

Safety Data Sheet

Residual Fuel Oil

Minerva Bunkering (USA) LLC
Minerva Bunkering PTE Ltd.

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	Residual Fuel Oil	
Synonyms	No. 6 Fuel Oil, Marine Fuel Oil, Slurry Oil, Slurry Blendstock, Vacuum Tower Bottoms, Heavy Gas Oil, Heavy Cat Heating Oil, Bunker Fuel, Bunker C, Reduced Crude, Clarified Oil, Asphalt Feed Stock, Bitumen Mixture, Blended Pitch, Marine Fuel Oil, Resid	
Chemical Family	Petroleum Hydrocarbon	
Intended Use	Fuel	
MARPOL Annex I Category	Fuel and Residual Oils, Including Ship's Bunkers	
Supplier	Minerva Bunkering (USA) LLC 20 E Greenway Plaza Suite 650 Houston, TX 77046, USA	Minerva Bunkering PTE Limited Marina View 12, Asia Square Tower 2 018961 Singapore, Singapore
24 Hour Emergency Numbers	Emergency phone: (24-hr) 800-424-9300 (Chemtrec) Other calls: 720-214-6215 Health, Safety & Environmental American Association of Poison Control Centers: 800-222-1222	

2. HAZARDS IDENTIFICATION

May contain or release highly poisonous hydrogen sulfide gas

GHS Classification

H227	Flammable liquids – Category 4
H315	Skin irritation – Category 2
H319	Eye irritation – Category 2
H332	Acute toxicity, inhalation – Category 4
H335	Specific target organ toxicity, single exposure, respiratory tract irritation– Category 3
H350	Carcinogenicity – Category 1B
H361	Reproductive toxicity – Category 2
H373	Specific target organ toxicity. repeated exposure - Category 2
H400	Hazardous to the aquatic environment, acute Category 1
H410	Hazardous to the aquatic environment, chronic Category 1

Label Elements



Signal Words Danger

GHS Hazard Statements

H227	Combustible Liquid
H315	Causes skin irritation
H320	Causes eye irritation
H332	Harmful if inhaled
H335	May cause respiratory irritation
H350	May cause cancer
H361	Suspected of damaging fertility of the unborn child

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2. HAZARDS IDENTIFICATION

H373 May cause damage to organs through prolonged or repeated exposure

H410 Very toxic to aquatic life with long lasting effects

GHS Precautionary Statements

P201 Obtain special instructions before use

P202 Do not handle until all safety precautions have been read and understood

P210 Keep away from heat/sparks/open flames/hot surfaces – no smoking

P260 Do not breathe dust/fumes/gas/mist/vapours/spray

P263 Avoid contact during pregnancy and while nursing

P264 Wash thoroughly after handling

P271 Use only outdoors or in a well-ventilated area

P273 Avoid release to the environment

P280 Wear protective gloves / protective clothing / eye protection / face protection

P281 Use personal protective equipment as required

P361, P352, P362 IF ON SKIN OR HAIR: Remove/take off immediately all contaminated clothing. Wash with plenty of soap and water. Take off contaminated clothing and wash before reuse.

P305,P351,P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

P313 If eye irritation persists, get medical advice/attention

P304,P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

P308, P313 IF exposed or concerned: get medical advice/attention

P312 Call a POISON CENTER or doctor/physician if you feel unwell

P370,P378 In case of fire: Use dry chemical, carbon dioxide, or foam for extinction

P391 Collect spillage

P403,P233, P235 Store in a well-ventilated place. Keep container tightly closed, Keep cool

P501 Dispose of contents/container to approved facility

Other Hazards

Contact with hot material can cause thermal burns

This material may contain or liberate hydrogen sulfide, a poisonous gas with the smell of rotten eggs. Hydrogen sulfide and other hazardous vapors may evolve and collect in the headspace of storage tanks or other enclosed vessels. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (light sensitivity) and pulmonary edema (fluid accumulation in lungs). Severe exposures can result in nausea, vomiting, muscle weakness or convulsions, respiratory failure and death.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Components	CAS Registration No.	Concentration (%)
Fuel Oil No. 6	68476-33-5	0 - 100
Vacuum Tower Bottoms	64741-56-6	50 - 100
Catalytic Cracked Clarified Oil	64741-62-4	0 - 100
Straight Run Middle Distillate	64741-44-2	0 - 50
Light Catalytic Cracked Distillate	64741-59-9	0 - 50
Light Vacuum Residues	68512-62-9	0 - 50
Heavy Catalytic Cracked Distillate	64741-61-3	0- 50
Petroleum Residues Vacuum Distillate	68955-27-1	0 - 100
Ethyl Benzene	100-41-4	< 1
Hydrogen Sulfide	7783-06-4	<0.1 - 3
Naphthalene	91-20-3	< 2
Polycyclic Aromatic Hydrocarbons	Mixture	< 10

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4. FIRST AID MEASURES

Inhalation (Breathing) Move the exposed person to fresh air. If not breathing, clear airways and give artificial respiration. If breathing is difficult, humidified oxygen should be administered by qualified personnel. Seek medical attention if breathing difficulties continue.

Eye Contact Flush eyes with water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye. Remove contact lenses, if worn, after initial flushing. Do not use eye ointment. Seek medical attention.

Skin Contact Remove contaminated shoes and clothing, and flush affected areas with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists. Launder or discard contaminated clothing.

Ingestion (Swallowing) Aspiration hazard. Do not induce vomiting or give anything by mouth because the material can enter the lungs and cause severe lung damage. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention

Most Important Symptoms and Effects **Acute:** Respiratory irritation, headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Ingestion can cause irritation of the digestive tract, nausea, diarrhea and vomiting
Delayed: Dry skin and possible irritation with repeated or prolonged exposure

Potential Acute Health Effects **Inhalation:** Breathing high concentrations may be harmful. Mist or vapor can irritate the throat and lungs. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness or unconsciousness. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (light sensitivity) and pulmonary edema (fluid accumulation in lungs). Severe exposures can result in nausea, vomiting, muscle weakness or convulsions, respiratory failure and death.

This material may contain or liberate hydrogen sulfide, a poisonous gas with the smell of rotten eggs. Hydrogen sulfide and other hazardous vapors may evolve and collect in the headspace of storage tanks or other enclosed vessels. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (light sensitivity) and pulmonary edema (fluid accumulation in lungs). Severe exposures can result in nausea, vomiting, muscle weakness or convulsions, respiratory failure and death. Before attempting rescue, first responders should be alert to the possible presence of hydrogen sulfide, and should consider the need for respiratory protection. Remove the victim to fresh air as quickly as possible. Immediately begin artificial respiration if breathing has ceased. Consider whether oxygen administration is needed. Obtain medical advice for further treatment.

Eye Contact: This product can cause eye irritation from short-term contact with liquid, mists or vapors. Symptoms include stinging, watering, redness and swelling. Effects may be more serious with repeated or prolonged contact.

Skin Contact: This product is a skin irritant. Contact may cause redness, itching, burning and skin damage.

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4. FIRST AID MEASURES

Ingestion: Ingestion may result in nausea, vomiting, diarrhea and restlessness. Aspiration (inadvertent suction) of liquid into the lungs must be avoided as even small quantities in the lungs can produce chemical pneumonitis, pulmonary edema or hemorrhage and even death.

Potential Chronic Health Effects

Chronic effects of overexposure are similar to acute effects including central nervous system (CNS) effects and CNS depression. Effects may also include irritation of the digestive tract, irritation of the respiratory tract, nausea, vomiting and skin dermatitis.

Notes to Physician

This material may contain or liberate hydrogen sulfide. In high doses, hydrogen sulfide may produce pulmonary edema and respiratory depression or paralysis. The first priority in treatment should be providing adequate ventilation and administering 100% oxygen. If unresponsive to supportive care, nitrites (amyl nitrite by inhalation or sodium nitrite by I.V.) may be an effective antidote, if delivered within the first few minutes of exposure. For adults, the dose is 10 ml of a 3NaNO₂ solution (0.5 gm NaNO₂ in 15 ml water) IV over 2 to 4 minutes. The dosage should be adjusted in children or in the presence of anemia and methemoglobin levels, arterial blood gases, and electrolytes should be monitored.

Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis. Inhalation overexposure can produce toxic effects, monitor for respiratory distress. If cough or breathing difficulties develop, evaluate for upper respiratory tract inflammation, bronchitis and pneumonitis.

Skin contact may aggravate an existing dermatitis. High pressure injection injuries may cause necrosis of underlying tissue regardless of superficial appearance. All injuries should be evaluated by a medical specialist in order to assess the extent of injury.

5. FIRE FIGHTING MEASURES

Flammability Classification

OSHA Classification (29 CFR 1910.1200): Combustible Liquid
NFPA Class-IIIA or IIIB Moderately or Slightly Combustible Liquid
NFPA Ratings: Health: 1, Flammability: 2, Reactivity: 0

Flash Point

>60°C, >150°F (ASTM D-92)

Flammable Limits

Lower Limit: 0.6%
Upper Limit: 6.0%

Auto ignition Temperature

260-340°C, 500-650°F

Combustion Products

Highly dependent on combustion conditions. Fume, smoke, carbon monoxide, carbon dioxide, sulfur and nitrogen oxides, aldehydes and unburned hydrocarbons.

Fire and Explosion Hazards

This material is combustible and can be ignited by heat, sparks, flames or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment and electronic devices such as cell phones, computers and calculators that have not been certified as intrinsically safe). Vapors are heavier than air and can accumulate in low areas. May create vapor/air explosion hazard indoors, in confined spaces, outdoors or in sewers. Vapors may travel considerable distances to a remote source

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5. FIRE FIGHTING MEASURES

of ignition where they can ignite, flash back or explode. Product can accumulate a static charge that may cause a fire or explosion. A product container, if not properly cooled, can rupture in the heat of a fire.

If stored under heat for extended periods for significantly agitated, this material might evolve or release hydrogen sulfide, a flammable and toxic gas, which can raise and widen this material's actual flammability limits and significantly lower its auto ignition temperature.

Extinguishing Media

Dry chemical, carbon dioxide or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting

Long duration fires involving crude or residual oil stored in tanks may result in a boilover. The contents of the tank may be expelled beyond the containment dikes or ditches. All personnel should be kept back a safe distance when a boilover is anticipated. Use water spray to cool fire-exposed containers and to protect personnel. Isolate immediate hazard area and keep unauthorized personnel out.

Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling.

For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by regulations, a self-contained breathing apparatus should be worn. Wear other appropriate protective equipment as conditions warrant.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

Combustible. Keep all sources of ignition and hot metal surfaces away from spill/release. May contain or release poisonous hydrogen sulfide gas. If the presence of dangerous amounts of H₂S around the spilled product is suspected, additional or special actions may be warranted, including access restrictions and use of protective equipment. The use of explosion-proof electrical equipment is recommended. Stay upwind and away from spill/release. Avoid direct contact with material. Isolate immediate hazard area and keep unauthorized personnel out. For large spillage, notify persons downwind of the spill/release. Wear appropriate protective equipment, including respiratory protection, as conditions warrant per Exposure Controls/Personal Protection guidelines.

Environmental Precautions

Stop and contain spill/release if it can be done safely. Prevent spilled material from entering waterways, sewers, storm drains, basements or confined areas. Contain release to prevent further contamination of soils, surface water or groundwater. Clean up spill as soon as possible using appropriate techniques such as applying non-combustible absorbent materials or pumping. A vapor suppressing foam may be used to reduce vapors. Use water sparingly to minimize environmental contamination and reduce disposal requirements. All equipment used when handling the product

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6. ACCIDENTAL RELEASE MEASURES

must be grounded. If spill occurs on water, notify appropriate authorities and advise shipping of any hazard.

Methods for Containment and Clean Up

Immediate cleanup of any spill is recommended. Build dike far ahead of spill for containment and later recovery or disposal of spilled material. Absorb spill with inert material such as sand or vermiculite and place in suitable container for disposal. If spilled on water, remove with appropriate equipment like skimmers, booms or absorbents. Use clean non-sparking tools to collect absorbed material. In case of soil contamination, remove contaminated soil for remediation or disposal in accordance with applicable regulations.

Reporting

Report spills/releases, as required, to appropriate local, state and federal authorities. Within the US, Coast Guard and Environmental Protection Agency regulations require immediate reporting of spills/release that could reach any waterway including intermittent dry creeks. Spills into or upon navigable waters, the contiguous zone or adjoining shorelines that cause a sheen or discoloration on the surface of the water may require notification of the National Response Center (800) 424-8802. In case of accident or road spill, call the 24 hour emergency number (800) 222-1222.

7. HANDLING AND STORAGE

Precautions for Safe Handling

Use non-sparking tools and explosion-proof equipment. Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharge. Explosion-proof electrical equipment is recommended and may be required by fire codes. Warning! Use of this material in spaces without adequate ventilation may result in the generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Use non-sparking tools and explosion-proof equipment. Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharge. Explosion-proof electrical equipment is recommended and may be required by fire codes.

Warning! Use of this material in spaces without adequate ventilation may result in the generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

To prevent and minimize fire or explosion risk from static accumulation and discharge, effectively bond and/or ground product transfer system. Do not use electronic devices (such as cellular phones, computers, calculators, pagers, etc.) in or around any fueling operation or storage area unless the devices are certified as intrinsically safe. Electrical equipment and fittings should comply with local fire codes.

Precautions for Safe Storage

Use and store this material in well-ventilated areas away from heat, direct sunlight, hot metal surfaces and all sources of ignition. Post area warnings: 'No Smoking or Open Flame'. Keep away from incompatible material. Outdoor or detached storage of portable containers is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

In a tank, barge or other closed container, the vapor space above materials containing hydrogen sulfide may result in concentrations of H₂S immediately

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7. HANDLING AND STORAGE

dangerous to life or health. Check atmosphere for oxygen content, H₂S and flammability prior to entry.

Portable containers should never be filled while they are in or on a motor vehicle or marine craft. Static electricity may ignite vapors when filling non-grounded containers or vehicles on trailers. To avoid static buildup, do not use a nozzle lock open device. Use only approved containers. Keep containers tightly closed. Place the container on the ground before filling. Keep the nozzle in contact with the container during filling.

Empty containers retain liquid and vapor residues and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat, flame, sparks, static electricity or other sources of ignition. They may explode and cause injury or death. Do not attempt to refill or clean containers since residue is difficult to remove. "Empty" drums should be completely drained, properly closed and returned to the supplier or a qualified drum reconditioner. All containers should be disposed of in an environmentally safe manner in accordance with government regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Component	ACGIH Exposure Limits	OSHA Exposure Limits	NIOSH Exposure Limits
Residual Fuel Oil	0.2 mg/m ³ TWA	0.2 mg/m ³ TWA	80 mg/m ³ IDLH
Limits Above Are Applicable to Coal Tar Pitch Volatiles as Benzene Solubles			
Ethyl Benzene	20 ppm TWA 125 ppm STEL	100 ppm, 435 mg/m ³ PEL 125 ppm STEL	100 ppm, 435 mg/m ³ TWA 125 ppm, 545 mg/m ³ STEL 800 ppm IDLH
Hydrogen Sulfide	1 ppm TWA 5 ppm STEL	20 ppm Ceiling 50 ppm Peak	5 ppm TWA 10 ppm Ceiling 100 ppm IDLH
Naphthalene	10 ppm TWA 15 ppm STEL	10 ppm, 50 mg/m ³ PEL	10 ppm, 50 mg/m ³ TWA 15 ppm, 75 mg/m ³ STEL 250 ppm IDLH

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional for further information.

ACGIH - American Conference of Government Industrial Hygienists, OSHA - Occupational Safety and Health Administration, NIOSH - National Institute for Industrial Safety and Health, TWA - Time Weighted Average (8 hour average for ACGIH and OSHA, 10 hour average for NIOSH), STEL - 15 Minute Short Term Exposure Level, Skin - indicates potential for cutaneous absorption of liquid or vapor through the eyes or mucous membranes, Ceiling - Ceiling Level, Peak - Acceptable peak over the ceiling concentration for a specified number of minutes, IDLH - Immediately Dangerous to Life and Health

Biological Exposure Indices (BEI)			
Material	Determinant	Sampling Time	BEI Level
Ethyl Benzene	Sum of mandelic acid and phenylglyoxylic acid in creatinine in urine	End of shift at end of work week	0.7 g/g
	Ethyl Benzene in end exhaled air	Not critical	
Naphthalene	1-naphthol with hydrolysis + 2-naphthol with hydrolysis	End of shift	

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Polycyclic Aromatic Hydrocarbons (PAH's)	1-hydroxypyrene in creatinine in urine	End of shift	
ACGIH - American Conference of Government Industrial Hygienists			

Personal Protective Equipment

General Considerations Consider the potential hazards of this material, applicable exposure limits, job activities and other substances in the work place when designing engineering controls and selecting personal protective equipment.

Engineering Controls Use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below the recommended exposure limits. An emergency eye wash station and quick-drench safety shower should be located near the work station.

Personal Protective Equipment If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, personal protective equipment (PPE) is recommended. A hazard assessment of the work should be conducted by a qualified professional to determine what PPE is required.

Respiratory Protection A respiratory protection program that meets or exceeds OSHA 29 CFR 1910.134 and ANSI Z.88.2 should be followed whenever workplace conditions warrant the use of a respirator. When there is the potential for airborne concentrations exceeding the established exposure limits given in Section 8, use a NIOSH approved air purifying respirator equipped with organic vapor cartridges/canisters. Use a full-face positive-pressure supplied air respirator in circumstances where air-purifying respirators may not provide adequate protection or where there may be the potential for airborne exposure above the exposure limits. If exposure concentration is unknown, in oxygen deficient atmospheres (<19,5% oxygen), under conditions that are immediately dangerous to life and health (IDLH) or there is a potential for exposure to hydrogen sulfide above exposure limits, use a NIOSH approved self contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode.

Eye Protection Eye protection that meets or exceeds ANSI Z.87.1 is recommended if there is a potential for liquid contact with or irritation or injury to the eyes. Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing or spraying of this material. A face shield may be necessary depending on conditions of use.

Skin and Body Protection Avoid skin contact. Wear long-sleeved fire-retardant garments while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing, spraying or other conditions could potentially cause skin contact, including chemical resistant boots, aprons, arm covers, hoods, coveralls, impervious gloves, additional facial protection and encapsulated suite. Suggested protective materials: nitrile rubber. Thoroughly clean shoes and wash contaminated clothing before reuse.

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Personal Protective Equipment

Hand Protection Avoid skin contact. The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. PVC and neoprene may be suitable for incidental contact. Nitrile rubber should be used for longer term protection when prolonged or frequent contact may occur. Gloves should be worn on clean hands and hands should be washed after removing gloves. Also wash hands with plenty of mild soap and water before eating, drinking, smoking, using toilet facilities or leaving work.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Black liquid	Physical Form	Liquid
Odor	Asphalt-like, sulfurous odor possible	Odor Threshold	Not established
pH	Neutral	Vapor Pressure	Negligible
Vapor Density	>1 (air = 1)	Boiling Point/Range	>310°F/>155°C
Percent Volatile	Negligible	Partition Coefficient	> 3.5
Specific Gravity	0.95 – 1.01 @ 60°F	Density	7.9 – 8.4 lb/gal @ 60°F
Molecular Weight	Not determined	Evaporation Rate	Not established
Flash Point	>150°F/>60°C	Test Method	ASTM D-92
Explosive Limits	0.6% LEL, 6.0% UEL	Autoignition Temperature	500-650°F/260-340°C
Solubility in Water	Slightly Soluble		

10. STABILITY AND REACTIVITY

Reactivity Not chemically reactive

Conditions to Avoid Avoid high temperatures and all possible sources of ignition. Prevent vapor accumulation.

Incompatibility (Materials to Avoid) Avoid contact with strong oxidizing agents such as strong acids, alkalis, chlorine and other halogens, dichromates or permanganates, which can cause fire or explosion.

Hazardous Decomposition Products Hazardous decomposition products are not expected to form during normal storage. The use of hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of combustion products (e.g., oxides of carbon, sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels.

Hazardous Polymerization Not known to occur

11. TOXICOLOGICAL INFORMATION

Overview This product is a black liquid with a strong hydrocarbon odor. It may also have a sulfurous or rotten egg odor. Hydrogen sulfide, an extremely flammable and very toxic gas may be present. This product is a combustible. Keep away from heat, sparks and flames and other sources of ignition. This product contains polycyclic aromatic hydrocarbons that are confirmed human carcinogens. It contains material that has caused cancer based on animal data.

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11. TOXICOLOGICAL INFORMATION

This material may contain ethyl benzene, naphthalene and polycyclic aromatic hydrocarbons (PAH) at concentrations above 0.1%. PAH are considered to be known human carcinogens by OSHA, IARC and NTP. IARC has identified several individual PAH as probably carcinogenic to humans (Group 2A) and ethyl benzene, naphthalene and several individual PAH as possibly carcinogenic to humans (Group 2B) based on laboratory animal studies.

Toxicological Information of the Material.

Acute Toxicity

Dermal: Low Toxicity: LD50 > 2000 mg/kg (rat)

Causes mild skin irritation. Repeated exposure may cause skin dryness or cracking that can lead to dermatitis. Contact with hot material can cause thermal burns that may result in permanent skin damage

Inhalation: Hydrogen Sulfide: Extremely toxic LCLo= 600 ppm, 30 min (human)

Product expected to have moderate degree of toxicity by inhalation:

LC 50 >1 mg/l, <5 mg/l, 4 hr (rat) (vapor)

Effect of overexposure may include irritation of the digestive tract, irritation of the respiratory tract, nausea, vomiting, diarrhea and signs of central nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue). Continued inhalation may result in unconsciousness and/or death.

Ingestion: Product expected to have low degree of toxicity by ingestion:

Oral LD50 >5000 mg/kg (rat)

Eye Damage / Irritation

Causes mild eye irritation.

Sensitization

Skin: Not expected to be a skin sensitizer

Respiratory: Not expected to be a respiratory sensitizer

Specific Target Organ Toxicity

Dermal application of a fuel oil blendstock to rats, 5 days a week, for 13 weeks resulted in limited evidence of liver damage (i.e., increased liver weight and changes in hepatic serum enzyme activity). Dermal application of fuel oil no. 6 to rabbits 5 days/week for 2 weeks resulted in limited evidence of liver damage.

Single Exposure: High concentrations may cause irritation of the skin, eyes, digestive tract, irritation of the respiratory tract, nausea, vomiting, diarrhea and signs of central nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue). Continued inhalation may result in unconsciousness and/or death.

Repeated Exposure: May cause damage to organs through prolonged or repeated exposure. Application of various heavy fuel oils to mouse and rat skin, five times a week for 10 to 13 weeks or by gavage at 1000 mg/kg/day for 10 weeks resulted in treatment related effects in the liver (necrosis), bone marrow (erythroid hypoplasia and anemia) and thymus (atrophy). Limited evidence of toxicity was seen in the lymph nodes (reactive hyperplasia) and kidney (tubular degeneration).

Conditions Aggravated by Overexposure

Disorders of the organs or organ systems that may be aggravated by significant exposure to this material or its components include the skin, respiratory system, liver, kidneys, CNS, cardiovascular system and blood-forming system.

Carcinogenicity

May cause cancer. Lifetime skin painting studies in animals with products similar to heavy catalytic cracked distillate, No. 6 fuel oil and/or its components have

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11. TOXICOLOGICAL INFORMATION

produced tumors in animals following prolonged and repeated skin contact. Repeated dermal application has produced severe irritation and systemic toxicity in subacute toxicity studies. Some components of this product were found to be positive in some mutagenicity tests while negative in others. The exact relationship between these results and human health is not known. Residual fuel oils have been identified as a possible carcinogen by IARC.

Catalytic cracked clarified oil may be present in large concentrations in this product. Lifetime skin painting studies in animals have produced tumors in animals following prolonged and repeated skin contact. Repeated dermal application of (30 mg/kg/day for 13 weeks) in rats resulted in anemia, liver degeneration and injury to bone marrow and lymphoid tissues. 100% mortality was observed at 2,000 mg/kg/day within three weeks.

The International Agency for Research on Cancer (IARC) has specifically evaluated aromatic oils, including high-boiling fractions of catalytically cracked oils, and determined them to be carcinogenic to experimental animals, and potentially humans. Also, the National Toxicology Program, USEPA, and ACGIH have independently classified various polycyclic aromatic hydrocarbon compounds such as benzo(a)phenanthrene and 5-methyl chrysene, present in this product as confirmed human (A1), suspected human (A2), or animal carcinogens (A3).

Petroleum middle distillates, a class of hydrocarbons distilled from crude oil at approximately 350-750°F, have been shown to cause skin tumors in mice following repeated and prolonged skin contact. The response is typically weak with a low tumor yield and long latency period. Additional studies have shown that these tumors are produced through a non-genotoxic mechanism associated with frequent cell damage and repair, and that they are not likely to cause tumors in the absence of prolonged skin irritation. Animal studies have also shown that washing the skin with soap and water can reduce the tumor response.

Residual Fuel Oil, No. 6 Fuel Oil	ACGIH	Group A4 Not classifiable as a human carcinogen
CC Clarified Oil HCC Distillate	IARC	IARC 2B Possibly carcinogenic to humans
Fuels, Diesel	ACGIH	Group A3 Confirmed animal carcinogen with unknown relevance to humans
	GHS/CLP	Carcinogenicity category 2
Ethyl Benzene	ACGIH	Group A3 Confirmed animal carcinogen with unknown relevance to humans
	IARC	IARC 2B Possibly carcinogenic to humans
	GHS/CLP	No carcinogenicity classification
	ACGIH	Group A4 Not classifiable as a human carcinogen
Naphthalene	NTP	Reasonably anticipated to be a human carcinogen
	IARC	IARC 2B Possibly carcinogenic to humans
	GHS/CLP	Carcinogenicity category 2

ACGIH - American Conference of Government Industrial Hygienists, IARC- International Agency for Research on Cancer, NTP – National toxicology Program, GHS/CLP GHS, Globally Harmonized System on Classification, Labeling and Packaging

Germ Cell Mutagenicity

Not expected to cause heritable genetic effects.

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11. TOXICOLOGICAL INFORMATION

Reproductive and Developmental Toxicity

Dermal application of fuel oil no. 6 to rabbits 5 days/week for 2 weeks resulted in limited evidence of liver damage. Repeated dermal application of catalytically cracked clarified oil (30 mg/kg/day) to pregnant rats during gestation produced maternal and fetal toxicity, some deaths and systemic toxicity (liver, thymus and blood). The number of viable offspring decreased at doses of 30 mg/kg/day and above. Many of the developmental effects (anomalies, resorptions and growth inhibition) were observed at doses that produced maternal toxicity. In a separate developmental study, clarified oil produced decreases in body weight and food consumption at doses from 10-250 mg/kg/day. Although fertility and reproductive function were not affected, the no observable adverse effect level for product administered dermally was 1 mg/kg/day.

Additional Information

This material may contain or liberate hydrogen sulfide, a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (sensitivity to light) and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats, convulsions, respiratory failure and death.

This material may contain varying concentrations of polycyclic aromatic hydrocarbons (PAHs) that have been known to produce a phototoxic reaction when contaminated skin is exposed to sunlight. The effect is similar in appearance to an exaggerated sunburn, and is temporary in duration if exposure is discontinued. Continued exposure to sunlight can result in more serious skin problems including pigmentation (discoloration), skin eruptions (pimples) and possible skin cancers.

Toxicological Information of Components

Ethyl Benzene 100-41-4

Target Organs: In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilic foci, hypertrophy, necrosis), thyroid (hyperplasia) and pituitary (hyperplasia).

Hydrogen Sulfide 7783-06-4

Hydrogen sulfide concentrations will vary significantly but may contain toxicologically significant levels of hydrogen sulfide in the vapor spaces of bulk storage tanks and transport compartments. Concentrations of H₂S as low as 10 ppm over an 8 hour workshift may cause eye or throat irritation. Prolonged breathing of 50-100 ppm H₂S vapors can produce significant eye and respiratory irritation. Exposure to 250-600 ppm for 15-30 minutes can produce headache, dizziness, nervousness, staggering gait, nausea and pulmonary edema or bronchial pneumonia. Concentrations >1,000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H₂S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H₂S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H₂S, respectively. Over the years a number of acute cases of H₂S poisonings have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.

Naphthalene 91-20-3

Carcinogenicity: Naphthalene has been evaluated in two-year inhalation studies in both rats and mice. The National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and

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olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has been identified as a carcinogen by IARC and NTP.

Polycyclic Aromatic Hydrocarbons

This product contains polycyclic aromatic hydrocarbons (PAH) at a level of >0.1%. Some PAH's that have been identified in this product such as benzo(a)pyrene, benz(a)anthracene and similar substance have been shown to be carcinogenic in experimental animals. An increased risk of cancer has been observed in workers employed in the aluminum production, coal gasification, coat-tar pitch, coke production and iron and steel industries that had been occupationally exposed to PAH;s. Since these kind of PAHs have been measured at high levels in air samples taken in these industries, the International Agency for Research on Cancer has concluded that these PAHs are probably carcinogenic to humans.

12. ECOLOGICAL INFORMATION

Toxicity This material is expected to be very toxic to aquatic organisms with the potential to cause long term adverse effects in the aquatic environment. Acute aquatic toxicity studies show acute toxicity values (LL/EL/IL50) less than 1 mg/l. These tests were carried out on water-accommodated fractions in closed systems to prevent evaporative loss.

GHS Classification

H400 – Hazardous to the aquatic environment, acute toxicity – Category 1

H410 – Hazardous to the aquatic environment, chronic toxicity - Category 1

Very toxic to aquatic life with long lasting effects

Coating action of oil can kill birds, plankton, aquatic life, algae and fish.

Persistence and Degradability This material is not readily biodegradable. Some constituents are inherently biodegradable while the higher molecular weight components are persistent in water. The individual hydrocarbon components of this material are differentially soluble in water with aromatic hydrocarbons tending to be more water soluble than aliphatic hydrocarbons. If spilled, any lighter components will generally evaporate but depending on local environmental conditions (temperature, wind, soil type, mixing or wave action in water, etc), photo-oxidation and biodegradation, the remainder may become dispersed in the water column or absorbed to soil or sediment. Because of their differential solubility, the occurrence of hydrocarbons in groundwater will be at different proportions than the parent material. Under anaerobic conditions, such as in anoxic sediments, rates of biodegradation are negligible.

Persistence per IOPC Fund Definition Persistent

Bioaccumulative Potential Contains components with the potential to bioaccumulate. The octanol water coefficient values measured for the hydrocarbon components of this material range from 2.7 to greater than 6, and therefore would be considered as having the potential to bioaccumulate.

Mobility **Air:** Lighter components will volatilize in the air.
Water: Spreads on a film on the surface of water although some components may

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be heavier than water and sink. Significant proportion of spill will remain after one day. Lower molecular weight aromatic hydrocarbons and some polar compounds have low but significant water solubility. Some higher molecular weight compounds are removed by emulsification and these also slowly biodegrade while others adsorb to sediment and sink. Heavier fractions agglomerate to form tars, some of which sink.

Soil: Some constituents may be mobile and contaminate groundwater.

Other Adverse Effects Films form on water and may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Recover or recycle if possible. It is the responsibility of the generator to determine the toxicity and physical properties of the material generated so as to properly classify the waste and ensure disposal methods comply with applicable regulations.

This material, if discarded as produced, is not a RCRA "listed" hazardous waste. However, it should be fully characterized prior to disposal (40 CFR 261). Use which results in chemical or physical change or contamination may subject it to regulation as a hazardous waste. Along with properly characterizing all waste materials, consult state and local regulations regarding the proper disposal of this material.

Do not dispose of tank water bottoms by draining onto the ground. This will result in soil and groundwater contamination. Waste arising from spillage or tank cleaning should be disposed of in accordance with applicable regulations.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a qualified drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

**United States
Department of
Transportation
(US DOT)**

Shipping Description: Fuel Oil No. 6, Combustible Liquid, NA1993, III or HOT Fuel Oil No. 6, 3, NA1993, III
Shipping Name: Fuel Oil No. 6
Hazard Class and Division: 3
ID Number: NA1993
Packing Group: III
Label: Combustible Liquid
Placard: Combustible
Emergency Response Guide: 128
Marine Pollutant: Yes.

**Transportation of
Dangerous Goods (TDG)
Canada**

Shipping Description: ELEVATED TEMPERATURE LIQUID, FLAMMABLE N.O.S. (Residual Fuel Oil)
Shipping Name: Elevated Temperature Liquid, n.o.s. (fuel oil, residual)
Hazard Class and Division: 3
UN Number: 3256
Marine Pollutant: Yes

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**International Maritime Organization
International Maritime Dangerous Goods Code (IMO/IMDG)**

Shipping Description: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Fuel Oil, residual)
Shipping Name: Environmentally Hazardous Substance, Liquid, n.o.s. (fuel oil, residual)
Hazard Class and Division: 9
UN Number: 3082
Label: 9
EMS Guide: F-A, S-F
Marine Pollutant: Yes

European Agreements Concerning the International Carriage by Rail (RID) and by Road (ADR)

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.(Fuel Oil, residual)
Hazard Class: 9
Packing Group: III
Label: 9
Danger Number: 90
UN Number: 3082

International Civil Aviation Organization / International Air Transport Association (ICAO/IATA)

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.(Fuel Oil, residual)
UN/ID Number: 3082
Hazard Class/Division: 9
Packing Group: III
Labels: Combustible Liquid

15. REGULATORY INFORMATION

United States Federal Regulatory Information

EPA TSCA Inventory This product and/or its components are listed on the Toxic Substances Control Act (TSCA) Inventory

EPA SARA 302/304 Emergency Planning and Notification This material contains the following chemicals subject to reporting under the Superfund Amendments and Reauthorization Act of 1986 (SARA): Material contains hydrogen sulfide, considered an extremely hazardous substance. TPQ– 500 lb, EPCRA RQ – 100 lb

EPA SARA 311/312 (Title III Hazard Categories)
Acute Health: Yes
Chronic Health: Yes
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

EPA SARA Toxic Chemical Notification and Release Reporting (40 CFR 372) and CERCLA Reportable Quantities (40 CFR 302.4)

Component	CAS Number	Concentration	RQ
Ethyl Benzene	100-41-4	< 1 %	1000 lb
Naphthalene	91-20-3	< 2 %	100 lb
Polycyclic Aromatics	mixture	< 10 %	1 lb

CERCLA Section 101(14) excludes crude oil and crude oil fractions, including hazardous constituents of petroleum, from the definition of hazardous substances. The petroleum exclusion applies to this product.

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EPA CWA and OPA This product is classified as an oil under Section 311 of the Clean Water Act (CWA) and Oil Pollution Act of 1990 (OPA), subject to spill reporting requirements.

Canadian Regulatory Information

DSL/NDSL Inventory This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the Regulations..

Workplace Hazardous Materials Information System (WHMIS) Hazard Class B3 - Combustible Liquid
D1B – Immediate/Serious-TOXIC
D2A: Material Causing Other Toxic Effects Very Toxic
D2B - Material Causing Other Toxic Effects - Toxic Material

European Union Regulatory Information

Labeling Product is dangerous as defined by the European Union Dangerous Substances / Preparations Directives
Contains: Aromatic Oils

Symbol T Toxic

Risk Phrases R45-63-48/21-52/53
May cause cancer. Possible risk of harm to the unborn child. Harmful: danger of serious damage to health by prolonged exposure in contact with skin. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases S53-45-61
Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions / Safety data sheets

California Proposition 65

This product may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects, or other reproductive harm and which may be subject to the warning requirements of California Proposition 65. Chemicals known to the State of California to cause cancer, birth defects or other reproductive harm are created by the combustion of this product.

Carcinogens: Benzene, Catalytic Cracked Clarified Oils (Petroleum), Heavy Catalytic Cracked Distillates (Petroleum), Fuel Oil. No. 6, Residual Fuel Oil, Ethyl Benzene, Naphthalene, various Polycyclic Aromatic Hydrocarbons (Individual PAH compounds and their CAS numbers include 5-Methylchrysene [3697-24-3] Chrysene (Benzo[a]phenanthrene) [218-01-9] Benzo[a]anthracene [56-55-3] Benzo[a]pyrene [50-32-8] 7,12-Dimethylbenz[a]anthracene [57-97-6] Indeno [1,2,3-c,d]pyrene [193-39-5] Dibenzo[a,h]anthracene [53-70-3] Benzo[b]fluoranthene [205-99-2] Benzo[j]fluoranthene [205-82-3] Benzo[k]fluoranthene [207-08-9] Dibenzo[a,h]pyrene [189-64-0] Dibenzo[a,e]pyrene [192-65-4] 7H-Dibenzo [c,g]carbazole [194-59-2])

Developmental Toxicity: Benzene, Toluene

Male Reproductive Toxicity: Benzene

Carcinogen Identification by International Agency for Research on Cancer

Group 1	Carcinogenic to Humans	Benzene, Coal Tar Pitch Volatiles (per 29 CFR 1910.1200.1002, OSHA has defined coal tar pitch volatiles to include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood and other organic matter

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Group 2A	Probably Carcinogenic to Humans	Several Individual Polycyclic Aromatic Hydrocarbons
Group 2B	Possibly Carcinogenic to Humans	Residual Fuel Oil, Ethyl Benzene, Naphthalene, Several Individual Polycyclic Aromatic Hydrocarbons
Group 3	Not Classifiable	

16. OTHER INFORMATION

Prepared By METI HSE

The information in this Material Safety Data Sheet (MSDS) is based on data considered to be accurate and obtained from sources which we believe are reliable. **However, the information is provided without any warranty, express or implied, regarding its correctness; and it should not be relied upon as a commercial specification of manufacturer or seller.** This information should be used to make an independent determination of the methods to safeguard workers and the environment.

The conditions or methods of handling, storage, use and disposal of the material are beyond our control and may be beyond our knowledge. **For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the material.**

The SDS was prepared and is to be used only for this material. If the material is used as a component in another product, this SDS information may not be applicable.