No. 6 Fuel Oil
Material Safety Data Sheet

Axeon Specialty Products
2230 N Loop 1604 W
San Antonio, TX 78278

Revision Date 06/06/2012

IMPORTANT: This MSDS is prepared in accordance with 29 CFR 1910.1200. Read this MSDS before transporting, handling, storing or disposing of this product and forward this information to employees, customers and users of this product.

EMERGENCY OVERVIEW

WARNING: Combustible liquid; vapor may cause flash fire. Vapors and fumes may be hazardous or fatal! Long-term heated storage (100° to 150°F) might evolve hydrogen sulfide, a flammable, toxic, sensitizing, and potentially deadly gas! When heated, may cause thermal burns on contact! If hot product contacts water, a violent eruption of steam and vapor may occur! Vapor may severely irritate the eyes and respiratory tract! Liquid contact may cause minimal to mild eye and/or mild to moderate skin irritation and inflammation! Contains 4- to 6-membered condensed-ring (polynuclear) aromatic hydrocarbons (PNAs), and possibly carbozoles! May cause skin cancer following extended and/or repeated contact! May be harmful to target organs and/or adversely affect reproduction if absorbed through the skin! Wash thoroughly after handling. Spills may create a slipping hazard! If used as fuel, its engine exhaust may cause upper respiratory tract irritation and reversible pulmonary effects. Long-term exposure to fuel exhaust particulates may cause cancer.

SECTION 1. IDENTIFICATION

Trade Name: Fuel Oil
Product Number: Various
CAS Number: 68553-004

Product Family: Petroleum Hydrocarbon Mixture
Synonyms: Residual Fuel Oil; Utility Fuel Oil; Long Resid; Cut Resid; Coker Unit Feed; No. 6 Grade Fuel Oil (meets ASTM D-396 Specifications); Heavy Fuel Oil; Heavy Fuel No. 6; Bunker Fuel; Bunker "C"; C9-C50 PetroleumHydrocarbons.
SECTION 2. COMPOSITION

<table>
<thead>
<tr>
<th>Component Name(s)</th>
<th>CAS Registry No.</th>
<th>Concentration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 6 Fuel Oil</td>
<td>68553-00-4</td>
<td>100</td>
</tr>
<tr>
<td>Vacuum Residues (Petroleum)</td>
<td>64741-56-6</td>
<td>50-100</td>
</tr>
<tr>
<td>Catalytic Cracked Clarified Oil (Petroleum)</td>
<td>64741-62-4</td>
<td>0-50</td>
</tr>
<tr>
<td>Straight-run Middle Distillate (Petroleum)</td>
<td>64741-44-2</td>
<td>0-15</td>
</tr>
<tr>
<td>Light Catalytic Cracked Distillate (Petroleum)</td>
<td>64741-59-9</td>
<td>0-15</td>
</tr>
<tr>
<td>Polynuclear Aromatic Hydrocarbons (4- to 6-member condensed-ring type)</td>
<td>68487-58-6</td>
<td>5-25</td>
</tr>
<tr>
<td>5-Methylchrysene</td>
<td>3697-24-3</td>
<td>0.01-0.3</td>
</tr>
<tr>
<td>Chrysene (Benzo[a]phenanthrene)</td>
<td>218-01-9</td>
<td>0.01-0.2</td>
</tr>
<tr>
<td>Benzo[a]anthracene</td>
<td>56-55-3</td>
<td>0.01-0.15</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>7783-06-4</td>
<td>0.0001-0.01</td>
</tr>
</tbody>
</table>

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin Contact. Eye Contact. Absorption. Inhalation.

Signs and Symptoms of Acute Exposure

Inhalation
May be harmful or fatal if inhaled! Inhalation of the vapor or spray mist may cause severe nose, throat, respiratory tract, and lung irritation, depending on the concentration and duration of exposure. Symptoms are characterized by coughing, choking, or shortness of breath and may cause transient central nervous system (CNS) depression. The National Institute for Occupational Safety and Health has determined that atmospheres containing 100 ppm or more of hydrogen sulfide (H2S) are immediately dangerous to life and health. Concentrations of H2S at or below 250 ppm may cause respiratory tract irritation and pulmonary edema. H2S concentrations between 250 ppm and 500 ppm may result in headache, nausea, disorientation, irregular heartbeat, and/or low blood pressure. At greater than 500 ppm, H2S causes sudden collapse, unconsciousness, and respiratory paralysis leading to convulsions, coma, and/or death. (See Section 11.)

Eye Contact
Upon direct contact, hot material may cause severe thermal burns. Animal test results on similar unheated materials suggest that this product may cause minimal to mild eye irritation upon short-term exposure. Symptoms include stinging, watering, and redness. H2S vapors may cause moderate to severe eye irritation and photophobia (sensitivity to light).

Skin Contact
Skin contact with hot material may result in severe thermal burns. Animal test results on similar materials suggest that this material can cause mild to moderate skin irritation. Short-term contact symptoms include redness, itching, and burning of the skin. This material may also be absorbed through the skin and produce CNS depression effects (see "Inhalation" above). If the skin is damaged, absorption increases.

Prolonged and/or repeated contact may cause moderate dermatitis and/or more serious skin disorders. Chronic symptoms may include drying, swelling, scaling, blistering, cracking, and/or severe tissue damage. Based upon a similar product's animal test results, a mild allergic skin response may be expected on some sensitive individuals following repeated exposures.

Ingestion
Contact with hot material may cause thermal burns. If swallowed, no significant adverse health effects are anticipated; however, this material can cause a laxative effect. Ingestion of large quantities can cause intestinal obstruction.

Chronic Health Effects Summary

No. 6 Fuel Oils (Bunker Fuels) have been shown to be mutagenic and induce skin tumors. A 104-week laboratory animal skin painting study using the vacuum residues (petroleum) component did NOT show a dose-related skin tumor incidence; however, this substance is similar to other residual oils which did produce skin tumors and adverse effects in the liver and kidneys of laboratory animals following prolonged and repeated applications.

The catalytic-cracked clarified oil component of this mixture may cause adverse effects in the liver, kidneys, thymus, adrenal glands, bone marrow, testes, and embryo/fetus of laboratory animals following prolonged and repeated application. It is also considered to be potentially teratogenic. This material is
also a heavy residual oil distillate similar to those shown to produce skin tumors and adverse effects in the liver and kidneys of laboratory animals following prolonged and repeated applications. All tumors appeared at the site of application. Toxic effects are unlikely to occur if good personal hygiene is practiced.

The straight-run middle distillate and light catalytic cracked distillate components of this mixture has been shown to produce skin tumors on laboratory rodents following repeated applications. All tumors appeared at the site of application during the latter portion of the typical 2-year lifespan of the animals. Sub-chronic exposure to low levels of hydrogen sulfide can produce eye irritation and corneal opacity, bronchitis, pulmonary edema, excessive salivation, nausea, diarrhea, CNS depression, and cardiac irregularities. Whether or not there is a chronic toxicity of H2S distinct from its acute and sub-chronic effects is debatable. However, headaches, bronchitis, a grey-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been reported due to prolonged and/or repeated exposures. (See Section 11.)

### Conditions Aggravated by Exposure
Personnel with pre-existing nervous system disease, cardiac or neurological conditions, skin disorders, chronic respiratory diseases, impaired lung, liver, kidney, thymus, or bone marrow function, anemia, red blood cell abnormalities, immune system deficiencies, and those attempting to conceive should avoid exposure.

### Target Organs
This substance is toxic to respiratory tract and lungs, central nervous system, heart, mucous membranes, skin, eyes, and possibly, the liver, kidneys, thymus, adrenal glands, blood, bone marrow, immune system, testes, and unborn embryo/fetus.

### Carcinogenic Potential
This material contains middle distillates, polynuclear aromatic hydrocarbons (PNAs), and possibly naphthalene at concentrations at or above a 0.1% and it is considered to be carcinogenic by IARC and OSHA. Some of the PNA compounds have been determined to be carcinogenic by OSHA, IARC, and NTP. (See Section 11.)

### OSHA Health Hazard Classification
Irritant, Sensitizer, Carcinogenic

### OSHA Physical Hazard Classification
Combustible

The classifications are per OSHA Hazard Communication Standard (29 CFR 1910.1200)

## SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

### Inhalation
Immediately move exposed individual to fresh air. Monitor for respiratory distress and loosen any tight clothing such as a collar, tie, belt, or waistband. If the individual is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

### Eye Contact
If hot material is splashed into eyes, irrigate with large amounts of room-temperature water. Seek medical attention immediately. If ambient temperature material is splashed into eyes, check for and remove contact lenses. If irritation or redness develops, flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. Do not use eye ointment. Seek medical attention immediately.

### Skin Contact
If burned by hot material, cool skin by quenching with large amounts of cool water. Do not remove material from the skin. Seek medical attention immediately. For contact at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with soap and water. If tissue appears damaged or if irritation or pain persist, apply a clean dressing and seek medical attention. Do not use ointments. Thoroughly clean contaminated clothing before reuse. Discard contaminated leather goods.

### Ingestion
Do not induce vomiting or give anything by mouth. Rinse out mouth with water. 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. Allow small quantities to pass through system. If large amounts are swallowed or irritation or discomfort occurs, seek medical attention.
Notes to Physician

Inhalation overexposure can produce toxic effects. Nitrite as an antidote for acute hydrogen sulfide intoxication may only be effective within the first few minutes after the exposure. Conditions thereafter may actually slow sulfide removal from the body's tissues. Cardiac and arterial blood gas monitoring, 100 percent oxygen supplementation, chest x-ray, and supportive care for CNS complications are indicated for asphyxiated patients. If only cough or difficulty in breathing develop, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis using pulmonary function tests and chest x-rays. Vigorous anti-inflammatory/steroid treatment may be required at first evidence of upper airway or pulmonary edema. Administer 100 percent humidified supplemental oxygen with assisted ventilation, as required.

This material may affect the hematopoietic system or cause hepatotoxicity and/or nephrotoxicity. A complete blood count, liver function tests, renal function tests and urinalysis are suggested for significant exposures. In addition, monitoring arterial blood gases is suggested for significant exposures.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification          OSHA/NFPA Class-IIIA or IIIB Liquid. Moderately or slightly combustible!
Flash Point Method                        CLOSED CUP: 50° to 121°C (122° to 250°F) (Setiflash Open Cup [ASTM D-92]).
Lower Flammable Limit                     0.6 to 4.0%
Upper Flammable Limit                     7 to 44%
Auto-ignition Temperature                260° to 343°C (500° to 650°F)

Hazardous Combustion Products            Burning or excessive heating may produce carbon monoxide, carbon dioxide, and possibly smoke, fumes, unburned hydrocarbons, and oxides of sulfur and nitrogen.

Special Properties                       May be a "Combustible Liquid". This material releases vapors at or approaching its flash point temperature. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Mists or sprays may be flammable at temperatures below the flash point. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. May create vapor/air explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media                      SMALL FIRE: Use dry chemicals, carbon dioxide (CO2), foam, water fog, or inert gas (nitrogen). LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures but might cause frothing and/or may not achieve extinguishment. A water jet may be used to cool the vessel's external walls to prevent pressure build-up, auto-ignition, or explosion. NEVER use a water jet directly on the fire because it may spread the fire to a larger area.

Protection of Fire Fighters             Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from venting safety devices or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities if liquid(s) enter sewers/waterways.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

May be a "Combustible Liquid". Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and
security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent its entry into waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbent pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

A spill or leak may cause an immediate fire/explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Bond and ground all equipment before transferring this material from one container to another. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation/personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food, chewing, or smoking materials. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Empty containers may contain material residues which can ignite with explosive force. Misuse of empty containers can be dangerous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues. Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified re-conditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

Avoid water contact or contamination, especially when heated. Do not handle hot material, if possible. Handle material as close to ambient temperatures as feasible. Avoid contact with oxidizing agents. Do not breathe vapor and avoid repeated or prolonged skin contact. Use only with adequate ventilation and personal protection. Wash thoroughly after handling. Prevent contact with food, chewing, and smoking materials. Do not take internally.

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed and properly labeled. Keep away from all ignition sources! Do not store with strong oxidizing agents. Hydrogen sulfide vapors may be evolved from long-term heated storage and/or agitated transport. H2S is corrosive to most metals. It can cause steel pipe to become blistered, pitted, and brittle. Metal components used for storage should be resistant to sulfide stress cracking. (See appropriate API and NACE standards.) Where H2S is routinely stored, install monitoring equipment or system with alarms.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and/or mists below the pertinent exposure limits (see below). All electrical equipment should comply with the NFPA NEC Standards. Ensure that an emergency eye wash station and safety shower are near the work-station location.
Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.

This recommendation reflects minimum PPE when product is at elevated temperatures.

Eye Protection

Safety glasses with side shields are recommended as a minimum protection. During transfer operations or when there is a likelihood of misting, splashing, or spraying, chemical goggles and face shield should be worn. Suitable eye wash water should be readily available.

Hand Protection

When handling hot materials or those that might produce thermal burns, use long-cuffed leather or heat-resistant gloves over chemically-resistant gloves. When product is at ambient temperatures, use disposable gloves (PVC, neoprene, nitrile, vinyl, or PVC/NBR). Before eating, drinking, smoking, use of toilet facilities, or leaving work, wash hands with plenty of mild soap and water. DO NOT use gasoline, kerosene, other solvents, or harsh abrasive skin cleaners.

Body Protection

Avoid skin contact. It is recommended that fire-retardant garments (e.g. Nomex™) be worn while working with flammable and combustible liquids. If splashing or spraying is expected, chemical-resistant protective clothing (Tyvek®, nitrile, or neoprene) should be worn. This might include long-sleeves, apron, slicker suit, boots, and additional facial protection. If general contact occurs, IMMEDIATELY remove soaked clothing and take a shower. Contaminated leather goods should be removed promptly and discarded.

Respiratory Protection

For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA). For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirator use should follow OSHA requirements (29 CFR 1910.134) or equivalent standard (e.g. ANSI Z88.2).

General Comments

WARNING! Do not use this material as a fuel without adequate ventilation. Inadequate ventilation can result in hazardous levels of combustion products and inadequate oxygen levels for breathing. Odor is not adequate to warn of hazardous conditions.

The standards for "coal tar pitch volatiles, as benzene solubles" are based upon coal coking, not upon petroleum-derived oils. However, in 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. Accordingly, the coal tar pitch volatile standard may apply to the aerosol form of this material. The "hydrogen sulfide" standards apply only to vapors evolved from long-term heated storage and/or transport.

### Occupational Exposure Guidelines

#### Substance

**Hydrogen Sulfide**

<table>
<thead>
<tr>
<th>OHSA PEL – General Industry</th>
<th>CEIL 20 ppm; 50 ppm PEAK for single event (10-min max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA PEL – Construction Industry</td>
<td>TWA: 10 ppm, 15 mg/m^3</td>
</tr>
<tr>
<td>OSHA PEL – Maritime</td>
<td>TWA: 10 ppm, 15 mg/m^3</td>
</tr>
<tr>
<td>ACGIH TLV</td>
<td>TWA: 1 ppm, 14 mg/m^3; STEL 5 ppm</td>
</tr>
<tr>
<td>NIOSH REL</td>
<td>REL: 10 ppm, 15 mg/m^3CEIL (10 min)</td>
</tr>
</tbody>
</table>

**Oils, mist**

| OSHA PEL | TWA: 5 mg/m^3 |
| ACGIH TLV | TWA: 5 mg/m^3; STEL 10 mg/m^3 15-min max (Max 4 STEL/day; separated by 60-min) |
| NIOSH REL | TWA: 5 mg/m^3; STEL 10 mg/m^3 |

**Coal tar pitch volatiles, as benzene soluble (“A1” Confirmed Human Carcinogen)**

| OSHA PEL | TWA: 0.2 (mg/m^3) (Benzene-Soluble Fraction) |
| ACGIH TLV | TWA: 0.2 (mg/m^3) (Confirmed Human Carcinogen) |

**MSDS No. 17-100**

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NIOSH REL Ca TWA 0.1 mg/m³ (Cyclohexane-extractable Fraction) – Potential Carcinogen

Diesel exhaust, particulate aerodynamic diameter < 1 μm (“A2” Suspected Human Carcinogen)

Chrysene (Benzo[a]phenanthrene) See Coal Tar Pitch Volatiles “A3” Animal Carcinogen from ACGIH

Benzo[a]anthracene See Coal Tar Pitch Volatiles (Benzene Soluble Fraction) “A2” Suspected Human Carcinogen from ACGIH

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Viscous Liquid</th>
<th>Specific Gravity</th>
<th>0.95 to 0.99 at 60°F (Water = 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Brown to black</td>
<td>pH</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Odor</td>
<td>Slight burnt or cracked hydrocarbon to asphaltic. Low levels of hydrogen sulfide vapor in air have a rotten egg odor.</td>
<td>Vapor Density</td>
<td>&gt;10 (Air = 1 at 70°F)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vapor Pressure</td>
<td>&lt;0.1 mm of Hg at 21°C (70°F)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Melting/Freezing Point (ASTM D-97)</td>
<td>21°C to 30°C (70°F to 86°F)</td>
</tr>
<tr>
<td>Boiling Point/Range (ASTM D86)</td>
<td>155° to 760°C (310° to 1400°F)</td>
<td>Viscosity (cSt @ 40°C) (ASTM D-445)</td>
<td>195 to 1,950 cSt</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Negligible in cold water (LT 0.001%).</td>
<td>Volatile Characteristics</td>
<td>Negligible; no Volatile Organic Compounds (VOCs) present at 300°F.</td>
</tr>
<tr>
<td>Additional Properties</td>
<td>Average Density at 60°F = 8.078 lbs./gal. (ASTM D-2161); Saybolt Viscosity = 90 to 9,000 SUS at 100°F (38.6°C) (ASTM D-2161); 90% Boiling Point Temperature = 1,050° to 1,100°F (566° to 600°C) (ASTM D-86); Sulfur Content = 2.0 to 4.0 Wt.% (ASTM D-2622); Evaporation Rate = &lt;0.005 when n-Butyl acetate = 1.0.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability Stable

Hazardous Polymerization Not expected to occur.

Conditions to Avoid Keep away from extreme heat, strong acids, and strong oxidizing conditions.

Material Incompatibility Strong acids, alkalies, and oxidizers such as liquid chlorine and oxygen. Hydrogen sulfide is dangerously reactive with strong oxidizers (nitric acid, chlorine, fluorine, etc.), some metals, metal oxides, and metal powders. H₂S is corrosive to some metals and alloys, especially those containing copper and/or tungsten.

Hazardous Decomposition Composition suggests that sulfur and nitrogen compounds might be generated; but, no degradation data is available.

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data No. 6 Fuel Oil (Bunker Fuel or Heavy Fuel Oil No. 6):

ORAL (LD₅₀): Acute: >25,000 ml/kg (Rat).
ORAL (LD₉₀): Acute: 5,100 to 5,300 mg/kg (Rat).
DERMAL (LD₆₀): Acute: >5,000 mg/kg (Rabbit screen level).
DERMAL (LD₉₀): Acute: 5,200 mg/kg (Rabbit) - Diarrhea and hypermotility.
DRAIZE EYE: Acute: Minimal to mild eye irritant (Rabbit).
DRAIZE DERMAL: Acute: Minimal to mild skin irritant (Rabbit).
BUEHLER DERMAL: Acute: Non-sensitizing to mildly sensitizing (Guinea Pig).
12-Day DERMAL: Sub-chronic: 20 mL/kg/day (Rabbit) - Dermatitis, weight loss or deceased weight gain, and some deaths.
14-Day DERMAL: Sub-chronic: 0% Mortality at 7,000 mg/kg/day and 38% mortality at 8,000 mg/kg/day (Rabbit) - Dermatitis, weight loss liver damage, and some deaths.
This material contains poly cyclic aromatic hydrocarbons (PHAs or PNAs), some of which have been reported to cause skin cancer on humans under conditions of poor personal hygiene, prolonged/repeated contact, and exposure to sunlight. This material contains alkylcarbazoles and alkylbenzocarbazoles which if absorbed through the skin might be responsible, in whole or part, for systemic toxicity to the liver, kidneys, spleen, and/or testes based upon limited laboratory animal studies.

### Catalytic Cracked Clarified Oil:

**ORAL (LD<sub>50</sub>):** Acute: 5,270 mg/kg (Rat males) & 4,320 mg/kg (Rat females) - Somnolence, diarrhea, hypermotility, ataxia, prostration, larcimation, eye opacity, piloerection, and hair loss.

**DERMAL (LD<sub>50</sub>):** Acute: > 2,000 mg/kg (Rabbit screen level).

**DRAIZE EYE:** Acute: Mild eye irritant (Rabbit).

**DRAIZE DERMAL:** Acute: Minimal to mild skin irritant (Rabbit).

**BUEHLER DERMAL:** Acute: Non-sensitizing (Guinea Pig).

**I/P DERMAL:** Acute: Tumor initiator & possibly promoter activity (Mouse).

**28-Day DERMAL:** Sub-chronic: 0% Mortality at 200, 10% at 400, 40% at 1,000, & 100% at 2,000 & 4,000 mg/kg/day (Rat & Rabbit) - Edema, skin ulceration, and depression. Minimal to moderate diffuse hepatocytomegaly in all animals at 400 mg/kg/day; slight skin hyperplasia and hyperkeratosis. Liver, thymus, and testes damage and increased liver-to-body weight ratios at 400 & 1,000 mg/kg/day. Studies at 2,000 and 4,000 mg/kg/day were terminated on day 11 due to early deaths.

**12-Week DERMAL:** Sub-chronic: 5% Mortality at 40, 35% at 200, & 100% at 400 mg/kg/day (Rat) - Hepatocellular necrosis and generalized systemic toxicity.

**52-Week DERMAL:** Chronic: 5 uL/kg 2x/week (Mouse) - Significant increase in contact point skin tumors with 22-week mean latency, increased liver and liver-to-body weight ratios, & decreased survivability (87% mortality).

**104-Week DERMAL:** Chronic: 0.5 uL/kg 2x/week (Mouse) - 90% of the animals had contact-point skin tumors with 72-week mean latency.

**MUTAGENICITY:** Many different in-vivo and in-vitro mutagenic assays have shown "positive" responses with or without S9 metabolic activation. The only "negative" mutagenic responses were when using the Mouse Cell Transformation Assay without S9 activation, in-vitro Chinese Hamster Ovary Cell Assay, and in-vivo Mouse Bone Marrow Assay.

**TERATOGENESIS:** in-vitro Ovarian Tumor Attachment Inhibition Assay: Suspect teratogen (rating 3) (Mouse). Embryonic Palatal HEPM Cell Growth Inhibition Assay: Suspect teratogen (rating 3) with and without S9 metabolic activation (Human).

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 (NTP), U.S. Environmental Protection Agency (EPA), and American Conference of Governmental Industrial Hygienists (ACGIH) have independently classified various polynuclear aromatic hydrocarbon (PNA) compounds present in this product as "confirmed human (A1), suspected human (A2), or animal carcinogens (A3)".

A TSCA Section 8(e) notification from Atlantic Richfield Company (ARCO) states that in a developmental toxicity study, catalytically cracked clarified oil (CBO) was applied on the skin of pregnant rats over a 20-day period from mating to termination of pregnancy by cesarean section. Starting with the lowest dose tested (1 mg/kg/day), there was a dose-related decrease in maternal weight gain and an increase in fetal toxicity. No litters survived at the 250 mg/kg/day dose.

A TSCA Section 8(e) notification from Mobil Oil Company states that catalytically cracked clarified oil (CSO) was not only carcinogenic, but also produced severe dose-dependent, organ-specific (liver, kidney, and testes) damage in rats during a 90-day sub-chronic dermal assay. Mortality occurred in 5% of the animals at 30 mg/kg/day; 55% at 125; 85% at 500; and 100% at 2,000. As a result of conducting additional dermal absorption studies, Mobil Oil believes that it is likely that alkyl- and alkylbenzocarbazoles present in this oil may have been responsible, in whole or in part, for the systemic toxicity. Epidemiology studies of Mobil refinery workers have not shown ant effects corresponding to those observed animals.
Straight-run Middle Distillate (Petroleum):

GAS (LC50): Acute: 4.60 to 7.64 mg/L for 4 hours [Rat] - Dyspnea, nasal discharge alopecia, and excess salivation.
ORAL (LD50): Acute: >500,000 mg/kg [Rat screen] - Diarrhea, hyperactivity, ptosis, urine-stained stomach, and somnolence.
DERMAL (LD50): Acute: >2,000 mg/kg [Rabbit screen].
BUEHLER DERMAL: Acute: Non-sensitizing [Guinea Pig].
DERMAL (LD50): Acute: >2,000 mg/kg [Rabbit screen].
14-Day DERMAL: Sub-chronic: 0.05 ml/kg applied 3 times per week [Mouse, Human skin grafted to Athymic nude Mice] - Irritation and epidermal hyperplasia.
62-Week DERMAL: Chronic: 0.05 ml/kg applied 3 times per week [Mouse] - Extreme skin irritation; derate increase in contact-point skin tumors.

Light Catalytic Cracked Distillate (Petroleum):

GAS (LC50): Acute: 4.65 to 5.4 mg/L for 4 hours [Rat].
GAS (LC50): Acute: 3.35 mg/L for 4 hours [Rat males only].
ORAL (LD50): Acute: 4,660 to 7,180 mg/kg [Rat males only].
ORAL (LD50): Acute: 3,200 to 6,790 mg/kg [Rat females only] - Somnolence.
DERMAL (LD50): Acute: >2,000 mg/kg [Rabbit screen].
BUEHLER DERMAL: Acute: Non-sensitizing [Guinea Pig].
I/P DERMAL: Acute: Promotion activity and possibly a tumor initiator [Mouse].
28-Day DERMAL: Subchronic: No mortality at 200, 250, 500, and 1,000 mg/kg/day and 10% mortality at 2,000 mg/kg/day. Moderate irritation at 200 to 1,000 mg/kg/day and severe irritation at 2,000 mg/kg/day with decreased body weights and increased heart weights observed at 1,000 and 2,000 mg/kg/day.

Laboratory data associated some mixtures of petroleum hydrocarbons with boiling ranges between 300° and 700°F, commonly referred to as "middle distillates, including both hydrodesulfurized middle distillate and hydrodesulfurized light catalytic cracked distillate” have caused increased incidence of skin tumors at the site of contact when applied repeatedly (twice per week) over the lifetime of the test animals (12 to 24 months). A few studies have shown that washing the animal's skin with soap and water between applications greatly reduces the carcinogenic effect of these middle distillates. Similar materials have also been associated with liver and kidney damage in subchronic (90-day) inhalation studies with male rats.

Studies with mice and rats have also shown that chronic exposures (8 hours/day, 7 days/week, for 24 months) to unfiltered diesel fuel exhaust produced lung tumors and lymphomas.

Hydrogen sulfide (H₂S):

GAS: (TEL0): Acute: AP 1 ppm (Human) - Odor response threshold.
GAS: (TCL0): Acute: AP 10 ppm (Human) (15 minutes) - Eye irritation.
GAS: (TCL0): Acute: 50 to 100 ppm (Human) (15 minutes) - Respiratory irritation.
GAS: (LCL0): Acute: 600 ppm (Human) (30 minutes) - Unconsciousness, respiratory paralysis, and death.
GAS: (LC100): Acute: 600 to 750 ppm (Human) (15 minutes) - Unconsciousness, respiratory paralysis, and death.
GAS: (LC50): Acute: 5,700 ug/kg (Human) - Chronic pulmonary edema, coma, and death.
GAS: (LC50): Acute: 800 ppm (Rat) (5 minutes).
GAS: (LC50): Acute: 635 ppm (Mouse) (1 hour).
GAS: (LC50): Acute: 445 ppm (Rat) (4 hours) - Hypermotility, diarrhea, and increased urine volume.
5-Day GAS: Sub-chronic: 1,200 mg/M3 (Rat) (2 hours/day) - Decreased cholinesterase and degenerative brain changes.
35-Day GAS: Sub-chronic: 100 ppm (Rat) (8 hours/day) - Decreased cytochrome oxidases and degenerative brain and pulmonary effects.
90-Day GAS: Sub-chronic: 80 ppm (Rat & Mouse) (6 hours/day) - Decreased brain weight and weight loss or decreased weight gain.

TERATOGENESIS: Sub-chronic: 20 ppm for 24 hours on days 6 thru 22 of pregnancy (Rat) - Developmental physical effects.

OTHER REPRODUCTIVE EFFECTS: One unconfirmed study mentions \( \text{H}_2\text{S} \) as causing damage to the human testes and/or male reproduction. Recent studies do not confirm this association. Other studies mention increased risk of miscarriage, abortion, and difficulties during pregnancy and labor, but these studies involved mixed chemical exposures and/or physical confounders.

**Hydrogen sulfide (\( \text{H}_2\text{S} \))** causes eye and/or respiratory tract irritation at concentrations of 4 to 100 ppm in air. At low concentrations (< 20 ppm), \( \text{H}_2\text{S} \) has an odor of rotten eggs. At higher concentrations (> 50 ppm), \( \text{H}_2\text{S} \) odor is not apparent. NIOSH has determined that atmospheres containing 100 ppm or more \( \text{H}_2\text{S} \) are immediately dangerous to life and health. For the average human adult, exposure to \( \text{H}_2\text{S} \) concentrations above 500 ppm causes unconsciousness and death by respiratory paralysis. At concentrations between 600 and 750 ppm, death occurs within 15 minutes. The effects from repeated or prolonged exposures to low concentrations of \( \text{H}_2\text{S} \) is unclear. Headaches, bronchitis, a gray-green line on the gums, eye disorders, cardiac arrhythmias, and neurological symptoms including psychological disorders have been associated with long-term, low-level exposures to \( \text{H}_2\text{S} \). An inhalation study using rats exposed to 100 ppm of \( \text{H}_2\text{S} \) for 8 hours per day for 5 weeks showed pulmonary effects, degenerative brain changes, and decreases in cytochrome oxidase. And, when pregnant rats were exposed to 20 ppm for 24 hours during days 6 through 22 of their pregnancy, their off-spring showed slow developmental physical effects.

### SECTION 12. ECOLOGICAL INFORMATION

**Exotoxicity**

Ecological effects testing has not been conducted on this material. If spilled, this heavy distillate, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. This material is estimated to have a slow rate of biodegradation. Based upon spill investigation analysis, oils containing **polynuclear aromatic hydrocarbon compounds** similar to this material were shown to bioaccumulate in tissues of various aquatic organisms.

**Environmental Fate**

This heavy residual oil is potentially toxic to freshwater and saltwater ecosystems. It will normally float on water with its lighter components gradually evaporating. In stagnant or slow-flowing waterways, this hydrocarbon oil layer can cover a large surface area. As a result, this covering layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway might be enough to cause a fish kill or create an anaerobic environment. This coating action can also be harmful or fatal to plankton, algae, aquatic life, and water birds. Additionally, potable water and boiler feed water systems should NEVER be allowed more than 5 ppm contamination from this material.

For additional ecological information concerning components of this product, users should refer to the Hazardous Substances Data Bank® and the Oil and Hazardous Materials/Technical Assistance Data System (OHM/TADS) maintained by the U.S. National Library of Medicine. (See Section 2 for components.)

### SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. If spilled material is introduced into a wastewater treatment system, chemical and biological oxygen demand (COD and BOD) will likely increase slowly. This material is slowly biodegradable if gradually exposed to microorganisms, preferably in an aerobic environment with plenty of agitation. In sewage-seeded wastewater, at or below concentrations of 0.2 vol.% of this material, there is little or no effect on bio-oxidation and/or digestion. However, at 1 vol.%, it doubles the required digestion period. Higher concentrations interfere with floe formation and sludge settling and also plug filters or exchange beds.

Conditions of use may cause this material to become a hazardous waste, as defined by Federal or State regulations. It is the responsibility of the user to determine if the material is a RCRA “hazardous waste” at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR Parts 260 through 271). State
and/or local regulations might be even more restrictive. Contact the RCRA/Superfund Hotline at (800) 424-9346 or your regional EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

Dot Status

Depending upon its flash point temperature, this product is either not regulated by the U.S. Department of Transportation (DOT) or is regulated when transported in bulk.

Proper Shipping Name

Not regulated in non-bulk containers (Petroleum oil, N.O.I.B.N.);
Fuel Oil No. 6 for bulk container shipments.

If this product has a flash point temperature of between 150° and 200°F (65° to 93°C), for bulk shipments, it is classified as a DOT "Combustible liquid". However, according to 49 CFR 173.150(f)(2), certain transportation-related requirements, such as labeling, may not apply to this product when shipped in non-bulk "limited quantity" containers of less than 119 gallons capacity. However, pursuant to 49 CFR 173.150(b) and 173.150(f)(3), "limited-quantities" offered for or transported via aircraft or products which are defined as DOT "Marine Pollutants" may be subject to DOT regulation.

Hazard Class

Not a DOT regulated material or a “Combustible Liquid”.

Packing Group

Not applicable or PG III

UN/NA ID

Not applicable or NA 1993

Reportable Quantity

The Reportable Quantity (RQ) substance component in this material which might require DOT HAZMAT bill-of-lading display is Hydrogen sulfide.

Placards

A Combustible placard may not be required for this material when transported in a non-bulk container with maximum capacity LT 450 L (LT 119 Gal.).

SECTION 15. REGULATORY INFORMATION

TSCA Inventory

This material and/or its components are listed on the Toxic Substance Control Act (TSCA) inventory.

SARA 302/304

The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for “Extremely Hazardous Substances” listed in 40 CFR 302.4 and 40 CFR 355. A minor component substance of this material subject to the reporting requirements under this statute is: Hydrogen sulfide [CAS No. 7783-06-4] concentration: 0.0001 to 0.01%.

SARA 311/312

The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by “Hazard Category” as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: Acute (Immediate) and Chronic (Delayed) Health Hazards, and possibly the Fire Hazard.

SARA 313

This material does not contain any components in concentrations which are at or above de minimis levels and listed as “toxic chemicals” in 40 CFR Part 372 pursuant to the requirements of Section 313.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of “hazardous substances” equal to or greater than the reportable quantities (RQ’s) listed in 40 CFR 302.4. As defined by CERCLA, the term “hazardous substance” does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this material subject to this statute are:
Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9] (RQ = 100 lbs. [45.36 kg]) conc.: 0.01 to 0.2%
Benzo[a]anthracene [CAS No. 56-55-3] (RQ = 10 lbs. [4.536 kg]) concentration: 0.01 to 0.15%
Benzo[a]pyrene [CAS No. 50-32-8] (RQ = 1 lb. [0.4536 kg]) concentration: 0.001 to 0.09%
7,12-Dimethylbenz[a]anthracene [CAS No. 57-97-6] (RQ = 1 lb. [0.4536 kg]) conc.: 0.001 to 0.07%
Indeno[1,2,3-c,d]pyrene [CAS No. 193-39-5] (RQ = 100 lbs. [45.36 kg]) concentration: 0.0005 to 0.05%
Dibenzo[a,h]anthracene [CAS No. 53-70-3] (RQ = 1 lb. [0.4536 kg]) concentration: 0.0005 to 0.015%
Benzo[b]fluoranthene [CAS No. 205-99-2] (RQ = 1 lb. [0.4536 kg]) concentration: 0.0005 to 0.015%
Benzo[k]fluoranthene [CAS No. 207-08-9] (RQ = 5000 lbs. [2270 kg]) concentration: 0.0001 to 0.01%
Hydrogen sulfide [CAS No. 7783-06-4] (RQ = 100 lbs. [45.36 kg]) concentration: 0.0001 to 0.01%.

CWA

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65

This material contains detectable concentrations of the following chemical substances which are known to the State of California to cause cancer, birth defects, or other reproductive harm; and therefore, it might be subject to requirements of California Health & Safety Code Section 25249.5:

5-Methylchrysene [CAS No. 3697-24-3]
Chrysene (Benzo[a]phenanthrene) [CAS No. 218-01-9]
Benzo[a]anthracene [CAS No. 56-55-3]
Benzo[a]pyrene [CAS No. 50-32-8]
7,12-Dimethylbenz[a]anthracene [CAS No. 57-97-6]
Indeno[1,2,3-c,d]pyrene [CAS No. 193-39-5]
Dibenzo[a,h]anthracene [CAS No. 53-70-3]
Benzo[b]fluoranthene [CAS No. 205-99-2]
Benzo[k]fluoranthene [CAS No. 207-08-9]
Dibenzo[a,h]pyrene [CAS No. 189-64-0]
Dibenzo[a,e]pyrene [CAS No. 192-65-4]
7H-Dibenzo[c,g]carbazole [CAS No. 194-59-2].

New Jersey Right-to-Know Label

For New Jersey labeling, refer to components listed in Section 2.

Additional Regualtory Remarks

In regulations promulgated pursuant to the Clean Air Act - Section 112(r) (40 CFR 68.130), the EPA requires development, implementation, and submission of risk management plans (RMPs) for facilities that manufacture, process, use, or otherwise handle regulated substances in quantities that exceed listed thresholds. A chemical substance present in this material which is subject to this statute is:

Hydrogen sulfide [CAS No. 7783-06-4] concentration: 0.0001 to 0.01%.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

Revision Information

Version Number 5.1
Revision Date: 6-6-12
Print Date: 6-6-12

Abbreviations

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists
AIHA: American Industrial Hygiene Association
IARC: International Agency for Research on Cancer
NTP: National Toxicology Program
NIOSH: National Institute of Occupational Safety and Health
OSHA: Occupational Safety and Health Administration
NPCA: National Paint and Coating Manufacturers Association
HMIS: Hazardous Materials Information System
NFPA: National Fire Protection Association
EPA: US Environmental Protection Agency
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FUEL OIL

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