



HELLENIC PETROLEUM S.A.

MATERIAL SAFETY DATA SHEET FOR HEAVY FUEL OIL, RME380, 4TH VERSION, APRIL 2008

1. PRODUCT AND COMPANY DATA

1.1 PRODUCT DATA :

CAS Number : 92045-14-2

UNECS Number : 295-396-7

USE : As external combustion fuel for different types of engines, mainly for industrial purposes (boilers, furnaces)

1.2 COMPANY DATA :

- HELLENIC PETROLEUM S.A., 17th km National Road Athens - Korinthos, 193 00 ASPROPYRGOS, GREECE
- EMERGENCY TELEPHONE NUMBERS : + 30 - 210 - 5533000, + 30 - 210 - 5539000
- PERSON RESPONSIBLE FOR MARKETING THE PRODUCT : Director of Supply, International Sales and Risk Management, tel. : + 30 - 210 - 5539090.

2. COMPOSITION / INFORMATION ON INGREDIENTS

Complex combination of saturated olefins and aromatic hydrocarbons, having carbon numbers predominantly in the range of C₂₀ - C₅₀. The mixture also contains asphaltenes, small quantities of heterocyclic components with sulphur, nitrogen and oxygen as well as traces of heavy metals (vanadium, nickel).

It is a mixture (partly or whole) produced from atmospheric residue and residue from thermal or catalytic cracking. It may also contain diesel or kerosene.

- **Hazardous components** : Polynuclear Aromatic Hydrocarbons, (mainly of 3-7 rings at 8% m/m if produced from atmospheric distillation and up to 20% if produced from thermal or catalytic cracking).

CLASSIFICATION OF THE MOST HAZARDOUS COMPONENTS *

- naphthalene Carcinogenic Category 3, Harmful Xn, Dangerous for the Environment N
Risk phrases : **R40, R22, R50/53**
- benzo{a}pyrene Carcinogenic Category 2 T, Mutagenic Category 2, Reproductive Toxicant Category 2, Dangerous for the Environment N
Risk phrases : **R45, R46, R60/61, R50/53**
- benzo{e}pyrene Carcinogenic Category 2 T, Dangerous for the Environment N
Risk phrases : **R45, R50/53**
- benzo{a}anthracene Carcinogenic Category 2 T, Dangerous for the Environment N
Risk phrases : **R45, R50/53**
- dibenzo{a,h}anthracene Carcinogenic Category 2 T, Dangerous for the Environment N
Risk phrases : **R45, R50/53**

3. HAZARDS IDENTIFICATION

SAFETY

- Risk of fire if product is heated to temperature higher than the flash point.
- Although heavy fuel oil RME380 is not classified as flammable, accumulation of light hydrocarbons vapors on storage tanks' top is possible, resulting to concentrations within explosion limits even under temperatures below the flash point.
- Risk of explosion/ignition if product comes in contact with warm surfaces or leaks through high-pressure piping.

+ According to Decision 41/2002 of the Supreme Chemical Council, Government Gazette 755B/2002



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HEALTH

- Under normal conditions of use, heavy fuel oil RME380 will not present a hazard to health, providing skin contact is avoided.
- Significant concentrations of hydrogen sulphide (H₂S), a particularly toxic gas, may arise due to product heating.
- Risks to health are minimized when the necessary precautions are taken, as storage and product handling take place in closed systems.

ATTENTION ! Due to product's high storage temperature, there is always a burn hazard

ENVIRONMENT

- Pollution of water resources with heavy fuel oil No3 can cause mortality to aquatic life.
- Large quantities of heavy fuel oil RME380 coming into contact with the ground are slowly absorbed.

CLASSIFICATION AND LABELLING OF PRODUCT ACCORDING TO DECISION 41/2002 OF THE SUPREME CHEMICAL COUNCIL

Carcinogenic Category 2, **T**
Dangerous for the Environment, **N**



Risk phrases : **R45 , R66, R52/53**

4. FIRST AID

SKIN

- Remove casualty from the incident area.
- Take off clothing.
- Wash carefully with cold water and neutral soap body parts which have come into contact with the product.
- DO NOT use kerosene, gasoline or solvents.
- If skin inflammation persists, IMMEDIATELY call for medical assistance.

EYES

- Remove casualty from the incident area.
- Wash eyes carefully with plenty of running water for 15', keeping eyelids open.
- If inflammation persists after washing, immediately call for medical assistance – refer to oculist.
- DO NOT administer collyrium or other liquid without medical approval.

INGESTION

- Remove casualty to a quiet, cool and well ventilated place.
- DO NOT induce vomiting (risk of pulmonary complications).
- Place casualty in supine position, with feet slightly elevated.
- Loosen belt and collar, cover with blanket.
- If patient is not breathing, apply artificial respiration.
- Seek medical assistance.
- Gastric lavage should only be done after endotracheal intubation in view of the risk of aspiration which can cause pulmonary edema.

INHALATION

Remove patient to a quiet, cool and well ventilated place.

A. If patient remains conscious

- Place patient in supine position, with feet slightly elevated.
- Loosen belt and collar, cover with blanket.
- Seek medical assistance.

B. If patient is unconscious or is conscious but breathes with difficulty

- Seek medical assistance immediately.
- Place patient in supine position, with feet slightly elevated.
- Loosen belt and collar, cover with blanket.
- Provide oxygen, check respiration and pulse.
- If necessary, provide external cardiac massage.



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C. If patient is not breathing

- Apply artificial respiration.
- Seek medical assistance immediately.
- Place casualty in supine position, with feet slightly elevated.
- Loosen belt and collar, cover with blanket.
- Provide oxygen if respiration is restored. Check respiration and pulse.
- If necessary, provide external cardiac massage.

USEFUL ADVICE

- In serious cases of skin contact, surgical intervention and special treatment may be necessary in order to minimize tissue damage and loss of nerve function.
- Special examination is required to determine the excess of the damage.
- DO NOT use local anesthetics or hot soaks.
- Prolonged exposure to high hydrogen sulphide (H₂S) concentrations may cause chemical pneumonitis or/and pulmonary edema. Therefore, it is recommended the patient remains hospitalized.

5. FIRE FIGHTING MEASURES

- The most effective extinguishing agents are dry powder, foam and carbon dioxide.
- Water must be used ONLY for cooling tanks and containers exposed to fire.
- Escape routes must always be open.
- Large fires are faced by properly trained personnel.

6. ACCIDENTAL RELEASE MEASURES

GROUND SPILLS

- Isolate spill.
- Evacuate area of people not involved in dealing with the incident.
- Electrical equipment that is not explosion proof must cease to operate.
- Ensure absorption of leaked heavy fuel oil RME380 with sand or other neutral material, carefully transport to special containers, and wash area with water.
ATTENTION! Leaks make surfaces slippery
- Avoid washing into drainage systems.
- In case of leak or spill without fire, use water in spray form to order to disperse possible vapors and protect staff dealing with the incident.
- In case of large spills, inform inhabitants of surrounding area who are considered to be at greatest risk.
- Alert local authorities in case product pollutes soil, water or vegetation.

SEA SPILLS

- Spills from ships are faced according to Appendix of Protocol 1978 of the International Treaty 1973 and its amendments (MARPOL 73/78).
- Leaking quantities of heavy fuel oil No3 are blocked though the use of floating barriers and are removed by skimming and with the use of special absorbing materials.
- Alert coast guard, nearest port, local authorities and shipowner Company involved in incident.

7. HANDLING AND STORAGE

- storage / delivery temperature. °C : 55-70
- Produce and transport heavy fuel oil through secluded systems to avoid health and environmental risks. During mixing, asphaltenes –polar aromatic compounds with great molecular weight (2000-5000)-must remain suspended in the temperatures designated above.
- The design, construction and maintenance of storage spaces must be performed according to relevant legislation. The heating elements and their corresponding thermostats are always placed below the level of the tank draw off line. Storage facilities must be insulated, well ventilated, kept away from oxidizers, heat sources or any other ignition source.
- It is important to earth storage tanks, transportation and sampling systems to prevent spark risk and accumulation of electrostatic charges.
- The superior part of the storage tank is potentially flammable due to the possibility of lighter hydrocarbons' vapor creation. Harmful concentrations of H₂S may arise in this part as well as within the transportation equipment. In order to minimize exposure some preventive measures must be taken (upwind positioning, good ventilation, use of respiratory apparatuses and constant air-measurements).
- It is important to label containers properly and keep them closed, away from children.



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- When high concentrations of vapors or mists occur and it is not possible to make alterations, it is necessary to install general / local explosion-proof ventilation systems in order to keep concentrations at acceptable levels.
- Areas where large quantities of heavy fuel oil are stored must have special fire-fighting systems and Emergency Plans according to relevant legislation.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1. EXPOSURE LIMITS

- Although no occupational exposure limits have been established for heavy fuel oils, exposure to the product should be reduced to a minimum.
- Hydrogen sulphide is a component of the vapors that accumulate at the tanks' top.
for hydrogen sulphide (Government Gazette 94A/99)
 - TWA for 8 hours exposure : 10 ppm
 - Short term exposure: 15 ppm
- for naphthalene (Government Gazette 94A/99) :
 - TWA for 8 hours exposure : 10 ppm
- for benzo(a)pyrene (Government Gazette 94A/99) :
 - TWA for 8 hours exposure : 0.005 mg/m³

8.2. EXPOSURE CONTROLS

- Product exhibits a relatively low volatility under normal conditions. Hazardous concentrations of vapor/mist are likely to occur only under higher temperature. Leaking quantities finish up in water reservoirs and in the ground. Lighter components evaporate.
- Cleaning, inspection and maintenance of heavy fuel oil storage tanks require the implementation of strict procedures and precautions, such as issuing of relevant work permits, gas freeing, use of safety belts and air-supplied breathing apparatuses.
- Avoid ingestion, contact with eyes and skin, as well as inhalation of heavy fuel oil No3 vapors/mist. Prolonged skin exposure is considered the most dangerous means of exposure.
- Exposure to product can arise from both industrial activities (due to mishandling) and extensive use (e.g. spilling of small quantities during filling of vehicle tanks) or indirectly as a consequence of leakages or spills. Emissions during production are low and concentrations in the distillery are considered negligible.
- Entrance in secluded spaces is prohibited when hydrogen sulphide concentration is >10 ppm, available oxygen <20% v/v and gases >1% of the Lower Explosion Limit (LEL). These parameters must be measured regularly. There must always be personnel outside the storage tank in case of emergency with an abundance of personal protection equipment.
- It is necessary to keep rules of personal hygiene.

PERSONAL PROTECTIVE EQUIPMENT

- When skin contact is possible, use impervious nitrile or neoprene gloves (EN 374, 388, 407, 420), appropriate protective clothing (EN 340, 465, 466, 467) and safety shoes (EN 345, 346).
- When contact with eyes is possible, use goggles or face shields (EN 166, CR 13464).
- Use full face masks with filters for organic vapors/mist in case of minor spills (EN 136, 141) with no hydrogen sulphide presence.
- Use individual air-supplied breathing apparatuses (EN 137), impervious overalls, boots, gloves, during cleaning and inspection of equipment, as well as in major spill incidents.
- In case of large scale fires, use fire resistant overalls (EN 469, 1486) and individual air-supplied breathing apparatuses (EN 137).

ATTENTION !

- Protective clothing must be washed carefully after each use if it comes into contact with the product.
- DO NOT use gasoline or kerosene to remove heavy fuel oil from skin or clothes.
- Footwear permeated with the product must be discarded.
- Risk of burning when in contact with tubing that lacks insulation.

9. PHYSICAL AND CHEMICAL PROPERTIES *

Dark-colored (dark brown to black) viscous colloid liquid, with heavy, characteristic odour.

- Viscosity at 50 °C, cSt : 181-380
- Density at 15°C, kg/m³ : max. 991
- Flash point, °C : min. 66
- Autoignition temp. °C : 220-300
- Lower Explosion Limit (LEL), %v/v : 1
- Upper Explosion Limit (UEL), % v/v : 6

* According to current specifications, Supreme Chemical Council Decision 173B/2007



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10. STABILITY AND REACTIVITY

- Thermal Stability : Stable
- Conditions to be avoided :
Very high temperatures, heat sources, naked flames and other sources of ignition
- Materials to be avoided : halogens, strong acids and oxidizers, alkalis
- Hazardous decomposition products :
It does not decompose under ambient temperatures
- Hazardous products of thermal cracking :
Carbon monoxide and dioxide, nitrogen oxides, sulphur dioxide, hydrogen sulphide, unburned hydrocarbons, polynuclear aromatic hydrocarbons, particulates. Ash from heavy fuel oil burning contains heavy metal oxides.

11. TOXICOLOGICAL INFORMATION

Indicative values for the acute toxicity of heavy fuel oil RME380:

LD₅₀ (oral rats) > 5 g/kg

LD₅₀ (skin, rabbits) > 2 g/kg

Some of the polynuclear aromatic hydrocarbons have carcinogenic effects on animals, which have not been ascertained on humans.

No mutagenic effects have been ascertained.

SKIN

- Excessive or/and repeated contact with skin (directly or through contaminated clothes) might cause dryness, irritation, and dermatitis.
- In rare cases, prolonged exposure can cause permanent skin disorders that might evolve to skin cancer, due to presence of polynuclear aromatic hydrocarbons.

EYES

- Contact of eyes with heavy fuel oil droplets or highly concentrated mist causes irritation and burns if the product's temperature is at high levels.

INHALATION

- Due to heavy fuel oil low volatility there is no risk of inhalation under normal temperatures.
- In high temperatures and under conditions of inadequate ventilation, inhalation of vapors gradually causes irritation to nose and throat, headache, shivering, spasms, nausea and mental confusion.
- Prolonged inhalation of high concentrations of heavy fuel oil vapor may result in respiratory and nervous system depression, with eventual loss of consciousness.
- As temperature rises, hydrogen sulphide –particularly toxic– is emitted. Concentrations above the ones mentioned in paragraph 8.1 cause headache, dizziness, nausea, irritation of the eyes and of the upper respiratory tract. If concentrations exceed 500 ppm, eventual loss of consciousness is observed. Finally, concentration that exceeds 1000 ppm provokes instant death.

ATTENTION !

Risk of poisoning is magnified when exposure to H₂S is prolonged because smell grows accustomed to its presence.

INGESTION

- Considered unlikely because of the product's nature and its handling temperature. In such a case however, it causes inflammation of the gastrointestinal tract.
- Vomiting is possible but this should not be induced.
- Aspiration of liquid into the lungs (either directly or as a result of vomiting) causes damage to the lung tissue, with possible risk of chemical pneumonitis (possibly lethal in serious cases).

12. ECOLOGICAL INFORMATION

- Releases of heavy fuel oil into water will result in films of hydrocarbons floating and spreading on the surface.
- Volatilization is an important loss process for the lighter components because they exhibit a higher vapor pressure under ambient temperatures. In the air, the hydrocarbon constituents of heavy fuel oil No3 react readily with hydroxyl radicals, and their half-life is less than one day.
- The water-soluble part which contains mostly aromatic hydrocarbons and polar compounds is responsible for toxic effects on marine life. The heavier part is deposited as sediment. This process has a long-term impact on marine life and coastal zones.
- There are indications that heavy fuel oil biodegradability is slow and depends on the components structure.
- The bioaccumulation tendency is practically limited due to the metabolic process. The log K_{ow} values vary between 2.7 and >6 (K_{ow} = Octanol /Water Partition Coefficient).
- In case small quantities of heavy fuel oil come into contact with the soil, the natural process is absorption from the superior aerobic layers and aerobic degradation.
- In cases of soil pollution with significant quantities of heavy fuel oil, the main part will penetrate the anaerobic layers where degradation is practically absent, possibly reaching the groundwater level.



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13. DISPOSAL

- Disposal of the product (usually through burning) must be according to relevant legislation.
- The approval of local authorities is required through recognized waste contractor
- Do not dispose in sewers. Highly contaminated material must be incinerated.
- Ash originating from burning is considered a hazardous waste.
- In case of sea pollution product is collected and discarded to the soil according to legislation.

14. TRANSPORT INFORMATION

- Transportation through : tankers, tank – trucks, trains
- Transport Temperature, °C : 55-70
- Road / Rail transport : ADR/RID 2003 :
Not classified for road and rail transport.
Sea transport (Government Gazette 272A/96):
Class : 3.3

15. REGULATORY INFORMATION

Safety phrases (According to Decision 41/2002 of the Supreme Chemical Council)

- S45** In case of accident or if you feel unwell, seek medical advice immediately
S53 Avoid exposure – obtain special instructions before use
S61 Avoid release to the environment. Refer to special instructions / MSDS

16. OTHER INFORMATION

16.1. Full text of relevant Risk phrases, referred in paragr. 2 and 3 of the present MSDS

- R22** Harmful if swallowed (*naphthalene*).
R40 Limited evidence of a carcinogenic effect (*naphthalene*).
R45 May cause cancer (*benzo{a}pyrene, benzo{e}pyrene, benzo{a}anthracene, dibenzo[a,h]anthracene, product*).
R46 May cause heritable genetic damage (*benzo{a}pyrene*).
R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment (*naphthalene, benzo{a}pyrene, benzo{e}pyrene, benzo{a}anthracene, dibenzo[a,h]anthracene*).
R52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment (product).
R60/61 May impair fertility and may cause harm to the unborn child (*benzo{a}pyrene*).
R66 Repeated exposure may cause skin dryness or cracking (product)

16.2. Recommended restrictions on use

Use the product exclusively as external combustion fuel for bunkers

16.3. Training advice

The information of the present document, may be used for training purposes

16.4. References

This MSDS is based on current legislation guidelines for the compilation of Safety Data Sheets (Decision 195/2002 of the Supreme Chemical Council), and on information from bibliography according to the latest scientific developments. Will be updated according to REACH requirements

Technical contact point : Chr. Kotsiki, tel.: +30-210-5539148.

NOTE

The above information and recommendations concern only the specific material, as determined above, and may not apply for the same material if used in combination with any other material or in any process. They are accurate and reliable, according to data which HELLENIC PETROLEUM S.A. had available on the above date. However, HELLENIC PETROLEUM S.A. cannot guarantee their accuracy and reliability and does not assume any responsibility for loss or damage which may arise from the use of the above materials. The present SDS is supplied to consumers for them to consider and judge their adequacy concerning the particular use of the material (the attention of consumers is particularly urged in case of changes in the packing of the above product).