March 4, 2021

Scott McDaniel
Haile Gold Mine, Inc.
6911 Snowy Owl Road
Kershaw, SC 29067

RE: Permit Number LOA-005615
Haile Gold Mine, Inc.
Treatment Chemical Change
Wastewater Construction Permit #19830-IW
Lancaster County

Dear Mr. McDaniel:

The Department received the request dated March 1, 2021 to replace the sodium hypochlorite used in the wastewater treatment system with sodium permanganate. The permanganate will be added prior to the 1st Stage Reaction Tank in order to maximize residence time in the lower pH section of the treatment circuit. This change is to eliminate a chlorine source that may negatively impact the WET test. The Department hereby grants approval to proceed with the treatment chemical change per your request.

If you have any comments, please contact me at 803-898-4236 or amickbm@dhec.sc.gov.

Sincerely,

Byron M Amick
Environmental Engineer Associate
Industrial Wastewater Permitting Section
Water Facilities Permitting Division

cc via email: Veronica Barringer, Midlands EA Lancaster
Erin Evans, Midlands EA Lancaster
BOW/WPC Enforcement

Wastewater - Industrial - Preliminary Engineering Review (PER) and Other Request Form - New

version 2.3

(Submission #: HP6-WRQ1-5DS63, version 1)

Details

Submission ID	HP6-WRQ1-5DS63
Submission Reason	New
Status	Submitted

Form Input

Request Information

Do you anticipate this project being funded by State Revolving Fund (SRF)?
No

Request Type:
Preliminary Engineering Report (PER) (For new, expanding, and/or upgrading facilities only.)

What type of Preliminary Engineering Report are you submitting?
Other: Reagent Change from NaOCl to NaMnO4

Permittee Information

Permittee

Organization Name
Haile Gold Mine

Phone Type	Number	Extension
Business	8034752943	

Email
scott.mcdaniel@oceanagold.com

Fax
NONE PROVIDED

Address

6911 Snowy Owl Road

Kershaw, SC 29067

United States

Owner Information

Owner

Organization Name
Haile Gold Mine

Phone Type	Number	Extension
Business	8034752943	

Email
scott.mcdaniel@oceanagold.com

Fax
NONE PROVIDED

Address

6911 Snowy Owl Road

Kershaw, SC 29067

Is the owner also the operator?
Yes

Contact Information

Facility Contact

Prefix
NONE PROVIDED

First Name	Last Name
Scott	*McDaniel*

Title
Environmental Manager

Organization Name
Haile Gold Mine

Phone Type	Number	Extension
Business	8034752943	

Email
scott.mcdaniel@oceanagold.com

Fax
NONE PROVIDED

Address

6911 Snowy Owl Road

Kershaw, SC 29067

United States

Engineer Information

PER Engineer

Prefix
NONE PROVIDED

First Name	Last Name
Sam	*Billin*

Title
NONE PROVIDED

Organization Name
HAILE GOLD MINE INC

Phone Type	Number	Extension
Business	7757778003	

Email
Sam.Billin@linkan.biz

Fax
NONE PROVIDED

Address

2720 Ruby Vista Drive

Elko, NV 89801

United States

Engineer's S.C. Registration Number:
38192

LLR Licensing Lookup
Engineers and Land Surveyors - Licensee Lookup

Project Information

Project Name:
Haile Gold Mine

Facility Name
HAILE GOLD MINE

NPDES/ND Permit Number and Name
HAILE GOLD MINE - SC0040479

Project Address:

6911 Snowy Owl Road

Kershaw, SC 29067

Project County
Lancaster

Project Location:
34.5985,-80.5347

Project Description of Wastewater Systems:
Two Stage Water Treatment facility

Project Details

Is this project part of a phased project?
No

What is this project submission based on?
Neither

Wastewater Systems

AVERAGE DESIGN FLOW

Project average design flow (GPD)
1,728,000

RECEIVING FACILITY

Construction, LOA, or Other Permit, if applicable.
NONE PROVIDED

Facility Address
NONE PROVIDED

NPDES/ND Number and Name
NONE PROVIDED

DISPOSAL SITES

Effluent Disposal Site (Description)
NONE PROVIDED

Sludge Disposal Site (Description)
Haile Gold Mine Tailing Storage Facility

Submittal Requirements

Additional Documents:

NaOCl vs NaMnO4.pdf - 03/01/2021 10:35 AM
Sodium Permanganate 40% 5287.pdf - 03/01/2021 10:35 AM

Comment

Purpose of this change is to eliminate a chlorine source that may negatively impact the WET test.

Use the space below to bring to the Department's attention any additional information that you believe should be considered in the permit decision.

NONE PROVIDED

Attachments

Date	Attachment Name	Context	User
3/1/2021 10:35 AM	NaOCl vs NaMnO4.pdf	Attachment	Scott McDaniel
3/1/2021 10:35 AM	Sodium Permanganate 40% 5287.pdf	Attachment	Scott McDaniel

Status History

	User	Processing Status
3/1/2021 10:22:03 AM	Scott McDaniel	Draft
3/1/2021 10:37:16 AM	Scott McDaniel	Submitting
3/1/2021 10:37:32 AM	Scott McDaniel	Submitted

Audit

Event	Event Description	Event By	Event Date
Submission Locked	Submission Locked	Patty G Barnes	3/2/2021 2:04 PM
Submission Unlocked	Submission Unlocked	Patty G Barnes	3/2/2021 2:07 PM

MEMORANDUM

DATE: 2/15/2021

TO: Justin Johns, Scott McDaniel

FROM: Sam Billin, P.E., Scott Barton

SUBJECT: Sodium Permanganate to Replace Sodium Hypochlorite

REFERENCE NO.: 69.12

INTRODUCTION

This memorandum presents the attributes of sodium hypochlorite (NaOCl) and sodium permanganate (NaMnO4) when they are used as oxidants in water treatment. This information is intended to facilitate replacing NaOCl with NaMnO4 at Oceana Gold's Haile Mine Contact Water Treatment Plant (CWTP). This change is beneficial in order to treat manganese more effectively, which in turn is a major contributor to thallium mitigation. Additionally, $NaMnO_4$ does not contribute to disinfection byproducts (DBPs) formation, which are being increasingly regulated by the US EPA.

$NaMnO_4$ is used commercially in many industrial applications as an oxidizer, with much of this use being for the removal of manganese from treated waters. Its proposed application at Oceana Gold's Haile facility is not novel or experimental. Additionally, bench tests have been performed that show its effectiveness is equivalent to, or surpassing that of, NaOCl in regard to manganese removal.

NaOCl –vs- $NaMnO_4$

Sodium hypochlorite has been in use at Oceana Gold's Haile facility to oxidize contact water in order for it to undergo the water treatment process. This oxidation has been performed using 12.5% by weight NaOCl, which is the highest commercially available concentration of this chemical. In order to use the facility's existing pump capacity, and to have oxidative effects that are effective across a broad spectrum of water quality and seasonal variations, the use of $NaMnO_4$ is suggested. This manganese oxyanion is similar in oxidative strength to NaOCl, with the MnO_4 oxyanion having an electrode potential of +1.68 V compared with the +1.63 V potential of NaOCl. However, this permanganate compound has a solubility that allows it to be made up in concentrated solutions of up to 40% by weight, which is a commercially available product. This solubility of this chemical exceeds that of potassium permanganate ($KMnO_4$),

which is also commercially available, but which would not offer the high oxidative capability of $NaMnO_4$ using the current pumps at the site due to its limited solubility.

Control of sodium permanganate is achievable via monitoring using a standard residual free chlorine test and visual indicators (it imparts a purple tint to the water when added, and exhibits a light pink tint after the oxidation reactions if a residual exists, with the water turning clear when it is fully neutralized). This visual aspect is beneficial for the operators, as it allows for additional verification of their analytical test results.

Destruction of the residual will be performed using sodium meta-bisulfite (SMBS), which will create sodium bisulfite (SBS) when it is mixed with water and made into a solution that can be delivered via pumps. The SBS is a strong reducing agent and a small dose of a few mg/L will neutralize the $NaMnO_4$ residual without imparting toxicity. This residual destruction is exactly the same as is used for NaOCl, with this system already being operational at the Haile CWTP.

Process control will be similar to that used with NaOCl as an oxidant, with the $NaMnO_4$ chemistry being dosed in the smallest amounts that provide results in alignment with the water treatment goals, and with careful consideration of the whole effluent toxicity (WET) tests.

END

Safety Data Sheet

Sodium Permanganate 40%

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sodium Permanganate 40%

Synonyms/Generic Names: None

Product Number: 5287

Product Use: Industrial, Manufacturing or Laboratory use

Manufacturer: Columbus Chemical Industries, Inc.
N4335 Temkin Rd.
Columbus, WI. 53925

For More Information: 920-623-2140 (Monday-Friday 8:00-4:30)
www.columbuschemical.com

In Case of Emergency Call: CHEMTREC - 800-424-9300 or 703-527-3887 (24 Hours/Day, 7 Days/Week)

2. HAZARDS IDENTIFICATION

OSHA Hazards: Not classified

Target Organs: Respiratory tract irritation

Signal Word: Danger

Pictograms: 

GHS Classification:

Oxidizing liquid	Category 2
Acute toxicity, Oral	Category 4
Skin corrosion	Category 1B
Serious eye damage	Category 1
STOT	Category 3
Acute aquatic toxicity	Category 1
Chronic aquatic toxicity	Category 1

GHS Label Elements, including precautionary statements:

Hazard Statements:

H272	May intensify fire; oxidizer.
H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H335	May cause respiratory irritation.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements:

P210	Keep away from heat.
P221	Take any precaution to avoid mixing with combustibles.
P220	Keep/Store away from clothing and other combustible materials.
P271	Use only outdoors or in well-ventilated area.
P260	Do not breathe mist or vapors.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P270	Do not eat, drink or smoke when using this product.
P264	Wash hands thoroughly after handling.
P370	In case of fire: Use water for extinction.
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.
P363	Wash contaminated clothing before reuse.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P310	Immediately call a POISON CENTER or doctor/physician.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P405	Store locked up.
P403	Store in a well-ventilated place.
P233	Keep container tightly closed.
P501	Dispose of contents/container in accordance with local regulations.
P273	Avoid release to the environment.
P391	Collect spillage.

Potential Health Effects

Eyes	Causes burns to eye and mucous membranes. Permanent eye damage including blindness could result.
Inhalation	May cause respiratory tract irritation.
Skin	Harmful if absorbed through skin. Cause severe skin burns.
Ingestion	Harmful if swallowed.

NFPA Ratings

Health	3
Flammability	0
Reactivity	1
Specific hazard	OX

HMIS Ratings

Health	3
Fire	0
Reactivity	1

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Weight %	CAS #	EINECS# / ELINCS#	Formula	Molecular Weight
Sodium Permanganate	40	10101-50-5	233-251-1	$NaMnO_4$	141.925 g/mol

4. FIRST-AID MEASURES

Eyes	Rinse with plenty of water for at least 15 minutes and seek medical attention if necessary.
Inhalation	Move casualty to fresh air and keep at rest. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention if necessary.
Skin	Flush with plenty of water for at least 15 minutes while removing contaminated clothing and wash using soap. Get medical attention if necessary.
Ingestion	**Do Not Induce Vomiting!** Never give anything by mouth to an unconscious person. If conscious, wash out mouth with water. Get medical attention if necessary.

5. FIRE-FIGHTING MEASURES

Suitable (and unsuitable) extinguishing media	Flood with water from a distance, water spray or fog. Dry chemical, Foam, Carbon dioxide are ineffective.
Special protective equipment and precautions for firefighters	Wear self-contained, approved breathing apparatus and full protective clothing, including eye protection and boots.
Specific hazards arising from the chemical	May intensify fire; oxidizer. May ignite combustibles (wood, paper, oil, clothing, etc. Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction. Oxidizing agent may cause spontaneous ignition of combustible materials. By heating and fire, corrosive vapors/gasses may be formed.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	See section 8 for recommendations on the use of personal protective equipment.
Environmental precautions	Prevent spillage from entering drains. Any release to the environment may be subject to federal/national or local reporting requirements.
Methods and materials for containment and cleaning up	Absorb spill with noncombustible absorbent material, then place in a suitable container for disposal. Clean surfaces thoroughly with water to remove residual contamination. Dispose of all waste and cleanup materials in accordance with regulations.

7. HANDLING AND STORAGE

Precautions for safe handling
See section 8 for recommendations on the use of personal protective equipment. Use with adequate ventilation. Wash thoroughly after using. Keep container closed when not in use. Avoid formation of aerosols.

Conditions for safe storage, including any incompatibilities
Store in cool, dry well ventilated area. Keep away from incompatible materials (see section 10 for incompatibilities).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational exposure controls:

Component	Exposure Limits	Basis	Form	Entity
Sodium Permanganate	5 mg/m^3	CEIL		OSHA
	0.1 mg/m^3	TWA	Inhalable fraction	ACGIH
	0.02 mg/m^3		Respirable fraction	ACGIH
	3 mg/m^3	STEL	Fume	NIOSH
	1 mg/m^3	TWA	Fume	NIOSH

TWA: Time Weighted Average over 8 hours of work.
TLV: Threshold Limit Value over 8 hours of work.
REL: Recommended Exposure Limit
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit during x minutes.

IDLH: Immediately Dangerous to Life or Health
WEEL: Workplace Environmental Exposure Levels
CEIL: Ceiling

Personal Protection

Eyes	Wear chemical safety glasses or goggles.
Inhalation	Provide local exhaust, preferably mechanical. If exposure levels are excessive, use an approved respirator.
Skin	Wear nitrile or rubber gloves, and apron or lab coat.
Other	Not Available

Other Recommendations
Provide eyewash stations, quick-drench showers and washing facilities accessible to areas of use and handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance (physical state, color, etc.)	Dark purple liquid
Odor	Odorless
Odor threshold	Not Available
pH	5-8
Melting point/freezing point	<24.8 °F (<-4°C)
Initial boiling point and boiling range	>213.8 °F (>101 °C)
Flash point	Does not flash
Evaporation rate	As water
Flammability (solid, gas)	Not applicable
Upper/lower flammability or explosive limit	Not applicable
Vapor pressure	760 mm Hg (105 °C)
Vapor density	Not Available
Relative density	1.37 – 1.4 (20°C) (Water = 1)
Solubility (ies)	Miscible with water
Partition coefficient: n-octanol/water	Not Available
Auto-ignition temperature	Not Available
Decomposition temperature	Not Available

10. STABILITY AND REACTIVITY

Chemical Stability	Stable
Possibility of Hazardous Reactions	Contact with combustible material may cause fire. Can explode in contact with sulfuric acid, peroxides and metal powders.
Conditions to Avoid	Contact with incompatible material or heat (135°C / 275°F) could result in violent exothermic chemical reaction.
Incompatible Materials	Acids. Peroxides. Reducing agents. Combustible material. Metals powders.
Hazardous Decomposition Products	By heating and fire, corrosive vapors/gases may be formed. Contact with hydrochloric acid liberates chlorine gas.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Potassium Permanganate:

Skin	LD50 Dermal - Rat - 2000mg/kg
Eyes	Not available
Respiratory	Not available
Ingestion	LD50 Oral - Rat - 2000mg/kg

Carcinogenicity

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

Signs & Symptoms of Exposure

Skin	Causes burns to skin
Eyes	Causes burns to eye and mucous membranes.
Respiratory	Irritation
Ingestion	Irritation

Chronic Toxicity	Not Available
Teratogenicity	Not Available
Mutagenicity	Not Available
Embryotoxicity	Not Available
Specific Target Organ Toxicity	Not Available
Reproductive Toxicity	Not Available
Respiratory/Skin Sensitization	Not Available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Potassium permanganate

Aquatic Vertebrate	LC50 – Bluegill (Lepomis macrochirus) – 2.7 mg/l, 96 hours, static LC50 – Carp (Cyprinus carpio) – 3.16 mg/l, 96 hours
	LC50 – Carp (Cyprinus carpio) – 3.16 – 3.77 mg/l, 96 hours
	LC50 – Goldfish (Carassius auratus) – 3.3 -3.93 mg/l, 96 hours, static
	LC50 – Rainbow trout (Oncorhynchus mykiss) – 1.8 mg/l, 96 hours
Aquatic Invertebrate	Not Available
Terrestrial	Not Available

Persistence and Degradability	Expected to be readily converted by oxidizable material to insoluble manganese oxide.
Bioaccumulative Potential	Potential to bioaccumlate is low
Mobility in Soil	The product is miscible with water. May spread in water systems.
PBT and vPvB Assessment	Not Available
Other Adverse Effects	Not Available

13. DISPOSAL CONSIDERATIONS

Waste Product or Residues	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product or residue.
Product Containers	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product container.

The information offered in section 13 is for the product as shipped. Use and/or alterations to the product may significantly change the characteristics of the material and alter the waste classification and proper disposal methods.

14. TRANSPORTATION INFORMATION

US DOT	UN3214, Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate), 5.1, pg II
TDG	UN3214, PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. (Sodium permanganate), 5.1, PG II
IMDG	UN3214, PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. (Sodium permanganate), 5.1, PG II
Marine Pollutant	Yes
IATA/ICAO	UN3214, Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate), 5.1, pg II

15. REGULATORY INFORMATION

TSCA Inventory Status	All ingredients are listed on the TSCA Active inventory.
DSL	Listed: Potassium permanganate
NDSL	Listed: Sodium Permanganate
California Proposition 65	Not Listed
SARA 302	Not Listed
SARA 304	Not Listed
SARA 311	Fire Hazard, Acute Health Hazard, Chronic Health Hazard
SARA 312	Fire Hazard, Acute Health Hazard, Chronic Health Hazard
SARA 313	Listed: Potassium permanganate
WHMIS Canada	Listed: Potassium permanganate Class C: Oxidizing material Class E: Corrosive material

16. OTHER INFORMATION

Revision	Date
Original	04/22/2020

Wastewater - Industrial - Preliminary Engineering Review (PER) and Other Request Form - New

version 2.3

(Submission #: HP6-WRQ1-5DS63, version 1)

Details

Submission ID	HP6-WRQ1-5DS63
Submission Reason	New

Form Input

Request Information

Do you anticipate this project being funded by State Revolving Fund (SRF)?
No

Request Type:
Preliminary Engineering Report (PER) (For new, expanding, and/or upgrading facilities only.)

What type of Preliminary Engineering Report are you submitting?
Other: Reagent Change from NaOCl to NaMnO4

Permittee Information

Permittee

Organization Name
Haile Gold Mine

Phone Type	Number	Extension
Business	8034752943	

Email
scott.mcdaniel@oceanagold.com

Fax
NONE PROVIDED

Address
6911 Snowy Owl Road
Kershaw, SC 29067
United States

Owner Information

Owner

Organization Name
Haile Gold Mine

Phone Type	Number	Extension
Business	8034752943	

Email
scott.mcdaniel@oceanagold.com

Fax
NONE PROVIDED

Address
6911 Snowy Owl Road
Kershaw, SC 29067

Is the owner also the operator?
Yes

Contact Information

Facility Contact

Prefix
NONE PROVIDED

First Name	Last Name
Scott	*McDaniel*

Title
Environmental Manager

Organization Name
Haile Gold Mine

Phone Type	Number	Extension
Business	8034752943	

Email
scott.mcdaniel@oceanagold.com

Fax
NONE PROVIDED

Address
6911 Snowy Owl Road
Kershaw, SC 29067
United States

Engineer Information

PER Engineer

Prefix
NONE PROVIDED

First Name	Last Name
Sam	*Billin*

Title
NONE PROVIDED

Organization Name
HAILE GOLD MINE INC

Phone Type	Number	Extension
Business	7757778003	

Email
Sam.Billin@linkan.biz

Fax
NONE PROVIDED

Address

2720 Ruby Vista Drive
Elko, NV 89801
United States

Engineer's S.C. Registration Number:
38192

LLR Licensing Lookup
Engineers and Land Surveyors - Licensee Lookup

Project Information

Project Name:
Haile Gold Mine

Facility Name
HAILE GOLD MINE

NPDES/ND Permit Number and Name
HAILE GOLD MINE - SC0040479

Project Address:

6911 Snowy Owl Road
Kershaw, SC 29067

Project County
Lancaster

Project Location:
34.5985,-80.5347

Project Description of Wastewater Systems:
Two Stage Water Treatment facility

Project Details

Is this project part of a phased project?
No

What is this project submission based on?
Neither

Wastewater Systems

AVERAGE DESIGN FLOW

Project average design flow (GPD)
1,728,000

RECEIVING FACILITY

Construction, LOA, or Other Permit, if applicable.
NONE PROVIDED

Facility Address
NONE PROVIDED

NPDES/ND Number and Name
NONE PROVIDED

DISPOSAL SITES

Effluent Disposal Site (Description)
NONE PROVIDED

Sludge Disposal Site (Description)
Haile Gold Mine Tailing Storage Facility

Submittal Requirements

Additional Documents:

NaOCl vs NaMnO4.pdf - 03/01/2021 10:35 AM
Sodium Permanganate 40% 5287.pdf - 03/01/2021 10:35 AM

Comment
Purpose of this change is to eliminate a chlorine source that may negatively impact the WET test.

Use the space below to bring to the Department's attention any additional information that you believe should be considered in the permit decision.
NONE PROVIDED

MEMORANDUM

DATE: 2/15/2021

TO: Justin Johns, Scott McDaniel

FROM: Sam Billin, P.E., Scott Barton

SUBJECT: Sodium Permanganate to Replace Sodium Hypochlorite

REFERENCE NO.: 69.12

INTRODUCTION

This memorandum presents the attributes of sodium hypochlorite (NaOCl) and sodium permanganate (NaMnO4) when they are used as oxidants in water treatment. This information is intended to facilitate replacing NaOCl with NaMnO4 at Oceana Gold's Haile Mine Contact Water Treatment Plant (CWTP). This change is beneficial in order to treat manganese more effectively, which in turn is a major contributor to thallium mitigation. Additionally, $NaMnO_4$ does not contribute to disinfection byproducts (DBPs) formation, which are being increasingly regulated by the US EPA.

$NaMnO_4$ is used commercially in many industrial applications as an oxidizer, with much of this use being for the removal of manganese from treated waters. Its proposed application at Oceana Gold's Haile facility is not novel or experimental. Additionally, bench tests have been performed that show its effectiveness is equivalent to, or surpassing that of, NaOCl in regard to manganese removal.

NaOCl –vs- $NaMnO_4$

Sodium hypochlorite has been in use at Oceana Gold's Haile facility to oxidize contact water in order for it to undergo the water treatment process. This oxidation has been performed using 12.5% by weight NaOCl, which is the highest commercially available concentration of this chemical. In order to use the facility's existing pump capacity, and to have oxidative effects that are effective across a broad spectrum of water quality and seasonal variations, the use of $NaMnO_4$ is suggested. This manganese oxyanion is similar in oxidative strength to NaOCl, with the MnO_4 oxyanion having an electrode potential of +1.68 V compared with the +1.63 V potential of NaOCl. However, this permanganate compound has a solubility that allows it to be made up in concentrated solutions of up to 40% by weight, which is a commercially available product. This solubility of this chemical exceeds that of potassium permanganate ($KMnO_4$),

which is also commercially available, but which would not offer the high oxidative capability of $NaMnO_4$ using the current pumps at the site due to its limited solubility.

Control of sodium permanganate is achievable via monitoring using a standard residual free chlorine test and visual indicators (it imparts a purple tint to the water when added, and exhibits a light pink tint after the oxidation reactions if a residual exists, with the water turning clear when it is fully neutralized). This visual aspect is beneficial for the operators, as it allows for additional verification of their analytical test results.

Destruction of the residual will be performed using sodium meta-bisulfite (SMBS), which will create sodium bisulfite (SBS) when it is mixed with water and made into a solution that can be delivered via pumps. The SBS is a strong reducing agent and a small dose of a few mg/L will neutralize the $NaMnO_4$ residual without imparting toxicity. This residual destruction is exactly the same as is used for NaOCl, with this system already being operational at the Haile CWTP.

Process control will be similar to that used with NaOCl as an oxidant, with the $NaMnO_4$ chemistry being dosed in the smallest amounts that provide results in alignment with the water treatment goals, and with careful consideration of the whole effluent toxicity (WET) tests.

END

Safety Data Sheet

Sodium Permanganate 40%

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sodium Permanganate 40%

Synonyms/Generic Names: None

Product Number: 5287

Product Use: Industrial, Manufacturing or Laboratory use

Manufacturer: Columbus Chemical Industries, Inc.
N4335 Temkin Rd.
Columbus, WI. 53925

For More Information: 920-623-2140 (Monday-Friday 8:00-4:30)
www.columbuschemical.com

In Case of Emergency Call: CHEMTREC - 800-424-9300 or 703-527-3887 (24 Hours/Day, 7 Days/Week)

2. HAZARDS IDENTIFICATION

OSHA Hazards: Not classified

Target Organs: Respiratory tract irritation

Signal Word: Danger

Pictograms: 

GHS Classification:

Oxidizing liquid	Category 2
Acute toxicity, Oral	Category 4
Skin corrosion	Category 1B
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P233	Keep container tightly closed.
P501	Dispose of contents/container in accordance with local regulations.
P273	Avoid release to the environment.
P391	Collect spillage.

Potential Health Effects

Eyes	Causes burns to eye and mucous membranes. Permanent eye damage including blindness could result.
Inhalation	May cause respiratory tract irritation.
Skin	Harmful if absorbed through skin. Cause severe skin burns.
Ingestion	Harmful if swallowed.

NFPA Ratings

Health	3
Flammability	0
Reactivity	1
Specific hazard	OX

HMIS Ratings

Health	3
Fire	0
Reactivity	1

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Weight %	CAS #	EINECS# / ELINCS#	Formula	Molecular Weight
Sodium Permanganate	40	10101-50-5	233-251-1	$NaMnO_4$	141.925 g/mol

4. FIRST-AID MEASURES

Eyes	Rinse with plenty of water for at least 15 minutes and seek medical attention if necessary.
Inhalation	Move casualty to fresh air and keep at rest. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention if necessary.
Skin	Flush with plenty of water for at least 15 minutes while removing contaminated clothing and wash using soap. Get medical attention if necessary.
Ingestion	**Do Not Induce Vomiting!** Never give anything by mouth to an unconscious person. If conscious, wash out mouth with water. Get medical attention if necessary.

5. FIRE-FIGHTING MEASURES

Suitable (and unsuitable) extinguishing media	Flood with water from a distance, water spray or fog. Dry chemical, Foam, Carbon dioxide are ineffective.
Special protective equipment and precautions for firefighters	Wear self-contained, approved breathing apparatus and full protective clothing, including eye protection and boots.
Specific hazards arising from the chemical	May intensify fire; oxidizer. May ignite combustibles (wood, paper, oil, clothing, etc. Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction. Oxidizing agent may cause spontaneous ignition of combustible materials. By heating and fire, corrosive vapors/gasses may be formed.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	See section 8 for recommendations on the use of personal protective equipment.
Environmental precautions	Prevent spillage from entering drains. Any release to the environment may be subject to federal/national or local reporting requirements.
Methods and materials for containment and cleaning up	Absorb spill with noncombustible absorbent material, then place in a suitable container for disposal. Clean surfaces thoroughly with water to remove residual contamination. Dispose of all waste and cleanup materials in accordance with regulations.

7. HANDLING AND STORAGE

Precautions for safe handling
See section 8 for recommendations on the use of personal protective equipment. Use with adequate ventilation. Wash thoroughly after using. Keep container closed when not in use. Avoid formation of aerosols.

Conditions for safe storage, including any incompatibilities
Store in cool, dry well ventilated area. Keep away from incompatible materials (see section 10 for incompatibilities).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational exposure controls:

Component	Exposure Limits	Basis	Form	Entity
Sodium Permanganate	5 mg/m^3	CEIL		OSHA
	0.1 mg/m^3	TWA	Inhalable fraction	ACGIH
	0.02 mg/m^3		Respirable fraction	ACGIH
	3 mg/m^3	STEL	Fume	NIOSH
	1 mg/m^3	TWA	Fume	NIOSH

TWA: Time Weighted Average over 8 hours of work.
TLV: Threshold Limit Value over 8 hours of work.
REL: Recommended Exposure Limit
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit during x minutes.

IDLH: Immediately Dangerous to Life or Health
WEEL: Workplace Environmental Exposure Levels
CEIL: Ceiling

Personal Protection

Eyes	Wear chemical safety glasses or goggles.
Inhalation	Provide local exhaust, preferably mechanical. If exposure levels are excessive, use an approved respirator.
Skin	Wear nitrile or rubber gloves, and apron or lab coat.
Other	Not Available

Other Recommendations
Provide eyewash stations, quick-drench showers and washing facilities accessible to areas of use and handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance (physical state, color, etc.)	Dark purple liquid
Odor	Odorless
Odor threshold	Not Available
pH	5-8
Melting point/freezing point	<24.8 °F (<-4°C)
Initial boiling point and boiling range	>213.8 °F (>101 °C)
Flash point	Does not flash
Evaporation rate	As water
Flammability (solid, gas)	Not applicable
Upper/lower flammability or explosive limit	Not applicable
Vapor pressure	760 mm Hg (105 °C)
Vapor density	Not Available
Relative density	1.37 – 1.4 (20°C) (Water = 1)
Solubility (ies)	Miscible with water
Partition coefficient: n-octanol/water	Not Available
Auto-ignition temperature	Not Available
Decomposition temperature	Not Available

10. STABILITY AND REACTIVITY

Chemical Stability	Stable
Possibility of Hazardous Reactions	Contact with combustible material may cause fire. Can explode in contact with sulfuric acid, peroxides and metal powders.
Conditions to Avoid	Contact with incompatible material or heat (135°C / 275°F) could result in violent exothermic chemical reaction.
Incompatible Materials	Acids. Peroxides. Reducing agents. Combustible material. Metals powders.
Hazardous Decomposition Products	By heating and fire, corrosive vapors/gases may be formed. Contact with hydrochloric acid liberates chlorine gas.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Potassium Permanganate:

Skin	LD50 Dermal - Rat - 2000mg/kg
Eyes	Not available
Respiratory	Not available
Ingestion	LD50 Oral - Rat - 2000mg/kg

Carcinogenicity

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

Signs & Symptoms of Exposure

Skin	Causes burns to skin
Eyes	Causes burns to eye and mucous membranes.
Respiratory	Irritation
Ingestion	Irritation

Chronic Toxicity	Not Available
Teratogenicity	Not Available
Mutagenicity	Not Available
Embryotoxicity	Not Available
Specific Target Organ Toxicity	Not Available
Reproductive Toxicity	Not Available
Respiratory/Skin Sensitization	Not Available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Potassium permanganate

Aquatic Vertebrate	LC50 – Bluegill (Lepomis macrochirus) – 2.7 mg/l, 96 hours, static LC50 – Carp (Cyprinus carpio) – 3.16 mg/l, 96 hours
	LC50 – Carp (Cyprinus carpio) – 3.16 – 3.77 mg/l, 96 hours
	LC50 – Goldfish (Carassius auratus) – 3.3 -3.93 mg/l, 96 hours, static
	LC50 – Rainbow trout (Oncorhynchus mykiss) – 1.8 mg/l, 96 hours
Aquatic Invertebrate	Not Available
Terrestrial	Not Available

Persistence and Degradability	Expected to be readily converted by oxidizable material to insoluble manganese oxide.
Bioaccumulative Potential	Potential to bioaccumlate is low
Mobility in Soil	The product is miscible with water. May spread in water systems.
PBT and vPvB Assessment	Not Available
Other Adverse Effects	Not Available

13. DISPOSAL CONSIDERATIONS

Waste Product or Residues	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product or residue.
Product Containers	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product container.

The information offered in section 13 is for the product as shipped. Use and/or alterations to the product may significantly change the characteristics of the material and alter the waste classification and proper disposal methods.

14. TRANSPORTATION INFORMATION

US DOT	UN3214, Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate), 5.1, pg II
TDG	UN3214, PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. (Sodium permanganate), 5.1, PG II
IMDG	UN3214, PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. (Sodium permanganate), 5.1, PG II
Marine Pollutant	Yes
IATA/ICAO	UN3214, Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate), 5.1, pg II

15. REGULATORY INFORMATION

TSCA Inventory Status	All ingredients are listed on the TSCA Active inventory.
DSL	Listed: Potassium permanganate
NDSL	Listed: Sodium Permanganate
California Proposition 65	Not Listed
SARA 302	Not Listed
SARA 304	Not Listed
SARA 311	Fire Hazard, Acute Health Hazard, Chronic Health Hazard
SARA 312	Fire Hazard, Acute Health Hazard, Chronic Health Hazard
SARA 313	Listed: Potassium permanganate
WHMIS Canada	Listed: Potassium permanganate Class C: Oxidizing material Class E: Corrosive material

16. OTHER INFORMATION

Revision	Date
Original	04/22/2020