MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**Spent Hydrotreating Catalyst**
Version #	03
Issue date	06-10-2011
Revision date	11-13-2012
Supersedes date	09-28-2012
CAS #	Mixture
MSDS Number	902
Product use	This product is intended for use as a refinery feedstock, fuel or for use in engineered processes. Use in other applications may result in higher exposures and require additional controls, such as local exhaust ventilation and personal protective equipment.
Synonym(s)	Spent hydrotreating catalyst. See section 16 for complete information.
Manufacturer/Supplier	Valero Marketing & Supply Company and Affiliates P.O. Box 696000 San Antonio, TX 78269-6000
General Assistance	210-345-4593
Emergency	24 Hour Emergency 866-565-5220 1-800-424-9300 (CHEMTREC USA)

2. Hazards Identification

Physical state	Solid.
Appearance	Black solid.
Emergency overview	DANGER! May be fatal if inhaled, absorbed through skin, or swallowed. Causes skin, eye and respiratory tract burns. May cause allergic respiratory and skin reactions. Cancer hazard - can cause cancer. Hydrogen sulfide, a highly toxic gas, may be present or released. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.
OSHA regulatory status	This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Inhalation. Eye contact. Skin contact. Ingestion.
Eyes	Causes eye burns.
Skin	May be fatal if absorbed through skin. Causes skin burns. May cause allergic skin reaction.
Inhalation	May be fatal if inhaled. Causes respiratory tract burns. May cause allergic respiratory reaction.
Ingestion	May be fatal if swallowed. May cause burns in mucous membranes, throat, esophagus and stomach.
Chronic effects	May cause allergic respiratory and skin reactions. Repeated overexposure to arsenic, and nickel can increase the risk of developing cancer.
Signs and symptoms	Contact with this material will cause burns to the skin, eyes and mucous membranes. Persons with pre-existing respiratory tract, skin and lung (such as asthma) disorders may be aggravated by exposure to this product. Hydrogen sulfide, a highly toxic gas, may be present. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.
Potential environmental effects	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

3. Composition / Information on Ingredients

Components	CAS #	Percent
Silicon dioxide	7631-86-9	20 - 60

Components	CAS #	Percent
Nickel	7440-02-0	2 - 30
Nickel oxide	7782-39-0	2 - 30
Vanadium	7440-62-2	2 - 30
Vanadium pentoxide	1314-62-1	2 - 30
Molybdenum	7439-98-7	1 - 20
Molybdenum trioxide	1313-27-5	1 - 20
Aluminum oxide	1344-28-1	2 - 10
Coke	64741-79-3	1 - 10
Phosphorus pentoxide	1314-56-3	0.1 - 10
Calcium oxide	1305-78-8	2 - 6
Cobalt	7440-48-4	0.1 - 7
Cobalt oxide	1307-96-6	0.1 - 7
Iron oxide	1309-37-1	2 - 4
Magnesium oxide	1309-48-4	1 - 3
Arsenic	7440-38-2	0.1 - 3
Arsenic pentoxide	1303-28-2	0.1 - 3
Chromium	7440-47-3	0.1 - 3
Titanium dioxide	13463-67-7	0.5 - 2
Antimony	7440-36-0	0.1 - 2
Antimony trioxide	1309-64-4	0.1 - 2
Potassium	7440-09-7	0.1 - 2
Potassium Oxide	12136-45-7	0.1 - 2
Sodium oxide	12401-86-4	0.1 - 2
Hydrogen sulfide	7783-06-4	0 - 2
Benzene	71-43-2	0.1 - 1

4. First Aid Measures

First aid procedures

Eye contact
Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.

Skin contact
Wash off immediately with soap and plenty of water. Remove contaminated clothing and shoes. Call a physician or poison control center immediately. Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes.

Inhalation
Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Call a physician or poison control center immediately.

Ingestion
Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center. Do not give mouth-to-mouth resuscitation. If vomiting occurs, keep head low so that stomach content does not get into the lungs. Call a physician or poison control center.

Notes to physician
In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.

General advice
If exposed or concerned: get medical attention/advice. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use.

5. Fire Fighting Measures

Flammable properties
No unusual fire or explosion hazards noted.

Extinguishing media

Suitable extinguishing media	Water spray. Water fog. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use a solid water stream as it may scatter and spread fire.

Protection of firefighters

Protective equipment and precautions for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. In the event of fire, cool tanks with water spray.
Specific methods	In the event of fire and/or explosion do not breathe fumes.
Hazardous combustion products	Carbon oxides. Nitrogen oxides. Sulfur oxides. Metal oxides.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Local authorities should be advised if significant spills cannot be contained. Keep upwind. Keep out of low areas. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Review Firefighting Measures section before proceeding with clean up. Stop leak if it can be done without risk. Use water spray to disperse vapors. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, contact the National Response Center at 800-424-8802. For highway or railway spills, contact Chemtrec at 800-424-9300.
Methods for containment	Dike the spilled material, where this is possible. Prevent entry into waterways, sewers, basements or confined areas.
Methods for cleaning up	Sweep or scoop up and remove. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Nonsparking tools should be used. Clean surface thoroughly to remove residual contamination. This material and its container must be disposed of as hazardous waste. Large Spills: Prevent product from entering drains. Do not allow material to contaminate ground water system. Should not be released into the environment.
Other information	Clean up in accordance with all applicable regulations.

7. Handling and Storage

Handling	Wear personal protective equipment. Do not breathe dust. Do not get in eyes, on skin, on clothing. Do not taste or swallow. Avoid prolonged exposure. Use only with adequate ventilation. Wash thoroughly after handling. Avoid release to the environment.
Storage	Keep container tightly closed in a cool, well-ventilated place. Keep away from food, drink and animal feedingstuffs. Keep out of the reach of children.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH

Material	Type	Value	Form
Spent Hydrotreating Catalyst (CAS Mixture)	TWA	0.5 mg/m3	(total dust)
Components	**Type**	**Value**	**Form**
Molybdenum trioxide (CAS 1313-27-5)	TWA	3 mg/m3	Respirable fraction.
		10 mg/m3	Inhalable fraction.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	TWA	1 mg/m3	Respirable fraction.
Antimony trioxide (CAS 1309-64-4)	TWA	0.5 mg/m3	
Arsenic (CAS 7440-38-2)	TWA	0.01 mg/m3	
Arsenic pentoxide (CAS 1303-28-2)	TWA	0.01 mg/m3	
Benzene (CAS 71-43-2)	STEL	2.5 ppm	
	TWA	0.5 ppm	
Calcium oxide (CAS 1305-78-8)	TWA	2 mg/m3	
Cobalt (CAS 7440-48-4)	TWA	0.02 mg/m3	
Cobalt oxide (CAS 1307-96-6)	TWA	0.02 mg/m3	
Hydrogen sulfide (CAS 7783-06-4)	STEL	5 ppm	
	TWA	1 ppm	
Iron oxide (CAS 1309-37-1)	TWA	5 mg/m3	Respirable fraction.
Molybdenum (CAS 7439-98-7)	TWA	3 mg/m3	Respirable fraction.
		10 mg/m3	Inhalable fraction.
Nickel (CAS 7440-02-0)	TWA	1.5 mg/m3	Inhalable fraction.
Titanium dioxide (CAS 13463-67-7)	TWA	10 mg/m3	
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.05 mg/m3	Inhalable fraction.

U.S. - OSHA

Components	Type	Value	Form
Molybdenum trioxide (CAS 1313-27-5)	TWA	15 mg/m3	Total dust.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Components	Type	Value
Arsenic (CAS 7440-38-2)	TWA	0.01 mg/m3
Benzene (CAS 71-43-2)	STEL	5 ppm
	TWA	1 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
Antimony trioxide (CAS 1309-64-4)	PEL	0.5 mg/m3	
Calcium oxide (CAS 1305-78-8)	PEL	5 mg/m3	
Cobalt (CAS 7440-48-4)	PEL	0.1 mg/m3	Dust and fume.
Iron oxide (CAS 1309-37-1)	PEL	10 mg/m3	Fume.
Molybdenum (CAS 7439-98-7)	PEL	15 mg/m3	Total dust.
Nickel (CAS 7440-02-0)	PEL	1 mg/m3	
Titanium dioxide (CAS 13463-67-7)	PEL	15 mg/m3	Total dust.
Vanadium pentoxide (CAS 1314-62-1)	Ceiling	0.5 mg/m3	Respirable dust.
		0.1 mg/m3	Fume.

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value
Benzene (CAS 71-43-2)	Ceiling	25 ppm
	TWA	10 ppm
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	20 ppm

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value
Silicon dioxide (CAS 7631-86-9)	TWA	0.8 mg/m3
		20 mppcf

Canada - Alberta

Components	Type	Value
Molybdenum trioxide (CAS 1313-27-5)	TWA	10 mg/m3

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

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	TWA	10 mg/m3	
Antimony trioxide (CAS 1309-64-4)	TWA	0.5 mg/m3	
Arsenic (CAS 7440-38-2)	TWA	0.01 mg/m3	
Arsenic pentoxide (CAS 1303-28-2)	TWA	0.01 mg/m3	
Benzene (CAS 71-43-2)	STEL	8 mg/m3	
		2.5 ppm	
	TWA	1.6 mg/m3	
		0.5 ppm	
Calcium oxide (CAS 1305-78-8)	TWA	2 mg/m3	
Cobalt (CAS 7440-48-4)	TWA	0.02 mg/m3	
Cobalt oxide (CAS 1307-96-6)	TWA	0.02 mg/m3	
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	21 mg/m3	
		15 ppm	
	TWA	14 mg/m3	
		10 ppm	
Iron oxide (CAS 1309-37-1)	TWA	5 mg/m3	Respirable.
Nickel (CAS 7440-02-0)	TWA	1.5 mg/m3	
Titanium dioxide (CAS 13463-67-7)	TWA	10 mg/m3	
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.05 mg/m3	Respirable particulate or fume.

Canada - British Columbia

Components	Type	Value	Form
Molybdenum trioxide (CAS 1313-27-5)	TWA	3 mg/m3	Respirable fraction.
		10 mg/m3	Inhalable fraction.

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

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	TWA	1 mg/m3	Respirable.
Antimony trioxide (CAS 1309-64-4)	TWA	0.5 mg/m3	
Arsenic (CAS 7440-38-2)	TWA	0.01 mg/m3	

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

Components	Type	Value	Form
Arsenic pentoxide (CAS 1303-28-2)	TWA	0.01 mg/m3	
Benzene (CAS 71-43-2)	STEL	2.5 ppm	
	TWA	0.5 ppm	
Calcium oxide (CAS 1305-78-8)	TWA	2 mg/m3	
Cobalt (CAS 7440-48-4)	TWA	0.02 mg/m3	
Cobalt oxide (CAS 1307-96-6)	TWA	0.02 mg/m3	
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	10 ppm	
Iron oxide (CAS 1309-37-1)	STEL	10 mg/m3	Fume.
	TWA	5 mg/m3	Fume.
		5 mg/m3	Dust.
		3 mg/m3	Respirable fraction.
		10 mg/m3	Total dust.
Molybdenum (CAS 7439-98-7)	TWA	3 mg/m3	Respirable.
		10 mg/m3	Inhalable
Nickel (CAS 7440-02-0)	TWA	0.05 mg/m3	
Silicon dioxide (CAS 7631-86-9)	TWA	4 mg/m3	Total
		1.5 mg/m3	Respirable.
Titanium dioxide (CAS 13463-67-7)	TWA	3 mg/m3	Respirable fraction.
		10 mg/m3	Total dust.
Vanadium pentoxide (CAS 1314-62-1)	Ceiling	0.05 mg/m3	Respirable dust and/or fume.
	TWA	0.2 mg/m3	Total dust.

Canada - Ontario

Components	Type	Value	Form
Molybdenum trioxide (CAS 1313-27-5)	TWA	3 mg/m3	Respirable
		10 mg/m3	Inhalable

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

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	TWA	1 mg/m3	Respirable fraction.
Antimony trioxide (CAS 1309-64-4)	TWA	0.5 mg/m3	
Arsenic (CAS 7440-38-2)	STEL	0.05 mg/m3	
	TWA	0.01 mg/m3	
Arsenic pentoxide (CAS 1303-28-2)	STEL	0.05 mg/m3	
Benzene (CAS 71-43-2)	STEL	2.5 ppm	
	TWA	0.5 ppm	
Calcium oxide (CAS 1305-78-8)	TWA	2 mg/m3	
Cobalt (CAS 7440-48-4)	TWA	0.02 mg/m3	
Cobalt oxide (CAS 1307-96-6)	TWA	0.02 mg/m3	
Hydrogen sulfide (CAS 7783-06-4)	STEL	15 ppm	
	TWA	10 ppm	
Iron oxide (CAS 1309-37-1)	TWA	5 mg/m3	Respirable fraction.
Molybdenum (CAS 7439-98-7)	TWA	10 mg/m3	Inhalable fraction.
Nickel (CAS 7440-02-0)	TWA	1 mg/m3	Inhalable

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

Components	Type	Value	Form
Silicon dioxide (CAS 7631-86-9)	TWA	10 mg/m3	
Titanium dioxide (CAS 13463-67-7)	TWA	10 mg/m3	
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.05 mg/m3	Inhalable fraction.

Canada - Quebec

Components	Type	Value
Molybdenum trioxide (CAS 1313-27-5)	STEL	10 mg/m3

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

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	TWA	10 mg/m3	Total dust.
Antimony trioxide (CAS 1309-64-4)	TWA	0.5 mg/m3	
Arsenic (CAS 7440-38-2)	TWA	0.1 mg/m3	
Arsenic pentoxide (CAS 1303-28-2)	TWA	0.1 mg/m3	
Benzene (CAS 71-43-2)	STEL	15.5 mg/m3	
		5 ppm	
	TWA	3 mg/m3	
		1 ppm	
Calcium oxide (CAS 1305-78-8)	TWA	2 mg/m3	
Cobalt (CAS 7440-48-4)	TWA	0.02 mg/m3	
Cobalt oxide (CAS 1307-96-6)	TWA	0.02 mg/m3	
Hydrogen sulfide (CAS 7783-06-4)	STEL	21 mg/m3	
		15 ppm	
	TWA	14 mg/m3	
		10 ppm	
Iron oxide (CAS 1309-37-1)	TWA	5 mg/m3	Dust and fume.
		10 mg/m3	Total dust.
Molybdenum (CAS 7439-98-7)	TWA	10 mg/m3	
Nickel (CAS 7440-02-0)	TWA	1 mg/m3	
Silicon dioxide (CAS 7631-86-9)	TWA	6 mg/m3	Respirable dust.
Titanium dioxide (CAS 13463-67-7)	TWA	10 mg/m3	Total dust.
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.05 mg/m3	Respirable dust and/or fume.

Mexico

Components	Type	Value
Molybdenum trioxide (CAS 1313-27-5)	STEL	10 mg/m3
	TWA	5 mg/m3

Mexico. Occupational Exposure Limit Values

Components	Type	Value	Form
Aluminum oxide (CAS 1344-28-1)	TWA	10 mg/m3	
Antimony trioxide (CAS 1309-64-4)	TWA	0.5 mg/m3	
Arsenic pentoxide (CAS 1303-28-2)	TWA	0.01 mg/m3	

Mexico. Occupational Exposure Limit Values

Components	Type	Value	Form
Benzene (CAS 71-43-2)	STEL	16 mg/m3	
		5 ppm	
	TWA	3.2 mg/m3	
		1 ppm	
Calcium oxide (CAS 1305-78-8)	TWA	2 mg/m3	
Cobalt (CAS 7440-48-4)	TWA	0.1 mg/m3	Dust and fume.
Hydrogen sulfide (CAS 7783-06-4)	STEL	21 mg/m3	
		15 ppm	
	TWA	14 mg/m3	
		10 ppm	
Iron oxide (CAS 1309-37-1)	STEL	10 mg/m3	
	TWA	5 mg/m3	
Molybdenum (CAS 7439-98-7)	STEL	20 mg/m3	
	TWA	10 mg/m3	
Nickel (CAS 7440-02-0)	TWA	1 mg/m3	
Titanium dioxide (CAS 13463-67-7)	STEL	20 mg/m3	
	TWA	10 mg/m3	
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.5 mg/m3	Respirable dust and/or fume.

Engineering controls Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

Personal protective equipment

Eye / face protection Safety glasses.

Skin protection Wear chemical-resistant, impervious gloves. Full body suit and boots are recommended when handling large volumes or in emergency situations. Flame retardant protective clothing is recommended.

Respiratory protection Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. If workplace exposure limits for product or components are exceeded, NIOSH approved equipment should be worn. Proper respirator selection should be determined by adequately trained personnel, based on the contaminants, the degree of potential exposure and published respiratory protection factors. This equipment should be available for nonroutine and emergency use.

General hygiene considerations Consult supervisor for special handling instructions. Do not breathe dust. Keep away from food and drink. Wash hands before breaks and immediately after handling the product. Provide eyewash station and safety shower. Handle in accordance with good industrial hygiene and safety practice.

9. Physical & Chemical Properties

Appearance Black solid.

Physical state Solid.

Form Powder or granules.

Color Black.

Odor Faint.

Odor threshold Not available.

pH Not available.

Vapor pressure Not applicable.

Vapor density	Not applicable.
Boiling point	Not available.
Melting point/Freezing point	246.2 °F (119 °C)
Solubility (water)	Insoluble.
Specific gravity	2.1
Flash point	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Evaporation rate	Not applicable.
Viscosity	Not applicable.
Partition coefficient (n-octanol/water)	No data available.
Other data	
Flammability (solid, gas)	Combustible dust.

10. Chemical Stability & Reactivity Information

Chemical stability	Stable under normal temperature conditions and recommended use.
Conditions to avoid	None known.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Nitrogen oxides. Sulfur oxides. Metal oxides.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Components	Species	Test Results
Antimony trioxide (CAS 1309-64-4)		
Acute		
Oral		
LD50	Rat	> 20 g/kg
Arsenic (CAS 7440-38-2)		
Acute		
Oral		
LD50	Mouse	145 mg/kg
	Rat	763 mg/kg
Arsenic pentoxide (CAS 1303-28-2)		
Acute		
Oral		
LD50	Mouse	55 mg/kg
	Rat	8 mg/kg
Benzene (CAS 71-43-2)		
Acute		
Oral		
LD50	Rat	930 mg/kg
Calcium oxide (CAS 1305-78-8)		
Acute		
Oral		
LD50		500 - 2000 mg/kg

Components	Species	Test Results
Cobalt oxide (CAS 1307-96-6)		
Acute		
Oral		
LD50	Rat	202 mg/kg
Other		
LD50	Mouse	125 mg/kg
Hydrogen sulfide (CAS 7783-06-4)		
Acute		
Inhalation		
LC50	Mouse	> 0.024 mg/l, 960 Minutes
	Rat	> 0.38 mg/l, 960 Minutes
Molybdenum trioxide (CAS 1313-27-5)		
Acute		
Dermal		
LD50	Rat	> 20000 mg/kg
Inhalation		
LC50	Rat	> 5.84 mg/l, 4 hours
Oral		
LD50	Rat	> 2000 mg/kg
Silicon dioxide (CAS 7631-86-9)		
Acute		
Oral		
LD50	Mouse	> 15000 mg/kg
	Rat	> 22500 mg/kg

Sensitization May cause allergic respiratory and skin reactions.

Acute effects May be fatal if inhaled, absorbed through skin, or swallowed. Causes skin, eye and respiratory tract burns. Hydrogen sulfide, a highly toxic gas, may be present due to the contents of sulfur. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.

Local effects

US. ACGIH Threshold Limit Values

Benzene (CAS 71-43-2)	Can be absorbed through the skin.

Chronic effects Contains benzene. Human epidemiology studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-producing system and serious blood disorders, including leukemia. Animal tests suggest that prolonged and/or repeated overexposure to benzene may damage the embryo/fetus. The relevance of these animal studies to humans has not been fully established.

Carcinogenicity Cancer hazard - can cause cancer.

ACGIH Carcinogens

Aluminum oxide (CAS 1344-28-1)	A4 Not classifiable as a human carcinogen.
Antimony trioxide (CAS 1309-64-4)	A2 Suspected human carcinogen.
Arsenic (CAS 7440-38-2)	A1 Confirmed human carcinogen.
Arsenic pentoxide (CAS 1303-28-2)	A1 Confirmed human carcinogen.
Benzene (CAS 71-43-2)	A1 Confirmed human carcinogen.
Cobalt (CAS 7440-48-4)	A3 Confirmed animal carcinogen with unknown relevance to humans.
Cobalt oxide (CAS 1307-96-6)	A3 Confirmed animal carcinogen with unknown relevance to humans.
Iron oxide (CAS 1309-37-1)	A4 Not classifiable as a human carcinogen.
Molybdenum (CAS 7439-98-7)	A3 Confirmed animal carcinogen with unknown relevance to humans.

Molybdenum trioxide (CAS 1313-27-5)	A3 Confirmed animal carcinogen with unknown relevance to humans.
Nickel (CAS 7440-02-0)	A5 Not suspected as a human carcinogen.
Titanium dioxide (CAS 13463-67-7)	A4 Not classifiable as a human carcinogen.
Vanadium pentoxide (CAS 1314-62-1)	A3 Confirmed animal carcinogen with unknown relevance to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Antimony trioxide (CAS 1309-64-4)	2B Possibly carcinogenic to humans.
Arsenic (CAS 7440-38-2)	1 Carcinogenic to humans.
Arsenic pentoxide (CAS 1303-28-2)	1 Carcinogenic to humans.
Benzene (CAS 71-43-2)	1 Carcinogenic to humans.
Cobalt (CAS 7440-48-4)	2B Possibly carcinogenic to humans.
Cobalt oxide (CAS 1307-96-6)	2B Possibly carcinogenic to humans.
Iron oxide (CAS 1309-37-1)	3 Not classifiable as to carcinogenicity to humans.
Nickel (CAS 7440-02-0)	2B Possibly carcinogenic to humans.
Silicon dioxide (CAS 7631-86-9)	3 Not classifiable as to carcinogenicity to humans.
Titanium dioxide (CAS 13463-67-7)	2B Possibly carcinogenic to humans.
Vanadium pentoxide (CAS 1314-62-1)	2B Possibly carcinogenic to humans.

US NTP Report on Carcinogens: Anticipated carcinogen

Nickel (CAS 7440-02-0)	Reasonably Anticipated to be a Human Carcinogen.

US NTP Report on Carcinogens: Known carcinogen

Arsenic (CAS 7440-38-2)	Known To Be Human Carcinogen.
Arsenic pentoxide (CAS 1303-28-2)	Known To Be Human Carcinogen.
Benzene (CAS 71-43-2)	Known To Be Human Carcinogen.
Nickel (CAS 7440-02-0)	Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Arsenic (CAS 7440-38-2)	Cancer hazard.
Benzene (CAS 71-43-2)	Cancer hazard.

Reproductive effects Possible birth defect hazard based on animal data.

12. Ecological Information

Ecotoxicological data

Product		Species	Test Results
Spent Hydrotreating Catalyst (CAS Mixture)			
Aquatic			
Crustacea	EC50	Daphnia	0.4777 mg/l, 48 Hours, estimated
Components		**Species**	**Test Results**
Antimony trioxide (CAS 1309-64-4)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	361.5 - 496 mg/l, 48 hours
Fish	LC50	Fathead minnow (Pimephales promelas)	> 80 mg/l, 96 hours
Arsenic (CAS 7440-38-2)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	9.9 mg/l, 96 hours
Arsenic pentoxide (CAS 1303-28-2)			
Aquatic			
Fish	LC50	Striped bass (Morone saxatilis)	6.4 - 13.5 mg/l, 96 hours
Benzene (CAS 71-43-2)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	8.76 - 15.6 mg/l, 48 Hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	5 mg/l, 96 Hours
Calcium oxide (CAS 1305-78-8)			
Aquatic			
Fish	LC50	Carp (Cyprinus carpio)	1070 mg/l, 96 Hours

Components		Species	Test Results
Hydrogen sulfide (CAS 7783-06-4)			
Aquatic			
Fish	LC50	Lake whitefish (Coregonus clupeaformis)	0.002 mg/l, 96 hours
Molybdenum (CAS 7439-98-7)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	800 mg/l, 96 hours
Molybdenum trioxide (CAS 1313-27-5)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	70 mg/l, 96 hours

Ecotoxicity Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Persistence and degradability No data available.

Bioaccumulation / Accumulation No data available.

Partition coefficient No data available.

Benzene 2.13

Mobility in environmental media No data available.

13. Disposal Considerations

Waste codes D004: Waste Arsenic

Disposal instructions Dispose in accordance with all applicable regulations. Incinerate the material under controlled conditions in an approved incinerator. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container.

14. Transport Information

DOT

Basic shipping requirements:

UN number UN3077

Proper shipping name Environmentally hazardous substances, solid, n.o.s. (Potassium), MARINE POLLUTANT

Hazard class 9

Packing group III

Environmental hazards

Marine pollutant Yes

Additional information:

Special provisions 8, 146, B54, IB8, IP3, N20, T1, TP33

Packaging exceptions 155

Packaging non bulk 213

Packaging bulk 240

IATA

UN number UN3077

UN proper shipping name Environmentally hazardous substance, solid, n.o.s. (Potassium)

Transport hazard class(es) 9

Packing group III

Environmental hazards Yes

ERG code 9L

IMDG

UN number UN3077

UN proper shipping name ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (POTASSIUM), MARINE POLLUTANT

Transport hazard class(es) 9

Packing group III

Environmental hazards

Marine pollutant Yes

EmS F-A, S-F

TDG

Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (POTASSIUM), MARINE POLLUTANT
Hazard class	9
UN number	UN3077
Packing group	III
Marine pollutant	Yes
Special provisions	16

15. Regulatory Information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard 29 CFR 1910.1200 (OSHA) and 8 CCR § 5194 (Cal/OSHA).
All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Antimony trioxide (CAS 1309-64-4)
Arsenic (CAS 7440-38-2)
Arsenic pentoxide (CAS 1303-28-2)
Benzene (CAS 71-43-2)
Cobalt (CAS 7440-48-4)
Cobalt oxide (CAS 1307-96-6)
Nickel (CAS 7440-02-0)

US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Spill: Reportable quantity

Arsenic pentoxide (CAS 1303-28-2)	1 LBS
Vanadium pentoxide (CAS 1314-62-1)	1000 LBS

US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Substance: Threshold planning quantity, lower value

Arsenic pentoxide (CAS 1303-28-2)	100 LBS
Vanadium pentoxide (CAS 1314-62-1)	100 LBS

US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Substance: Threshold planning quantity, upper value

Arsenic pentoxide (CAS 1303-28-2)	10000 LBS
Vanadium pentoxide (CAS 1314-62-1)	10000 LBS

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration

Aluminum oxide (CAS 1344-28-1)	1.0 %
Antimony trioxide (CAS 1309-64-4)	1.0 % N010
Arsenic (CAS 7440-38-2)	0.1 %
Arsenic pentoxide (CAS 1303-28-2)	0.1 % N020
Benzene (CAS 71-43-2)	0.1 %
Cobalt (CAS 7440-48-4)	0.1 %
Molybdenum trioxide (CAS 1313-27-5)	1.0 %
Nickel (CAS 7440-02-0)	0.1 %
Vanadium (CAS 7440-62-2)	1.0 %
Vanadium pentoxide (CAS 1314-62-1)	1.0 % N770

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

Aluminum oxide (CAS 1344-28-1)	Listed.
Antimony trioxide (CAS 1309-64-4)	N010 Listed.
Arsenic (CAS 7440-38-2)	Listed.
Benzene (CAS 71-43-2)	Listed.
Molybdenum trioxide (CAS 1313-27-5)	Listed.
Nickel (CAS 7440-02-0)	Listed.
Vanadium (CAS 7440-62-2)	Listed.
Vanadium pentoxide (CAS 1314-62-1)	N770 Listed.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)

Nickel: 100
Nickel oxide: 100
Vanadium pentoxide: 1000
Arsenic: 1
Arsenic pentoxide: 1
Antimony trioxide: 1000
Benzene: 10

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance (40 CFR 355, Appendix A)	Yes
Section 311/312 (40 CFR 370)	Yes
Drug Enforcement Administration (DEA) (21 CFR 1308.11-15)	Not controlled
WHMIS status	Controlled
WHMIS classification	D1A - Immediate/Serious-VERY TOXIC D2A - Other Toxic Effects-VERY TOXIC D2B - Other Toxic Effects-TOXIC E - Corrosive

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s)

State regulations

US - California Hazardous Substances (Director's): Listed substance

Aluminum oxide (CAS 1344-28-1)	Listed.
Antimony trioxide (CAS 1309-64-4)	Listed.
Arsenic (CAS 7440-38-2)	Listed.
Arsenic pentoxide (CAS 1303-28-2)	Listed.
Benzene (CAS 71-43-2)	Listed.
Calcium oxide (CAS 1305-78-8)	Listed.
Cobalt (CAS 7440-48-4)	Listed.
Cobalt oxide (CAS 1307-96-6)	Listed.
Iron oxide (CAS 1309-37-1)	Listed.

Molybdenum (CAS 7439-98-7)	Listed.
Molybdenum trioxide (CAS 1313-27-5)	Listed.
Nickel (CAS 7440-02-0)	Listed.
Nickel oxide (CAS 7782-39-0)	Listed.
Silicon dioxide (CAS 7631-86-9)	Listed.
Vanadium (CAS 7440-62-2)	Listed.
Vanadium pentoxide (CAS 1314-62-1)	Listed.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Antimony trioxide (CAS 1309-64-4)	Listed.
Arsenic (CAS 7440-38-2)	Listed.
Benzene (CAS 71-43-2)	Listed.
Cobalt (CAS 7440-48-4)	Listed.
Cobalt oxide (CAS 1307-96-6)	Listed.
Nickel (CAS 7440-02-0)	Listed.
Titanium dioxide (CAS 13463-67-7)	Listed.
Vanadium pentoxide (CAS 1314-62-1)	Listed.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Antimony trioxide (CAS 1309-64-4)	Listed: October 1, 1990 Carcinogenic.
Arsenic (CAS 7440-38-2)	Listed: February 27, 1987 Carcinogenic.
Arsenic pentoxide (CAS 1303-28-2)	Listed: February 27, 1987 Carcinogenic.
Benzene (CAS 71-43-2)	Listed: February 27, 1987 Carcinogenic.
Cobalt (CAS 7440-48-4)	Listed: July 1, 1992 Carcinogenic.
Cobalt oxide (CAS 1307-96-6)	Listed: July 1, 1992 Carcinogenic.
Nickel (CAS 7440-02-0)	Listed: October 1, 1989 Carcinogenic.
Titanium dioxide (CAS 13463-67-7)	Listed: September 2, 2011 Carcinogenic.
Vanadium pentoxide (CAS 1314-62-1)	Listed: February 11, 2005 Carcinogenic.

US - California Proposition 65 - CRT: Listed date/Developmental toxin

Arsenic pentoxide (CAS 1303-28-2)	Listed: May 1, 1997 Developmental toxin.
Benzene (CAS 71-43-2)	Listed: December 26, 1997 Developmental toxin.

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997 Male reproductive toxin.

US - New Jersey RTK - Substances: Listed substance

Aluminum oxide (CAS 1344-28-1)	Listed.
Antimony trioxide (CAS 1309-64-4)	Listed.
Arsenic (CAS 7440-38-2)	Listed.
Arsenic pentoxide (CAS 1303-28-2)	Listed.
Benzene (CAS 71-43-2)	Listed.
Calcium oxide (CAS 1305-78-8)	Listed.
Cobalt oxide (CAS 1307-96-6)	Listed.
Iron oxide (CAS 1309-37-1)	Listed.
Molybdenum (CAS 7439-98-7)	Listed.
Molybdenum trioxide (CAS 1313-27-5)	Listed.
Nickel (CAS 7440-02-0)	Listed.
Nickel oxide (CAS 7782-39-0)	Listed.
Silicon dioxide (CAS 7631-86-9)	Listed.
Titanium dioxide (CAS 13463-67-7)	Listed.
Vanadium (CAS 7440-62-2)	Listed.
Vanadium pentoxide (CAS 1314-62-1)	Listed.

US - Pennsylvania RTK - Hazardous Substances: All compounds of this substance are considered environmental hazards

Arsenic (CAS 7440-38-2)	LISTED
Cobalt (CAS 7440-48-4)	LISTED
Nickel (CAS 7440-02-0)	LISTED

US - Pennsylvania RTK - Hazardous Substances: Special hazard

Arsenic (CAS 7440-38-2)	Special hazard.
Arsenic pentoxide (CAS 1303-28-2)	Special hazard.
Benzene (CAS 71-43-2)	Special hazard.
Nickel (CAS 7440-02-0)	Special hazard.

US. Massachusetts RTK - Substance List

Aluminum oxide (CAS 1344-28-1)	Listed.
Antimony trioxide (CAS 1309-64-4)	Listed.
Arsenic (CAS 7440-38-2)	Listed.
Arsenic pentoxide (CAS 1303-28-2)	Listed.

Benzene (CAS 71-43-2)	Listed.
Calcium oxide (CAS 1305-78-8)	Listed.
Cobalt (CAS 7440-48-4)	Listed.
Iron oxide (CAS 1309-37-1)	Listed.
Molybdenum (CAS 7439-98-7)	Listed.
Molybdenum trioxide (CAS 1313-27-5)	Listed.
Nickel (CAS 7440-02-0)	Listed.
Nickel oxide (CAS 7782-39-0)	Listed.
Silicon dioxide (CAS 7631-86-9)	Listed.
Titanium dioxide (CAS 13463-67-7)	Listed.
Vanadium (CAS 7440-62-2)	Listed.
Vanadium pentoxide (CAS 1314-62-1)	Listed.

US. New Jersey Worker and Community Right-to-Know Act

Aluminum oxide (CAS 1344-28-1)	500 LBS
Antimony trioxide (CAS 1309-64-4)	500 LBS
Arsenic (CAS 7440-38-2)	500 LBS
Arsenic pentoxide (CAS 1303-28-2)	100 LBS
Benzene (CAS 71-43-2)	500 LBS
Cobalt oxide (CAS 1307-96-6)	500 LBS
Molybdenum trioxide (CAS 1313-27-5)	500 LBS
Nickel (CAS 7440-02-0)	500 LBS
Nickel oxide (CAS 7782-39-0)	500 LBS
Vanadium (CAS 7440-62-2)	500 LBS
Vanadium pentoxide (CAS 1314-62-1)	100 LBS

US. Pennsylvania RTK - Hazardous Substances

Aluminum oxide (CAS 1344-28-1)	Listed.
Antimony trioxide (CAS 1309-64-4)	Listed.
Arsenic (CAS 7440-38-2)	Listed.
Arsenic pentoxide (CAS 1303-28-2)	Listed.
Benzene (CAS 71-43-2)	Listed.
Calcium oxide (CAS 1305-78-8)	Listed.
Cobalt (CAS 7440-48-4)	Listed.
Iron oxide (CAS 1309-37-1)	Listed.
Molybdenum (CAS 7439-98-7)	Listed.
Molybdenum trioxide (CAS 1313-27-5)	Listed.
Nickel (CAS 7440-02-0)	Listed.
Nickel oxide (CAS 7782-39-0)	Listed.
Silicon dioxide (CAS 7631-86-9)	Listed.
Titanium dioxide (CAS 13463-67-7)	Listed.
Vanadium (CAS 7440-62-2)	Listed.
Vanadium pentoxide (CAS 1314-62-1)	Listed.

16. Other Information

Other information

Note: This Material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical Specifications vary greatly depending on the products and are not reflected in this document. Consult specification sheets for technical information.

HMIS® ratings

Health: 3*
Flammability: 1
Physical hazard: 0

NFPA ratings

Health: 3
Flammability: 1
Instability: 0

Disclaimer

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