Silver Sand

Section 1. Identification of the Substance and Company

1.1 Product Identification:

Product Name: Silver Sand
Synonyms: Ag Sand

1.2 Uses

Identified Uses:

Transported isolated intermediate used in the production of refined silver.

1.3 Company Identification

Manufactured by:
Vale Canada Limited
Port Colborne Refinery
187 Davis Street
Port Colborne, ON
Canada, L3K5W2

Canada Contact Information
Vale Canada Limited
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Canada, M5J 2K2
Email:msds@vale.com

EU REACH Contact
Vale Europe Limited
Clydach Refinery
Clydach Swansea
UK, SA6 5QR
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For Fire, Spill, or chemical emergency call CHEMTREC: +1 703 527-3887
for Europe call CHEMTREC: +(44) 870 8200418

Section 2. Hazards Identification

2.1 Classification of the Substance:

Skin Corrosion/irritation – Category 2
Serious eye damage/eye irritation – Category 2A
Hazardous to the aquatic environment – Acute Category 1, Chronic Category 1

Hazard Pictograms:	GHS07 – Exclamation Mark GHS09 – Environment
Signal Word:	Warning
Hazard Statements:	H315 – Causes skin irritation H319 – Causes serious eye irritation H400 – Very toxic to aquatic life H410 – Very toxic to aquatic life with long lasting effects
Precautionary Statements:	P264, P273, P280, P302+P352, P321, P362+P364, P391, P332+P313 P305+P351+P338, P337+P313, P501

<u>2.2: Label elements</u>

Product identifier: Silver Sand

Symbols:

GHS07 –Exclamation Mark

GHS09 – Environment

Signal Word:	Warning
Hazard Statements:	H315 – Causes skin irritation H319 – Causes serious eye irritation H410 – Very toxic to aquatic life with long lasting effects

Precautionary Statements

P273 – Avoid release to the environment
P280 – Wear protective gloves/protective clothing/eye protection/face protection
P302+P352 – IF ON SKIN: Wash with plenty of water
P305+P351+P338 – IF IN EYES: Rinse cautiously with water for several minutes.
P391 – Collect spillage

P501 – Dispose of contents/containers in accordance to local/regional/national/international regulations.

(NOTE: P-statements have been reduced).
For full text of Precautionary Statements see section 15.

Section 3. Composition

☒ **Substance (UVCB)** ☐ **Mixture**

Component	Typical Composition (% dry wt)	C.A.S. Number	EINECS/EC Label No.
Silver (Ag)	65-90	7440-22-4	231-131-3
Silver Sulphide (Ag_2S)	5-20	21548-72-2	244-438-2
Silver Selenide (Ag2Se)	1-4	1302-09-6	215-099-8
Ag5ClTeO2	1-15	N/A	N/A
Palladium	0-2	7440-05-3	231-115-6
Platinum	0-1	7440-06-4	231-116-1

Section 4. First Aid Measures

Ingestion:	Wash out mouth with water. Get medical advice/attention.
Inhalation:	Remove to fresh air. Get medical advice/attention.
Skin:	Remove contaminated clothing, and wash affected areas thoroughly with soap and water. If skin irritation or rash occurs: Get medical advice/attention.
Eyes:	Irrigate eyeball thoroughly with water for at least 15 minutes. Remove contact lenses if present and easy to do, continue rinsing. If discomfort persists get medical attention.

Section 5. Fire Fighting Measures

Suitable extinguishing media:	Any, type to be selected according to materials stored in the immediate neighbourhood.

Special risks:	Silver is a moderate fire hazard in the form of dust when exposed to flame. Silver is a moderate fire hazard also by chemical reaction with oxidisers. Keep containers cool with water spray.
Special protective equipment for fire fighting:	Do not enter fire area without proper protective equipment, including respiratory protection.

Section 6. Accidental Release Measures

Person related precautionary measures:	Avoid generation of dusty atmospheres. Do not inhale dusts. Contaminated work clothing should not be allowed out of the workplace. Use personal protective equipment as required. Wash hands, and face thoroughly after handling.
Environmental Protection measures:	Silver is a moderate fire hazard in the form of dust when exposed to flame. Silver is a moderate fire hazard also by chemical reaction with oxidisers. Keep containers cool with water spray.
Procedures for cleaning/absorption:	Pick up and replace in original container. Nickel-containing material is normally collected to recover nickel values.

Section 7. Handling and Storage

Precautions for Safe Handling:	Prevent the generation of inhalable dusts e.g. by the use of suitable ventilation. Do not inhale dust. Wear appropriate nationally approved respirators if handling is likely to cause the concentration limits of airborne nickel to exceed the locally prescribed exposure limits. Wear suitable protective clothing and gloves. Contaminated work clothing should not be allowed out of the workplace
Conditions for Safe Storage:	Keep in the container supplied, and keep container closed when not in use. Local regulations should be followed regarding the storage of this product.

Section 8. Exposure Controls / Personal Protection

8.1.1 Exposure Limits:

	Exposure Limit (mg/m^3)
ACGIH TLV-TWA [1]	0.1
UK WEL [2]	0.1

DNEL's

	Unit	DNEL
Inhalation		
Acute local	mgNi/m^3	0.1
Long-term	mgNi/m^3	0.1
Long-term local	mgNi/m^3	0.1

8.1.2 Environmental Limits:

PNEC's

Compartment	Unit	PNEC
Freshwater	µg Ag/L	0.04
Sediment	mg Ni/kg	438.13
Marine water	µg Ag/L	0.86
Sediment (marine	mg Ni/kg	438.13
Agricultural soil	mg Ni/kg	1.24
Sewage Treatment Plant	Mg Ag/L	0.025

8.2.1 Occupational exposure controls:

Only properly trained and authorised personnel should handle this substance.
Substance-handling procedures must be well documented and strictly supervised by the site operator.
When handling these process materials, make correct use of local exhaust ventilation (LEV) equipment, such as filter hoods and dust boxes. Maintain airborne dust levels as low as possible. Avoid repeated skin contact.

PPE

Respiratory protection:	Use an approved respirator with particulate filters, type P3.
Eye protection:	Wear safety spectacles.
Hand & Skin Protection:	Wear suitable protective clothing and gloves, which should be selected specifically for the working place, depending on concentration and quantity of the hazardous material (overalls and leather/rubber gloves). Wash skin

thoroughly after handling and before eating, drinking or smoking. Change contaminated clothing frequently.

Section 9. Physical and Chemical Properties

Silver-grey odourless metal

Physical state at 20°C and 101.3 kPa	solid
Melting / freezing point	>800°C
Boiling point	Not available
Decomposition temperature	Not available
Relative density	Not available
Vapour pressure	Not applicable
Vapour density	Not applicable
Surface tension	Not applicable
Water solubility	Sparingly soluble
pH	Not applicable
Evaporation rate	Not applicable
Partition coefficient n-octanol/water (log	Not applicable
Flash point	Not applicable
Flammability	Non-flammable
Explosive properties	Non-explosive
Self-ignition temperature	Not self- igniting
Oxidising properties	Non-oxidising
Granulometry	Not applicable
Stability in organic solvents and identity of relevant degradation products	Not applicable
Dissociation constant	Not applicable
Viscosity	Not applicable
Packaged Density	Not available

Section 10. Stability and Reactivity

Reactivity	Stable under normal conditions.
Chemical stability	Stable under normal conditions.
Possibility of hazardous reactions	Stable under normal conditions.

Conditions to avoid	Silver reacts with acetylene, acetylene compounds and ammonia to form explosive and shock sensitive compounds. Contact with strong hydrogen peroxide solutions will cause violent decomposition of the peroxide, releasing oxygen, gas and increasing the fire and explosion potential.
Incompatible materials	Incompatible with bromine azide, chlorine trifluoride, ethyleneimine, oxalic and tartaric acids and nitric acid in the presence of ethanol.
Hazardous Decomposition Product(s)	Not applicable

Section 11. Toxicological Information [3]

Silver

The information provided in this section is consistent with the information provided in the REACH Chemical Safety Report (CSR, 2010) for silver metal.

Toxicity endpoints	Absorption: Scientific information on absorption of silver compounds is scarce. In a well-documented comparative investigation assessing the bioavailability of the readily soluble $^{110m}AgNO_3$ in mice, rats, monkeys and dogs via oral, intravenous and intraperitoneal administration, only about 1% or less of an oral dose was absorbed with the exception of dogs (<10%). The authors argue that the extent of absorption was likely to be associated with transit time through the gastrointestinal tract, which is longer for dogs and humans than in mice and rats [Furchner (1968)].Since absorption is low for the soluble AgNO3, it may be assumed that oral absorption of the practically insoluble elemental silver metal is very low. Likewise, available data indicates a very low dermal absorption of silver (<1%) through intact skin. With regards to inhalation, there is no reliable information on absorption of silver after deposition in the lung. However, particle size plays a key role in the assessment inhalability and of fractional deposition in the respiratory tract. Further, significant fractions of inhaled silver will be subject to mucociliary clearance to the gastrointestinal tract. Distribution: Cited from ATSDR (1990): "*The distribution of silver to various body tissues depends upon the route and quantity of silver administered and its chemical form. An oral dose of silver, following absorption, undergoes a first pass effect through the liver resulting in excretion into the bile, thereby reducing systemic distribution to body tissues (Furchner et al. 1968). The subsequent distribution of the remaining silver is similar to the distribution of silver absorbed following exposure by the inhalation and dermal routes and following*

intramuscular or intravenous injection. Silver distributes widely in the rat following ingestion of silver chloride (in the presence of sodium thiosulfate) and silver nitrate in drinking water (at 88.9 mg silver/kg/day for silver nitrate) (Olcott 1948); The amount of silver in the various tissues was not measured, although qualitative descriptions of the degree of pigmentation were made. High concentrations were observed in the tissues of the reticuloendothelial system in the liver, spleen, bone marrow, lymph nodes, skin, and kidney. Silver was also distributed to other tissues including the tongue, teeth, salivary glands, thyroid, parathyroid, heart, pancreas, gastrointestinal tract, adrenal glands, and brain. Within these tissues advanced accumulation of silver particles was found in the basement membrane of the glomeruli, the walls of blood vessels between the kidney tubules, the portal vein and other parts of the liver, the choroid plexus of the brain, the choroid layer of the eye, and in the thyroid gland (Olcott 1948; Moffat and Creasey 1972; Walker 1971)."

Metabolism: Silver is not subject to any metabolism in its true sense regardless of its original chemical speciation.

Excretion: Cited from ATSDR (1990): "*Following oral exposure to silver acetate in humans, silver is eliminated primarily in the faeces, with only minor amounts eliminated in the urine (East et al. 1980). The rate of excretion is most rapid within the first week after a single oral exposure (East et al. 1980). Whole-body retention studies in mice and monkeys following oral dosing with radiolabelled silver nitrate indicate that silver excretion in these species follows a biexponential profile with biological half-lives of 0.1 and 1.6 days in mice and 0.3 and 3 days in monkeys. In similarly exposed rats and dogs, silver excretion followed a triexponential profile with biological half-lives of 0.1, 0.7, and 5.9 days in rats and 0.1, 7.6, and 33.8 days in dogs (Furchner et al. 1968). Data for whole body clearance of silver at two days after exposure for these four species are presented in Table 2-5 (Furchner et al. 1968). Transit time through the gut may explain some of these interspecies differences in silver excretion. Transit time is approximately 8 hours in mice and rats, and approximately 24 hours in dogs and monkeys (Furchner et al. 1968). Animals excrete from 90% to 99% of an administered oral dose of silver in the feces within 2 to 4 days of dosing (Furchner et al. 1968; Jones and Bailey 1974; Scott and Hamilton 1950). Excretion in the faeces is decreased and deposition in tissues, such as the pancreas, gastrointestinal tract, and thyroid, is increased when saturation of the elimination pathway in the liver occurs as a result of chronic or high level acute exposure to silver (see Table 2-4) (Constable et al. 1967; Olcott 1948; Scott and Hamilton 1950).*"

Acute Toxicity:	Silver metal is not acutely toxic via the oral, dermal or inhalation route. Oral, rat, gavage LD_{50} > 2000 mg/kg bw (OECD 401) [Allen (1993a)] Dermal Acute dermal toxicity testing is not justified based on low overall systemic toxicity of silver compounds and negligible percutaneous absorption potential. Inhalation LC50 > 5.16 mg/L (OECD 436) [Haferkorn, 2012]
Skin corrosion/irritation:	Based on available data, the classification criteria for skin irritation are not met. Not irritating (OECD 404, rabbit) [Allen (1993b)]
Serious eye damage/ /irritation:	Based on available data, the classification criteria for eye irritation are not met. Not irritating (OECD 405, rabbit) [Allen (1993c)]
Respiratory or Skin: *Sensitisation:*	Based on available data, silver is not considered to be sensitising. Two experimental studies in animals with soluble silver compounds do not indicate sensitisation [Prinsen (1995), Moore (1999)]. Further, long term industrial experience does not raise any concern on sensitisation attributable to silver substances (personal communication, members of the Silver Work Group of the Precious Metals and Rhenium Consortium, 2010-07-27).
Germ Cell Mutagenicity:	Considering the predominantly negative test results in highly reliable genotoxicity assays [e.g. Lloyd, 2010a/b], and by applying a weight-of-evidence approach the conclusion is reached that no genotoxicity is associated with exposure to silver ions, and hence to silver substances [CSR, 2010].
Carcinogenicity:	Silver is not considered to be a carcinogen. Silver or inorganic silver substances are not classified as a mutagen Category 3, nor are there indications of hyperplasia and/or pre-neoplastic lesions (which could indicate

a carcinogenic potential) in the available toxicological studies involving repeated exposure of experimental animals. In addition, despite a long history of use of silver and silver substances, there is no reliable human data indicating any concern for carcinogenicity. Animal toxicity and human occupational studies using normal routes of exposure (i.e. excluding implantation studies) have not provided evidence of carcinogenicity, and silver is not expected to pose a carcinogenic hazard to humans. [CSR, 2010]

Reproductive Toxicity: No data are available indicating that effects on fertility would be of specific concern. As regards developmental toxicity, a study with treatment of pregnant rats orally by gavage with different dose levels of silver acetate [Price et al., 2002] conducted for the US National Toxicology Program is available. Silver acetate is considered a soluble (=bioaccessible) substance and a suitable surrogate for other inorganic silver substances in which the silver ion Ag+ is the relevant moiety (worst case read-across for metallic silver and other poorly soluble silver compounds). At all tested doses (i. e. 10, 30 and 100 mg/kg/day, based on silver acetate) there is an absence of any biologically or statistically significant developmental toxicity [CSR, 2010].

STOT-single exposure: Based on available data, the classification criteria for STOT-single exposure are not met. There are no specific target organ effects after single exposure to silver metal.

STOT-repeated exposure: Based on available data, the classification criteria for STOT-repeated exposure are not met. There are no specific target organ effects after repeated exposure to silver metal.

Aspiration hazard: Not applicable (not an aerosol/mist).

Summary CMR effects: Carcinogenicity, mutagenicity and reproductive effects are not of particular concern for silver.

Information on the likely Route of exposure: During production and use of silver and silver compounds, exposure via dermal contact and inhalation is possible and should be avoided. Appropriate industrial hygiene practices need to be employed and personal protective equipment needs to be used, as appropriate to ensure that applicable exposure limit values are not exceeded (see sections 7+8 of this data sheet).

Section 12. Ecological Information

The information provided in this section is consistent with the information provided in the REACH Chemical Safety Report (CSR, 2012) for silver metal.

Silver metal and silver-containing compounds will generate silver ions in the environment. Analytical methods do not differentiate between silver ions, and so the environmental fate and ecotoxicity data cover silver in general.

Toxicity:

Organism	**Endpoint**	**Value**
AQUATIC		
Acute		
Fish: freshwater *Pimephales promelas* marine *Oligocottus maculosus*	96-hour LC_{50} 96-hour LC_{50}	1.2 µg Ag/L 331 µg Ag/L
Invertebrates: freshwater *Daphnia magna* marine *Acartia tonsa*	48-hour EC_{50} 48-hour EC_{50}	0.22 µg Ag/L 7.1 µg Ag/L
Chronic		
Fish: freshwater *Oncorhynchus mykiss* marine *Menidia beryllina*	196-day EC_{10} 28-day NOEC	0.17 µg Ag/L 130 µg Ag/L
Invertebrates: freshwater *Ceriodaphnia reticulata* marine *Arbacia punctulata*	7-day NOEC 30-day NOEC	1 µg Ag/L 8.6 µg Ag/L
Algae: freshwater *Pseudokirchneriella subcapitata* marine *Champia parvula*	24-hour EC_{10} 14-day NOEC	0.41 µg Ag/L 1.2 µg Ag/L
SEDIMENT		
Hyalella azteca	10-day NOEC	12.0 mg Ag/kg dry weight
SOIL		
Macro-organisms: *Eisenia fetida* Terrestrial plants: *Lactuca sativa* Soil microorganisms	56-day EC_{10} 17-day EC_{10} 28-day EC_{10}	15.05 mg Ag/kg soil dry weight 0.13 mg Ag/kg soil dry weight 0.3 mg Ag/kg soil dry weight

Persistence and Degradability: Silver cannot be degraded, but may be transformed between different phases, chemical species, and oxidation states.

Bioaccumulative Bioaccumulation of silver by aquatic organisms is low. A BCF of 70 has been

potential:	determined for fish. No reliable studies were available for the bioaccumulation of silver in terrestrial organisms.
Mobility in Soil:	A Log Kd value of 3.60 has been determined for soil
Results of PBT and vPvB assessment:	The PBT and vPvB criteria of Annex XIII to the Regulation do not apply to inorganic substances, such as silver.
Other adverse effects:	Silver is not expected to contribute to ozone depletion, ozone formation, global warming or acidification.

Section 13. Disposal Considerations

Waste treatment methods:	Recover or recycle if possible. Do not dispose, but collect in suitable bins/drums for recovery.
Additional Information:	No information available.

Section 14. Transport Information

International Maritime Dangerous Goods Code	UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S (CONTAINS SILVER POWDER), 9, pg III, Marine Pollutant
International Civil Aviation Organization Technical Instructions for the Carriage of Dangerous Goods by Air	UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S (CONTAINS SILVER POWDER), 9, pg III, Marine Pollutant
U.S. Dept. of Transportation Regulations	Not regulated.
Canadian Transportation of Dangerous Goods Act	Not regulated.
European Agreement Concerning the International Carriage of Dangerous Goods by Road	UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S (CONTAINS SILVER POWDER), 9, pg III, Marine Pollutant

MARPOL Annex V

Under the 7 Criteria contained within the MARPOL Annex V, This material is classified as:

X	**Harmful to the Marine Environment (HME)**
	Not Harmful to the Marine Environment (non-HME)

Section 15. Regulatory Information

Europe:

Classification according to Part 3 of Annex VI of EU Regulation No. 1272/2008

Skin Corrosion/irritation – Category 2
Serious eye damage/eye irritation – Category 2A
Hazardous to the aquatic environment – Acute Category 1, Chronic Category 1

Symbols:

GHS07 –Exclamation Mark

GHS09 – Environment

Signal Word: Warning

Hazard Statements:

H315 – Causes skin irritation
H319 – Causes serious eye irritation
H400 – Very toxic to aquatic life
H410 – Very toxic to aquatic life with long lasting effects

Precautionary Statements:

Prevention:
P264 – Wash thoroughly after handling
P273 – Avoid release to the environment
P280 – Wear protective gloves/protective clothing/eye protection/face protection

Response:
P302+352 – IF ON SKIN: Wash with plenty of water
P321– See Safety Data Sheet for specific treatment
P332+P313 – If skin irritation occurs: Get medical advice/attention

P362+P364 – Take off contaminated clothing and wash before reuse
P305+P351+P338 – IF IN EYES: Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing
P337+P313 – If eye irritation persists: Get medical advice / attention
P391 – Collect spillage

Disposal:
P501 - Dispose of contents/container in accordance to local/regional/national/international regulations

Canada:
WHMIS 2015 Classification:
Skin Corrosion/irritation – Category 2
Serious eye damage/eye irritation – Category 2A

All components are listed on the Canadian Domestic Substances List (DSL

Section 16. Other Information

Indications of change:

1.0 – Original document
1.1 – Added Long Harbour Refinery
2.0 – Updated for WHMIS 2015

The following acronyms may be found in this document:

ACGIH	American Conference of Governmental Industrial Hygienists
DNEL	Derived No Effect Level
LTEL	Long Term Exposure Limit
LR	Lead Registrant
MMAD	Mass Median Aerodynamic Diameter
NIOSH	National Institute of Occupational Safety and Health
OEL	Occupational Exposure Limits
OR	Only Representative
OSHA	Occupational Safety and Health Administration
PBT	PBT: Persistent, Bioaccumulative and Toxic

PNEC	Predicted No Effect Concentration
STEL	Short Term Exposure Limit
STOT	Specific Target Organ Toxicity
TLV-TWA	Threshold Limit Value – Time Weighted Average
vPvB	very Persistent and very Bioaccumulative
WEL	Workplace Exposure Limit (UK HSE EH40)

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Note:

Vale Canada believes that the information in this Safety Data Sheet is accurate. However, Vale Canada makes no express or implied warranty as to the accuracy of such information and expressly disclaims any liability resulting from reliance on such information.

1. Threshold Limit Values of the American Conference of Governmental Industrial Hygienists. 2016.
2. Maximum Exposure Limit of the Health and Safety Executive in the U.K. in EH40/2005.
3. Describes possible health hazards of the product supplied. If user operations change it to other chemical forms, whether as end products, intermediates or fugitive emissions, the possible health hazards of such forms must be determined by the user.