRIDES NITRO-ORGANIC COMPOUNDS

REACTIVE PHOPHOROUS COMPOUNDS
INTERHALOGENATED COMPOUNDS

Hazardous decomposition products : None

Section 11. Toxicological Information

Information on the likely routes of exposure: See First Aid discussion in Section 4.
Symptoms related to the physical, chemical and toxicological characteristics: See First Aid discussion in Section 4.
Delayed and immediate effects and also chronic effects from exposure: See First Aid in Section 4.
Carcinogen listing: Quicklime is not listed by MSHA, OSHA, or IARC as a carcinogen, but this product contains crystalline silica, which has been classified by IARC as (Group I) carcinogenic to humans when inhaled

Toxicological data

IARC Monographs. Overall Evaluation of Carcinogenicity
Quartz (CAS 14808-60-7) 1 Carcinogenic to humans.

NTP Report on Carcinogens
Quartz (CAS 14808-60-7) Known To Be Human Carcinogen.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)
Quartz (CAS 14808-60-7) Cancer

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.

Section 12. Ecological information

Ecotoxicity	: Because of the high pH of this product, it would be expected to produce significant ecotoxicity upon exposure to aquatic organisms and aquatic systems in high concentrations.
Persistence and degradability	: Reacts with atmospheric CO_2 over time to form calcium carbonate. The product solely consists of inorganic compounds which are not biodegradable.
Bioaccumulative potential	: This material shows no bioaccumulation effects of food chain concentration toxicity.
Mobility in soil	: There is no data available.
Other adverse effects	: This material is alkaline and if released into water or moist soil will cause an increase in pH.

Section 13. Disposal considerations

Dispose of in accordance with all applicable federal, state, and local environmental regulations. If this product as supplied, and unmixed, becomes a waste, it will not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act.

Section 14. Transport information

UN number	: UN1910
UN proper shipping name	: Calcium Oxide
Transport hazard class(es)	: When transported by air only: Hazard Class 8-Corrosive
Packing group	: When transported by air only: Packing Group III
Environmental hazards	: This material is alkaline and if released into water or moist soil will cause an increase in pH.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	: Not available.

Special Precautions which a user needs to be aware of , or needs to comply with, in connection with transport or conveyance either within or outside their premises: When being transported by air, quicklime is classified in the Department of Transportation (DOT) regulations as a hazardous material. (49 CFR 172.101). For aircraft transport only, Calcium Oxide is classified as Hazard Class 8-Corrosive, UN1910, Packing Group III. For passenger aircraft, the maximum net quantity allowed per container is 25 kg. For cargo aircraft the maximum net quantity allowed per container is 100kg. For quantities greater than 25kg up to and including 100kg, the container shall be labeled with CARGO AIRCRAFT ONLY. Because express carriers (i.e., Federal Express, Airborne Express, and United Parcel Service) ship by air, quicklime presented to these carriers for shipment must be packaged, marked, and labeled in accordance with IATA requirements, and must be accompanied by the appropriate shipping documentation. Only personnel trained and certified under applicable DOT Hazardous Materials Regulations (contained in Title 49 of the Code of Federal Regulations) may prepare any quicklime product for air transport. Quicklime is not classified as a hazardous material by DOT when transported by means other than air.

Section 15. Regulatory information

National Chemical Inventory Listings:
All Chemical ingredients are listed on the USEPA TSCA Inventory List

US Federal Regulations:

RCRA Hazardous Waste Number: not listed (40 CFR 261.33)
RCRA Hazardous Waste Classification (40 CFR 261): not classified
CERCLA Hazardous Substance (40 CFR 302.4) unlisted specific per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307(a), CAA, Sec. 112
CERCLA Reportable Quantity, not listed.
SARA 311/312 Codes: not listed.
SARA Toxic Chemical (40 CFR 372.65): not listed.

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed, Threshold Planning Quantity (TPQ): not listed

Specific State Regulations: Consult State and Local authorities for guidance.

State Regulations:

Consult state and local authorities for guidance.

California Proposition 65

WARNING: This product can expose you to SILICA, CRYSTALLINE QUARTZ, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

These naturally occurring impurities may also regulated by other States.
Canadian DSL: Listed
Canadian NPRI: None of the components are listed
CEPA Toxic Substance: None of the components are listed

Section 16. Other information

History

Date of issue (mm/dd/yyyy) : 06/01/2015
Revision date (mm/dd/yy) :09/30/2019
Version : 2

Disclaimer: The information contained in this document applies to this specific material as supplied. Pete Lien & Sons, Inc. believes that the information contained in this SDS is accurate. The suggested precautions and recommendations are based on recognized good work practices and experience as of the date of publication. They are not necessarily all-inclusive or fully adequate in every circumstance as not all use circumstances can be anticipated. The suggestions should not be confused with nor followed in violation of applicable laws, regulation, rules or insurance requirement.

It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for one's own particular use. Since the actual use of the product described herein is beyond our control, Pete Lien & Sons, Inc. , assumes no liability arising out of the use of the product by others. Appropriate warnings and safe handling procedures should be provided to handlers and users. Product must not be used in a manner which could result in harm.

Section Break

SAFETY DATA SHEET
Sodium Hydroxide 50% Solution

SDS # : 1310-73-2--50
Revision date: 2015-03-27
Format: NA
Version 1.01

TRONOX

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name Sodium Hydroxide 50% Solution

Other means of identification

Product Code(s) 1310-73-2--50

Synonyms Caustic Soda Solution; Lye Solution; Sodium Hydrate Solution, White Caustic Solution

Recommended use of the chemical and restrictions on use

Recommended Use: pH adjustment

Restrictions on Use: See section 16 for more information

Manufacturer Address

Tronox Specialty Alkali Corporation
1735 Market Street
Philadelphia, PA 19103
Tel: +1 877 / 362-2248 or +1 215 / 299-6904
www.tronox.com

Emergency telephone number

1 307 / 872 2452 (Plant - Green River, WY)
(303) 595-9048 (Medical - U.S. - Call Collect)

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin corrosion/irritation	Category 1 Sub-category A
Serious eye damage/eye irritation	Category 1
Corrosive to Metals	Category 1

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Danger

Hazard Statements
H314 - Causes severe skin burns and eye damage
H290 - May be corrosive to metals

Precautionary Statements - Prevention
P264 - Wash face, hands and any exposed skin thoroughly after handling
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection
Precautionary Statements - Response
P310 - Immediately call a POISON CENTER or doctor/ physician
P390 - Absorb spillage to prevent material damage
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P303 + P361 + P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower
P363 - Wash contaminated clothing before reuse
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P301 + P330 + P331 - IF SWALLOWED: rinse mouth. Do NOT induce vomiting

Precautionary Statements - Storage
P405 - Store locked up
P406 - Store in corrosive resistant/ stainless steel container with a resistant inner liner

Precautionary Statements - Disposal
P501 - Dispose of contents/ container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
No hazards not otherwise classified were identified.

Other Information
Harmful to aquatic life with long lasting effects

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula NaOH

Chemical name	CAS-No	Weight %
Sodium Hydroxide	1310-73-2	50
Water	7732-18-5	50

Synonyms are provided in Section 1.

4. FIRST AID MEASURES

General Advice	Flush with plenty of water immediately. Continue flushing during transport to hospital or medical center.
Eye Contact	In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Seek immediate medical attention/advice.
Skin Contact	Immediately flush with plenty of water while removing contaminated clothing and/or shoes, and thoroughly wash with soap and water. Seek immediate medical attention/advice.
Inhalation	Remove person to fresh air. If signs/symptoms continue, get medical attention.
Ingestion	Rinse mouth with water and afterwards drink plenty of water or milk. Do not induce vomiting or give anything by mouth to an unconscious person. Call a physician immediately.
Most important symptoms and effects, both acute and delayed	None known.
Indication of immediate medical attention and special treatment needed, if necessary	Sodium hydroxide at this concentration is corrosive. Prolonged dilution with water is required. Neutralization of eye burns is absolutely contraindicated; for skin, 2% acetic acid has been recommended, but washing with water is effective. Ingestion requires milk or water dilution, consideration of esphagoscopy and management for possible esophageal stricture.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Specific Hazards Arising from the Chemical	Not flammable
Explosion data	
Sensitivity to Mechanical Impact	Not sensitive.
Sensitivity to Static Discharge	Not sensitive.
Protective equipment and precautions for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	In case of spill, avoid contact. Isolate area and keep out animals and unprotected persons. Wear suitable protective clothing, gloves and eye/face protection. For personal protection see section 8.
Other	For further clean-up instructions, call Emergency Hotline number listed in Section 1 "Product and Company Identification" above.
Environmental Precautions	See Section 12 for additional Ecological Information.
Methods for Containment	Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
Methods for cleaning up	Clean contaminated surface thoroughly. Dispose of waste as indicated in Section 13.

7. HANDLING AND STORAGE

Handling	Always wash equipment and containers before use. Dangerous chemical reactions can occur due to improper cleaning. Always add caustic soda to water. Adding water to caustic soda can cause a dangerous reaction. Ensure that water being used for dilution is lukewarm. Never dilute caustic with hot or cold water. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Avoid contact by using personal protective equipment. Refer to Section 8.

Storage Keep containers tightly closed in a cool, well-ventilated place. Keep away from incompatible products (acids).

Incompatible products Acids, flammable liquids, organic halogen compounds, nitro compounds, and amphoteric metals, such as aluminum, magnesium and zinc

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Ingredients with workplace control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Sodium Hydroxide 1310-73-2	Ceiling: 2 mg/m³	TWA: 2 mg/m³	IDLH: 10 mg/m³ Ceiling: 2 mg/m³	Mexico: Ceiling 2 mg/m³
Chemical name	**British Columbia**	**Quebec**	**Ontario TWAEV**	**Alberta**
Sodium Hydroxide 1310-73-2	Ceiling: 2 mg/m³	Ceiling: 2 mg/m³	CEV: 2 mg/m³	Ceiling: 2 mg/m³

Appropriate engineering controls

Engineering measures Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Use chemical splash-type monogoggles and a full-face shield made of polycarbonate, acetate, polycarbonate/acetate, PETG or thermoplastic.

Skin and Body Protection Rubber or vinyl apron. Rubber or plastic boots.

Hand Protection Rubber or vinyl gloves with gauntlets. Wash the outside of gloves with soap and water prior to removal. Inspect regularly for leaks.

Respiratory Protection Wear full face-piece respirators approved by MSHA/NIOSH if mists are expected.

Hygiene measures Avoid contact with skin, eyes and clothing. Avoid breathing vapors, mist or gas. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

General information If the product is used in mixtures, it is recommended that you contact the appropriate protective equipment suppliers

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance Clear to cloudy white, odorless liquid
Physical State Liquid
Color No information available
Odor odorless
Odor threshold No information available
pH 13.7
Melting point/freezing point Not applicable
Boiling Point/Range 145 °C / 293 °F
Flash point Not applicable
Evaporation Rate No information available
Flammability (solid, gas) No information available
Flammability Limit in Air
Upper flammability limit: No information available
Lower flammability limit: No information available
Vapor pressure 6.33 mm Hg @ 40 °C

Vapor density	No information available
Density	No information available
Specific gravity	1.53 @ 15.5 °C
Water solubility	completely soluble
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Viscosity, kinematic	No information available
Viscosity, dynamic	No information available
Explosive properties	No information available
Oxidizing properties	Non-oxidizing
Molecular weight	No information available
Bulk density	No information available

10. STABILITY AND REACTIVITY

Reactivity Not applicable

Chemical Stability Stable under normal conditions.

Possibility of Hazardous Reactions Reacts with many compounds.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Excessive heat, Incompatible products

Incompatible materials Acids, flammable liquids, organic halogen compounds, nitro compounds, and amphoteric metals, such as aluminum, magnesium and zinc.

Hazardous Decomposition Products None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Product Information

Serious eye damage/eye irritation Corneal lesions and irreversible damage if contact with the eyes.
Skin corrosion/irritation Corrosive to skin.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium Hydroxide (1310-73-2)	400 mg/kg (rabbit) (37% solution)	= 1350 mg/kg (Rabbit)	Corrosive

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Chronic toxicity	Sodium hydroxide may produce inflammation of the eyes, skin, and mucous membranes. Esophageal carcinoma at the site of a chronic lye stricture has been reported. [Gosselin , Smith & Hodge 1984].
Mutagenicity	No information available
Carcinogenicity	Not recognized as carcinogenic by Research Agencies (IARC, NTP, OSHA, ACGIH).
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Chemical name	Toxicity to algae	Toxicity to fish	Toxicity to daphnia and other aquatic invertebrates
Sodium Hydroxide 1310-73-2		96 h LC50: = 45.4 mg/L (Oncorhynchus mykiss)	

Persistence and degradability There is no degradation of sodium hydroxide in waters, only loss by absorption or through chemical neutralization.

Bioaccumulation No information available.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261). It must undergo special treatment, e.g. at suitable disposal site, to comply with local regulations. Can be disposed as waste water, when in compliance with local regulations.

Contaminated Packaging Dispose of in accordance with local regulations.

Chemical name	California Hazardous Waste Status
Sodium Hydroxide 1310-73-2	Toxic Corrosive

14. TRANSPORT INFORMATION

DOT

UN/ID no	UN1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II
Reportable Quantity (RQ)	Sodium hydroxide: RQ = 1000 lbs.
Special Provisions	B2, IB2, N34, T7, TP2
Emergency Response Guide Number	154

TDG

UN/ID no	UN1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II

ICAO/IATA

UN/ID no	UN1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II
Special Provisions	A3
Limited quantity	0.5 L

IMDG/IMO

UN/ID no	UN1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II
EmS No.	F-A, S-B

ADR/RID

UN/ID no	UN1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II
Classification code	C5
Tunnel restriction code	(E)
ADR/RID-Labels	8

15. REGULATORY INFORMATION

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic health hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

Clean Water Act
This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42):

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Sodium Hydroxide 1310-73-2	1000 lb			X

CERCLA

Chemical name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Sodium Hydroxide 1310-73-2	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
Sodium Hydroxide 1310-73-2	X	X	X

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/ELINCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)
Sodium Hydroxide 1310-73-2 (50)	X	X	X	X	X	X	X	X
Water 7732-18-5 (50)	X	X	X		X	X	X	X

Chemical name	Carcinogen Status	Mexico
Sodium Hydroxide		Mexico: Ceiling 2 mg/m³

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

WHMIS Hazard Class D2B - Toxic materials
E - Corrosive material

16. OTHER INFORMATION

NFPA	**Health Hazards** 3	**Flammability** 0	**Instability** 0	**Special Hazards** -
HMIS	**Health Hazards** 3	**Flammability** 0	**Physical hazard** 0	**Personal Protection** J

NFPA/HMIS Ratings Legend Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

Product Certifications
This product meets the chemical testing specifications defined in the Food Chemicals Codex (FCC), 8th Edition.

This product is certified to NSF/ANSI Standard 60 for use in drinking water treatment at the specified maximum use limit. The MUL (maximum use level) for caustic soda is 200 mg/L under NSF/ANSI Standard 60.

OU Kosher Certification

NSF
Certified to NSF/ANSI 60

American Water Works Association

Revision date: 2015-03-27
Revision note Format Change

Disclaimer
Tronox Limited believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specified product designated and may not be applicable where such product is used in combination with any other materials or in any process. Further, since the conditions and methods of use are beyond the control of Tronox Limited, Tronox Limited expressly disclaims any and all liability as to any results obtained or arising from any use of the products or reliance on such information.

Prepared By:

Tronox Limited

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End of Safety Data Sheet

Section Break

SAFETY DATA SHEET
THE DOW CHEMICAL COMPANY

Product name: TERGITOL™ NP-9 Surfactant

Issue Date: 07/06/2018
Print Date: 07/19/2018

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

1. IDENTIFICATION

Product name: TERGITOL™ NP-9 Surfactant

Recommended use of the chemical and restrictions on use
Identified uses: Multi-purpose surfactant. We recommend that you use this product in a manner consistent with the listed use. If your intended use is not consistent with the stated use, please contact your sales or technical service representative.

COMPANY IDENTIFICATION
THE DOW CHEMICAL COMPANY
2030 DOW CENTER
MIDLAND MI 48674-0000
UNITED STATES

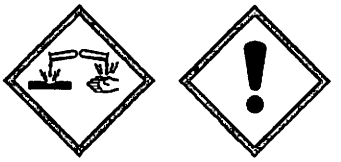
Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: CHEMTREC +1 800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification
GHS classification in accordance with 29 CFR 1910.1200
Acute toxicity - Category 4 - Oral
Acute toxicity - Category 4 - Inhalation
Serious eye damage - Category 1

Label elements
Hazard pictograms



Signal word: **DANGER!**

Hazards
Harmful if swallowed or if inhaled.
Causes serious eye damage.

Precautionary statements

Prevention
Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear eye protection/ face protection.

Response
IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/doctor.

Disposal
Dispose of contents/ container to an approved waste disposal plant.

Other hazards
Slipping hazard.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: 4-Nonylphenol branched, ethoxylated
This product is a substance.

Component	CASRN	Concentration
4-Nonylphenol branched, ethoxylated	127087-87-0	>= 97.0 %
Poly(ethylene oxide)	25322-68-3	<= 3.0 %
Dinonylphenyl polyoxyethylene	9014-93-1	<= 2.0 %

4. FIRST AID MEASURES

Description of first aid measures
General advice:
First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air. If not breathing, give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask, etc). If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

Skin contact: Wash off with plenty of water.

Eye contact: Immediately flush eyes with water; remove contact lenses, if present, after the first 5 minutes, then continue flushing eyes for at least 15 minutes. Obtain medical attention without delay, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.

Ingestion: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.

Most important symptoms and effects, both acute and delayed:
Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed
Notes to physician: Maintain adequate ventilation and oxygenation of the patient. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIREFIGHTING MEASURES

Suitable extinguishing media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Unsuitable extinguishing media: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture
Hazardous combustion products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.

Unusual Fire and Explosion Hazards: Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters
Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES

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

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

Methods and materials for containment and cleaning up: Contain spilled material if possible. Absorb with materials such as: Sand. Dirt. Collect in suitable and properly labeled containers. Do not use water for cleanup. See Section 13, Disposal Considerations, for additional information. Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).

7. HANDLING AND STORAGE

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

Conditions for safe storage: No specific requirements. Additional storage and handling information on this product may be obtained by calling your sales or customer service contact. The shelf life given is for unopened containers stored under moderate temperature conditions.

Storage stability

Shelf life: Use within
24 Month

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
If exposure limits exist, they are listed below. If no exposure limits are displayed, then no values are applicable.

Component	Regulation	Type of listing	Value/Notation
Poly(ethylene oxide)	US WEEL	TWA aerosol	10 mg/m3

Exposure controls
Engineering controls: Use engineering controls to maintain airborne level below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations.

Individual protection measures
Eye/face protection: Use chemical goggles.
Skin protection
Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Examples of preferred glove barrier

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

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive-pressure supplied-air will depend on the specific operation and the potential airborne concentration of the material. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus.

The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	Liquid.
Color	Pale yellow slightly hazy
Odor	Mild
Odor Threshold	No test data available
pH	No test data available
Melting point/range	Not applicable to liquids
Freezing point	3.8 °C (38.8 °F) *Calculated.*
Boiling point (760 mmHg)	> 250 °C (> 482 °F) *Calculated.* Decomposes before boiling
Flash point	**closed cup** 247 °C (477 °F) *ASTM D 93* **open cup** 282 °C (540 °F) *ASTM D92*
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammability (solid, gas)	Not applicable to liquids
Lower explosion limit	No test data available
Upper explosion limit	No test data available
Vapor Pressure	< 0.01 mmHg at 20 °C (68 °F) *Calculated.*
Relative Vapor Density (air = 1)	>1 *Calculated.*
Relative Density (water = 1)	1.057 at 20 °C (68 °F) / 20 °C *Calculated.*
Water solubility	Completely soluble but some compositions may form gels
Partition coefficient: n-octanol/water	log Pow: 2.1 - 3.4 *Calculated.*
Auto-ignition temperature	No test data available
Decomposition temperature	No test data available
Kinematic Viscosity	237 cSt at 25 °C (77 °F) *Calculated.*

Explosive properties	No data available
Oxidizing properties	No data available
Molecular weight	616 g/mol *Calculated.*

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: No data available

Chemical stability: Thermally stable at typical use temperatures.

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Exposure to elevated temperatures can cause product to decompose.

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

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials.

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity
Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

Typical for this family of materials.
LD50, Rat, 960 - 3,980 mg/kg

Acute dermal toxicity
Prolonged skin contact is unlikely to result in absorption of harmful amounts.

Typical for this family of materials.
LD50, Rabbit, 2,000 - 2,991 mg/kg

Acute inhalation toxicity
Prolonged excessive exposure to mist may cause serious adverse effects, even death. Vapor may cause irritation of the upper respiratory tract (nose and throat).

Typical for this family of materials.
LC50, Rat, 4 Hour, dust/mist, 1.15 mg/l

Skin corrosion/irritation
Prolonged contact may cause slight skin irritation with local redness.

Serious eye damage/eye irritation
May cause severe eye irritation.
May cause severe corneal injury.

Sensitization
For this family of materials:
Did not cause allergic skin reactions when tested in humans.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
For this family of materials:
In animals, effects have been reported on the following organs:
Kidney.
Liver.

Carcinogenicity
For this family of materials: Did not cause cancer in laboratory animals.

Teratogenicity
For this family of materials: Has been toxic to the fetus in laboratory animals at doses toxic to the mother. Did not cause birth defects in laboratory animals.

Reproductive toxicity
No relevant data found.

Mutagenicity
For this family of materials: In vitro genetic toxicity studies were negative.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity

Acute toxicity to fish
For this family of materials:
Material is moderately toxic to aquatic organisms on an acute basis (LC50/EC50 between 1 and 10 mg/L in the most sensitive species tested).

For this family of materials:
LC50, Pimephales promelas (fathead minnow), 96 Hour, 3.8 - 6.2 mg/l, OECD Test Guideline 203 or Equivalent

Acute toxicity to aquatic invertebrates

For this family of materials:
LC50, Daphnia magna (Water flea), 48 Hour, 9.3 - 21.4 mg/l, OECD Test Guideline 202 or Equivalent

Toxicity to bacteria
For this family of materials:
IC50, Bacteria, 16 Hour, > 1,000 mg/l

Persistence and degradability
Biodegradability: For this family of materials: Based on stringent OECD test guidelines, this material cannot be considered as readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions.
10-day Window: Not applicable
Biodegradation: < 60 %
Exposure time: 28 d
Method: OECD Test Guideline 301B or Equivalent

Theoretical Oxygen Demand: 2.15 - 2.25 mg/mg

Chemical Oxygen Demand: 2.09 - 2.25 mg/mg

Bioaccumulative potential
Bioaccumulation: For this family of materials:
Partition coefficient: n-octanol/water(log Pow): 2.1 - 3.4 Calculated.
Bioconcentration factor (BCF): 5.9 - 48 Fish Estimated.

Mobility in soil
No relevant data found.

13. DISPOSAL CONSIDERATIONS

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

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s.(Nonylphenol polyethylene glycol ether)
UN number	UN 3082
Class	9
Packing group	III

Marine pollutant	Nonylphenol polyethylene glycol ether

Classification for SEA transport (IMO-IMDG):

Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.(Nonylphenol polyethylene glycol ether)
UN number	UN 3082
Class	9
Packing group	III
Marine pollutant	Nonylphenol polyethylene glycol ether
Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s.(Nonylphenol polyethylene glycol ether)
UN number	UN 3082
Class	9
Packing group	III

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312
Acute toxicity (any route of exposure)
Serious eye damage or eye irritation

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 103
This material does not contain any components with a CERCLA RQ.

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

California Prop. 65
This product contains a chemical that is at or below California Propositions 65's "safe harbor level" as determined via a risk assessment. Therefore, the chemical is not required to be listed as a Prop 65 chemical on the SDS or label.

United States TSCA Inventory (TSCA)
All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

16. OTHER INFORMATION

Product Literature
Additional information on this and other products may be obtained by visiting our web page. Additional information on this product may be obtained by calling your sales or customer service contact. Ask for a product brochure.

Hazard Rating System
NFPA

Health	Flammability	Instability
2	1	0

Revision
Identification Number: 189015 / A001 / Issue Date: 07/06/2018 / Version: 11.0
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

TWA	8-hr TWA
US WEEL	USA. Workplace Environmental Exposure Levels (WEEL)

Full text of other abbreviations
AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire

Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Information Source and References
This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

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

Section Break

Appendix D

Climatic Data

Henderson Mine Precipitation Data

Table D-1 5-Year Annual Mine Precipitation Totals	
Year	**Total Annual Precipitation**
2016	32.00
2017	36.97
2018	28.18
2019	32.64
2020	21.59
Mean	**30.28**

Table D-2 Greatest Annual Precipitation on Record by Month	
Month	**2017 (inches)**
January	6.85
February	4.34
March	3.10
April	3.49
May	3.32
June	1.21
July	3.45
August	2.59
September	2.17
October	2.49
November	1.45
December	2.51
Total	**36.97**

Henderson Mill Precipitation Data

Table D-3 5-Year Annual Precipitation Totals	
Year	**Total Annual Precipitation**
2016	22.75
2017	21.57
2018	18.88
2019	24.67
2020	18.89
Mean	**21.35**

Table D-4 Greatest Annual Precipitation on Record by Month	
Month	**1936 – WRCC Dillon 1E Station (inches)**
January	3.65
February	6.97
March	3.6
April	0.6
May	0.76
June	0.75
July	2.54
August	4.43
September	0.73
October	1.12
November	0.35
December	0.78
Total	**26.28**

Table D-5
Henderson Mine Temperature Data

Month	2016			2017			2018		
	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)
	Min	Max		Min	Max		Min	Max	
January	16.07	18.68	17.36	-14.30	36.87	16.60	-3.73	44.92	22.36
February	21.96	24.23	23.11	-3.86	47.07	24.40	-8.39	37.19	18.72
March	22.76	25.16	23.93	0.21	54.54	31.25	0.73	44.95	24.49
April	29.08	31.51	30.27	7.09	56.84	30.44	2.61	55.38	30.87
May	23.89	59.88	39.89	14.16	61.12	38.09	23.06	67.05	43.48
June	32.06	75.74	53.76	31.19	71.51	51.68	33.48	75.63	53.55
July	39.59	74.16	56.05	35.43	74.62	55.70	35.26	75.27	56.71
August	34.19	70.63	50.85	36.66	68.76	51.89	35.94	74.32	53.64
September	26.48	67.51	48.05	21.78	70.29	47.33	27.64	71.44	50.29
October	16.90	59.81	40.49	11.77	59.40	35.53	-2.13	56.05	33.75
November	1.74	53.69	30.49	5.34	51.37	32.79	-4.36	37.90	20.11
December	-10.44	38.24	18.68	-3.84	41.42	21.40	-13.85	38.91	15.55

Month	2019			2020		
	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)
	Min	Max		Min	Max	
January	-15.29	41.27	18.20	-5.7	39.1	18.0
February	-11.81	37.78	17.17	-14.4	46.5	15.6
March	-3.39	50.36	22.21	4.7	44.7	26.0
April	6.58	54.07	31.58	-0.3	58.0	29.4
May	13.62	58.33	33.75	15.7	66.7	42.0
June	26.49	70.75	47.00	24.6	71.9	49.5
July	37.73	75.45	56.21	33.3	75.3	54.9
August	38.83	72.19	55.75	37.6	73.3	56.1
September	30.87	73.13	50.84	12.9	74.2	46.3
October	-13.00	62.64	29.40	-11.0	65.6	38.1
November	-4.14	48.43	27.22	2.8	54.3	27.1
December	-12.37	44.66	17.74	-7.3	43.9	16.9

Table D-6
Henderson Mill Temperature Data

Month	2016			2017			2018		
	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)
	Min	Max		Min	Max		Min	Max	
January	-19.0	42.9	15.0	-15.8	45.6	16.6	-12.5	49.5	20.7
February	-15.0	49.3	21.5	-9.9	53.4	26.2	-12.8	46.3	21.6
March	-2.9	50.6	25.2	-5.6	59.9	33.7	-1.4	55.0	27.5
April	2.3	64.1	34.4	5.0	66.6	35.4	7.8	67.8	36.0
May	13.1	71.2	43.0	18.1	72.2	43.6	25.1	82.0	49.3
June	30.8	86.2	58.3	28.9	81.6	56.1	26.6	90.0	58.4
July	37.0	84.6	60.7	32.9	87.1	61.6	33.1	88.8	62.9
August	32.8	86.9	56.1	35.7	83.9	57.2	33.6	90.8	59.5
September	26.0	78.5	52.2	20.8	84.5	52.0	23.5	81.7	54.4
October	15.1	69.0	42.5	11.9	66.2	38.0	0.6	68.3	38.2
November	-3.2	61.6	31.2	4.6	60.4	33.8	-8.3	45.6	21.5
December	-16.6	43.8	14.9	-4.3	51.3	21.5	-14.6	37.7	13.9

Month	2019			2020		
	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)
	Min	Max		Min	Max	
January	-16.0	38.8	15.4	-12.6	40.5	16.7
February	-17.7	46.8	17.7	-24.0	53.7	15.6
March	-6.1	55.6	23.9	-1.6	49.9	27.9
April	8.4	63.2	36.3	-3.3	67.4	32.8
May	16.4	71.4	40.3	18.8	79.4	46.3
June	25.7	83.2	52.3	28.1	84.9	54.2
July	35.4	85.9	61.5	30.3	87.3	59.6
August	34.0	84.9	60.8	38.5	85.8	60.8
September	24.3	84.2	54.9	20.8	85.8	50.3
October	-9.7	77.6	31.7	-8.4	72.8	39.5
November	-8.1	51.0	27.2	-5.0	56.9	26.5
December	-15.0	43.1	15.0	-12.0	40.1	13.8

Table D-7
URAD Temperature Data

Month	2016			2017			2018		
	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)
	Min	Max		Min	Max		Min	Max	
January	-8.1	41.5	18.3	-15.1	38.3	17.0	-2.8	46.4	23.5
February	-12.1	48.1	22.4	-6.0	48.2	25.3	-8.8	37.6	19.6
March	-2.8	53.3	24.0	2.6	54.1	31.9	2.9	44.9	25.0
April	2.9	47.2	31.9	6.5	57.0	31.1	5.7	58.3	31.8
May	24.4	60.7	40.6	15.1	61.9	39.0	22.4	67.4	44.0
June	31.6	77.8	54.8	33.3	72.0	52.5	34.8	76.5	54.3
July	40.4	73.7	57.0	37.0	73.8	56.3	35.3	76.2	57.7
August	35.8	70.5	51.6	37.5	69.7	52.3	36.9	71.9	54.4
September	27.1	68.4	48.5	22.7	71.5	47.9	30.5	72.2	51.2
October	17.0	62.3	41.2	12.2	59.8	36.3	31.2	57.5	46.3
November	0.7	54.6	31.2	2.4	52.3	33.5	3.1	40.0	23.2
December	-12.7	39.0	18.5	-3.0	42.0	22.4	-13.6	39.9	16.6

Month	2019			2020		
	Range (°F)		Mean (°F)	Range (°F)		Mean (°F)
	Min	Max		Min	Max	
January	-5.5	34.0	18.7	-6.6	39.8	19.1
February	-10.2	36.4	17.3	-9.6	46.4	16.3
March	2.6	49.4	22.2	9.1	43.3	26.6
April	7.5	54.4	32.0	2.7	58.2	30.1
May	13.1	58.3	34.2	16.3	67.6	42.4
June	27.1	70.8	46.9	25.3	73.1	49.9
July	38.0	73.9	56.2	40.2	76.8	55.4
August	41.1	72.1	53.6	38.4	73.5	56.4
September	31.4	73.2	48.4	15.5	75.4	46.7
October	-9.9	56.6	28.3	-8.5	65.9	38.7
November	3.0	49.4	27.7	1.6	57.8	27.6
December	-9.3	43.9	17.6	-6.1	45.6	17.5

Henderson Mine, Mill, and URAD Wind Speed and Direction

Table D-8
Annual Average Wind Speed and Direction

Year	Mine		Mill		URAD	
	Average Speed (mph)	Average Direction (deg)	Average Speed (mph)	Average Direction (deg)	Average Speed (mph)	Average Direction (deg)
2016	10.1	241.6	4.7	195.7	9.4	181.0
2017	10.2	237.7	5.1	197.8	10.0	170.8
2018	10.3	240.1	4.8	200.2	10.1	176.3
2019	9.7	242.5	4.7	200.3	9.1	175.0
2020	9.9	244.5	4.3	203.0	10.0	176.4

Table D-9
Monthly Average Wind Speed and Direction (2016-2020)

Month	Mine		Mill		URAD	
	Average Speed (mph)	Average Direction (deg)	Average Speed (mph)	Average Direction (deg)	Average Speed (mph)	Average Direction (deg)
January	11.9	252.4	3.6	202.0	10.9	184.6
February	12.5	248.3	5.1	215.7	12.5	180.8
March	11.2	246.0	5.1	212.8	10.9	181.4
April	10.8	242.8	5.2	211.3	10.3	176.7
May	8.1	229.9	5.1	189.1	8.2	166.8
June	8.9	243.6	5.5	197.6	9.0	179.3
July	7.8	233.7	4.9	188.9	7.7	167.0
August	7.8	234.8	4.6	186.9	7.5	168.0
September	8.5	237.3	4.8	187.9	8.5	173.0
October	10.5	238.4	4.6	203.6	10.5	174.0
November	11.1	246.8	4.0	193.3	11.0	183.4
December	11.7	249.0	3.7	201.7	10.6	180.7

Section Break

Appendix E

Geochemical Analyses of Waste Rock Used For Railroad Haulage Construction (1995)

ACZ

Analytical Results

ACZ Laboratories, Inc.
30100 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: *L6186-01*
Client Sample ID: *HM-W1 (Hand. West#1)*
Client Project ID: *Henderson Mine*
ACZ Report ID: *RG10986*

S.M. Stoller Corporation
Mining Services Division 4891 Independence St., Suite 27
Wheat Ridge, CO 80033
Michael Ellis

Date Sampled: *6/19/95*
Date Received: *6/23/95*
Date Reported: *7/10/95*

Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Acid Generation Potential	Calc. M600/2-78-054			tons/KT	1	5	7/10/95	as
Acid Neutralization Potential	Calc. M600/2-78-054	36		tons/KT	1	5	7/10/95	as
Acid-Base Potential (calc)	M600/2-78-054 1.	36		tons/KT	1	5	7/10/95	as
Neutralization Potential as CaCO3	M600 2-78-054 3.	3.7		%	0.1	0.5	7/8/95	as
Sulfur, total	ASTM D-4239-85C, LECO Furnace	0.01	B	%	0.01	0.1	7/7/95	jb

Soil Preparation

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Crush and Pulverize	USDA No. 1, 1972						6/30/95	as
Dry at Room Temperature	USDA No. 1, 1972						6/26/95	as

Inorganic Qualifiers (based on EPA CLP Asm)
U = Analyte was analyzed for but not detected
B = Analyte concentration detected at a value between MDL and PQL
PQL = Practical Quantitation Limit

Ralph V. Poulsen
Vice President of Operations: Ralph Poulsen

REPINO0103.98.01 Page 1 of 1

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: *L6186-02*
Client Sample ID: *HM-W2 (Hend. West#2)*
Client Project ID: *Henderson Mine*
ACZ Report ID: *RC10987*

S.M. Stoller Corporation
Mining Services Division 4891 Independence St., Suite 27
Wheat Ridge, CO 80033
Michael Ellis

Date Sampled: *6/19/95*
Date Received: *6/23/95*
Date Reported: *7/10/95*

Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Acid Generation Potential	Calc. M600/2-78-054			tons/KT	1	5	7/10/95	as
Acid Neutralization Potential	Calc. M600/2-78-054	38		tons/KT	1	5	7/10/95	as
Acid-Base Potential (calc)	M600/2-78-054 1.	38		tons/KT	1	5	7/10/95	as
Neutralization Potential as CaCO3	M600 2-78-054 3.	3.8		%	0.1	0.5	7/8/95	as
Sulfur, total	ASTM D-4239-85C, LECO Furnace		U	%	0.01	0.1	7/1/95	jh

Soil Preparation

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Crush and Pulverize	USDA No. 1, 1972						6/30/95	ns
Dry at Room Temperature	USDA No. 1, 1972						6/26/95	as

Inorganic Qualifiers (based on EPA CLP SOW)
U = Analyte was analyzed for but not detected
B = Analyte concentration detected at a value between MDL and PQL
PQL = Practical Quantitation Limit

Ralph V. Poulsen
Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: *L6186-03*
Client Sample ID: *HM-W3 (Haul. Wash#3)*
Client Project ID: *Henderson Mine*
ACZ Report ID: *R010988*

S.M. Stoller Corporation
Mining Services Division 4891 Independence St., Suite 27
Wheat Ridge, CO 80033
Michael Ellis

Date Sampled: *6/19/95*
Date Received: *6/23/95*
Date Reported: *7/10/95*

Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Acid Generation Potential	Calc. M600/2-78-054			tons/KT	1	5	7/10/95	as
Acid Neutralization Potential	Calc. M600/2-78-054	24		tons/KT	1	5	7/10/95	as
Acid-Base Potential (calc)	M600/2-78-054 1.	24		tons/KT	1	5	7/10/95	as
Neutralization Potential as CaCO3	M600 2-78-054 3.	2.4		%	0.1	0.5	7/8/95	as
Sulfur, total	ASTM D-4239-85C, LECO Furnace		U	%	0.01	0.1	7/7/95	jb

Soil Preparation

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Crush and Pulverize	USDA No. 1, 1972						6/30/95	as
Dry at Room Temperature	USDA No. 1, 1972						6/26/95	as

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

Ralph V. Poulsen

Vice President of Operations: Ralph Poulsen

REPIN00103.95.01

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80477
(800) 334-5493

Lab Sample ID: *L6186-04*
Client Sample ID: *HM-E4 (Hand. Rast#4)*
Client Project ID: *Henderson Mine*
ACZ Report ID: *R011098V*

S.M. Stoller Corporation
Mining Services Division 4891 Independence St., Suite 27
Wheat Ridge, CO 80033
Michael Ellis

Date Sampled: *6/19/95*
Date Received: *6/23/95*
Date Reported: *7/10/95*

Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Acid Generation Potential	Calc. M600/2-78-054			tons/KT	1	5	7/10/95	ss
Acid Neutralization Potential	Calc. M600/2-78-054	19		tons/KT	1	5	7/10/95	ss
Acid-Base Potential (calc)	M600/2-78-054 1.	19		tons/KT	1	5	7/10/95	ss
Neutralization Potential as CaCO3	M600 2-78-054 3.	1.9		%	0.1	0.5	7/8/95	as
Sulfur, total	ASTM D-4239-85C, LECO Furnace		U	%	0.01	0.1	7/7/95	jh

Soil Preparation

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Crush and Pulverize	USDA No. 1, 1972						6/30/95	as
Dry at Room Temperature	USDA No. 1, 1972						6/26/95	as

Inorganic Qualifiers (based on EPA CLP SOW)
U = Analyte was analyzed for but not detected
B = Analyte concentration detected at a value between MDL and PQL
PQL = Practical Quantitation Limit

Ralph V. Poulsen
Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Dewdell Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: *L6186-05*
Client Sample ID: *HM-BS (Hend. East#5)*
Client Project ID: *Henderson Mine*
ACZ Report ID: *RG10990*

S.M. Stoller Corporation
Mining Services Division 4891 Independence St., Suite 27
Wheat Ridge, CO 80033
Michael Ellis

Date Sampled: *6/19/95*
Date Received: *6/23/95*
Date Reported: *7/10/95*

Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date Analyzed	
Acid Generation Potential	Calc. M600/7-78-054			tons/KT	1	5	7/10/95	ax
Acid Neutralization Potential	Calc. M600/2-78-054	24		tons/KT	1	5	7/10/95	ag
Acid-Base Potential (calc)	M600/2-78-054 1.	24		tons/KT	1	5	7/10/95	ax
Neutralization Potential as CaCO3	M600 2-78-054 3.	2.4		%	0.1	0.5	7/10/95	ag
Sulfur, total	ASTM D-4239-85C, LECO Furnace		U	%	0.01	0.1	7/7/95	jh

Soil Preparation

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date Analyzed	
Crush and Pulverize	USDA No. 1, 1972						6/30/95	ax
Dry at Room Temperature	USDA No. 1, 1972						6/26/95	ax

Inorganic Qualifiers (based on EPA CLP 3-90)
U = Analyte was analyzed for but not detected
B = Analyte concentration detected at a value between MDL and PQL.
PQL = Practical Quantitation Limit

Ralph V. Poulsen
Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487
(303) 879-9048

Lab Sample ID: *L6186-06*
Client Sample ID: *HM-B6 (Hend. East#6)*
Client Project ID: *Henderson Mine*
ACZ Report ID: *RQ10991*

S.M. Stoller Corporation
Mining Services Division 4891 Independence St., Suite 27
Wheat Ridge, CO 80033
Michael Ellis

Date Sampled: *6/19/95*
Date Received: *6/23/95*
Date Reported: *7/10/95*

Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date Analyzed	Analyst
Acid Generation Potential	Calc. M600/2-78-054			tons/KT	1	5	7/10/95	as
Acid Neutralization Potential	Calc. M600/2-78-054	20		tons/KT	1	5	7/10/95	as
Acid-Base Potential (calc)	M600/2-78-054 1.	20		tons/KT	1	5	7/10/95	as
Neutralization Potential as CaCO3	M600 2-78-054 3.	2.0		%	0.1	0.5	7/8/95	as
Sulfur, total	ASTM D-4239-85C, LECO Furnace	0.01	B	%	0.01	0.1	7/7/95	jb

Soil Preparation

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date Analyzed	Analyst
Crush and Pulerize	USDA No. 1, 1972						6/30/95	as
Dry at Room Temperature	USDA No. 1, 1972						6/26/95	as

Inorganic Qualifiers (based on EPA CLP 3/90)
U = Analyte was analyzed for but not detected
B = Analyte concentration detected at a value between MDL and PQL
PQL = Practical Quantitation Limit

Ralph V. Penlesen
Vice President of Operations: Ralph Penlesen