SCREENING-LEVEL HAZARD CHARACTERIZATION

Lubricating Oil Basestocks Category
(See Appendix)

The High Production Volume (HPV) Challenge Program[1] was conceived as a voluntary initiative aimed at developing and making publicly available screening-level health and environmental effects information on chemicals manufactured in or imported into the United States in quantities greater than one million pounds per year. In the Challenge Program, producers and importers of HPV chemicals voluntarily sponsored chemicals; sponsorship entailed the identification and initial assessment of the adequacy of existing toxicity data/information, conducting new testing if adequate data did not exist, and making both new and existing data and information available to the public. Each complete data submission contains data on 18 internationally agreed to "SIDS" (Screening Information Data Set[1,2]) endpoints that are screening-level indicators of potential hazards (toxicity) for humans or the environment.

The Environmental Protection Agency's Office of Pollution Prevention and Toxics (OPPT) is evaluating the data submitted in the HPV Challenge Program on approximately 1400 sponsored chemicals by developing hazard characterizations (HCs). These HCs consist of an evaluation of the quality and completeness of the data set provided in the Challenge Program submissions. They are not intended to be definitive statements regarding the possibility of unreasonable risk of injury to health or the environment.

The evaluation is performed according to established EPA guidance[2,3] and is based primarily on hazard data provided by sponsors; however, in preparing the hazard characterization, EPA considered its own comments and public comments on the original submission as well as the sponsor's responses to comments and revisions made to the submission. In order to determine whether any new hazard information was developed since the time of the HPV submission, a search of the following databases was made from one year prior to the date of the HPV Challenge submission to the present: (ChemID to locate available data sources including Medline/PubMed, Toxline, HSDB, IRIS, NTP, ATSDR, IARC, EXTOXNET, EPA SRS, etc.), STN/CAS online databases (Registry file for locators, ChemAbs for toxicology data, RTECS, Merck, etc.) and Science Direct. OPPT's focus on these specific sources is based on their being of high quality, highly relevant to hazard characterization, and publicly available.

OPPT does not develop HCs for those HPV chemicals which have already been assessed internationally through the HPV program of the Organization for Economic Cooperation and Development (OECD) and for which Screening Initial Data Set (SIDS) Initial Assessment Reports (SIAR) and SIDS Initial Assessment Profiles (SIAP) are available. These documents are presented in an international forum that involves review and endorsement by governmental authorities around the world. OPPT is an active participant in these meetings and accepts these documents as reliable screening-level hazard assessments.

[1] U.S. EPA. High Production Volume (HPV) Challenge Program; http://www.epa.gov/chemrtk/index.htm.
[2] U.S. EPA. HPV Challenge Program – Information Sources; http://www.epa.gov/chemrtk/pubs/general/guidocs.htm.
[3] U.S. EPA. Risk Assessment Guidelines; http://cfpub.epa.gov/ncea/raf/rafguid.cfm.

These hazard characterizations are technical documents intended to inform subsequent decisions and actions by OPPT. Accordingly, the documents are not written with the goal of informing the general public. However, they do provide a vehicle for public access to a concise assessment of the raw technical data on HPV chemicals and provide information previously not readily available to the public.

Chemical Abstract Service Registry Number (CASRN)	**Sponsored Streams** **See Appendix A**
Chemical Abstract Index Name	**Sponsored Streams** **Subcategory I** **Unrefined and Mildly Refined Base Oils** **(4 chemicals)** **Subcategory II** **Highly and Severely Refined Distillate Base Oils** **(26 chemicals)** **Subcategory III** **Residual Base Oils** **(6 chemicals)** **See Appendix A for names of category members**
Structural Formula	**See Appendix B**

Summary

The Lubricating Oil Basestocks Category consists of 36 petroleum process streams that are complex mixtures composed primarily of saturated hydrocarbons with carbon numbers ranging from C15 to C50. At ambient temperatures, lubricating base oils are liquids of varying viscosities, with negligible to low water solubility and negligible to low vapor pressure. All the substances in this category are expected to have low mobility in soil. Volatilization from water is expected to be low for the category members, even though their estimated Henry's Law constant is high. The rate of hydrolysis is expected to be negligible since the substances in this category lack reactive functional groups. The rate of atmospheric photooxidation is considered moderate to rapid for members of the category; however, this is not expected to be an important environmental fate process for most category members, since these are not expected to exist in the vapor phase in the atmosphere. The overall weight of experimental evidence and data from structurally similar compounds suggest that most of the components of these mixtures are expected to have low (P1) to moderate (P2) persistence. The members of this category are expected to have low (B1) to high (B3) bioaccumulation potential.

Human Health Hazard

For human health assessment, the Lubricating Oil Basestocks category is subdivided into three subcategories.

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Acute oral toxicity to rats and acute dermal toxicity to rabbits of Unrefined and Mildly Refined Distillate Base Oils is low. A rat repeated-dose dermal toxicity study on the supporting chemical, Heavy Vacuum Gas Oil (no CASRN), despite methodological flaws, suggested a LOAEL of approximately 500 mg/kg/day (based on hematology effects) and a NOAEL of approximately 125 mg/kg/day. No reproductive or developmental toxicity data were available. CASRN 6741-50-0 induced gene mutations in mammalian cells *in vitro*. No chromosomal aberrations data are available. CASRNs 64741-53-3, 64741-50-0, and 64741-51-1 increased incidence of skin tumors in mice. CASRN 64741-50-0 is irritating to rabbit skin and eyes, and not sensitizing to guinea pigs.

The repeated-dose and reproductive/developmental toxicity by the oral route, and chromosomal aberrations endpoints were identified as data gaps for Subcategory I under the HPV Challenge Program.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Acute oral toxicity to rats and acute dermal toxicity to rabbits of Highly and Severely Refined Distillate Base Oils is low. Acute inhalation toxicity to rats is moderate. The LOAECs for repeated-dose rat inhalation studies performed with CASRNs 64742-70-7, 8042-47-5, and 64742-54-7 (0.05 mg/L/day, 0.05 mg/L/day, and 0.22 mg/L/day, respectively) are based on lung weight changes in conjunction with lung histopathology (foamy macrophages in the aleveolar spaces). A NOAEC for repeated-inhalation toxicity in rats is 0.05 mg/L/day for CASRN 64742-54-7. The LOAEL for systemic toxicity in rat repeated-dose dermal studies is approximately 125 mg/kg/day for CASRN 8042-47-5 (based on decreased body weight) and 2000 mg/kg/day for CASRN 64742-54-7 (based on histopathological changes in liver). The NOAELs for systemic toxicity in rat repeated-dose dermal studies was not established for CASRN 8042-47-5; 800 mg/kg/day for CASRN 64742-54-7; 1000 mg/kg/day for CASRN 64742-56-9, CASRN 64742-65-0, and CASRN 645741-88-4 (only dose tested) and could not be established for CASRN 64742-70-7. No adequate reproductive or developmental toxicity data were available. CASRN 64741-88-4 induced gene mutations in bacteria and CASRN 64742-53-6 induced gene mutations in mammalian cells *in vitro*. CASRN 64742-56-9 did not induce chromosomal aberrations in mouse micronuclei. CASRN 64752-53-6 is irritating to rabbit skin and eyes. CASRN 8042-47-5 was sensitizing to guinea pig. CASRNs 64742-34-3, 64742-35-4 and 64742-53-6 increased incidence of dermal tumors in mice.

The repeated-dose and reproductive/developmental toxicity by the oral route were identified as data gaps for Subcategory II under the HPV Challenge Program.

Subcategory III: Residual Base Oils

No health effects data are available for Residual Base Oils with the exception of a repeated-dose dermal toxicity study in rat. The NOAEL for systemic toxicity is 2000 mg/kg/day (only dose tested). No reproductive or developmental toxicity data are available. No data for gene mutation and chromosomal aberration are available.

The acute, repeated-dose, reproductive/developmental toxicity (by the oral route) and genetic toxicity (gene mutations and chromosomal aberrations) endpoints have been identified as data gaps for Subcategory III under the HPV Challenge Program.

Hazard to the Environment

The acute toxicity to fish and aquatic invertebrates, and the toxicity to aquatic plants exposed to the Lubricating Base Oils Category members are considered as "no effects at saturation" based on data for the supporting chemical CASRN 1120-36-1. The chronic toxicity to aquatic invertebrates exposed to the Lubricating Base Oils Category members is "no effects at saturation" based on data for the supporting chemical CASRN 1120-36-1.

No data gaps were identified for ecotoxicity under the HPV Challenge Program.

The Sponsor, the American Petroleum Institute's Petroleum HPV Testing Group, submitted a Test Plan and Robust Summaries to EPA for Lubricating Oil Basestocks on March 24, 2003. EPA posted the submission on the ChemRTK HPV Challenge website on April 4, 2003 (http://www.epa.gov/hpv/pubs/summaries/lubolbse/c14364tc.htm). EPA comments on the original submission were posted to the website on August 8, 2003. Public comments were also received and posted to the website. The Sponsor submitted updated/revised documents on January 13, 2004, which were posted to the ChemRTK website on April 26, 2004. The Sponsor submitted a revised "Category Assessment Document" on April 11, 2011, which was posted to the ChemRTK website on May 3, 2011. The Lubricating Oil Basestocks category consists of 36 substances, which are listed in Table 1 below.

In its 2003 comments, EPA found the category definition to be adequate, but requested additional information on various issues, including those related to health effects and ecotoxicity. While the sponsor submitted amended robust summaries in 2004, and indicated that it would perform a reproductive/developmental screening test (OECD 422) on a member of Subcategory II, Highly and Severely Refined Distillate Base Oils and a member of Subcategory III, Residual Base Oils. These studies were not submitted. In that 2004 submission, the Sponsor stated that its 90-day dermal toxicity study with heavy vacuum gas oil adequately characterized reproductive/developmental effects for Subcategory I, Unrefined and Mildly Refined Distillate Base Oils. However, EPA had concluded that first, the 90-day repeated-dose toxicity study alone does not address the reproductive and developmental toxicity endpoints and the second, the dermal route and the test substance application methods were not consistent with OECD guideline methods for that route. While the Sponsor's 2004 revised submission presented its rationale for why the dermal route for the proposed toxicity studies was appropriate, EPA continues to consider the oral route of administration to be relevant and appropriate.

The Sponsor's 2011 submission included a proposal to create new subcategories and to redistribute existing Category members among original and new subcategories. Furthermore, this submission proposed the use of a modeling system to predict certain health hazard endpoints. EPA did not find the rationale for the re-categorization to be justified as further elaborated on in the "Category Justification" below.

Category Justification

The Lubricating Oil Basestocks category consists of 36 petroleum process streams and finished products that are complex mixtures of paraffinic, isoparaffinic, naphthenic and aromatic hydrocarbons in the C15-C50 range that boil between 570 and 1100 °F. The Sponsor reports that members of this category are the primary hydrocarbon components of industrial lubricants including engine oils, transmission fluids, hydraulic fluids, gear oils, metalworking oils, greases, heat transfer oils, general-purpose oils, and machine oils. The more refined basestocks may also be used as food machinery lubricants, pharmaceutical white oils, laxatives, body lotions, cosmetics, direct food additives, and in a number of food-contact applications.

Because of the inherent variability in petroleum materials, Category members are not defined by detailed compositional information, but rather by process history, physical properties and product use specifications. The Category includes both refinery streams and finished products and is divided into three subcategories: Subcategory I, Unrefined and Mildly Refined Distillate Base Oils; Subcategory II, Highly and Severely Refined Distillate Base Oils; and Subcategory III, Residual Base Oils. The residuum from crude oil distillation at atmospheric pressure is the starting material for the Lubricating Oil Basestocks Category chemicals. This residuum is distilled under vacuum to yield a range of distillate fractions and a "vacuum residuum". The distillate fractions undergo varying degrees of processing to produce streams of the Unrefined and Highly Refined Distillate Base Oil subcategories I and II chemicals; removal of asphalt components and additional processing of the Vacuum Residuum results in streams of the Residual Base Oils, Subcategory III chemicals.

In its 2003 and 2004 submissions, the Sponsor justified the grouping of the category members on the basis of production streams that originate from a single starting material, similar physiochemical and environmental properties and low acute and aquatic toxicities. EPA agreed that the Subcategory definitions are adequate, but did not believe that the Sponsor's read-across approach is appropriate across all chemicals within the category from substances in one subcategory to another subcategory because the Sponsor did not provide sufficient toxicity data on each subcategory. Nevertheless, EPA agrees with reading across toxicities *within* subcategories. For the ecotoxicity data, EPA believes that it is not necessary to use of subcategories to describe the toxicity for the Lubricating Oil Basestock Category because C15-C50 or C20-C50 hydrocarbons are expected to exert similar toxicity to aquatic organisms due to the low water solubility (< 1 ppm) and moderate to high estimated Log K_{ow} values (5.7-25).

In its 2011 submission, the Sponsor proposed a different subcategorization scheme. While all of the original 36 category members were retained in the Category, Category members were redistributed among subcategories (some of which appeared to be new subcategories) in a nontransparent manner. Only one subcategory (Subcategory II, Residual Base Oils), which was

assigned a different name in the more recent submission, retained all of its original members. EPA finds that scheme inadequate for several reasons. 1) The new subcategories have different descriptors/names relative to those in the earlier submissions, and use of such descriptors is inconsistent in the new submission, making it impossible to determine which subcategory is being addressed. This precludes a clear understanding of the rationale for reassignment of CASRNs in the new submission and assessing differences between the new categorization scheme and the original scheme. 2) While the Sponsor states that it had recently received additional compositional content on category members, and that it used this information in addressing data gaps (by using predictive statistical models based on polycyclic aromatic compound (PAC) composition), the Sponsor did not identify the specific category members on which it had received additional information, and the submission appeared to include no new compositional data on subcategory members (or any summary of such data). 3) The Sponsor's new categorization scheme was not clearly communicated, including the relationship between subcategory designations in the previous and current submissions. 4) The PAC modeling approach had been reviewed by a Toxicology Excellence for Risk Assessment (TERA) Peer Consultation Panel, which issued a report on January 28, 2008 (http://www.tera.org/peer/API/PAC%20MEETING%20REPORT%20Final.pdf, accessed 05/23/2011). The Panelists raised a number of questions, strongly suggesting that more work and broader input were needed. The revised submission (January 2, 2011) does not indicate that the Sponsor has performed additional work to address comments made in the Peer Consultation report. The EPA believes that without additional information/documentation of models' performance, the models cannot be evaluated for accuracy. Therefore, at this time the modeling approach is not acceptable. When all pertinent information is available, this modeling approach can be revised in the future.

Because of these issues, this hazard characterization uses the categorization scheme that the Sponsor proposed in its 2003 and 2004 submissions.

Justification for Supporting Chemicals

The Sponsor proposed the use of three supporting chemicals: heavy vacuum gas oil (CASRN 64741-57-7), white oils (CASRN 8012-95-1 or not specified) and distillate aromatic extract (CASRN 64742-04-7).

For health effects, the Sponsor stated that heavy vacuum gas oil has a process history similar to unrefined distillate base oils. Both are produced by the vacuum distillation of the residuum from atmospheric distillation of crude oil and are composed of predominantly non-aromatic hydrocarbons, with carbon numbers in the range of C20-C50 for heavy vacuum gas oil and C15 - C50 for unrefined distillate base oils. They have similar boiling point ranges (350 - 600 °C) and have received little or no processing to remove potential contaminants. EPA therefore agrees to the use of heavy vacuum gas oil as a supporting chemical for the repeated-dose and developmental toxicity endpoints for the unrefined and Mildly Refined Distillate Base Oils (Subcategory I).

EPA does not agree with the Sponsor's proposed use of white oils (CASRN 8012-95-1) and white oils (no CASRN) for repeated-dose toxicity, reproductive/developmental toxicity and carcinogenicity for the Highly and Severely Refined Distillate Base Oils subcategory

(Subcategory II). The food-grade white oils are severely refined distillate base oils that have undergone numerous processing steps that essentially eliminate or transform all undesired components, including unsaturated hydrocarbons and aromatics. They are thus expected to be among the least toxic of the Highly and Severely Refined Distillate Base Oils subcategory and not to adequately characterize the potential toxicity of this Subcategory.

For the ecotoxicity effects, EPA agrees using the C14 compound, 1-tetradecene (CASRN 1120-36-1), as an appropriate supporting chemical for the Lubricating Base Oils Category members. Because it has a similar structure and physical-chemical properties, the data provided for this compound can read across to all of the Lubricating Base Oils Category members.

1. Chemical Identity

1.1 Identification and Purity

The physical-chemical properties of the sponsored substances and supporting chemicals in the Lubricating Oil Basestocks category are summarized in Table 1. The environmental fate properties are provided in Table 2. Representative structures of the sponsored chemicals and supporting chemicals are provided in the Appendix.

1.2 Physical-Chemical Properties

The members of this category are liquids of varying viscosities, with negligible to low water solubility and negligible to low vapor pressure. The category members are generally complex mixtures of saturated hydrocarbons with carbon ranges of approximately C15-C50.

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category[1]						
Subcategory I: Unrefined and Mildly Refined Distillate Base Oils						
Property	**Distillates (petroleum), light paraffinic**	**Distillates (petroleum), heavy paraffinic**	**Distillates (petroleum), light naphthenic**	**Distillates (petroleum), heavy naphthenic**	**Gas oils (petroleum), heavy vacuum (supporting chemical)**	**Extracts (petroleum), heavy paraffinic distillate solvent (supporting chemical)**
CASRN	64741-50-0	64741-51-1	64741-52-2	64741-53-3	64741-57-7	64742-04-7
Molecular Weight	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)
Physical State	Liquids of varying viscosities	Liquids of varying viscosities	Liquids of varying viscosities	Liquids of varying viscosities	Highly viscous liquid or semi-solid substance	Highly viscous liquid or semi-solid substance
Melting Point	15.5°C (measured pour point)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	31–35°C (measured pour point)[2]	-6–36°C (measured pour point)[3]
Boiling Point	313–432°C (measured)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	232–418°C (measured)	350–600°C (measured)[2]	250–680°C (measured)[3]
Vapor Pressure	3.5×10^{-7} to 0.001 mm Hg at 25°C (estimated)[4]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[4]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[4]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[4]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[4]	<0.075 mm Hg at 25°C (measured)[3]; $<1\times10^{-7}$ to 0.038 mm Hg at 25°C (estimated)[4]
Dissociation Constant (pK_a)	Not applicable					
Henry's Law Constant	21.9 to 101 atm-m^3/mol (estimated)[5,6]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[5,6]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[5,6]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[5,6]	7.0×10^{-5} to 372 atm-m^3/mol (estimated)[5,6]	3.4×10^{-5} to 0.012 atm-m^3/mol (estimated)[5,6]
Water Solubility	2.0×10^{-9} to 0.003 mg/L at 25°C (estimated)[5,6]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[5,6]	$<1.0\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[5,6]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[5,6]	$<1.0\times10^{-10}$ to 1.4×10^{-4} mg/L at 25°C (estimated)[5,6]	1.4 to 5.8 mg/L (measured)[3]; $<1\times10^{-6}$ to 0.002 mg/L (estimated)[5,6]

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category[1]						
Subcategory I: Unrefined and Mildly Refined Distillate Base Oils						
Property	**Distillates (petroleum), light paraffinic**	**Distillates (petroleum), heavy paraffinic**	**Distillates (petroleum), light naphthenic**	**Distillates (petroleum), heavy naphthenic**	**Gas oils (petroleum), heavy vacuum (supporting chemical)**	**Extracts (petroleum), heavy paraffinic distillate solvent (supporting chemical)**
Log K_{ow}	7.6–13.5 (estimated)[5,6]	9.3–24.3 (estimated)[5,6]	6.4–14.7 (estimated)[5,6]	8.9–24.2 (estimated)[5,6]	8.8–19.3 (estimated)[5,6]	8.0–19.6 (estimated)[5,6]

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of April 7, 2011.
[2] The Petroleum HPV Testing Group. 2004. Robust Summary and Test Plan for the Heavy Fuel Oils. Available online at http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm as of April 7, 2011.
[3] The Petroleum HPV Testing Group. 2009. Revised Test Plan and Robust Summary for Aromatic Extracts. Available online at http://www.epa.gov/chemrtk/pubs/summaries/aroexcat/c14900tc.htm as of April 7, 2011.
[4] NOMO5. 1987. Programs to Enhance PC-Gems Estimates of Physical Properties for Organic Compounds. The Mitre Corp.
[5] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[6] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]						
Subcategory II: Highly and Severely Refined Distillate Base Oils						
Property	**Distillates (petroleum), heavy hydrocracked**	**Distillates (petroleum), solvent-refined heavy paraffinic**	**Distillates (petroleum), solvent-refined light paraffinic**	**Distillates (petroleum), solvent-refined heavy naphthenic**	**Distillates (petroleum), solvent-refined light naphthenic**	**Distillates (petroleum), acid-treated heavy naphthenic**
CASRN	64741-76-0	64741-88-4	64741-89-5	64741-96-4	64741-97-5	64742-18-3
Molecular Weight	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)
Physical State	Liquids of varying viscosities					
Melting Point	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)
Boiling Point	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)
Vapor Pressure	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]
Dissociation Constant (pK_a)	Not applicable					
Henry's Law Constant	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]
Water Solubility	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[3,4]
Log K_{ow}	6.4–14.9 (estimated)[3,4]	9.3–24.3 (estimated)[3,4]	6.4–14.7 (estimated)[3,4]	8.9–24.2 (estimated)[3,4]	6.4–14.7 (estimated)[3,4]	8.9–24.2 (estimated)[3,4]

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.
[2] NOMO5. 1987. Programs to Enhance PC-Gems Estimates of Physical Properties for Organic Compounds. The Mitre Corp.
[3] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[4] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]						
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)						
Property	**Distillates (petroleum), acid-treated light naphthenic**	**Distillates (petroleum), chemically neutralized heavy naphthenic**	**Distillates (petroleum), chemically neutralized light naphthenic**	**Distillates (petroleum), clay-treated light paraffinic**	**Distillates (petroleum), clay-treated heavy naphthenic**	**Distillates (petroleum), hydrotreated heavy naphthenic**
CASRN	64742-19-4	64742-34-3	64742-35-4	64742-37-6	64742-44-5	64742-52-5
Molecular Weight	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	440 (average molecular weight)
Physical State	Liquids of varying viscosities					
Melting Point	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	-24°C (measured pour point)
Boiling Point	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	338–604°C (measured)
Vapor Pressure	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]
Dissociation Constant (pK_a)	Not applicable					
Henry's Law Constant	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]
Water Solubility	$<1.0\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[3,4]
Log K_{ow}	6.4–14.7 (estimated)[3,4]	8.9–24.2 (estimated)[3,4]	6.4–14.7 (estimated)[3,4]	6.4–14.7 (estimated)[3,4]	8.9–24.2 (estimated)[3,4]	8.9–24.2 (estimated)[3,4]

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.
[2] NOMO5. 1987. Programs to Enhance PC-Gems Estimates of Physical Properties for Organic Compounds. The Mitre Corp.
[3] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[4] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Distillates (petroleum), hydrotreated light naphthenic**	**Distillates (petroleum), hydrotreated heavy paraffinic**	**Distillates (petroleum), hydrotreated light paraffinic**	**Distillates (petroleum), solvent-dewaxed light paraffinic**	**Distillates (petroleum), solvent-dewaxed heavy naphthenic**	**Distillates (petroleum), solvent-dewaxed heavy paraffinic**	**Paraffin oils (petroleum), catalytic dewaxed heavy**
CASRN	64742-53-6	64742-54-7	64742-55-8	64742-56-9	64742-63-8	64742-65-0	64742-70-7
Molecular Weight	290 (average molecular weight)	500 (average molecular weight)	360 (average molecular weight)	280 (average molecular weight)	280–700 (average molecular weight for other category members)	390 (average molecular weight)	280–700 (average molecular weight for other category members)
Physical State	Liquids of varying viscosities						
Melting Point	-60°C (measured pour point)	-9°C (measured pour point)	-18°C (measured pour point)	-18°C (measured pour point)	No data. <25°C (liquid)	-12°C (measured pour point)	No data. <25°C (liquid)
Boiling Point	232–418°C (measured)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)
Vapor Pressure	9.9×10^{-7} to 0.098 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1.3\times10^{-6}$ mm Hg at 25°C (measured); $<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]
Dissociation Constant (pK_a)	Not applicable						
Henry's Law Constant	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	5.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Distillates (petroleum), hydrotreated light naphthenic**	**Distillates (petroleum), hydrotreated heavy paraffinic**	**Distillates (petroleum), hydrotreated light paraffinic**	**Distillates (petroleum), solvent-dewaxed light paraffinic**	**Distillates (petroleum), solvent-dewaxed heavy naphthenic**	**Distillates (petroleum), solvent-dewaxed heavy paraffinic**	**Paraffin oils (petroleum), catalytic dewaxed heavy**
Water Solubility	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 0.0001 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[3,4]
Log K_{ow}	6.4–14.7 (estimated)[3,4]	9.3–24.3 (estimated)[3,4]	6.4–14.7 estimated)[3,4]	6.4–14.7 (estimated)[3,4]	8.9–24.2 (estimated)[3,4]	9.3–24.3 (estimated)[3,4]	9.3–24.3 (estimated)[3,4]

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.

[2] NOMO5. 1987. Programs to Enhance PC-Gems Estimates of Physical Properties for Organic Compounds. The Mitre Corp.

[3] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.

[4] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Paraffin oils (petroleum), catalytic dewaxed light**	**Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based**	**White mineral oil (petroleum)**	**Lubricating oils (petroleum), hydrotreated spent**	**Foots oil (petroleum)**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based, contg. solvent deasphalted residual oil**
CASRN	64742-71-8	72623-85-9	72623-86-0	8042-47-5	64742-58-1	64742-67-2	72623-84-8
Molecular Weight	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	400 (average molecular weight)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)	280–700 (average molecular weight for other category members)
Physical State	Liquids of varying viscosities						
Melting Point	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	-15°C (measured pour point)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)
Boiling Point	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)	300–600°C (typical boiling point range for distillate base oils)
Vapor Pressure	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ to 0.0023 mm Hg at 25°C (estimated)[2]
Dissociation Constant (pK_a)	Not applicable						
Henry's Law Constant	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	90.2 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	1.44 to 1.5×10^{3} atm-m^3/mol (estimated)[3,4]

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Paraffin oils (petroleum), catalytic dewaxed light**	**Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based**	**White mineral oil (petroleum)**	**Lubricating oils (petroleum), hydrotreated spent**	**Foots oil (petroleum)**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based, contg. solvent deasphalted residual oil**
Water Solubility	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.0029 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.03 mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 1.4×10^{-5} to mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 0.04 mg/L at 25°C (estimated)[3,4]
Log K_{ow}	6.4–14.7 (estimated)[3,4]	9.3–24.3 (estimated)[3,4]	6.4–14.7 (estimated)[3,4]	7.7–24.2 (estimated)[3,4]	6.5–24.2 (estimated)[3,4]	9.9–24.2 (estimated)[3,4]	6.4–14.7 (estimated)[3,4]

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.
[2] NOMO5. 1987. Programs to Enhance PC-Gems Estimates of Physical Properties for Organic Compounds. The Mitre Corp.
[3] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[4] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

Table 1. Physical-Chemical Properties of the Lubricating Oil Basestocks Category (continued)[1]						
Subcategory III: Residual Base Oils						
Property	**Residual oils (petroleum), solvent deasphalted**	**Lubricating oils (petroleum), C>25, hydrotreated bright stock-based**	**Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based**	**Residual oils (petroleum), solvent-refined**	**Residual oils (petroleum), hydrotreated**	**Residual oils (petroleum), solvent-dewaxed**
CASRN	64741-95-3	72623-83-7	72623-87-1	64742-01-4	64742-57-0	64742-62-7
Molecular Weight	700 (average molecular weight for a residual base oil CASRN 64742-62-7)	700 (average molecular weight for a residual base oil CASRN 64742-62-7)	700 (average molecular weight for a residual base oil CASRN 64742-62-7)	700 (average molecular weight for a residual base oil CASRN 64742-62-7)	700 (average molecular weight for a residual base oil CASRN 64742-62-7)	700 (average molecular weight)
Physical State	Liquids of varying viscosities					
Melting Point	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	No data. <25°C (liquid)	-6°C (measured pour point)
Boiling Point	Residual base oils have boiling ranges upwards of 800°C	Residual base oils have boiling ranges upwards of 800°C	Residual base oils have boiling ranges upwards of 800°C	Residual base oils have boiling ranges upwards of 800°C	Residual base oils have boiling ranges upwards of 800°C	Residual base oils have boiling ranges upwards of 800°C
Vapor Pressure	$<1\times10^{-7}$ mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ mm Hg at 25°C (estimated)[2]	$<1\times10^{-7}$ mm Hg at 25°C (estimated)[2]
Dissociation Constant (pK_a)	Not applicable					
Henry's Law Constant	32.5 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	32.5 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	7.9 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	32.5 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	32.5 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]	32.5 to 4.4×10^{5} atm-m^3/mol (estimated)[3,4]
Water Solubility	$<1.0\times10^{-10}$ to 1.6×10^{-7} mg/L at 25°C (estimated)[3,4]	$<1.0\times10^{-10}$ to 1.6×10^{-7} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 4.5×10^{-5} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 1.6×10^{-7} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 1.6×10^{-7} mg/L at 25°C (estimated)[3,4]	$<1\times10^{-10}$ to 1.6×10^{-7} mg/L at 25°C (estimated)[3,4]
Log K_{ow}	11.7–24.2 (estimated)[3,4]	11.7–24.2 (estimated)[3,4]	9.3–24.3 (estimated)[3,4]	11.7–24.3 (estimated)[3,4]	11.7–24.3 (estimated)[3,4]	11.7–24.3 (estimated)[3,4]

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.
[2] NOMO5. 1987. Programs to Enhance PC-Gems Estimates of Physical Properties for Organic Compounds. The Mitre Corp.
[3] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[4] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category[1]						
Subcategory I: Unrefined and Mildly Refined Distillate Base Oils						
Property	**Distillates (petroleum), light paraffinic**	**Distillates (petroleum), heavy paraffinic**	**Distillates (petroleum), light naphthenic**	**Distillates (petroleum), heavy naphthenic**	**Gas oils (petroleum), heavy vacuum (supporting chemical)**	**Extracts (petroleum), heavy paraffinic distillate solvent (supporting chemical)**
CASRN	64741-50-0	64741-51-1	64741-52-2	64741-53-3	64741-57-7	64742-04-7
Photodegradation Half-life	2.6–7.0 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]	0.7–5.0 hours (estimated)[2,3]	0.6–1.7 hours (estimated)[2,3]
Hydrolysis Half-life	Stable					
Biodegradation	No data	No data	No data	No data	No data	No data
Bioaccumulation Factor	BAF = 130 to 7.1×10^4 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]	0.9 to 1.7×10^6 (estimated)[2,3]	1.0 to 2.6×10^5 (estimated)[2,3]
Log K_{oc}	4.4–8.1 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]	5.6–13.2 (estimated)[2,3]	5.6–13 (estimated)[2,3]
Fugacity (Level III Model)[2,3]						
Air (%)	0.3–13.4	1.1–6.1	1.5–4.8	1.1–3.8	<0.1–3.9	<0.1–0.3
Water (%)	22.3–82.5	41.1–82.5	39.0–62.4	40.5–79.9	6.2–88	6.3–15.4
Soil (%)	3.3–77.3	9.4–57.4	13.6–42.1	19.0–31.4	4.3–93.8	58.2–93.7
Sediment (%)	0.1–10.9	<0.1–18.9	<0.1–42.7	<0.1–27.7	<0.1–31.6	<0.1–26.2
Persistence[4]		P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P3 (high)	P2 (moderate) to P3 (high)
Bioaccumulation[4]	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.

[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.

[3] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

[4] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category (continued)[1]						
Subcategory II: Highly and Severely Refined Distillate Base Oils						
Property	**Distillates (petroleum), heavy hydrocracked**	**Distillates (petroleum), solvent-refined heavy paraffinic**	**Distillates (petroleum), solvent-refined light paraffinic**	**Distillates (petroleum), solvent-refined heavy naphthenic**	**Distillates (petroleum), solvent-refined light naphthenic**	**Distillates (petroleum), acid-treated heavy naphthenic**
CASRN	64741-76-0	64741-88-4	64741-89-5	64741-96-4	64741-97-5	64742-18-3
Photodegradation Half-life	3.2–5.1 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]
Hydrolysis Half-life	Stable					
Biodegradation	No data	3–22% after 28 days (not readily biodegradable)	22–29% after 28 days (not readily biodegradable); 61–63% after 21 days (readily biodegradable)	No data	1.5% after an unspecified time frame	No data
Bioaccumulation Factor	BAF = 5.0 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]
Log K_{oc}	4.3–8.3 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]
Fugacity (Level III Model)[2,3] Air (%) Water (%) Soil (%) Sediment (%)	 1.5–6.1 39.0–82.5 9.4–57.4 <0.1–42.7	 1.1–6.1 41.1–82.5 9.4–57.4 <0.1–18.9	 1.5–7.5 39.0–77.2 13.6–42.1 <0.1–42.7	 1.1–3.8 40.5–79.9 19.0–31.4 <0.1–27.7	 1.5–4.8 39.0–62.4 13.6–42.1 <0.1–42.7	 1.1–3.8 40.5–79.9 19.0–31.4 <0.1–27.7
Persistence[4]	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)
Bioaccumulation[4]	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.

[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.

[3] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

[4] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category (continued)[1]						
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)						
Property	**Distillates (petroleum), acid-treated light naphthenic**	**Distillates (petroleum), chemically neutralized heavy naphthenic**	**Distillates (petroleum), chemically neutralized light naphthenic**	**Distillates (petroleum), clay-treated light paraffinic**	**Distillates (petroleum), clay-treated heavy naphthenic**	**Distillates (petroleum), hydrotreated heavy naphthenic**
CASRN	64742-19-4	64742-34-3	64742-35-4	64742-37-6	64742-44-5	64742-52-5
Photodegradation Half-life	3.2–4.7 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]
Hydrolysis Half-life	Stable					
Biodegradation	No data	No data	No data	No data	No data	No data
Bioaccumulation Factor	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]
Log K_{oc}	4.3–8.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]
Fugacity (Level III Model)[2,3]						
Air (%)	1.5–4.8	1.1–3.8	1.5–4.8	1.5–7.5	1.1–3.8	1.1–3.8
Water (%)	39.0–62.4	40.5–79.9	39.0–62.4	39.0–77.2	40.5–79.9	40.5–79.9
Soil (%)	13.6–42.1	19.0–31.4	13.6–42.1	13.6–42.1	19.0–31.4	19.0–31.4
Sediment (%)	<0.1–42.7	<0.1–27.7	<0.1–42.7	<0.1–42.7	<0.1–27.7	<0.1–27.7
Persistence[4]	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)
Bioaccumulation[4]	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.

[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.

[3] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

[4] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Distillates (petroleum), hydrotreated light naphthenic**	**Distillates (petroleum), hydrotreated heavy paraffinic**	**Distillates (petroleum), hydrotreated light paraffinic**	**Distillates (petroleum), solvent-dewaxed light paraffinic**	**Distillates (petroleum), solvent-dewaxed heavy naphthenic**	**Distillates (petroleum), solvent-dewaxed heavy paraffinic**	**Paraffin oils (petroleum), catalytic dewaxed heavy**
CASRN	64742-53-6	64742-54-7	64742-55-8	64742-56-9	64742-63-8	64742-65-0	64742-70-7
Photodegradation Half-life	3.2–4.7 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	1.8–4.3 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]
Hydrolysis Half-life	Stable						
Biodegradation	No data	31% in 28 days (not readily biodegradable)	No data	No data	No data	20–26% in 28 days (not readily biodegradable)	No data
Bioaccumulation Factor	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 1.4×10^6 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]
Log K_{oc}	4.3–8.1 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	5.7–13.1 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]
Fugacity (Level III Model)[2,3]							
Air (%)	1.5–4.8	1.1–6.1	1.5–7.5	1.5–7.5	1.1–3.8	1.1–6.1	1.1–6.1
Water (%)	39.0–62.4	41.1–82.5	39.0–77.2	39.0–77.2	40.5–79.9	41.1–82.5	41.1–82.5
Soil (%)	13.6–42.1	9.4–57.4	13.6–42.1	13.6–42.1	19.0–31.4	9.4–57.4	9.4–57.4
Sediment (%)	<0.1–42.7	<0.1–18.9	<0.1–42.7	<0.1–42.7	<0.1–27.7	<0.1–18.9	<0.1–18.9
Persistence[4]	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)
Bioaccumulation[4]	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.
[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[3] Data range is based upon the representative structures; see Appendix for detailed information on the structures.
[4] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Paraffin oils (petroleum), catalytic dewaxed light**	**Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based**	**White mineral oil (petroleum)**	**Lubricating oils (petroleum), hydrotreated spent**	**Foots oil (petroleum)**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based, contg. solvent deasphalted residual oil**
CASRN	64742-71-8	72623-85-9	72623-86-0	8042-47-5	64742-58-1	64742-67-2	72623-84-8
Photodegradation Half-life	3.2–4.7 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]	1.8–7.1 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	1.8–4.8 hours (estimated)[2,3]	3.2–4.7 hours (estimated)[2,3]
Hydrolysis Half-life	Stable						
Biodegradation	No data	No data	No data	0–24% after 28 days (not readily biodegradable)	No data	No data	No data
Bioaccumulation Factor	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	0.9 to 9.5×10^5 (estimated)[2,3]	0.9 to 1.8×10^4 (estimated)[2,3]	BAF = 6.8 to 1.5×10^6 (estimated)[2,3]
Log K_{oc}	4.3–8.1 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]	4.5–13.1 (estimated)[2,3]	4.4–13.1 (estimated)[2,3]	5.6–13.1 (estimated)[2,3]	4.3–8.1 (estimated)[2,3]
Fugacity (Level III Model)[2,3]							
Air (%)	1.5–7.5	1.1–6.1	1.5–7.5	1.1–11.1	1.1–6.1	1.1–5.9	1.5–7.5
Water (%)	39.0–77.2	41.1–82.5	39.0–77.2	43.2–79.9	34.3–82.5	41.1–82.5	39.0–77.2
Soil (%)	13.6–42.1	9.4–57.4	13.6–42.1	5.6–36.5	9.4–57.4	7.4–57.4	13.6–42.1
Sediment (%)	<0.1–42.7	<0.1–18.9	<0.1–42.7	<0.1–18.9	<0.1–56.6	<0.1–2.5	<0.1–42.7
Persistence[4]	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category (continued)[1]							
Subcategory II: Highly and Severely Refined Distillate Base Oils (continued)							
Property	**Paraffin oils (petroleum), catalytic dewaxed light**	**Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based**	**White mineral oil (petroleum)**	**Lubricating oils (petroleum), hydrotreated spent**	**Foots oil (petroleum)**	**Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based, contg. solvent deasphalted residual oil**
Bioaccumulation[4]	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.
[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.
[3] Data range is based upon the representative structures; see Appendix for detailed information on the structures.
[4] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

Table 2. Environmental Fate Characteristics of the Lubricating Oil Basestocks Category (continued)[1]						
Subcategory III: Residual Base Oils						
Property	**Residual oils (petroleum), solvent deasphalted**	**Lubricating oils (petroleum), C>25, hydrotreated bright stock-based**	**Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based**	**Residual oils (petroleum), solvent-refined**	**Residual oils (petroleum), hydrotreated**	**Residual oils (petroleum), solvent-dewaxed**
CASRN	64741-95-3	72623-83-7	72623-87-1	64742-01-4	64742-57-0	64742-62-7
Photodegradation Half-life	1.8–3.8 hours (estimated)[2,3]	1.8–3.8 hours (estimated)[2,3]	1.8–5.1 hours (estimated)[2,3]	1.8–3.8 hours (estimated)[2,3]	1.8–3.8 hours (estimated)[2,3]	1.8–3.8 hours (estimated)[2,3]
Hydrolysis Half-life	Stable					
Biodegradation	No data	No data	No data	No data	No data	No data
Bioaccumulation Factor	BAF = 0.9 to 7,361 (estimated)[2,3]	BAF = 0.9 to 7,361 (estimated)[2,3]	BAF = 0.9 to 7.3×10^5 (estimated)[2,3]	BAF = 0.9 to 7,361 (estimated)[2,3]	BAF = 0.9 to 7,361 (estimated)[2,3]	BAF = 0.9 to 7,361 (estimated)[2,3]
Log K_{oc}	7.1–13.1 (estimated)[2,3]	7.1–13.1 (estimated)[2,3]	5.8–13.1 (estimated)[2,3]	7.1–13.1 (estimated)[2,3]	7.1–13.1 (estimated)[2,3]	7.1–13.1 (estimated)[2,3]
Fugacity (Level III Model)[2,3]						
Air (%)	0.6–3.1	0.6–3.1	1.1–6.1	0.6–3.1	0.6–3.1	0.6–3.1
Water (%)	30.0–79.9	30.0–79.9	41.1–82.5	30.0–79.9	30.0–79.9	30.0–79.9
Soil (%)	19.0–68.3	19.0–68.3	9.4–57.4	19.0–68.3	19.0–68.3	19.0–68.3
Sediment (%)	<0.1–1.0	<0.1–1.0	<0.1–18.9	<0.1–1.0	<0.1–1.0	<0.1–1.0
Persistence[4]	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)	P1 (low) to P2 (moderate)
Bioaccumulation[4]	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)	B1 (low) to B3 (high)

[1] The Petroleum HPV Testing Group. 2004. Revised Test Plan and Robust Summary for Lubricating Oil Basestock Category. Available online at http://www.epa.gov/chemrtk/pubs/summaries/lubolbse/c14364tc.htm as of February 28, 2011.

[2] U.S. EPA. 2011. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of February 28, 2011.

[3] Data range is based upon the representative structures; see Appendix for detailed information on the structures.

[4] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–60204.

2. General Information on Exposure

2.1 Production Volume and Use Pattern

The Lube Oil base stocks category chemicals had an aggregated production and/or import volume in the United States greater than 20 billion and 61 million pounds in calendar year 2005.

- CASRN 64741-50-0: 1 billion pounds and greater;
- CASRN 64741-51-1: 1 billion pounds and greater;
- CASRN 64741-52-2: 1 billion pounds and greater;
- CASRN 64741-53-3: 1 billion pounds and greater;
- CASRN 64741-76-0: 1 billion pounds and greater;
- CASRN 64741-88-4: 1 billion pounds and greater;
- CASRN 64741-89-5: 1 billion pounds and greater;
- CASRN 64741-96-4: 100 to <500 million pounds;
- CASRN 64742-52-5: 1 billion pounds and greater;
- CASRN 64742-53-6: 1 billion pounds and greater;
- CASRN 64742-54-7: 1 billion pounds and greater;
- CASRN 64742-55-8: 1 billion pounds and greater;
- CASRN 64742-56-9: 50 million to <100 million pounds
- CASRN 64742-65-0: 1 billion pounds and greater;
- CASRN 64742-70-7: 1 billion pounds and greater;
- CASRN 64742-71-8: 100 to <500 million pounds;
- CASRN 72623-85-9: 1 billion pounds and greater;
- CASRN 72623-86-0: 10 million to <50 million pounds
- CASRN 8042-47-5: 100 million to <500 million pounds
- CASRN 64742-58-1: 100 million to <500 million pounds;
- CASRN 64742-67-2: 100 million to <500 million pounds;
- CASRN 72623-84-8: 1 million to <10 million pounds
- CASRN 64741-95-3: 1 billion pounds and greater;
- CASRN 72623-83-7: 500 million to <1 billion pounds;
- CASRN 72623-87-1: 1 billion pounds and greater;
- CASRN 64742-01-4: 1 billion pounds and greater;
- CASRN 64742-57-0: 1 billion pounds and greater;
- CASRN 64742-62-7: 1 billion pounds and greater;

CASRN 64741-97-5, 64742-18-3, 64742-19-4, 64742-34-3, 64742-35-4, 64742-37-6, 64742-44-5 and 64742-63-8 were not reported in the 2006 IUR.

CASRN 64741-50-0, 64741-51-1, 64741-52-2, 64741-53-3, 64741-76-0, 64741-89-5, 64741-96-4, 64742-53-6, 64742-55-8, 64742-56-9, 64742-70-7, 64742-71-8, 72623-85-9, 64742-58-1, 64742-67-2, 72623-84-8, 64741-95-3, 72623-87-1, 64742-57-0, and 64742-62-7:

No industrial processing and uses, and commercial and consumer uses were reported for these chemicals.

CASRN 64741-88-4:
Non-confidential information in the IUR indicated that the industrial processing and uses for the chemical include other rubber product manufacturing as intermediates; all other chemical product and preparation manufacturing as lubricants. Non-confidential commercial and consumer uses of this chemical include lubricants, greases and fuel additives; rubber and plastic products.

CASRN 64742-52-5, 64742-65-0, 72623-86-0, 8042-47-5, and 64742-01-4:
Industrial processing and uses, and commercial and consumer uses of these chemicals are claimed confidential.

CASRN 64742-54-7:
Industrial processing and uses of this chemical are claimed confidential. Non-confidential commercial and consumer uses of this chemical include lubricants, greases and fuel additives.

CASRN 72623-83-7:
Non-confidential information in the IUR indicated that the industrial processing and uses for the chemical include all other chemical product and preparation manufacturing as lubricants. No commercial and consumer uses were reported for this chemical.

CASRN 8042-47-5:
Industrial processing and uses, and commercial and consumer uses of this chemical are claimed confidential.

2.2 Environmental Exposure and Fate

The substances in the Lubricating Oil Basestocks category are expected to have low mobility in soil. Biodegradation data exist for several substances in this category. Solvent-refined heavy paraffinic distillates (petroleum)(CASRN 64741-88-2) degraded 3–22% after 28 days in several modified Sturm tests (OECD 301B) and is considered not readily biodegradable. Solvent-refined light paraffinic distillates (petroleum) (CASRN 64741-89-5) was not readily biodegradable using a modified Sturm test; however, it achieved 63% mean degradation after 21 days using CEC Method L-33-T-82 and test medium from ISO Standard 7827 and OECD 301A and 301E. , Hydrotreated heavy paraffinic distillates (petroleum) (CASRN 64742-54-7) was degraded 31% after 28 days using the manometric respirometry (OECD 301F) test. Volatilization from water is expected to be low for the category members, even though their estimated Henry's Law constant is high. The rate of hydrolysis is expected to be negligible since the substances in this category do not have reactive functional groups. The overall weight of experimental evidence and data from structurally similar compounds suggest that most of the components of these mixtures are expected to have low (P1) to moderate persistence (P2). The members of this category are expected to have low (B1) to high (B3) bioaccumulation potential.

3. Human Health Hazard

A summary of the human health toxicity data submitted for SIDS endpoints is provided in Table 3. The Table also indicates where data for tested category members are read-across (RA) to untested members of the category.

Acute Oral Toxicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), light paraffinic (CASRN 64741-50-0)
Sprague-Dawley rats (5/sex/dose) were administered CASRN 64741-50-0(API-84-01) via an unspecified oral route at 5000 mg/kg and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 5000 mg/kg

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
Sprague-Dawley rats (5/sex/dose) were administered CASRN 64742-53-6 (API 83-12) via an unspecified oral route at 5000 mg/kg and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 5000 mg/kg

Distillates (petroleum), hydrotreated heavy paraffinic (CASRN 64752-54-7)
Sprague-Dawley rats (5/sex/dose) were administered CASRN 64752-54-7 (Ssangyong 150N) via oral gavage at 15,000 mg/kg and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 15,000 mg/kg

Distillates (petroleum), solvent-dewaxed heavy paraffinic (CASRN 64742-65-0)
Sprague-Dawley rats (5/sex/dose) were administered CASRN64742-65-0 (Stock 142) via oral gavage at 15,000 mg/kg and observed for 14 days following dosing. One male and one female died.
LD_{50} < 15,000 mg/kg

Subcategory III: Residual Base Oils

No data

Acute Inhalation Toxicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), solvent-dewaxed heavy paraffinic (CASRN 64742-65-0)
(1) Sprague-Dawley rats (10/sex/dose) were sham-exposed or were exposed to 100, 510, or 2400 mg/m^3 (0.10, 0.51, or 2.40 mg/L) aerosolized CASRN 64742-65-0 (Stock 142) for four hours in whole-body chambers. Animals were observed for 14 days following dosing. No mortalities were observed.
LC_{50} > 2.4 mg/L (2400 mg/m^3)

(2) Sprague-Dawley rats (10/sex/dose) were sham-exposed or were exposed to 110, 520, or 2460 mg/m^3 (0.11, 0.52, or 2.46 mg/L) aerosolized CASRN 64742-65-0 (Stock 141) for four hours in whole-body chambers. Animals were observed for 14 days following dosing. No mortalities were observed.
LC_{50} > 2.5 mg/L (2500 mg/m^3)

(3) Sprague-Dawley rats (5/sex/dose) were sham-exposed or were exposed to 4,026 mg/m^3 (4.0 mg/L) aerosolized CASRN 64742-65-0 (MRD-87-101) for four hours in whole-body chambers. Animals were observed for 14 days following dosing. No mortalities were observed.
LC_{50} > 4.0 mg/L (4026 mg/m^3)

Distillates (petroleum), solvent-refined heavy paraffinic (CASRN 64741-88-4)
(1) Sprague-Dawley rats (5/sex/dose) were sham-exposed or were exposed to 5530 mg/m^3 (5.5 mg/L) aerosolized 64741-88-4 (MRD-87-102) for four hours in whole-body chambers. Animals were observed for 14 days following dosing. No mortalities were observed.
LC_{50} > 5.5 mg/L (5530 mg/m^3)

(2) Fischer 344 rats (5/sex/dose) were exposed to CASRN 65741-88-4 (70 Orchard Spray) as an aerosol at 0, 3.2, 3.6, 4.0, 4.7 or 5.5 mg/L for 4 hours and observed for 14 days following dosing. Mortalities occurred at $\geq$ 3.6 mg/L and occurred during the 14 day observation days following dosing (TSCATS OTS0556095).
LC_{50} = 3.9 mg/L (3900 mg/m^3)

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
Sprague-Dawley rats (5/sex/dose) were exposed to CASRN 64742-53-6 (API 83-12) as an aerosol at 0, 1, 1.5, 2.5, 3.5 or 5 mg/L for 4 hours and observed for 14 days following dosing. No animals died in the 0 and 1.5 mg/L groups. One of 5 animals of each sex died in the 1.0 mg/L treatment group, 3 of 5 of each sex died in the 2.5 mg/L group, and 5 of 5 of each sex died in the 3.5 and 5.0 mg/L treatment groups.
LC_{50} = 2.2 mg/L (2200 mg/m^3)

Distillates (petroleum), solvent-dewaxed light paraffinic (CASRN 64742-56-9)
Sprague-Dawley rats (5/sex/dose) were sham-exposed or were exposed to 5,399 mg/m^3 (5.4 mg/L) aerosolized CASRN 64742-56-9 (MRD 87-099) for four hours in whole-body chambers. Animals were observed for 14 days following dosing. No mortalities were observed.
LC_{50} > 5.4 mg/L (5399 mg/m^3)

White mineral oil (petroleum) (CASRN 8042-47-5)
Sprague-Dawley rats (10/sex/dose) were sham-exposed or were exposed to 140, 550, or 2460 mg/m^3 (0.14, 0.55, or 2.46 mg/L) aerosolized CASRN 8042-47-5 (Stock 461) for four hours in whole-body chambers. Animals were observed for 14 days following dosing. No mortalities were observed.
LC_{50} > 2.5 mg/L (2460 mg/m^3)

Acute Dermal Toxicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), light paraffinic (CASRN 64741-50-0)
New Zealand White rabbits (4/sex) were administered CASRN 64741-50-0 (API-84-01) via the dermal route at 2000 mg/kg under occluded conditions for 24 hours and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 2000 mg/kg

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), hydrotreated heavy paraffinic (CASRN 64742-54-7)
New Zealand White rabbits (3/sex) were administered CASRN 64742-54-7 (Ssangyong 150N) via the dermal route at 5000 mg/kg under occluded conditions for 24 hours and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 5000 mg/kg

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
New Zealand White rabbits (2/sex) were administered CASRN 64742-53-6 (API 83-12) via the dermal route at 2000 mg/kg under occluded conditions for 24 hours and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 2000 mg/kg

Distillates (petroleum), solvent-dewaxed heavy paraffinic (CASRN 64742-65-0)
In two separate studies, New Zealand White rabbits (3/sex/dose) were administered CASRN 64742-6500 (Stocks 141 or 142) via the dermal route at 5000 mg/kg under occluded conditions for 24 hours and observed for 14 days following dosing. No mortalities were observed.
LD_{50} > 5000 mg/kg

Repeated-Dose Toxicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data.

Heavy Vacuum Gas Oil (no CASRN; supporting substance)
In a 13-week study, Sprague-Dawley rats (10/sex/dose) were dermal applied undiluted heavy vacuum gas oil at 0, 30, 125, 500, and 2000 mg/kg-day for 5 days/week. The application sites were not covered. Animals were fitted with Elizabethan collars to prevent ingestion of the test

substance. Two males and one female in the 2000 mg/kg/day group died during the study. The male deaths only were considered treatment related. At
13 weeks, the males in the 2000 mg/kg/day group weighed 20% less than controls, and the females in that group weighed 15% less than controls. Erythrocytes and platelets were reduced in males and females in the 2000 mg/kg/day and in the 500 mg/kg/day females. Clinical chemistry changes were observed in the 2000 mg/kg/day males and females in sorbitol dehydrogenase, cholesterol and uric acid (2X increase, 2X increase, and 50% reduction, respectively). No information was provided on any observed toxicity at the application site. Neither data, nor information on statistical significance, were provided for either hematology or clinical chemistry. Relative thymus weights were reduced by 25% in the 500 mg/kg/day males and females, and by 50% in the 2000 mg/kg/day males and females. There also was a reduction in thymic lymphocytes in the 2000 mg/kg/day males and females as determined microscopically. Relative liver weights were increased at 500 and 2000 mg/kg/day, but neither percentages nor actual data were provided. Furthermore, histological examination revealed decreased erythropoeisis and fibrosis of the bone marrow in the 2000 mg/kg/day males. No effects were found on either sperm morphology or in the results of urinalysis. *Because application sites were not covered, exposure may have been less than intended. This enables only an estimate of a LOAEL and NOAEL.*
LOAEL (systemic toxicity) ≈ 500 mg/kg/day (based on hematology effects)
NOAEL (systemic toxicity) ≈ 125 mg/kg/day

Subcategory II: Highly and Severely Refined Distillate Base Oils

Paraffin oils (petroleum), catalytic dewaxed heavy (CASRN 64742-70-7)
(1) In a 4-week study, Sprague-Dawley rats (10/sex/dose) were exposed to CASRN 64742-70-7 via an aerosol at nominal concentrations of 0, 0.05, 0.22 or 1 mg/L for 6 hours/day, 5 days/week. Nominal concentrations were very close to the measured ones. There were no reported treatment-related effects on body weights, clinical observations, hematological parameters, sperm morphology and breakage, necropsy observations or organ weight changes (except lungs). Statistically significant lung weight increases in treated groups relative to controls were observed in males at 0.22 and 1 mg/L (12 and 33%, respectively) and in females at 1 mg/L (38%). Foamy macrophages were present in the alveolar spaces of the lungs of all of the animals treated with the test substance.
LOAEC (systemic toxicity) = 0.05 mg/L (based on lung histopathological changes)
NOAEC (systemic toxicity) = Not established

(2) Sprague-Dawley rats (10/sex) were administered paraffin oils (petroleum), catalytic dewaxed heavy (Stock 142) via the dermal route at 1720 mg/kg or were sham treated for 3 weeks (5 days/week). Sites were not covered and were not otherwise wrapped. Animals were fitted with Elizabethan collars to prevent ingestion of the test substance. No mortality occurred during the study. Erythema and flaking skin were observed in 50% of the treated males. Treated males had a mean body weight that as approximately 11% less than that of the sham controls; the difference of which was statistically significant. Statistically significant increases in relative liver weights (to body weight) compared to controls were observed in both the female and male treated groups (21% and 18%, respectively). There were no other changes that suggested treatment effects. *This study was inappropriate for the derivation of a LOAEL or NOAEL for*

systemic toxicity because it used a single dose. Application sites were not covered or occluded, and exposure may have been less than intended, even for application site toxicity. Nevertheless, the estimated LOAEL for application site toxicity is useful to report here because it provides some information that would not otherwise be available.
LOAEL (local effects) ≈ 1720 mg/kg (based on erythema and flaking of skin)
NOAEL (local effects) = Not established

White mineral oil (petroleum) (CASRN 8042-47-5)

(1)In a 13-week study, Sprague-Dawley rats (10/sex/dose) were administered CASRN 8042-47-5 via the dermal route at 125, 500, or 2000 mg/kg/day, were sham treated, or received no treatment 5 days/week. The application sites were not covered or were not otherwise wrapped (i.e., were not consistent with occlusive conditions). Animals were fitted with Elizabethan collars to prevent ingestion of the test substance. No mortality occurred during the study. No abnormal clinical signs were observed with the exception of erythema, scabs, and flaking of the skin, which were noted in nearly all treated animals. A few sham treated animals were also observed with skin flaking and scabs. Body weights in males decreased in a dose-related manner and were statistically significant at all doses at week 13 with a 14% decrease in the high-dose group relative to the untreated male group. Female body weight at week 13 in the 2000 mg/kg/day group was significantly decreased statistically (11%) relative to the untreated female group. Statistically significant decreases in body weights of this group were also noted at weeks 4 and 9. Data on organ weights, gross observations at necropsy, and histopathology were not available to the study's Study Director or Sponsor. However, the sponsor indicated that there were no significant treatment-related effects seen on absolute organ weights in either sex, although organ weights in treated animals were higher relative to sham-treated controls. No treatment related changes in clinical chemistry were apparent. *Definitive LOAELs/NOAELs for systemic and application site toxicity could not be derived from this study because histopathological findings were unavailable and exposure may have been less than intended, even for application site toxicity (application sites were not covered or occluded).*
LOAEL (local effects) ≈ 125 mg/kg/day (based on erythema, scabs and flaking of skin)
NOAEL (local effects) = Not established
LOAEL (systemic toxicity) ≈ 125 mg/kg/day (based on decreased body weights)
NOAEL (systemic toxicity) ≈ Not established

(2) In a 4-week study, Sprague-Dawley rats (10/sex/dose) were exposed to CASRN 8042-47-5 via an aerosol at nominal concentrations of 0, 0.05, 0.22 or 1 mg/L for 6 hours/day, 5 days/week. Nominal concentrations were very close to those of the measured ones. There were no reported treatment-related effects on body weights, clinical observations, hematological parameters, sperm morphology and breakage, gross necropsy observations or organ weight changes (except lungs). Statistically significant lung weight increases in treated groups relative to controls were observed in males at 1 mg/L/day (31%) and in females at 0.22 and 1 mg/L/day (23 and 64%, respectively). Foamy macrophages were present in the alveolar spaces of the lungs of all of the animals treated with the test substance. Control values were not reported.
LOAEC = 0.05 mg/L/day (based on lung histopathological changes)
NOAEC = Not established

Distillates (petroleum), hydrotreated heavy paraffinic (CASRN 64742-54-7)
(1) In a 4-week study, Sprague-Dawley rats (10/sex/dose) were exposed to CASRN 64742-54-7 aerosol at nominal concentrations of 0, 0.05, 0.22 or 1 mg/L for 6 hours/day, 5 days/week. Nominal concentrations were very close to measured. There were no reported treatment-related effects on body weights, clinical observations, hematological parameters, sperm morphology and breakage, gross necropsy observations or organ weight changes (except lungs). Statistically significant lung weight increases of treated relative to controls were observed in s at 1 mg/L/day (32%), and females at 0.22 and 1 mg/mL/day (34% and 36%, respectively). Also, non-statistically significant increases in lung weights were observed in males at 0.22 mg/L/day (6%) relative to controls. Foamy macrophages were present in the alveolar spaces of the lungs of 16 out of 20 animals (sex unspecified) at 0.22 and 1 mg/L/day.
LOAEC = 0.22 mg/L/day (based on lung weights and lung histopathological changes)
NOAEC = 0.05 mg/L/day

(2) In a 13-week study, Sprague-Dawley rats (5/sex/dose) were dermally exposed to 0 (sham treated) 800 or 2000 mg/kg CASRN 64742-54-7 (Ssangyong 150N), 5 days/week. The application sites were not covered or were not otherwise wrapped (i.e., were not consistent with occlusive conditions). Animals were fitted with Elizabethan collars to prevent ingestion of the test substance. Neither treatment-related deaths nor abnormal clinical signs were reported. Slight erythema and flaking of the skin were observed during the dosing phase, and minimal epidermal thickening and chronic inflammation of the dermis were noted microscopically in about half of the treated males and 2/3 of the treated females, although incidences in each treatment group were not reported. Body weights in treated males were s statistically ignificantly reduced at both doses by approximately 10%, although the sampling variation was high. The mean liver weight in the 2000 mg/kg/day female group was statistically significantly higher than that of controls by 14%, and the mean liver weight in the 800 mg/kg/day female group was decreased by 7% (but was not statistically significant). Histopathology evaluation revealed livers of 3 females in the 2000 mg/kg/day group had an increased frequency of mitotic figures that were considered a test material effect. Female adrenal weights were increased at 800 mg/kg/day (not statistically significant) and at 2000 mg/kg/day (statistically significant). The study authors considered this to be a "nonpathologic adaptive change". In females, an increase in relative weights of thyroid and uterus in the 2000 mg/kg/day; these changes were not considered to be related to the test material or significant in the absence of corresponding histopathological findings. However, no data for these organ weights, in contrast to other organ weights, were presented for independent assessment. No treatment effects were observed for hematology, clinical chemistry, urinalysis, or sperm head morphology or general sperm morphology. *Definitive LOAELs/NOAELs for systemic and application site toxicity could not be derived from this study because exposure may have been less than intended, even for application site toxicity (application sites were not covered or occluded).*
LOAEL (local effects) ≈ 800 mg/kg/day (based on erythema, scabs and flaking of skin)
NOAEL (local effects) = Not established
LOAEL (systemic toxicity) ≈ 2000 mg/kg/day (based on liver changes in females)
NOAEL (systemic toxicity) ≈ 800 mg/kg/day

Distillates (petroleum), solvent-dewaxed light paraffinic (CASRN 64742-56-9)
In a 4-week, single dose study, New Zealand white rabbits (5/sex) were dermally exposed to 1000 mg/kg/day CASRN 64742-56-9 (MRD-87-099), or sham-dosed under covered and occlusive conditions for 6 hours/day, 5 days/week. All animals survived until study termination. No biologically meaningful differences were observed in body weights, food consumption, or organ weights. Females had a statistically significant increase in cholesterol and platelets (although platelet counts were highly variable); in males there was a statistically significant increase in cholesterol levels compared to controls. Histopathological evidence of irritation in the treated skin (inflammation, hyperplasia of hair follicles and hyperplasia/hyperkeratosis on epidermis) were observed in the treatment groups, which were consistent with macroscopic observations of erythema and edema at the application site.
LOAEL (local effects) = 1000 mg/kg/day (based on histopathological changes in the skin—only dose tested)
NOAEL (systemic toxicity) = 1000 mg/kg/day

Distillates (petroleum), solvent-dewaxed heavy paraffinic (CASRN 64742-65-0)
In two 4-weeks studies New Zealand white rabbits (5/sex/dose) were dermally exposed to 1000 mg/kg/day CASRN 64742-65-0 (MRD-87-100 and MRD-87-101) or were sham-dosed under occlusive conditions 6 hours/day, 5 days/week. The test material was left in contact with the skin for at least 6 hours. All animals survived until study termination, and no biologically meaningful effects were observed in clinical signs, organ weights, and clinical chemistry. Treated skin showed signs of irritation, which were also observed microscopically. No other histopathological changes were noted.
LOAEL (local effects) = 1000 mg/kg/day (based on histopathological changes in the skin)
NOAEL (systemic toxicity) = 1000 mg/kg/day

Distillates (petroleum), solvent-refined heavy paraffinic (CASRN 64741-88-4)
In a 4-week study, CASRN 64741-88-4 (MRD 87-102) was applied to the skin of New Zealand white rabbits (5/sex/dose) at 1000 mg/kg/day, or were sham-dosed, under occlusive conditions, 6 hours/day, 5 days/week. One control animal, but no treatment animals, died before the scheduled sacrifice. No biologically meaningful differences were observed in body weights, food consumption, organ weights, clinical chemistry or hematology. Histopathological evidence of irritation in the treated skin (inflammation, hyperplasia of hair follicles and hyperplasia/hyperkeratosis on epidermis) was observed in the treatment group, which was consistent with macroscopic observations of erythema and edema at the application site.
LOAEL (local effects) = 1000 mg/kg (based on histopathological changes in the skin—only dose tested)
NOAEL (local effects) = Not established
NOAEL (systemic toxicity) = 1000 mg/kg/day (only dose tested)

Subcategory III: Residual Base Oils

Lubricating oils (petroleum) C_{25}, hydrotreated bright stock-based (CASRN 72623-83-7)
In a 13-week single dose study, Sprague-Dawley rats (10/sex) were dermally exposed to 2000 mg/kg/day CASRN 72623-83-7 (Stock 345) or were sham exposed for 6 hours/day, 5 days/week. The application sites were not covered and were not otherwise wrapped (i.e., were not consistent

with occlusive conditions). Animals were fitted with Elizabethan collars to prevent ingestion of the test substance. Neither treatment-related deaths nor abnormal clinical signs were reported. No irritation was noted at the application site, although histopathologically, epidermal hyperplasia was noted in treated animals, with signs of chronic inflammation in the superficial dermis. The mean absolute liver weight was 7.6% higher in treated females than in controls (not statistically significant) and relative liver weight was increased in females by 11.2% (statistically significant). This may reflect the small decrease in final body weight of treated females (approximately 4%) combined with their absolute 1iver weight increase of 7.6%. Neither of these changes was statistically significant. No changes were observed in the liver microscopically. A relative kidney weight increase (9.4%) was noted in treated males, which may have reflected the 6.9% decrease in final body weight of this group. *Definitive LOAELs/NOAELs for systemic and application site toxicity could not be derived from this study because exposure may have been less than intended, even for application site toxicity (application sites were not covered or occluded).*
LOAEL (local effects) ≈2000 mg/kg/day (based on epidermal hyperplasia—only dose tested)
NOAEL (systemic toxicity) ≈ 2000 mg/kg/day (only dose tested)

Reproductive Toxicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data.

Subcategory II: Highly and Severely Refined Distillate Base Oils

No data.

Subcategory III: Residual Base Oils

No data.

Developmental Toxicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data.

Subcategory II: Highly and Severely Refined Distillate Base Oils

No adequate data.

Subcategory III: Residual Base Oils

No data.

Genetic Toxicity – Gene Mutation

In vitro

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), light paraffinic (CASRN 64741-50-0)
In a mouse lymphoma forward mutation assay, L5178Y cells were exposed to CASRN 64741-50-0 (API 84-01) (in acetone) at concentrations of 50-1000 nL/mL in the absence of metabolic activation, and 400-1000 nL/mL in the presence of metabolic activation. Little or no toxicity was observed well into the insoluble range. No significant increases in mutant frequency were observed without metabolic activation. However, in the presence of metabolic activation, the test substance induced significant increases in the mutant frequency (from 2.1X-7.3X above background). Both positive and negative controls were run and responded appropriately. (TSCATS, OTS0000285-5).
CASRN 64741-50-0 was mutagenic in this assay.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
In a mouse lymphoma forward mutation assay, L5178Y cells were exposed to CASRN 6742-53-6 (API 83-12) in ethanol at concentrations of 250-1200 nL/mL in the absence of metabolic activation and 400-1600 nL/mL in the presence of metabolic activation. The test substance was soluble at all concentration assayed. Cells were exposed to the test substance for 4 hours. Results were positive. Both positive and negative controls were run. Positive control responded appropriately. (TSCATS, OTS0000285-5).
CASRN 64742-53-6 was mutagenic in this assay.

Distillates (petroleum), hydrotreated heavy (CASRN 64742-52-5)
Distillates (petroleum), hydrotreated heavy was evaluated In a mouse lymphoma forward mutation assay L5178Y cells were exposed to CASRN 64742-52-5 (API 83-15) in DMSO at concentrations of 200-1000 nL/mL in the presence of metabolic activation, and 400-1000 nL/mL in the absence of metabolic activation. The test substance was insoluble at > 500 nL/mL. Little or no toxicity was induced, but the test substance was assayed well into the insoluble range. Results were negative. Both positive and negative controls were run. No significant increases in mutation frequency were observed. Positive control responded appropriately. (TSCATS, OTS0000285-5).
CASRN 64742-52-5 was not mutagenic in this assay.

Distillates (petroleum), solvent-refined heavy paraffinic (CASRN 64741-88-4)
Salmonella typhimurium strain TA98 was exposed (in triplicate) to CASRN 64741-88-4 at concentrations of 5, 7, 10, 20, 30, 40, 50 or 60 μL/plate with and without metabolic activation. Both positive and negative controls were run. Positive control responded appropriately. The test results were positive. While 5 strains are generally required for this assay, if at least one is positive, the test substance is considered mutagenic in the presence and absence of metabolic activation. Therefore, this study is considered valid for this hazard characterization. (TSCATS OTS0539074-1).
CASRN 64741-88-4 was mutagenic in this assay.

Subcategory III: Residual Base Oils

No data. Testing is recommended.

In vivo

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data.

Subcategory II: Highly and Severely Refined Distillate Base Oils

No data.

Subcategory III: Residual Base Oils

No data.

Genetic Toxicity – Chromosomal Aberrations

In vitro

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data.

Subcategory II: Highly and Severely Refined Distillate Base Oils

No data.

Subcategory III: Residual Base Oils

No data.

In vivo

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

No data.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), solvent-dewaxed light paraffinic (CASRN 64742-56-9)
Albino rats (5/sex/dose) were administered CASRN 64742-56-9 via gavage in corn oil at 0, 500, 1000 or 2000 mg/kg for 5 days as part of a bone marrow cytogenetic assay. A positive control group was also tested which responded appropriately. CASRN 64742-56-9 did not induce any significant aberrations compared to the negative controls. (TSCATS, OTS0000139-0).
CASRN 64742-56-9 did not induce chromosomal aberrations in this assay.

Distillates (petroleum), solvent-refined heavy naphthenic (CASRN 64741-96-4)
Sprague-Dawley rats (10/sex/dose) were administered CASRN 64741-96-4 (API-79-1) at a concentration of 0.5, 1.67 or 5 g/kg/day for 5 days. Bone marrow was sampled 6 hours after the last dose. No increases in chromosome aberrations were found compared to controls. (TSCATS OTS0000195-0).
CASRN 64741-96-4 did not induce chromosomal aberrations in this assay.

Subcategory II: Highly and Severely Refined Distillate Base Oils

No data.

Subcategory III: Residual Base Oils

No data.

Additional Information

Skin Irritation

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), light paraffinic (CASRN 64741-50-0)
In a Draize test, undiluted CASRN 64741-50-0 (API 84-01) was applied to the shaved dorsal skin of six male rabbits (strain not reported) on two areas each, one intact and the other abraded, under occluded conditions for 24 hours. Animals were observed for 14 days. The primary dermal irritation index was 4.3. Erythema and edema were observed for both intact and abraded skin immediately following exposure. Signs of irritation diminished through day 7 and completely resolved by day 14.
CASRN 64741-50-0 was irritating to rabbit skin in this study.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
In a Draize test, undiluted CASRN 64742-53-6 (API 83-12) was applied to the shaved dorsal skin of six male rabbits (strain not reported) on two areas each, one intact and the other abraded, under occluded conditions for 24 hours. Animals were observed for 14 days. Irritation was

scored by the Draize method. The primary dermal irritation index was 5.4. Erythema and edema were observed for both intact and abraded skin immediately following exposure. Signs of irritation diminished through day 7 and had completely resolved by day 14.
CASRN 64742-53-6 was irritating to rabbit skin in this study.

Subcategory III: Residual Base Oils

No data.

Eye Irritation

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), light paraffinic (CASRN 64741-50-0)
Nine rabbits (strain and sex not reported) were administered undiluted CASRN 64741-50-0 (API 84-01) to the corneal surface of one eye each. The treated eye of three of the rabbits was washed after approximately 30 seconds after treatment. Observations for ocular irritation were recorded at 1, 24, 48 and 72 hours and 7 days after treatment. Irritation was scored by the method of Draize. Primary irritation scores were 3.0 and 4.0 at 1 hour for unwashed and washed eyes, respectively, and 1.7 and 0 at 24 hours for unwashed and washed eyes, respectively. All irritation cleared by 48 hours.
CASRN 64741-50-0 was irritating to rabbit eyes in this study.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
Nine rabbits (strain and sex not reported) were administered undiluted CASRN 64742-53-6 (API 83-12) to the corneal surface of one eye. The treated eye of three of the rabbits was washed after approximately 30 seconds after treatment. Observations for ocular irritation were recorded at 1, 24, 48 and 72 hours and 7 days after treatment. Irritation was scored by the method of Draize. Primary irritation scores were 2.7 and 2.0 at 1 hour for unwashed and washed eyes, respectively, and 0.3 and 0 at 24 hours for unwashed and washed eyes, respectively. All irritation cleared by 48 hours.
CASRN 64742-53-6 was irritating to rabbit eyes in this study.

Subcategory III: Residual Base Oils

No data.

Sensitization

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), light paraffinic (CASRN 64741-50-0)
Guinea pigs (10/sex) received topical applications of a CASRN 64741-50-0 (API 84-01) in paraffin oil under occluded conditions at 25% in the induction phase and 1% in the challenge phase. 2,4-Dinitrochlorobenzene was used as the positive control which responded as expected.
CASRN 64741-50-0 was non-sensitizing to guinea pigs in this study.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), solvent-dewaxed heavy paraffinic (CASRN 64742-65-0)
(1) Guinea pigs (5/sex) received topical applications of CASRN 64742-65-0 (Stock 141) under occlusive conditions at 100% in the induction phase and 25% in the challenge and rechallenge phases. Squibb mineral oil was used as the vehicle for the challenge and rechallenge phases only. No irritation/positive reactions were noted. 2,4-Dinitrochlorobenzene was used as the positive control and responded as expected.
CASRN 64742-65-0 was not -sensitizing to guinea pigs in this study.

(2) Another sensitization test on this substance was performed according to the same procedure as that noted above with the exception that in this study, Stock 142 was tested, and 15% of Squibb mineral oil was used for challenge and rechallenge. No irritation/positive reactions were noted. Positive control findings were not reported.
CASRN 64742-65-0 was not sensitizing to guinea pigs in this study.

Distillates (petroleum), hydrotreated light naphthenic, (CASRN 64742-53-6)
Guinea pigs (10/sex) received topical applications of CASRN 64742-53-6 (API 83-12) in paraffin oil under occlusive conditions at 50% in the induction phase and 1% in the challenge phase. No irritation/positive reactions were noted. 2,4-Dinitrochlorobenzene was used as the positive control and responded as expected.
CASRN 64742-53-6 was not sensitizing to guinea pigs in this study.

White mineral oil (CASRN 8042-47-5)
Guinea pigs (10 males) received topical applications of CASRN 8042-47-5 under occlusive conditions at 10% solution in dipropylene glycol monomethyl ether for the first induction treatment. The second induction application was reduced to 5% due to slight redness at the application site. Four guinea pigs exhibited slight erythema at the application site following challenge with white mineral oil. Positive controls responded appropriately.
(TSCATS OTS0530469).
CASRN 8042-47-5 was sensitizing to guinea pigs in this study.

Subcategory III: Residual Base Oils

No data.

Carcinogenicity

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Distillates (petroleum), heavy naphthenic (CASRN 64741-53-3)
(1) In a single dose dermal carcinogenicity study, CASRN 64741-53-3 was applied (50 mg/treatment, 2X/week) to the skin of C_3H male mice (50/group) for 80 weeks, or until skin lesions formed. A negative control group was included in the study, but it is unclear if this group was a sham treatment group. A positive control group, treated with 0.05% benzo-a-pyrene was also included in the study; it is assumed that dermal applications in this group were made in the same manner as for the test substance animals. No information was provided on whether the application sites were covered or wrapped. Application sites only were evaluated for the presence of potential tumors using visual inspection and microscopic examination. Seven mice died during the first 52 weeks of treatment; however, two of these animals that died during week 28 had a total of 2 tumors (benign). The total number of test substance treated mice that had tumors was 43, compared to 1 untreated control mouse and 48 positive control group animals. Eleven of the test-substance treated animals had a papilloma, and 32 had a squamous cell carcinoma. The time to tumor for substance material treated animals was 38 weeks, which was the same as observed in the positive control group. (TSCATS OTS0536011).
CASRN 64741-53-3 increased incidence of skin tumors in mice in this study.

(2) In two dermal carcinogenicity studies, CASRN 64741-53-3 was applied (20 mg/ treatment, 3X/week) to the skin of CD1 mice in two studies. In the first study, test substance was applied for 18 months to the skin of females only. Few methodologic details were presented. The first observable mass on the skin was noted at 5 months. Thirty percent of the animals were observed to have skin tumors. Fourteen of these tumors were squamous cell carcinomas and 16 were papillomas (benign). In the second study, test substance was applied to the skin of 25 males and 25 females for the first 18 months of a 24 month study. The first observable mass on the skin was noted at 5 months in females and 7 months in males. Two of the 25 males and 4 of the 25 females had skin tumors. Tissue lost to autolysis or cannibalism was 0 in the male group and 6 in the female group. This may have reduced the number of detected squamous cell carcinomas in the female group (one). No males were observed with squamous cell carcinoma. Additionally, 2 males and 3 females had benign papillomas, and 0 males and 6 females had unknown tumor types. (TSCATS (OTS0200438).
CASRN 64741-53-3 increased incidence of skin tumors in mice in this study.

Distillates (petroleum), light paraffinic (CASRN 64741-50-0(1)
CASRN 64741-50-0 ("100 Distillate") was applied to the shaved backs of male C_3H mice (50/group) at approximately 20 mg/mouse/application, 3X/week for 24 months. Untreated, sham-treated, and positive control groups of 100 mice each were evaluated concurrently. Positive, untreated and sham-treated controls responded appropriately. Relative to untreated and sham treatment groups, CASRN 64741-50-0 was observed to have an increase in the incidence of skin tumors, mainly of the form of squamous cell carcinomas. (TSCATS OTS0546325).
CASRN 64741-50-0 increased incidence of skin tumors in mice in this study.

(2) In a single dose (50 mg/kg) carcinogenicity study, CASRN 64741-50-0 (API 84-01) was applied to the shaved skin of 50 male CH3/HEJ mice twice a week for one year. Additionally, the study included 50 male sham control animals and benzo-a-pyrene positive control male mice, 50 of which were treated with 0.01%, and 50 of which were treated with 0.05%. Dermal neoplasms in the test substance group were significantly elevated. Incidences and latency times were not reported. (TSCATS OTS0000426-7).
CASRN 64741-50-0 increased incidence of skin tumors in mice in this study.

Distillates (petroleum), heavy paraffinic (CASRN 64741-51-1)
Three types of undiluted distillates (petroleum), heavy paraffinic ("200 distillate", "light intermediate distillate", and "heavy intermediate distillate", all identified by CASRN 64741-51-1, were applied to the shaved backs of male C_3H mice (50/group) at approximately 20 mg/mouse/application 3X/week for 24 months. Untreated, sham-treated, and positive control groups of 100 mice each were evaluated concurrently. Positive, untreated and sham-treated controls responded appropriately. Relative to untreated and sham treatment groups, the three treatment groups treated with distillates (petroleum), heavy paraffinic hadan increase in the incidence of skin tumors, mainly of the form of squamous cell carcinomas.
(TSCATS OTS0546325).
CASRN 64741-51-1 increased incidence of skin tumors in mice in this study.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Distillates (petroleum), chemically neutralized heavy naphthenic (CASRN 64742-34-3)
(1) Groups of CD-1 mice (25/sex/group) received CASRN 64742-34-3 (0.03 mL) via the dermal route 3 days/week for 18 months. The positive control was not identified, but presumably responded as appropriate. The negative control, mineral oil, was not further identified, but which resulted in an incidence or tumors that were considered high for a negative control group. Despite the high negative control incidence, an elevated incidence of malignant epidermal neoplasms was observed in the test substance group compared to the negative control.
(TSCATS OTS0535761).
CASRN 64742-34-3 increased incidence of skin tumors in mice in this study.

(2) CD-1 mice (25/sex/group) received CASRN 64742-34-3 (50 μL) via the dermal route 3 days/week for an uncertain duration (possibly as long as 2 years). The positive control was initially "clarified slurry oil", but was changed to benzo-a-pyrene during the in-life portion of the study. Positive and negative controls were tested simultaneously and responded appropriately. Mice treated with the test substance demonstrated a significant increase in malignant epidermal neoplasms and benign proliferations over controls.
(TSCATS (OTS0535762).
CASRN 64741-34-3 increased incidence of skin tumors in mice in this study.

Distillates (petroleum), chemically neutralized light naphthenic (CASRN 64742-35-4)
(1) Groups of CD-1 mice (25/sex/group) received CASRN 64742-35-4 (0.03 mL) via the dermal route 3 days/week for 18 months. The positive control was not identified, but presumably responded appropriately. The negative control, mineral oil, was not further identified, but which resulted in an incidence or tumors that were considered high for a negative control group. Despite the high negative control incidence, an elevated incidence of malignant epidermal neoplasms was observed in the treatment group compared to the negative control. (TSCATS OTS0535761).
CASRN 64742-35-4 increased incidence of skin tumors in mice in this study.

(2) CD-1 mice (25/sex/group) received CASRN 64742-35-4 (50 μL) via the dermal route 3 days/week for an uncertain duration (possibly as long as 2 years). The positive control was initially "clarified slurry oil", but was changed to benzo-a-pyrene during the in-life portion of the study. Positive and negative controls were tested simultaneously and responded appropriately. Mice treated with CASRN 64742-35-4 demonstrated a significant increase in malignant epidermal neoplasms and benign proliferations over controls. (TSCATS OTS0535762).
CASRN 64742-35-4 increased incidence of skin tumors in mice in this study.

Distillates (petroleum), hydrotreated light naphthenic (CASRN 64742-53-6)
In a single dose (50 mg/kg) carcinogenicity study, CASRN 64742-53-6 (API 83-12) was applied to the shaved skin of 50 male CH3/HEJ mice twice a week for one year. Additionally, the study included 50 male sham control animals and benzo-a-pyrene positive control male mice, 50 of which were treated with 0.01%, and 50 of which were treated with 0.05%. Dermal neoplasms in the test substance group were significantly elevated. Incidences and latency times were not reported. (TSCATS OTS0000426-7).
Distillates (petroleum), hydrotreated light naphthenic was carcinogenic to mice in this study.

Conclusion

Human Health Hazard

Subcategory I: Unrefined and Mildly Refined Distillate Base Oils

Acute oral toxicity to rats and acute dermal toxicity to rabbits of Unrefined and Mildly Refined Distillate Base Oils is low. A rat repeated-dose dermal toxicity study on the supporting chemical, Heavy Vacuum Gas Oil (no CASRN), despite methodological flaws, suggested a LOAEL of approximately 500 mg/kg/day (based on hematology effects) and a NOAEL of approximately 125 mg/kg/day. No reproductive or developmental toxicity data were available. CASRN 6741-50-0 induced gene mutations in mammalian cells *in vitro*. No chromosomal aberrations data are available. CASRNs 64741-53-3, 64741-50-0, and 64741-51-1 increased incidence of skin tumors in mice. CASRN 64741-50-0 is irritating to rabbit skin and eyes, and not sensitizing to guinea pigs.

Subcategory II: Highly and Severely Refined Distillate Base Oils

Acute oral toxicity to rats and acute dermal toxicity to rabbits of Highly and Severely Refined Distillate Base Oils is low. Acute inhalation toxicity to rats is moderate. The LOAECs for repeated-dose rat inhalation studies performed with CASRNs 64742-70-7, 8042-47-5, and 64742-54-7 (0.05 mg/L/day, 0.05 mg/L/day, and 0.22 mg/L/day, respectively) are based on lung weight changes in conjunction with lung histopathology (foamy macrophages in the aleveolar spaces). A NOAEC for repeated-inhalation toxicity in rats is 0.05 mg/L/day for CASRN 64742-54-7:. The LOAEL for systemic toxicity in rat repeated-dose dermal studies is approximately 125 mg/kg/day for CASRN 8042-47-5 (based on decreased body weight) and 2000 mg/kg/day for CASRN 64742-54-7 (based on histopathological changes in liver). The NOAELs for systemic toxicity in rat repeated-dose dermal studies was not established for CASRN 8042-47-5; 800 mg/kg/day for CASRN 64742-54-7; 1000 mg/kg/day for CASRN 64742-56-9, CASRN 64742-65-0, and CASRN 645741-88-4 (only dose tested) and could not be established for CASRN 64742-70-7. No adequate reproductive or developmental toxicity data were available. CASRN 64741-88-4 induced gene mutations in bacteria and CASRN 64742-53-6 induced gene mutations in mammalian cells *in vitro*. CASRN 64742-56-9 did not induce chromosomal aberrations in mouse micronuclei. CASRN 64752-53-6 is irritating to rabbit skin and eyes. CASRN 8042-47-5 was sensitizing to guinea pig. CASRNs 64742-34-3, 64742-35-4 and 64742-53-6 increased incidence of dermal tumors in mice.

Subcategory III: Residual Base Oils

No health effects data are available for Residual Base Oils with the exception of a repeated-dose dermal toxicity study in rat. The NOAEL for systemic toxicity is 2000 mg/kg/day (only dose tested). No reproductive or developmental toxicity data are available. No data for gene mutation and chromosomal aberration are available.

Table 3. Summary of Human Health Data[4]

	Subcategory I: Unrefined and Mildly Refined Distillate Base Oils					Subcategory II: Highly and Severely Refined Distillate Base Oils		
Endpoints	**Distillates (petroleum), light paraffinic (64741-50-0)**	**Distillates (petroleum), heavy paraffinic (64741-51-1)**	**Distillates (petroleum), light naphthenic (64741-52-2)**	**Distillates (petroleum), heavy naphthenic (64741-53-3)**	**Heavy vacuum gas oil (64741-57-7; supporting chemical)**	**Distillates (petroleum), heavy hydrocracked (64741-76-0)**	**Distillates (petroleum), solvent-refined heavy paraffinic (64741-88-4)**	**Distillates (petroleum), solvent-refined light paraffinic (64741-89-5)**
Acute Oral Toxicity LD_{50} (mg/kg)	**> 5000**	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	–	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)
Acute Inhalation Toxicity LC_{50} (mg/L)	No data	No data	No data	No data	–	No data 2.2 (RA)	**3.9**	No data 2.2 (RA)
Acute Dermal Toxicity LD_{50} (mg/kg)	**> 2000**	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	–	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No data	No data	No data	No data	–	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	No data NOAEL ≈ 125[1] LOAEL ≈ 500 (RA)	No data NOAEL ≈ 125[1] LOAEL ≈ 500 (RA)	No data NOAEL ≈ 125[1] LOAEL ≈ 500 (RA)	No data NOAEL ≈ 125[1] LOAEL ≈ 500 (RA)	**NOAEL ≈ 125** **LOAEL ≈ 500** *see RS text*	No data NOAEL = 1000[2] (RA)	**NOAEL = 1000**	No data NOAEL = 1000[2] (RA)
Reproductive Toxicity NOAEL/LOAEL Oral (mg/kg//day)	No data	No data	No data	No data	–	No data	No data	No data

Table 3. Summary of Human Health Data[4]

	Subcategory I: Unrefined and Mildly Refined Distillate Base Oils					Subcategory II: Highly and Severely Refined Distillate Base Oils		
Endpoints	**Distillates (petroleum), light paraffinic (64741-50-0)**	**Distillates (petroleum), heavy paraffinic (64741-51-1)**	**Distillates (petroleum), light naphthenic (64741-52-2)**	**Distillates (petroleum), heavy naphthenic (64741-53-3)**	**Heavy vacuum gas oil (64741-57-7; supporting chemical)**	**Distillates (petroleum), heavy hydrocracked (64741-76-0)**	**Distillates (petroleum), solvent-refined heavy paraffinic (64741-88-4)**	**Distillates (petroleum), solvent-refined light paraffinic (64741-89-5)**
Developmental Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	–	No data	No data	No data
Genetic Toxicity – Gene Mutation *In vitro*	**Positive**	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	–	No data Positive (RA)	**Positive**	No data Positive (RA)
Genetic Toxicity – Gene Mutation *In vivo*	No data	No data	No data	No data	–	No Data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Genetic Toxicity – Chromosomal Aberrations *In vivo*	No data	No data	No data	No data	–	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Additional Information					–			
Skin Irritation	**Irritating**	–	–	–		–	–	–
Eye Irritation	**Irritating**	–	–	–		–	–	–
Skin Sensitization	**Negative**	–	–	–		–	–	–
Carcinogenicity	**Positive**	**Positive**	–	–		–	–	–

Table 3. Summary of Human Health Data[5]

Subcategory II: Highly and Severely Refined Distillate Base Oils								
Endpoints	**Distillates (petroleum), solvent-refined heavy naphthenic (64741-96-4)**	**Distillates (petroleum), solvent-refined light naphthenic (64741-97-5)**	**Distillates (petroleum), acid-treated heavy naphthenic (64742-18-3)**	**Distillates (petroleum), acid-treated light naphthenic (64742-19-4)**	**Chemically neutralized heavy naphthenic distillate (petroleum) (64742-34-3)**	**Chemically neutralized light naphthenic distillate (petroleum) (64742-35-4)**	**Distillates (petroleum), clay-treated light paraffinic (64742-37-6)**	**Distillates (petroleum), clay-treated heavy naphthenic (64742-44-5)**
Acute Oral Toxicity ALD (mg/kg)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)
Acute Inhalation Toxicity LC_{50} (mg/L)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)
Acute Dermal Toxicity LD_{50} (mg/kg)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA))	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL≈ 2000 (RA)
Reproductive Toxicity NOAEL/LOAEL Oral (mg/kg//day)	No data	No data	No data	No data	No data	No data	No data	No data

Table 3. Summary of Human Health Data[5]

Subcategory II: Highly and Severely Refined Distillate Base Oils								
Endpoints	**Distillates (petroleum), solvent-refined heavy naphthenic (64741-96-4)**	**Distillates (petroleum), solvent-refined light naphthenic (64741-97-5)**	**Distillates (petroleum), acid-treated heavy naphthenic (64742-18-3)**	**Distillates (petroleum), acid-treated light naphthenic (64742-19-4)**	**Chemically neutralized heavy naphthenic distillate (petroleum) (64742-34-3)**	**Chemically neutralized light naphthenic distillate (petroleum) (64742-35-4)**	**Distillates (petroleum), clay-treated light paraffinic (64742-37-6)**	**Distillates (petroleum), clay-treated heavy naphthenic (64742-44-5)**
Developmental Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	No data	No data	No data	No data
Genetic Toxicity – Gene Mutation ***In vitro***	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)
Genetic Toxicity – Gene Mutation ***In vivo***	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Genetic Toxicity – Chromosomal Aberrations ***In vivo***	**Negative**	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Additional Information								
Skin Irritation	–	–	–	–	–	–	–	–
Eye Irritation	–	–	–	–	–	–	–	–
Skin Sensitization	–	–	–	–	–	–	–	–
Carcinogenicity	–	–	–	–	**Positive**	**Positive**	–	–

Table 3. Summary of Human Health Data[6]

Subcategory II: Highly and Severely Refined Distillate Base Oils								
Endpoints	**Distillates (petroleum), hydrotreated heavy naphthenic (64742-52-5)**	**Distillates (petroleum), hydrotreated light naphthenic (64742-53-6)**	**Distillates (petroleum), hydrotreated heavy paraffinic (64742-54-7)**	**Distillates (petroleum), hydrotreated light paraffinic (64742-55-8)**	**Distillates (petroleum), solvent-dewaxed light paraffinic (64742-56-9)**	**Distillates (petroleum), solvent-dewaxed heavy naphthenic (64742-63-8)**	**Distillates (petroleum), solvent-dewaxed heavy paraffinic (64742-65-0)**	**Paraffin oils (petroleum), catalytic dewaxed heavy (64742-70-7)**
Acute Oral Toxicity LD_{50} (mg/kg)	No data > 5000 (RA)	**>5000**	**>15,000**	No data > 5000 (RA)	–	No data > 5000 (RA)	**> 15,000**	No data > 5000 (RA)
Acute Inhalation Toxicity LC_{50} (mg/L)	No data 2.2 (RA)	**2.2**	No data 2.2 (RA)		**>5.4**	No data 2.2 (RA)	**>2.4**	No data 2.2 (RA)
Acute Dermal Toxicity LD_{50} (mg/kg)	No data > 2000 (RA)	**> 2000**	**> 5000**	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	**> 5000**	No data > 2000 (RA)
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	**NOAEC = 0.05** **LOAEC = 0.22**	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	No data NOAEC = NE[7] LOAEC = 0.05 (RA)	**NOAEC = NE** **LOAEC = 0.05**
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)	No data Est NOAEL = 500[3] Est LOAEL: 2000 (RA)	**NOAEL = 800** **LOAEL = 2000** *See RS text*	No data Est NOAEL = 800[4] Est LOAEL: 2000 (RA)	**Est NOAEL = 1000** *See RS text*	No data Est NOAEL = 500[3] Est LOAEL: 2000 (RA)	**NOAEL = 1000**	No data Est NOAEL = 500[3] Est LOAEL: 2000 (RA)
Reproductive Toxicity NOAEL/LOAEL Oral (mg/kg//day)	No data	No data	No data	No data	No data	No data	No data	No data

Table 3. Summary of Human Health Data[6]

Subcategory II: Highly and Severely Refined Distillate Base Oils								
Endpoints	**Distillates (petroleum), hydrotreated heavy naphthenic (64742-52-5)**	**Distillates (petroleum), hydrotreated light naphthenic (64742-53-6)**	**Distillates (petroleum), hydrotreated heavy paraffinic (64742-54-7)**	**Distillates (petroleum), hydrotreated light paraffinic (64742-55-8)**	**Distillates (petroleum), solvent-dewaxed light paraffinic (64742-56-9)**	**Distillates (petroleum), solvent-dewaxed heavy naphthenic (64742-63-8)**	**Distillates (petroleum), solvent-dewaxed heavy paraffinic (64742-65-0)**	**Paraffin oils (petroleum), catalytic dewaxed heavy (64742-70-7)**
Developmental Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	No data	No data	No data	No data
Genetic Toxicity – Gene Mutation ***In vitro***	**Negative**	**Positive**	No data Positive (RA)	No data Positive (RA)	**Positive**	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)
Genetic Toxicity – Gene Mutation ***In vivo***	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	**Negative**	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Genetic Toxicity – Chromosomal Aberrations ***In vivo***	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Additional Information								
Skin Irritation	–	**Irritating**	–	–	–	–	–	–
Eye Irritation	–	**Irritating**	–	–	–	–	–	–
Skin Sensitization	–	**Negative**	–	–	–	–	**Negative**	–
Carcinogenicity	–	**Positive**	–	–	–	–	–	–

Table 3. Summary of Human Health Data

Subcategory II: Highly and Severely Refined Distillate Base Oils							
Endpoints	**Paraffin oils (petroleum), catalytic dewaxed light (64742-71-8)**	**Lubricating oils (petroleum), C20 – 50, hydrotreated neutral oil-based, high-viscosity (72623-85-9)**	**Lubricating oils (petroleum), C15 – 30, hydrotreated neutral oil-based (72623-86-0)**	**White mineral oil (petroleum) (8042-47-5)**	**Lubricating oils, petroleum, hydrotreated spent (64742-58-1)**	**Foots oil, petroleum (64742-67-2)**	**Lubricating oils, (petroleum) C15 – 30, hydrotreated neutral oil based, contg. solvent deasphalted residual oil (72623-84-8)**
Acute Oral Toxicity LD_{50} (mg/kg)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)	No data > 5000 (RA)
Acute Inhalation Toxicity LC_{50} (mg/L)	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)	**> 2.5**	No data 2.2 (RA)	No data 2.2 (RA)	No data 2.2 (RA)
Acute Dermal Toxicity LD_{50} (mg/kg)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)	No data > 2000 (RA)
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No data NOAEC = NE[5] LOAEC = 0.05 (RA)	No data NOAEC = NE[5] LOAEC = 0.05 (RA)	No data NOAEC = NE[5] LOAEC = 0.05 (RA)	**NOAEC = NE LOAEC = 0.05**	No data NOAEC = NE[5] LOAEC = 0.05 (RA)	No data NOAEC = NE[5] LOAEC = 0.05 (RA)	No data NOAEC = NE[5] LOAEC = 0.05 (RA)
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)	**NOAEL ≈ 500 LOAEL ≈ 2000 *See RS text***	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)	No data NOAEL ≈ 500[3] LOAEL ≈ 2000 (RA)
Reproductive Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	No data	No data	No data
Developmental Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	No data	No data	No data

Table 3. Summary of Human Health Data

Subcategory II: Highly and Severely Refined Distillate Base Oils							
Endpoints	**Paraffin oils (petroleum), catalytic dewaxed light (64742-71-8)**	**Lubricating oils (petroleum), C20 – 50, hydrotreated neutral oil-based, high-viscosity (72623-85-9)**	**Lubricating oils (petroleum), C15 – 30, hydrotreated neutral oil-based (72623-86-0)**	**White mineral oil (petroleum) (8042-47-5)**	**Lubricating oils, petroleum, hydrotreated spent (64742-58-1)**	**Foots oil, petroleum (64742-67-2)**	**Lubricating oils, (petroleum) C15 – 30, hydrotreated neutral oil based, contg. solvent deasphalted residual oil (72623-84-8)**
Genetic Toxicity – Gene Mutation ***In vitro***	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)	No data Positive (RA)
Genetic Toxicity – Gene Mutation ***In vivo***	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Genetic Toxicity – Chromosomal Aberrations ***In vivo***	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)	No data Negative (RA)
Additional Information **Skin Irritation**	–	–	–	–	–	–	–
Eye Irritation	–	–	–	–	–	–	–
Skin Sensitization	–	–	–	**Positive**	–	–	–
Carcinogenicity	–	–	–	–	–	–	–

Table 3. Summary of Human Health Data

Subcategory III: Residual Base Oils						
Endpoints	**Residual oils (petroleum), solvent deasphalted (64741-95-3)**	**Lubricating oils (petroleum) C>25, hydrotreated bright stock-based (72623-83-7)**	**Lubricating oils (petroleum), C20-C50, hydrotreated neutral oil-based (72623-87-1)**	**Residual oils (petroleum), solvent-refined (64742-01-4)**	**Residual oils (petroleum), hydrotreated (64742-57-0)**	**Residual oils, petroleum, solvent-dewaxed (64742-62-7)**
Acute Oral Toxicity LD_{50} (mg/kg)	No data	No data	No data	No data	No data	No data
Acute Inhalation Toxicity LC_{50} (mg/L)	No data	No data	No data	No data	No data	No data
Acute Dermal Toxicity LD_{50} (mg/kg)	No data	No data	No data	No data	No data	No data
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No data	No data	No data	No data	No data	No data
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	NOAEL ≈ 2000[6] (RA)	**NOAEL ≈ 2000** *See RS text*	NOAEL ≈ 2000[6] (RA)	NOAEL ≈ 2000[6] (RA)	NOAEL ≈ 2000[6] (RA)	NOAEL ≈ 2000[6] (RA)
Reproductive Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	No data	No data
Developmental Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No data	No data	No data	No data	No data	No data
Genetic Toxicity – Gene Mutation *In vitro*	No data	No data	No data	No data	No data	No data
Genetic Toxicity – Chromosomal Aberrations	No data	No data	No data	No data	No data	No data

Measured data in bold text; (RA) = Read Across; – indicates that endpoint was not evaluated for this chemical; [1]RA from CASRN 64741-57-7; [2]RA from CASRN 64741-88-4: [3]RA from CASRN 8042-47-5; [4]RA from CASRN 64742-54-7; [5]RA from 8042-47-5; [6]RA from CASRN 72623-83-7; [7]RA from CASRN 64742-70-7; RS = Robust summary; NE = Not established

4. Hazard to the Environment

A summary of aquatic toxicity data submitted for SIDS endpoints is provided in Table 5. The table also indicates where data for the supporting chemical, 1-tetradecene, (CASRN 1120-36-1) are used to read across to all the members of the Lubricating Base Oils Category. EPA cinsidered submitted data for the CASRNs, 64741-89-5, 64742-01-4, CASRN 64742-55-8, CASRN 64742-57-0, and 64741-88-4 to be inadequate to address the toxicity to aquatic organisms because these substances were tested above their water solubility limit. In addition, these studies used WAF (water accommodated fraction) preparation methods without the analytical data to accompany the values for loading rates, which makes calculating an LC_{50} or EC_{50} value impossible. These studies are included here as a contribution to the weight of evidence for characterizing the available information on hazard associated with the Lubricating Oil Basestocks category members. Because the physical-chemical properties of the sponsored chemicals (high Log K_{ow} and low water solubility) are reasonably similar to those of the supporting chemical CASRN 1120-36-1, the ecotoxicity for the Lubricating Oil Basestocks Category members is expected to be no effects at saturation.

Acute Toxicity to Fish

1-Tetradecene (CASRN 1120-36-1, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/AOalfaolefins.pdf
96-h EC_{50} = No effects at saturation

Distillates (petroleum), solvent-refined, light paraffinic (CASRN 64741-89-5)
Rainbow trout (*Oncorhynchus mykiss*) were exposed to WAF (water accommodated fraction) preparations of CASRN 64741-89-5 for 96 hours in a static-limit test (20 fish per concentration). Concentrations were 0 and 1,000 mg/L based on nominal loading rates. No adverse effects were observed during the test.
No effects at saturation.

Solvent-refined residual oil, (CASRN 64742-01-4)
Rainbow trout (*Oncorhynchus mykiss*) were exposed to WAF (water accommodated fraction) preparations of CASRN 64742-01-4for 96 hours in a static-limit test (20 fish per concentration). Concentrations were 0 and 1,000 mg/L based on nominal loading rates. No adverse effects were observed during the test.
No effects at saturation.

Acute Toxicity to Aquatic Invertebrates

1-Tetradecene (CASRN 1120-36-1, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/AOalfaolefins.pdf
48-h EC_{50} = No effects at saturation

Distillates (petroleum), hydrotreated light paraffinic (CASRN 64742-55-8)
Daphnia magna were exposed to distillates (petroleum), hydrotreated light paraffinic at nominal concentrations of 0, 1, 1.8, 3.2, 5.6 or 10 mg/L under flow-through conditions for 48 hours. Mortalities occurred at all concentrations with over 50% mortality at ≥ 3.2 mg/L and 100% mortality at 10 mg/L. This study was reported in TSCATS (OTS0556107).
48-h EC_{50} = 2.2 mg/L**

Residual oils (petroleum), hydrotreated (CASRN 64742-57-0)
Daphnia magna were exposed to residual oils (petroleum), hydrotreated at nominal concentrations of 0, 1, 1.8, 3.2, 5.6 or 10 mg/L under flow-through conditions for 48 hours. Mortalities occurred at all concentrations with over 50% mortality at ≥ 5.6 mg/L. This study was reported in TSCATS (OTS0556093).
48-h EC_{50} = 3.8 mg/L**

Toxicity to Aquatic Plants

1-Tetradecene (CASRN 1120-36-, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/AOalfaolefins.pdf
48-h LC_{50} = No effects at saturation

Solvent-refined residual oil, (CASRN 64742-01-4)
Scenedesmus subspicatus was exposed to WAF preparations of CASRN 64742-01-4 in a static 72-hour test with nominal loading rates of 0 and 1,000 mg/L. Six replicates of a single test concentration and 3 replicates of a control were examined in this study. No adverse effects were observed during the test.
No effects at saturation.

Chronic Toxicity to Aquatic Invertebrates

1-Tetradecene (CASRN 1120-36-1, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/AOalfaolefins.pdf
ChV = No effects at saturation

Distillates (petroleum), solvent-refined, heavy paraffinic (CASRN 64741-88-4)
Daphnia magna were exposed to WAF preparations of CASRN 64741-88-4 for 21 days with nominal loading rates of 0, 10, and 1,000 mg/L. Fresh WAFs were prepared on days 0, 2, 4, 7, 9, 11, 14, 16, and 18. No adverse effects were observed during the test.
No effects at saturation.

Solvent-refined residual oil, (CASRN 64742-01-4)
Daphnia magna were exposed to WAF preparations of CASRN 64742-01-4 for 21 days with nominal loading rates of 0, 10 and 1,000 mg/L. At the start of the test, 10 daphnids were placed within each of 4 test flasks per concentration, and the flasks were covered to reduce evaporation. Fresh WAFs were prepared on days 0, 2, 4, 7, 9, 11, 14, 16, and 18.
No adverse effects were observed during the test.
No effects at saturation

Conclusion:
The acute toxicity to fish and aquatic invertebrates, and the toxicity to aquatic plants exposed to the Lubricating Base Oils Category members are considered as "no effects at saturation" based on data for the supporting chemical CASRN 1120-36-1. The chronic toxicity to aquatic invertebrates exposed to the Lubricating Base Oils Category members is "no effects at saturation" based on data for the supporting chemical CASRN 1120-36-1.

** For CASRNs 64742-55-8 and 64742-57-0, effects are considered to be due to physical, not intrinsically toxicological effects. These studies are included in the document to serve as a consideration to the weight of evidence for characterizing the available information on hazard associated with the Lubricating Oil Basestocks category members. Based on the fact that these studies were conducted above the water solubility limits for these compounds, and similar physical-chemical properties to the other category members and to the supporting chemical CASRN 1120-36-1, acute toxicity is considered to be no effects at saturation (NES).

Table 5. Summary Table of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program: Aquatic Toxicity Data		
Endpoints	**Sponsored Chemicals****	**1-Tetradecene CASRN 1120-36-1 (supporting chemical)**
Fish 96-h LC_{50} (mg/L)	NES (RA)	**NES**
Aquatic Invertebrates 48-h EC_{50} (mg/L)	NES (RA)	**NES**
Aquatic Plants 72-h EC_{50} (mg/L) (biomass) (growth rate)	NES (RA)	**NES**
Chronic Toxicity to Aquatic Invertebrates 21-day EC_{50} (mg/L)	NES (RA)	**NES**

****See Table 1. NES = no effects at saturation; bold = measured data (i.e., derived from testing); (RA) = read across.**

The following pages show:

- Appendix A: Names and CASRNs for category members
- Appendix B: Short Description of Category and Generalized examples of possible processes used in the production of Lubricating Oil Basestocks Category members.
- Appendix C: Chemical Structures

APPENDIX

Appendix A

Subcategories in the Lubricating Oil Basestocks (LOB) Category* *36 Category Members*		
LOB	**CASRN**	**Chemical Abstract Index Name**
Subcategory I: ***Unrefined and Mildly Refined Distillate Base Oils***		
Sponsored Substances (4 members)		
Distillates (petroleum), light paraffinic	64741-50-0	Distillates (petroleum), light paraffinic
Distillates (petroleum), heavy paraffinic	64741-51-1	Distillates (petroleum), heavy paraffinic
Distillates (petroleum), light naphthenic	64741-52-2	Distillates (petroleum), light naphthenic
Distillates (petroleum), heavy naphthenic	64741-53-3	Distillates (petroleum), heavy naphthenic
Supporting Substances (2 members)		
Heavy vacuum gas oil	64741-57-7	Gas oils (petroleum), heavy vacuum
Distillate aromatic extract	64742-04-7	Extracts (petroleum), heavy paraffinic distillate solvent
Subcategory II: ***Highly and Severely Refined Distillate Base Oils***		
Sponsored Substances (26 members)		
Distillates (petroleum), heavy hydrocracked	64741-76-0	Distillates (petroleum), heavy hydrocracked
Distillates (petroleum), solvent-refined heavy paraffinic	64741-88-4	Distillates (petroleum), solvent-refined heavy paraffinic
Distillates (petroleum), solvent-refined light paraffinic	64741-89-5	Distillates (petroleum), solvent-refined light paraffinic
Distillates (petroleum),solvent-refined heavy naphthenic	64741-96-4	Distillates (petroleum), solvent-refined heavy naphthenic
Distillates (petroleum), solvent-refined light naphthenic	64741-97-5	Distillates (petroleum), solvent-refined light naphthenic
Distillates (petroleum), acid-treated heavy naphthenic	64742-18-3	Distillates (petroleum), acid-treated heavy naphthenic
Distillates (petroleum), acid-treated light	64742-19-4	Distillates (petroleum), acid-treated light naphthenic

naphthenic		
Chemically neutralized heavy naphthenic distillate (petroleum)	64742-34-3	Chemically neutralized heavy naphthenic distillate (petroleum)
Chemically neutralized light naphthenic distillate (petroleum)	64742-35-4	Distillates (petroleum), chemically neutralized light naphthenic
Distillates (petroleum), clay-treated light paraffinic	64742-37-6	Distillates (petroleum), clay-treated light paraffinic
Distillates (petroleum), clay-treated heavy naphthenic	64742-44-5	Distillates (petroleum), clay-treated heavy naphthenic
Distillates (petroleum), hydrotreated heavy naphthenic	64742-52-5	Distillates (petroleum), hydrotreated heavy naphthenic
Distillates (petroleum), hydrotreated light naphthenic	64742-53-6	Distillates (petroleum), hydrotreated light naphthenic
Distillates (petroleum), hydrotreated heavy paraffinic	64742-54-7	Distillates (petroleum), hydrotreated heavy paraffinic
Distillates (petroleum), hydrotreated light paraffinic	64742-55-8	Distillates (petroleum), hydrotreated light paraffinic
Distillates (petroleum), solvent-dewaxed light paraffinic	64742-56-9	Distillates (petroleum), solvent-dewaxed light paraffinic
Distillates (petroleum), solvent-dewaxed heavy naphthenic	64742-63-8	Distillates (petroleum), solvent-dewaxed heavy naphthenic
Distillates (petroleum), solvent-dewaxed heavy paraffinic	64742-65-0	Distillates (petroleum), solvent-dewaxed heavy paraffinic
Paraffin oils (petroleum), catalytic dewaxed heavy	64742-70-7	Paraffin oils (petroleum), catalytic dewaxed heavy
Paraffin oils (petroleum), catalytic dewaxed light	64742-71-8	Paraffin oils (petroleum), catalytic dewaxed light
Lubricating oils (petroleum), C20 - 50, hydrotreated neutral oil-based, high-viscosity	72623-85-9	Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity
Lubricating oils (petroleum), C15 - 30, hydrotreated neutral oil-based	72623-86-0	Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based

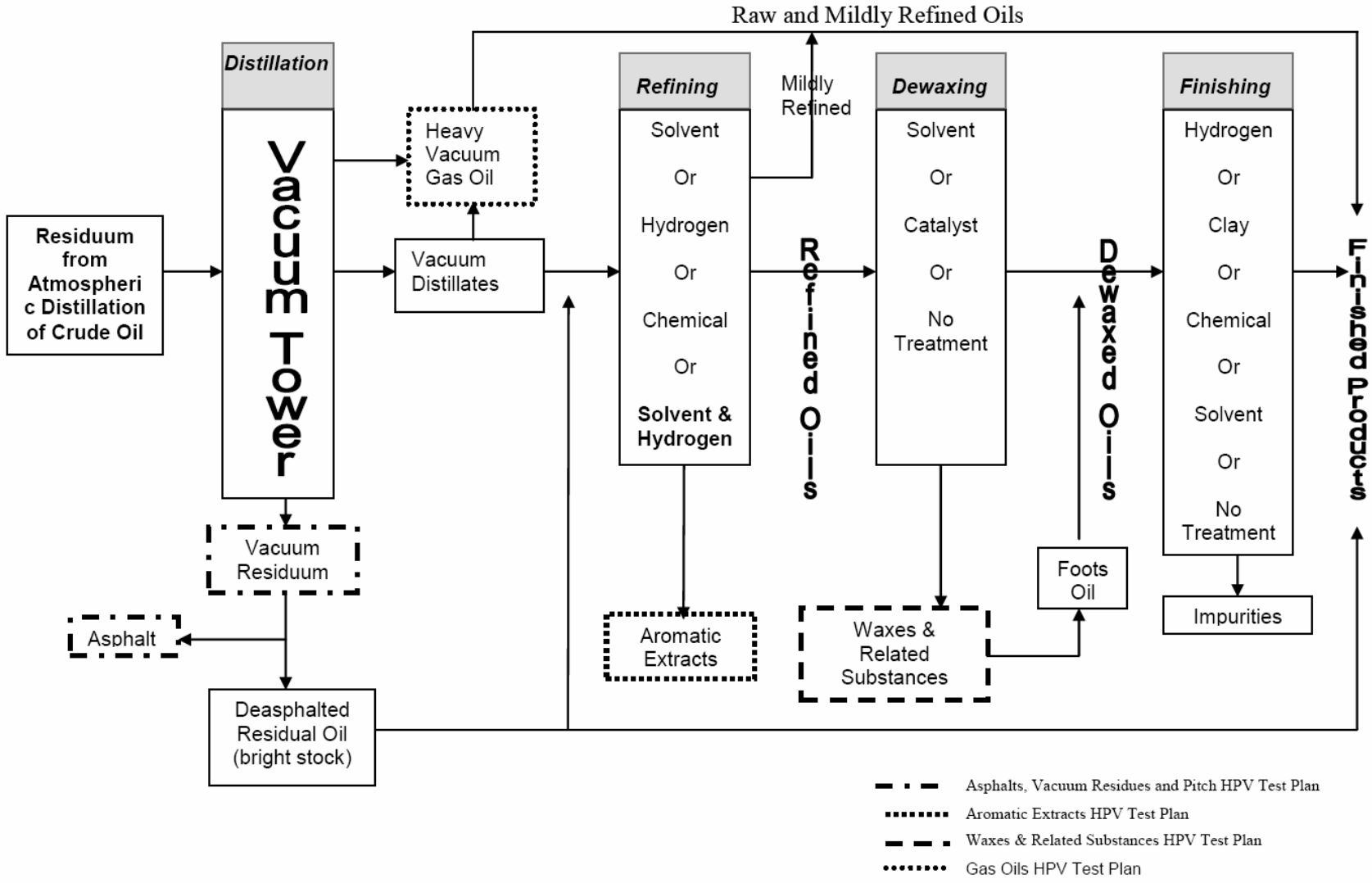
White mineral oil (petroleum)	8042-47-5	White mineral oil (petroleum)
Lubricating oils, petroleum, hydrotreated spent	64742-58-1	Lubricating oils, petroleum, hydrotreated spent
Lubricating oils, petroleum, hydrotreated spent	64742-67-2	Lubricating oils, petroleum, hydrotreated spent
Lubricating oils, (petroleum) C15 - 30, hydrotreated neutral oil based, contg. solvent deasphalted residual oil	72623-84-8	Lubricating oils, (petroleum) C15-30, hydrotreated neutral oil based, contg. solvent deasphalted residual oil
Subcategory III: Residual Base Oils		
Sponsored Substances (6 members)		
Residual oils (petroleum), solvent deasphalted	64741-95-3	Residual oils (petroleum), solvent deasphalted
Lubricating oils (petroleum) C > 25, hydrotreated bright stock-based	72623-83-7	Lubricating oils (petroleum) C > 25, hydrotreated bright stock-based
Lubricating oils (petroleum), C20 – C50, hydrotreated neutral oil-based	72623-87-1	Lubricating oils (petroleum), C20-C50, hydrotreated neutral oil-based
Residual oils (petroleum), solvent-refined	64742-01-4	Residual oils (petroleum), solvent-refined
Residual oils (petroleum), hydrotreated	64742-57-0	Residual oils (petroleum), hydrotreated
Residual oils, petroleum, solvent-dewaxed	64742-62-7	Residual oils, petroleum, solvent-dewaxed

*Note: The above subcategorization of Category members is for purpose of evaluating health effects only. For ecotoxicity, the Category has not been subcategorized, and 1-Tetradecene (CASRN 1120-36-1) is a supporting substance for read-across (RA) for the entire Category.

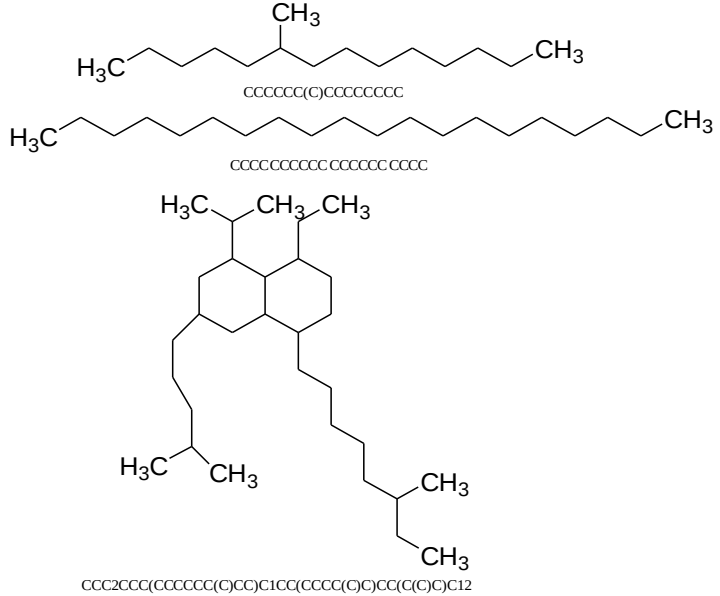
Appendix B

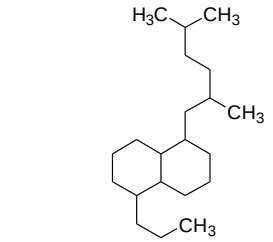
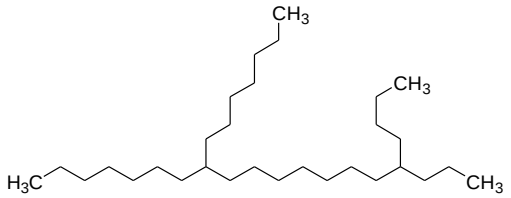
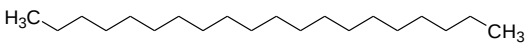
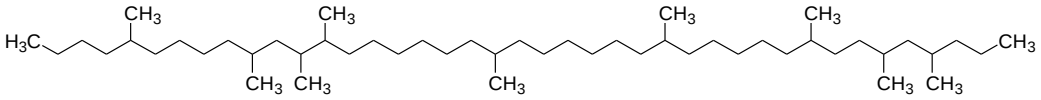
The materials in this category are complex petroleum mixtures composed primarily of saturated hydrocarbons with carbon numbers ranging from C15 to C50. The molecular makeup of these oils consists of paraffinic, isoparaffinic, naphthenic, and aromatic hydrocarbon groupings that are varied in complexity and number. Because they are complex mixtures, the lubricating oil basestocks are typically not defined by detailed compositional information but instead by process history, physical properties, and product use specifications. Base oils are produced by first distilling crude oil at atmospheric pressure to remove lighter components (e.g., gasoline and distillate fuel components), leaving a residue (residuum) that contains base oil precursors. This atmospheric residuum is then distilled under vacuum to yield a range of distillate fractions (unrefined distillate base oils) and a vacuum residuum. Removal of the asphalt components of the vacuum residuum results in unrefined residual base oils. These distillate and residual base oil fractions may then undergo a series of extractive or transforming processes that improve the base oils' performance characteristics and reduce or eliminate undesirable components.
The unrefined and mildly refined distillate oils receive no or minimal treatment beyond the initial vacuum distillation. Consequently, they contain the highest levels of undesirable components, have the largest variation of hydrocarbon molecules, and have shown the highest carcinogenic and mutagenic activity. Refined distillate base oils are produced from unrefined base oil fractions by undergoing additional processing designed to reduce or transform the undesirable components including aromatics, metals, waxes, and trace components causing unwanted colors or odors (e.g.,, sulfur compounds). They also contain a narrower range of hydrocarbon molecules (increasing concentration of paraffins and naphthenes).

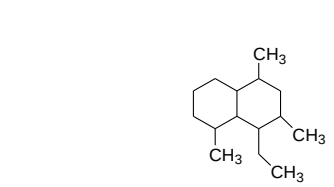
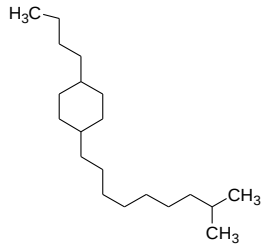
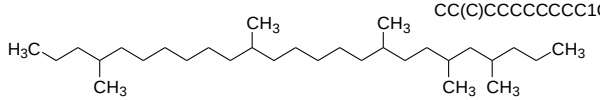
Figure 1. Generalized examples of possible processes used in the production of LOBs.

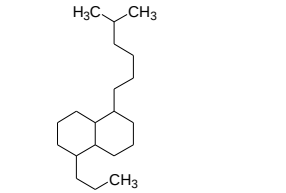
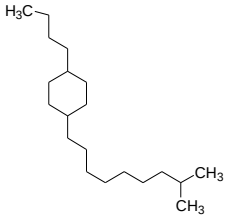
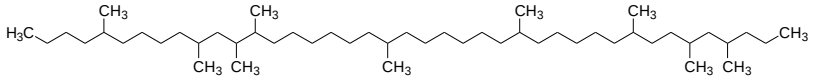


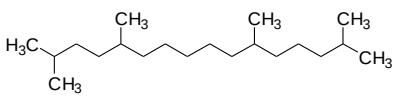
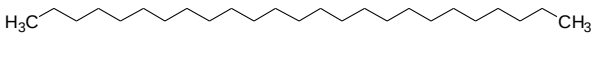
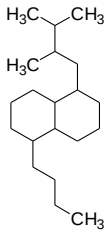
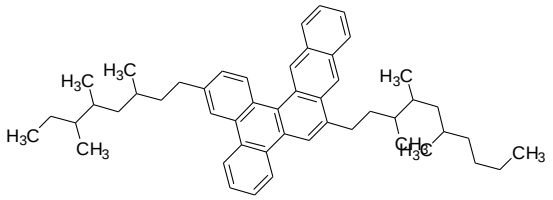
Appendix C

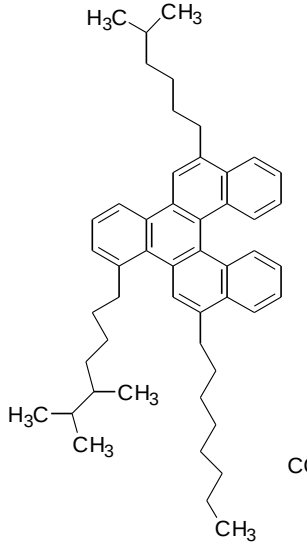
Chemical Name	CASRN	Structure
Subcategory I: Unrefined and Mildly Refined Distillate Base Oils[1]		
Sponsored Chemicals		
Distillates (petroleum), light paraffinic	64741-50-0	 A complex combination of hydrocarbons produced by vacuum distillation of the residuum from atmospheric distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains a relatively large proportion of saturated aliphatic hydrocarbons normally present in this distillation range of crude oil.

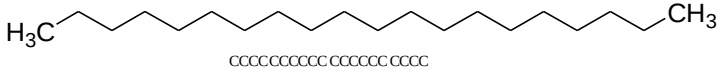
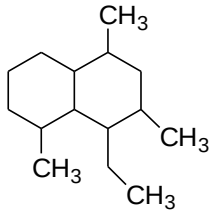
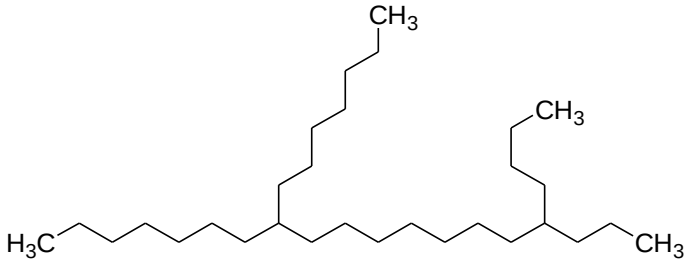
Chemical Name	CASRN	Structure
Distillates (petroleum), heavy paraffinic	64741-51-1	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCCC(CCCC)CCC)CCCCCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons produced by vacuum distillation of the residuum from atmospheric distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C). It contains a relatively large proportion of saturated aliphatic hydrocarbons.

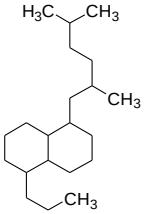
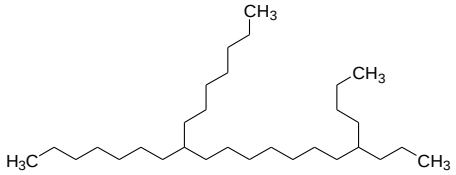
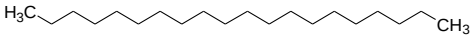
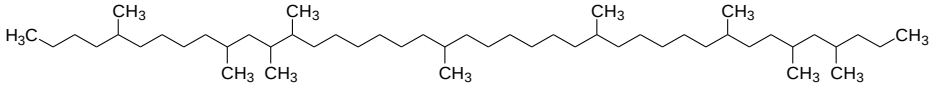
Chemical Name	CASRN	Structure
Distillates (petroleum), light naphthenic	64741-52-2	 CC2CC(C)C(CC)C1C(C)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC A complex combination of hydrocarbons produced by vacuum distillation of the residuum from atmospheric distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

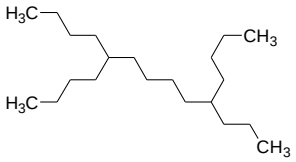
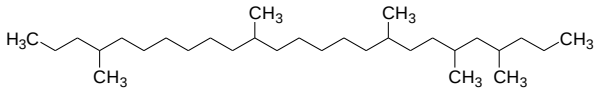
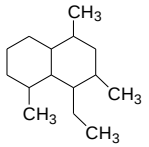
Chemical Name	CASRN	Structure
Distillates (petroleum), heavy naphthenic	64741-53-3	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons produced by vacuum distillation of the residuum from atmospheric distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

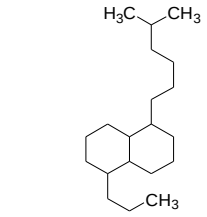
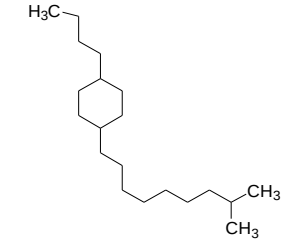
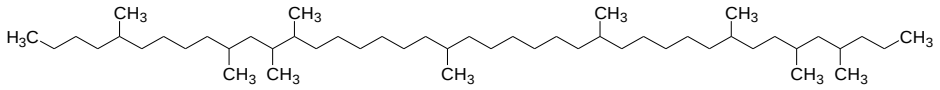
Chemical Name	CASRN	Structure
Subcategory I: Unrefined and Mildly Refined Distillate Base Oils[1]		
Supporting Chemicals		
Gas oils (petroleum), heavy vacuum	64741-57-7	  CCCCCCCCCCCCCCCCCCCCCCCCC CC(C)CCC(C)CCCCCC(C)CCCC(C)C   CC(C)C(C)CC2CCCC1C(CCCC)CCCC12 CC(CCCC)CC(C)C(C)CCC(C5=C4C=C6C(C=CC=C6)=C5)=CC1=C4C(C=CC(CCC(C)CC(C)C(C)CC)=C3)=C3C2=C1C=CC=C2 A complex combination of hydrocarbons produced by the vacuum distillation of the residuum from atmospheric distillation of crude oil. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and boiling in the range of approximately 350– 600°C (662–1,112°F). This stream is likely to contain 5 wt. % or more of 4- to 6-membered condensed ring aromatic hydrocarbons.

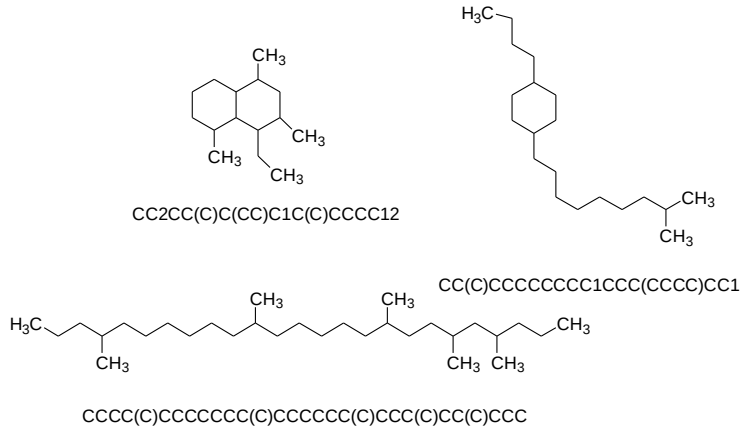
Chemical Name	CASRN	Structure
Extracts (petroleum), heavy paraffinic distillate solvent	64742-04-7	 CC(C)C(C)CC1=C2C(C(CCCC)=CC=C2)=CC=C1 CCCCCCCCC(C5=C4C=CC=C5)=CC1=C4C(C(C=CC=C6)=C6C(CCCCC(C)C)=C3)=C3C2=C1C(CCCCC(C)C(C)C)=CC=C2 A complex combination of hydrocarbons obtained as the extract from a solvent extraction process. It consists of aromatic hydrocarbons having carbon numbers predominantly in the range of C20 through C50. This stream is likely to contain 5 wt. % or more of 4- to 6-membered condensed ring aromatic hydrocarbons.

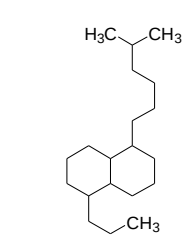
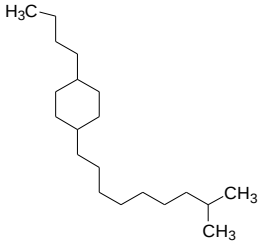
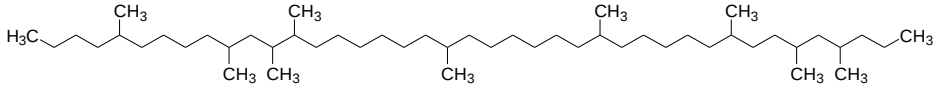
Chemical Name	CASRN	Structure
Subcategory II: Highly and Severely Refined Distillate Base Oils[2]		
Distillates (petroleum), heavy hydrocracked	64741-76-0	 CCCCCCCCCC CCCCCC CCCC  CC2CC(C)C(CC)C1C(C)CCCC12  CCCCCCCC(CCCCCCCC(CCCC)CCC)CCCCCCC A complex combination of hydrocarbons from the distillation of the products from a hydrocracking process. It consists predominantly of saturated hydrocarbons having carbon numbers in the range of C15 to C39 and boiling in the range of approximately 260– 600°C (500–1,112°F).

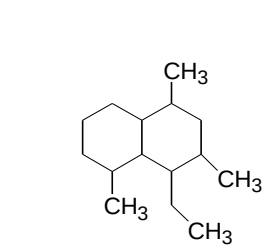
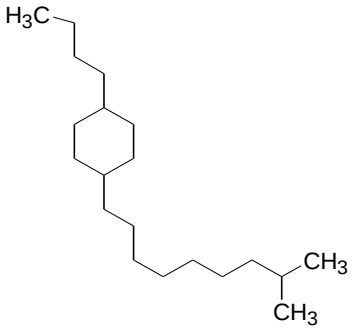
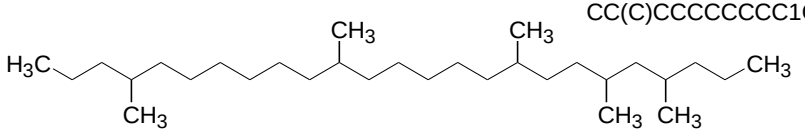
Chemical Name	CASRN	Structure
Distillates (petroleum), solvent-refined heavy paraffinic	64741-88-4	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained as the raffinate from a solvent extraction process. It consists of saturated hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finish oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C).

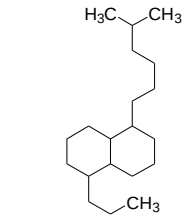
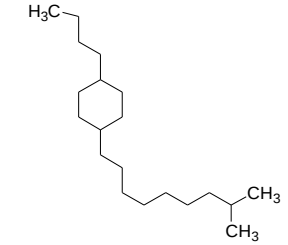
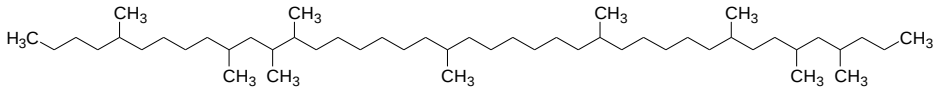
Chemical Name	CASRN	Structure
Distillates (petroleum), solvent-refined light paraffinic	64741-89-5	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons obtained as the raffinate from a solvent extraction process. It consists predominantly of saturated hydrocarbons having carbon numbers in the range of C15 through C30 and produces finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C).

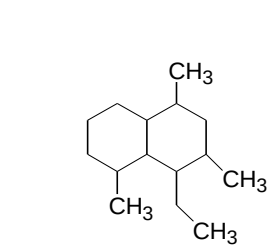
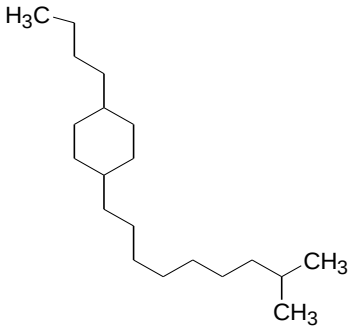
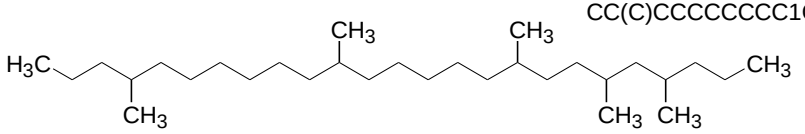
Chemical Name	CASRN	Structure
Distillates (petroleum), solvent-refined heavy naphthenic	64741-96-4	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained as the raffinate from a solvent extraction process. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

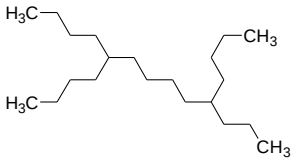
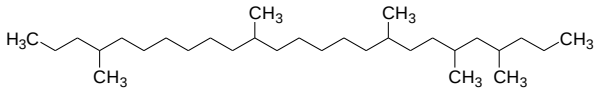
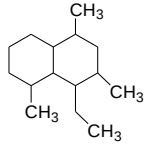
Chemical Name	CASRN	Structure
Distillates (petroleum), solvent-refined light naphthenic	64741-97-5	 A complex combination of hydrocarbons obtained as the raffinate from a solvent extraction process. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces finished oil with a viscosity of <100 SUS at 100°F (19 cSt at 40°C). It contains relatively few normal paraffins.

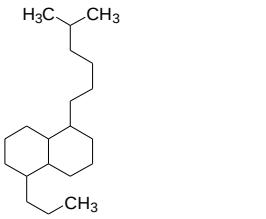
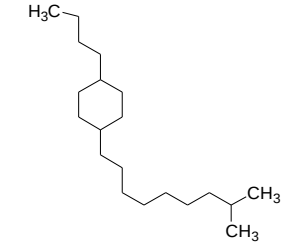
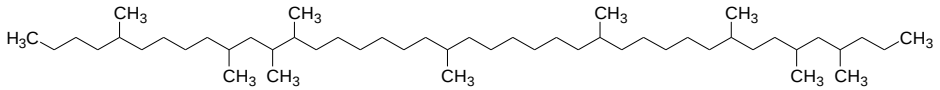
Chemical Name	CASRN	Structure
Distillates (petroleum), acid-treated heavy naphthenic	64742-18-3	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained as a raffinate from a sulfuric acid treating process. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

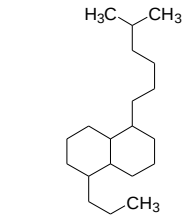
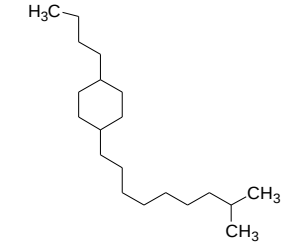
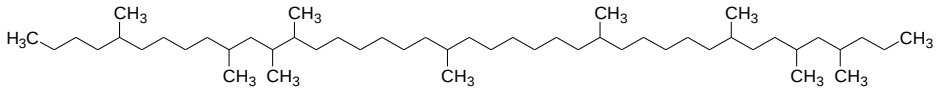
Chemical Name	CASRN	Structure
Distillates (petroleum), acid-treated light naphthenic	64742-19-4	 CC2CC(C)C(CC)C1C(C)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC A complex combination of hydrocarbons obtained as a raffinate from a sulfuric acid treating process. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

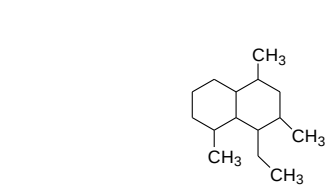
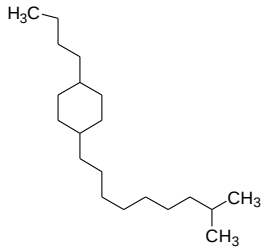
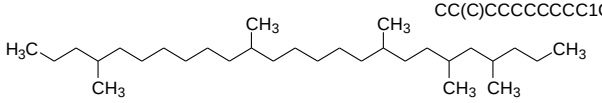
Chemical Name	CASRN	Structure
Distillates (petroleum), chemically neutralized heavy naphthenic	64742-34-3	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons produced by a treating process to remove acidic materials. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

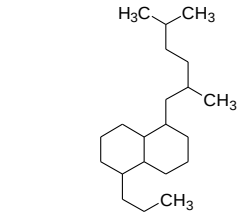
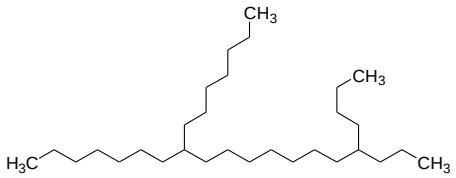
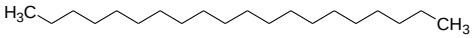
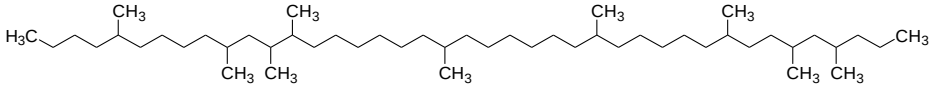
Chemical Name	CASRN	Structure
Distillates (petroleum), chemically neutralized light naphthenic	64742-35-4	 CC2CC(C)C(CC)C1C(C)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC A complex combination of hydrocarbons produced by a treating process to remove acidic materials. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

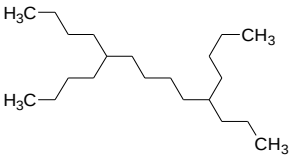
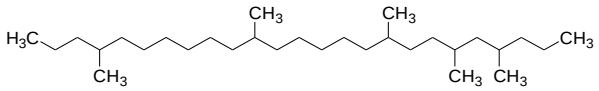
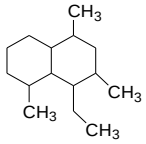
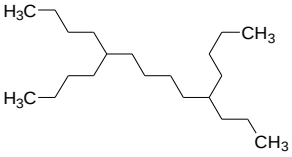
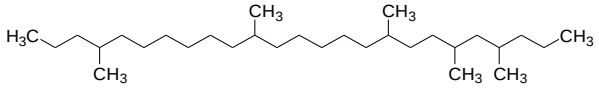
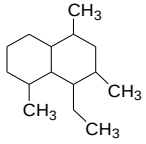
Chemical Name	CASRN	Structure
Distillates (petroleum), clay-treated light paraffinic	64742-37-6	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons resulting from treatment of a petroleum fraction with natural or modified clay in either a contacting or percolation process to remove the trace amounts of polar compounds and impurities present. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains a relatively large proportion of saturated hydrocarbons.

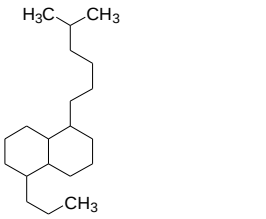
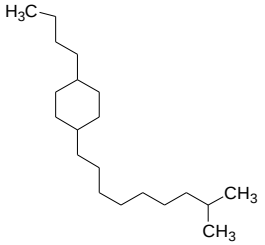
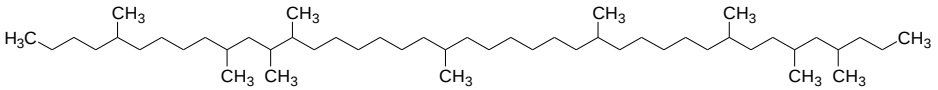
Chemical Name	CASRN	Structure
Distillates (petroleum), clay-treated heavy naphthenic	64742-44-5	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons resulting from treatment of a petroleum fraction with natural or modified clay in either a contacting or percolation process to remove the trace amounts of polar compounds and impurities present. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

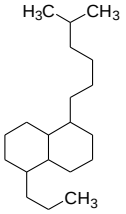
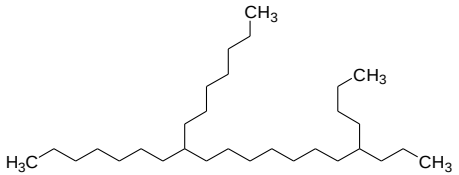
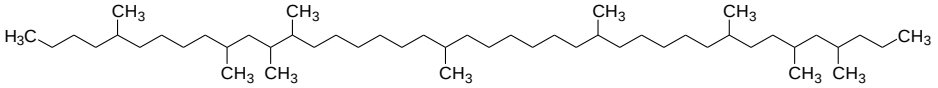
Chemical Name	CASRN	Structure
Distillates (petroleum), hydrotreated heavy naphthenic	64742-52-5	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating a petroleum fraction with hydrogen in the presence of a catalyst. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

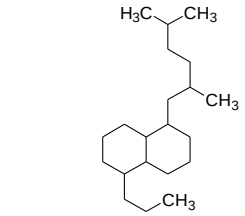
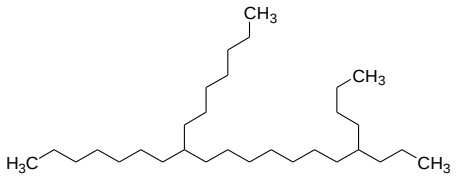
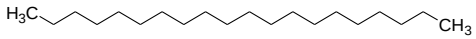
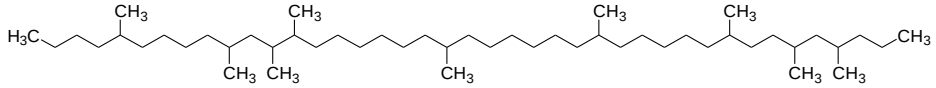
Chemical Name	CASRN	Structure
Distillates (petroleum), hydrotreated light naphthenic	64742-53-6	 CC2CC(C)C(CC)C1C(C)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC A complex combination of hydrocarbons obtained by treating a petroleum fraction with hydrogen in the presence of a catalyst. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

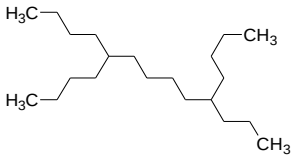
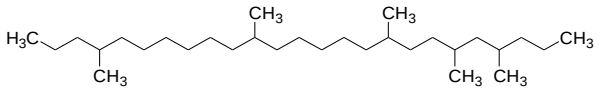
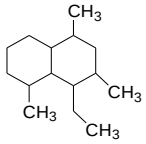
Chemical Name	CASRN	Structure
Distillates (petroleum), hydrotreated heavy paraffinic	64742-54-7	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating a petroleum fraction with hydrogen in the presence of a catalyst. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil of at least 100 SUS at 100°F (19cSt at 40°C). It contains a relatively large proportion of saturated hydrocarbons.

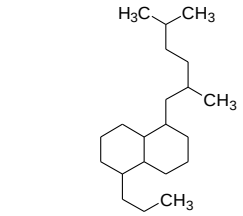
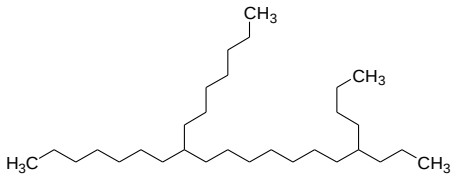
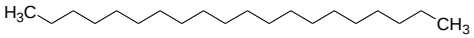
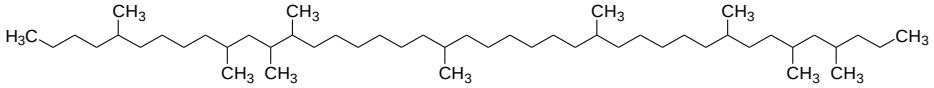
Chemical Name	CASRN	Structure
Distillates (petroleum), hydrotreated light paraffinic	64742-55-8	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons obtained by treating a petroleum fraction with hydrogen in the presence of a catalyst. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C). It contains a relatively large proportion of saturated hydrocarbons.
Distillates (petroleum), solvent-dewaxed light paraffinic	64742-56-9	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons obtained by removal of normal paraffins from a petroleum fraction by solvent crystallization. It consists predominantly of hydrocarbons having carbon numbers in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C).

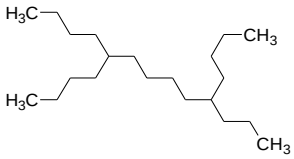
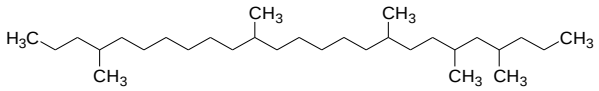
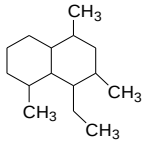
Chemical Name	CASRN	Structure
Distillates (petroleum), solvent-dewaxed heavy naphthenic	64742-63-8	 CC(C)CCCCC2CCCC1C(CCC)CCCC12  CC(C)CCCCCCCC1CCC(CCCC)CC1  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by removal of normal paraffins from a petroleum fraction by solvent crystallization. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil of at least 100 SUS at 100°F (19cSt at 40°C). It contains relatively few normal paraffins.

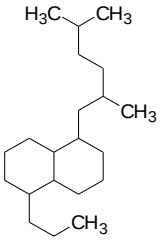
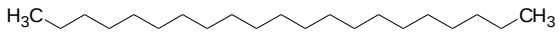
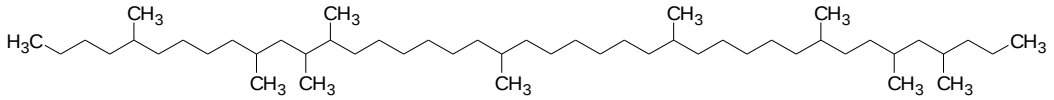
Chemical Name	CASRN	Structure
Distillates (petroleum), solvent-dewaxed heavy paraffinic	64742-65-0	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by removal of normal paraffins from a petroleum fraction by solvent crystallization. It consists predominantly of hydrocarbons having carbon numbers in the range of C20 through C50 and produces a finished oil with a viscosity at least 100 SUS at 100°F (19cSt at 40°C).

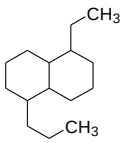
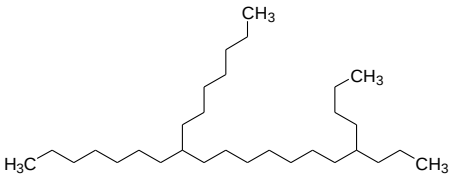
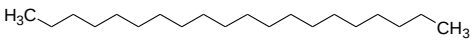
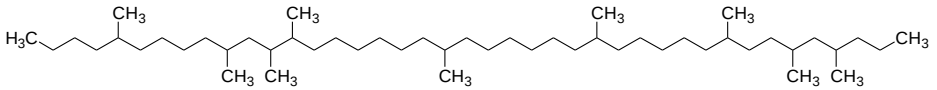
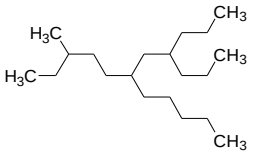
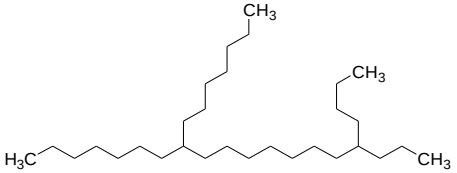
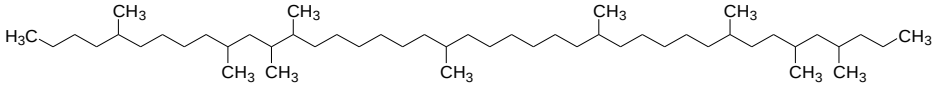
Chemical Name	CASRN	Structure
Paraffin oils (petroleum), catalytic dewaxed heavy	64742-70-7	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained from a catalytic dewaxing process. It consists predominantly of hydrocarbons having carbon numbers in the range of C20 through C50 and produces a finished oil with a viscosity of at least 100 SUS at 100°F (19cSt at 40°C).

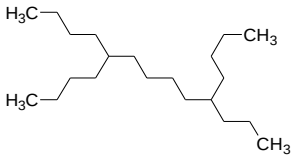
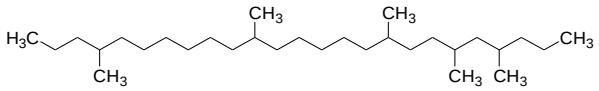
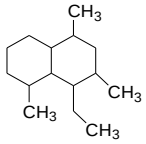
Chemical Name	CASRN	Structure
Paraffin oils (petroleum), catalytic dewaxed light	64742-71-8	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons obtained from a catalytic dewaxing process. It consists predominantly of hydrocarbons having carbon numbers in the range of C15 through C30 and produces a finished oil with a viscosity of <100 SUS at 100°F (19cSt at 40°C).

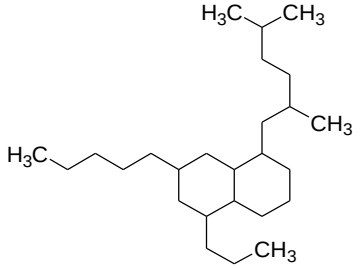
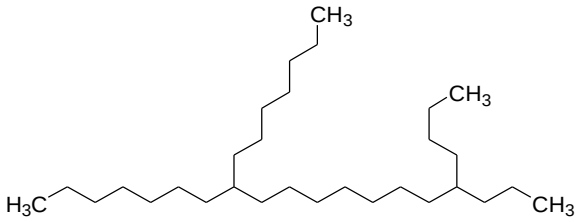
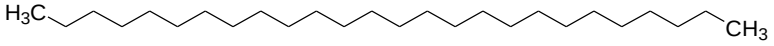
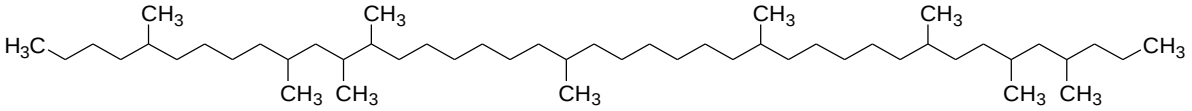
Chemical Name	CASRN	Structure
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high-viscosity	72623-85-9	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating light vacuum gas oil, heavy vacuum gas oil, and solvent deasphalted residual oil with hydrogen in the presence of a catalyst in a two stage process, with dewaxing being carried out between the two stages. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil having a viscosity of approximately 112cSt at 40°C (104°F). It contains a relatively large proportion of saturated hydrocarbons.

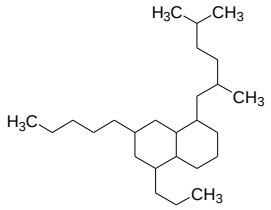
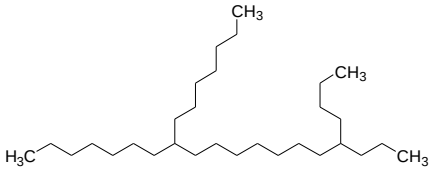
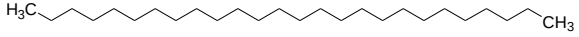
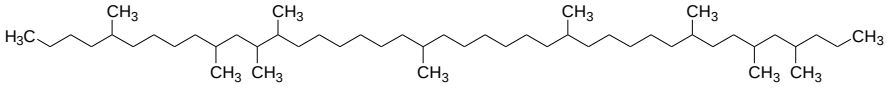
Chemical Name	CASRN	Structure
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons obtained by treating light vacuum gas oil and heavy vacuum gas oil with hydrogen in the presence of a catalyst in a two stage process, with dewaxing being carried out between the two stages. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil with a viscosity of approximately 15cSt at 40°C (104°F). It contains a relatively large proportion of saturated hydrocarbons.

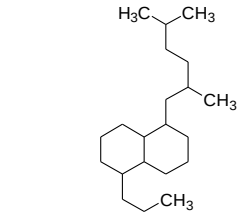
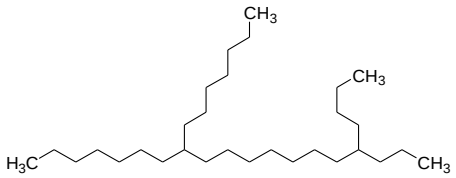
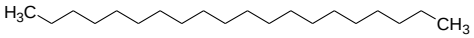
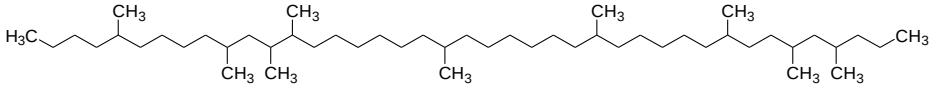
Chemical Name	CASRN	Structure
White mineral oil (petroleum)	8042-47-5	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A highly refined petroleum mineral oil consisting of a complex combination of hydrocarbons obtained from the intensive treatment of a petroleum fraction with sulfuric acid and oleum, or by hydrogenation, or by a combination of hydrogenation and acid treatment. Additional washing and treating steps may be included in the processing operation. It consists of saturated hydrocarbons having carbon numbers predominantly in the range of C15 through C50.

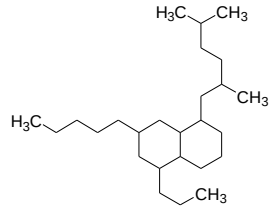
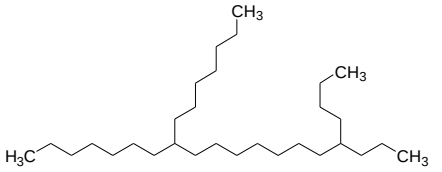
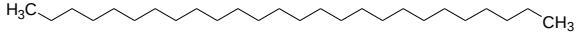
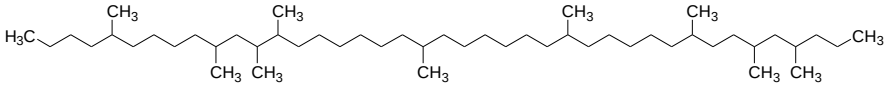
Chemical Name	CASRN	Structure
Lubricating oils (petroleum), hydrotreated spent	64742-58-1	 CCC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating a spent lube oil with hydrogen in the presence of a catalyst. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C50.
Foots oil (petroleum)	64742-67-2	 CC(CC)CCC(CCCCC)CC(CCC)CCC  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained as the oil fraction from a solvent deoiling or a wax sweating process. It consists predominantly of branched chain hydrocarbons having carbon numbers in the range of C20 through C50.

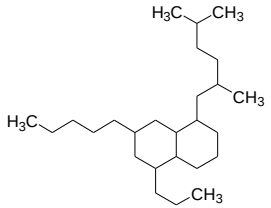
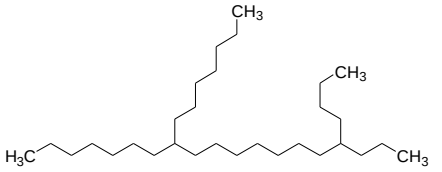
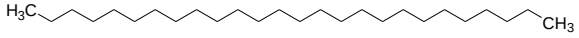
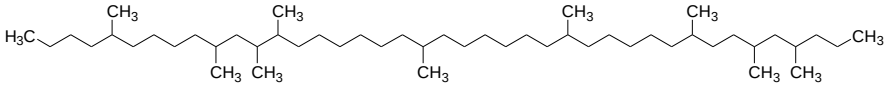
Chemical Name	CASRN	Structure
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based, contg. solvent deasphalted residual oil	72623-84-8	 CCCCC(CCCC)CCCCC(CCC)CCCC  CCCC(C)CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC  CC2CC(C)C(CC)C1C(C)CCCC12 A complex combination of hydrocarbons obtained by treating light vacuum gas oil, heavy vacuum gas oil, and solvent deasphalted residual oil with hydrogen in the presence of a catalyst in a two stage process, with dewaxing being carried out between the two stages. It consists of hydrocarbons having carbon numbers predominantly in the range of C15 through C30 and produces a finished oil having a viscosity of approximately 10cSt at 40°C (104°F). It contains a relatively large proportion of saturated hydrocarbons.

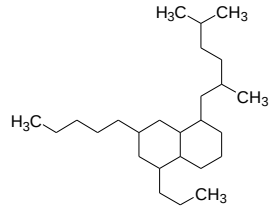
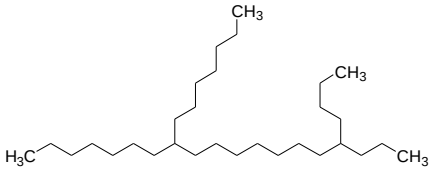
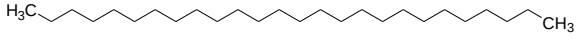
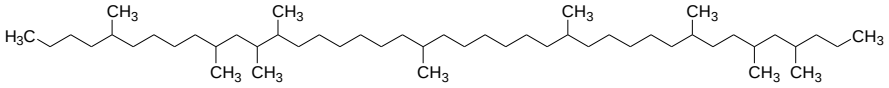
Chemical Name	CASRN	Structure
Subcategory III: Residual Base Oils		
Residual oils (petroleum), solvent deasphalted	64741-95-3	 CC(CCC(C)C)CC2CCCC1C(CCC)CC(CCCCC)CC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained as the solvent soluble fraction from C3 – C4 solvent deasphalting of a residuum. It consists of hydrocarbons having carbon numbers predominantly higher than C25 and boiling above approximately 400°C (752°F).

Chemical Name	CASRN	Structure
Lubricating oils (petroleum), C>25, hydrotreated bright stock-based	72623-83-7	 CC(CCC(C)C)CC2CCCC1C(CCC)CC(CCCCC)CC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating solvent deasphalted residual oil with hydrogen in the presence of a catalyst in two stages, with dewaxing carried out between stages. It consists of hydrocarbons having carbon numbers predominantly greater than C25 and produces a finished oil with a viscosity of approximately 440cSt at 40°C (104°F). It contains a relatively large proportion of saturated hydrocarbons.

Chemical Name	CASRN	Structure
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	72623-87-1	 CC(CCC(C)C)CC2CCCC1C(CCC)CCCC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating light vacuum gas oil, heavy vacuum gas oil and solvent deasphalted residual oil with hydrogen in the presence of a catalyst in a two stage process, with dewaxing being carried out between the two stages. It consists of hydrocarbons having carbon numbers predominantly in the range of C20 through C50 and produces a finished oil with a viscosity of approximately 32cSt at 40°C (104°F). It contains a relatively large proportion of saturated hydrocarbons.

Chemical Name	CASRN	Structure
Residual oils (petroleum), solvent-refined	64742-01-4	 CC(CCC(C)C)CC2CCCC1C(CCC)CC(CCCCC)CC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained as the solvent insoluble fraction from solvent refining of a residuum using a polar organic solvent such as phenol or furfural. It consists of hydrocarbons having carbon numbers predominantly higher than C25 and boiling above approximately 400°C (752°F).

Chemical Name	CASRN	Structure
Residual oils (petroleum), hydrotreated	64742-57-0	 CC(CCC(C)C)CC2CCCC1C(CCC)CC(CCCCC)CC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by treating a petroleum fraction with hydrogen in the presence of a catalyst. It consists of hydrocarbons having carbon numbers predominantly greater than C25 and boiling above approximately 400°C (752°F).

Chemical Name	CASRN	Structure
Residual oils (petroleum), solvent-dewaxed	64742-62-7	 CC(CCC(C)C)CC2CCCC1C(CCC)CC(CCCCC)CC12  CCCCCCCC(CCCCCCC)CCCCCCCC(CCC)CCCC  CCCCCCCCCCCCCCCCCCCCCCCCC  CC(CCCCCCC(C)CCCCCC(C)CCC(C)CC(C)CCC)CCCCCCC(C)C(C)CC(C)CCCCC(C)CCCC A complex combination of hydrocarbons obtained by removal of long, branched chain hydrocarbons from a residual oil by solvent crystallization. It consists of hydrocarbons having carbon numbers predominantly greater than C25 and boiling above approximately 400°C (752°F).
1-Tetradecene	1120-36-1	$CH_2=CH-(CH_2)_{11}-CH_3$

[1]Unrefined category members may also contain aromatics, including polycyclic aromatic hydrocarbons. According to the Test Plan, an unspecified, unrefined lubricating oil was 79.1% non aromatic (paraffins and naphthenes) and 20.9% aromatic; however, a severely refined (medicinal grade) oil contained no aromatic constituents (2×10^{-5} %). The aromatic components are represented by the two supporting chemicals in Subcategory I, Gas oils (petroleum), heavy vacuum (CASRN 64741-57-7) and Extracts (petroleum), heavy paraffinic distillate solvent (CASRN 64742-04-7).

[2]Distillate base oils are often described as either "naphthenic" (saturated ring hydrocarbons) or "paraffinic" (straight or branched chain hydrocarbons) depending on their crude source and/or the dominant hydrocarbons present. The difference between naphthenic and paraffinic base oils is one of relative percentage since naphthenes and paraffins are present in both types of oils. Thus, a base oil might be called a paraffinic oil if it is 60% paraffins and 30% naphthenes or a naphthenic oil if it is 60% naphthenes and 30% paraffins.