SCREENING-LEVEL HAZARD CHARACTERIZATION

Reclaimed Petroleum Hydrocarbons Category: Residual Hydrocarbon Wastes from Petroleum Refining

SPONSORED CHEMICALS

Hydrocarbons, C ≥ 20, petroleum wastes	**CASRN 68476-53-9**
Wastes, petroleum	**CASRN 68477-26-9**
Residues (petroleum), clay-treating filter wash	**CASRN 68918-73-0**

SUPPORTING CHEMICALS

Atmospheric Residue	**No CASRN**
Atmospheric Distillate	**No CASRN**
Clarified Slurry Oil	**No CASRN**
Cracked Distillate	**No CASRN**
Cracked Residue	**No CASRN**
Residual Fuel Oils	**No CASRN**
Heavy Gas Oil	**No CASRN**
Vacuum Distillate	**No CASRN**
Vacuum Residue	**No CASRN**
1-Tetradecene	**CASRN 1120-36-1**
1-Hexadecene	**CASRN 629-73-2**

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

[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.

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.

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.

[3] U.S. EPA. Risk Assessment Guidelines; http://cfpub.epa.gov/ncea/raf/rafguid.cfm.

Chemical Abstract Service Registry Number (CASRN)	**Sponsored Chemicals** **See Appendix** **Supporting Chemicals** **No CASRNs are available**
Chemical Abstract Index Name	**Sponsored Chemicals** **See Appendix**
Structural Formula	**Sponsored Chemicals** **See Appendix** **Supporting Chemicals** **No structural formulae are available**

Summary

The reclaimed petroleum hydrocarbons category contains complex waste streams derived from the refining of petroleum crude oils and are commonly referred to as slop oils. Because they are not intentionally manufactured and come from many parts of the refinery process, the slop oils are made up of an almost infinite combination of petroleum hydrocarbons and water. The components of this category are generally liquids that are expected to possess negligible to high vapor pressure and negligible to moderate water solubility. The category members are expected to possess high to low mobility in soil. Volatilization is expected to be moderate to high. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is slow to rapid. The members of the reclaimed petroleum hydrocarbons category are expected to possess low (P1) to high (P3) persistence and low (B1) to high (B3) bioaccumulation potential.

The acute oral and dermal toxicity of atmospheric residue sample F-132 (supporting chemical, no CASRN) is low in rats and rabbits respectively. A 28-day dermal repeated-dose toxicity study in rats with atmospheric residue sample F-132 (supporting chemical, no CASRN) showed no adverse treatment related effects; the NOAEL for systemic toxicity is 927.9 mg/kg-bw/day (highest dose tested). A 13-week dermal repeated-dose toxicity study in rats with CASRN 68477-26-9 showed a significant increase in liver to body weight ratios in males at 60 mg/kg-bw/day (lowest dose tested) and above; the NOAEL for systemic toxicity is not established. A 13-week dermal repeated-dose toxicity study in rats with atmospheric distillates (supporting chemical, no CASRN) showed increases in relative liver and spleen weights and hematological effects at 500 mg/kg-bw/day; the NOAEL for systemic toxicity is 125 mg/kg-bw/day.
No specific reproductive toxicity study is available; however, in the dermal repeated-dose toxicity study in rats with CASRN 68477-26-9, significant decreases in prostate and epididymal weights and increases in testes weight were observed. In the dermal repeated-dose toxicity study with atmospheric distillates (supporting chemical, no CASRN), no effects on the reproductive organs in males (only sex evaluated) were observed. In a dermal prenatal developmental toxicity

study in rats, CASRN 68477-26-9 showed statistically significant changes in maternal clinical chemistry parameters and significantly decreased resorptions at 125 mg/kg-bw/day (lowest dose tested); the NOAEL for maternal/developmental toxicity is not established. Clarified slurry oil (supporting chemical, No CASRN) was not mutagenic in bacteria *in vitro* and did not induce sister chromatid exchange (SCE) in mammalian cells *in vitro,* but was positive for SCE in mice *in vivo*. Heavy vacuum gas oil and catalytically cracked clarified oil (supporting chemicals, No CASRNs) did not induce micronuclei and chromosomal aberrations *in vivo*. Heavy fuel oil and cracked residue (supporting chemicals, No CASRNs) are irritating to the rabbit eye and skin, respectively. Atmospheric residue (supporting chemical, No CASRN) is not sensitizing to guinea pig skin.

No data are available for the sponsored substances. Based on the supporting chemicals, CASRNs 1120-36-1 and 629-73-2, acute and chronic toxicity of the reclaimed petroleum hydrocarbons category members to fish, aquatic invertebrates and aquatic plants are considered to be no effects at saturation (NES) based on no effects observed at the water solubility limit (saturation).

The reproductive toxicity endpoint was identified as a data gap under the HPV Challenge Program.

The sponsor, American Petroleum Institute (API) Petroleum HPV Testing Group, submitted a Test Plan and Robust Summaries to EPA for Reclaimed Petroleum Hydrocarbons category. EPA posted the submission on the ChemRTK HPV Challenge website on November 20, 2003 (http://www.epa.gov/chemrtk/pubs/summaries/recpethy/c14755tc.htm). EPA comments on the original submission were posted to the website on April 6, 2004. The sponsor submitted updated/revised documents on July 16, 2004 and September 3, 2010, which were posted to the ChemRTK website on September 20, 2004 and November 15, 2010, respectively.

Category Justification

The sponsor proposed a category comprised of hydrocarbon mixtures that have been reclaimed from process water, catalysts, filters, and other materials in contact with refinery streams, including spilled oil and oil recovered from wastewater treatment plants. In its original test plan, the sponsor grouped five waste streams into the reclaimed petroleum hydrocarbons category. In the final submission, however, the sponsor separated them into two categories: (1) Reclaimed petroleum hydrocarbons; residual hydrocarbon wastes from petroleum refining category and (2) Reclaimed petroleum hydrocarbons; naphtha hydrocarbon wastes from petroleum refining category. This hazard characterization pertains to the Reclaimed petroleum hydrocarbons; residual hydrocarbon wastes from petroleum refining category. A separate hazard characterization has been prepared for the Reclaimed petroleum hydrocarbons; naphtha hydrocarbon wastes from petroleum refining category.

These members of the reclaimed petroleum hydrocarbons; residual hydrocarbon wastes from petroleum refining category (see Table 1) are represented by the residual hydrocarbon waste streams from petroleum refining which include hydrocarbons C ≥ 20, petroleum wastes (CASRN 68476-53-9); petroleum wastes (CASRN 68477-26-9); and clay-treating filter wash residues, petroleum (CASRN 68918-73-0).

Table 1. Residual Hydrocarbon Waste Streams Names and Assigned CASRNs for Sponsored Streams

Streams	CASRN	CASRN Definition
Hydrocarbons, C ≥ 20, petroleum wastes	68476-53-9	A complex combination of hydrocarbons produced as waste material from slop oil, sediments, and water. It consists of hydrocarbons having a carbon number predominantly greater than C20 and boiling above approximately 350 °C (662 °F).
Waste, petroleum	68477-26-9	The waste products from any petroleum refinery or production process which has been dewatered. It is commonly called slop oil.
Residues (petroleum), clay-treating filter wash	68918-73-0	A complex residuum from the solvent washing of clay-treating filters. It consists predominantly of unsaturated hydrocarbons having carbon numbers predominantly greater than C20 and boiling above approximately 350°C (662 °F).

The sponsor proposed category membership based on the similar source of material from which the substances are derived. The sponsor indicated that, because it is not possible to predict what hydrocarbons might be present in any particular reclaimed oil mixture, there is no "representative" composition of any of these materials that could be proposed as a candidate test material. As such, the sponsor proposed to characterize the hazard of the members for the residual hydrocarbon wastes category with data from refinery streams and products from other HPV petroleum categories.

EPA agrees conceptually with the sponsor's proposal to assess complex mixtures (in this case, the diverse materials identified as reclaimed waste streams) by examining data on components of that mixture (in this case, petroleum streams that are in other HPV submissions and are somehow related to the reclaimed waste streams).

Justification for Supporting Chemicals

Human Health Endpoints
Data are available for only one sponsored category member (CASRN 68477-26-9). To supplement available data for the category member(s), the sponsor proposed the use of data from refinery streams and other HPV petroleum categories. EPA is preparing hazard characterizations for the HPV petroleum categories which are and will be available for viewing at the following link: http://iaspub.epa.gov/oppthpv/hpv_hc_characterization.get_report?doctype=2.

These waste streams are all complex substances that are reflective of the crude oils (see EPA hazard characterization for Crude Oil: http://iaspub.epa.gov/oppthpv/hpv_hc_characterization.get_report_by_cas?doctype=2) and product streams generated within an oil refinery. Because wastes streams are not uniform and are often mixed and combined in a tank or other containment structure, the composition of the wastes are not static, but change rapidly as they are collected and stored for processing. Typically they contain hydrocarbons boiling over 350 degrees Fahrenheit and may contain significant amounts of polycyclic aromatic compounds (PAC). Limited compositional information (see Appendix) is available that suggests that the use of the proposed supporting chemical data (see Table 2) is appropriate for read-across to the sponsored substances for the human health endpoints.

Ecotoxicity Endpoints
For the ecotoxicity endpoints, the sponsor provided robust summaries for the aquatic toxicity of the proposed supporting chemicals fuel oil, residual (CASRN 68476-33-5) and fuel oil No. 6 (no CASRN); however, results were reported based on nominal loading rates, not measured concentrations. EPA determined that the measured data from 1-tetradecene (CASRN 1120-36-1) and 1-hexadecene (CASRN 629-73-2) were more appropriate to support this category based on their similar physico-chemical properties, environmental fate and mode of toxic action (narcosis). In addition, 1-tetradecene (C14) and 1-hexadecene (C16) cover the low and high carbon numbers in the category (C14 - $\geq$ C20) with respect to toxicity. Therefore, data from these supporting chemicals can adequately characterize the aquatic toxicity hazard for this category and were used for the preparation of this hazard characterization.

The supporting chemical 1-tetradecene (CASRN 1120-36-1: SIAM 11) has been assessed in the OECD HPV program as a member of the alpha olefins category (http://www.chem.unep.ch/irptc/sids/OECDSIDS/AOalfaolefins.pdf)
The supporting chemical 1-hexadecene (CASRN 629-73-2: SIAM 19) has been assessed in the OECD HPV program as a member of the higher olefins category (http://www.chem.unep.ch/irptc/sids/OECDSIDS/HigherOlefins.pdf).

Table 2. Supporting Chemicals for Reclaimed Petroleum Hydrocarbons; Residual Hydrocarbon Wastes from Petroleum Refining Category

CASRN	Name
Human Health Endpoints	
No CASRN	Atmospheric residue
No CASRN	Atmospheric distillate
No CASRN	Clarified slurry oil
No CASRN	Cracked distillate
No CASRN	Cracked residue
No CASRN	Residual fuel oils
No CASRN	Heavy fuel oil
No CASRN	Slop oil
No CASRN	Vacuum distillate
No CASRN	Vacuum residue
Ecotoxicity Endpoints	
1120-36-1	1-Tetradecene
629-73-2	1-Hexadecene

1. Chemical Identity

1.1 Identification and Purity

The following description is taken from the Category Assessment Document (August 2010):

These waste streams are all complex substances that are reflective of the crude oils and product streams generated within an oil refinery. Because wastes streams are not uniform and are often mixed and combined in a tank or other containment structure, the composition of the wastes are not static, but change rapidly as they are collected and stored for processing. Typically they contain hydrocarbons boiling over 350 degrees Fahrenheit and may contain significant amounts of polycyclic aromatic compounds (PAC). All exist as liquids, emulsions, or suspensions at room temperature with variable solution densities and viscosities.

1.2 Physical-Chemical Properties

The physical-chemical properties of the residual hydrocarbon wastes are summarized in Table 3. A description of the complex mixtures used to describe this category is provided in the Appendix. Residual hydrocarbon wastes can either exist as oily liquids, aqueous emulsions, or sludge depending on their source within the refinery, the type of crude being processed, and the degree of recovery and reuse the wastes have undergone.

The components of this category are generally liquids that possess negligible vapor pressure and negligible water solubility.

Table 3. Physical-Chemical Properties of the Reclaimed Petroleum Hydrocarbons; Residual Hydrocarbon Wastes from Petroleum Refining Category[1]

Property	SPONSORED CHEMICAL Wastes, petroleum[1]	SPONSORED CHEMICAL Hydrocarbons, C≥20, petroleum wastes[1]	SPONSORED CHEMICAL Residues (petroleum), clay-treating filter wash[1]
CASRN	68477-26-9	68476-53-9	68918-73-0
Molecular Weight	Complex mixture with carbon number predominantly greater than C20	Complex mixture with carbon number predominantly greater than C20	Complex mixture with carbon number predominantly greater than C20
Physical State	Oily liquids, aqueous emulsions, or sludge	Oily liquids, aqueous emulsions, or sludge	Oily liquids, aqueous emulsions, or sludge
Melting Point	<25 °C	<25 °C	<25 °C
Boiling Point	28 –608 °C (measured); 37– >300 °C (measured/estimated)[3-5]	>300 °C (estimated)[3,5]	>300 °C (estimated)[3,5]
Vapor Pressure	$<1 \times 10^{-4}$–528 mm Hg at 25 °C (measured/estimated)[3-5]	$0.002 – 3.5 \times 10^{-7}$ mm Hg at 25 °C (estimated)[3,5]	$0.002 – 1 \times 10^{-4}$ mm Hg at 25 °C (estimated)[3,5]
Dissociation Constant (pK_a)	Not applicable	Not applicable	Not applicable
Henry's Law Constant	0.0066–90.2 atm-m^3/mol (measured/estimated)[3-5]	0.0003 – 90.2 atm-m^3/mol (estimated)[3,5]	4.2 – 22.4 atm-m^3/mol (estimated)[3,5]
Water Solubility	$<1 \times 10^{-4}$–526 mg/L (measured/estimated)[3-5]	$1.4 \times 10^{-5} – 1.9 \times 10^{-5}$ mg/L (estimated)[3,5]	$2.3 \times 10^{-5} – 3.5 \times 10^{-5}$ mg/L (estimated)[3,5]
Log K_{ow}	2.6–9.9 (measured/estimated)[3-5]	8.2–9.9 (estimated)[3,5]	9.4–9.7 (estimated)[3,5]

[1] American Petroleum Institute Petroleum HPV Testing Group. Revised Test Plan and Robust Summary for the Reclaimed Petroleum Hydrocarbons Category (Residual hydrocarbon wastes from petroleum refining). Available at: http://www.epa.gov/chemrtk/pubs/summaries/recpethy/c14755tc.htm as of December 22, 2010.
[2] American Petroleum Institute Petroleum HPV Testing Group. Revised Test Plan and Robust Summary for the Reclaimed Petroleum Hydrocarbons Category (Naphtha hydrocarbon wastes from petroleum refining). Available at: http://www.epa.gov/chemrtk/pubs/summaries/recpethy/c14755tc.htm as of December 22, 2010.

[3] Data range based upon the CASRN definition, from which representative structures were derived; see Appendix for detailed information on structures and composition.
[4] SRC. The Physical Properties Database (PHYSPROP). Syracuse, NY: Syracuse Research Corporation. Available online at http://www.syrres.com/esc/physprop.htm as of December 15, 2010.
[5] U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online from: http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of December15, 2010.
[6] Solubility corresponds to water-accommodated fractions (WAFs) at nominal loading rates of 50 – 1,000 mg/L of gasoline blending streams.

2. General Information on Exposure

2.1 Production Volume and Use Pattern

The residual hydrocarbon wastes category chemicals had an aggregated production and/or import volume in the United States greater than 2 billion pounds in calendar year 2005.

- CASRN 68476-53-9: 1 billion pounds and greater;
- CASRN 68477-26-9: 1 billion pounds and greater;

CASRN 68918-73-0 was not reported in the 2006 IUR.
CASRN 68476-53-9:
No industrial processing and uses and commercial and consumer uses were reported for this chemical.

CASRN 68477-26-9:
Non-confidential information in the IUR indicated that the industrial processing and uses for the chemical include petroleum refineries as intermediates. No commercial and consumer uses were reported for this chemical.

2.2 Environmental Exposure and Fate

The components of the residual hydrocarbon wastes category contain high molecular weight components that are expected to possess high to low mobility in soil. These mixtures are likely to contain both readily biodegradable and not readily biodegradable substances. Hydrocarbons, C≥20, petroleum wastes (68476-53-9) and residues (petroleum), clay-treating filter wash (CASRN 68918-73-0) consist of high molecular weight hydrocarbons obtained from waste material from slop oil, sediments, and water having a carbon number predominantly greater than C20 and boiling above approximately 350°C. Many of these substances may be persistent in the environment. The rate of hydrolysis is expected to be negligible since the substances in this category do not possess functional groups that hydrolyze under environmental conditions. The members of the reclaimed petroleum hydrocarbons category are expected to contain substances that have low (P1) to high (P3) persistence and low (B1) to high (B3) high bioaccumulation potential.

The environmental fate properties are provided in Table 4.

Table 4. Environmental Fate Properties of the Reclaimed Petroleum Hydrocarbons; Residual Hydrocarbon Wastes from Petroleum Refining Category[1]			
Property	**SPONSORED CHEMICAL Wastes, petroleum[1]**	**SPONSORED CHEMICAL Hydrocarbons, C≥20, petroleum wastes[1]**	**SPONSORED CHEMICAL Residues (petroleum), clay-treating filter wash[1]**
CASRN	68477-26-9	68476-53-9	68918-73-0
Photodegradation Half-life	2.2–24.6 hours (estimated)[3,4]	1.0–5.0 hours (estimated)[3,4]	1.0–1.6 hours (estimated)[3,4]
Hydrolysis Half-life	Stable	Stable	Stable
Biodegradation	No data. Mixture is likely to contain biodegradable and not readily biodegradable substances.	No data. Mixture is likely to contain high molecular weight hydrocarbons that are not likely to be biodegradable	No data. Mixture is likely to contain high molecular weight unsaturated hydrocarbons that are not likely to be biodegradable
Bioaccumulation Factor	$35.4–1.6\times10^4$ (estimated)[3,4]	$1.5\times10^4–1.6\times10^4$ (estimated)[3,4]	$3.7\times10^4–6.7\times10^6$ (estimated)[3,4]
Log K_{oc}	1.9–5.6 (estimated)[3,4]	5.6–6.1 (estimated)[3,4]	5.6–6.1 (estimated)[3,4]
Fugacity (Level III Model)[3,4]			
Air (%)	1.6–29.5	<0.1–3.9	<0.1–0.5
Water (%)	41.2–95.4	7.0–87.4	27.6–78.9
Soil (%)	2.6–39.4	4.2–47.3	13.9–54.5
Sediment (%)	0.4–4.6	4.6–45.7	6.7–17.8
Persistence[5]	P1 (low) to P3 (high)	P2 (moderate) to P3 (high)	P2 (moderate) to P3 (high)
Bioaccumulation[5]	B1 (low) to B3 (high)	B3 (high)	B3 (high)

[1] American Petroleum Institute Petroleum HPV Testing Group. Revised Test Plan and Robust Summary for the Reclaimed Petroleum Hydrocarbons Category (Residual hydrocarbon wastes from petroleum refining). Available at: http://www.epa.gov/chemrtk/pubs/summaries/recpethy/c14755tc.htm as of December 22, 2010.

[2] American Petroleum Institute Petroleum HPV Testing Group. Revised Test Plan and Robust Summary for the Reclaimed Petroleum Hydrocarbons Category (Naphtha hydrocarbon wastes from petroleum refining). Available at: http://www.epa.gov/chemrtk/pubs/summaries/recpethy/c14755tc.htm as of December 22, 2010.

[3] Data range based upon the CASRN definition, from which representative structures were derived; see Appendix for detailed information on structures and composition.

[4] U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online from: http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of December15, 2010.

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

Conclusion: The residual hydrocarbon wastes category contains complex waste streams derived from the refining of petroleum crude oils and are commonly referred to as slop oils. Because they are not intentionally manufactured and come from many parts of the refinery process, the slop oils are made up of an almost infinite combination of petroleum hydrocarbons and water. The components of this category are generally liquids that are expected to possess negligible vapor pressure and negligible water solubility. The category members are expected to possess low mobility in soil. Volatilization is expected to be moderate to high. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is slow to rapid. The members of the residual hydrocarbon wastes category are expected to possess low (P1) to high (P3) persistence and low (B1) to high (B3) bioaccumulation potential.

3. Human Health Hazard

A summary of the human health toxicity data submitted for SIDS endpoint is provided in Table 5. The table indicates where test data are read-across (RA) to the sponsored chemicals of the reclaimed petroleum hydrocarbons: residual hydrocarbon wastes from petroleum refining category.

Acute Oral Toxicity
(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Atmospheric residue (no CASRN, supporting chemical)
Sprague-Dawley fasted rats (5/sex) were administered undiluted test material (F-132) via oral gavage at 5000 mg/kg. Animals were observed hourly for four hours and then twice daily for 14 days. No mortalities were reported during the study.
LD_{50} > 5000 mg/kg

Vacuum distillates mixture (no CASRN, supporting chemical)
In several studies, Sprague-Dawley fasted rats (5/sex) were administered a single undiluted dose of test material (identified as heavy vacuum gas oil, visbreaker HGO, vis gas oil VIBRA or VB mittelol) via oral gavage at 5000 mg/kg. Animals were observed 30 minutes after dosing and 1 and 4 hours daily thereafter for 14 days. No deaths occurred during the studies.

Heavy vacuum gas oil	**LD_{50} > 5000 mg/kg**
Visbreaker HGO	**LD_{50} > 5000 mg/kg**
Vis gas oil VIBRA	**LD_{50} > 5000 mg/kg**
VB mittelol	**LD_{50} > 5000 mg/kg**

Cracked residue (no CASRN, supporting chemical)
Sprague-Dawley rats (5/sex/dose) were administered a single dose of test material (API-15)via oral gavage at 0, 3200, 4000, 6250, and 7810 mg/kg. Animals were observed at hourly intervals for six hours and twice daily thereafter for 14 days. Mortalities were seen in males rats at 3200 (1/5), 4000 (1/5), 5000 (2/5), 6250 (3/5) and 7810 (5/5) mg/kg. Mortalities for in female rats were seen at 3200 (1/5), 4000 (3/5), 5000 (2/5), 6250 (5/5), and 7810 (5/5) mg/kg.
LD_{50} (females) = 4320 mg/kg

LD_{50} (males) = 5270 mg/kg

Heavy gas oil (no CASRN, supporting chemical)

Sprague-Dawley fasted rats (5/sex) were administered a single dose of the test material (F-97) via oral gavage at 5000 mg/kg. Animals were observed at hourly intervals for four hours and twice daily thereafter for 14 days. No animals died during the study.

LD_{50} > 5000 mg/kg

No. 6 Heavy fuel oil (no CASRN, supporting chemical)

In several studies, Sprague-Dawley rats (5/sex) were fasted and then administered a single dose of one of the undiluted test material (identified as API 78-6, API 78-7, API 78-8 or API 79-2***)*** via oral gavage at 25 ml/kg. The animals were observed daily for 14 days. No animals died during the study.

API 78-6 LD_{50} > 25 mL/kg
API 78-7 LD_{50} > 25 mL/kg
API 78-8 LD_{50} > 25 mL/kg
API 79-2 LD_{50} > 5.13 mL/kg

Acute Dermal Toxicity

(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Atmospheric Residue (no CASRN, supporting chemical)

New Zealand White rabbits (5/sex) were administered a single dose of undiluted test material (F-132) at 2000 mg/kg to shaved skin. The application site was covered for 24 hours. Observations were made hourly for 4 hours and then twice daily for 14 days. No animals died during the study.

LD_{50} > 2000 mg/kg

Vacuum Distillate (no CASRN, supporting chemical)

New Zealand White rabbits (3/sex) were administered a single dose of undiluted test material (HVGO) at 2000 mg/kg to shaved skin. The application site was covered for 24 hours. Observations were made 2 and 4 hours after dosing and daily thereafter for 14 days. No deaths occurred during the study.

Visbreaker HGO LD_{50} > 2000 mg/kg
Vis gas oil VIBRA LD_{50} > 2000 mg/kg
VB Mittelol LD_{50} > 2000 mg/kg

Cracked Residue (no CASRN, supporting chemical)

New Zealand White rabbits (4/sex) were administered a single dose of undiluted test material (API 81-15) at 2000 mg/kg on abraded or intact skin. The application site was covered for 24 hours. Observations were made hourly for six hours and then twice daily for 14 days. No deaths occurred during the study

LD_{50} > 2000 mg/kg

Cracked Distillate (no CASRN, supporting chemical)
New Zealand White rabbits (5/sex) were administered a single dose of undiluted test material (F-97-01) at 2000 mg/kg on shaved skin. The application site was covered for 24 hours. Observations were made hourly for 4 hours and then twice daily for 13 days. /No deaths occurred during the study.
LD_{50} > 2000 mg/kg

Repeated-Dose Toxicity

Atmospheric residue (no CASRN supporting chemical)
(1) In a 28-day dermal repeated dose toxicity test, Sprague-Dawley rats (10/sex/dose) were administered the test substance (F-132) on occluded skin five days per week for four weeks at 0.01, 0.25, or 1.0 mL/kg (9.0, 231, or 927.9 mg/kg-bw/day). The test substance was applied to the application site for six hours and observed twice daily for signs of toxicity and viability. No deaths occurred during the study. There were no treatment-related effects seen on clinical parameters (hematology, clinical chemistry, organ weights and histopathological changes) (Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).
NOAEL = 927.9 mg/kg-bw/day (highest dose tested)

DAF Float Blend (CASRN 68477-26-9)
(2) In a 13-week dermal repeated-dose toxicity study, Sprague-Dawley rats (10/sex/dose) were administered CASRN 68477-26-9 on clipped and shaved skin at 0, 60, 250 or 1000 mg/kg/day five days per week for 13 weeks. One death occurred at 1000 mg/kg/day. Both sexes showed significant decreases in body weight gain at this dose. Significantly elevated levels of ketone and protein were observed in males (1000 mg/kg/day) and females (250 and 1000 mg/kg/day). Significant ($p < 0.01$ or 0.05) changes in clinical chemistry parameters were seen in males (glucose) at all doses and in females at 60 mg/kg/day (uric acid) and 1000 mg/kg/day (uric acid, urea, creatinine and potassium concentrations). Absolute (250 mg/kg/day and above for males and 1000 mg/kg/day for females) and relative liver weights (all doses in males and 250 mg/kg/day and above for females) were significantly increased in both sexes. Significant ($p < 0.01$ or 0.05) changes in other organ weights were also observed in both sexes. In males, the affected organs were thymus at 250 mg/kg/day and above and adrenals, heart, kidneys, relative brain weight, prostate, testes and epididymes at 1000 mg/kg/day. In females, the affected organs were thymus and brain at 1000 mg/kg/day.
LOAEL = 60 mg/kg/day (based on liver and thymus effects)
NOAEL = Not Established

Atmospheric distillate (no CASRN, supporting chemical)
(3) In a 13-week dermal repeated-dose toxicity study, Sprague-Dawley rats (10/sex/dose) were administered the test substance (HAGO) on occluded skin at 0, 30, 125 and 500 mg/kg-bw/day for five days per week for 13 weeks. An additional 10 males were assessed for reproductive health (prostate, epididymides and testes). Two moribund animals were sacrificed: one male at the high-dose showed treatment-related effects; one male at the low dose was considered

incidental. Serum chemistry parameters showed statistically significant dose-dependent treatment-related effects in female rats at 125 and 500 mg/kg-bw/day with increases in blood urea nitrogen, sorbitol dehydrogenase, and cholesterol. A statistically significant decrease in red blood cell count, hemoglobin, hematocrit and platelets were seen in male and female rats at the high dose. An increase in absolute and relative liver and thymus weights was seen in male female rats at 500 mg/kg/day; and only in the spleen at 500 mg/kg-bw/day in females. No treatment-related effects were seen on male reproductive parameters (Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).
LOAEL = 500 mg/kg-bw/day (based on increases in relative liver and spleen weights and hematological effects)
NOAEL = 125 mg/kg-bw/day

Reproductive Toxicity

No specific reproductive toxicity studies are available.

DAF Float Blend (CASRN 68477-26-9)
In a 13-week dermal repeated-dose toxicity study, Sprague-Dawley rats (10/sex/dose) were administered the test substance on occluded skin at 0, 30, 125 and 500 mg/kg-bw/day for five days per week for 13 weeks.

Atmospheric distillate (no CASRN, supporting chemical)
In a 13-week dermal repeated-dose toxicity study, Sprague-Dawley rats (10/sex/dose) were administered the test substance (HAGO) on occluded skin at 0, 30, 125 and 500 mg/kg-bw/day for five days per week for 13 weeks. An additional 10 males were assessed for reproductive health (prostate, epididymides and testes). Two moribund animals were sacrificed: one male at the high-dose showed treatment-related effects; one male at the low dose was considered incidental. No treatment-related effects were seen on male reproductive parameters (Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Developmental Toxicity

DAF Float Blend (CASRN 68477-26-9)
In a prenatal developmental toxicity study, pregnant Sprague-Dawley rats (15/dose) were administered CASRN 68477-26-9 on non-occluded skin at 0, 125, 500, and 1000 mg/kg-bw/day daily on gestation days 0-19. Animals were observed at least once a day throughout gestation until sacrifice for signs of disease, abortion, premature delivery and/or death. Dams were sacrificed on gestation day 20. Hematology and serum chemistry analyses were performed. Thoracic and abdominal organs, uterus and ovaries were examined for gross malformations. The uterine weights, the number and location of implantations, early and late resorptions, and live/dead fetuses were recorded. Each fetus was gendered, weighed and grossly examined. Half of the fetuses were used for soft tissue examinations, while the other half was examined for

skeletal abnormalities. A statistically significant decrease in red blood cells, hemoglobin and hematocrit were observed at 1000 mg/kg-bw/day. A statistical significant increase in glucose, urea nitrogen, aspartate aminotransferase, protein, albumin, albumin/globulin, and calcium was observed at 500 and 1000 mg/kg-bw/day. A decrease in creatinine and triglycerides was seen at the same dose levels. At 500 and 1000 mg/kg-bw/day, a treatment of the high dose rats (1000 mg/kg-bw/day) were discontinued at gestation day 15 due to a suspected high incidence (95%) of resorptions indicated by severe red vaginal discharge in several dams (13). A statistical significant difference in mean percent of resorptions was observed at 125 mg/kg/day (16.6%) in 10 dams and at 500 mg/kg/day (84%) in 12 dams. A statistically significant decrease in litter size was observed at 500 and 1000 mg/kg/day. Maternal body weights were significantly decreased at 500 and 1000 mg/kg/day from gestations days 13 to 20. Gravid uterine weight, carcass weight, and net maternal body weight were decreased at the same dose levels. Macroscopic examinations revealed a statistical significant increase in lymph node size, decreased thymus size and decreased absolute and relative thymus weights at 500 and 1000 mg/kg/day in the dams. Fetuses in the 500 and 1000 mg/kg-bw/day dams showed a significant decrease in body weight. No significant soft tissue or skeletal abnormalities were observed in the fetuses.
LOAEL (maternal/developmental toxicity) = 125 mg/kg-bw/day (based on the number of dams with resorptions and an increase in mean number/percent resorptions)
NOAEL (maternal/developmental toxicity) = Not Established

Genetic Toxicity – Gene Mutation

In Vitro
(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Clarified slurry oil (no CASRN, supporting chemical)
Salmonella typhimurium strain TA98 was exposed to clarified slurry oil (API 81-15) at concentrations of 1000, 5000, 10,000, 25,000 and 50,000 ug/plate in the absence and presence of metabolic activation (two at 10% and two at 80%). In trial two of the 10% and 80%, a lower dose range of 33-3333ug/plate was used in order to demonstrate a dose-response.
Clarified slurry oil was mutagenic in this study.

Catalytically cracked clarified oil (no CASRN, supporting chemical)
Mouse lymphoma L5178Y cells were exposed to test material (API 81-15) for four hours in at concentration specified by a previous cytotoxicity test. Positive and negative controls responded appropriately. API 81-15 caused an increase in mutation frequency with and without metabolic activation.
Catalytically cracked clarified oil was mutagenic in this assay.

Clarified slurry oil (no CASRN, supporting chemical)
In a bacterial forward mutation assay, CHO-K1-BH4 Chinese Hamster Ovary (CHO) cells were exposed to clarified slurry oil at concentrations of 0.1, 1, 3, 10, and 30 ug/mL without activation and 0.1, 1, 10, 100, and 200 ug/mL with activation. Clarified slurry oil did not increase mutation frequency.

Clarified slurry oil did not induce mutations in this assay.

Genetic Toxicity – Chromosomal Aberrations

In Vivo

(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Heavy vacuum gas oil (no CASRN, supporting chemical)

In a micronucleus assay, Sprague-Dawley rats (10/sex/dose) were exposed dermally to heavy vacuum oil (HVGO) daily/5 days/week for 13 weeks at doses of 0, 30, 125, 500, or 2000 mg/kg-bw/day. After 13-weeks the femurs were taken from 5/sex/dose with the exception of the 125 and 2000 mg/kg-bw/day group. Heavy vacuum gas oil did not increase micronuclei frequency.

Heavy vacuum gas oil did not induce micronuclei in this assay.

Catalytically cracked clarified oil (*no CASRN, supporting chemical*) In a cytogenetic assay, Sprague-Dawley rats (10/sex/dose) were administered the test material (API-15) by oral gavage daily for five days at 0, 100, 300 and 13/sex at 1000 mg/kg-bw/day. Positive and negative controls responded appropriately. Catalytically cracked clarified oil did not induce chromosome aberration.

Catalytically cracked clarified oil did not induce chromosomal aberrations in this study.

Slurry oil (no CASRN, supporting chemical)

Male Fischer (F-344) rats (3/dose) were administered slurry oil (API 81-15) via oral gavage at 50, 200 and 1000mg/kg-bw/day. Animals were treated at 2 and 12 hours. Positive controls responded appropriately. Slurry oil induced chromosome aberration.

Slurry oil induced chromosomal aberrations in this study.

Genetic Toxicity – Other

(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Clarified slurry oil (no CASRN, supporting chemical)

In a sister chromatid exchange (SCE) assay, B6C3F1 Mice (5/sex/dose) were administered a single intraperitoneal dose of clarified slurry oil (API 81-15) at 400 and 4000 mg/kg/day and 4 males and 5 females were administered 2000 mg/kg-bw/day for an unspecified time but less than 24 hours. Positive and negative controls responded appropriately. Clarified slurry oil induced sister chromatid exchange.

Clarified slurry oil induced sister chromosome exchange in this assay.

Clarified oil (no CASRN, supporting chemical)

In a sister chromatid exchange assay, Chinese Hamster Ovary (CHO) cells were exposed to clarified oil at concentrations of 5 to 100 ug/mL without activation and 100 to 5000 ug/mL with activation.

Clarified oil did not induce sister chromatid exchange in this assay.

Additional Information

Skin Irritation
(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Cracked residue (no CASRN, supporting chemical)
Rabbits (6; sex not specified) were administered 0.5mL of undiluted test sample (API 81-15) on two areas (one side abraded, one side intact) of dorsal skin then covered for 24 hours. After treatment, the dressing was removed and the treated skin was wiped to remove the test material. The skin was observed at 24, 72 and 96 hours; then again on days 7 and 14.
Cracked residue sample API 81-15 is irritating to the rabbit skin in this study.

Eye Irritation
(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Vacuum residue (no CASRN, supporting chemical)
(1) New Zealand white rabbits (12, sex not specified) were administered 0.1mL of undiluted test material in the right eye for 30 seconds. Six of the treated eyes were washed for one minute with lukewarm water and six were unwashed. The left untreated control eyes were flushed in a manner similar as the treated eyes. Observations were conducted at 1, 24, 48 and 72 hours; and also at 4, 7, 10 and 14 days after treatment.
Vacuum residues are irritating to rabbit rinsed eyes but not in un-rinsed eyes in this study.

Heavy fuel oil samples 78-6, 78-7, 78-8, 79-2 (no CASRN, supporting chemicals)
New Zealand white rabbits (9) were administered 0.1mL of undiluted test samples in the right eye for 30 seconds. Treated eyes of three rabbits (two females, one male) were rinsed for one minute with warm distilled water after 30 seconds of treatment. Treated right eyes of the other six rabbits were not rinsed. The untreated left eyes of all rabbits served as controls. Animals were observed at 24, 48 and 72 hours after treatment. For two samples (79-2; one not specified) the observation period was extended until no irritation was seen.
API 78-6 is irritating to rabbit eyes in this study.
API 78-7 is irritating to rabbit eyes in this study.
API 78-8 is irritating to rabbit eyes in this study.
API 79-2 is irritating to rabbit eyes in this study.

Sensitization
(Data from HPV Challenge submission: Heavy Fuel Oils Category, http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm).

Atmospheric residue (no CASRN, supporting chemical)
Guinea Pigs (10/sex not specified) were administered 0.5mL of undiluted test material (F-132) on shorn skin for six hours, once a week for three weeks. Fourteen days after the third

induction,animals were challenged at different skin sites at doses of 0.5mL in the same manner as the induction doses. The skin was observed 24 and 48 hours after each induction and challenge dose.
Atmospheric residues sample F-132 is not sensitizing in this study.

Conclusion: The acute oral and dermal toxicity of atmospheric residue sample F-132 (supporting chemical, no CASRN) is low in rats and rabbits respectively. A 28-day dermal repeated-dose toxicity study in rats with atmospheric residue sample F-132 (supporting chemical, no CASRN) showed no adverse treatment related effects; the NOAEL for systemic toxicity is 927.9 mg/kg-bw/day (highest dose tested). A 13-week dermal repeated-dose toxicity study in rats with CASRN 68477-26-9 showed a significant increase in liver to body weight ratios in males at 60 mg/kg-bw/day (lowest dose tested) and above; the NOAEL for systemic toxicity is not established. A 13-week dermal repeated-dose toxicity study in rats with atmospheric distillates (supporting chemical, no CASRN) showed increases in relative liver and spleen weights and hematological effects at 500 mg/kg-bw/day; the NOAEL for systemic toxicity is 125 mg/kg-bw/day. No specific reproductive toxicity study is available; however, in the dermal repeated-dose toxicity study in rats with CASRN 68477-26-9, significant decreases in prostate and epididymal weights and increases in testes weight were observed. In the dermal repeated-dose toxicity study with atmospheric distillates (supporting chemical, no CASRN), no effects on the reproductive organs in males (only sex evaluated) were observed. In a dermal prenatal developmental toxicity study in rats, CASRN 68477-26-9 showed statistically significant changes in maternal clinical chemistry parameters and significantly decreased resorptions at 125 mg/kg-bw/day (lowest dose tested); the NOAEL for maternal/developmental toxicity is not established. Clarified slurry oil (supporting chemical, No CASRN) was not mutagenic in bacteria *in vitro* and did not induce sister chromatid exchange (SCE) in mammalian cells *in vitro,* but was positive for SCE in mice *in vivo*. Heavy vacuum gas oil and catalytically cracked clarified oil (supporting chemicals, No CASRNs) did not induce micronuclei and chromosomal aberrations *in vivo*. Heavy fuel oil and cracked residue (supporting chemicals, No CASRNs) are irritating to the rabbit eye and skin, respectively. Atmospheric residue (supporting chemical, No CASRN) is not sensitizing to guinea pig skin.

Table 5. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program - Human Health Data

Endpoint	SPONSORED CHEMICAL Hydrocarbons, C ≥20, petroleum wastes (68476-53-9)	SPONSORED CHEMICAL Wastes, Petroleum (68477-26-9)	SPONSORED CHEMICAL Residues (petroleum), clay-treating filter wash (68918-73-0)	SUPPORTING CHEMICAL Atmospheric distillate (No CASRN)	SUPPORTING CHEMICAL Atmospheric Residue (No CASRN)	SUPPORTING CHEMICAL Clarified Slurry (No CASRN)	SUPPORTING CHEMICAL Heavy Fuel Oil (No CASRN)	SUPPORTING CHEMICAL Cracked Residue (No CASRN)
Acute Oral Toxicity LD_{50} (mg/kg)	No Data >5,000 (RA)	No Data >5,000 (RA)	No Data >5,000 (RA)	–	**>5,000**	–	–	–
Acute Dermal Toxicity LD_{50} (mg/kg)	No Data >2,000 (RA)	No Data >2,000 (RA)	No Data >2,000 (RA)	–	**>2,000**	–	–	–
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	No Data LOAEL = 60 NOAEL = Not Established (RA)	**(13-week) LOAEL = 60 NOAEL = Not Established**	No Data LOAEL = 60 NOAEL = Not Established (RA)	–	**(28-d) LOAEL = Not Established NOAEL = 927.9**	–	–	–
Reproductive Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	No Data NOAEL = 500 (highest dose tested) (RA)	No Data NOAEL = 500 (highest dose tested) (RA)	No Data NOAEL = 500 (highest dose tested) (RA)	**NOAEL = 500 (highest dose tested)**	–	–	–	–
Developmental Toxicity NOAEL/LOAEL Dermal (mg/kg/day) Maternal/Developmental Toxicity	No Data LOAEL= 125 NOAEL= Not Established LOAEL= 125 NOAEL= Not Established (RA)	**LOAEL= 125 NOAEL= Not Established LOAEL= 125 NOAEL= Not Established**	No Data LOAEL= 125 NOAEL= Not Established LOAEL= 125 NOAEL= Not Established (RA)	–	–	–	–	–

Table 5. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program - Human Health Data

Endpoint	SPONSORED CHEMICAL Hydrocarbons, C ≥20, petroleum wastes (68476-53-9)	SPONSORED CHEMICAL Wastes, Petroleum (68477-26-9)	SPONSORED CHEMICAL Residues (petroleum), clay-treating filter wash (68918-73-0)	SUPPORTING CHEMICAL Atmospheric distillate (No CASRN)	SUPPORTING CHEMICAL Atmospheric Residue (No CASRN)	SUPPORTING CHEMICAL Clarified Slurry (No CASRN)	SUPPORTING CHEMICAL Heavy Fuel Oil (No CASRN)	SUPPORTING CHEMICAL Cracked Residue (No CASRN)
Genetic Toxicity – Gene Mutation *In vitro*	–	–	–	–	–	**Positive**	–	–
Genetic Toxicity – Chromosomal Aberrations *In vivo*	–	–	–	–	–	**Positive**	–	–
Genetic Toxicity – Other SCE *in vitro*	–	–	–	–	–	**Negative**	–	–
SCE *in vivo*						**Positive**		
Additional Information								
Skin Irritation	–	–	–	–	–	–	–	**Irritating**
Eye Irritation	–	–	–	–	–	–	**Irritating**	–
Skin Sensitization	–	–	–	–	**Negative**	–	–	–

Measured data in bold text; (RA) = read-across; − endpoint not addressed for this chemical

Table 5. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program - Human Health Data

Endpoint	SUPPORTING CHEMICAL Cracked Distillate (No CASRN)	SUPPORTING CHEMICAL Heavy Gas Oil (No CASRN)	SUPPORTING CHEMICAL Vacuum Distillate (No CASRN)	SUPPORTING CHEMICAL Vacuum Residue (No CASRN)
Acute Oral Toxicity LD_{50} (mg/kg)	–	**>5,000**	**>5,000**	–
Acute Dermal Toxicity LD_{50} (mg/kg)	**>2,000**	–	**>2,000**	–
Repeated-Dose Toxicity NOAEL/LOAEL (mg/kg/day)	–	–	–	–
Reproductive Toxicity NOAEL/LOAEL (mg/kg/day)	–	–	–	–
Developmental Toxicity NOAEL/LOAEL (mg/kg/day) Maternal/Developmental Toxicity	–	–	–	–
Genetic Toxicity – Gene Mutation *In vitro*	–	–	–	–
Genetic Toxicity – Chromosomal Aberrations *In vivo*	–	**Negative**	–	–
Genetic Toxicity – Other SCE *in vitro* SCE *in vivo*	–	–	–	–
Additional Information				
Skin Irritation	–	–	–	–
Eye Irritation	–	–	–	**Irritating**
Skin Sensitization	–	–	–	–

Measured data in bold text; (RA) = read-across; − endpoint not addressed for this chemical

4. Hazard to the Environment

There were no data submitted for the sponsored chemicals. A summary of aquatic toxicity data for supporting chemicals for SIDS endpoints is provided in Table 6. The table indicates where test data are read-across (RA) to the sponsored chemicals of the reclaimed petroleum hydrocarbons: residual hydrocarbon wastes from petroleum refining category.

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

1-Hexadecene (CASRN 629-73-2, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/HigherOlefins.pdf
96-h LC_{50} > Predicted Solubility limit (0.00144 mg/L)

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

1-Hexadecene (CASRN 629-73-2, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/HigherOlefins.pdf
96-h LC_{50} > Predicted Solubility limit (0.00144 mg/L)

Toxicity to Aquatic Plants

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

1-Hexadecene (CASRN 629-73-2, supporting chemical)
http://www.chem.unep.ch/irptc/sids/OECDSIDS/HigherOlefins.pdf
72-h EC_{50} (biomass) > Predicted Solubility limit (0.00144 mg/L)
72-h EC_{50} (growth rate) > Predicted Solubility limit (0.00144 mg/L)

Chronic Toxicity to Aquatic Invertebrates

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

Conclusion: No data are available for the sponsored substances. Based on the supporting chemicals, CASRNs 1120-36-1 and 629-73-2, acute and chronic toxicity of the reclaimed petroleum hydrocarbons category members to fish, aquatic invertebrates and aquatic plants are considered to be no effects at saturation (NES) based on no effects observed at the water solubility limit (saturation).

Table 6. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program – Aquatic Toxicity Data

Endpoints	SUPPORTING CHEMICAL 1-Tetradecene C14 (1120-36-1)	SUPPORTING CHEMICALS 1-Hexadecene C16 (629-73-2)	SPONSORED CHEMICAL Wastes, petroleum (68477-26-9)	SPONSORED CHEMICAL Residues (petroleum), clay-treating filter wash (68918-73-0)	SPONSORED CHEMICAL Hydrocarbons, C≥20, petroleum wastes (68476-53-9)
Fish **96-h LC_{50} (mg/L)**	**NES**	**NES**	No Data NES (RA)	No Data NES (RA)	No Data NES (RA)
Aquatic Invertebrates **48-h EC_{50} (mg/L)**	**NES**	**NES**	No Data NES (RA)	No Data NES (RA)	No Data NES (RA)
Aquatic Plants **72-h EC_{50} (mg/L) Biomass** **Growth Rate**	**NES** **NES**	**NES** **NES**	No Data NES NES (RA)	No Data NES NES (RA)	No Data NES NES (RA)
Chronic Aquatic Invertebrates **21-d ChV (mg/L) NOEC** **LOEC**	**NES** -	- -	- -	- -	- -

Bold = experimental data (i.e. derived from testing); (e) = estimated data; RA = read across; − indicates that endpoint was not addressed for this chemical; ChV = chronic value; NES = No effects at saturation (the water solubility limit of the substance).

APPENDIX

The following pages below:

- Table 7: Chemical composition of slop oil and sludges from an oil refinery (taken from the Category assessment document for the HPV Challenge submission: http://www.epa.gov/chemrtk/pubs/summaries/recpethy/c14755ca1.pdf)
- Table 8: Representative structures of the sponsored substances chemicals, description of the origin of the residual hydrocarbon wastes category members and the associated diagram are taken from the sponsor's original final 2010 Category Summary.
    - The table also includes a list of supporting chemicals used to evaluate the human health toxicity for category members.
- Figure 1: Crude Oil Distillation Process
- Figure 2: Processing Plan for Petroleum Refinery

Table 7. Chemical Composition of Slop Oil and Sludges from an Oil Refinery

Constituent	API Slop Oil Emulsion	API Sludge	DAF Floating Solids
Toluene (mg/L)	5.78	2.72	5.72
Xylene (mg/L)	0.10	---	0.53
Trimethylbenzene (mg/L)	0.31	0.06	0.11
Methylethylbenzene (mg/L)	0.10	---	---
Methylpropylbenzene (mg/L)	0.06	---	---
Dimethylethylbenzene (mg/L)	0.21	---	---
Tetrmethylbenzene (mg/L)	0.29	0.04	0.24
C_5 – benzene (mg/L)	1.16	---	---
Dihydroindene (mg/L)	0.04	---	---
Methyl dihydroindene (mg/L)	0.04	1.00	---
C_2 – dihydrindene (mg/L)	0.60	---	---
Naphthalene (mg/L)	1.61	0.15	0.32
Methyl naphthalene (mg/L)	9.83	1.20	2.58
Dimethyl naphthalene (mg/L)	15.98	3.19	5.35
Ethyl naphthalene (mg/L)	1.08	0.57	0.45
C_3 – naphthalene (mg/L)	11.73	2.44	4.48
C_4 – naphthalene (mg/L)	1.61	0.84	0.70
Tetrahydrohapthol (mg/L)	0.26	---	---
Dimethyldihydronaphthalene (mg/L)	0.14	---	---
Methyl tetralol (mg/L)	0.20	---	---
Dimethyl thiaindene (mg/L)	0.08	---	0.11
Biphenyl (mg/L)	0.56	---	0.18
Acenaphthene(mg/L)	0.13	---	0.32
Methyl (acenaphthene/biphenyl) (mg/L)	5.11	0.58	1.43
C_2 – (acenaphthene/biphenyl) (mg/L)	1.58	---	0.50
C_3 – (acenaphthene/biphenyl) (mg/L)	---	---	0.46
Fluorene (mg/L)	1.25	0.14	0.26
Methyl fluorene (mg/L)	1.48	0.76	0.36
C_2 – fluorene (mg/L)	1.18	0.40	0.97
C_3 – fluorene (mg/L)	0.52	0.11	0.58
Naphthol thianaphthene (mg/L)	---	0.84	1.31
Dibenzothiophene (mg/L)	0.56	0.50	0.62
Methyl dibenzothiophene (mg/L)	1.36	1.00	1.62
C_2 – dibenzothiophene (mg/L)	0.24	2.10	3.72
C_3 – dibenzothiophene (mg/L)	---	0.82	---
Anthracene/phenanthrene (mg/L)	5.14	3.57	6.23
Methyl (anthracene/phenanthrene) (mg/L)	11.64	13.85	21.90

Constituent	API Slop Oil Emulsion	API Sludge	DAF Floating Solids
C_2 – (anthracene/phenanthrene) (mg/L)	8.60	16.36	22.54
C_3 – (anthracene/phenanthrene) (mg/L)	2.23	5.67	4.20
C_4 - (anthracene/phenanthrene) (mg/L)	---	1.90	1.44
C_5 – (anthracene/phenanthrene) (mg/L)	---	0.22	
Pyrene/fluoranthene (mg/L)	1.65	9.43	10.16
Methyl (pyrene/fluoranthene) (mg/L)	2.13	---	11.47
C_2 – (pyrene/fluoranthene) (mg/L)	0.51	6.04	6.30
C_3 – (pyrene/fluoranthene) (mg/L)	---	16.86	---
Chrysene/benzanthracene (mg/L)	1.51	14.90	15.26
Methyl (chrysene/benzanthracene) (mg/L)	0.35	13.84	9.67
Benzopyrene/benzofluoranthene (mg/L)	2.86	22.71	11.43

* taken from Burks and Wagner, 1983

Table 8. The structures chosen for each category member were based on the description of the process stream provided in the Test Plan and Robust Summary and supplemented by information from the CASRN definition included in the CASRN registry name. According to the revised Test Plan this category consists of complex waste streams derived from the refining of petroleum crude oils. Therefore, these streams can contain a wide range of differing substances. They likely consist of paraffinic, olefinic, napthenic and aromatic components ranging in carbon length from C5 to greater than C20. The structures depicted below are chosen to represent the wide range of values that may be expected for both the physical-chemical and environmental fate properties of these streams and are not a comprehensive listing of the expected substances in these process streams.

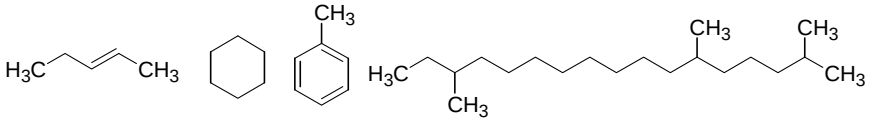
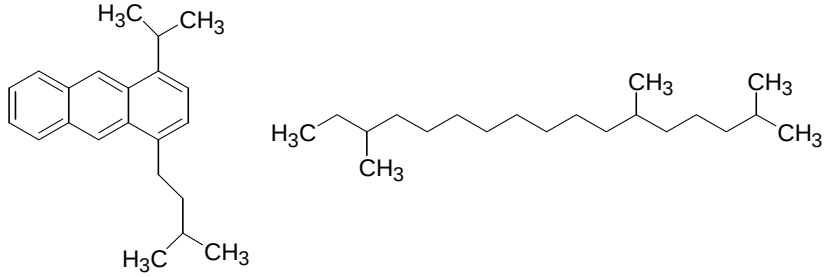
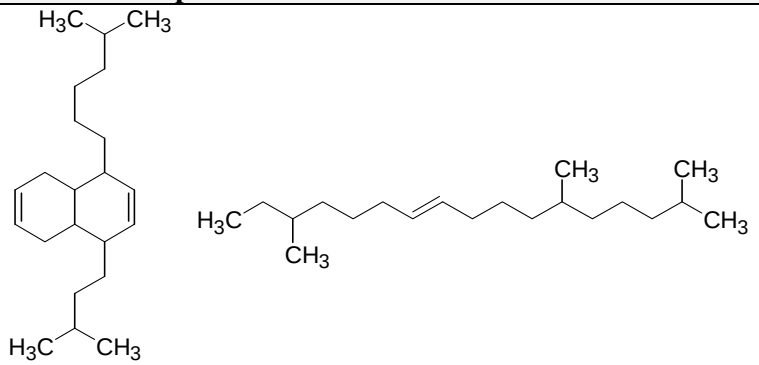
Table 8. Process Streams, CASRN, and Description of the Reclaimed Petroleum Hydrocarbons: Residual Hydrocarbon Wastes from Petroleum Refining category.[1]		
Name	**CASRN**	**TSCA Description**
Sponsored Chemicals		
Wastes, petroleum	68477-26-9	 The waste products from any petroleum refinery or production process which has been dewatered. It is commonly called slop oil. This CASRN is used to describe any petroleum waste which has been dewatered. It can range from lighter hydrocarbons derived from fuel manufacturing processes to heavier materials from lube manufacturing.
Hydrocarbons, C≥20, petroleum wastes	68476-53-9	 A complex combination of hydrocarbons produced as waste material from slop oil, sediments, and water. It consists of hydrocarbons having a carbon number predominantly greater than C20 and boiling above approximately 350°C

Table 8. Process Streams, CASRN, and Description of the Reclaimed Petroleum Hydrocarbons: Residual Hydrocarbon Wastes from Petroleum Refining category.[1]		
Name	**CASRN**	**TSCA Description**
Residues (petroleum), clay-treating filter wash	68918-73-0	 A complex residuum from the solvent washing of clay-treating filters. It consists predominantly of unsaturated hydrocarbons having carbon numbers predominantly greater than C20 and boiling above approximately 350°C
Supporting Chemicals		
Atmospheric Residue Atmospheric Distillate Clarified Slurry Oil Cracked Distillate Cracked Residue Heavy Gas Oil Vacuum Distillate Vacuum Residue	No CASRNs	***No Chemical Structures Are Available*** See additional information in the heavy fuel oils category at: http://www.epa.gov/chemrtk/pubs/summaries/heavyfos/c15368tc.htm
1-Tetradecene	1120-36-1	**See:** http://www.chem.unep.ch/irptc/sids/OECDSIDS/AOalfaolefins.pdf
1-Hexadecene	629-73-2	**See:** http://www.chem.unep.ch/irptc/sids/OECDSIDS/HigherOlefins.pdf

Crude Oil Distillation Process

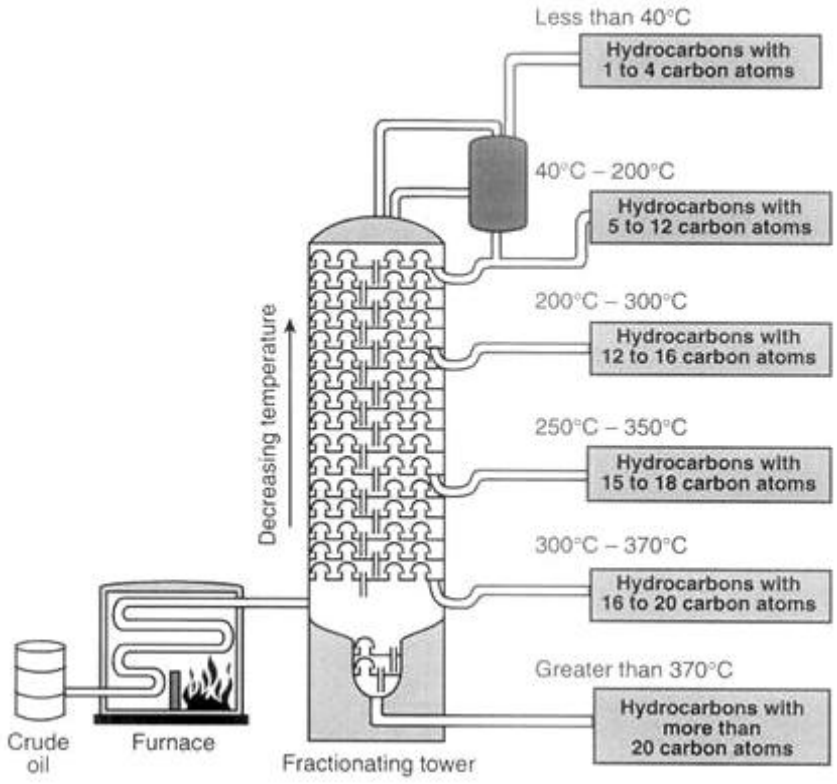


Figure 1. Crude Oil Distillation Process

As shown in Figure 1, the refining of crude oil into petroleum products uses distillation as well as chemical treatment, catalysts, and pressure to separate and combine the basic types of hydrocarbon molecules into petroleum streams, which have the characteristics needed for blending commercial petroleum products. As is the case for many industrial processes, the refining of petroleum products produces a number of unintentional byproducts, wastes, and other hydrocarbon-containing process streams that are not typically sold as products. For example, oil is recovered from wastewater streams and the catalysts, filters and other materials in contact with oil are washed to recover hydrocarbons. The oil that is occasionally spilled and the oil recovered from wastewater treatment are generally recycled back into the refinery (naphtha hydrocarbon waste).

Processing Plan for Petroleum Refinery

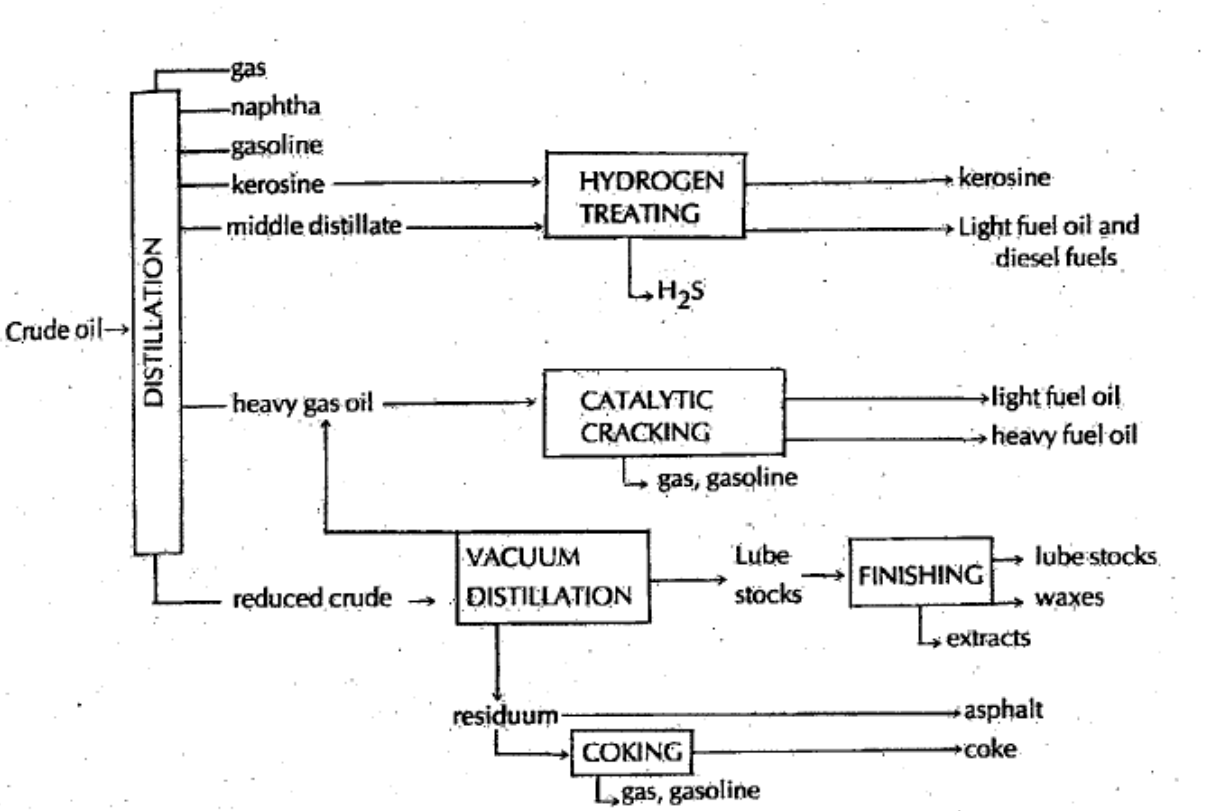


Figure 2. Processing Plan for Petroleum Refinery
U.S. Public Health Service, 1960

For a more background information on residual hydrocarbon waste generation and waste separation see the U.S. EPA HPV Challenge Program Category Assessment Document for Reclaimed Petroleum Hydrocarbons: Residual Hydrocarbon Wastes from Petroleum Refining at: http://www.petroleumhpv.org/docs/rec_subs/Residual%20hydrocarbon%20wastes%20-%20CAD%20final%208_30_10.pdf.