Safety Data Sheets: Petroleum Industry Practices

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Regulatory and Scientific Affairs Department

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Safety Data Sheets: Petroleum Industry Practices

Executive Summary

This document presents a summary of how petroleum industry companies develop and distribute Safety Data Sheets (SDSs)¹ for purposes of hazard communication. To the extent possible, this summary addresses the specific issue of how hazard information regarding MARPOL Annex I cargoes and marine fuels is communicated to shippers and seafarers.

Petroleum industry companies prepare SDSs to meet the legal requirements of the countries in which they market products and distribute materials, with the guidance of international standards such as those published by the American National Standards Institute (ANSI) and the International Standards Organization (ISO). These requirements and standards are moving toward convergence around an internationally harmonized system for SDS format and content—the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). There is international consensus on the need to achieve more conformity among SDSs globally, because inconsistency in format and content impedes effective hazard communication.

In a typical petroleum industry company, SDSs are authored by a multidisciplinary group devoted to the purpose, staffed by experts in fields such as toxicology, industrial hygiene, environmental science, and regulatory compliance. These groups use state-of-the art scientific information to characterize the hazards of each material and to accurately communicate the associated warnings and precautions through the SDS. Petroleum substances are well-characterized materials, and there is a solid body of information used by SDS authors to thoroughly communicate associated health and environmental hazards.

In major petroleum companies, SDSs are stored in electronic databases and distributed to customers and other requestors in a variety of ways. In petroleum industry companies that own and operate ships, seafarers are trained within the overall hazard communication framework of the company. It is the responsibility of the company that operates a ship to ensure the safety of its crewmembers, and this includes use of SDSs authored by petroleum companies for Annex I cargoes and marine fuels.

Petroleum companies generate a variety of quality control data (e.g., physical/chemical property data) on products (e.g., fuels and oils). These data are used for commercial purposes, to assure the manufacturer and its customers that

¹ In the U.S., the data sheets are called material safety data sheets (MSDSs). The term SDS is used in this document to refer to safety data sheets in general, and MSDS is used when referring specifically to U.S. Occupational Safety and Health (OSHA) requirements.

products meet specifications. Quality control data are provided to customers, with some data provided to shippers as discussed herein. Quality control data generally are not used in the SDS authoring process—rather, an SDS is developed based on the specification for a product. When data indicate a range for a property (e.g., flash point), the conservative end of the range is used to characterize hazard. This document provides some information on quality control data, to clarify the distinction between the commercial data generated for quality control purposes and the health, environmental, and safety information used to produce an SDS.

The SDS is only one element of a comprehensive hazard communication program. This paper includes brief information on other key elements of a hazard communication program, to provide context on the role of the SDS. Based on interviews conducted for this project, current SDS practices of the major petroleum companies produce high-quality SDSs, which are appropriate and valuable tools for use within a hazard communication system.

I. Introduction

In October 2008, the American Petroleum Institute (API) conducted a review of member company practices for development and delivery of SDSs and hazard communication to shippers and seafarers. The information presented in this document applies to practices for MARPOL Annex I type cargoes and marine fuel oils (e.g., crude oils; fuel and residual oils; unfinished distillates, hydraulic oils, and lubricating oils; gas oils; kerosenes; naphthas and condensates; gasoline blending stocks; gasoline and spirits; and asphalt solutions).

API also reviewed relevant hazard communication regulations and standards, as well as example API member company SDSs. The goal of this document is to summarize the information API collected on petroleum industry practices for SDSs and hazard communication relevant to shippers and seafarers.

II. The SDS as One Element of a Hazard Communication Program

An SDS is not a standalone tool or an all-purpose instrument. Rather, under various regulatory schemes around the world, the SDS is intended to be one element of a hazard communication program. For example, under U.S. Occupational Safety and Health Administration (OSHA) hazard communication requirements, employers are required to:

- have a written hazard communication plan that is available to all employees;
- maintain a hazardous chemical inventory;
- maintain an MSDS for every hazardous chemical on site and make MSDSs accessible to all shifts;

- ensure that all containers of chemicals are labeled with the identity of the material and its hazard warnings; and
- provide employees with information and training on the hazards of materials in their workplace.

Other countries also have comprehensive requirements for hazard communication programs, of which the SDS is only one element. OSHA and other country requirements do not cover activities of ships on the water, but country requirements drive preparation of the SDS and define its essential purpose and scope.

In a comprehensive hazard communication program, information is presented to workers through training, day-to-day communication, and established procedures and practices. Employers use communication and training tools such as in-person training, computer-based training, summary sheets, slides, signs, and so forth. The SDS is a relatively complete reference document, but it may not be the primary reference for the worker. Labels are likely the information source that workers most commonly read.

Some companies produce hazard summary documents that are targeted for those working with the materials (and supplement the SDS). These summary documents highlight key points such as required personal protective equipment (PPE) and what to do in case of a spill, and do not include less action-oriented information such as regulatory citations and toxicity data. The International Programme on Chemical Safety (IPCS) has developed a program to promote the use of International Chemical Safety Cards (ICSCs). An ICSC summarizes essential health and safety information on chemicals for their use in work places. An ICSC includes standard phrases summarizing health and safety information collected, verified and peer reviewed by internationally recognized experts, taking into account advice from manufacturers and Poison Control Centers.

In addition to hazard communication programs, companies also have programs for transportation compliance, which address requirements for transportation classification, labels and placards, packaging, and so forth.

Specific to the marine environment, U.S. Coast Guard Navigation and Vessel Inspection Circular No. 3-92 (NVIC 3-92) provides voluntary guidance to the marine industry on implementing a health and safety program. NVIC 3-92 covers topics including health risk assessment, exposure monitoring, exposure control, training, recordkeeping, and program audits. Effective hazard communication is best achieved through a comprehensive hazard communication program tailored to the setting (e.g., the marine environment).

III. SDS Regulations and Standards

A. Country-Specific Laws and International Standards

All member companies interviewed reported that they develop SDSs for their products and crude oils, including MARPOL Annex I cargoes and marine fuels, to meet the specific requirements of the countries in which their materials will be distributed. Country-specific regulations are the primary drivers of SDS format and content. Distinct SDS and hazard communication laws are in place in the U.S., EU, Canada, Japan, Mexico, and many other countries. Country requirements may address format (e.g., sections of the SDS) and/or content (e.g., hazard classifications, risk phrases, precautionary statements, occupational exposure limits). One interviewee reported that SDSs are produced for approximately 100 countries. SDSs are produced in dozens of languages.

Petroleum industry companies have internal guidelines for SDS preparation, which are applied to all company SDSs. Internal standards start with country-specific requirements, and use countryspecific SDS templates that reflect the data elements and other SDS parameters (e.g., format, language) required by each country. Major petroleum companies have professionals whose primary job is to track regulations around the world that impact SDSs and hazard communication. Company internal guidelines also are based on standards such as ANSI Z400.1 and ISO 11014 (discussed directly below). When a country requirement is not clear on required information such as occupational exposure thresholds, companies may use commonly accepted values such as those established by the American Conference of Industrial Hygienists (ACGIH).

The EU petroleum industry group Conservation of Clean Air and Water in Europe (CONCAWE) has issued a guidance document *Classification and Labelling of Petroleum Substances According to the EU Dangerous Substances Directive*. That document provides detailed guidance on classification and labeling, including for materials that are Annex I cargoes and marine fuels.

The OSHA hazard communication standard is performance-based and does not contain details on the format and content of SDSs. Thus, in 1993, ANSI developed ANSI Z400.1: *American National Standard for Hazardous Industrial Chemicals* — *Material Safety Data Sheets* — *Preparation*. The ANSI standard was developed to address the need for an MSDS format that is comprehensive, understandable, and consistent. The standard guides preparation of MSDSs to meet U.S. requirements, but is flexible enough to be used as a framework for

SDSs in other countries as well. Some API members report that they use the ANSI standard to guide SDS preparation for countries in which there are no SDS requirements or only very general requirements. Another standard commonly consulted is ISO 11014. Appendix A contains additional information on and references for selected standards and local laws.

B. GHS Implementation

The United Nations (UN) has adopted the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).² Countries around the world are in the process of incorporating GHS "building blocks" into their regulatory frameworks. GHS prescribes harmonized criteria for the classification of health, physical, and environmental hazards, and specifies what information should be included on labels and SDSs for hazardous materials (which include MARPOL Annex I type cargoes and fuels). GHS includes a 16-section SDS format, with descriptions of the data elements to be provided in each section. Three examples of GHS conformant SDSs (for Petroleum Crude Oil, Bunker Fuels 500, and Diesoline) are provided in Appendix B.

Some API member companies report that they are moving toward GHS format for SDSs in advance of full GHS implementation in individual countries, to the extent possible while still maintaining compliance with current local laws. Companies are working toward evaluating all of their products and crude oils for GHS classification, so they can move quickly as countries around the world implement GHS. Another driving factor is customer requests—customers around the world increasingly request GHS conformant SDSs even when not legally required.

In September 2008, the European Parliament approved legislation that would adopt the GHS into European Union (EU) law. GHS for chemical substances will be incorporated into EU law starting in 2010, with provisions for mixtures taking effect in 2015. Petroleum companies have begun the rollout of GHS conformant labels and SDSs for the EU.

Implementation of GHS in the U.S. as it relates to SDSs and labels for industrial products is the responsibility of OSHA, which will need to propose and publish regulations to implement it. OSHA requested comments on an Advance Notice of Proposed Rulemaking in September 2006³ and is in the process of writing a Notice of Proposed Rulemaking.

² Globally Harmonized System of Classification and Labeling of Chemicals (GHS), Second revised edition, United Nations, ST/SG/AC.10/30/Rev.2 ("GHS"), 2007.

³ 71 *FR* 53617-53627, September 12, 2006.

Countries in the Asia-Pacific region have been early to implement GHS. New Zealand was the first to implement GHS and required GHS compliance by July 1, 2008. Taiwan will require GHS compliance by December 31, 2008. Petroleum companies have rolled out GHS compliant SDSs and labels for these countries.

GHS notwithstanding, companies will need to produce varying countryspecific SDSs for the foreseeable future because GHS implementation is advancing at different paces and in different forms around the world. Although countries are using the building blocks of GHS, there will still be inconsistencies among country requirements even after GHS implementation due to countries using different building blocks and constructing them in their own ways. Furthermore, the need to produce SDSs in different languages will persist.

C. Guidance Specific to Marine Transport

*The International Safety Guide for Oil Tankers and Terminals (ISGOTT)*⁴ contains safety guidance for tankers and terminals. *ISGOTT* provides guidance on exposure limits, PPE, and procedures for handling cargo and bunker fuels containing benzene and H₂S. The guidance on these practices is consistent with petroleum industry practice. *ISGOTT* also includes some guidance on SDSs that is derived from proposed MSC.150(77), including that the SDS should indicate the type and probable concentrations of hazardous or toxic components in the cargo or bunkers to be loaded, particularly H₂S and benzene.

U.S. Coast Guard NVIC 3-92 describes a recommended program for protection of merchant mariners from occupational health problems. NVIC 3-92 includes guidance on hazard assessment and communication for the ship environment, exposure monitoring and control, training, and other hazard communication program elements. NVIC 3-92 does not address SDS format or content, but rather focuses on hazard communication *systems* in the marine transport environment.

IV. SDS Creation Processes

API member companies each have their own system to author and produce SDSs. Although each system is unique to the particular company, interviews with API member companies identified some important common elements in SDS systems.

• Each company has a group devoted to SDSs, staffed by multidisciplinary professionals.

⁴ Oil Companies International Marine Forum (OCIMF) and International Chamber of Shipping (ICS), *International Safety Guide for Oil Tankers and Terminals*, 5th edition, 2006.

- The primary goal of SDS authors is to produce SDSs that thoroughly and accurately communicate the hazards of the material, with as much consistency as possible given various regulations around the world.
- SDSs are prepared and maintained in central systems, then distributed to various businesses, customers, and other handlers—including shippers.
- SDS systems are supported by information technology (IT) platforms that usually are linked to other business systems such as those that control manufacturing, distribution, and sales.

The workflow, expertise, and information management systems behind SDS preparation are discussed further below. All of this information applies to preparation of SDSs for MARPOL Annex I type cargoes and marine fuels.

A. Workflow

Creation of an SDS starts with a request from a business. The business submits basic information on the product or material to the product stewardship group.⁵ The information the business submits to product stewardship includes the material identity and composition, and physical/chemical properties based on the specification sheet for the product. (See Section IV below for more discussion of physical/chemical property information.) SDS authors request any additional information about material characteristics that may be necessary for assessing the hazards of the material.

SDS authors begin to create the SDS with the information provided by the business, and then use available data to make hazard classifications. Often, authors use toxicology and other information for single chemicals to do an evaluation of the hazards of a mixture. API member companies use IT platforms that contain chemical, regulatory, toxicology, environmental, safety, and other data. Product stewards use information that is stored in internal databases and available from external sources (e.g., databases of scientific literature). They use their IT systems to input data and other information needed to create the SDS.

IT systems typically contain rules or guidance to promote consistency in SDS phrases. Most systems can generate SDS statements automatically based on hazard classifications assigned by the SDS author. These IT systems are powerful tools, but ultimately it is the responsibility of the SDS author to determine the appropriate content for each section of the SDS.

⁵ The names of such groups vary by company, e.g., Product Stewardship, Product Regulatory Support, or Product Safety. "Product stewardship" is used herein as a generic term for these staff groups.

The primary goal of SDS authors is to produce SDSs that thoroughly and accurately communicate the hazards of the subject material, taking into account various potential exposure scenarios. Systems are designed to achieve as much consistency of communication as possible given disparate global regulations. Clear hazard communication would be hindered by inconsistency (e.g., labeling a chemical a carcinogen in one country and not another), so companies standardize phrases and other information—to the extent possible to achieve congruence in SDSs.

After a draft SDS has been created, it goes through an established review process that may involve review by other product stewards and/or the requesting business or site. Product stewardship groups use a team approach to take advantage of the variety of expertise in the groups. Final SDSs are loaded into a database or other electronic repository. (See Section IV.C for more discussion of information management systems.) Product stewards are responsible for maintaining the documentation for the information on the SDS (e.g., toxicology or environmental data), and this documentation can often be housed in the same database as the SDSs, although usually in a separate portion of the database.

The process for *revising* an SDS is basically the same as creating a new one. Revisions may be triggered by a formulation change, new information on hazards, or changes in regulations. Some companies have policies of reviewing SDSs on a regular basis, e.g., once every three years. Companies have procedures that require businesses to request a new or revised SDS whenever they create or obtain new products or change product specifications. Some customers request revised SDSs on a regular basis.

Petroleum companies receive many SDSs from other companies for purchased materials. These may be scanned directly into the SDS system and made available to company workers, but are usually not altered in the process. Whether a company is in the role of sender or receiver, the company requires an SDS for materials shipped, compliant with the laws of the relevant country. If a product is manufactured or imported by the company, it would have a company SDS. For a product or other material received from another company, an SDS is requested from the supplier.

API member company SDS systems include SDSs for thousands of materials. The number of SDSs for MARPOL Annex I type cargoes and marine fuel oils would be on the order of tens or dozens of materials. Although a typical company system would have SDSs for a few thousand products (both manufactured and purchased), the total number of SDS documents on a company system can reach 100,000 when all versions (e.g., different languages) are considered.

B. Expertise

Product stewardship groups in API member companies usually comprise professionals and technical staff with a variety of expertise. Larger companies have 20 – 30 staff devoted to product stewardship and SDS authoring. Product stewardship groups generally include or have access to professionals in chemistry, toxicology, industrial hygiene, occupational health, environmental science, and other relevant sciences—with many professionals at the PhD level. Teams also may include pharmacists, regulatory professionals, quality control, and technical staff. Significant scientific and other professional resources and expertise are behind the content of each SDS.

Product stewards may work in one central location, or at a few locations, depending on the company. Team members regularly consult one another for specific areas of expertise (e.g., an SDS author might go to a toxicologist or environmental science colleague with a question on data or interpretation of it). Companies typically have separate groups that address transportation issues including compliance with national and international classification (e.g., proper shipping names), labeling, packaging, and other transportation requirements.

C. Information Management Systems

API members use sophisticated IT platforms to manage the authoring, storage , and distribution of SDSs. Many use proprietary systems purchased from IT providers and some have developed their own systems. Available IT solutions for SDS management include ProSteward by CGI, the Wercs, and the EHS module of SAP.

A typical IT platform for SDS authoring and management contains thousands of SDS phrases, including phrases in multiple languages and in compliance with multiple regulations. An SDS IT platform usually contains product classifications and transportation classifications as defined under various regulatory schemes (e.g., in the EU, Canada, under GHS). Systems include a document management function to house thousands of SDSs. Some systems have a function to store underlying data, e.g., full toxicology studies. In many systems, the SDS system is directly linked to other IT systems such as those for manufacturing, sales, and distribution. This creates a clear link between a material and its SDS, and facilitates automatic distribution of SDSs. For instance, the system can be programmed to send an SDS with every shipment, with the first shipment of each material to each customer in a given year, and so forth.

Most companies make SDSs available to all businesses and employees via intranet access to the main SDS database. Some companies or businesses within companies also post SDSs on a web site for external access (e.g., for customers or other handlers).

V. SDS Information

Information on basic material properties originates from the business functions in companies, not product stewardship groups or SDS authors. Businesses generate and "own" information including identification of the substance or mixture and of the supplier (GHS SDS Section 1), composition/information on ingredients (GHS SDS Section 3), and physical and chemical properties (GHS SDS Section 9). SDS authors start with this information and then apply their scientific expertise to create the rest of the content of an SDS.

A. Substance Identification and Composition Information

SDSs may be produced at a more general level than specification sheets. For instance, several different fuel oils with different sulfur content (and thus different specification sheets) could all have the same Chemical Abstracts Service (CAS) Number⁶, substance name, and SDS. This is appropriate because the hazards of the different "flavors" of fuel oil are identical. In this example, the fuel oils would all have the same hydrogen sulfide warning. If a fuel oil had, for example, a lower flash point that resulted in a different flammability category, a separate SDS would be created for it. Some companies produce a distinct SDS for each trade name of a product, but others are moving away from this in order to reduce redundancy in the SDS system.

SDS information management systems link product codes to SDSs, and it is not unusual for more than one product code to be associated with the same SDS. For examples of the level of substance identification on some petroleum product SDS, see the sample SDSs in Appendix B.

Composition information for an SDS comes from the business. Product stewards request information on specific components (e.g., benzene) as necessary to ensure correct SDS information on hazards and precautions. For instance, if benzene content of a product

⁶ CAS establishes unique identifying numbers for chemicals, which are used worldwide. There are also other numbering systems used within some countries and regions (e.g., EINECS number in the EU), for chemical inventory purposes.

changed from 1% to 2%, there would be no change in hazard, warnings, and precautions—the same carcinogen phrases would be used in either case.

SDS authors may need composition information to determine whether specific requirements apply. For example, U.S. Coast Guard regulations at 46 *CFR* Part 197 for marine occupational safety and health contain a standard for benzene (Subpart C) that applies to vessels of U.S. registry that are carrying liquids with benzene at or above 0.5%.⁷ Therefore, it is necessary to identify which materials have benzene concentration at or above 0.5%. However, for purposes of the SDS, the benzene concentration may be reported as a range, with the maximum value driving the hazard warning statements and regulatory applicability determinations.

B. Physical/Chemical Property Information

Physical/chemical property information on an SDS is based on product specifications received from the business. The information is usually in ranges, which is sufficient information to accurately characterize the hazards of the material. Product stewardship groups often use forms to collect the physical/chemical property information that is necessary to characterize hazards, and request additional information if necessary to accurately assign specific hazard categories for each endpoint. Product stewards request additional analysis from a business if necessary for a complete hazard characterization. Some physical/chemical property information available from specification sheets may be irrelevant to health, environmental, and safety issues (e.g., pour point and cloud point), and they typically are not required or included on SDSs.

The purpose of physical/chemical property information on an SDS is to identify associated hazards (e.g., flammable, severe irritation) and provide the precautions necessary to protect workers from the hazard. Warnings and precautions are triggered by hazard classifications that are associated with ranges or limits, not specific values. If the range of data for a product straddles more than one hazard classification, companies use the most conservative hazard classification.

C. Warning, Precautions, and Other SDS Information

Most SDS information beyond substance identification, ingredients, and physical/chemical properties is developed by product

⁷ The benzene standard contains requirements for permissible exposure limits, regulated areas, programs to reduce exposure, respiratory protection, medical surveillance, and other activities.

stewardship staff and incorporated into the SDS through the authoring process. SDS authors (in consultation with relevant experts such as toxicologists and industrial hygienists) assess health and environmental hazards and ensure that appropriate warnings and precautions appear on the SDS. Phrases for first aid and firefighting measures, accidental release measures, handling and storage, exposure controls/personal protection, and regulatory information are usually determined using database rules or internal guidance. Standard phrases are linked to and generated from hazard classifications.

Warnings and advice are based on properties and components of a material. For example, a company may have standard warning and advice on the SDS for a material that contains hydrogen sulfide (which would include some MARPOL Annex I cargoes and fuels). A company may have two separate sets of standard warnings: (1) materials with known hazardous concentrations of hydrogen sulfide, and (2) materials where the levels are low, but the potential for further generation via decomposition is possible (which is almost always presumed). The warnings would differ somewhat in SDS Section 2 on hazards identification. However, the remaining SDS information would be identical in the two sets for warnings for first aid measures, fire fighting measures, handling and storage, exposure controls and personal protection, and stability and reactivity.

Petroleum companies have decades of experience producing SDSs for their products. At this point, the health, environmental, and safety hazards are very well understood for the vast majority of petroleum products. The warnings and precaution statements used on SDSs are validated with the best available information in the scientific literature, and updated when that information changes. The computerized systems that petroleum companies used help ensure accuracy and consistency of the warning and precautions on SDSs.

VI. SDS Distribution

As described in Section IV.C, API member companies have central electronic repositories of SDSs, which include SDSs for MARPOL Annex I type cargoes and marine fuels. Many of these systems have all SDSs available for internal access and a subset available for external access (e.g., to customers). It is not necessary to have all SDSs available for external access because some materials are limited to company sites (e.g., intermediate refinery streams). Some IT platforms integrate the SDS distribution process with product sales and distribution. For example, a computer routine reviews sales data nightly, checks whether the current SDS for the product sold that day has already been sent to the customer, and generates and sends an SDS if necessary.

These systems contain information fields with the preferred customer method and contact information (e.g., fail, e-mail, mail) for receiving SDSs. They are also programmed to send SDSs at the frequency required by law and/or requested by the customer. Some businesses routinely send an SDS with every shipment. In some instances, petroleum companies have noted that third party distributors (e.g., carriers, terminals) may not receive the same automatic distribution as customers. In these cases, some companies provide the third parties with SDSs by CD or other method.

In the case where a major petroleum company owns and operates marine vessels, the shipping employees are included within the hazard communication framework of the company as if they were located at a stationary site. A health/environment/safety professional covers these employees with a hazard communication program that includes training and making sure employees have access to SDSs and understand them. Dock personnel can access SDSs in the company system. They print SDSs and include them with the shipping papers for each product. Hazard communication practices of other companies, e.g., transport companies, vary widely.

There are various means through which SDSs are provided to shipping companies and then to individual ships. One petroleum industry practice is to send to each vessel operator the company works with an annual CD with all relevant SDSs. Some shippers use commercially available online subscription services for MSDSs. Procedures for hazard communication on the vessel are the responsibility of the ship (ultimately, the ship's captain), and these practices vary.

One example of a process for North America is as follows. When a ship is at a terminal prior to loading, there is a pre-load conference, including the dock and ship Person in Charge (PIC). The SDS is provided to the ship PIC at this point. Another practice is that a ship receives an SDS prior to taking delivery of the cargo. When the SDS is delivered to the ship, it is passed to the Chief Officer and included with the cargo orders. Any hazards are discussed during a cargo safety briefing to ensure that crewmembers are familiar with appropriate procedures.

There is substantial variation regarding how SDSs are used on vessels and with seafarers. Also, language is a challenge, because officers and crew may not speak the language of the country in which the cargo was loaded or unloaded (although there is a requirement that there be at least one English speaker if the ship is loaded in the U.S.). The manufacturer will have created SDSs in the language of the origin country and sometimes the destination country. However, unless the vessel charterer or operator has asked the manufacturer to provide the SDS in other languages, it is likely that in some cases the ship will not receive the SDS in the language of a different flag state or in all the languages of crew on board.

VII. Product Quality Data

Petroleum products are marketed based on technical specifications related to product performance and product integrity. Product specification endpoints may include, but are not limited to, density, viscosity, flash point, pour point, cloud point, sulfur content, cetane index, carbon residue, ash, appearance, sediment, and other properties. Petroleum companies conduct sampling and testing for these endpoints as part of systematic commercial quality assurance/quality control (QA/QC) programs.

Frequency of QA/QC sampling and analysis varies for different products. Statistical methods are used to determine sampling frequency for QA/QC purposes. Some products are tested by batch, but other products are not analyzed that frequently. Most refineries sample and analyze products at regular intervals, e.g., daily. Commercial agreements often specify tests to be conducted and sampling frequency. In general, the most rigorous and well-documented testing is conducted on finished products, as compared to intermediate streams.

Sampling is often conducted in conjunction with ship cargo and fuel transfer operations (e.g., at the flange of the vessel and/or in vessel compartments after loading). These samples are either analyzed by manufacturing facilities and confirmed by third party laboratories, or analyzed only by an agreed-upon third party inspector. In some cases, samples are retained and analyzed only if there is a problem.

Manufacturers often provide for each shipment a certificate of quality (CoQ), which simply certifies that a product is within specifications, or a certificate of analysis (CoA), which usually includes the analytical results on which the CoQ is based. Data elements included on a CoQ or CoA vary, and there is no standard format for these documents. The two main purposes of the CoQ/CoA are (1) to assure the refinery is producing on-spec products (and to provide the opportunity for correction if not) and (2) to assure the customer that the product is within the specification stated in the contract. Manufacturers provide the CoA or CoQ to the customer. It may be given to the ship in some cases, e.g., for bunker fuels.

In conjunction with a ship taking delivery of fuel, the Chief Mate and Chief Engineer receive a bunker delivery note with essential MARPOL specifications at a minimum. MARPOL Annex VI includes requirements for the composition of marine fuels. Regulation 18 (3) stipulates that details of the fuel oil have to be recorded by means of a bunker delivery note. The bunker delivery note contains at least the following information:

- name and IMO number of receiving ship;
- bunkering port;
- date of commencement of delivery;
- name, address and telephone number of marine fuel oil supplier;
- product name;
- quantity in metric tons;
- density at 15 °C kg/m³;
- sulphur content (% m/m)⁸; and
- a declaration signed and certified by the fuel oil suppliers representative that the fuel oil supplied is in conformity with Regulation 14 and 18 of Annex VI.

Bunker delivery notes are required to be kept on board readily available for inspection until the fuel is completely consumed but in any case for a time period of not less than three years.

A number of national and international standards for the specification of petroleum products exist and are used by API members. These guide the testing that petroleum companies conduct for purposes of product specification and QA/QC. For example, standards relevant to specification of petroleum products include:

- ISO 8217:2005 Petroleum Products Fuels (class F) Specification of marine fuels
- ISO 91-1:1992 Petroleum measurement tables Part 1: Tables based on reference temperatures of 15 °C and 60 °F
- ISO 2719:2002 Determination of flash point Pensky-Martens closed cup method
- ISO 3015:1992 Petroleum products Determination of cloud point
- ISO 3016:1994 *Petroleum products Determination of pour point*
- ISO 3104:1994 Petroleum products Transparent and opaque liquids Determination of kinematic viscosity and calculation of dynamic viscosity
- ISO 3675:1998 Crude petroleum and liquid petroleum products Laboratory determination of density Hydrometer method
- ISO 3679:2004 Determination of flash point Rapid equilibrium closed cup method
- ISO 3733:1999 Petroleum products and bituminous materials Determination of water Distillation method
- ISO 4259:1992 Petroleum products Determination and application of precision data in relation to methods of test
- ISO 4264:1995 Petroleum products Calculation of cetane index of middledistillate fuels by the four-variable equation
- ISO 6245:2001 Petroleum products Determination of ash
- ISO 8754:2003 Petroleum products Determination of sulfur content Energy-

⁸ MARPOL Annex VI requires that the bunker delivery note state the detailed sulphur content of the fuel oil and that general statements shall not be accepted.

dispersive X-ray fluorescence spectrometry

- ISO 10307-1:1993 Petroleum products Total sediment in residual fuel oils Part 1: Determination by hot filtration
- ISO 10307-2:1993 Petroleum products Total sediment in residual fuel oils Part 2: Determination using standard procedures for ageing
- ISO 10370:1993 Petroleum products Determination of carbon residue Micro method
- ISO 10478:1994 Petroleum products Determination of aluminium and silicon in fuel oils Inductively coupled plasma emission and atomic absorption spectroscopy methods
- ISO 12185:1996 Crude petroleum and petroleum products Determination of density Oscillating U-tube method
- ISO/TR 13739:1998 Petroleum products Methods for specifying practical procedures for the transfer of bunker fuels to ships
- ISO 14596:1998 Petroleum products Determination of sulfur content Wavelength-dispersive X-ray fluorescence spectrometry
- ISO 14597:1997 Petroleum products Determination of vanadium and nickel content Wavelength- dispersive X-ray fluorescence spectrometry
- IP 470/03 Determination of aluminium, silicon, vanadium, nickel, iron, calcium, zinc and sodium in residual fuel oil by ashing, fusion and atomic absorption spectrometry
- IP 500/03 Determination of the phosphorus content of residual fuels by ultra-violet spectrometry
- IP 501/03 Determination of aluminium, silicon, vanadium, nickel, iron, sodium, calcium, zinc and phosphorus in residual fuel oil by ashing, fusion and inductively coupled plasma emission spectrometry

As discussed above, results of QA/QC testing are used for purposes of internal manufacturing controls and for providing assurance to customers that products meet specifications. The information discussed above generally is not passed on to product stewards and SDS authors, because the information is commercial data that is not relevant to hazard characterization or the warnings and precautions that need to be on the SDS. The business commercial data is generated by a separate process and for a separate purpose than information used in SDS preparation.

Instead, as described earlier, the specification itself is usually the starting point for an SDS. Ongoing QA/QC testing is to ensure that products meet specifications—the results of this ongoing testing are irrelevant for the SDS. If a test were to determine that a product or batch of products were outside the specification, the product would be changed (or rerouted, or whatever action is necessary to return to specified quality)—not the SDS.

VIII. Conclusion

API member companies have invested resources over many years to develop and implement comprehensive systems to produce SDSs that thoroughly and accurately communicate the hazards of petroleum products and other materials. These systems start with basic product information and allow experts to apply scientific knowledge to build an accurate characterization of the material for purpose of communicating its hazards. Sampling and testing also occurs on an ongoing basis for commercial quality control purposes, but these data are not often relevant for purposes of the SDS.

Legal requirements and international standards drive SDS format and content. Countries and companies are moving toward international harmonization of SDS formats through GHS. Product stewardship groups who specialize in characterizing and communicating the hazards of materials develop the information on SDSs. This is an entirely different function than the QA/QC function that conducts sampling and analysis for product integrity purposes.

The SDS is one tool in a hazard communication system that depends on key elements, including the SDS, labels, training, and day-to-day procedures. Attempts to improve hazard communication for seafarers should explore the broad area of hazard communication *system* implementation in the marine environment. There is also variation in quality among SDSs, (e.g., global variation, variation in SDSs of large versus some small companies) and substandard SDSs should be raised to a higher lever of quality, such as that produced under the current petroleum industry practices described herein. Improvements in programs for seafarer health and safety would be best achieved through enhancement of training, communication, and other supporting systems for seafarer health and safety—not by modifying current petroleum company SDSs to include more details.

Appendix A: Summary of Selected SDS Requirements and Standards and Guidance

The main requirements and standards that guide SDS preparation are summarized very briefly below, with references to additional information.

A. ANSI Standard Z400.1

The purpose of the standard is to provide a consistent format for an MSDS that allows inclusion of information to comply with applicable laws. It addresses formatting issues, effective communication principles, general MSDS information (e.g., revision date, page numbering, units of measure), and guidance on information collection and hazards determination. It enumerates and discusses the individual sections of an MSDS. It also includes discussion on evaluating the completed MSDS. Annexes contain a sample MSDS, glossary of terms, MSDS preparation resources, and regulatory information enumerating SDS requirements under GHS as well as the laws of the U.S., Canada, the European Union, Mexico, and Japan. ANSI Z400.1–2004 is available at www.ansi.org.

B. International Standards Organization (ISO) 11014-1

ISO 11014-1, *Safety data sheet for chemical products* — *Part 1: Content and order of sections* is intended to promote consistency in information provided on SDSs. It was developed for worldwide application and follows the SDS model as outlined in EC Commission Directive 91/155/EEC. The standard presents information for the compilation and completion of an SDS. It defines:

- general layout of the SDS;
- 16 standard headings;
- numbering and the sequence of the 16 headings; and
- the items necessary to fill in an SDS and the conditions of their applicability or utilization.

ISO 11014-1 provides brief guidance for developing the content of each SDS section. For example, regarding Section 2 on composition/ingredients, the standards guides SDS preparers to identify components contributing to the hazard of the material, and their concentration or concentration range. ISO 11014 is available at: <u>http://www.iso.org/iso/store.htm</u>.

C. Globally Harmonized System for Classification and Labeling of Chemicals (GHS)

In 2003, the United Nations (UN) adopted the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). GHS prescribes criteria for the classification of health, physical and environmental hazards, and specifies what information should be included on labels and SDSs of hazardous chemicals. GHS addresses a globally recognized need to harmonize chemical hazard communication rules at the national, regional, and worldwide level. GHS recognized the fundamental principle that consistency in communication of hazards is necessary to protect of human health and the environment during the use and transport of chemicals. It is intended to remedy an existing situation of multiple classifications, labels, and SDSs for the same chemical—which leads to inconsistent communication and potential confusion for workers and consumers.

GHS is designed to achieve convergence of country requirements for hazard communication, primarily through chemical labels and SDSs. It is up to the competent authorities of individual nations to decide how to apply the elements of GHS within their own legal framework. The GHS provides "building blocks" that authorities can use in their regulatory scheme. The building blocks include standard classification criteria for substances and mixtures in the areas of physical hazards, health hazards, and environmental hazards. GHS includes a 16-section SDS format, with descriptions of the data elements to be provided in each section. The data elements include the use of standard phrases and symbols to communicate hazards. GHS asserts that an SDS should be provided for:

- all substances/mixtures meeting GHS harmonized criteria for physical, health, and environmental hazards;
- mixtures containing substances meeting criteria for carcinogenicity, toxicity for reproduction, or specific target organ toxicity, in concentration exceeding cut-off values; and
- other substances/mixtures not meeting the criteria for classification as hazardous but containing hazardous substances in certain concentrations, if required by the competent authority.

While governments, regional institutions and international organizations are the primary audiences for the GHS, it also contains sufficient context and guidance for those in industry who are preparing SDSs. Some API member companies report that they are moving toward GHS format for SDSs in advance of full implementation in individual countries, to the extent possible while still maintaining compliance with current local laws. GHS has maximum value as a single standard to be adopted in all sectors: workplace, consumer, and transport. Complete information on GHS is available at: <u>http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html</u>.

Many countries around the world are in the process of revising their laws to reflect GHS, and some have already completed the effort. The UN tracks the status of GHS implementation around the world and posts the information at: <u>http://www.unece.org/trans/danger/publi/ghs/implementation_e.html</u>.

D. U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200)

The OSHA Hazard Communication Standard (HCS) comprises regulations at 29 *CFR* 1910.1200. The purpose of the HCS is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. The HCS is a "performance-based standard," i.e., it is not prescriptive about what subject entities need to do to comply (although the regulations do contain advisory guidelines for compliance). The main requirements of the standard are as follows.

- Written Hazard Communication Plan. The HCS requires all workplaces (employers) where employees are exposed to hazardous chemicals to have a written plan that describes how that facility will implement the HCS. The written plan must list the chemicals present at the site and indicate where written materials will be made available to employees. It should describe site-specific actions for labels and other forms of warning, materials safety data sheets, and employee information and training.
- **Hazardous Chemical Inventory.** Employers must have a list of the hazardous chemicals known to be present in the workplace, using an identity that is referenced on the appropriate material safety data sheet (MSDS).
- **Labels.** Containers of hazardous chemicals must be labeled, tagged, or marked with the identity of the material and appropriate hazard warnings. Chemical manufacturers, importers, and distributors must ensure that every container of hazardous chemicals they ship is appropriately labeled with this information and with the name and address of the producer or other responsible party. If the material is subsequently transferred from a labeled container to another container, the employer is required to label that container (unless it is subject to the portable container exemption).
- **Material Safety Data Sheets (MSDSs).** Chemical manufacturers and importers are required to obtain or develop an MSDS for each hazardous chemical they produce or import. Distributors are responsible for

ensuring that their customers are provided a copy of these MSDSs. Employers must have an MSDS for each hazardous chemical they use. MSDSs must be readily accessible to employees when they are in their work areas during their work shifts. There is no specific format for the MSDS under the HCS, although there are specific information requirements. Under the rule, the role of MSDSs is to provide detailed information on each hazardous chemical, including its potential hazardous effects, its physical and chemical characteristics, and recommendations for appropriate protective measures.

• **Training.** Each employee who may be exposed to hazardous chemicals when working must be provided information and be trained prior to initial assignment to work with a hazardous chemical, and whenever the hazard changes.

OSHA is currently working on revisions to the OSHA HCS in order to implement GHS. The current OSHA HCS is available at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STA NDARDS&p_id=10099.

E. Canada Workplace Hazardous Materials Information System (WHMIS)

The Workplace Hazardous Materials Information System (WHMIS) is Canada's national hazard communication standard. Similar to U.S. requirements, the key elements of WHMIS are cautionary labeling of containers of WHMIS "controlled products," material safety data sheets (MSDSs), and worker education and training programs.

Canada has a nine-heading MSDS requirement. However, MSDSs that use the ILO, ISO, EC, ANSI or GHS 16 heading format are accepted as meeting compliance requirements, provided that required content specified under Canada's Controlled Products Regulations (CPR) is provided. Canada is also on track to implement GHS.

Additional information on WHMIS is available at: <u>http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php</u>.

F. European Union Directives

Directives 67/548/EEC and 99/45/EC require producers of dangerous chemicals in EC (European Community) member states to provide industrial and professional users with detailed health, safety, and environmental information and advice about their products in the form of SDSs. Article 27 of the Directive imposes an obligation on suppliers to provide an SDS, on paper or electronically, at or before the first delivery of a dangerous

substance or preparation. The supplier is also required to inform users of any relevant new information which becomes known. Directive 91/155/EEC, as amended by Directives 93/112/EEC and 2001/58/EC, set out the requirements for the information which should be included in a safety data sheet. Directive 2001/58/EC provides detailed guidance for the preparation of MSDSs, and includes the 16-section headings in the ANSI Z400.1 standard.

In September 2008, the European Parliament approved legislation that will adopt the GHS into EU law. There is a transitional period during which both the current and new regulations will be in place. The deadline for substance reclassification is November 30, 2010 and for mixtures is May 31, 2015. The current Directives on classification, labeling and packaging, i.e., Council Directive 67/48/EEC and Directive 1999/45/EC, will be repealed on June 1, 2015.

Additional information, with a focus on the new GHS legislation, is available at:

http://ec.europa.eu/enterprise/reach/ghs legislation en.htm

G. International Safety Guide for Oil Tankers and Terminals

The Oil Companies International Marine Forum (OCIMF) and International Chamber of Shipping (ICS) *International Safety Guide for Oil Tankers and Terminals (ISGOTT)* contains guidance, including guidance on SDSs to assist ship's crews. The guidance indicates that the SDS should indicate the type and probable concentrations of hazardous or toxic components in the cargo or bunkers to be loaded, particularly H₂S and benzene. *ISGOTT* provides guidance on exposure limits, PPE, and procedures for handling cargo and bunker fuels containing benzene and H₂S.

H. U.S. Coast Guard Navigation and Vessel Inspection Circular No. 3-92 (NVIC 3-92)

U.S. Coast Guard Navigation and Vessel Inspection Circular No. 3-92 (NVIC 3-92) describes a recommended program for protection of merchant mariners from occupational health problems. NVIC 3-92 includes guidance on:

- initial assessment of health hazards and exposure potential;
- exposure monitoring;
- exposure control;
- training;
- recordkeeping;
- program audits; and
- personnel and laboratory support.

NVIC 3-92 does not address SDS format or content, but rather focuses on hazard communication *systems* in the marine transport environment. For example, the document discusses developing a hazard chemical inventory, reviewing the hazards associated with specific work practices, developing and implementing an exposure monitoring program, developing a written exposure control strategy, making hazard information available to the crew, guidelines for PPE, designing a training program relevant to job tasks, incident reporting, and auditing the program.

NVIC 3-92 is available at:

http://www.uscg.mil/hq/cg5/NVIC/pdf/1992/n3-92.pdf.

Example SDS Crude Oil, GHS

SAFETY DATA SHEET

SECTION 1

PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name:CRUDE OIL SOURProduct Description:Petroleum Crude OilProduct Code:Intended Use:Crude oil

COMPANY IDENTIFICATION

Supplier:

Not Applicable - GHS example

SECTION 2 HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Flammable liquid: Category 2.

Carcinogen: Category 1B. Target organ toxicant (central nervous system): Category 3. Target organ toxicant (repeated exposure): Category 2. Aspiration toxicant: Category 1. Chronic aquatic toxicant: Category 3.



Signal Word: Danger

Hazard Statements:

Physical: H225: Highly flammable liquid and vapor.

Health: H304: May be fatal if swallowed and enters airways. H336: May cause drowsiness or dizziness. H350: May cause cancer. H373: May cause damage to organs through prolonged or repeated exposure. Environmental: H412: Harmful to aquatic life with long lasting effects.

Precautionary Statements:

Prevention: P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P210: Keep away from heat/sparks/open flames/hot surfaces. – No smoking. P233: Keep container tightly closed. P240: Ground / bond container and receiving equipment. P241: Use explosion-proof electrical, ventilating, and lighting equipment. P242: Use only non-sparking tools. P243: Take precautionary

measures against static discharge. P260: Do not breathe mist / vapours. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear protective gloves and eye / face protection. P281: Use personal protective equipment as required.

- Response: P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. P304 + P340: IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. P308 + P313: IF exposed or concerned: Get medical advice/ attention. P312: Call a POISON CENTER or doctor/physician if you feel unwell. P331: Do NOT induce vomiting. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) for extinction.
- Storage: P403 + P233: Store in a well-ventilated place. Keep container tightly closed. P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.

Disposal: P501: Dispose of contents and container in accordance with local regulations.

Contains: BENZENE, PETROLEUM CRUDE OIL

Other hazard information:

PHYSICAL / CHEMICAL HAZARDS

Material can accumulate static charges which may cause an incendiary electrical discharge. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Hydrogen sulfide, a highly toxic gas, is expected to be present. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere. Repeated exposure may cause skin dryness or cracking. Excessive exposure may result in eye, skin, or respiratory irritation. May cause central nervous system depression. Prolonged and repeated exposure to benzene may cause serious injury to blood forming organs and is associated with anemia and to the later development of acute myelogenous leukemia (AML).

ENVIRONMENTAL HAZARDS

No additional hazards.

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3

COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
PETROLEUM CRUDE OIL	8002-05-9	100 %	H225, H304, H336, H350(1B), H373, H412

Hazardous Constituent(s) Contained in Complex Substance(s) required for disclosure Name CAS# Concentration* GHS Hazard Codes

BENZENE	71-43-2	1 - 5%	H225, H303, H304, H336, H340(1B), H350(1A), H315, H319(2A), H372
CYCLOHEXANE	110-82-7	1 - 5%	H225, H304, H336, H315, H410
HYDROGEN SULFIDE	7783-06-4	> 0.005%	H224, H330(1), H400
N-HEXANE	110-54-3	1 - 5%	H225, H304, H336, H361(F), H315, H372, H411
NAPHTHALENE	91-20-3	1 - 5%	H302, H351, H370, H372, H410
POLYNUCLEAR AROMATIC HYDROCARBONS		0.1 - 1%	None
TOLUENE	108-88-3	1 - 5%	H225, H304, H336, H361(D), H315, H373
XYLENES	1330-20-7	1 - 5%	H226, H303, H304, H333, H335, H336, H316, H320(2B), H373

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

SECTION 4

FIRST AID MEASURES

INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. Remove contaminated clothing. Dry wipe exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury. For hot product: Immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately.

PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE

Benzene- Individuals with liver disease may be more susceptible to toxic effects.

SECTION 5

FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect personnel attempting to stop a leak. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Highly flammable. Vapors are flammable and heavier than air. Vapors may travel across the ground and reach remote ignition sources causing a flashback fire danger. Exposure to fire can generate toxic fumes. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Oxides of carbon, Smoke, Fume, Sulfur oxides, Hydrogen sulfide, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: <21C (70F) [ASTM D-92] Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D Autoignition Temperature: N/D

SECTION 6

ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for Personal Protective Equipment.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapor; but may not prevent ignition in closed spaces.

Water Spill: Stop leak if you can do it without risk. Remove from the surface by skimming or with suitable absorbents. If permitted by regulatory authorities the use of suitable dispersants should be considered where indicated in local oil spill contingency plans.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a

water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Use booms as a barrier to protect shorelines. Use containment booms when the ambient temperature is below the flash point of the material. Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid breathing mists or vapors. H2S is present. Avoid contact with skin. Use nonsparking tools and explosion-proof equipment. Potentially toxic/irritating fumes/vapors may be evolved from heated or agitated material. Use only with adequate ventilation. Do not enter storage areas or confined spaces unless adequately ventilated. Use proper bonding and/or grounding procedures. The inherent toxic and olfactory (sense of smell) fatiguing properties of hydrogen sulfide require that air monitoring alarms be used if concentrations are expected to reach harmful levels such as in enclosed spaces, heated transport vessels and spill or leak situations. If the air concentration exceeds 10 ppm TLV, the area should be evacuated unless respiratory protection is in use. Material may contain trace amounts of naturally occurring radioactive material (NORM), which will accumulate in process equipment and storage vessels. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source).

Static Accumulator: This material is a static accumulator.

STORAGE

Ample fire water supply should be available. A fixed sprinkler/deluge system is recommended. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Outside or detached storage preferred. Storage containers should be grounded and bonded. Drums must be grounded and bonded and equipped with self-closing valves, pressure vacuum bungs and flame arresters.

SECTION 8

EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit / Standard			Note	Source	Year
BENZENE		TWA	3.25	1 ppm	Skin	EU. Dir.	2007
			mg/m3			04/37/EC	
						Annex III A	
BENZENE		STEL	2.5 ppm		Skin	ACGIH	2008
BENZENE		TWA	0.5 ppm		Skin	ACGIH	2008
CYCLOHEXANE		TWA	100 ppm			ACGIH	2008
ETHYL BENZENE		STEL	125 ppm			ACGIH	2008
ETHYL BENZENE		TWA	100 ppm			ACGIH	2008
HYDROGEN SULFIDE		STEL	15 ppm			ACGIH	2008
HYDROGEN SULFIDE	TWA	10 ppm		ACGIH	2008		
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N-HEXANE	TWA	50 ppm	Skin	ACGIH	2008		
NAPHTHALENE	STEL	15 ppm	Skin	ACGIH	2008		
NAPHTHALENE	TWA	10 ppm	Skin	ACGIH	2008		
TOLUENE	TWA	20 ppm		ACGIH	2008		
XYLENES	STEL	150 ppm		ACGIH	2008		
XYLENES	TWA	100 ppm		ACGIH	2008		

Biological limits

Substance Name	Specimen	Sampling Time	Limit	Determinant	Source
BENZENE	Urine	End of shift	25 ug/g	S-Phenylmercapturic	ACGIH BELs
			creatinine	acid	
N-HEXANE	Urine	End of shift at	.4 mg/l	2,5-Hexanedion, without	ACGIH BELs
		end of work wk	_	hydrolysis	
NAPHTHALENE	Urine	End of shift at		1-Hydroxypyrene, with	ACGIH BELs
		end of work wk		hydrolysis (1-HP)	
TOLUENE	Blood	Prior to last shift	.05 mg/l	Toluene	ACGIH BELs
		of work wk	-		
TOLUENE	Urine	End of shift	.5 mg/l	o-Cresol	ACGIH BELs
XYLENES	Urine	End of shift	1.5 g/g	Methylhippuric acids	ACGIH BELs
			creatinine		

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Positive-pressure, air-supplied respirator in areas where H2S vapors may accumulate is recommended. Acid gas/organic vapor

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ

depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

If prolonged or repeated contact is likely, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves. Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves. Nitrile, Viton

Eye Protection: Chemical goggles and face shield are recommended. Chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended. Chemical / oil resistant clothing if contact with material is likely.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below.

GENERAL INFORMATION

Physical State: Liquid Color: Dark Brown Odor: Rotten Egg Odor Threshold: N/D

IMPORTANT HEALTH. SAFETY. AND ENVIRONMENTAL INFORMATION Relative Density (at 15 C): 0.661 - 1.013 Flash Point [Method]: <21C (70F) [ASTM D-92] Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D Flammability (Solid, Gas): N/A Autoignition Temperature: N/D Boiling Point / Range: > 35C (95F) Decomposition Temperature: N/D Vapor Density (Air = 1): N/D Vapor Pressure: 0 kPa (0 mm Hg) at 20 C - 106.4 kPa (800 mm Hg) at 20 C Evaporation Rate (n-butyl acetate = 1): N/D pH: N/A Log Pow (n-Octanol/Water Partition Coefficient): N/D Solubility in Water: Negligible Viscosity: >0.42 cSt (0.42 mm2/sec) at 40 C Freezing Point: N/D Melting Point: N/A

Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

SECTION 10

Pour Point: -73°C (-100°F) - 48°C (118°F)

STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other ignition sources.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Not determined.
Irritation: No end point data.	Elevated temperatures or mechanical action may form vapors, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	May dry the skin leading to discomfort and dermatitis. Based on test data for structurally similar materials.
Eye	
Irritation (Rabbit): Data available.	Based on test data for structurally similar materials.

OTHER HEALTH EFFECTS FROM SHORT AND LONG TERM EXPOSURE

Anticipated health effects from sub-chronic, chronic, respiratory or skin sensitization, mutagenicity, reproductive toxicity, carcinogenicity, target organ toxicity (single exposure or repeated exposure), aspiration toxicity and other effects based on human experience and/or experimental data.

For the product itself:

Vapor/aerosol concentrations above recommended exposure levels are irritating to the eyes and respiratory tract, may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness and other central nervous system effects including death. May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion and blurred vision) and/or damage. Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema. Crude oil: Contains polycyclic aromatic compounds (PACs). Prolonged and / or repeated exposure by skin or inhalation of certain PACs may cause cancer of the skin, lung, and of other sites of the body. In animal studies, some crudes produced skin tumors in mice, while other crudes produced no tumors. Developmental studies of crude oil in lab animals showed reduced fetal weight and increased fetal resorptions at maternally toxic levels. Repeated dermal exposure to crude oils in rats resulted in toxicity to the blood, liver, thymus, and bone morrow.

Contains:

BENZENE: Caused cancer (leukemia), damage to the blood-producing system, and serious blood disorders from prolonged, high exposure based on human epidemiology studies. Caused genetic effects and effects on the immune system in laboratory animal and some human studies. Caused toxicity to the fetus in laboratory animal studies. HYDROGEN SULFIDE : Chronic health effects due to repeated exposures to low levels of H2S have not been established. High level (700 ppm) acute exposure can result in sudden death. High concentrations will lead to cardiopulmonary arrest due to nervous system toxicity and pulmonary edema. Lower levels (150 ppm) may overwhelm sense of smell, eliminating warning of exposure. Symptoms of overexposure to H2S include headache, fatigue, insomnia, irritability, and gastrointestinal problems. Repeated exposures to approximately 25 ppm will irritate mucous membranes and the respiratory system and have been implicated in some eye damage.

NAPHTHALENE: Exposure to high concentrations of naphthalene may cause destruction of red blood cells, anemia, and cataracts. Naphthalene caused cancer in laboratory animal studies, but the relevance of these findings to humans is uncertain. N-HEXANE: Prolonged and/or repeated exposures to n-Hexane can cause progressive and potentially irreversible damage to the peripheral nervous system (e.g. fingers, feet, arms, legs, etc.). Simultaneous exposure to Methyl Ethyl Ketone (MEK) or Methyl Isobutyl Ketone (MIBK) and n-Hexane can potentiate the risk of adverse effects from n-Hexane on the peripheral nervous system. n-Hexane has been shown to cause testicular damage at high doses in male rats. The relevance of this effect for humans is unknown. TOLUENE: Concentrated, prolonged or deliberate inhalation may cause brain and nervous system damage. Prolonged and repeated exposure of pregnant animals (> 1500 ppm) have been reported to cause adverse fetal developmental effects. ETHYLBENZENE: Caused cancer in laboratory animal studies. The relevance of these findings to humans is uncertain.

Additional information is available by request.

IARC Classification:

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
BENZENE	71-43-2	1
NAPHTHALENE	91-20-3	3

	REGULATORY LISTS SEARCHED			
1 = IARC 1	2 = IARC 2A	3 = IARC 2B		

SECTION 12	ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Expected to be harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Low molecular wt. component -- Expected to be inherently biodegradable

High molecular wt. component -- Expected to biodegrade slowly.

Photolysis:

More water soluble component -- Expected to degrade at a moderate rate in water when exposed to sunlight.

Atmospheric Oxidation:

More volatile component -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Components -- Has the potential to bioaccumulate.

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Acute Toxicity	48 hour(s)	Invertebrate	EC50 10 - 100 mg/l

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

TRANSPORT INFORMATION

LAND (ADR)

Proper Shipping Name: PETROLEUM CRUDE OIL Hazard Class: 3 Hazchem Code: 3WE UN Number: 1267 Packing Group: II Label(s) / Mark(s): 3

SEA (IMDG)

Proper Shipping Name: PETROLEUM CRUDE OIL Hazard Class & Division: 3 EMS Number: F-E, S-E UN Number: 1267 Packing Group: II Marine Pollutant: No Label(s): 3 Transport Document Name: PETROLEUM CRUDE OIL, 3, UN1267, PG II, (21°C c.c.)

AIR (IATA)

Proper Shipping Name: PETROLEUM CRUDE OIL Hazard Class & Division: 3 UN Number: 1267 Packing Group: II Label(s): 3 Transport Document Name: PETROLEUM CRUDE OIL, 3, UN1267, PG II

SECTION 15

REGULATORY INFORMATION

This material is considered hazardous according to the Regulation of Labeling and Hazard Communication of Dangerous and Harmful Materials.

This material contains component(s) that are regulated under RLHCDHA Appendix 1.

REGULATORY STATUS AND APPLICABLE LAWS AND REGULATIONS

Regulation of Toxic Chemical substances labeling and Material data sheet: Regulated

Complies with the following national/regional chemical inventory requirements: AICS, IECSC, DSL, EINECS, ENCS, KECI, PICCS, TSCA

SECTION 16

OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 2 AND 3 OF THIS DOCUMENT (for information only):

H224: Extremely flammable liquid and vapor; Extreme Flam Liq and Vapor

H225: Highly flammable liquid and vapor; Highly Flam Liq and Vapor

H226: Flammable liquid and vapor; Flammable Liquid and Vapor

H302: Harmful if swallowed; Acute Tox Oral, Cat 4

H303: May be harmful if swallowed; Acute Tox Oral, Cat 5

H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1

H315: Causes skin irritation; Skin Corr/Irritation, Cat 2 H316: Causes mild skin irritation; Skin Corr/Irritation, Cat 3 H319(2A): Causes serious eve irritation: Serious Eve Damage/Irr. Cat 2A H320(2B): Causes eye irritation; Serious Eye Damage/Irr, Cat 2B H335: May cause respiratory irritation; Target Organ Single, Resp Irr H336: May cause drowsiness or dizziness; Target Organ Single, Narcotic H340(1B): May cause genetic defects; Germ Cell Mutagenicity, Cat 1B H350(1A): May cause cancer; Carcinogenicity, Cat 1A H350(1B): May cause cancer; Carcinogenicity, Cat 1B H351: Suspected of causing cancer; GHS Carcinogenicity, Cat 2 H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop) H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility) H370: Causes damage to organs; Target Organ, Single, Cat 1 H372: Causes damage to organs through prolonged or repeated exposure: Target Organ, Repeated, Cat 1 H373: May cause damage to organs through prolonged or repeated exposure: Target Organ, Repeated, Cat 2 H400: Very toxic to aquatic life; Acute Env Tox, Cat 1 H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1 H411: Toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 2

H412: Harmful to aquatic life with long lasting effects; Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

Updates made in accordance with implementation of GHS requirements.

THIS SDS COVERS THE FOLLOWING MATERIALS: CRUDE OIL SOUR ("Sour" applied by definition of Society of Petroleum Engineers for oils containing sulfur compounds >1%)

DGN: 7091114 (1015394)

Example SDS Bunker Fuels – 500 GST, GHS

SAFETY DATA SHEET

PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

SECTION 1

Product Name:BUNKER FUELS - 500 CSTProduct Description:Hydrocarbons and AdditivesProduct Code:Intended Use:Fuel

COMPANY IDENTIFICATION

Supplier:

Not Applicable - GHS example

SECTION 2 HAZARDS IDENTIFICATION

Hazard Classification: HAZARDOUS SUBSTANCE. NON-DANGEROUS GOOD.

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Flammable liquid: Category 4.

Carcinogen: Category 1B. Reproductive toxicant (developmental): Category 2. Target organ toxicant (repeated exposure): Category 2.

Chronic aquatic toxicant: Category 3.

Label: Symbol:



Signal Word: Danger

Hazard Statements:

Physical: H227: Combustible liquid.

Health: H350: May cause cancer. H361: Suspected of damaging the unborn child. H373: May cause damage to organs through prolonged or repeated exposure.

Environmental: H412: Harmful to aquatic life with long lasting effects.

Precautionary Statements:

Prevention: P210: Keep away from flames and hot surfaces. – No smoking. P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P260: Do not breathe mist / vapours. P273: Avoid release to the environment. P280: Wear protective gloves and eye / face protection. P281: Use personal protective equipment as required.

Response: P308 + P313: IF exposed or concerned: Get medical advice/ attention. P314: Get

medical advice/attention if you feel unwell. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) for extinction.

Storage: P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up. Disposal: P501: Dispose of contents and container in accordance with local regulations.

Contains: Fuel oil, residual

Other hazard information:

PHYSICAL / CHEMICAL HAZARDS

Contact with hot material can cause thermal burns which may result in permanent damage. Contact with hot material can cause thermal burns which may result in permanent damage or blindness. Thermal burn hazard - contact with hot material may cause thermal burns. Material can accumulate static charges which may cause an incendiary electrical discharge. Material can release vapours that readily form flammable mixtures. Vapour accumulation could flash and/or explode if ignited. Combustible.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Hydrogen sulphide, a highly toxic gas, is expected to be present. Signs and symptoms of overexposure to hydrogen sulphide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odour does not provide a reliable indicator of the presence of hazardous levels in the atmosphere. Excessive exposure may result in eye, skin, or respiratory irritation.

ENVIRONMENTAL HAZARDS

No additional hazards.

Note: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
Fuel oil, residual	68476-33-5	> 99 %	H350(1B), H361(D), H373, H412

Hazardous Constituent(s) Contained in Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
Hydrogen Sulphide	7783-06-4	< 0.1%	H224, H330(1), H400

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume. Other ingredients determined not to be hazardous.

SECTION 4 FIRST AID MEASURES	
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INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped,

assist ventilation with a mechanical device.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. Remove contaminated clothing. Dry wipe exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury. For hot product: Immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

EYE CONTACT

Flush thoroughly with water for at least 15 minutes. Get medical assistance.

INGESTION

Seek immediate medical attention.

SECTION 5

FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Combustible. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Incomplete combustion products, Oxides of carbon, Hydrogen Sulphide, Sulphur Oxides, Smoke, Fume

FLAMMABILITY PROPERTIES

Flash Point [Method]: >62C (144F) [ASTM D-93] Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D Autoignition Temperature: N/D

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do so without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapour-suppressing foam may be used to reduce vapour. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapour, but may not prevent ignition in enclosed spaces. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do so without risk. Confine the spill immediately with booms. Warn other shipping. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid breathing mists or vapour. Avoid all personal contact. Avoid contact with skin. Use proper bonding and/or earthing procedures. Harmful amounts of H2S may be present. The inherent toxic and olfactory (sense of smell) fatiguing properties of hydrogen sulfide require that air monitoring alarms be used if concentrations are expected to reach harmful levels, such as in enclosed spaces, heated transport vessels and spill or leak situations. If the air concentration exceeds 10 ppm TLV, the area should be evacuated unless respiratory protection is in use. Do not use electronic devices (including but not limited to cellular phones, computers, calculators, pagers or other electronic devices etc) in or around any fuelling operation or storage area unless the devices are certified intrinsically safe by an approved national testing agency and to the safety standards required by national and/or local laws and regulations. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source).

Static Accumulator: This material is a static accumulator.

Storage

Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Storage containers should be earthed and bonded. Drums must be earthed and bonded and equipped with self-closing valves, pressure vacuum bungs and flame arresters. **Storage Temperature:** < 55°C (131°F)

SECTION 8

EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit/Sta	andard		Note	Source	Year
Fuel oil, residual		TWA	0.1 mg/kg		benzene solubles	[company]	2008
Hydrogen Sulphide		STEL	21 mg/m3	15 ppm		New Zealand OELs	2002
Hydrogen Sulphide		TWA	14 mg/m3	10 ppm		New Zealand OELs	2002
Hydrogen Sulphide		STEL	15 ppm			ACGIH	2008
Hydrogen Sulphide		TWA	10 ppm			ACGIH	2008

Biological limits

No biological limits allocated.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Positive-pressure, air-supplied respirator in areas where H2S vapours may accumulate is recommended.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material

include:

Thermally protective, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet-style gloves. If prolonged or repeated contact is likely, chemical-resistant gloves are recommended. If contact with forearms is likely, wear gauntlet-style gloves. Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves. Nitrile,Viton

Eye Protection: If contact with material is likely, chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

Chemical/oil resistant clothing is recommended. If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended. If product is hot, thermally protective, chemical resistant apron and long sleeves are recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid Form: Viscous Colour: dark brown Odour: Ammonia-like Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.96 - 1.01 Flash Point [Method]: >62C (144F) [ASTM D-93] Flammability (Solid, Gas): N/A Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D Explosive properties: N/D Autoignition Temperature: N/D Boiling Point / Range: > 204C (400F) Decomposition Temperature: N/D Vapour Density (Air = 1): > 0.9 at 101 kPa Vapour Pressure: < 0.133 kPa (1 mm Hg) at 20 C Evaporation Rate (N-Butyl Acetate = 1): N/D pH: N/A Log Pow (n-Octanol/Water Partition Coefficient): N/D Solubility in Water: Negligible Viscosity: [N/D at 40 °C] | 380 cSt (380 mm²/sec) at 50C - 500 cSt (500 mm²/sec) at 50C 50C Molecular Weight: N/D Oxidising properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D Melting Point: N/A Pour Point: < 30°C (86°F)

SECTION 10

STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Open flames and high energy ignition sources.

MATERIALS TO AVOID: Halogens, Strong Acids, Alkalies, Strong oxidisers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Toxicity

Route of Exposure	Conclusion / Remarks
INHALATION	
Toxicity (Rat): LC50 > 5000 mg/m ³	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data.	Elevated temperatures or mechanical action may form vapours, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs. Based on assessment of the components.
INGESTION	
Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	May dry the skin leading to discomfort and dermatitis. Based on assessment of the components.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.

OTHER HEALTH EFFECTS FROM SHORT AND LONG TERM EXPOSURE

Anticipated health effects from sub-chronic, chronic, respiratory or skin sensitization, mutagenicity, reproductive toxicity, carcinogenicity, target organ toxicity (single exposure or repeated exposure), aspiration toxicity and other effects based on human experience and/or experimental data.

For the product itself:

Residual fuel oil: Carcinogenic in animal tests. Caused mutations in-vitro. Dermal exposure to high concentrations resulted in maternal toxicity, decreased fetal weight and

fetal survival, and some external fetal malformations. Dermal studies in animals: increased mortality, skin irritation, liver, kidney, thymus, bone marrow, blood and lymphoid tissue toxic effects. Possible allergen and photoallergen. **Contains:**

HYDROGEN SULPHIDE: Chronic health effects due to repeated exposures to low levels of H2S have not been established. High level (700 ppm) acute exposure can result in sudden death. High concentrations will lead to cardiopulmonary arrest due to nervous system toxicity and pulmonary edema. Lower levels (150 ppm) may overwhelm sense of smell, eliminating warning of exposure. Symptoms of overexposure to H2S include headache, fatigue, insomnia, irritability, and gastrointestinal problems. Repeated exposures to approximately 25 ppm will irritate mucous membranes and the respiratory system and have been implicated in some eye damage.

Additional information is available by request.

IARC Classification:

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
Fuel oil, residual	68476-33-5	3

	REGULATORY LISTS SEAR	CHED
1 = IARC 1	2 = IARC 2A	3 = IARC 2B

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Expected to be harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

High molecular wt. component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY Biodegradation:

Majority of components -- Expected to be inherently biodegradable

Atmospheric Oxidation:

More volatile component -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Base oil component -- Potential to bioaccumulate is low.

SECTION 13

DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (5433) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

Material is Hazardous as defined by the Hazardous Substances (Minimum Degree of Hazard) Regulation 2001.

REGULATORY STATUS AND APPLICABLE LAWS AND REGULATIONS

Complies with the following national/regional chemical inventory requirements: AICS, TSCA, EINECS, DSL

SECTION 16

OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 2 AND 3 OF THIS DOCUMENT (for information only):

H224: Extremely flammable liquid and vapor; Extreme Flam Liq and Vapor H350(1B): May cause cancer; Carcinogenicity, Cat 1B H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop) H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2 H400: Very toxic to aquatic life; Acute Env Tox, Cat 1 H412: Harmful to aquatic life with long lasting effects; Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

Updates made in accordance with implementation of GHS requirements.

DGN: 7091109 (1015393)	

End of (M)SDS

Example SDS Gas Oil, New Zealand, GHS

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name	:	Diesoline
Restrictions of Use	•	ruer for on-road diesel-powered engines.
Other Names / Synonyms Product Code	:	Gas Oil
Manufacturer/Supplier	:	
Telephone Fax	:	
Emergency Telephone Number	:	0800 474 355 (24h) National Poisons Centre 0800 764 766. New Zealand Fire Service - 111

2. HAZARDS IDENTIFICATION

HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. Classified as hazardous according to criteria in the Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001.

Not classified as Dangerous Goods for transport, according to New Zealand Standard 5433:2007 Transport of Dangerous Goods on Land.

Hazardous Substances Classification	:	6.7B, 9.1B, 6.1E, 3.1D, 6.3B
GHS Classification	:	CARCINOGENICITY, Category 2
		ASPIRATION HAZARD, Category 1
		SPECIFIC TARGET ORGAN SYSTEMIC TOXICITY (SINGLE
		EXPOSURE), Category 3
		AQUATIC TOXICITY (CHRONIC), Category 2
		FLAMMABLE LIQUIDS, Category 4
		SKIN CORROSION/IRRITATION, Category 3

GHS Label Elements Signal Words GHS Hazard Statements	:	Danger PHYSICAL HAZARDS:
		Combustible liquid.
		HEALTH HAZARDS:
		Suspected of causing cancer.
		May cause drowsiness or dizziness.
		May be fatal if swallowed and enters airways.
		Causes mild skin irritation.

	ENVIRONMENTAL HAZARDS:
	Toxic to aquatic life with long lasting effects.
GHS Precautionary :	PREVENTION:
Statements	Obtain special instructions before use.
	Do not handle until all safety precautions have been read and understood.
	Use personal protective equipment asrequired.
	Avoid breathing dust/fume/gas/mist/vapours/spray.
	Use only outdoors or in a well-ventilated area.
	Avoid release to the environment.
	Keep away from heat/sparks/open flames/hot surfaces.No smoking.
	Wear protective gloves/protective clothing/eye protection/face protection.
	RESPONSE:
	In case of fire: Use appropriate media for extinction.
	IF exposed or concerned: Get medical advice/attention.
	If skin irritation occurs: Get medical advice/attention.
	IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting.
	Collect spillage.
	STORAGE:
	Store locked up.

Store in a well-ventilated place. Keep container tightly closed. Keep cool.

DISPOSAL:

:

Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

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	•

Other Hazards which do not result in Classification	:	Vapour in the headspace of tanks and containers may ignite and explode at temperatures exceeding auto-ignition temperature, where vapour concentrations are within the flammability range. May ignite on surfaces at temperatures above auto-ignition temperature. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Repeated exposure may cause skin dryness or cracking.

Additional Information : This product is intended for use in closed systems only. Refer to chapter 15 for for further information on classification. HSNO does not specifically address these categories within GHS classification: STOST (Single Exposure) Category 3 and Aspiration Hazard.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Preparation description	: Complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon numbers predominantly in the C9 to C25 range. May also contain several additives at <0.1% v/v each. May contain cetane improver (Ethyl Hexyl Nitrate) at <0.2% v/v. May contain catalytically cracked oils in which polycyclic aromatic compounds, mainly 3-ring but some 4- to 6-ring
	species are present.

Hazardous Components

Symbol(s)

Chemical Identity	CAS	Identification No.	Conc.
Fuels, diesel, no.2	68476-34-6	270-676-1	0.00 - 100.00 %
Fuels, diesel	68334-30-5	269-822-7	0.00 - 100.00 %
Additional Information	Dyes and markers of prevent fraud.	can be used to indicate tax	status and

4. FIRST AID MEASURES

Inhalation	:	Remove to fresh air. If rapid recovery does not occur, transport
		to nearest medical facility for additional treatment.

Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (37° C), shortness of breath, chest congestion or continued coughing or wheezing.
Most Important Symptoms/Effects, Acute & Delayed	:	If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance.
Immediate medical attention, special treatment	:	Treat symptomatically. Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Administration of carbon for medicinal use (carbo medicinalis) may reduce absorption from the digestive tract.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Suitable Extinguishing Media Unsuitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only. Do not use water in a jet.
Specific hazards arising from Chemicals	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Oxides of sulphur. Unidentified organic and inorganic compounds. Carbon monoxide may be evolved if incomplete combustion occurs. Will float and can be reignited on surface water. Flammable vapours may be present even at temperatures below the flash point.
Protective Equipment & Precautions for Fire Fighters	:	Wear full protective clothing and self-contained breathing apparatus.
Additional Advice	•	Reep adjacent containers cool by spraying with water.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe all relevant local and international regulations. Evacuate the area of all non-essential personnel. Ventilate contaminated area thoroughly.

Personal Precautions, : Do not breathe fumes, vapour. Do not operate electrical

Protective Equipment and Emergency Procedures	equipment.
Environmental Precautions	 Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Methods and Material for Containment and Clean Up	 For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely.
Additional Advice	 Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26.
7. HANDLING AND STORAGE	
General Precautions	 Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Air-dry contaminated clothing in a well-ventilated area before laundering. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Prevent spillages. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Never siphon by mouth. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse. For comprehensive advice on handling, product transfer, storage and tank cleaning refer to the product supplier. Maintenance and Fuelling Activities - Avoid inhalation of vapours and contact with skin.
Precautions for Safe	 Avoid inhaling vapour and/or mists. Avoid prolonged or repeated contact with skin. When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Earth all equipment. Electrostatic

Conditions for Safe Storage	charges may be generated during pump discharge may cause fire. The vapour is spreads along the ground and distant ign Drum and small container storage: Drum a maximum of 3 high. Use properly labe containers. Tank storage: Tanks must be for use with this product. Bulk storage ta (bunded). Locate tanks away from heat a ignition. Must be stored in a diked (bund area, away from sunlight ignition source	ing. Electrostatic heavier than air, hition is possible. Is should be stacked to lled and closeable e specifically designed nks should be diked and other sources of ed) well-ventilated
Product Transfer	heat. Vapours from tanks should not be atmosphere. Breathing losses during sto controlled by a suitable vapour treatmen is heavier than air. Beware of accumulat spaces. Keep in a bunded area with a se permeability) floor, to provide containme Prevent ingress of water. Avoid splash filling. Wait 2 minutes after such as those on road tanker vehicles) b or manholes. Wait 30 minutes after tank storage tanks) before opening hatches of containers closed when not in use. Do n for filling, discharging or handling. Conta product transfer may give rise to light hy the headspace of tanks that have previo gasoline. This vapour may explode if the ignition. Partly filled containers present a those that are full, therefore handling.	released to rage should be t system. The vapour ion in pits and confined ealed (low nt against spillage. tank filling (for tanks before opening hatches filling (for large or manholes. Keep ot use compressed air mination resulting from drocarbon vapour in usly contained ere is a source of a greater hazard than apsfer and sampling
Decommonded Motoriale	activities need special care.	
Recommended Materials	steel. Aluminium may also be used for a does not present an unnecessary fire ha suitable materials are: high density polye Viton (FKM), which have been specifical compatibility with this product. For conta amine-adduct cured epoxy paint. For sea graphite. PTFE. Viton A. Viton B.	pplications where it zard. Examples of ethylene (HDPE) and ly tested for iner linings, use als and gaskets use:
Unsuitable Materials	Some synthetic materials may be unsuit container linings depending on the mate intended use. Examples of materials to a rubber (NR), nitrile rubber (NBR), ethyle (EPDM), polymethyl methacrylate (PMM polyvinyl chloride (PVC), polyisobutylene be suitable for glove materials	able for containers or rial specification and avoid are: natural ne propylene rubber A), polystyrene, e. However, some may
Container Advice	Containers, even those that have been e explosive vapours. Do not cut, drill, grind	emptied, can contain I, weld or perform
Other Advice	Ensure that all local regulations regardin facilities are followed.	g handling and storage

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Oil mist,	NZ OEL	TWA	5 mg/m3	
,		[Mist.]	0	

mineral				
	NZ OEL	STEL [Mist.]	10 mg/m3	

Biological Exposure Index (BEI) - See reference for full details

Data not available

Additional Information	:	In the absence of a national exposure limit, the American Conference of Governmental Industrial Hygienists (ACGIH) recommends the following values for Diesel Fuel: TWA - 100 mg/m3 Critical effects based on Skin and Irritation.
Appropriate Engineering Controls	:	The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use.
Individual Protection	:	Personal protective equipment (PPE) should meet
Respiratory Protection		If engineering controls do not maintain airborne concentrations
		to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. Where air- filtering respirators are suitable, select an appropriate combination of mask and filter. All respiratory protection equipment and use must be in accordance with local regulations.
Hand Protection	:	Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Select gloves tested to a relevant standard (e.g. Europe EN374, US F739). When prolonged or frequent repeated contact occurs, Nitrile gloves may be suitable. (Breakthrough time of > 240 minutes.) For incidental contact/splash protection Neoprene, PVC gloves may be suitable.
Eye Protection	:	Chemical splash goggles (chemical monogoggles). Approved to EU Standard EN166.
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron (where risk of splashing).
Thermal Hazards	:	Not applicable.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to

		confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance Odour	:	Colourless. Pale straw. Yellow. Liquid.
Odour threshold	÷	Data not available
рН	:	Data not available
Initial Boiling Point and	:	ca. 180 °C / 356 °F ca. 360 °C / 680 °F
Boiling Range		
Melting / freezing point	:	Data not available
Flash point	:	> 60 °C / 140 °F (Pensky-Martens Closed Cup)
Upper / Iower	:	1 - 6 %(V)
Flammability or		
Explosion limits		
Auto-ignition temperature	:	> 220 °C / 428 °F
Vapour pressure	:	< 0.1 kPa at 20 °C / 68 °F
Relative Density	:	Data not available
Density	÷	820 - 845 kg/m3 at 15 °C / 59 °F
Water solubility	÷	Negligible.
Solubility in other	÷	Data not available
n-octanol/water partition		3 - 6
coefficient (log Pow)	·	
Dynamic viscosity	:	Data not available
Kinematic viscosity	:	2 - 7 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 5
Evaporation rate	:	Data not available
(nBuAc=1)		
Flammability	:	Data not available

10. STABILITY AND REACTIVITY

Chemical Stability Possibility of Hazardous Reactions	:	Stable under normal conditions of use. Data not available
Conditions to Avoid Incompatible Materials Hazardous Decomposition Products	:	Avoid heat, sparks, open flames and other ignition sources. Strong oxidising agents. Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on product data, a knowledge of the
		components and the toxicology of similar products.
Likely Routes of	:	Exposure may occur via inhalation, ingestion, skin absorption,

Exposure		skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	Low toxicity: LD50 > 5000 mg/kg
Acute Dermal Toxicity	:	Low toxicity: LD50 > 5000 mg/kg
Acute Inhalation Toxicity	:	Low toxicity by inhalation. High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.
Skin Corrosion/Irritation	:	Causes mild skin irritation. Prolonged/repeated contact may cause defatting of the skin which can lead to dermatitis.
Serious Eye	:	Slightly irritating.
Respiratory Irritation	:	Slightly irritating.
Respiratory or Skin	:	Not a skin sensitiser.
Aspiration Hazard	:	Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Repeated Dose Toxicity	:	Kidney: caused kidney effects in male rats which are not considered relevant to humans
Germ Cell Mutagenicity	:	In-vitro mutagenicity studies show that mutagenic activity is related to 4-6 ring polycyclic aromatic content.
Carcinogenicity	:	Limited evidence of carcinogenic effect. Repeated skin contact has resulted in irritation and skin cancer in animals.
Reproductive and Developmental Toxicity	:	Not expected to be a developmental toxicant.
12. ECOLOGICAL INFORMATIC	N	
Basis for Assessment	:	Information given is based on a knowledge of the components and the ecotoxicology of similar products. Fuels are typically made from blending several refinery streams. Ecotoxicological studies have been carried out on a variety of hydrocarbon blends and streams but not those containing additives.
Acute Toxicity	:	Toxic:LL/EL/IL50 1-10 mg/l(to aquatic organisms)(LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Mobility Persistence/degradability	:	Floats on water. Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. Large volumes may penetrate soil and could contaminate groundwater. Contains volatile constituents. Major constituents are inherently biodegradable. The volatile constituents will oxidize rapidly by photochemical reactions in air.

Bioaccumulative Potential	:	Contains constituents with the potential to bioaccumulate.
Other Adverse Effects	:	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal :	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Container Disposal :	Send to drum recoverer or metal reclaimer. Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.
Local Legislation :	Disposal should be in accordance with the New Zealand Hazardous Substances Disposal Regulations 2001. Treat the substance using a method that changes the characteristics or composition of the substance so that the substance is no longer a hazardous substance.

14. TRANSPORT INFORMATION

NZS 5433:2007

This material is not classified as dangerous according to NZS 5433:2007.

IMDG

This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply) This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

HSNO Approval Number : HSR001441

Other Information	 New Zealand Workplace Exposure Limits 2002 (WES). New Zealand Standard 5433:2007 Transport of Dangerous Goods on Land. Hazardous Substances (Identification) Regulations 2001. Hazardous Substances (Classification) Regulations 2001. Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001. Hazardous Substances (Disposal) Regulations 2001. Hazardous Substances (Emergency Management) Regulations 2001. Hazardous Substances (Emergency Classes 1 to 5 Controls) Regulations 2001 and Amendments 2004. Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations 2001. Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001.
	The classifications and label elements relating to the HSNO Categories are described/included in the GHS information. Shell Health Services recommends (at a global level) the following classification:
	FLAMMABLE LIQUIDS Category 3
	CARCINOGENICITY Category 2
	ASPIRATION HAZARD Category 1
	SPECIFIC TARGET ORGAN SYSTEMIC TOXICITY (SINGLE EXPOSURE) Category 3
	AQUATIC TOXICITY (CHRONIC) Category 2
16. OTHER INFORMATION	
Additional Information	: This document contains important information to ensure the safe storage, handling and use of this product. The information in this document should be brought to the attention of the

person in your organisation responsible for advising on safety

: A vertical bar (|) in the left margin indicates an amendment

: The content and format of this MSDS is in accordance with

HSNO Approved Code of Practice (No. HSNO CoP 8-1 09-06):

This product must not be used in applications other than those

recommended in Section 1, without first seeking the advice of

This product is not to be used as a solvent or cleaning agent;

: The information in this document should be made available to

: This information is based on our current knowledge and is

for lighting or brightening fires; as a skin cleanser.

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matters.

: 01.07.2008

the supplier.

from the previous version.

Preparation of Safety Data Sheets.

all who may handle the product.

: 1.0

:

MSDS Version Number

MSDS Effective Date

MSDS Revisions

MSDS Regulation

MSDS Distribution

Disclaimer

Uses and Restrictions

intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

THERE THIS CAME FROM.

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