Section 1 - Product and Company Identification

Synonyms: Vacuum Gas Oil ; V.G.O.; Heavy petroleum distillates (vacuum)
Chemical Name: Gas Oils (petroleum), heavy vacuum
Chemical Family: Hydrocarbon
Material Use: Industrial feedstock
Chemical Formula: Not available; complex mixture

In case of Emergency
NOVA Chemicals (Canada) Ltd.
P.O. Box 3060, Sarnia,
Ontario, CANADA N7T 8C7
1-800-561-6682  1-403-314-8767 (NOVA Chemicals)(24 hours)
1-800-424-9300 (CHEMTREC-USA)
1-613-996-6666 (Canutec-Canada)(24 hours)

Section 2 - Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Component</th>
<th>Percent by Wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>64741-57-7</td>
<td>Gas oils, petroleum, heavy vacuum</td>
<td>100</td>
</tr>
</tbody>
</table>

Additional Information
- Product contains <1% total sulfur compounds by weight.
- This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
- This material is a controlled product under Canadian WHMIS regulations.
- This material is not regulated as a hazardous material/dangerous goods for transportation.
- See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

Section 3 - Hazards Identification

HMIS Ratings: Health: 1* Fire: 2 Reactivity: 0 Pers. Prot.: chemical goggles, gloves, respirator
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe  * = Chronic hazard
NFPA Ratings: Health: 0 Fire: 2 Reactivity: 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Emergency Overview
- WARNING This product is flammable when heated to high temperatures. Material is a darkly colored, thick waxy liquid with a heavy fuel oil odor. If released, prevent entry into ditches, sewers, and waterways. Small amounts of this product, if aspirated into the lungs, may cause mild to severe pulmonary injury. This product may be irritating to the eyes, skin, and respiratory system. Ingestion or inhalation of heated vapors or mists may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision. May cause skin cancer.

Potential Health Effects: Eyes
- This product may cause irritation to the eyes on contact with heated vapours or liquid.

Potential Health Effects: Skin
- Skin contact with this product may cause irritation/dermatitis. Prolonged and/or repeated contact may cause severe irritation/dermatitis, chemical blistering and possible skin cancer.

Potential Health Effects: Ingestion
- Ingestion can cause gastrointestinal irritation, nausea, vomiting and diarrhea. Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision. Swallowing or vomiting of liquid may cause aspiration into the lungs, and subsequent pulmonary injury.

Potential Health Effects: Inhalation
- Excessive inhalation of this material causes headache, dizziness, nausea and loss of coordination. Inhalation of heated vapors or mists may cause headache, dizziness, nausea and loss of coordination. Aspiration of liquid into the lungs can cause mild to severe pulmonary injury.
Material Safety Data Sheet
Material Name: VGO (Vacuum Gas Oil)

Section 4 - First Aid Measures

First Aid: Eyes
Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention at once.

First Aid: Skin
Remove contaminated clothing. For skin contact, wash immediately with soap and water. Seek medical attention if irritation or dermatitis persists.

First Aid: Inhalation
Remove to fresh air. Assist breathing if necessary. Obtain medical attention.

First Aid: Ingestion
If the material is swallowed, get immediate medical attention or advice -- DO NOT INDUCE VOMITING.

First Aid: Notes to Physician
For more detailed medical emergency support information call 1-800-561-6682 (NOVA Chemicals Emergency Response, 24 hours).
Ensure thorough eye and skin decontamination. Treat unconsciousness, nausea, seizures and cardiac arrhythmia's in the conventional manner. This material, if aspirated into the lungs, may cause chemical pneumonitis; treat the affected person appropriately. 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.

Section 5 - Fire Fighting Measures

Flammability Class: Flammable when heated
Flash Point: >70°C (>158°F)
Upper flammability limit: 5% (estimated)
Flash Point Method: PMCC
Lower flammability limit: 1% (estimated)
Auto Ignition: >260°C, (>500°F, estimated)

General Fire Hazards
This product is flammable when heated to high temperatures. Empty containers when heated may pose a fire risk. Fire and container explosion hazards are serious when this product is exposed to heat or flame. Vapors may travel to some distant source of ignition and flash back. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also consider initial evacuation for 800 meters (1/2 mile) in all directions.

Hazardous Combustion Products
Upon decomposition, this product emits carbon monoxide, carbon dioxide, sulfur oxides and/or low molecular weight hydrocarbons and toxic (acidic) gases.

Extinguishing Media
Dry chemical, foam, carbon dioxide, water fog. Use water to cool fire-exposed containers and to protect personnel. Water may be an ineffective extinguishing medium.

Fire Fighting Equipment/Instructions
Position upwind. Keep unnecessary personnel away. Move containers from fire area if you can do it without risk. Set up to fight fire at a safe distance. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Fire fighters should avoid inhaling any combustion products. ALWAYS stay away from tanks engulfed in fire. Immediately withdraw in case of fire and tank venting or heat discoloration of a tank. Control runoff waters to prevent entry into sewers, drains, underground or confined spaces and waterways.

Section 6 - Accidental Release Measures

Evacuation Procedures
Isolate area. Keep unnecessary personnel away. Ground all approved equipment used in area.

Small Spills
Absorb spill with inert material. Shovel material into appropriate container for disposal.
Material Safety Data Sheet
Material Name: VGO (Vacuum Gas Oil)

Large Spills
Eliminate ignition sources. Spill or leak area should be isolated immediately. Keep upwind and out of low areas. Stop or reduce discharge if safe to do so. Prevent entry into ditches, sewers and waterways. Contain discharge by booming on water or diking on ground. Remove material with non-sparking, approved pumps, skimmers or vacuum equipment. Absorb/adsorb residual materials with DRY earth, sand or other non-combustible materials. Soil remediation may be required.

Special Procedures
Contact local police and appropriate emergency telephone numbers provided in Section 1. Ensure statutory and regulatory reporting requirements in the applicable jurisdiction are met. Persons not wearing appropriate protective equipment should be excluded from area of spill until clean-up has been completed. Wear appropriate protective equipment and clothing during clean-up.

Section 7 - Handling and Storage

Handling Procedures
Handle in fully grounded, properly designed and approved containers and equipment systems. Control temperature in shipping and handling to recommended levels. Keep away from welding operations, sparks, flames or other ignition sources. No smoking or open flame in storage, use or handling areas. Empty containers when heated may pose a fire risk. Provide local and general exhaust ventilation to effectively remove and prevent buildup of any heated vapors or mists generated from the handling of this product. Avoid skin and eye contact. Wear suitable protective equipment including impervious gloves and eye protection. After handling, always wash hands thoroughly with soap and water.

Incompatibility
This product may react with oxidizing agents. This product may react with strong acids. Heated vapors or mists may from explosive mixtures in air.

Storage Procedures
Storage area should be clearly identified, well illuminated, clear of obstruction and accessible only to authorized personnel. Store in fully grounded, properly designed and approved containers. Store away from heat, sparks, open flame, or any other ignition source. Store away from incompatible materials, such as strong acids. Have appropriate extinguishing capability in storage area (e.g. sprinkler system, portable fire extinguishers). Storage tanks should be above ground and diked to hold entire contents.

Section 8 - Exposure Controls / Personal Protection

Exposure Guidelines
A: General Material Information
Follow all applicable exposure limits. When handling heated material, use non-sparking, grounded ventilation systems separate from other exhaust systems.

B: Component Exposure Limits
Gas oils, petroleum, heavy vacuum (64741-57-7)
ACGIH: 5 mg/m³ TWA (as sampled by a method that does not collect vapor) (related to Oil mist, mineral)
10 mg/m³ STEL (as sampled by a method that does not collect vapor) (related to Oil mist, mineral)
0.2 mg/m³ TWA (inhalable fraction); A2 - suspected human carcinogen (poorly and mildly refined); A4 - not classifiable as a human carcinogen (highly refined); TLV basis: respiratory (related to Mineral oil) (Notice of Intended Changes)
0.005 mg/m³ (proposed for the sum total of 15 polynuclear aromatic hydrocarbons (PAHs) listed as carcinogens by the U.S. National Toxicology Program.)

OSHA: 5 mg/m³ TWA (related to Oil mist, mineral)
NIOSH 5 mg/m³ TWA (related to Oil mist, mineral)
10 mg/m³ STEL (related to Oil mist, mineral)

Engineering Controls
Provide local and general exhaust ventilation to effectively remove and prevent buildup of any vapors or mists generated from the handling of this product.
PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face
Wear safety glasses; chemical goggles are recommended if splashing is possible or to prevent eye irritation from heated vapors or mists.

Personal Protective Equipment: Skin/Hands/Feet
Wear impervious gloves for repeated or prolonged contact. Wear impervious footwear (not leather), with good traction to avoid slipping. If splashing or contact with hot material is possible, wear thermal protective clothing. Remove contaminated clothing and clean thoroughly before reuse. Synthetic clothing can generate static electricity and is not recommended where flammable heated vapor release may occur.

Personal Protective Equipment: Respiratory
Not required in normal conditions. In poorly ventilated areas NIOSH approved organic vapor cartridge respirators or SCBA should be used. Air supplied breathing apparatus must be used when airborne concentrations may exceed the limits of the air-purifying respirator used.

Personal Protective Equipment: General
Personal protective equipment (PPE) must not be considered a long term solution to exposure control. PPE must be accompanied by employer programs to properly select, maintain, clean, fit and use equipment. Consult a competent industrial hygiene resource to determine hazard potential and/or the PPE manufacturers and applicable regulations to ensure adequate protection.

Section 9 - Physical & Chemical Properties

<table>
<thead>
<tr>
<th>Physical state and appearance:</th>
<th>Thick waxy liquid</th>
<th>Color:</th>
<th>Dark, orange to brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity:</td>
<td>varies between 40-65 cSt @50°C / 122 ºF</td>
<td>Odor:</td>
<td>Fuel oil, heavy</td>
</tr>
<tr>
<td>Odor threshold:</td>
<td>Not available</td>
<td>pH:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor Pressure:</td>
<td>6 mm of Hg @20ºC</td>
<td>Vapor Density (Air=1):</td>
<td>Estimate: 1</td>
</tr>
<tr>
<td>Boiling Point:</td>
<td>315 to 595ºC (&gt; 600 ºF)</td>
<td>Melting Point:</td>
<td>12- 40ºC (54- 104ºF)</td>
</tr>
<tr>
<td>Solubility (H2O):</td>
<td>Negligible</td>
<td>Specific Gravity (Water=1):</td>
<td>0.91</td>
</tr>
<tr>
<td>Softening Point:</td>
<td>Not available</td>
<td>Evaporation Rate (n-Butyl Acetate=1):</td>
<td>slow; only partially volatile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dispersion properties:</td>
<td>Limited dispersion in hot or cold water</td>
</tr>
</tbody>
</table>

Section 10 - Stability & Reactivity Information

Chemical Stability
This is a stable material when handled and stored at recommended temperatures.

Chemical Stability: Conditions to Avoid
Keep away from uncontrolled heat, sparks, or open flame.

Incompatibility
This product may react with oxidizing agents. This product may react with strong acids. Heated vapors or mists may from explosive mixtures in air.

Hazardous Polymerization
Not likely to occur.

Corrosivity
Not considered to be corrosive.

Hazardous Decomposition
Upon decomposition, this product emits carbon monoxide, carbon dioxide, sulfur oxides and/or low molecular weight hydrocarbons and toxic (acidic) gases.

Special Remarks
This product is flammable when heated to high temperatures. Empty containers when heated may pose a fire risk.
### Section 11 - Toxicological Information

#### Acute Toxicity

**A: General Material Information**
- Severe skin irritation or dermatitis is possible on prolonged contact. Product is eye, skin, and respiratory tract irritant. Eye irritation testing in animals indicates a mild irritation that clears in 48 hours. Skin Irritation: 4.3 (unrefined) to 5.4 (highly refined) Draize Tests in rabbits.
- Product is a CNS depressant. Exposure can cause headache, nausea, weakness, dizziness, sleepiness, loss of coordination and even loss of consciousness. It is a pulmonary aspiration hazard.
- Unrefined lube base oils are not skin sensitizers when tested in animals.

**B: Acute Toxicity - LD50/LC50**
- Oral LD50 Rats: > 5000 mg/kg (unrefined & highly refined Lube Oil Base samples, API, CONCAWE)
- Dermal LD50 Rabbits: > 5000 mg/kg (unrefined & highly refined Lube Oil Base samples, API, CONCAWE)
- Inhalation (aerosol) LC50 Rats: 2.18 mg/l

**C: Chronic Toxicity-General Material Information**
- Petroleum distillates 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 has the potential to cause skin cancer. No Adverse Observed Effect (NOAEL) for all other toxic effects (lung, liver, thymus and blood) is 125 mg/kg/day. Material is likely to contain polycyclic aromatic hydrocarbons, some of which are known to be carcinogenic.
- A similar VGO was tested in the Modified Pre-incubation Mutagenesis assay (Ames TA98 & S9) and demonstrated a Mutagenicity Index of 3.8. Therefore VGO is predicted to produce tumours in standard mouse skin painting bioassay.

**D: Chronic Toxicity - Carcinogenic Effects**
- ACGIH, IARC, OSHA, and NTP carcinogen lists have been checked for those components with CAS registry numbers.
- **Gas oils, petroleum, heavy vacuum (64741-57-7)**
  - OSHA: Present (related to Mineral oils, untreated and mildly treated) (Select Carcinogen)
  - IARC: Supplement 7, 1987; Monograph 33, 1984 (related to Mineral oils, untreated and mildly treated)
    - Group 1 (carcinogenic to humans)

### Section 12 - Ecological Information

#### Ecotoxicity
- Similar materials have been tested and reported in API’s HPV’s data summary for Lubricating Oil Basestocks (Mar. 2003). Material is considered environmentally toxic and damaging on contact with plants, birds, and water mammals.
- Testing of various base oil samples:
  - Fish (rainbow trout) 96-h LC50: 1000 mg/L (measured); algae 96-h NOEC: 50% WAF (measured); daphnid 48-h LC-50: 10mg/l (measured); daphnid 21-d LL0: 1000mg/l WAF(measured).

#### Environmental Fate
- This product has not been tested. In ambient conditions, the product has minimal to no volatility into air. Any volatile component degrades by reaction with hydroxyl radicals, in the troposphere, under the influence of sunlight, with half-lives less than one day. These waxy hydrocarbon mixtures are not subject to hydrolysis reactions with water. This complex petroleum mixture is expected to partition primarily to soil and/or sediment.

#### Mobility
- This material is very waxy and sets up at normal room temperature. Mobility in the aquatic and atmospheric environment of these hydrocarbon mixtures is low due to low water solubility and low vapor pressure. These components will partition rapidly to the terrestrial compartment, where the main fate process is expected to be slow biodegradation of base oil components in soil and sediment.

#### Persistence/Degradability
- Similar products have been measured and shown to biodegrade in the environment under both aerobic (20-26% in 28 days) and anaerobic (86% in 28 days) with rates dependent of soil moisture, bacteria, and other conditions. Possibly hazardous short-term degradation products are not likely. Product is sticky, will solidify, and strongly adhere to soils and sediment. Recovery time for land and waters following a major spill is estimated to extend into months, possibly years.
Bioaccumulation/Accumulation
This product has not been tested, but is not expected to bioaccumulate in either terrestrial or aquatic systems. Spilled product will accumulate on the surface of plants, waterfowls and mammals, resulting in serious injury and possible death.

Section 13 - Disposal Considerations
North American Waste Number & Descriptions
A: General Material Information
This product is not known to be a hazardous waste according to US RCRA and Canadian regulations. The use, mixing or processing of this material may alter this product. Contact federal, provincial/state and local authorities in order to generate or ship a waste material associated with this product to ensure materials are handled appropriately and meet all criteria for disposal of hazardous waste. Vent to a burning flame at an appropriate facility. DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION.

B: Component Waste Numbers
No EPA Waste Numbers are applicable for this product’s components.

Section 14 - Transportation Information
US DOT Information
Shipping Name: Not regulated as a hazardous material for transportation.
Additional Information: This material is regulated under 49 CFR 130 (Regulations applicable to oil spill prevention and response plans) when transported by highway or rail.

TDG Information
Shipping Name: Not regulated as a hazardous material for transportation.

International Air Transport Association (IATA) Regulations
Shipping Name: Not regulated as a hazardous material for transportation.

International Maritime Dangerous Goods (IMDG) Code
Shipping Name: Not regulated as a hazardous material for transportation.

Section 15 - Regulatory Information
A: International Regulations
Components of this product have been checked against the following Chemical Control Inventories.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>US - TSCA</th>
<th>CANADA - DSL</th>
<th>EU - EINECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas oils, petroleum, heavy vacuum</td>
<td>64741-57-7</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

B: USA Federal & State Regulations
General Material Information
Federal, state, or local regulations may apply to spills or other emissions. Check individual U.S. state requirements.

USA OSHA Hazard Communication Class
HCS CLASS: MAY CAUSE CANCER
HCS CLASS: Irritating substance.

USA Right-to-Know - Federal
None of this product’s components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).
Material Safety Data Sheet
Material Name: VGO (Vacuum Gas Oil)

USA Right-to-Know - State
Trace 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>NJ</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas oils, petroleum, heavy vacuum (related to Mineral oil mist)</td>
<td>64741-57-7</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

C: Canadian Regulations - Federal and Provincial

Canadian Federal WHMIS IDL
The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>NJ</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas oils, petroleum, heavy vacuum</td>
<td>64741-57-7</td>
<td>1% (English item 1224, French Item 977) (related to Oil, mineral)</td>
<td></td>
</tr>
</tbody>
</table>

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

WHMIS Class D2A: Carcinogen
WHMIS Class D2B: Material causing other toxic effects.

Canadian Provincial Regulations
Federal, provincial or local regulations may apply to spills or other emissions. Check individual provincial and local requirements.

Section 16 - Other Information

Label Information
PRECAUTIONS: WARNING! This product is flammable when heated to high temperatures. This product is a darkly colored, thick waxy liquid with a heavy fuel oil odor. Prevent entry into ditches, sewers, and waterways. Small amounts of this product, if aspirated into the lungs, may cause mild to severe injury. This product may be irritating to the eyes, skin, and respiratory system. Ingestion or inhalation of heated vapors or mists may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision. May cause skin cancer.

FIRST AID: For more detailed medical emergency support information call 1-800-561-6682 ((NOVA Chemicals Emergency Response, 24 hours).
SKIN: Remove contaminated clothing. For skin contact, wash immediately with soap and water. Seek medical attention if irritation or dermatitis persists.
EYES: Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention at once.
INHALATION: Remove to fresh air. Assist breathing if necessary. Obtain medical attention.
INGESTION: If the material is swallowed, get immediate medical attention or advice -- DO NOT INDUCE VOMITING.
IN CASE OF A LARGE SPILL: Eliminate ignition sources. Keep upwind and out of low areas. Spill or leak area should be isolated immediately. Prevent entry into water intakes and waterways. Stop or reduce discharge if safe to do so. Contain discharge by booming on water or diking on ground. Remove material with non-sparking, approved pumps, skimmers or vacuum equipment. Absorb/adsorb residual materials with DRY earth, sand or other non-combustible materials. Soil remediation may be required.

References
Available on request.