

Material Safety Data Sheet

Material Name: **Residual Fuel Oil (RFO)**

MSDS ID: NOVA-0023

Section 1 - Product and Company Identification

Synonyms: Bunker "C"; Fuel Oil, no. 6; Vacuum Residual Fuel Oil (VRFO); HFO (Heavy Fuel Oil)**Chemical Name:** Fuel Oil, residual**Chemical Family:** Hydrocarbons**Material Use:** Industrial applications: fuel oil**Chemical Formula:** Not available: complex mixture**NOVA Chemicals**

P.O. Box 2518, Station M

Calgary, Alberta, Canada T2P 5C6

Product Information: 1-412-490-4063**MSDS Information Email:**msdsemail@novachem.com**EMERGENCY Telephone Numbers:****North America (Canada and US):**

1-800-561-6682, 1-403-314-8767 (NOVA Chemicals) (24 hours)

1-800-424-9300 (CHEMTREC-USA) (24 hours)

1-613-996-6666 (Canutec-Canada) (24 hours)

General Comments

This product has been assigned a CAS # of 68476-33-5.

Section 2 - Hazards Identification

HMIS Ratings: Health: 2* Fire: 2 Physical Hazard: 0 Personal Protection: chemical goggles, gloves, respirator, coveralls*Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard***NFPA Ratings: Health: 2 Fire: 2 Reactivity: 0***Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe***Emergency Overview**

WARNING! COMBUSTIBLE. Product is a dark brown to black liquid with a strong distinctive odour. This product is combustible and burns readily when heated to high temperatures. This product is harmful by inhalation, if it is swallowed, and if it is absorbed through the skin. This product is irritating to the eyes and skin. Ingestion or excessive inhalation of this product may result in vomiting, nausea, and abdominal pain as well as central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. Excessive inhalation of this material may cause damage to blood systems. Heated vapours or mists, if aspirated into the lungs may cause mild or severe injury. This product may cause cancer. Prevent entry into ditches, drains, sewers and waterways.

Potential Health Effects: Eye

This product is irritating to the eyes. Contact with hot, oil liquids or mist can cause severe eye irritation and damage.

Potential Health Effects: Skin

Prolonged and/or repeated skin contact with this product may cause irritation/dermatitis and possible chemical blistering. Hot product may cause severe skin burns. Product contains component(s) that may be absorbed through the skin. Prolonged contact with this product may cause allergic skin reactions and possibly skin cancer.

Potential Health Effects: Ingestion

This product is harmful if swallowed. Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. Heated vapours or mists, if aspirated into the lungs may cause mild or severe injury. Ingestion may cause kidney and liver damage and blood disorders.

Potential Health Effects: Inhalation

This product may be harmful by inhalation. Excessive inhalation of this product may result in heartbeat irregularities and central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. Excessive inhalation of this product when heated may cause damage to blood systems and, over time, may cause kidney and liver damage, and blood disorders. Heated vapours or mists, if aspirated into the lungs may cause mild or severe injury.

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Section 3 - Composition / Information on Ingredients

CAS #	Component	Percent by Wt.
68476-33-5	Fuel oil, residual *	100
The above listed CAS number and product is comprised of the following components:		
Not Available	Heavy fraction hydrocarbons (mixture) **	10-20
91-20-3	Naphthalene	0.85-1.5
91-20-3	Naphthalene	1.5-3.5
Not Available	Sulphur containing compounds (total, mixture)	1-2

Additional Information

* This product may also be described as Fuel oil, no. 6 (CAS # 68553-00-4). This product is considered to be a blended chemical substance of unknown or variable composition.

** Heavy fraction hydrocarbons are the residues after very high temperature distillation. It contains mixed asphaltenes (< 10% by weight), methylnaphthalenes (< 0.5% by weight) and other polynuclear aromatic hydrocarbons (PAHs), analyzed as < 0.02% by weight (total).

The actual components and weight % concentrations vary based on operating conditions.

This product is hazardous under 29 CFR 1910.1200 (Hazard Communication).

This material is a controlled product under Canadian WHMIS regulations.

This material is regulated as a combustible material for transportation in the U.S.A.

See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

Section 4 - First Aid Measures

First Aid: Eyes

Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

First Aid: Skin

Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist. Completely decontaminate clothing, shoes and other protective equipment before reuse or discard.

First Aid: Inhalation

Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, is unconscious or if any other symptoms persist. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

First Aid: Notes to Physician

For more detailed medical emergency support information call 1-800-561-6682 or 1-403-314-8767 (24 hours, NOVA Chemicals Emergency Response). Ensure thorough eye and skin decontamination. Treat unconsciousness, nausea, hypotension, seizures and cardiac arrhythmias in the conventional manner. Aspiration of this product during induced emesis can result in lung injury. If evacuation of stomach contents is considered necessary, use the method least likely to cause aspiration, such as gastric lavage after protecting the airway. Observe hospitalized patients for delayed chemical pneumonia, acute tubular necrosis, encephalopathy and dysrhythmias. Monitor for urinary phenol within 72 hours of acute exposure.

Section 5 - Fire Fighting Measures

See Section 9: Physical Properties for flammability limits, flash point and auto-ignition information.

General Fire Hazards

Fire and container explosion hazards are possible when this product is exposed to heat or flame. Empty containers when heated may pose a fire risk. Vapours are heavier than air and may travel along the ground to some distant source of ignition and flash back. Consider initial downwind evacuation for at least 300 metres (984 feet). If tank is involved in a fire, ISOLATE for 800 metres (1/2 mile) in all directions.

Explosion Hazards

Heated vapours or mists may form explosive mixture with air. Keep containers away from source of heat or fire. Containers may explode when involved in a fire.

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Hazardous Combustion Products

Upon combustion this product emits carbon monoxide, carbon dioxide, low molecular weight hydrocarbons, acidic gases, nitrogen oxides and sulphur oxides.

Extinguishing Media

Dry chemical, foam, carbon dioxide and water spray or fog. Use water to cool fire-exposed containers and to protect personnel. Water spray may be an ineffective extinguishing medium and may actually spread flames. Monitor water run-off for flammability and prevent from entering drains and sewers or other confined or underground spaces.

Fire Fighting Equipment/Instructions

Reference 2008 Emergency Response Guidebook, Guide No. 128 for additional details and instructions. Position upwind. Keep unnecessary personnel away. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned holders or monitor nozzles. Immediately withdraw in case of fire and container venting or heat discoloration of a container. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Avoid inhaling any smoke and combustion materials. Remove and clean or destroy any contaminated clothing. Cool containers with flooding quantities of water until well after the fire is out. Control run-off waters to prevent entry into sewers, drains, ditches, underground or confined spaces and waterways.

Section 6 - Accidental Release Measures

Evacuation Procedures

Isolate area. Keep unnecessary personnel away. Alert stand-by emergency and fire fighting personnel. Monitor surrounding area for buildup of flammable concentrations in air.

Small Spills

Eliminate ignition sources. Spill or leak area should be isolated. Keep upwind and out of low areas. Stop discharge if safe to do so. Contain discharge by booming on water or diking on ground. Absorb/adsorb residual materials and clean up with non-sparking tools. Prevent entry into sewers, drains, ditches, underground or confined spaces, water intakes and waterways. Shovel product with non-sparking tools into appropriate container for disposal.

Large Spills

Consider downwind evacuation for 300 metres (984 feet). Eliminate ignition sources. Keep upwind and out of low areas. Stop discharge if safe to do so. Contain discharge by booming on water or diking on ground. Absorb/adsorb residues with DRY earth, sand or other non-combustible materials. Soil remediation may be required. Prevent entry into sewers, drains, ditches, underground or confined spaces, water intakes and waterways.

Special Procedures

Contact local police/emergency services and appropriate emergency telephone numbers provided in Section 1. Ensure that statutory and regulatory reporting requirements in the applicable jurisdiction are met. Wear appropriate protective equipment and clothing during cleanup. Individuals without appropriate protective equipment should be excluded from area of spill until cleanup has been completed.

See Section 8 for recommended Personal Protective Equipment and see Section 13 for waste disposal considerations.

Section 7 - Handling and Storage

Handling Procedures

Keep locked up or secured. Handle in fully grounded, properly designed and approved equipment systems that are suitable for combustible liquids. Use with adequate ventilation. Do not ingest or inhale. Keep away from heat and ignition sources. No smoking or open flames permitted in storage, use or handling areas. Dissipate static electricity during transfer by grounding and bonding containers and equipment. Take special precautions when cold cutting or breaking into lines, or when cleaning and disposing of empty containers. Parts and equipment should be steam cleaned prior to maintenance procedures. Do not breathe gas, fumes, vapour or spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately. Avoid contact with skin and eyes. Keep away from incompatible materials such as oxidizing agents and acids. Oil-contaminated clothing must be removed and cleaned prior to reuse. After handling, always wash hands thoroughly with soap and water.

Recommended maximum temperature for storage and loading is below the flash point.

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Storage Procedures

Storage area should be clearly identified, well-illuminated, clear of obstruction and accessible only to trained and authorized personnel. Adequate security must be provided so that unauthorized personnel do not have access to product. Store in grounded, properly designed and approved vessels and away from incompatible materials. Store and use away from heat, sparks, open flame, or any other ignition source. Store according to applicable regulations for combustible materials for storage tanks, containers, piping, buildings, rooms, cabinets, allowable quantities and minimum storage distances. Use non-sparking ventilation systems, approved explosion-proof equipment, and intrinsically safe electrical systems. Have appropriate extinguishing capability in storage area, (e.g. portable fire extinguishers (dry chemical, foam or carbon dioxide)) and flammable gas detectors. Water spray is ineffective for extinguishing fires. Prevent soil contamination. Keep absorbents for leaks and spills readily available. Inspect vents during winter conditions for vapour ice buildup. Storage tanks should be above ground and diked to hold entire contents.

See Section 8 for appropriate Personal Protective Equipment and see Section 10 for information on Incompatibilities.

Section 8 - Exposure Controls / Personal Protection

Exposure Guidelines

A: General Product Information

Refer to published exposure limits - use effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are in close proximity to work locations.

B: Component Exposure Limits

ACGIH, OSHA, NIOSH, EPA, Alberta, and Ontario exposure limit lists have been checked for major components listed with CAS registry numbers. Other exposure limits may apply, check with proper authorities.

*Note: The Vacated OSHA Permissible Exposure Limits (PELs) are those provided in the 1989 update to OSHA's Air Contaminants Standard 29 CFR 1910.1000. These limits were vacated by the U.S. Court of Appeals, Eleventh Circuit but may be enforceable in some states.

Fuel oil, residual (68476-33-5)

- ACGIH: 5 mg/m³ TWA (inhalable fraction) (related to Mineral oil, pure, highly and severely refined)
-- TWA (exposure by all routes should be carefully controlled to levels as low as possible)
(related to Mineral oil, poorly and mildly refined)
- OSHA (Vacated)*: 5 mg/m³ TWA (related to Oil mist, mineral)
- OSHA (Final): 5 mg/m³ TWA (related to Oil mist, mineral)
- NIOSH: 5 mg/m³ TWA; 10 mg/m³ STEL
2500 mg/m³ IDLH (related to Oil mist (mineral))
- Alberta: 5 mg/m³ TWA; 10 mg/m³ STEL (related to Oil mist, mineral)
- Ontario: 5 mg/m³ TWA; 10 mg/m³ STEL (related to Oil, mineral - mist)
(sampled by method that does not collect vapour)

Heavy fraction hydrocarbons (mixture) (CAS # Not Available)

- ACGIH: 0.2 mg/m³ TWA (as benzene soluble aerosol) (related to Coal tar pitch volatiles)
- OSHA (Vacated)*: 0.2 mg/m³ TWA (benzene soluble fraction) (related to Coal tar pitch volatiles)
- OSHA (Final): 0.2 mg/m³ TWA (benzene soluble fraction) (related to Coal tar pitch volatiles)
- NIOSH: 0.1 mg/m³ TWA (cyclohexane-extractable fraction) (related to Coal tar pitch volatiles)
80 mg/m³ IDLH (related to Coal tar pitch volatiles)
- Alberta: 0.2 mg/m³ TWA (as benzene solubles) (related to Coal tar pitch volatiles (PPAH, Particulate polycyclic aromatic hydrocarbons))
- Ontario: 0.2 mg/m³ TWA (as benzene soluble aerosol) (related to Coal tar pitch volatiles)

Naphthalene (91-20-3)

- ACGIH: 10 ppm TWA; 52 mg/m³ TWA; 15 ppm STEL; 79 mg/m³ STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
- OSHA (Vacated)*: 10 ppm TWA; 50 mg/m³ TWA; 15 ppm STEL; 75 mg/m³ STEL
- OSHA (Final): 10 ppm TWA; 50 mg/m³ TWA
- NIOSH: 10 ppm TWA; 50 mg/m³ TWA; 15 ppm STEL; 75 mg/m³ STEL
250 ppm IDLH
- Alberta: 10 ppm TWA; 52 mg/m³ TWA; 15 ppm STEL; 79 mg/m³ STEL
Substance may be readily absorbed through intact skin
- Ontario: 10 ppm TWA; 15 ppm STEL
Danger of cutaneous absorption

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Sulphur containing compounds (total, mixture) (CAS # Not Available)

Alberta: 10 mg/m³ TWA (related to Sulphur)

ENGINEERING CONTROLS

Engineering methods to reduce hazardous exposure are preferred controls. Methods include mechanical ventilation (dilution and local exhaust) process or personal enclosure, remote and automated operation, control of process conditions, leak detection and repair systems and other process modifications. Ensure all exhaust ventilation systems are discharged to outdoors, away from air intakes and ignition sources. Supply sufficient replacement air to make up for air removed by exhaust systems. Administrative (procedure) controls and use of personal protective equipment may also be required.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses; chemical goggles are recommended if splashing is possible and to prevent eye irritation from vapours.

Personal Protective Equipment: Skin/Hands/Feet

Use chemical-resistant gloves when handling product. Wear chemical-resistant safety footwear with good traction to prevent slipping. Work clothing that sufficiently prevents skin contact should be worn, such as coveralls and/or long sleeves and pants. If splashing or contact with liquid is possible, consider the need for an impervious overcoat. Fire resistant (i.e., Nomex) or natural fibre clothing (i.e., cotton or wool) is recommended. Synthetic clothing can generate static electricity and is not recommended where a flammable vapour release may occur. Static Dissipative (SD) rated footwear is recommended.

Personal Protective Equipment: Respiratory

If engineering controls and ventilation are not sufficient to prevent buildup of aerosols or vapours, appropriate NIOSH approved air-purifying respirators or self-contained breathing apparatus (SCBA) appropriate for exposure potential should be used. Air-supplied breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.

Personal Protective Equipment: General

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation and/or applicable regulations to determine hazard potential and ensure adequate protection.

Section 9 - Physical & Chemical Properties

Physical State and Appearance:	Liquid, thick, oily	Colour:	Dark brown to black
Odour:	Strong, tar-like, with naphthalene (mothball)	pH:	Not applicable
Vapour Pressure:	Range: 1 to 15 mm Hg at 20°C (68°F)	Vapour Density at 0°C (Air=1):	>1 (estimated)
Boiling Point:	Range: 204°C to 700°C (399.2°F to 1292°F)	Pour Point:	Range: -27°C to -6°C (-16.6°F to 21.2°F)
Solubility (H₂O):	Insoluble	Specific Gravity (Water=1):	Range: 0.94 to 0.985 at 15°C (60°F)
Evaporation Rate (n-Butyl Acetate=1):	Slow; some components may volatilize	Viscosity:	Range: 50 to 625 cSt; typically 500 to 600 cSt at 50°C (122°F)
Percent Volatile:	<10% at 20°C (68°F) (estimated)	Octanol/H₂O Coeff.:	Not available
Auto Ignition:	407°C (764.6°F)	Flash Point:	Range: 80°C to 110°C (176°F to 230°F)
Flash Point Method:	Pensky-Martens, closed cup	Upper Flammable Limit (UFL):	5%
Lower Flammable Limit (LFL):	1 %	Flammability Classification:	Combustible

Section 10 - Stability & Reactivity Information

Chemical Stability

This product is a stable material. Product is heated prior to loading and transportation due to its inherent high viscosity.

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Chemical Stability: Conditions to Avoid

Fire and explosion hazards are moderate when this product is exposed to heat or flame. Keep away from heat, sparks or open flame.

Incompatibility

May react with strong acids, alkalis or oxidizing agents.

Possibility of Hazardous Reactions or Hazardous Polymerization

Hazardous polymerization not likely to occur.

Corrosivity

Not corrosive to the common metals.

Hazardous Decomposition

Upon decomposition this product emits carbon monoxide, carbon dioxide, low molecular weight hydrocarbons, acidic gases, nitrogen oxides and sulphur oxides.

Section 11 - Toxicological Information

A: Acute Toxicity - General Product Information

Similar materials have been tested under the EPA's High Production Volume (HPV) program for Heavy Fuels Oil Category submitted by the American Petroleum Institute (API). Product is an eye, skin and respiratory tract irritant and a CNS depressant. Severe skin irritation or dermatitis is possible on prolonged contact. Exposure can cause headache, nausea, weakness, dizziness, sleepiness, loss of coordination and even loss of consciousness. Heated vapours or mists, if aspirated into the lungs may cause mild or severe injury. The following additional information has been found for its components:

Naphthalene - Can irritate the skin, eyes, nose and throat. Contact may cause corneal damage. Inhalation of high concentrations may result in central nervous system (CNS) depression causing headache, fatigue, confusion, nausea, vomiting and unconsciousness. Ingestion can cause nausea, vomiting, diarrhoea, liver damage, kidney damage and haemolytic anemia which may lead to methemoglobinemia.

B: Acute Toxicity - LD50/LC50

Fuel oil, residual (68476-33-5)

Oral LD50 Mouse: 22 g/kg (related to Oil mist, mineral)

Inhalation LC50 Rat: >5050 mg/m³/4H; Oral LD50 Rat: >5 g/kg (related to Polymers (petroleum), viscous)

Oral LD50 Rat: 4320 mg/kg; Dermal LD50 Rat: >2000 mg/kg; Dermal LD50 Rabbit: >2000 mg/kg (related to Fuel oil No. 6)

Naphthalene (91-20-3)

Inhalation LC50 Rat: >340 mg/m³/1H; Oral LD50 Rat: 490 mg/kg; Dermal LD50 Rat: >2500 mg/kg;

Dermal LD50 Rabbit: >20 g/kg

Sulphur containing compounds (total, mixture) (CAS # Not Available)

Inhalation LC50 Rat: >9.23 mg/L/4H; Oral LD50 Rat: >3000 mg/kg; Dermal LD50 Rabbit: >2000 mg/kg (related to Sulphur)

C: Chronic Toxicity - General Product Information

Similar materials have been tested under the EPA's High Production Volume (HPV) program for Heavy Fuels Oil Category submitted by the American Petroleum Institute (API). Petroleum residues of this type have been shown to cause skin cancer in laboratory animals following prolonged and frequent skin contact. Based on skin painting studies on other refinery streams this product is expected to possess weak to moderate carcinogenic activity. The following additional information has been found for its components:

Fuel oil, residual - This product has low levels of polycyclic aromatic hydrocarbons, some of which are known to be carcinogenic.

Naphthalene - Prolonged and repeated exposure can cause cataracts allergic skin reactions. If allergy develops, very low repeated exposure can cause itching and a skin rash. Chronic exposure may result in jaundice, optical neuritis, aplastic anemia, liver damage, kidney damage and haemolytic anemia which may lead to methemoglobinemia. Naphthalene has been shown to cause nasal and lung cancer in animal tests and has been classified by IARC as Group 2B (possibly carcinogenic to humans). NTP has listed naphthalene as "Reasonably Anticipated to be a Carcinogen". Naphthalene was not mutagenic in the Ames Salmonella microsome assay.

D: Chronic Toxicity - Carcinogenic Effects

ACGIH, EPA, IARC, OSHA, and NTP carcinogen lists have been checked for selected similar materials or those components with CAS registry numbers.

Fuel oil, residual (68476-33-5)

IARC: Monograph 45 [1989] (related to Fuel oils, residual (heavy)) (Group 2B (possibly carcinogenic to humans))

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Heavy fraction hydrocarbons (mixture) (CAS # Not Available)

ACGIH: A1 - Confirmed Human Carcinogen (as benzene soluble aerosol) (related to Coal tar pitch volatiles)
NTP: Known Carcinogen (related to Coal tar pitches)
Reasonably Anticipated To Be A Carcinogen (related to Polycyclic aromatic hydrocarbons (PAH))
IARC: Supplement 7 [1987], Monograph 35 [1985] (related to Coal tar pitches) (Group 1 (carcinogenic to humans))

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen
EPA: Classification: possible human carcinogen
NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)
IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Section 12 - Ecological Information

Ecotoxicity

A: General Product Information

This product has not been tested as a mixture. Similar materials have been tested under the EPA's High Production Volume (HPV) program for Heavy Fuel Oils Category submitted by the American Petroleum Institute (API). Product is largely insoluble in water, has minimal volatility and becomes a persistent solid residue on land. Extensive ecosystem studies have been conducted on various grades of processed hydrocarbon oils following water and land spills and recovery. This product would likely have effects similar to other heavy, mildly refined crude oil products.

B: Component Analysis - Ecotoxicity - Aquatic/Terrestrial Toxicity

Fuel oil, residual (68476-33-5)

Test & Species

Test & Species	Concentration	Conditions
96 Hr LC50 Pimephales promelas	35 mg/L	[flow-through]
96 Hr LC50 Brachydanio rerio	48 mg/L	[semi-static]
96 Hr LC50 Brachydanio rerio	48 mg/L	[semi-static] related to Fuel oil No. 6

Naphthalene (91-20-3)

Test & Species

Test & Species	Concentration	Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L	[flow-through]
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L	[flow-through]
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L	[static]
96 Hr LC50 Pimephales promelas	1.99 mg/L	[static]
96 Hr LC50 Lepomis macrochirus	31.0265 mg/L	[static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L	
48 Hr LC50 Daphnia magna	2.16 mg/L	
48 Hr EC50 Daphnia magna	1.96 mg/L	[flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L	[static]

Sulphur containing compounds (total, mixture) (CAS # Not Available)

Test & Species

Test & Species	Concentration	Conditions
96 Hr LC50 Brachydanio rerio	866 mg/L	[static]
96 Hr LC50 Lepomis macrochirus	<14 mg/L	[static]
96 Hr LC50 Oncorhynchus mykiss	>180 mg/L	[static] related to Sulphur

Environmental Fate/Mobility

Under ambient conditions the product has minimal to no volatility. Product is sticky, will solidify and strongly adheres to soils and sediment. Contact with product is harmful to plants, birds and water mammals.

Persistence/Degradability

Components of this product are expected to biodegrade in the environment under both aerobic and anaerobic conditions. Hazardous short-term degradation products are not likely. Recovery time for land and water following a major spill is estimated to extend into months, possibly years. Some trace PAH components are considered persistent and bioaccumulative toxins.

Bioaccumulation/Accumulation

This product will accumulate on the surface of plants, waterfowl and mammals resulting in serious injury and possible death.

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Section 13 - Disposal Considerations

U.S./Canadian Waste Information

A: General Product Information

This product is known to be a hazardous waste according to US and Canadian regulations. Using, mixing or processing this product may alter its properties or hazards. Contact federal, provincial/state and local authorities before generating or shipping any waste material associated with this product to ensure appropriate handling and disposal. **DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION.** Since emptied containers retain product residue, follow safe handling/label warnings even after container is emptied.

See Section 7: Handling and Storage and Section 8: Exposure Controls/Personal Protection for additional handling information that may be applicable for safe handling and the protection of employees.

Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

B: Component Waste Numbers

Naphthalene (91-20-3)

RCRA: waste number U165

Section 14 - Transportation Information

US DOT Information

Shipping Name: Combustible Liquid, N.O.S. (Fuel oil, No 6)

UN/NA#: NA1993 **Hazard Class:** Combustible Liquid **Packing Group:** III

Required Label(s): None

Additional Info.: This product must be reclassified when shipped in bulk at a temperature above the flash point, **OR** when the flash point is greater than 93.3°C (200°F) but not above 100°C (212°F) and product is shipped at a temperature lower than the flash point, **OR** when product is shipped at a temperature above 100°C (212°F) but lower than the flash point.

2008 Emergency Response Guidebook, Guide No. 128

Canadian TDG Information

Shipping Name: Not regulated as dangerous goods unless this product is shipped at a temperature above the flash point, **OR** when product is shipped at a temperature above 100°C (212°F) but lower than the flash point.

International Air Transport Association (IATA) and International Civil Aviation Organization (ICAO) Information

Shipping Name: Not regulated as dangerous goods unless this product is shipped at a temperature above the flash point, **OR** when product is shipped at a temperature above 100°C (212°F) but lower than the flash point.

International Maritime Dangerous Goods (IMDG) Code

Shipping Name: Not regulated as dangerous goods unless this product is shipped at a temperature above the flash point, **OR** when product is shipped at a temperature above 100°C (212°F) but lower than the flash point.

Section 15 - Regulatory Information

A: International Regulations

Component Analysis - International Inventory Status

Component	CAS #	US - TSCA	CANADA - DSL	EU - EINECS
Fuel oil, residual	68476-33-5	Yes	Yes	Yes
Naphthalene	91-20-3	Yes	Yes	Yes

B: USA Federal & State Regulations

Ongoing occupational hygiene, medical surveillance programs, site emission or spill reporting may be required by federal or state regulations. Check for applicable regulations.

USA OSHA Hazard Communication Class

This product is hazardous under 29 CFR 1910.1200 (Hazard Communication). HCS Classes:

HCS CLASS: MAY CAUSE CANCER

HCS CLASS: Irritating substance.

HCS CLASS: Target organ effects.

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USA Right-to-Know - Federal

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

SARA 313: 0.1 % de minimis concentration
CERCLA: 100 lb final RQ; 45.4 kg final RQ

USA Right-to-Know - State

The following components appear on one or more of the following state hazardous substances lists. Some components (including those present only in trace quantities and therefore not listed in this document) may be included on the Right-To-Know lists of other U.S. states. The reader is therefore cautioned to contact his or her NOVA Chemicals' representative or NOVA Chemicals' Product Integrity group for further U.S. State Right-To-Know information.

Component	CAS #	NJ	PA
Fuel oil, residual (¹related to Oil mist, mineral)	68476-33-5	Yes¹	Yes
Heavy fraction hydrocarbons (mixture) (¹related to Coal tar pitch) (²related to Particulate polycyclic aromatic hydrocarbons)	Not Available	Yes¹	Yes²
Naphthalene	91-20-3	Yes	Yes
Sulfur containing compounds (total, mixture) (¹related to Sulfur)	Not Available	Yes¹	Yes¹

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

C: Canadian Regulations - Federal and Provincial

Canadian Environmental Protection Act (CEPA): All components of this product are on the Domestic Substances List (DSL) or are exempt and are acceptable for use under the provisions of CEPA.

WHMIS Ingredient Disclosure List (IDL)

The following components are identified under the Canadian Hazardous Products Act - Ingredient Disclosure List (IDL):

Component	CAS #	Minimum Concentration
Heavy fraction hydrocarbons (mixture)	Not Available	0.1 % (related to Coal tar pitch volatiles)
Naphthalene	91-20-3	1 %

WHMIS Classification

Workplace Hazardous Materials Information System (WHMIS): This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and the MSDS contains all the information required by the CPR.

WHMIS CLASS B3: Combustible liquid with a flash point between 37.8°C and 93.3°C (100°F - 200°F).

WHMIS CLASS D1B: Toxic (Naphthalene)

WHMIS CLASS D2A: Carcinogen

WHMIS CLASS D2B: Toxic (Skin/Eye Irritant, Skin Sensitization)

Other Regulations

Ongoing occupational hygiene, medical surveillance programs, site emission or spill reporting may be required by federal or provincial regulations. Check for applicable regulations.

Section 16 - Other Information

Label Information

WARNING! COMBUSTIBLE. Product is a dark brown to black liquid with a strong distinctive odour. This product is combustible and burns readily when heated to high temperatures. This product is harmful by inhalation, if it is swallowed, and if it is absorbed through the skin. This product is irritating to the eyes and skin. Ingestion or excessive inhalation of this product may result in vomiting, nausea, and abdominal pain as well as central nervous system effects including headache, sleepiness, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. Excessive inhalation of this material may cause damage to blood systems. Heated vapours or mists, if aspirated into the lungs may cause mild or severe injury. This product may cause cancer. Prevent entry into ditches, drains, sewers and waterways.

FIRST AID:

SKIN: Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist. Completely decontaminate clothing, shoes and other protective equipment before reuse or discard.

EYES: Remove contact lenses if it can be done safely. Immediately flush eyes with water for at least 15 minutes while holding eyelids open. Seek medical attention if symptoms develop or persist.

Material Safety Data Sheet

Material Name: **Residual Fuel Oil (RFO)**

MSDS ID: NOVA-0023

INHALATION: Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, is unconscious or if any other symptoms persist. **WARNING:** Contact through mouth-to-mouth resuscitation may pose a secondary risk to the rescuer. Avoid mouth-to-mouth contact by using a mouth shield or guard to perform artificial respiration.

INGESTION: DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

IN CASE OF A LARGE SPILL: Consider downwind evacuation for 300 metres (984 feet). Eliminate ignition sources. Keep upwind and out of low areas. Stop discharge if safe to do so. Contain discharge by booming on water or diking on ground. Absorb/adsorb residues with DRY earth, sand or other non-combustible materials. Soil remediation may be required. Prevent entry into sewers, drains, ditches, underground or confined spaces, water intakes and waterways.

References

Available on request.

Special Considerations

For additional information on equipment bonding and grounding, refer to the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity".

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADR = Transport of Dangerous Goods by Road; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CEPA = Canadian Environmental Protection Act; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; CPR = Controlled Products Regulations; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EC50 = Effective Concentration 50%; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EPA = Environmental Protection Agency; EU = European Union; FDA = Food and Drug Administration; GHS = Globally Harmonized System for the Classification and Labelling of Chemicals; HCS = Hazard Communication Standard; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IATA = International Air Transport Association; ICAO = International Civil Aviation Organization; IDL = Ingredient Disclosure List; IDLH = Immediately Dangerous to Life or Health; IMDG = International Maritime Dangerous Goods; IMO = International Maritime Organization; ISHL = Industrial Safety and Health Law; Kow = Octanol/water partition coefficient; LC50 = Lethal Concentration 50%; LD50 = Lethal Dose 50%; LEL = Lower Explosive Limit; LFL = Lower Flammable Limit; LLV = Level Limit Ceiling Limit (Sweden dust); MAK = Maximum Concentration Value in the Workplace; MITI = Ministry of International Trade and Industry; MSDS = Material Safety Data Sheet; NAB = Threshold Values (Indonesia); NCEC = National Chemical Emergency Centre; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OEL = Occupational Exposure Limit; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit; PNOC = Particulates Not Otherwise Classified; PPE = Personal Protective Equipment; PRTR = Designated Chemical Substance Law (Japan); PSD = Short Term Exposure Limit (Indonesia); RCRA = Resource Conservation and Recovery Act; REACH = Registration, Evaluation, Authorisation and Restriction of Chemical Substances; REL = Recommended Exposure Limit; RID = Transport of Dangerous Goods by Rail; SARA = Superfund Amendments and Reauthorization Act; SCBA = Self Contained Breathing Apparatus; SDS = Safety Data Sheet; SEPA = State Environmental Protection Administration; STEL = Short Term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average; UEL = Upper Explosive Limit; UFL = Upper Flammable Limit; VLA-ED = Valor límite Ambiental de Exposición Diaria (Environmental Exposure Daily Limit Value); VME = valeur limite d'exposition (Occupational Exposure Limits); WHMIS = Workplace Hazardous Materials Information Systems

MSDS Prepared by: NOVA Chemicals

MSDS Information Phone Number: 1-412-490-4063

Other Information

Notice to Reader:

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This is the end of MSDS # NOVA-0023.