

SECTION 1: IDENTIFICATION**1.1. Product Identifier**

Product Form: Mixture

Product Name: D2 TOOL STEEL

1.2. Intended Use of the Product

Feedstock for 3D Metal Printing

1.3. Name, Address, and Telephone of the Responsible Party**Company**

MarkForged, Inc

85 School St

Watertown MA 02472

T: 844-700-1035 (9:00 A.M to 6:00 P.M. EST)

support@markforged.com

www.markforged.com**1.4. Emergency Telephone Number**

Emergency Number : +1 703-741-5970 / 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION**2.1. Classification of the Substance or Mixture****GHS-US/CA Classification**

Not classified

2.2. Label Elements**GHS-US/CA Labeling**

No labeling applicable

2.3. Other Hazards

Exposure may aggravate pre-existing eye, skin, or respiratory conditions. During processing, the most significant route of exposure is by the inhalation (breathing) of fumes. If fumes are inhaled, they can cause a condition commonly known as metal fume fever with symptoms which resemble influenza. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Due to the product's final form, combustible dusts are not likely to be generated.

2.4. Unknown Acute Toxicity (GHS-US/CA)

No data available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS**3.1. Substance**

Not applicable

3.2. Mixture

Name	Product Identifier	% *	GHS Ingredient Classification
Paraffin waxes and Hydrocarbon waxes	(CAS-No.) 8002-74-2	1.5 - 11	Comb. Dust
Chromium	(CAS-No.) 7440-47-3	4.75 - 5.5	Comb. Dust
Molybdenum	(CAS-No.) 7439-98-7	1.1 - 1.75	Comb. Dust
Silicon	(CAS-No.) 7440-21-3	0.8 - 1.2	Comb. Dust
Vanadium	(CAS-No.) 7440-62-2	0.8 - 1.2	Comb. Dust
Manganese	(CAS-No.) 7439-96-5	0.2 - 0.5	Comb. Dust
Graphite	(CAS-No.) 7782-42-5	0.32 - 0.45	Comb. Dust
Phosphorus elemental	(CAS-No.) 7723-14-0	<= 0.03	Pyr. Sol. 1, H250 Acute Tox. 1 (Oral), H300

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			Acute Tox. 2 (Dermal), H310 Acute Tox. 4 (Inhalation:dust,mist), H332 Skin Corr. 1A, H314 Eye Dam. 1, H318 Aquatic Acute 1, H400 Aquatic Chronic 3, H412
Sulfur	(CAS-No.) 7704-34-9	<= 0.03	Skin Irrit. 2, H315 Aquatic Acute 3, H402 Comb. Dust
Maleic anhydride	(CAS-No.) 108-31-6	< 0.001	Acute Tox. 3 (Oral), H301 Skin Corr. 1B, H314 Eye Dam. 1, H318 Resp. Sens. 1, H334 Skin Sens. 1, H317 STOT RE 1, H372 Aquatic Acute 3, H402 Comb. Dust

Full text of H-phrases: see section 16

*Percentages are listed in weight by weight percentage (w/w%) for liquid and solid ingredients. Gas ingredients are listed in volume by volume percentage (v/v%).

SECTION 4: FIRST AID MEASURES

4.1. Description of First-aid Measures

General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

Inhalation: When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.

Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation develops or persists.

Eye Contact: Rinse cautiously with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention.

Ingestion: Rinse mouth. Do NOT induce vomiting. Obtain medical attention.

4.2. Most Important Symptoms and Effects Both Acute and Delayed

General: Not expected to present a significant hazard under anticipated conditions of normal use. During processing or physical alteration, flakes or powder cause irritation of the respiratory tract, eyes, skin, and are harmful. Molten material may release toxic, and irritating fumes.

Inhalation: During processing, the most significant route of exposure is by the inhalation (breathing) of dust or fumes. If fumes are inhaled, they can cause a condition commonly known as metal fume fever with symptoms which resemble influenza. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. May cause an allergic reaction in sensitive individuals. Prolonged exposure may cause irritation.

Skin Contact: Contact with fumes or metal powder will irritate skin. Contact with hot, molten metal will cause thermal burns. Dust may cause irritation in skin folds or by contact in combination with tight clothing.

Eye Contact: During metal processing. Dusts caused from milling and physical alteration will likely cause eye irritation. Fumes from thermal decomposition or molten material will likely be irritating to the eyes. Mechanical damage via flying particles and chipped slag is possible. May cause slight irritation to eyes.

Ingestion: Ingestion is not considered a potential route of exposure. Ingestion may cause adverse effects.

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Chronic Symptoms: None expected under normal conditions of use. In massive form, no hazard exists. If physically altered to present slivers, ribbons, dusts or fumes from molten material: Chromium: Certain hexavalent chromium compounds have been demonstrated to be carcinogenic on the basis of epidemiological investigations on workers and experimental studies in animals. Increased incidences of respiratory cancer have been found in chromium (VI) workers. There is an increased incidence of lung cancer in industrial workers exposed to chromium (VI) compounds. Please refer to IARC volume 23 for a more detailed discussion. Repeated inhalation of iron oxide dust can cause siderosis a benign condition. Manganese: Chronic exposure can cause inflammation of the lung tissue, scarring the lungs (pulmonary fibrosis). Chronic exposure to excessive manganese levels can lead to a variety of psychiatric and motor disturbances, termed manganism. Molybdenum: Chronic exposure to molybdenum compounds is suspected of causing cancer. Compounds are also known to cause irritation to the skin, eyes, and respiratory tract. Chronic dermal exposure to sulfur dust has been linked to headache, vertigo, irritation to the airways, breathing difficulties, coordination disturbances, accelerated pulse, hypotonia, cramps and unconsciousness. Frequent dermal contact with sulfur dusts mainly caused skin damage in the form of eczematous or ulcerous changes. Silicon: Can cause chronic bronchitis and narrowing of the airways. Vanadium: May cause gastrointestinal discomfort, renal damage, nervous system depression and irritation of the respiratory passages. May also cause cardiac palpitations and asthma.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention. If medical advice is needed, have product container or label at hand.

SECTION 5: FIRE-FIGHTING MEASURES

5.1. Extinguishing Media

Suitable Extinguishing Media: Dry sand; Class D Extinguishing Agent (for metal powder fires).

Unsuitable Extinguishing Media: Do not use water when molten material is involved, may react violently or explosively on contact with water. Do not use a heavy water stream. Use of heavy stream of water may spread fire.

5.2. Special Hazards Arising From the Substance or Mixture

Fire Hazard: Not flammable.

Explosion Hazard: Product itself is not explosive but if dust is generated, dust clouds suspended in air can be explosive.

Reactivity: Stable at ambient temperature and under normal conditions of use. Hazardous reactions will not occur under normal conditions.

5.3. Advice for Firefighters

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

Firefighting Instructions: Use water spray or fog for cooling exposed containers. Do not breathe fumes from fires or vapors from decomposition.

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

Hazardous Combustion Products: Metal oxides. Carbon oxides (CO, CO₂). Hydrocarbons. Nitrogen oxides. Sulfur compounds. Sulfur oxides.

Reference to Other Sections

Refer to Section 9 for flammability properties.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Avoid prolonged contact with eyes, skin and clothing. Avoid breathing dust. Avoid generating dust. Where possible allow molten material to solidify naturally.

6.1.1. For Non-Emergency Personnel

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

Emergency Procedures: Evacuate unnecessary personnel.

6.1.2. For Emergency Personnel

Protective Equipment: Equip cleanup crew with proper protection.

Emergency Procedures: Ventilate area. Upon arrival at the scene, a first responder is expected to recognize the presence of dangerous goods, protect oneself and the public, secure the area, and call for the assistance of trained personnel as soon as conditions permit.

6.2. Environmental Precautions

Prevent entry to sewers and public waters.

6.3. Methods and Materials for Containment and Cleaning Up

For Containment: Contain and collect as any solid. Contain solid spills with appropriate barriers and prevent migration and entry into sewers or streams. Avoid generation of dust during clean-up of spills.

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Methods for Cleaning Up: Clean up spills immediately and dispose of waste safely. Cool molten material to limit spreading. For particulates and dust: Recover the product by vacuuming, shoveling or sweeping. Utilize a dust suppressant when removing mechanically. Transfer spilled material to a suitable container for disposal. Contact competent authorities after a spill.

6.4. Reference to Other Sections

See Section 8 for exposure controls and personal protection and Section 13 for disposal considerations.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Additional Hazards When Processed: Contains substances that are combustible dusts. If the material is further processed and dust is allowed to accumulate, may form combustible dust concentrations in air that could ignite and cause an explosion. Risk of thermal burns on contact with molten product. Molten metal and water can be an explosive combination.

Precautions for Safe Handling: Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Avoid prolonged contact with eyes, skin and clothing. Protect skin and eyes from contact with molten material. Do not breathe vapors from molten product. Avoid breathing dust. Avoid creating or spreading dust. Use appropriate personal protective equipment (PPE).

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures.

7.2. Conditions for Safe Storage, Including Any Incompatibilities

Technical Measures: Comply with applicable regulations.

Storage Conditions: Keep container closed when not in use. Store in a dry, cool place. Keep/Store away from direct sunlight, extremely high or low temperatures and incompatible materials.

Incompatible Materials: Alkalis. Strong acids, strong bases, strong oxidizers. Corrosive substances in contact with metals may produce flammable hydrogen gas.

7.3. Specific End Use(s)

Feedstock for 3D Metal Printing

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control Parameters

For substances listed in section 3 that are not listed here, there are no established Exposure limits from the manufacturer, supplier, importer, or the appropriate advisory agency including: ACGIH (TLV), AIHA (WEEL), NIOSH (REL), OSHA (PEL), or Canadian provincial governments.

Graphite (7782-42-5)		
USA ACGIH	ACGIH TWA (mg/m ³)	2 mg/m ³ (all forms except graphite fibers-respirable particulate matter)
USA OSHA	OSHA PEL (TWA) (mg/m ³)	15 mg/m ³ (synthetic-total dust) 5 mg/m ³ (synthetic-respirable fraction)
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	2.5 mg/m ³ (natural-respirable dust)
USA IDLH	US IDLH (mg/m ³)	1250 mg/m ³
Alberta	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except Graphite fibres-respirable)
British Columbia	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except Graphite fibres-respirable)
Manitoba	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except Graphite fibers-respirable particulate matter)
New Brunswick	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except graphite fibres)
Newfoundland & Labrador	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except Graphite fibers-respirable particulate matter)
Nova Scotia	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except Graphite fibers-respirable particulate matter)
Nunavut	OEL STEL (mg/m ³)	4 mg/m ³ (natural, all forms, except Graphite fibres-respirable fraction)
Nunavut	OEL TWA (mg/m ³)	2 mg/m ³ (natural, all forms, except Graphite fibres-respirable fraction)
Northwest Territories	OEL STEL (mg/m ³)	4 mg/m ³ (natural, all forms, except Graphite fibres-respirable fraction)
Northwest Territories	OEL TWA (mg/m ³)	2 mg/m ³ (natural, all forms, except Graphite fibres-respirable fraction)

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Ontario	OEL TWA (mg/m ³)	2 mg/m ³ (except Graphite fibres-respirable)
Prince Edward Island	OEL TWA (mg/m ³)	2 mg/m ³ (all forms except Graphite fibers-respirable particulate matter)
Québec	VEMP (mg/m ³)	2 mg/m ³ (containing no Asbestos and <1% Crystalline silica, except Graphite fibres-respirable dust)
Saskatchewan	OEL STEL (mg/m ³)	4 mg/m ³ (natural, except Graphite fibres-respirable fraction)
Saskatchewan	OEL TWA (mg/m ³)	2 mg/m ³ (natural, except Graphite fibres-respirable fraction)
Yukon	OEL TWA (mg/m ³)	20 mppcf 30 mppcf (synthetic) 10 mg/m ³ (synthetic)

Chromium (7440-47-3)		
USA ACGIH	ACGIH TWA (mg/m ³)	0.5 mg/m ³ (inhalable particulate matter)
USA OSHA	OSHA PEL (TWA) (mg/m ³)	1 mg/m ³
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	0.5 mg/m ³
USA IDLH	US IDLH (mg/m ³)	250 mg/m ³
Alberta	OEL TWA (mg/m ³)	0.5 mg/m ³
British Columbia	OEL TWA (mg/m ³)	0.5 mg/m ³ (total)
Manitoba	OEL TWA (mg/m ³)	0.5 mg/m ³ (inhalable particulate matter)
New Brunswick	OEL TWA (mg/m ³)	0.5 mg/m ³
Newfoundland & Labrador	OEL TWA (mg/m ³)	0.5 mg/m ³ (inhalable particulate matter)
Nova Scotia	OEL TWA (mg/m ³)	0.5 mg/m ³ (inhalable particulate matter)
Nunavut	OEL STEL (mg/m ³)	1.5 mg/m ³ (metal)
Nunavut	OEL TWA (mg/m ³)	0.5 mg/m ³ (metal)
Northwest Territories	OEL STEL (mg/m ³)	1.5 mg/m ³ (metal)
Northwest Territories	OEL TWA (mg/m ³)	0.5 mg/m ³ (metal)
Ontario	OEL TWA (mg/m ³)	0.5 mg/m ³
Prince Edward Island	OEL TWA (mg/m ³)	0.5 mg/m ³ (inhalable particulate matter)
Québec	VEMP (mg/m ³)	0.5 mg/m ³
Saskatchewan	OEL STEL (mg/m ³)	1.5 mg/m ³
Saskatchewan	OEL TWA (mg/m ³)	0.5 mg/m ³
Yukon	OEL STEL (mg/m ³)	3 mg/m ³
Yukon	OEL TWA (mg/m ³)	0.1 mg/m ³

Manganese (7439-96-5)		
USA ACGIH	ACGIH TWA (mg/m ³)	0.02 mg/m ³ (respirable particulate matter) 0.1 mg/m ³ (inhalable particulate matter)
USA ACGIH	ACGIH chemical category	Not Classifiable as a Human Carcinogen
USA OSHA	OSHA PEL (Ceiling) (mg/m ³)	5 mg/m ³ (fume)
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	1 mg/m ³ (fume)
USA NIOSH	NIOSH REL (STEL) (mg/m ³)	3 mg/m ³
USA IDLH	US IDLH (mg/m ³)	500 mg/m ³
Alberta	OEL TWA (mg/m ³)	0.2 mg/m ³
British Columbia	OEL TWA (mg/m ³)	0.2 mg/m ³ (total) 0.02 mg/m ³ (respirable)
Manitoba	OEL TWA (mg/m ³)	0.02 mg/m ³ (respirable particulate matter) 0.1 mg/m ³ (inhalable particulate matter)
New Brunswick	OEL TWA (mg/m ³)	0.2 mg/m ³
Newfoundland & Labrador	OEL TWA (mg/m ³)	0.02 mg/m ³ (respirable particulate matter) 0.1 mg/m ³ (inhalable particulate matter)
Nova Scotia	OEL TWA (mg/m ³)	0.02 mg/m ³ (respirable particulate matter) 0.1 mg/m ³ (inhalable particulate matter)

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Nunavut	OEL STEL (mg/m ³)	0.6 mg/m ³
Nunavut	OEL TWA (mg/m ³)	0.2 mg/m ³
Northwest Territories	OEL STEL (mg/m ³)	0.6 mg/m ³
Northwest Territories	OEL TWA (mg/m ³)	0.2 mg/m ³
Ontario	OEL TWA (mg/m ³)	0.2 mg/m ³
Prince Edward Island	OEL TWA (mg/m ³)	0.02 mg/m ³ (respirable particulate matter) 0.1 mg/m ³ (inhalable particulate matter)
Québec	VEMP (mg/m ³)	0.2 mg/m ³ (total dust and fume)
Saskatchewan	OEL STEL (mg/m ³)	0.6 mg/m ³
Saskatchewan	OEL TWA (mg/m ³)	0.2 mg/m ³
Yukon	OEL Ceiling (mg/m ³)	5 mg/m ³
Molybdenum (7439-98-7)		
	Internal TWA (mg/m ³)	5 mg/m ³ (Molybdenum (as Mo), Soluble Compounds)
USA ACGIH	ACGIH TWA (mg/m ³)	10 mg/m ³ (inhalable particulate matter) 3 mg/m ³ (respirable particulate matter)
USA OSHA	OSHA PEL (TWA) (mg/m ³)	5 mg/m ³ (Molybdenum (as Mo), Soluble Compounds) 15 mg/m ³ (Molybdenum (as Mo), Insoluble Compounds (Total dust))
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	5 mg/m ³ (Molybdenum (as Mo), Soluble Compounds)
USA IDLH	US IDLH (mg/m ³)	5000 mg/m ³
Alberta	OEL TWA (mg/m ³)	10 mg/m ³ (total) 3 mg/m ³ (respirable)
British Columbia	OEL TWA (mg/m ³)	3 mg/m ³ (respirable) 10 mg/m ³ (inhalable)
Manitoba	OEL TWA (mg/m ³)	3 mg/m ³ (respirable particulate matter) 10 mg/m ³ (inhalable particulate matter)
Newfoundland & Labrador	OEL TWA (mg/m ³)	3 mg/m ³ (respirable particulate matter) 10 mg/m ³ (inhalable particulate matter)
Nova Scotia	OEL TWA (mg/m ³)	3 mg/m ³ (respirable particulate matter) 10 mg/m ³ (inhalable particulate matter)
Nunavut	OEL STEL (mg/m ³)	20 mg/m ³ (metal-inhalable fraction) 6 mg/m ³ (metal-respirable fraction)
Nunavut	OEL TWA (mg/m ³)	10 mg/m ³ (metal-inhalable fraction) 3 mg/m ³ (metal-respirable fraction)
Northwest Territories	OEL STEL (mg/m ³)	20 mg/m ³ (metal-inhalable fraction) 6 mg/m ³ (metal-respirable fraction)
Northwest Territories	OEL TWA (mg/m ³)	10 mg/m ³ (metal-inhalable fraction) 3 mg/m ³ (metal-respirable fraction)
Ontario	OEL TWA (mg/m ³)	10 mg/m ³ (metal-inhalable) 3 mg/m ³ (metal-respirable)
Prince Edward Island	OEL TWA (mg/m ³)	3 mg/m ³ (respirable particulate matter) 10 mg/m ³ (inhalable particulate matter)
Saskatchewan	OEL STEL (mg/m ³)	20 mg/m ³ (inhalable fraction) 6 mg/m ³ (respirable fraction)
Saskatchewan	OEL TWA (mg/m ³)	10 mg/m ³ (inhalable fraction) 3 mg/m ³ (respirable fraction)
Phosphorus elemental (7723-14-0)		
Alberta	OEL TWA (mg/m ³)	0.1 mg/m ³ (yellow)
New Brunswick	OEL TWA (mg/m ³)	0.1 mg/m ³ (yellow)
New Brunswick	OEL TWA (ppm)	0.02 ppm (yellow)
Québec	VEMP (mg/m ³)	0.1 mg/m ³ (yellow)
Sulfur (7704-34-9)		

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Alberta	OEL TWA (mg/m ³)	10 mg/m ³
Silicon (7440-21-3)		
USA OSHA	OSHA PEL (TWA) (mg/m ³)	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	10 mg/m ³ (total dust) 5 mg/m ³ (respirable dust)
British Columbia	OEL TWA (mg/m ³)	10 mg/m ³ (total dust) 3 mg/m ³ (respirable fraction)
New Brunswick	OEL TWA (mg/m ³)	10 mg/m ³
Nunavut	OEL STEL (mg/m ³)	20 mg/m ³
Nunavut	OEL TWA (mg/m ³)	10 mg/m ³
Northwest Territories	OEL STEL (mg/m ³)	20 mg/m ³
Northwest Territories	OEL TWA (mg/m ³)	10 mg/m ³
Québec	VEMP (mg/m ³)	10 mg/m ³ (containing no Asbestos and <1% Crystalline silica-total dust)
Saskatchewan	OEL STEL (mg/m ³)	20 mg/m ³
Saskatchewan	OEL TWA (mg/m ³)	10 mg/m ³
Yukon	OEL STEL (mg/m ³)	20 mg/m ³
Yukon	OEL TWA (mg/m ³)	30 mppcf 10 mg/m ³
Vanadium (7440-62-2)		
USA OSHA	OSHA PEL (Ceiling) (mg/m ³)	0.5 mg/m ³ (respirable dust) 0.1 mg/m ³ (fume)
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	1 mg/m ³
USA NIOSH	NIOSH REL (STEL) (mg/m ³)	3 mg/m ³
Paraffin waxes and Hydrocarbon waxes (8002-74-2)		
USA ACGIH	ACGIH TWA (mg/m ³)	2 mg/m ³ (fume)
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	2 mg/m ³ (fume)
Alberta	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
British Columbia	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Manitoba	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
New Brunswick	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Newfoundland & Labrador	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Nova Scotia	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Nunavut	OEL STEL (mg/m ³)	4 mg/m ³
Nunavut	OEL TWA (mg/m ³)	2 mg/m ³
Northwest Territories	OEL STEL (mg/m ³)	4 mg/m ³
Northwest Territories	OEL TWA (mg/m ³)	2 mg/m ³
Ontario	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Prince Edward Island	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Québec	VEMP (mg/m ³)	2 mg/m ³ (fume)
Saskatchewan	OEL STEL (mg/m ³)	4 mg/m ³
Saskatchewan	OEL TWA (mg/m ³)	2 mg/m ³
Yukon	OEL STEL (mg/m ³)	6 mg/m ³ (fume)
Yukon	OEL TWA (mg/m ³)	2 mg/m ³ (fume)
Maleic anhydride (108-31-6)		
USA ACGIH	ACGIH TWA (mg/m ³)	0.01 mg/m ³ (inhalable fraction and vapor)
USA ACGIH	ACGIH chemical category	dermal sensitizer, Not Classifiable as a Human Carcinogen
USA OSHA	OSHA PEL (TWA) (mg/m ³)	1 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	0.25 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	1 mg/m ³

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USA NIOSH	NIOSH REL (TWA) (ppm)	0.25 ppm
USA IDLH	US IDLH (mg/m ³)	10 mg/m ³
Alberta	OEL TWA (mg/m ³)	0.4 mg/m ³
Alberta	OEL TWA (ppm)	0.1 ppm
British Columbia	OEL TWA (ppm)	0.1 ppm
Manitoba	OEL TWA (mg/m ³)	0.01 mg/m ³ (inhalable fraction and vapor)
New Brunswick	OEL TWA (mg/m ³)	1 mg/m ³
New Brunswick	OEL TWA (ppm)	0.25 ppm
Newfoundland & Labrador	OEL TWA (mg/m ³)	0.01 mg/m ³ (inhalable fraction and vapor)
Nova Scotia	OEL TWA (mg/m ³)	0.01 mg/m ³ (inhalable fraction and vapor)
Nunavut	OEL STEL (ppm)	0.3 ppm
Nunavut	OEL TWA (ppm)	0.1 ppm
Northwest Territories	OEL STEL (ppm)	0.3 ppm
Northwest Territories	OEL TWA (ppm)	0.1 ppm
Ontario	OEL TWA (mg/m ³)	0.01 mg/m ³ (inhalable fraction and vapor)
Prince Edward Island	OEL TWA (mg/m ³)	0.01 mg/m ³ (inhalable fraction and vapor)
Québec	VEMP (mg/m ³)	1 mg/m ³
Québec	VEMP (ppm)	0.25 ppm
Saskatchewan	OEL STEL (ppm)	0.3 ppm
Saskatchewan	OEL TWA (ppm)	0.1 ppm
Yukon	OEL STEL (mg/m ³)	1 mg/m ³
Yukon	OEL STEL (ppm)	0.25 ppm
Yukon	OEL TWA (mg/m ³)	1 mg/m ³
Yukon	OEL TWA (ppm)	0.25 ppm
Particulates not otherwise classified (PNOC)		
USA ACGIH	ACGIH TWA (mg/m ³)	3 mg/m ³ Respirable fraction 10 mg/m ³ Total Dust
USA OSHA	OSHA PEL (TWA) (mg/m ³)	5 mg/m ³ Respirable fraction 15 mg/m ³ Total Dust
Alberta	OEL TWA (mg/m ³)	10 mg/m ³ (total) 3 mg/m ³ (respirable)
British Columbia	OEL TWA (mg/m ³)	10 mg/m ³ (nuisance dust-total dust) 3 mg/m ³ (nuisance dust-respirable fraction)
Manitoba	OEL TWA (mg/m ³)	10 mg/m ³ (inhalable particles, recommended) 3 mg/m ³ (respirable particles, recommended)
New Brunswick	OEL TWA (mg/m ³)	3 mg/m ³ (particulate matter containing no Asbestos and <1% Crystalline silica, respirable fraction) 10 mg/m ³ (particulate matter containing no Asbestos and <1% Crystalline silica, inhalable fraction)
Newfoundland & Labrador	OEL TWA (mg/m ³)	10 mg/m ³ (inhalable particles, recommended) 3 mg/m ³ (respirable particles, recommended)
Nova Scotia	OEL TWA (mg/m ³)	10 mg/m ³ (inhalable particles, recommended) 3 mg/m ³ (respirable particles, recommended)
Nunavut	OEL STEL (mg/m ³)	20 mg/m ³ (insoluble or poorly soluble-inhalable fraction) 6 mg/m ³ (insoluble or poorly soluble-respirable fraction)
Nunavut	OEL TWA (mg/m ³)	10 mg/m ³ (insoluble or poorly soluble-inhalable fraction) 3 mg/m ³ (insoluble or poorly soluble-respirable fraction)
Northwest Territories	OEL STEL (mg/m ³)	20 mg/m ³ (insoluble or poorly soluble-inhalable fraction) 6 mg/m ³ (insoluble or poorly soluble-respirable fraction)
Northwest Territories	OEL TWA (mg/m ³)	10 mg/m ³ (insoluble or poorly soluble-inhalable fraction) 3 mg/m ³ (insoluble or poorly soluble-respirable fraction)

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Ontario	OEL TWA (mg/m ³)	10 mg/m ³ (inhalable) 3 mg/m ³ (respirable)
Prince Edward Island	OEL TWA (mg/m ³)	10 mg/m ³ (inhalable particles, recommended) 3 mg/m ³ (respirable particles, recommended)
Québec	VEMP (mg/m ³)	10 mg/m ³ (including dust, inert or nuisance particulates-total dust)
Saskatchewan	OEL STEL (mg/m ³)	20 mg/m ³ (insoluble or poorly soluble-inhalable fraction) 6 mg/m ³ (insoluble or poorly soluble-respirable fraction)
Saskatchewan	OEL TWA (mg/m ³)	10 mg/m ³ (insoluble or poorly soluble-inhalable fraction) 3 mg/m ³ (insoluble or poorly soluble-respirable fraction)

8.2. Exposure Controls

Appropriate Engineering Controls: Suitable eye/body wash equipment should be available in the vicinity of any potential exposure. Ensure adequate ventilation, especially in confined areas. Ensure all national/local regulations are observed.

Personal Protective Equipment: Gloves. Protective clothing. Protective goggles.



Materials for Protective Clothing: Chemically resistant materials and fabrics.

Hand Protection: Wear protective gloves.

Eye and Face Protection: Chemical safety goggles.

Skin and Body Protection: Wear suitable protective clothing.

Respiratory Protection: If exposure limits are exceeded or irritation is experienced, approved respiratory protection should be worn. In case of inadequate ventilation, oxygen deficient atmosphere, or where exposure levels are not known wear approved respiratory protection.

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

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on Basic Physical and Chemical Properties

Physical State	: Solid
Appearance	: Not available
Odor	: Not available
Odor Threshold	: Not available
pH	: Not available
Evaporation Rate	: Not available
Melting Point	: Not available
Freezing Point	: Not available
Boiling Point	: Not available
Flash Point	: Not available
Auto-ignition Temperature	: Not available
Decomposition Temperature	: Not available
Flammability (solid, gas)	: Not available
Lower Flammable Limit	: Not available
Upper Flammable Limit	: Not available
Vapor Pressure	: Not available
Relative Vapor Density at 20°C	: Not available
Relative Density	: Not available
Specific Gravity	: Not available
Solubility	: Not available
Partition Coefficient: N-Octanol/Water	: Not available
Viscosity	: Not available

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SECTION 10: STABILITY AND REACTIVITY

- 10.1. Reactivity:** Stable at ambient temperature and under normal conditions of use. Hazardous reactions will not occur under normal conditions.
- 10.2. Chemical Stability:** Stable under recommended handling and storage conditions (see section 7).
- 10.3. Possibility of Hazardous Reactions:** Hazardous polymerization will not occur.
- 10.4. Conditions to Avoid:** Protect from moisture. Incompatible materials. Direct sunlight, extremely high or low temperatures, and incompatible materials. Dust accumulation (to minimize explosion hazard).
- 10.5. Incompatible Materials:** Alkalis. Strong acids, strong bases, strong oxidizers. Corrosive substances in contact with metals may produce flammable hydrogen gas.
- 10.6. Hazardous Decomposition Products:** None expected under normal conditions of use. Thermal decomposition generates: Metal oxides. Irritating fumes.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on Toxicological Effects - Product

Acute Toxicity (Oral): Not classified

Acute Toxicity (Dermal): Not classified

Acute Toxicity (Inhalation): Not classified

LD50 and LC50 Data: Not available

Skin Corrosion/Irritation: Not classified

Eye Damage/Irritation: Not classified

Respiratory or Skin Sensitization: Not classified

Germ Cell Mutagenicity: Not classified

Carcinogenicity: Not classified

Specific Target Organ Toxicity (Repeated Exposure): Not classified

Reproductive Toxicity: Not classified

Specific Target Organ Toxicity (Single Exposure): Not classified

Aspiration Hazard: Not classified

Symptoms/Injuries After Inhalation: During processing, the most significant route of exposure is by the inhalation (breathing) of dust or fumes. If fumes are inhaled, they can cause a condition commonly known as metal fume fever with symptoms which resemble influenza; Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. May cause an allergic reaction in sensitive individuals. Prolonged exposure may cause irritation.

Symptoms/Injuries After Skin Contact: Contact with fumes or metal powder will irritate skin. Contact with hot, molten metal will cause thermal burns. Dust may cause irritation in skin folds or by contact in combination with tight clothing.

Symptoms/Injuries After Eye Contact: During metal processing. Dusts caused from milling and physical alteration will likely cause eye irritation. Fumes from thermal decomposition or molten material will likely be irritating to the eyes. Mechanical damage via flying particles and chipped slag is possible. May cause slight irritation to eyes.

Symptoms/Injuries After Ingestion: Ingestion is not considered a potential route of exposure. Ingestion may cause adverse effects.

Chronic Symptoms: None expected under normal conditions of use. In massive form, no hazard exists. If physically altered to present slivers, ribbons, dusts or fumes from molten material: Chromium: Certain hexavalent chromium compounds have been demonstrated to be carcinogenic on the basis of epidemiological investigations on workers and experimental studies in animals. Increased incidences of respiratory cancer have been found in chromium (VI) workers. There is an increased incidence of lung cancer in industrial workers exposed to chromium (VI) compounds. Please refer to IARC volume 23 for a more detailed discussion. Repeated inhalation of iron oxide dust can cause siderosis a benign condition. Manganese: Chronic exposure can cause inflammation of the lung tissue, scarring the lungs (pulmonary fibrosis). Chronic exposure to excessive manganese levels can lead to a variety of psychiatric and motor disturbances, termed manganism. Molybdenum: Chronic exposure to molybdenum compounds is suspected of causing cancer. Compounds are also known to cause irritation to the skin, eyes, and respiratory tract. Chronic dermal exposure to sulfur dust has been linked to headache, vertigo, irritation to the airways, breathing difficulties, coordination disturbances, accelerated pulse, hypotonia, cramps and unconsciousness. Frequent dermal contact with sulfur dusts mainly caused skin damage in the form of eczematous or ulcerous changes. Silicon: Can cause chronic bronchitis and narrowing of the airways. Vanadium: May

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cause gastrointestinal discomfort, renal damage, nervous system depression and irritation of the respiratory passages. May also cause cardiac palpitations and asthma.

11.2. Information on Toxicological Effects - Ingredient(s)

LD50 and LC50 Data:

Chromium (7440-47-3)	
LD50 Oral Rat	> 5000 mg/kg
LC50 Inhalation Rat	> 5.41 mg/l/4h
Manganese (7439-96-5)	
LD50 Oral Rat	> 2000 mg/kg
LC50 Inhalation Rat	> 5.14 mg/l/4h
Molybdenum (7439-98-7)	
LD50 Oral Rat	> 2000 mg/kg
LD50 Dermal Rat	> 2000 mg/kg
LC50 Inhalation Rat	> 3.92 mg/l/4h
Phosphorus elemental (7723-14-0)	
LD50 Oral Rat	3030 µg/kg
LD50 Dermal Rat	100 mg/kg
LC50 Inhalation Rat	4.3 mg/l (Exposure time: 1 h)
Sulfur (7704-34-9)	
LD50 Oral Rat	> 3000 mg/kg
LD50 Dermal Rabbit	> 2000 mg/kg
LC50 Inhalation Rat	> 9.23 mg/l/4h
Silicon (7440-21-3)	
LD50 Oral Rat	3160 mg/kg
Vanadium (7440-62-2)	
LD50 Oral Rat	> 2000 mg/kg
Paraffin waxes and Hydrocarbon waxes (8002-74-2)	
LD50 Oral Rat	> 5000 mg/kg
LD50 Dermal Rabbit	> 3600 mg/kg
Maleic anhydride (108-31-6)	
LD50 Oral Rat	235 mg/kg
LD50 Dermal Rabbit	2620 mg/kg
Chromium (7440-47-3)	
IARC Group	3

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecology - General: Not classified. This product contains components that are environmentally hazardous and small chips and dust from processing may be very toxic to aquatic life.

Manganese (7439-96-5)	
NOEC Chronic Fish	3.6 mg/l (Exposure time: 96h; Species: Oncorhynchus mykiss)
Phosphorus elemental (7723-14-0)	
LC50 Fish 1	33.2 mg/l Red Phosphorous (Exposure time: 96 h - Species: Danio rerio [static])
EC50 Daphnia 1	0.03 mg/l (Exposure time: 48 h - Species: Daphnia magna)
LC50 Fish 2	0.001 - 0.004 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [static])
EC50 Daphnia 2	0.025 - 0.037 mg/l (Exposure time: 48 h - Species: Daphnia magna [Static])
Sulfur (7704-34-9)	
LC50 Fish 1	866 mg/l (Exposure time: 96 h - Species: Brachydanio rerio [static])
EC50 Daphnia 1	736 mg/l (Exposure time: 48 h - Species: Daphnia magna)
LC50 Fish 2	14 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [static])

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Maleic anhydride (108-31-6)	
LC50 Fish 1	75 mg/l
NOEC Chronic Algae	150 mg/l

12.2. Persistence and Degradability

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Persistence and Degradability	Not established.

12.3. Bioaccumulative Potential

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Bioaccumulative Potential	Not established.
Phosphorus elemental (7723-14-0)	
BCF Fish 1	< 200
Maleic anhydride (108-31-6)	
BCF Fish 1	(hydrolysis)

12.4. Mobility in Soil Not available

12.5. Other Adverse Effects

Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste Disposal Recommendations: Dispose of contents/container in accordance with local, regional, national, territorial, provincial, and international regulations.

Ecology - Waste Materials: Avoid release to the environment.

SECTION 14: TRANSPORT INFORMATION

The shipping description(s) stated herein were prepared in accordance with certain assumptions at the time the SDS was authored, and can vary based on a number of variables that may or may not have been known at the time the SDS was issued.

- 14.1. In Accordance with DOT** Not regulated for transport
- 14.2. In Accordance with IMDG** Not regulated for transport
- 14.3. In Accordance with IATA** Not regulated for transport
- 14.4. In Accordance with TDG** Not regulated for transport

SECTION 15: REGULATORY INFORMATION

15.1. US Federal Regulations

Graphite (7782-42-5)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Chromium (7440-47-3)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Subject to reporting requirements of United States SARA Section 313	
CERCLA RQ	5000 lb no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is >100 µm
SARA Section 313 - Emission Reporting	1 %
Manganese (7439-96-5)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Subject to reporting requirements of United States SARA Section 313	
SARA Section 313 - Emission Reporting	1 %
Molybdenum (7439-98-7)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Phosphorus elemental (7723-14-0)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Listed on the United States SARA Section 302	
Subject to reporting requirements of United States SARA Section 313	

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CERCLA RQ	1 lb
SARA Section 302 Threshold Planning Quantity (TPQ)	100 lb (this material is a reactive solid, the TPQ does not default to 10000 pounds for non-powder, non-molten, non-solution form)
SARA Section 313 - Emission Reporting	1 % (yellow or white)
Sulfur (7704-34-9)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Silicon (7440-21-3)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Vanadium (7440-62-2)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Subject to reporting requirements of United States SARA Section 313	
SARA Section 313 - Emission Reporting	1 % (except when contained in an alloy)
Paraffin waxes and Hydrocarbon waxes (8002-74-2)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Maleic anhydride (108-31-6)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Subject to reporting requirements of United States SARA Section 313	
CERCLA RQ	5000 lb
SARA Section 313 - Emission Reporting	1 %

15.2. US State Regulations

Graphite (7782-42-5)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List
Chromium (7440-47-3)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances U.S. - Pennsylvania - RTK (Right to Know) List
Manganese (7439-96-5)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) List
Molybdenum (7439-98-7)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List
Phosphorus elemental (7723-14-0)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) List
Sulfur (7704-34-9)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List
Silicon (7440-21-3)

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U.S. - Massachusetts - Right To Know List
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) List

Vanadium (7440-62-2)

U.S. - Massachusetts - Right To Know List
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
U.S. - Pennsylvania - RTK (Right to Know) List

Paraffin waxes and Hydrocarbon waxes (8002-74-2)

U.S. - Massachusetts - Right To Know List
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) List

Maleic anhydride (108-31-6)

U.S. - Massachusetts - Right To Know List
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
U.S. - Pennsylvania - RTK (Right to Know) List

15.3. Canadian Regulations

Graphite (7782-42-5)

Listed on the Canadian DSL (Domestic Substances List)

Chromium (7440-47-3)

Listed on the Canadian DSL (Domestic Substances List)

Manganese (7439-96-5)

Listed on the Canadian DSL (Domestic Substances List)

Molybdenum (7439-98-7)

Listed on the Canadian DSL (Domestic Substances List)

Phosphorus elemental (7723-14-0)

Listed on the Canadian DSL (Domestic Substances List)

Sulfur (7704-34-9)

Listed on the Canadian DSL (Domestic Substances List)

Silicon (7440-21-3)

Listed on the Canadian DSL (Domestic Substances List)

Vanadium (7440-62-2)

Listed on the Canadian DSL (Domestic Substances List)

Paraffin waxes and Hydrocarbon waxes (8002-74-2)

Listed on the Canadian DSL (Domestic Substances List)

Maleic anhydride (108-31-6)

Listed on the Canadian DSL (Domestic Substances List)

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

Date of Preparation or Latest : 12/03/2018

Revision

Other Information : This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200 and Canada's Hazardous Products Regulations (HPR) SOR/2015-17.

GHS Full Text Phrases:

Acute Tox. 1 (Oral)	Acute toxicity (oral) Category 1
Acute Tox. 2 (Dermal)	Acute toxicity (dermal) Category 2
Acute Tox. 3 (Oral)	Acute toxicity (oral) Category 3
Acute Tox. 4 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 4

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Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Aquatic Acute 3	Hazardous to the aquatic environment - Acute Hazard Category 3
Aquatic Chronic 3	Hazardous to the aquatic environment - Chronic Hazard Category 3
Comb. Dust	Combustible Dust
Eye Dam. 1	Serious eye damage/eye irritation Category 1
Pyr. Sol. 1	Pyrophoric solids Category 1
Resp. Sens. 1	Respiratory sensitization, Category 1
Skin Corr. 1A	Skin corrosion/irritation Category 1A
Skin Corr. 1B	Skin corrosion/irritation Category 1B
Skin Irrit. 2	Skin corrosion/irritation Category 2
Skin Sens. 1	Skin sensitization, Category 1
STOT RE 1	Specific target organ toxicity (repeated exposure) Category 1
H250	Catches fire spontaneously if exposed to air
H300	Fatal if swallowed
H301	Toxic if swallowed
H310	Fatal in contact with skin
H314	Causes severe skin burns and eye damage
H315	Causes skin irritation
H317	May cause an allergic skin reaction
H318	Causes serious eye damage
H332	Harmful if inhaled
H334	May cause an allergy or asthma symptoms or breathing difficulties if inhaled
H372	Causes damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H402	Harmful to aquatic life
H412	Harmful to aquatic life with long lasting effects

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

NA GHS SDS 2015 (Can, US)



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