Section 1: IDENTIFICATION

Product Name:	Sulphur, Solid
Synonyms:	Sulfur; Solid Sulphur.
Product Use:	A raw material used in the manufacture of sulphuric acid and other chemical manufacturing.
Restrictions on Use:	Not available.
Manufacturer/Supplier:	Penn West Petroleum Ltd. Suite 200, 207-9th Avenue SW Calgary, Alberta T2P 1K3
Phone Number:	(403) 777-2500
Emergency Phone:	Emergency Telephone Number: 1-877-792-2990
	Emergency Spill Information: (613) 996-6666 Canutec (Canada) (800) 424-9300 Chemtrec (USA)
Date of Preparation of SDS:	December 8, 2014

Section 2: HAZARD(S) IDENTIFICATION

GHS INFORMATION

Classification: Skin Irritation, Category 2

LABEL ELEMENTS

Hazard Pictogram(s):

Signal Word: Warning

Hazard Statements: Causes skin irritation.

Precautionary Statements

Prevention: Wash thoroughly after handling.
Wear protective gloves, protective clothing and eye protection.

Response: If on skin: Wash with plenty of soap and water.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash it before reuse.

Storage: Not applicable.

Disposal: Not applicable.

Hazards Not Otherwise Classified: Not applicable.

Ingredients with Unknown Toxicity: None.

This material is considered hazardous by the OSHA Hazard Communication Standard, (29 CFR 1910.1200).

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient(s)	Common name / Synonyms	CAS No.	% wt./wt.
Sulfur	Not available.	7704-34-9	100
Sulfur dioxide	Not available.	7446-09-5	Trace
Hydrogen sulfide (H2S)	Not available.	7783-06-4	Trace

Impurities / Stabilizing additives: Hydrogen sulphide; Sulfur dioxide.

Section 4: FIRST-AID MEASURES

Inhalation: If inhaled: Call a poison center or doctor if you feel unwell.

Acute and delayed symptoms and effects: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. This product may contain small amounts of Hydrogen sulphide which may accumulate in confined spaces. Inhalation of Hydrogen sulphide may cause loss of sense of smell, major irritation of the respiratory tract, headache, nausea, vomiting, dizziness, and fluid buildup in the lungs (pulmonary edema), which can be fatal. At 300 ppm unconsciousness may occur after 20 minutes. From 300 to 500 ppm, death can occur within 1 to 4 hours of continuous exposure. At 500 ppm the respiratory system is paralyzed, the victim collapses almost instantaneously, and death can occur after exposure of only 30 to 60 minutes. Above 500 ppm Hydrogen sulphide may cause immediate loss of consciousness; death is rapid, and possibly immediate. Inhalation of Sulphur dioxide at concentrations of approximately 6 ppm will result in eye, nose and throat irritation. Severe overexposure may result in death from systemic acidosis, pulmonary edema or from respiratory arrest. Prolonged or repeated inhalation of sulphur dioxide may cause impaired lung function, bronchitis, cough and fatigue.

Eye Contact: If in eyes: Rinse cautiously with water for at least 20 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a poison center or doctor if you feel unwell.

Acute and delayed symptoms and effects: May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin Contact: If on skin: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse.

Acute and delayed symptoms and effects: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: If swallowed: Call a poison center or doctor if you feel unwell. If vomiting occurs naturally, have victim lean forward to reduce the risk of aspiration. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

Acute and delayed symptoms and effects: May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea. Sulphur may be converted into Hydrogen sulphide in the intestine.

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show the label or SDS where possible).

Note to Physicians: Symptoms may not appear immediately. For inhalation of Hydrogen Sulphide, consider oxygen.

Section 5: FIRE-FIGHTING MEASURES

FLAMMABILITY AND EXPLOSION INFORMATION

Combusts slowly in air with pale flame which may be hard to see, especially in low humidity atmospheres. Flammable solid in powder form. May form combustible dust concentrations in air. Avoid contact with hot exhaust pipes and spark sources of ignition e.g. steel tracked vehicles. Does not meet criteria for classification as Class 4.1 Flammable Solids under IMOT/TDG Regulations. When heated, this material may evolve toxic and flammable Hydrogen sulphide.

Sensitivity to Mechanical Impact: This material is not sensitive to mechanical impact.

Sensitivity to Static Discharge: In the form of dust, this material is sensitive to static discharge and may form explosive mixtures with air. This material is sensitive to static discharge at temperatures at or above the flash point.

MEANS OF EXTINCTION

Suitable Extinguishing Media: Small Fire: Dry chemical, CO2, sand, earth, water spray or regular foam. Flood with water. Apply extinguishing media carefully to avoid creating airborne dust.

Large Fire: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk.

Unsuitable Extinguishing Media: Not available.

Products of Combustion: Oxides of sulphur.

Protection of Firefighters: Fire may produce irritating and/or toxic gases. Contact may cause burns to skin and eyes. Runoff from fire control may cause pollution. Hydrogen sulphide is heavier than air and may collect in low lying areas and confined spaces. Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Section 6: ACCIDENTAL RELEASE MEASURES

Emergency Procedures: Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).

Personal Precautions:	Do not touch or walk through spilled material. Use personal protection recommended in Section 8. Keep away from heat, sparks and flame. Keep container closed (and grounded). Prevent dust accumulation (to minimize explosion hazard). Don full-face, positive pressure, self-contained breathing apparatus.
Environmental Precautions:	Prevent entry into waterways, sewers, basements or confined areas.
Methods for Containment:	Do not flush to sewer or allow to enter waterways.
Methods for Clean-Up:	Use explosion-proof equipment. Dust can be a fire or explosion hazard. Sweep up and shovel into suitable containers for disposal. Cleaning methods (e.g. compressed air) which can generate potentially combustible dust clouds should not be used.
Other Information:	See Section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Handling:
Minimize dust generation and accumulation. Airborne dusts are potentially explosive. Do not swallow. Keep away from heat, sparks, open flames, and hot surfaces. – No smoking. Wash thoroughly after handling. See Section 8 for information on Personal Protective Equipment.

Storage:
Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Store away from incompatible materials. See Section 10 for information on Incompatible Materials. Keep out of the reach of children. Head spaces in storage containers may contain toxic hydrogen sulphide gas. Structural materials and lighting and ventilation systems should be corrosion resistant.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines
Component

Sulphur [CAS No. 7704-34-9]
- **ACGIH:** 10 mg/m³ (TWA) (Inhalable.); 3 mg/m³ (TWA) (Respirable.); For Particles (Insoluble or Poorly Soluble) Not Otherwise Specified
- **OSHA:** 15 mg/m³ (Total dust) (TWA), 5 mg/m³ (Respirable fraction) (TWA); For Particulates Not Otherwise Regulated (PNOR).

Sulphur dioxide [CAS No. 7446-09-5]
- **ACGIH:** 0.25 ppm (STEL); A4 (2008)
- **OSHA:** 5 ppm (TWA), 13 mg/m³ (TWA);
  2 ppm (TWA); 15 ppm (STEL) [Vacated];

Hydrogen sulphide [CAS No. 7783-06-4]
- **ACGIH:** 1 ppm (TWA); 5 ppm (STEL); (2009)
- **OSHA:** 20 ppm (C); 50 ppm (Peak) (Maximum duration: 10 mins. once only if no other meas. exp. occurs.)
  10 ppm (TWA); 15 ppm (STEL) [Vacated]

TWA: Time-Weighted Average
STEL: Short-Term Exposure Limit
C: Ceiling

Engineering Controls: 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 ventilation adequate to keep exposures (airborne levels of dust, fume, vapour, gas, etc.) below recommended exposure limits. Use explosion-proof electrical, ventilating, and lighting equipment.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye/Face Protection: Wear safety glasses. Indirect vented, dust-tight goggles are required if dust is generated when handling this product. Use equipment for eye protection that meets the standards referenced by CSA Standard CAN/CSA-Z94.3-92 and OSHA regulations in 29 CFR 1910.133 for Personal Protective Equipment.

Hand Protection: Wear protective gloves. Consult manufacturer specifications for further information.

Skin and Body Protection: Wear protective clothing. Flame resistant clothing that meets the NFPA 2112 and CAN/CGSB 155.20 standards is recommended in areas where material is stored or handled.

Respiratory Protection: If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate NIOSH/MSHA approved air-purifying respirator that meets the requirements of CSA Standard CAN/CSA-Z94.4-11, with particulate filter, or self-contained breathing apparatus must be used. Supplied air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.

General Hygiene Considerations: Handle according to established industrial hygiene and safety practices. Consult a competent industrial hygienist to determine hazard potential and/or the PPE manufacturers to ensure adequate protection. 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.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Yellow formed solid (prills).
Colour:	Yellow.
Odour:	Odourless when pure. Rotten eggs when hydrogen sulfide present.
Odour Threshold:	0.0047 ppm, (Hydrogen sulphide) 0.67 ppm (Sulphur dioxide)
Physical State:	Solid.
pH:	Not available.
Melting Point / Freezing Point:	113 to 120 °C (235.4 to 248 °F)
Initial Boiling Point:	Not available.
Boiling Point:	445 °C (833 °F)
Flash Point:	207 °C (404.6 °F) (COC)
Evaporation Rate:	Not available.
Flammability (solid, gas):	See Section 5.
Lower Flammability Limit:	35 g/m³ (for Sulphur)
Upper Flammability Limit:	1400 g/m³ (for Sulphur)
Vapor Pressure:	3.95×10^{-6} mmHg at 30.4 °C (86.7 °F)
Vapor Density:	0.00005 lb/ft³ at 32.2 °C (90 °F)
Relative Density:	Not available.
Solubilities:	Insoluble in water.
Partition Coefficient: n-Octanol/Water:	Not available.
Auto-ignition Temperature:	232 °C (449.6 °F)
Decomposition Temperature:	Not available.
Viscosity:	Not available.
Percent Volatile, wt. %:	0
VOC content, wt. %:	Not available.
Density:	2.07 kg/L at 20°C (68 °F)
Coefficient of Water/Oil Distribution:	Not available.

Section 10: STABILITY AND REACTIVITY

Reactivity:	Contact with incompatible materials. Sources of ignition. Exposure to heat.
Chemical Stability:	Stable under normal storage conditions.

Possibility of Hazardous Reactions: None known.

Conditions to Avoid: Contact with incompatible materials. Sources of ignition. Exposure to heat.

Incompatible Materials: Acids. Oxidizers.

Hazardous Decomposition Products: Hazardous sulphur dioxide, and related oxides of sulphur may be generated upon combustion.

Section 11: TOXICOLOGICAL INFORMATION

EFFECTS OF ACUTE EXPOSURE

Product Toxicity

Oral: Not available.

Dermal: Not available.

Inhalation: Not available.

Component Toxicity

Component	CAS No.	LD_{50} oral	LD_{50} dermal	LC_{50}
Sulphur	7704-34-9	> 8437 mg/kg (rat)	Not available.	Not available.
Sulphur dioxide	7446-09-5	Not available.	Not available.	2520 ppm (rat); 1H
Hydrogen sulphide	7783-06-4	Not available.	Not available.	444 ppm (rat); 4H

Likely Routes of Exposure: Eye contact. Skin contact. Inhalation. Ingestion.

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Central nervous system.

Symptoms (including delayed and immediate effects)

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. This product may contain small amounts of Hydrogen sulphide which may accumulate in confined spaces. Inhalation of Hydrogen sulphide may cause loss of sense of smell, major irritation of the respiratory tract, headache, nausea, vomiting, dizziness, and fluid buildup in the lungs (pulmonary edema), which can be fatal. At 300 ppm unconsciousness may occur after 20 minutes. From 300 to 500 ppm, death can occur within 1 to 4 hours of continuous exposure. At 500 ppm the respiratory system is paralyzed, the victim collapses almost instantaneously, and death can occur after exposure of only 30 to 60 minutes. Above 500 ppm Hydrogen sulphide may cause immediate loss of consciousness; death is rapid, and possibly immediate. Inhalation of Sulphur dioxide at concentrations of approximately 6 ppm will result in eye, nose and throat irritation. Severe overexposure may result in death from systemic acidosis, pulmonary edema or from respiratory arrest. Prolonged or repeated inhalation of sulphur dioxide may cause impaired lung function, bronchitis, cough and fatigue.

Eye: May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea. Sulphur may be converted into Hydrogen sulphide in the intestine.

Skin Sensitization: Not available.

Respiratory Sensitization: Not available.

Medical Conditions Aggravated By Exposure: Not available.

EFFECTS OF CHRONIC EXPOSURE (from short and long-term exposure)

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Central nervous system.

Chronic Effects: Prolonged or repeated contact may dry skin and cause irritation. Prolonged overexposure to Sulphur dust can produce possible skin sensitization and permanent eye damage (clouding of the lens and chronic irritation). Prolonged inhalation can cause irritation of mucous membranes. Several human studies have shown that repeated exposure to Sulphur dioxide at levels exceeding the exposure limit has caused permanent pulmonary impairment. Hydrogen sulphide may reduce lung function; cause neurological effects such as headaches, nausea, depression and personality changes; eye and mucous membrane irritation: damage to cardiovascular system.

Carcinogenicity: Product is not classified as a carcinogen. See Component Carcinogenicity table below for information on individual components.

Component Carcinogenicity

Component	ACGIH	IARC	NTP	OSHA	Prop 65
Sulphur dioxide	A4	Group 3	Not listed.	Not listed.	Not listed.

Mutagenicity: Not available.

Reproductive Effects: Not available.

Developmental Effects

Teratogenicity: Not available.

Embryotoxicity: Not available.

Toxicologically Synergistic Materials: Not available.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity:

Daphnia magna (Water flea, age <24 hr): EC50 >5000000 ug/L, 48-hr, freshwater, static; Effect: intoxication, immobilization;

Daphnia magna (Water flea, 1st instar larvae); EC50 = 3850000 ug/L, 96 hr, freshwater, static; Effect: intoxication, immobilization;

Americamysis bahia (Opossum Shrimp, age 24 hr): LC50 = 736000 ug/L, 96 hr (95% confidence interval: 646000-839000 ug/L), saltwater, static;

Lepomis macrochirus (Bluegill): LC50 < 14000 ug/L, 96 hr, freshwater, static;

Lepomis macrochirus (Bluegill, juvenile): LC50 > 180000 ug/L, 96 hr, freshwater, static;

Oncorhynchus mykiss (Rainbow trout): Concentration: LC50 > 180000 ug/L, 96 hr, freshwater, static.

Persistence / Degradability: Solid sulfur is biodegradable; microbiological reduction to hydrogen sulfide or oxidation to acidic oxy-sulfur species is possible. Both of these products can have environmental consequences. Reclamation of sulfur rich wastes is preferred over solid waste disposal. Commercial sulfur waste reclaimers are available. Disposal must be in a certified landfill site approved for the use of elemental sulfur. Special simultaneous application of limestone normally required.

Bioaccumulation / Accumulation: Not anticipated to be bioaccumulative.

Mobility in Environment: Fugitive sulfur dust can be carried considerable distances from origin especially in low humidity and windy conditions. Prolonged exposure of soil and vegetation to such dust can be harmful.

Other Adverse Effects: Not available.

Section 13: DISPOSAL CONSIDERATIONS

Disposal Instructions: Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: TRANSPORT INFORMATION

U.S. Department of Transportation (DOT)

Proper Shipping Name: Not regulated.

Class: Not applicable.

UN Number: Not applicable.

Packing Group: Not applicable.

Label Code: Not applicable.

Canada Transportation of Dangerous Goods (TDG)

Proper Shipping Name: Not regulated.

Class: Not applicable.

UN Number: Not applicable.

Packing Group: Not applicable.

Label Code: Not applicable.

IMDG Code Amendment 36-12 applying to IMO/TDG/ICAO regulations effective 1 Jan 2014 specifically states that Class 4.1 TDG regulations should not apply to commercially formed solid elemental Sulphur as defined in Section 9 of this MSDS under “Physical State”.

Section 15: REGULATORY INFORMATION

Chemical Inventories

US (TSCA)
The components of this product are in compliance with the chemical notification requirements of TSCA.

Canada (DSL)
The components of this product are in compliance with the chemical notification requirements of the NSN Regulations under CEPA, 1999.

Federal Regulations

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

WHMIS Classification: Class D2B - Skin irritant.

Hazard Symbols:

United States
This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SARA Title III

Component	Section 302 (EHS) TPQ (lbs.)	Section 304 EHS RQ (lbs.)	CERCLA RQ (lbs.)	Section 313	RCRA CODE	CAA 112(r) TQ (lbs.)
Sulphur dioxide	500	500	Not listed.	Not listed.	Not listed.	5000
Hydrogen sulphide	500	100	100	313s	U135	10000

State Regulations
Massachusetts
US Massachusetts Commonwealth's Right-to-Know Law (Appendix A to 105 Code of Massachusetts Regulations Section 670.000)

Component	CAS No.	RTK List
Sulphur	7704-34-9	Listed.
Sulphur dioxide	7446-09-5	E
Hydrogen sulphide	7783-06-4	E

Note: E = Extraordinarily Hazardous Substance

New Jersey
US New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Component	CAS No.	RTK List
Sulphur	7704-34-9	Listed.
Sulphur dioxide	7446-09-5	Listed.
Hydrogen sulphide	7783-06-4	SHHS

Note: SHHS = Special Health Hazard Substance

Pennsylvania

US Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Component	CAS No.	RTK List
Sulphur	7704-34-9	Listed.
Sulphur dioxide	7446-09-5	E
Hydrogen sulphide	7783-06-4	E

Note: E = Environmental Hazard

California

California Prop 65: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Component	Type of Toxicity
Sulphur dioxide	developmental

Section 16: OTHER INFORMATION

Disclaimer:

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

Date of Preparation of SDS:	December 8, 2014
SDS Expiry Date (Canada):	December 7, 2017
Version:	1.0
GHS SDS Prepared by:	**Deerfoot Consulting Inc.**
	Phone: (403) 720-3700