



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI, and Canadian Standards

PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

PRODUCT:	ASPHALT CEMENT
TRADE NAMES/SYNONYMS:	AC-10, AC-20, AC-40, AC-8000, AC-10 Fortified, AC-20 Fortified, Pen Stock; PG-58-28, PG-64-22, Vac Resid; Vacuum Bottoms; Vac Bottoms, Vacuum Residuum
CHEMICAL NAME/CLASS:	Petroleum Hydrocarbon Mixture
PRODUCT USE:	Various Applications
SUPPLIER/MANUFACTURER'S NAME:	FRONTIER REFINING, INC.
ADDRESS:	PO Box 1588 Cheyenne, WY 82003
EMERGENCY PHONE:	1-800-424-9300 (CHEMTREC) International: 1-703-527-3887
BUSINESS PHONE:	(307) 634-3551
DATE OF PREPARATION:	August 7, 1997
DATE OF REVISION:	September 11, 2003

2. COMPOSITION and INFORMATION ON INGREDIENTS

This product is used as a heated material, which acts as cement when it cools. The heated material presents a thermal hazard to the persons using this product. This MSDS describes the hazards of the heated material in the appropriate sections. Although not a component of this product, Hydrogen Sulfide can evolve from this material, especially when heated. Hazards of Hydrogen Sulfide are described throughout the MSDS

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL Ppm	TWA ppm	STEL ppm		
Hydrogen Sulfide	7783-06-4	Transient Level	10 (NIC = 5)	15	10 (vacated 1989 PEL)	20 (ceiling), 10 (10-min. peak, once per 8-hr shift) 19 (vacated 1989 PEL)	100	NIOSH REL: STEL = 10 (ceiling) 10 min. DFG MAKs: TWA = 10 PEAK = 2•MAK 15 min. average value, 1-hr interval
Benzene	71-43-2	< 0.5 ppm	0.5 (skin)	2.5 (skin)	1 See 29 CFR 1910.1028	5	500	NIOSH RELs: TWA = 0.1 STEL = 1 DFG MAKs: Skin DFG MAK Germ Cell Mutagen Category: 3A Carcinogen: EPA-A, IARC-1, MAK-1, NIOSH-Ca, NTP-K, OSHA-Ca, TLV-A1
Ethyl Benzene	100-41-4	< 2 ppm	100	125	100	125 (vacated 1989 PEL)	800	NIOSH RELs: TWA = 100 STEL = 125 DFG MAK: Skin Carcinogen: EPA-D, IARC-2B, MAK-3, TLV-A3

NE = Not Established.

NIC = Notice of Intended Change

See Section 16 for Definitions of Terms Used.

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Toluene	108-88-3	< 2 ppm	50 (skin)	NE	200 100 (Vacated 1989 PEL)	300 (ceiling), 500 10 min., peak, per 8 hr shift (ceiling) 150 (Vacated 1989 PEL)	500	NIOSH RELs: TWA = 100 STEL = 150 DFG MAKs: TWA = 50 (skin) PEAK = 4•MAK 15 min., average value, 1-hr interval DFG MAK Pregnancy Risk Classification: C Carcinogen: EPA-D, IARC-3, TLV-A4
Xylenes	108-38-3	< 2 ppm	100	150	100	150 (Vacated 1989 PEL)	900	NIOSH RELs: TWA = 100 STEL = 150 DFG MAKs: TWA = 100 (skin) PEAK = 2•MAK 15 min. average value, 1-hr interval DFG MAK Pregnancy Risk Classification: D Carcinogen: EPA-D, IARC-3, TLV-A4
Asphalt Exposure limits are for Asphalt (Bitumen) fume	8052-42-4	> 99	0.5 mg/m ³ (inhalable fraction) as benzene- soluble aerosol	NE	500 (Petroleum Distillates) 400 [Petroleum Distillates] (Vacated 1989 PE)	NE	1100 (Petroleum Distillates)	NIOSH RELs: (Asphalt fume) STEL = 5 (ceiling) 15-min. DFG MAK: Skin (vapor & aerosol) Carcinogen: IARC-3, MAK-2, NIOSH-Ca, TLV-A4

NE = Not Established.

See Section 16 for Definitions of Terms Used.

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a hot, black, viscous, semi-solid with a strong petroleum odor. The primary hazards associated with this product are irritation of contaminated skin and eyes and burns from contact with the heated material. Asphalt fumes (and other trace components of this product) are potentially carcinogenic to humans. Toxic Hydrogen Sulfide may be evolved and can accumulate in the head-space of containers (e.g. tanks, trucks) containing this product, especially when heated. Presence of Hydrogen Sulfide may result in exposure that can cause severe irritation of the respiratory system, eyes, and skin and can cause central nervous system effects such as nausea, dizziness, headaches, and collapse. Thermal decomposition of this product can also produce other irritating vapors and toxic gases (e.g., carbon oxides, nitrogen oxides, sulfur oxides). This product may ignite if strongly heated. A fire involving this product may produce heavy, black smoke and toxic gases (including carbon monoxide, carbon dioxide, and hydrocarbons). This product is not reactive. Emergency responders must wear proper personal protective equipment for the releases to which they are responding and have adequate fire protection during emergency response situations.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The primary routes of overexposure for this material are via inhalation and contact with skin and eyes. The following paragraphs describe the symptoms of overexposure to this material.

INHALATION: Inhalation of excessive amounts of vapors from hot Asphalt can cause respiratory difficulty, shortness of breath, wheezing, headache, dizziness, indigestion, and nausea. Inhalation of high concentration of vapors may result in unconsciousness or death. Chronic over-exposures to the vapors can cause respiratory system irritation, resulting in symptoms such as coughing and wheezing, which may take a prolonged time to disappear after the over-exposure has ended. In addition, Fumes of Asphalt are suspected to be carcinogenic if exposure is chronic. Due to the possible off-gassing of Hydrogen Sulfide, inhalation of fumes from Asphalt may result in Hydrogen Sulfide poisoning. A summary of possible effects from various levels of Hydrogen Sulfide exposure are outlined on the following page.

3. HAZARD IDENTIFICATION (Continued)

INHALATION continued):

<u>CONCENTRATION of HYDROGEN SULFIDE</u>	<u>EXPOSURE SYMPTOM</u>
0.3-30 ppm:	Odor is obvious and unpleasant.
50 ppm:	Eye irritation. Dryness and irritation of nose, throat.
Slightly higher than 50 ppm:	Irritation of the respiratory system.
100-150 ppm:	Temporary loss of smell.
200-250 ppm:	Headache, vomiting, nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.
300-500 ppm:	Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm:	Headache, excitement, staggering, stomachache after brief exposure. Death occurs in 0.5 - 1 hour.
> 600 ppm:	Rapid onset of unconsciousness, coma, death.
> 1000 ppm:	Immediate respiratory arrest.

Severe overexposures to Hydrogen Sulfide that do not result in death may cause long-term neurological problems such as amnesia, tremors, equilibrium problems, memory loss, paralysis of facial muscles, and nerve tissue damage. Chronic exposures may also cause persistent low blood pressure.

CONTACT WITH SKIN or EYES: If hot Asphalt contaminates the eyes, pain, irritation, and tissue damage could occur. Blindness may result if eyes are contaminated with hot Asphalt. If eye exposure occurs to low levels of off-gassed Hydrogen Sulfide, exposure over several hours may result in "gas eyes" or "sore eyes" with symptoms of scratchiness, irritation, tearing, and burning. Exposure to higher concentrations can result in intense tearing, blurring of vision, and pain when looking at light. Exposed individuals may see rings around bright lights. Most eye symptoms disappear when exposure ceases; however, in serious cases, the eye can be permanently damaged. Contact with the vapors from the heated product can redden and irritate the eyes. If hot Asphalt contaminates the skin, pain, irritation and tissue damage can result. Such burns can leave scar tissue. Contact with the vapors from the heated material can cause irritation, reddening, and dryness. Repeated or prolonged exposure to the vapors can cause dermatitis (inflammation of the skin).

SKIN ABSORPTION: Some studies of asphalt products suggest that prolonged skin contact can cause symptoms described under "Inhalation".

INGESTION: Though not anticipated to be a significant route of occupational exposure, ingestion of Asphalt can irritate the tissue of the mouth, throat, and other tissues of the gastro-intestinal system. Symptoms of such over-exposure can include nausea, vomiting, and diarrhea. Ingestion of the heated material can result in burns to the mouth, throat, and other tissues.




INJECTION: Accidental injection of this material (via cut or puncture with a contaminated object) will cause pain and irritation in addition to the wound.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**.

ACUTE: The most likely routes of over-exposure are inhalation and skin contact. Symptoms include respiratory difficulty, shortness of breath, wheezing, headache, dizziness, indigestion, and nausea. If high concentrations of the vapors from the heated material are inhaled, unconsciousness or death may result. The vapors can also irritate the skin and eyes. Skin or eye contact with the heated material can result in burns and permanent damage to the contaminated area. Ingestion may cause stomach distress, vomiting, and diarrhea.

CHRONIC: Repeated or prolonged exposure to the vapors from the heated material can cause dermatitis (inflammation of the skin). Chronic over-exposures via inhalation of the vapor can cause respiratory system irritation, resulting in symptoms such as coughing and wheezing, which may take a prolonged time to disappear after the over-exposures have ended. Due to possible off-gassing of Hydrogen Sulfide, chronic overexposures may also cause persistent low blood pressure, loss of sense of smell, or permanent eye damage. Asphalt fumes are possibly carcinogenic to humans; prolonged exposure to this product may result in a cancer hazard. Some of the trace components of this product are known or suspected carcinogens and/or reproductive toxins. Refer to Section 11 (Toxicological Information) of this MSDS for additional information.

TARGET ORGANS: ACUTE: Respiratory system, skin, eyes. CHRONIC: Skin, respiratory system, blood system, central nervous system, liver, kidneys, nerves of feet and hands.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD	(BLUE)	1	
FLAMMABILITY HAZARD	(RED)	1	
REACTIVITY HAZARD	(YELLOW)	0	
PROTECTIVE EQUIPMENT			
EYES	RESPIRATOR	HANDS	BODY
	SEE SECTION 8		
For Routine Industrial Use and Handling Applications			

See Section 16 for Definition of Ratings

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and MSDS to physician or health professional with victim.

INHALATION: If the vapors from the heated material are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Victim must seek immediate medical attention if any adverse effect continues after removal to fresh air.

SKIN EXPOSURE: For contaminations which are associated with routine chemical use and which contaminate a small area of the skin, wash skin thoroughly with soap and water. If irritation develops or persists, consult a physician. For major contaminations, begin decontamination with running water for at least 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victims should seek immediate medical attention. If the hot material contaminates the skin, immediately begin decontamination with running water for at least 15 minutes. Treat exposure areas for burns. Victim should seek medical attention if irritation or other adverse effects occur.

EYE EXPOSURE: If either the heated product or the cooled, semi-solid enters the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim should seek immediate medical attention.

INGESTION: If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING unless directed by medical personnel. Have victim rinse mouth with water, if conscious. Never induce vomiting or give a diluent (e.g., water) to someone who is unconscious, having convulsions, or unable to swallow. If contaminated individual is convulsing, maintain an open airway and obtain immediate medical attention.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing dermatitis, other skin conditions, respiratory conditions, may be aggravated by overexposure to this product.

5. FIRE-FIGHTING MEASURES

FLASH POINT (Closed Cup): 164-246°C (327-475°F)

AUTOIGNITION TEMPERATURE: > 371°C (> 700°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not available.

Upper (UEL): Not available.

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (cooling)

Foam: NO (may cause frothing)

Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

Other: Any "B" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this material may decompose and produce irritating fumes and toxic gases including carbon monoxide and carbon dioxide, and heavy, black soot. Note: The heated asphalt can be a thermal hazard to fire fighters. Persons responding to a fire involving containers of this product should be aware that solvents may have been used to clean out containers and may increase the fire hazard (refer to "CAUTION" note in Section 7 [Handling and Storage], "Storage and Handling Practices" heading, for further information).

Explosion Sensitivity to Mechanical Impact: Not Sensitive.

Explosion Sensitivity to Static Discharge: Not Sensitive.

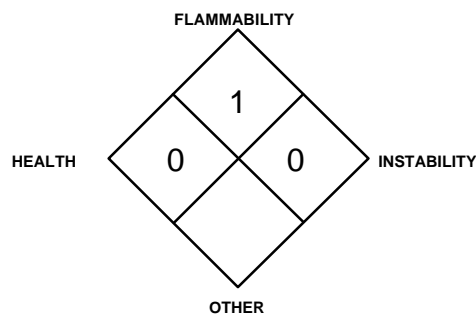
SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. A fog or mist should be used to control vapor spread and to keep exposed containers cool. A carefully applied water spray may be used to cause frothing and foaming on the surface of released material; the foaming action blankets the material and extinguishes fires involving this product. If possible, move containers from fire area if it can be done without risk to personnel. Control runoff water to prevent environmental contamination.

6. ACCIDENTAL RELEASE MEASURES

Uncontrolled releases should be responded to by trained personnel. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. Adequate fire protection should be provided. Absorb liquid with activated carbon, sand, or other suitable absorbent material. Shovel or vacuum-up solid material carefully. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. Reuse or dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations and those of Canada and its Provinces (see Section 13, Disposal Considerations).

NOTE: Allow hot asphalt to cool before clean-up operations begin.

NFPA RATING



See Section 16 for
Definition of Ratings

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing vapors or mists generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately. Employ engineering controls to maintain employee exposures below values recommended in Section 2, (Composition and Information on Ingredients). Be aware of any signs of dizziness or fatigue; however, exposure to a fatal concentration of this product may occur without any significant warning symptoms. Non-sparking tools should always be used in the handling of this product.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing vapors generated by this product. Containers must be properly labeled. Use in work areas which can be easily decontaminated. Wash thoroughly after using this material. Keep container closed when not in use. Store containers in secondary containment, away from incompatible materials (see Section 10, Stability and Reactivity). Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged. Transfer and storage equipment must be grounded and bonded. Do not pressurize, weld, cut, braze, solder, grind or drill on or near full or empty containers. Empty containers retain residue and may explode if subjected to heat or fire. Release of vapors must be controlled to prevent vapor accumulation or ignition. **CAUTION:** When solvents (i.e. diesel fuel, fuel oil, naphtha, etc.) are used to clean out the container, tank, transport, pump or piping system and are therefore introduced into the container with this product, the solvent may float to the surface. The vapor space above the liquid surface may have the same fire hazards as a container of the solvent. The container or tank should be labeled and treated in accordance with the hazards of the solvent in addition to the hazards of the product.

BULK SHIPMENTS: Bulk shipments of this product should be loaded and unloaded in strict accordance with truck manufacturer's recommendations and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Exposure Controls-Personal Protection). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Trucks must be level and wheels must be locked or blocked prior to loading or unloading. Truck and Asphalt-handling equipment must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be free of incompatible chemicals, prior to connection to the truck. Valves and hoses must be verified to be in the correct positions, before starting transfer operations.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Decontaminate equipment by steaming, purging with an inert gas, or using soapy water before maintenance begins. Entry into vessels used to store this material should be done after proper cleaning, purging, and with proper confined space entry and testing (per 29 CFR 1910.146). Collect all water and dispose of according to applicable U.S. Federal, State or local procedures and those of Canada and its Provinces.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: If appropriate, install monitoring equipment to detect the level of oxygen and the presence of potentially explosive air-gas mixtures. Provide natural or explosion-proof ventilation to ensure dispersion of combustible vapors from this product. Local exhaust ventilation is preferred, as it prevents dispersion of this product into the workplace by eliminating it at its source. If necessary, refer to U.S. OSHA Standards and Canadian WHMIS Standards.

RESPIRATORY PROTECTION: Maintain exposure levels of components below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent U.S. State standards, or Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

The following are NIOSH respiratory guidelines for Asphalt Fumes in air:

ASPHALT FUME

CONCENTRATION

RESPIRATORY EQUIPMENT

At Concentrations Above the NIOSH REL, or Where There is no REL, at Any Detectable Concentration: Any Self-Contained Breathing Apparatus (SCBA) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any Supplied-Air Respirator (SAR) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. (continued on following page)

Escape: Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type, SCBA.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

EYE PROTECTION: Splash goggles or safety glasses. If the potential for contact with this product exists, face-shields should be used. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards. Eyewash stations/safety showers should be near areas where this product is used or stored.

HAND PROTECTION: Wear chemically resistant gloves when using this product. Responder™ gloves are recommended. If necessary, refer to U.S. OSHA 29 CFR 1910.138 and appropriate Standards of Canada.

BODY PROTECTION: Use body protection as necessary to prevent body contact. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): > 1

SPECIFIC GRAVITY (water = 1): 1-1.06

SOLUBILITY IN WATER: Insoluble.

VAPOR PRESSURE, mm Hg @ 20°C: < 1

ODOR THRESHOLD: Not established.

COEFFICIENT WATER/OIL DISTRIBUTION: Not established.

APPEARANCE, ODOR AND COLOR: Black, viscous, semi-solid with a strong, petroleum odor. The product is usually used as a heated material.

HOW TO DETECT THIS SUBSTANCE (warning properties): The aromatic odor is detectable below the TLV; therefore, the odor may be a distinguishing characteristic of this material.

EVAPORATION RATE (n-BuAc=1): Not applicable.

MELTING POINT or RANGE: Not applicable.

BOILING RANGE: > 215.6°C (> 420°F)

pH: Not applicable

VISCOSITY @ 275°F, CST: > 300

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: The products of thermal decomposition from this product include black, sooty smoke, irritating vapors and toxic gases (e.g., carbon oxides).

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers, strong acids, strong bases, and amines.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following are toxicity data currently available for Asphalt.

TCLo (Inhalation-Rat) 100 mg/m³/6 hours/14 weeks-intermittent: Sense Organs and Special Senses (Olfaction): tumors; Behavioral: food intake (animal); Nutritional and Gross Metabolic: weight loss or decreased weight gain

TDLo (Intramuscular-Rat) 5400 mg/kg/weeks-intermittent: Tumorigenic: neoplastic by RTECS criteria, facilitates action of known carcinogen

TDLo (Skin-Mouse) 130 gm/kg/81 weeks-intermittent: Tumorigenic: carcinogenic by RTECS criteria; Lungs, Thorax, or Respiration: tumors; Skin and Appendages: tumors

TDLo (Intramuscular-Mouse) 12 gm/kg/12 weeks-intermittent: Tumorigenic: neoplastic by RTECS criteria; Tumorigenic: tumors at site of application

TD (Skin-Mouse) 69 gm/kg/ weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Lungs, Thorax, or Respiration: tumors; Skin and Appendages: tumors

TDLo (Skin-Mouse) 905 gm/kg/2 years-intermittent: Tumorigenic:- neoplastic by RTECS criteria; Lungs, Thorax, or Respiration: tumors; Skin and Appendages: tumors

DNA Adduct (Skin-Mouse) 600 mg/kg

SUSPECTED CANCER AGENT: Components of this product are listed by agencies tracking carcinogenic potential as follows:

ASPHALT (FUMES ONLY): ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); IARC-3 (Unclassifiable as to Carcinogenicity in Humans); MAK-2 (Substances that are Considered to Be Carcinogenic for Man Because Sufficient Data from Lon-Term Animal Studies or Limited Evidence From Animal Studies Substantiated by Evidence from Epidemiological Studies Indicated that They Make a Significant Contribution to Cancer Risk); NIOSH Ca (Potential Occupational Carcinogen Defined with no Further Categorization)

BENZENE: ACGIH TLV-A1 (Confirmed Human Carcinogen); EPA-A (Human Carcinogen); IARC-1 (Confirmed Human Carcinogen); MAK-1 (Substance That Cause Cancer in Man and Can Be Assumed to Make to Significant Contribution to Cancer Risk); NIOSH-Ca (Potential Occupational Carcinogen with no Further Designation); NTP-K (Known to Be a Human Carcinogen); OSHA-Ca (Carcinogen Defined with No Further Designation)

ETHYL BENZENE: ACGIH TLV-A3 (Confirmed Animal Carcinogen); IARC-2B (Possibly Carcinogenic to Humans); MAK-3 (Substances for Which *in-vitro* Tests or Animal Studies Have yielded evidence of Carcinogenic Effects that is Not Sufficient for Classification of the Substance in One of the Other Categories. Further studies are required before a final classification can be made. A MAK or BAT value can be established, provided no genotoxic effects have been detected.

TOLUENE: ACGIH TLV-A4 (Not Classified as a Human Carcinogen); EPA-D (Not Classifiable as to Human Carcinogenicity); IARC-3 (Unclassifiable as to Carcinogenicity in Humans)

XYLENES: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); EPA-D (Not Classifiable as to Human Carcinogenicity); IARC-3 (Unclassifiable as to Carcinogenicity in Humans);

IRRITANCY OF PRODUCT: The vapors from the heated product can be irritating to contaminated skin and eyes.

SENSITIZATION TO THE PRODUCT: The components of this product are not known to be skin or respiratory sensitizers.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: This product is not reported to produce mutagenic effects in humans. Tests involving the Benzene component of this product and specific human tissues produced mutagenic effects. Mutagenic data in microorganisms exist for the Benzene, Ethyl Benzene and Toluene components of this product. Animal mutagenic data from tests involving high levels of the Benzene component are available. There are also mutagenic data in animals for fumes of Asphalt.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: This product is not reported to produce mutagenic effects in humans. Tests involving the Benzene component of this product and specific human tissues produced mutagenic effects. Mutagenic data in microorganisms exist for the Benzene, Ethyl Benzene and Toluene components of this product. Animal mutagenic data from tests involving high levels of the Benzene component are available. There are also mutagenic data in animals for fumes of Asphalt.

Embryotoxicity: This product is not reported to produce embryotoxic effects in humans. There is some evidence of embryotoxic effects in animals during clinical studies for the Benzene, and Toluene components of this product.

Teratogenicity: This product is not reported to cause teratogenic effects in humans. There are animal test data that indicate teratogenic effects from exposure to high doses of the Benzene, Ethyl Benzene and Xylene components of this product. Animal tests involving the Toluene component of this product did not cause birth defects, but exposure to pregnant rats to concentrations greater than 500 ppm resulted in fetotoxic effects (e.g. reduced birth weights, delay in bone formation).

Reproductive Toxicity: This product is not reported to cause reproductive effects in humans. Clinical studies on test animals exposed to relatively high doses of the Benzene, Ethyl Benzene, Toluene and Xylene components of this product provided reproductive toxicity data.

A *mutagen* is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An *embryotoxin* is a chemical that causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A *teratogen* is a chemical that causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance that interferes in any way with the reproductive process.

ACGIH BIOLOGICAL EXPOSURE INDICES: Currently, the following ACGIH Biological Exposure Indices (BEIs) have been determined for the components of this product.

CHEMICAL: DETERMINANT	SAMPLING TIME	BEI
Benzene • S-Phenylmercapturic Acid in Urine • t,t-Muconic Acid in Urine	• End of Shift • End of Shift	• 25 µg/g Creatinine • 500 µg/g Creatinine
Ethyl Benzene • Mandelic Acid in Urine • Ethyl Benzene in End-Exhaled Air	• End of Shift at End of Workweek	• 1.5 g/g Creatinine
Toluene • o-Cresol in Urine • Hippuric Acid in Urine • Toluene in Blood	• End of Shift • End of Shift • Prior to Last Shift of Workweek	• 0.5 mg/L • 1.6 g/g Creatinine • 0.05 mg/L
Xylenes: • Methylhippuric Acids in Urine	• End of Shift	• 1.5 g/g Creatinine

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: Hydrocarbon and cycloalkanes are the main components of this product and are rapidly volatilized from soil and water sources. They are not photolyzed or hydrolyzed to any great extent. The biodegradation of both an n-alkane and several carboxylated cycloalkanes was examined within tailings produced by the extraction of bitumen from the Athabasca oil sands. The carboxylated cycloalkanes examined were structurally similar to naphthenic acids that have been associated with the acute toxicity of oil sand tailings. The biodegradation potential of naphthenic acids was estimated by determining the biodegradation of both the carboxylated cycloalkanes and hexadecane in oil sand tailings. Carboxylated cycloalkanes were biodegraded within oil sand tailings, although compounds with methyl substitutions on the cycloalkane ring were more resistant to microbial degradation. Microbial activity against hexadecane and certain carboxylated cycloalkanes was found to be nitrogen and phosphorus limited.

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF MATERIAL ON PLANTS or ANIMALS: This product may be harmful or fatal to contaminated plant and animal-life (especially if large quantities are released). Contact with hot Asphalt will result in damage or death to animals and plants.

EFFECT OF CHEMICAL ON AQUATIC LIFE: This product can be harmful or fatal to exposed aquatic plants or animals, especially if large quantities of this product are released into a body of water.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations or with regulations of Canada.

U.S. EPA WASTE NUMBER: Not applicable to wastes consisting only of this material.

14. TRANSPORTATION INFORMATION

THIS PRODUCT IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Elevated temperature liquid, n.o.s. (asphalt)
HAZARD CLASS NUMBER and DESCRIPTION: 9 (Miscellaneous Dangerous Goods)
UN IDENTIFICATION NUMBER: UN 3257
PACKING GROUP: III
DOT LABEL(S) REQUIRED: Class 9 (Miscellaneous Dangerous Goods)
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER, 2000: 128
MARINE POLLUTANT: Components of this product are not designated as a Marine Pollutant, per Appendix B to 49 CFR 172.101.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is considered as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

PROPER SHIPPING NAME: Elevated temperature liquid, n.o.s. (asphalt)
HAZARD CLASS NUMBER and DESCRIPTION: 9 (Miscellaneous Dangerous Goods)
UN IDENTIFICATION NUMBER: UN 3257
PACKING GROUP: III
HAZARD LABEL(S) REQUIRED: Class 9 (Miscellaneous Dangerous Goods)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX: 5
ERAP INDEX: None
PASSENGER CARRYING SHIP INDEX: None
PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX: Forbidden
MARINE POLLUTANT: Not applicable.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act and are listed as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Benzene	No	No	Yes
Ethyl Benzene	No	No	Yes
Hydrogen Sulfide	Yes	Yes	Yes
Toluene	No	No	Yes
m-Xylene	No	No	Yes

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this material. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. SARA EXTREMELY HAZARDOUS THRESHOLD PLANNING QUANTITY (SECTION 302): Hydrogen Sulfide = 500 lb (227 kg)

U.S. SARA EXTREMELY HAZARDOUS REPORTABLE QUANTITY (SECTION 304): Hydrogen Sulfide = 100 lb (45.4 kg)

U.S. CERCLA REPORTABLE QUANTITY (RQ): Benzene = 10 lb (4.54 kg); Ethyl Benzene = 1000 lb (2270 kg); Hydrogen Sulfide = 100 lb (227 kg); Toluene = 1000 lb (2270 kg); m-Xylene = 1000 lb (454 kg)

15. REGULATORY INFORMATION (Continued)

ADDITIONAL U.S. REGULATIONS (continued):

U.S. SARA SECTIONS 311/312 HAZARDOUS CHEMICAL REPORTING: This product has requirements of hazardous chemical reporting, as per 40 CFR, Part 370:

IMMEDIATE HEALTH (Acute Health Hazard)	DELAYED HEALTH (Chronic Health Hazard)	FIRE	SUDDEN RELEASE	REACTIVE
Yes	No	Yes	No	No

U.S. TSCA INVENTORY STATUS: Components of this product are listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: The Federal OSHA Permit-Required Confined-Space Standard (29 CFR 1910.146) may be applicable for certain operations involving this product. The requirements of the OSHA Benzene Standard (29 CFR 1910.1028) are not applicable to the material, due to its low concentration (the concentration of Benzene is less than 0.1%).

U.S. STATE REGULATORY INFORMATION: This compound has no requirements under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Asphalt, Petroleum Vapor, Ethylbenzene, Benzene, Toluene, Xylenes.

California - Permissible Exposure Limits for Chemical Contaminants: Asphalt Fumes, Ethylbenzene, Benzene, Toluene, Xylenes.

Florida - Substance List: Asphalt Fumes, Ethylbenzene, Benzene, Toluene, Xylenes.

Illinois - Toxic Substance List: Asphalt, Typical, Ethylbenzene, Benzene, Toluene, Xylenes.

Kansas - Section 302/313 List: Asphalt, Petroleum Vapor, Ethylbenzene, Benzene, Toluene, Xylenes.

Massachusetts - Substance List: Asphalt, Fumes, Ethylbenzene, Benzene, Toluene, Xylenes.

Michigan - Critical Materials Register: Benzene, Toluene, Xylene.

Minnesota - List of Hazardous Substances: Asphalt, Petroleum Vapor, Ethylbenzene, Benzene, Toluene, Xylenes.

Missouri - Employer Information/Toxic Substance List: Asphalt Fumes, Ethylbenzene, Benzene, Toluene, Xylenes.

New Jersey - Right to Know Hazardous Substance List: Asphalt Fumes, Ethylbenzene, Benzene, Toluene, Xylenes.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Benzene, Toluene, Xylenes.

Pennsylvania - Hazardous Substance : Asphalt, Ethylbenzene, Benzene, Toluene, Xylenes.

Rhode Island - Hazardous Substance List: Ethylbenzene, Benzene, Toluene, Xylenes.

Texas - Hazardous Substance List: Ethylbenzene, Benzene, Toluene, Xylenes.

West Virginia - Hazardous Substance List: Ethylbenzene, Benzene, Toluene, Xylenes.

Wisconsin - Toxic and Hazardous Substances: Ethylbenzene, Benzene, Toluene, Xylenes.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Soots, tars, and mineral oils (untreated and mildly treated), Benzene and Toluene are listed on California Proposition 65 lists. **WARNING:** This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

ANSI LABELING (Z129.1): **WARNING!** CONTACT WITH HOT PRODUCT WILL CAUSE THERMAL BURNS. MAY CAUSE RESPIRATORY TRACT, SKIN AND EYE IRRITATION. SUSPECT CANCER HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE CANCER. HARMFUL IF SWALLOWED. Avoid breathing vapors or mists. Avoid contact with skin, eyes and clothing. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, and appropriate body protection. **FIRST-AID:** In case of contact, immediately flush with plenty of water. Remove contaminated clothing and shoes. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, foam, dry chemical or CO₂. **IN CASE OF SPILL:** Trained employees must clean-up spills promptly, using procedures designed to prevent fire. Wash clothing before reuse. Use in accordance with information on the Material Safety Data Sheet.

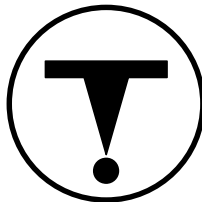
ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: The components of this product are listed on the DSL Inventory or are exempted as analogs of a listed compound.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITY SUBSTANCES LISTS: The Benzene component of this product is on the CEPA Priority Substances Lists.

CANADIAN WHMIS SYMBOLS: **D2A:** Materials Causing Other Toxic Effects/Contains Known Carcinogen



16. OTHER INFORMATION

PREPARED BY:

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DATE OF PRINTING:

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16. OTHER INFORMATION (Continued)

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Frontier Refining assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Frontier Refining assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

CAS #: This is the Chemical Abstract Service Number that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

LOQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELS: NIOSH's Recommended Exposure Limits.

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL that was vacated by Court Order.

SKIN: Used when there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

IDLH-Immediately Dangerous to Life and Health: This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD:

0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0". *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity LD₅₀ Rat:* < 5000 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ Rat:* < 20 mg/L.; **1 (Slight Hazard):** Minor reversible injury may occur; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *Oral Toxicity LD₅₀ Rat:* > 500-5000 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 1000-2000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 2-20 mg/L.; **2 (Moderate Hazard):** Temporary or transitory injury may occur. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity LD₅₀ Rat:* > 50-500 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 200-1000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.5-2 mg/L.; **3 (Serious Hazard):** Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation:* Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

HEALTH HAZARD (continued):

3 (continued): *Oral Toxicity LD₅₀ Rat:* > 1-50 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 20-200 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.05-0.5 mg/L.; **4 (Severe Hazard):** Life-threatening; major or permanent damage may result from single or repeated exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD₅₀ Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* ≤ 0.05 mg/L.

FLAMMABILITY HAZARD:

0 (Minimal Hazard): Materials that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.; **1 (Slight Hazard):** Materials that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials [e.g. wood, paper, etc.]; **2 (Moderate Hazard):** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, including: Liquids having a flash-point at or above 37.8°C [100°F]; Solid materials in the form of coarse dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); **3 (Serious Hazard):** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]; **4 (Severe Hazard):** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignites spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric].

PHYSICAL HAZARD:

0 (Water Reactivity): Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. *Unstable Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No "0" rating allowed. *Unstable Reactives:* Substances that will not polymerize, decompose, condense or self-react.; **1 (Water Reactivity):** Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives:* Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating.

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

1 (continued): *Oxidizers:* Packaging Group III; *Solids:* any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.; **2** (*Water Reactivity:* Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases:* Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group II **Solids:** any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3** (*Water Reactivity:* Materials that may form explosive reactions with water. *Organic Peroxides:* Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives:* Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases:* Pressure \geq 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group I **Solids:** any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. *Liquids:* Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); **4** (*Water Reactivity:* Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides:* Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives:* Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases:* No Rating. *Pyrophorics:* Add to the definition of Flammability “4”. *Oxidizers:* No “4” rating. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.).

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

HEALTH HAZARD: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure could cause death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD: **0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily.

INSTABILITY HAZARD: **0** Materials that in themselves are normally stable, even under fire conditions. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.

FLAMMABILITY LIMITS IN AIR: Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). **Flash Point** - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. **Autoignition Temperature:** The minimum temperature required to initiate combustion in air with no other source of ignition. **LEL** - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. **UEL** - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS (Continued)

ECOLOGICAL INFORMATION:

EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

U.S. and CANADA:

ACGIH: American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA or Superfund**); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label. **OSHA** - U.S. Occupational Safety and Health Administration.