SCREENING-LEVEL HAZARD CHARACTERIZATION

Propylene Streams Category

SPONSORED CHEMICALS
(See Section 1)

SUPPORTING CHEMICALS
(See Section 1)

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

[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.

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.

Chemical Abstract Service Registry Number (CASRN)	**Sponsored Chemicals** **115-07-1** **115-07-1** **No CASRN** **No CASRN** **Supporting Chemicals** **115-07-1** **74-98-6** **109-66-0** **513-35-9**
Chemical Abstract Index Name	**Sponsored Chemicals** **1-Propene, polymer grade** **1-Propene, chemical grade** **1-Propene streams** **Light ends from butadiene plant** **Supporting Chemicals** **1-Propene** **Propane** **Pentane** **2-Butene, 2-methyl-**
Structural Formula	**See Appendix**

Summary

The propylene streams category consists of four process streams rich in CASRN 115-07-1 which arise from the production processes associated with ethylene manufacturing. The substances of this category are gases possessing high vapor pressure and moderate water solubility. All category members are expected to possess high mobility in soil. Volatilization is expected to be high. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is expected to be negligible to moderate. The members of the Propylene Streams category are expected to possess low persistence (P1) and low bioaccumulation potential (B1).

No data are available for the sponsored streams. Based on the limited studies available, the supporting chemicals, CASRN 115-07-1 and CASRN 74-98-6, have low acute toxicity in rats by the inhalation route of exposure. Repeated-dose inhalation toxicity studies (of subchronic or chronic duration) in mice with CASRN 115-07-1 showed no gross or microscopic pathologic effects at concentrations as high as 10,000 ppm/day. Portal-of-entry effects (squamous metaplasia of the nasal epithelium in females only) were observed in rats exposed by inhalation to 5000 ppm/day CASRN 115-07-1, the lowest concentration tested, for 103-weeks. The NOAEC for systemic toxicity is 10,000 ppm/day (highest concentration tested). In a combined inhalation repeated-dose/reproductive/developmental toxicity screening test in rats, CASRN 74-98-6, showed decreased body weight gain in males and hematological effects in females at 12,168 ppm/day; the NOAEC for systemic toxicity is 3990 ppm/day. CASRN 74-98-6 also showed a decrease in the number of live pups and an increase in the number of stillborn pups at inhalation exposures of 3990 ppm/day; the NOAEC for reproductive/developmental toxicity is

1230 ppm/day. Based on the systemic effects observed at 12,168 ppm/day (decreased body weight gain and hematological effects), the NOAEC for maternal toxicity is 3990 ppm/day. No specific reproductive toxicity studies are available for CASRN 115-07-1; however, no effects were reported on the reproductive organs in the repeated-dose toxicity studies in rats and mice. A prenatal developmental toxicity by the inhalation route in rats with CASRN 115-07-1 showed no treatment-related maternal or developmental toxicity; the NOAEL is 10,000 ppm/day (highest concentration tested). CASRN 115-07-1 induced gene mutations in *Salmonella typhimurium* strain TA1535 in the presence of activation but was not mutagenic in any other *S. typhimurium* or *E. coli* strains tested. CASRN 74-98-6 did not induce gene mutations in bacteria *in vitro* and CASRN 115-07-1 did not induce chromosomal aberrations in rats *in vivo*. CASRN 115-07-1 showed no evidence of carcinogenicity in rats and mice.

Based on the supporting chemical, CASRN 109-66-0, the 96-h LC_{50} for fish is 4.26 mg/L and the 48-h EC_{50} for aquatic invertebrates is 2.7 mg/L. Based on the supporting chemicals, CASRNs 74-85-1, 513-35-9 and 109-66-0, the 72-h EC_{50} for aquatic plants ranges from 7.5 to 40 mg/L for biomass and 10.7 to 72 mg/L for growth rate.

No data gaps were identified under the HPV Challenge Program.

The sponsor, The American Chemistry Council Olefins Panel submitted a Test Plan and Robust Summaries to EPA for Propylene Streams on November 7, 2001. EPA posted the submission on the ChemRTK HPV Challenge website on December 6, 2001 (http://www.epa.gov/hpv/pubs/summaries/prplstrm/c13281tc.htm). EPA comments on the original submission were posted to the website on July 31, 2002. Public comments were also received and posted to the website. The sponsor submitted updated/revised documents on January 14, 2004 and September 15, 2004, which were posted to the ChemRTK website on April 27, 2004 and September 22, 2004, respectively. The propylene streams category members are listed in Table 1.

Category Justification

The sponsor proposed grouping four production streams in the propylene streams category based on reported similarities in (manufacturing process) origin, physicochemical properties and environmental fate. Selected members were included because they share a number of common constituents and are expected to exhibit comparable toxicity; however, the process streams are complex mixtures with differences in their respective compositions. Although chemical composition (*i.e.*, relative abundance of major constituents) varies between streams, these substances may be grouped as propylene streams in a broader sense. The process streams in this category include two propylene grades and two propylene-containing streams. This category represents hydrocarbon streams with a carbon number distribution that is predominantly C2-C3. Four streams are covered under the category: propylene (polymer grade), propylene (chemical grade), propylene stream and light ends from a butadiene plant. The four propylene streams differ in their propylene content, with propane constituting the major portion of the balance of each stream. The sponsor states that two CAS numbers describe the category streams: CASRN 115-07-1 (propylene) and CASRN 68606-26-8 (C3 hydrocarbons). The sponsor's primary justification for the category is the predominance of propylene and other C3 hydrocarbons (e.g., propane) in the four sponsored streams, and the streams' similar toxicological and environmental fate properties. EPA concurs with the use of this approach and will accept data from composite streams and/or stream components, where appropriate, in a conservative read-across approach whereby available data exhibiting the highest toxicity will be used to characterize the potential human health hazards for this category.

Table 1. Production Streams, CAS RNs, and CAS RN Names in the Propylene Streams Category

Production Streams	CAS RN	CAS RN Name
Propylene, Polymer Grade	115-07-1	1-Propene
Propylene, Chemical Grade	115-07-1	1-Propene
Propylene Stream	115-07-1, 74-84-0, 74-98-6	Mixture of 1-Propene, Ethane, and Propane
	68606-26-8	Hydrocarbons, C3
Light Ends from Butadiene Plant	68606-26-8	Hydrocarbons, C3

Note: The definitions found in the TSCA Chemical Substance Inventory for the CAS RNs in this category are vague with respect to composition. Therefore, it is not uncommon to find that one CAS RN is correctly used to describe different streams (different compositions) or that two or more CAS RNs are used to describe one stream (similar composition).

Supporting Chemical Justification

The Sponsor proposed to characterize the streams by using data for propylene and propane. EPA agrees that data for propylene and propane (CASRN 74-98-6) can be used to estimate the physicochemical properties and human health toxicity of all four of the streams. In addition, EPA agrees that data for ethane (CASRN 74-84-0) can be used to estimate the physicochemical properties and environmental fate for all four streams.

The sponsored and supporting chemicals provided by the sponsor have no or no adequate measured ecotoxicity data. For ecotoxicity purposes, EPA has determined that ethylene (CASRN 74-85-1), pentane (CASRN 109-66-0) and 2-butene, 2-methyl- (CASRN 513-35-9) are appropriate supporting chemicals for the propylene streams category based on their similar physicochemical properties, environmental fate and mode of toxic action (nonpolar narcosis).

The sponsored substance 1-propene (CASRN 115-07-1: SIAM 16; http://webnet.oecd.org/hpv/ui/Search.aspx) has been assessed in the OECD HPV program and the data can be viewed at the link provided in parentheses. The sponsored substance CASRN 68606-26-8 and the supporting chemical, CASRN 74-98-6, are being assessed in the HPV Challenge Program as part of the petroleum hydrocarbon gases category and the submission can be viewed at: http://www.epa.gov/hpv/pubs/summaries/ptrlgas/c13224tc.htm. A hazard characterization for this category is being prepared and will be available for viewing at http://iaspub.epa.gov/oppthpv/hpv_hc_characterization.get_report?doctype=2.

Supporting chemicals that have been assessed in the OECD HPV Program include: ethylene (CASRN 74-85-1; assessed in the OECD HPV program at SIAM 5: http://www.chem.unep.ch/irptc/sids/OECDSIDS/74851.pdf),

pentane (CASRN 109-66-0: SIAM 13 and SIAM 26, C5 aliphatic hydrocarbon solvents category; http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=ed4e1315-0f28-4a6f-9563-9a88b20a66bf&idx=0), and
2-methyl-2-butene (CASRN 513-35-9: SIAM 19; http://www.chem.unep.ch/irptc/sids/OECDSIDS/513359.pdf).

1. Chemical Identity

1.1 Identification and Purity

The typical constituents in the Propylene Streams category and their range in terms of percentage weight are listed in Table 2. The structural formulas and TSCA description of the Propylene Streams are presented in the Appendix. The chemical process operations associated with process streams in the Propylene Streams category are presented in Appendix. The following description is taken from the 2001 Test Plan.

The CAS numbers in the Propylene Streams category are associated with four streams that are commercial products or isolated intermediates. The four streams arise from production processes associated with ethylene manufacturing.

Polymer grade propylene is a high purity (99%+) product of the ethylene unit. It is obtained by fractionation of a portion of the condensed cracking furnace effluent and other processing steps (e.g., C3 acetylene removal). The final polymer grade propylene is produced as the distillate from the C3 splitter. The main impurities in the stream are typically ethane and propane.

Chemical grade propylene is a C3 product with a typical propylene content of 93-95%. Propane accounts for most of the balance of the composition. An ethylene process using a scheme similar to that used for polymer grade propylene, but with fewer or less rigorous purification steps, produces this grade.

The propylene stream is the C3 stream prior to separation into propylene and propane. Typically, this stream is produced as the overhead from the depropanizer in an ethylene unit. It is a narrow boiling-range mixture that consists predominantly of C3 hydrocarbons. A typical composition is 85% propylene, 12% propane, and 3% C3 acetylenes.

The light ends from the butadiene plant is a hydrocarbon stream produced by fractionation of the C4 Crude Butadiene to remove relatively low levels of propane and propylene that may be contained in the stream. The carbon number distribution for the stream is predominantly C3.

Table 2. Typical Constituent (percentage weight) Range in Streams of the Propylene Streams Category				
Constituent	**1-Propene Polymer Grade Stream (percentage weight)**	**1-Propene Chemical Grade Stream (percentage weight)**	**Propylene Stream (percentage weight)**	**Light Ends from Butadiene Plant Stream (percentage weight)**
Methane		0.5		
Ethylene		0.1–1.0		
Ethane		0.1–1.0		0.0–2.0
Propylene	95.0–100.0	90–99.8	85.0	25.0–40.0
Propane	0.1–0.5	0.2–10	12.0	60.0–70.0
Methylacetylene and propadiene			3.0	

1.2 Physical-Chemical Properties

The physical-chemical properties of the sponsored substances contained in the Propylene Streams category are summarized in Table 3. A description of the complex mixtures used to describe this category or the chemical structures of the specific compounds is provided in the Appendix. The components of this category are gasses that possess high vapor pressure and moderate water solubility.

Table 3. Physical-Chemical Properties of the Propylene Streams Category[1]						
Property	**SPONSORED CHEMICAL 1-Propene Polymer Grade Stream[2]**	**SPONSORED CHEMICAL 1-Propene Chemical Grade Stream[3]**	**SPONSORED CHEMICAL Propylene Stream[4]**	**SPONSORED CHEMICAL Light Ends from Butadiene Plant Stream[5]**	**SUPPORTING CHEMICAL Ethane**	**SUPPORTING CHEMICAL Propane**
CASRN	115-07-1	115-07-1	68606-26-8; 115-07-1; 74-84-0; 74-98-6	68606-26-8	74-84-0	74-98-6
Molecular Weight	42.08	42.08	Complex mixture	Complex mixture	30.07	44.10
Physical State	Gas	Gas	Gas	Gas	Gas	Gas
Melting Point (°C)	-185 (measured)[6]	-185 (measured)[6]	-187.6 to -182.8 (measured)[6]	-187.6 to -185 (measured)[6]	-182.8 (measured)[6]	-187.6 (measured)[6]
Boiling Point (°C)	-48 (measured)[6]	-48 (measured)[6]	-88.6 to -42.1 (measured)[6]	-48 to -42.1 (measured)[6]	-88.6 (measured)[6]	-42.1 (measured)[6]

Table 3. Physical-Chemical Properties of the Propylene Streams Category[1]						
Property	**SPONSORED CHEMICAL 1-Propene Polymer Grade Stream[2]**	**SPONSORED CHEMICAL 1-Propene Chemical Grade Stream[3]**	**SPONSORED CHEMICAL Propylene Stream[4]**	**SPONSORED CHEMICAL Light Ends from Butadiene Plant Stream[5]**	**SUPPORTING CHEMICAL Ethane**	**SUPPORTING CHEMICAL Propane**
Vapor Pressure (mm Hg at 25°C)	8,690 (measured)[6]	8,690 (measured)[6]	7,150–31,500 (measured)[6]	7,150–8,690 (measured)[6]	31,500 (measured)[6]	7,150 (measured)[6]
Dissociation Constant (pK_a)	Not applicable					
Henry's Law Constant (atm-m^3/mol)	0.196 (measured)[6]	0.196 (measured)[6]	0.196–0.707 (measured)[6]	0.196–0.707 (measured)[6]	0.500 (measured)[6]	0.707 (measured)[6]
Water Solubility (mg/L at 25°C)	200 (measured)[6]	200 (measured)[6]	60.2–200 (measured)[6]	62.4–200 (measured)[6]	60.2 (measured)[6]	62.4 (measured)[6]
Log K_{ow}	1.77 (measured)[6]	1.77 (measured)[6]	1.77–2.36 (measured)[6]	1.77–2.36 (measured)[6]	1.81 (measured)[6]	2.36 (measured)[6]

[1] Chemicals Manufacturing Association Olefins Panel. September, 2004. Revised Test Plan and Robust Summary for the Propylene Category. Available online from: http://www.epa.gov/chemrtk/pubs/summaries/prplstrm/c13281tc.htm as of August 18, 2010.
[2] This process stream is typically 99% or greater 1-propene.
[3] This process stream is typically 93–95% 1-propene.
[4] The sponsor states on page 1 of the revised Test Plan that this stream is a mixture of 1-propene, ethane, and propane; however, ethane was not listed as a significant component of this stream in other sections of the revised Test Plan.
[5] This process stream is composed primarily of propane (CASRN 74-98-6) and 1-propene (CASRN 115-07-1).
[6] SRC. The Physical Properties Database (PHYSPROP). SRC, Syracuse, NY. Available online from: http://www.syrres.com/esc/physprop.htm as of August 18, 2010.

2. General Information on Exposure

2.1 Production Volume and Use Pattern

The Propylene Streams category chemicals had an aggregated production and/or import volume in the United States greater than three billion pounds in calendar year 2005.

- CASRN 115-07-1: 1 billion pounds and greater;
- CASRN 74-84-0: 1 billion pounds and greater;
- CASRN 68606-26-8: 1 billion pounds and greater;

CASRN 115-07-1:
Non-confidential information in the IUR indicated that the industrial processing and uses of the chemical include other basic organic chemical manufacturing, other plastics product

manufacturing, petrochemical manufacturing, petroleum refineries, and resin and synthetic rubber manufacturing as intermediates; petrochemical manufacturing and petroleum refineries as not readily obtainable (NRO); petroleum refineries and other basic organic chemical manufacturing as "other"; other petroleum and coal products manufacturing and petroleum refineries as fuels; petroleum refineries as solvents which become part of product formulation or mixture. Commercial and consumer uses include lubricants, greases and fuel additives, rubber and plastic products; "other"; and not readily obtainable (NRO).

CASRN 74-84-0:
Non-confidential information in the IUR indicated that the industrial processing and uses of the chemical include other basic organic chemical manufacturing, petrochemical manufacturing, resin and synthetic rubber manufacturing, and oil and gas extraction as intermediates; petrochemical manufacturing as not readily obtainable (NRO); oil and gas extraction, and petroleum refineries as fuels; pipeline transportation of refined petroleum products, and oil and gas extraction as "other." Commercial and consumer uses include rubber and plastic products; "other"; and not readily obtainable (NRO).

CASRN 68606-26-8:
Non-confidential information in the IUR indicated that the industrial processing and uses of the chemical include pipeline transportation of refined petroleum products as "other." Commercial and consumer uses include not readily obtainable (NRO).

2.2 Environmental Exposure and Fate

The environmental fate properties are provided in Table 4. The components of the Propylene Streams category are expected to possess high mobility in soil. 1-Propene was not readily biodegradable, achieving 1% biodegradation within 28 days in a closed bottle test (OECD 301D); however, it was shown to degrade quickly using pure cultures isolated from various sources and is not considered highly persistent under environmental conditions. Ethane and propane, which are both components of these process streams, were shown to be completely oxidized by microorganisms isolated from lake water and soil samples within a 24-hour exposure period. Volatilization of these substances is expected to be high based on the Henry's Law constants of these substances. 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 Propylene Streams category are expected to possess low persistence (P1) and low bioaccumulation potential (B1).

Table 4. Environmental Fate Characteristics of the Propylene Streams Category[1]						
Property	**SPONSORED CHEMICAL 1-Propene Polymer Grade Stream[2]**	**SPONSORED CHEMICAL 1-Propene Chemical Grade Stream[3]**	**SPONSORED CHEMICAL Propylene Stream[4]**	**SPONSORED CHEMICAL Light Ends from Butadiene Plant Stream[5]**	**SUPPORTING CHEMICAL Ethane**	**SUPPORTING CHEMICAL Propane**
CASRN	115-07-1	115-07-1	68606-26-8; 115-07-1; 74-84-0; 74-98-6	68606-26-8	74-84-0	74-98-6
Photodegradation Half-life	4.9 hours (estimated)[6]	4.9 hours (estimated)[5]	4.9 hours to 39 days (estimated)[6]	4.9 hours to 8.4 days (estimated)[6]	39 days (estimated)[6]	8.4 days (estimated)[6]
Hydrolysis Half-life	Stable					
Biodegradation	1% after 28 days (not readily biodegradable)[7]; Quickly degraded by pure microbial cultures[8]	1% after 28 days (not readily biodegradable)[7]; Quickly degraded by pure microbial cultures[8]	1% after 28 days (not readily biodegradable)[7]; Quickly degraded by pure microbial cultures[8]; Completely oxidized to acetone and ethanol within 24 hours organisms isolated from lake water and soil samples[8]	1% after 28 days (not readily biodegradable)[7]; Quickly degraded by pure microbial cultures[8]; Completely oxidized to acetone within 24 hours organisms isolated from lake water and soil samples[8]	Completely oxidized to ethanol within 24 hours by organisms isolated from lake water and soil samples[8]	Completely oxidized to acetone within 24 hours organisms isolated from lake water and soil samples[8]
Bioaccumulation Factor	BAF = 6.4 (estimated)[6]	BAF = 6.4 (estimated)[6]	BAF = 6.4 to 21.1 (estimated)[6]	BAF = 6.4 to 21.1 (estimated)[6]	BAF = 6.9 (estimated)[6]	BAF = 21.1 (estimated)[6]
Log K_{oc}	1.3 (estimated)[6]	1.3 (estimated)[6]	1.1–1.3 (estimated)[6]	1.1–1.3 (estimated)[6]	1.1 (estimated)[6]	1.3 (estimated)[6]

Table 4. Environmental Fate Characteristics of the Propylene Streams Category[1]						
Property	**SPONSORED CHEMICAL 1-Propene Polymer Grade Stream[2]**	**SPONSORED CHEMICAL 1-Propene Chemical Grade Stream[3]**	**SPONSORED CHEMICAL Propylene Stream[4]**	**SPONSORED CHEMICAL Light Ends from Butadiene Plant Stream[5]**	**SUPPORTING CHEMICAL Ethane**	**SUPPORTING CHEMICAL Propane**
Fugacity (Level III Model)[6]						
Air (%)						
Water (%)	10.7	10.7	10.7–55.1	10.7–50.1	55.1	50.1
Soil (%)	87.7	87.7	44.3–87.7	49.2–87.7	44.3	49.2
Sediment (%)	1.4	1.4	0.6–1.4	0.6–1.4	0.6	0.6
	0.2	0.2	0.1–0.2	0.1–0.2	0.1	0.1
Persistence[9]	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P1 (low)
Bioaccumulation[9]	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)

[1] Chemicals Manufacturing Association Olefins Panel. September, 2004. Revised Test Plan and Robust Summary for the Propylene Category. Available online from: http://www.epa.gov/chemrtk/pubs/summaries/prplstrm/c13281tc.htm as of August 18, 2010.
[2] This process stream is typically 99% or greater 1-propene.
[3] This process stream is typically 93–95% 1-propene.
[4] The sponsor states on page 1 of the revised Test Plan that this stream is a mixture of 1-propene, ethane, and propane; however, ethane was not listed as a significant component of this stream in other sections of the revised Test Plan.
[5] This process stream is composed primarily of propane (CASRN 74-98-6) and 1-propene (CASRN 115-07-1).
[6] 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 August 18, 2010.
[7] National Institute of Technology and Evaluation. 2002. Biodegradation and Bioaccumulation of the Existing Chemical Substances under the Chemical Substances Control Law. Available online from: http://www.safe.nite.go.jp/english/kizon/KIZON_start_hazkizon.html as of August 18, 2010.
[8] Hazardous Substance Databank. National Library of Medicine, Bethesda, MD. Available online from: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB as of August 26, 2010.
[9] 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 Propylene Streams category consists of four process streams rich in 1-propene (CASRN 115-07-1) which arise from the production processes associated with ethylene manufacturing. The substances of this category are gasses possessing high vapor pressure and moderate water solubility. All category members are expected to possess high mobility in soil. Volatilization is expected to be high. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is expected to be negligible to moderate. The members of the Propylene Streams category are expected to possess low persistence (P1) and low bioaccumulation potential (B1).

3. Human Health Hazard

A summary of health effects data submitted for SIDS endpoints is provided in Table 5. The table also indicates where data for tested category members are read-across (RA) to untested members of the category. Most of the human health data available for this chemical category are with supporting chemical, CASRN 115-07-1. For additional information on all human health endpoints on the supporting chemical, CASRN 115-07-1, see human health data at:
http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=2c19bd91-c923-48b1-81c6-058e32600b99&idx=0
or http://www.epa.gov/chemrtk/pubs/summaries/ptrlgas/c13224tc.htm

Acute Toxicity

Supporting chemical CASRN 115-07-1 is a gas at normal temperature and pressure therefore, ingestion of this material is unlikely, as is dermal absorption. Hence, no acute oral or dermal toxicity studies have been conducted. Several acute toxicity studies have been conducted by the inhalation route. Most of the acute inhalation toxicity studies with CASRN 115-07-1 and with CASRN 74-98-6 were not conducted according to standard protocols and are of limited value; however, three acute inhalation toxicity studies, two with CASRN 115-07-1 and one with CASRN 74-98-6, are being presented here for completion.

Concentrations of CASRN 115-07-1 in oxygen or air have been shown in animal studies to induce narcosis, with symptoms of anesthesia occurring within 2 minutes of exposure. The asphyxiation limit for CASRN 115-07-1 in humans is estimated to be approximately 236,000 ppm (23.6 %); the level that will dilute the normal concentration of oxygen in air. However, since the lower flammability limit for CASRN 115-07-1 is 2%, the explosive range of airborne concentration is reached before any acute narcotic effects can be manifested (http://webnet.oecd.org/hpv/UI/handler.axd?id=05bca44c-4720-4926-843d-6539599b3de4).

Propylene (CASRN 115-07-1, supporting chemical)
(1) Sprague-Dawley rats were exposed to propylene at 65,000 ppm for 4 hours and observed for 24 hours. No mortalities were noted.
LC_{50} > 65,000 ppm

(2) Sprague-Dawley male rats (four or more/treatment) were exposed to propylene at 50,000 ppm for 4 hours. No mortalities were noted.
LC_{50} > 50,000 ppm

Propane (CASRN 74-98-6, supporting chemical)
Rats of unspecified strain (six males or females) were exposed whole-body to propane at 800,000 ppm for 15 minutes. They were observed for CNS effects over a 10 minute exposure period. Mortality was observed during exposure only: recovery from non-lethal exposure was rapid and the rats appeared normal within 10 minutes of exposure.
EC_{50} (CNS depression; 10 min) = 280,000 ppm
LC_{50} (15 min) > 800,000 ppm

Repeated-Dose Toxicity

Propylene (CASRN 115-07-1, supporting chemical)
(1) Fisher344 rats (9-11/sex/group) were exposed by inhalation for 6 hours/day, 5 days/week for 14 weeks to 0, 625, 1250, 2500, 5000 or 10,000 ppm CASRN 115-07-1 in air. No compound related-deaths or clinical signs were observed. No gross or microscopic pathologic effects (including reproductive organs or nasal cavity changes) were observed.
NOAEC = 10,000 ppm (highest concentration tested)

(2) B6C3F1 mice (10/sex/group) were exposed by inhalation for 6 hours/day, 5 days/week for 14 weeks to 0, 625, 1250, 2500, 5000 or 10,000 ppm CASRN 115-07-1 in air. No treatment-related deaths or clinical signs were observed. No gross microscopic pathologic effects (including reproductive organs or nasal cavity changes) were observed.
NOAEC = 10,000 ppm (highest concentration tested)

(3) Two groups of 50 Fisher344 rats of each sex were exposed to CASRN 115-07-1 in air by inhalation at concentrations of 0, 5000 or 10,000 ppm , 6 hours/day, 5 days/week, for 103 weeks. The survival of exposed and control rats was comparable. No compound-related adverse clinical signs were observed. No gross or microscopic lesions of the reproductive organs were reported. Histopathological examinations revealed portal-of-entry effects based on an increased incidence of squamous metaplasia (at 5000 and 10,000 ppm) and inflammation (at 10,000 ppm) of the nasal cavities in females only. These effects were not observed when rats were exposed to similar concentrations for 14 weeks.
NOAEC = 10,000 ppm (highest concentration tested)

(4) Two groups of 50 B6C3F1 mice of each sex were exposed to CASRN 115-07-1 in air by inhalation at concentrations of 0, 5000 or 10,000 ppm, 6 hours/day, 5 days/week, for 103 weeks. The survival of exposed and control rats was comparable. After week 59, slight decreases in mean body weights were observed at 10,000 ppm. No compound-related adverse clinical signs were observed. No gross or microscopic lesions of the reproductive organs or nasal cavity were reported.
NOAEC = 10,000 ppm (highest concentration tested)

Propane (CASRN 74-98-6, supporting chemical)
In a combined repeated-dose/reproductive/developmental toxicity screening test, Sprague-Dawley CD rats (12 males and 24 females/test concentration) were exposed whole-body to propane as a gas at nominal concentrations of 0, 1200, 4000 or 12,000 ppm, 6 hours/day, 7 days/week for at least 4 weeks. One half of the females were evaluated for subchronic effects after 28 days of exposure. The other half was allowed to mate to assess effects of propane on reproduction and development. Subchronic effect endpoints included body weight, feed

consumption, functional observational battery, motor activity, clinical observations, organ weights, histopathology, macroscopic observations, hematology and clinical chemistry. The mean measured concentrations were 0, 1230, 3990 or 12,168 ppm. There were no treatment-related effects on survival. Male rats exposed to 12,168 ppm exhibited a decrease in weight gain. Small, but significant increases were observed in hemoglobin concentration, hematocrit, erythrocytes and absolute eosinophils in females exposed to 12,168 ppm. Decreases in absolute and relative kidney weights were observed in males exposed to 1230 and 12,168 ppm. Decreases in absolute liver weights were observed in males at 12,168 ppm and decreases in relative liver weights were observed in females exposed to 3990 and 12,168 ppm. In the absence of kidney or liver pathological findings, the changes in organ weights were not considered to be treatment-related (Petroleum Hydrocarbon Gases Category: http://www.epa.gov/hpv/pubs/summaries/ptrlgas/c13224tc.htm).
LOAEC = 12,168 ppm/day (based on decreased weight gain in males and increases in hemoglobin concentration, hematocrit, erythrocytes and absolute eosinophils in females)
NOAEC = 3990 ppm/day

Reproductive Toxicity

Propylene (CASRN 115-07-1, supporting chemical)
In the repeated-dose inhalation toxicity studies in rats for 14 and 103 weeks described previously, no treatment-related effects were found in reproductive organ (mammary gland, seminal vesicles, prostate, testes, ovaries, or uterus) histology in either sex.

Propane (CASRN 74-98-6, supporting chemical)
In the combined repeated-dose/reproductive/developmental toxicity screening test described previously, Sprague-Dawley CD female rats (12/dose) were exposed to 12,168 ppm propane gas for 2 weeks prior to mating, during mating and on gestation days 0 – 19. Males were exposed during mating and post-mating periods for at least 28 days. The dams were allowed to deliver their litters, which were retained until lactation day 4. Reproductive endpoints included mating success, time to mating, number of females pregnant, male fertility, gestation duration, numbers of corpora lutea and implantation sites, number of stillborn pups, number of pups delivered and pup sex ratio. A statistically significant decrease in the number of live born pups, in combination with an increase in the number of stillborn pups, was observed at concentrations ≥ 3990 ppm. These effects were attributable to the loss of a single total litter at each of the two highest doses (3990 and 12,168 ppm); the losses were preceded by severely reduced body weight gain in the last week of gestation for two particular dams (Petroleum Hydrocarbon Gases Category: http://www.epa.gov/hpv/pubs/summaries/ptrlgas/c13224tc.htm).
LOAEC (reproductive toxicity) = 3990 ppm/day (based on a decrease in the number of live pups and increase in the number of stillborn pups)
NOAEC (reproductive toxicity) = 1230 ppm/day

Developmental Toxicity

Propylene (CASRN 115-07-1, supporting chemical)
In a prenatal developmental toxicity study, pregnant Wistar rats (25/group) were exposed to whole-body to CASRN 115-07-1 by whole-body inhalation at concentrations of 0, 200, 1000, and 10,000 ppm for 6 hours/day on gestation days 6 – 19. All animals were sacrificed on gestation day 20 and assessed by gross pathology. There were no differences in food and water consumption, body weight, uterine weights, or clinical and necropsy observations in dams. No

treatment-related maternal toxicity was observed at any dose tested. Likewise, no treatment-related effects were observed on conception rate, mean number of corpea lutea, total implantations, pre/post-implantation losses, or resorptions; or on the number of live fetuses, fetal sex ratio, fetal body weights, or on any of the external, soft tissue and/or skeletal examinations in offspring.
NOAEC (maternal and developmental toxicity) = 10,000 ppm (highest concentration tested)

Propane (CASRN 74-98-6, supporting chemical)
In the combined repeated-dose/reproductive/developmental toxicity screening test described previously, Sprague-Dawley CD female rats (12/test concentration) were exposed to up to 12,168 ppm propane gas for 2 weeks prior to mating, during mating and on gestation days 0 – 19. The dams were allowed to deliver their litters, which were retained until lactation day 4. Developmental endpoints included number of stillborn pups, number of live pups per litter, pre- and post-implantation loss, pup sex ratio, pup body weight and weight gain, macroscopic postmortem evaluations of pups and pup viability (4-day survival after birth). A statistically significant decrease in the number of live born pups, in combination with an increase in the number of stillborn pups, was observed at concentrations ≥ 3990 ppm. These effects were attributable to the loss of a single total litter at each of the two highest doses (3990 and 12,168 ppm); the losses were preceded by severely reduced body weight gain in the last week of gestation for two particular dams (Petroleum Hydrocarbon Gases Category: http://www.epa.gov/hpv/pubs/summaries/ptrlgas/c13224tc.htm).
LOAEC (maternal toxicity) = 12,168 ppm/day (based on increases in hemoglobin concentration, hematocrit, erythrocytes and absolute eosinophils)
NOAEC (maternal toxicity) = 3990 ppm/day
LOAEC (developmental toxicity) = 3990 ppm/day (based on a decrease in the number of live pups and increase in the number of stillborn pups)
NOAEC (developmental toxicity) = 1230 ppm/day

Genetic Toxicity – Gene Mutation

In vitro
Propylene (CASRN 115-07-1, supporting chemical)
(1) *Salmonella typhimurium* strains TA98, TA100, TA1535 and TA1537 and *Eschericia coli* strain WP2uvrA(pKM101) were exposed to CASRN 115-07-1 at concentrations of 310, 630, 1250, 2500, 5000 and 10,000 ppm/plate (~ 0.53, 1.08, 2.15, 4.30, 8.61 and 17.21 mg/L) with and without metabolic activation. Positive controls were included, but their responses were not provided in the available study summary. CASRN 115-07-1 was mutagenic in with activation for *Salmonella typhimurium* strain TA1535 at concentrations > 2.15 mg/L. CASRN 115-07-1 was not mutagenic for any other *Salmonella typhimurium* or *Escherichia coli* strains tested.
CASRN 115-07-1 was mutagenic in this assay.

(2) *Salmonella typhimurium* strain TA100 was exposed to CASRN 115-07-1 at concentrations of 5000 and 200,000 ppm/plate (~ 8.61 and 344.21 mg/L) with and without metabolic activation. The available summary of the study did not mention the use of positive controls.
CASRN 115-07-1 was not mutagenic in this assay.

(3) *Salmonella typhimurium* strains TA97 and TA98 were exposed to CASRN 115-07-1 dissolved in ethanol at a concentration of 629 μg/plate (~ 0.629 mg/L) with and without

metabolic activation. The available summary of the study did not mention the use of positive controls.
CASRN 115-07-1 was not mutagenic in this assay.

(4) Mouse lymphoma cells, strain L5178Y, were exposed to CASRN 115-07-1 at concentrations of 200,000 and 500,000 ppm/plate (~ 344.2 and 860.5 mg/L) for 4 hours with and without metabolic activation. The available summary of the study did not mention the use of positive controls. CASRN 115-07-1 was not mutagenic without activation, but could not be classified for strains with activation.
CASRN 115-07-1 was not mutagenic in this assay.

Propane (CASRN 74-98-6, supporting chemical)
Salmonella typhimurium strains TA98, TA100, TA1535, TA1537 and TA1538 were exposed to propane at concentrations ranging from 10,000 to 500,000 ppm/plate (~ 17.21 – 860.5 mg/L) with and without metabolic activation for 6 hours. Positive and negative controls were included and responded appropriately.
CASRN 74-98-6 was not mutagenic in this assay

In vivo
Propylene (CASRN 115-07-1, supporting chemical)
In the inhalation repeated-dose study described previously, Fischer 344 male rats exposed to 1-CASRN 115-07-1 as a vapor for 4 weeks (20 total exposures) were then euthanized by CO_2 asphyxiation. Spleens were removed and cultured overnight in supplemented media containing 1 mg 6-thioguanine/mL to select for Hprt mutant T-cells. CASRN 115-07-1 did not induce any mutagenic response at the Hprt locus of male F344 rats.
CASRN 115-07-1 was not mutagenic in this assay.

Genetic Toxicity – Chromosomal Aberrations

In vivo
Propylene (CASRN 115-07-1, supporting chemical)
In the inhalation repeated-dose study described previously, Fischer 344 male rats exposed to CASRN 115-07-1 as a vapor for 4 weeks (20 total exposures) were sacrificed within 2 hours of last exposure and bone marrow was sampled for use in a micronucleus assay. Controls were tested concurrently and responded appropriately. No toxicity was observed.
CASRN 115-07-1 did not induce chromosomal aberrations in this assay.

Additional Information

Carcinogenicity

Propylene (CASRN 115-07-1, supporting chemical)
(1) In the NTP inhalation repeated-dose study described previously, Fischer 344 and B6C3F1 mice were exposed to CASRN 115-07-1 for 103 weeks. Controls were tested concurrently. The sponsor suggested that the low incidences of vascular tumors and their appearance in a variety of organs were not related to CASRN 115-07-1 exposure. The occurrence of endometrial stromal polyps in female mice showed a positive trend, but was not considered clearly related to CASRN 115-07-1 exposure. In the nasal cavity, CASRN 115-07-1 exposure induced squamous

metaplasia of the rat respiratory epithelium and epithelial hyperplasia in female rats. There was no evidence of carcinogenicity.
CASRN 115-07-1 was not carcinogenic in this study.

(2) In the inhalation repeated-dose study described previously, Sprague-Dawley rats and Swiss mice exposed to CASRN 115-07-1 for 24 months and 18 months, respectively, did not have any significant dose-related differences in tumor incidence.
CASRN 115-07-1 was not carcinogenic in this study.

Other

Propylene (CASRN 115-07-1, supporting chemical)

Fisher-344 rats (8/sex/group) were exposed by inhalation to air concentrations of 0, 200, 2000 or 10,000 ppm CASRN 115-07-1 6 hours/day, for a total of 1, 3, or 20 exposures. Sections of the nasal cavity (epithelial lining of the nasal airways) were examined microscopically and immunohistochemically prepared for DNA synthesis using BrdU-labelling. No histopathologic lesions or inflammation of the nasal cavities were noted. No apparent exposure-related changes in the density of BrdU-labelling were noted. No test-substance related effects on cell proliferation in the liver or the nasal respiratory epithelium were observed at any concentration.

Conclusion: No data are available for the sponsored streams. Based on the limited studies available, the supporting chemicals, CASRN 115-07-1 and CASRN 74-98-6, have low acute toxicity in rats by the inhalation route of exposure. Repeated-dose inhalation toxicity studies (of subchronic or chronic duration) in mice with CASRN 115-07-1 showed no gross or microscopic pathologic effects at concentrations as high as 10,000 ppm/day. Portal-of-entry effects (squamous metaplasia of the nasal epithelium in females only) were observed in rats exposed by inhalation to 5000 ppm/day CASRN 115-07-1, the lowest concentration tested, for 103-weeks. The NOAEC for systemic toxicity is 10,000 ppm/day (highest concentration tested). In a combined inhalation repeated-dose/reproductive/developmental toxicity screening test in rats, CASRN 74-98-6, showed decreased body weight gain in males and hematological effects in females at 12,168 ppm/day; the NOAEC for systemic toxicity is 3990 ppm/day. CASRN 74-98-6 also showed a decrease in the number of live pups and an increase in the number of stillborn pups at inhalation exposures of 3990 ppm/day; the NOAEC for reproductive/developmental toxicity is 1230 ppm/day. Based on the systemic effects observed at 12,168 ppm/day (decreased body weight gain and hematological effects), the NOAEC for maternal toxicity is 3990 ppm/day. No specific reproductive toxicity studies are available for CASRN 115-07-1; however, no effects were reported on the reproductive organs in the repeated-dose toxicity studies in rats and mice. A prenatal developmental toxicity by the inhalation route in rats with CASRN 115-07-1 showed no treatment-related maternal or developmental toxicity; the NOAEL is 10,000 ppm/day (highest concentration tested). CASRN 115-07-1 induced gene mutations in *Salmonella typhimurium* strain TA1535 in the presence of activation but was not mutagenic in any other *S. typhimurium* or *E. coli* strains tested. CASRN 74-98-6 did not induce gene mutations in bacteria *in vitro* and CASRN 115-07-1 did not induce chromosomal aberrations in rats *in vivo*. CASRN 115-07-1 showed no evidence of carcinogenicity in rats and mice.

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

Endpoints	SPONSORED CHEMICAL Propylene, polymer grade (115-07-1)	SPONSORED CHEMICAL Propylene, chemical grade (115-07-1)	SPONSORED CHEMICAL Propylene streams (No CASRN)	SPONSORED CHEMICAL Light ends from butadiene plant (No CASRN)	SUPPORTING CHEMICAL Propylene (115-07-1)	SUPPORTING CHEMICAL Propane (74-98-6)
Acute Inhalation Toxicity LC_{50} (ppm)	No Data > 65,000 (RA)	No Data > 65,000 (RA)	No Data > 65,000 (RA)	No Data > 65,000 (RA)	**>65,000**	**>800,000 (15 min)**
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (ppm/day)	No Data NOAEC = 10,000 (RA)	No Data NOAEC = 10,000 (RA)	No Data NOAEC = 10,000 (RA)	No Data (rat) NOAEC= 3990 LOAEC= 12,168 (RA)	**NOAEC = 10,000 (highest concentration tested)**	**NOAEC= 3990 LOAEC= 12,168**
Reproductive Toxicity NOAEC/LOAEC Inhalation (ppm/day)	No Data No effects on reproductive organs in rats or mice in repeated-dose studies up to 24 months. (RA)	No Data No effects on reproductive organs in rats or mice in repeated-dose studies up to 24 months. (RA)	No Data No effects on reproductive organs in rats or mice in repeated-dose studies up to 24 months. (RA)	No Data NOAEC = 1230 LOAEC = 3990 (RA)	No effects on reproductive organs in rats or mice in repeated-dose studies up to 24 months.	**NOAEC = 1230 LOAEC = 3990**
Developmental Toxicity NOAEC/LOAEC Inhalation (ppm/day)						
Maternal Toxicity	No Data (rat) NOAEC = 10,000	No Data (rat) NOAEC = 10,000	No Data (rat) NOAEC = 10,000	No Data NOAEC = 3990 LOAEC=12,168	**NOAEC = 10,000 (highest concentration tested)**	**NOAEC = 3990 LOAEC=12,168**
Developmental Toxicity	NOAEC = 10,000 (RA)	NOAEC = 10,000 (RA)	NOAEC = 10,000 (RA)	NOAEC = 1230 LOAEC=3990 (RA)	**NOAEC = 10,000 (highest concentration tested)**	**NOAEC = 1230 LOAEC=3990**
Genetic Toxicity – Gene Mutation *In vitro*	No Data Positive (RA)	No Data Positive (RA)	No Data Positive (RA)	No Data Positive (RA)	**Positive**	**Negative**
Genetic Toxicity – Gene Mutation *In vivo*	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	**Negative**	–
Genetic Toxicity – Chromosomal Aberrations *In vivo*	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	**Negative**	–
Additional Information Carcinogenicity	–	–	–	–	**Negative**	–

Measured data in bold text; (RA) = Read Across; – indicates that endpoint was not evaluated for this substance

4. Hazard to the Environment

A summary of aquatic toxicity data submitted for SIDS endpoints for supporting chemicals is provided in Table 6 and supporting chemicals are used to read-across (RA) to the propylene streams category members. No aquatic toxicity tests were provided for the propylene stream category members.

Acute Toxicity to Fish

Pentane (CASRN 109-66-0, supporting chemical)
Rainbow trout (*Oncorhynchus mykiss)* were exposed to CASRN 109-66-0 for 96 hours. No other details were given: http://ecb.jrc.ec.europa.eu/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/REPORT/n-pentanereport043.pdf.
96-h LC_{50} = 4.26 mg/L

2-Butene, 2-methyl- (CASRN 513-35-9, supporting chemical)
Rainbow trout (*Oncorhynchus mykiss*) were exposed to CASRN 513-35-9 at nominal concentrations of 0, 2.13, 4.7, 10.3, 22.7 or 50 mg/L under static renewal conditions for 96 hours. Mean measured concentrations were 0, 1.67, 2.93, 5.33, 8.51 and 25.9 mg/L. Mortality was observed at concentrations ≥ 5.33 mg/L. One hundred percent mortality was observed at ≥ 8.51 mg/L. This study was obtained from the 2004 OECD SIDS SIAR for 2-methyl-2-butene: http://www.chem.unep.ch/irptc/sids/OECDSIDS/513359.pdf.
96-h LC_{50} = 4.99 mg/L

Acute Toxicity to Aquatic Invertebrates

Pentane (CASRN 109-66-0, supporting chemical)
Daphnia magna were exposed to CASRN 109-66-0 for 48 hours. The initial measured concentration was 2.7 mg/L. This study was obtained from the 2003 European Union Risk Assessment Report for n-pentane: http://ecb.jrc.ec.europa.eu/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/REPORT/n-pentanereport043.pdf.
48-h EC_{50} = 2.7 mg/L

2-Butene, 2-methyl- (CASRN 513-35-9, supporting chemical)
Daphnia magna were exposed to CASRN 513-35-9 at nominal concentrations of 2.13, 4.7, 10.3, 22.7 or 50 mg/L under static conditions for 48 hours. Mean measured concentrations were 0.691, 1.74, 2.95, 6.63 and 23.6 mg/L. Immobilization was observed at ≥ 2.95 mg/L. One hundred percent immobilization was observed at ≥ 6.63 mg/L. This study was obtained from the 2004 OECD SIDS SIAR for 2-methyl-2-butene: http://www.chem.unep.ch/irptc/sids/OECDSIDS/513359.pdf.
48-h EC_{50} = 3.84 mg/L

Toxicity to Aquatic Plants

Ethylene (CASRN 74-85-1, supporting chemical)
Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 74-85-1 at nominal concentrations of 8.2 – 131 mg/L for 72 hours. Mean measured concentrations were 3.3, 7.8, 13.9, 32 and 58 mg/L. Growth inhibition was observed at concentrations ≥ 32 mg/L. During the 72-h exposure period there was a loss of ethylene in the range of 64-91 %, however in

calculation of results the mean measured ethylene concentration was used. This study was obtained from the 2002 OECD SIDS SIAR for ethylene:
http://www.chem.unep.ch/irptc/sids/OECDSIDS/74851.pdf.
72-h EC_{50} (biomass) = 40 mg/L
72-h EC_{50} (growth) = 72 mg/L

Pentane (CASRN 109-66-0, supporting chemical)
Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 109-66-0 for 72 hours. This study was obtained from the 2003 European Union Risk Assessment Report for n-pentane:
http://ecb.jrc.ec.europa.eu/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/REPORT/n-pentanereport043.pdf.
72-h EC_{50} = 7.5 mg/L (biomass)
72-h EC_{50} = 10.7 mg/L (growth rate)

2-Butene, 2-methyl- (CASRN 513-35-9, supporting chemical)
Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 513-35-9 at nominal concentrations of 0, 3.20, 7.04, 15.5, 34.1 and 75.0 mg/L for 96 hours. Mean measured concentrations were 0, 0.689, 1.53, 3.61, 7.22 and 21.1 mg/L. This study was obtained from the 2004 OECD SIDS SIAR for 2-methyl-2-butene:
http://www.chem.unep.ch/irptc/sids/OECDSIDS/513359.pdf.
72-h EC_{50} = 10.5 mg/L (biomass)
72-h EC_{50} = 12.0 mg/L (growth rate)

Conclusion: Based on the supporting chemical, CASRN 109-66-0, the 96-h LC_{50} for fish is 4.26 mg/L and the 48-h EC_{50} for aquatic invertebrates is 2.7 mg/L. Based on the supporting chemicals, CASRNs 74-85-1, 513-35-9 and 109-66-0, the 72-h EC_{50} for aquatic plants ranges from 7.5 to 40 mg/L for biomass and 10.7 to 72 mg/L for growth rate.

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

Endpoints	SUPPORTING CHEMICAL Ethylene (C2) (74-85-1)	SPONSORED CHEMICAL Propylene, chemical grade (115-07-1)	SPONSORED CHEMICAL Propylene streams (No CASRN)	SPONSORED CHEMICAL Light ends from butadiene plant (No CASRN)	SPONSORED CHEMICAL Propylene, polymer grade (115-07-1)	SUPPORTING CHEMICAL 2-Butene, 2-methyl- (C5) (513-35-9)	SUPPORTING CHEMICAL Pentane (C5) (109-66-0)
Fish 96-h LC_{50} (mg/L)	–	No Data 4.26 (RA)	No Data 4.26 (RA)	No Data 4.26 (RA)	No Data 4.26 (RA)	**4.99**	**4.26**
Aquatic Invertebrates 48-h EC_{50} (mg/L)	–	No Data 2.7 (RA)	No Data 2.7 (RA)	No Data 2.7 (RA)	No Data 2.7 (RA)	**3.84**	**2.7**
Aquatic Plants 72-h EC_{50} (mg/L)							
(biomass)	**40**	No Data 7.5 – 40	No Data 7.5 – 40	No Data 7.5 – 40	No Data 7.5 – 40	**10.5**	**7.5**
(growth rate)	**72**	10.7 – 72 (RA)	10.7 – 72 (RA)	10.7 – 72 (RA)	10.7 – 72 (RA)	**12.0**	**10.7**

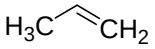
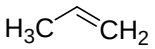
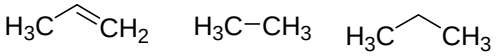
Bold = measured data (i.e., derived from testing); (RA) = Read-Across; – indicates that endpoint was not addressed for this chemical.

APPENDIX

The following pages show:

- Table 7 shows representative structures of the sponsored substances and the supporting chemicals
- Description of ethylene manufacturing process and the associated diagram are taken from the sponsor's original HPV submission of Propylene Streams Category - November 2001, http://www.epa.gov/hpv/pubs/summaries/prplstrm/c13281tp.pdf

Table 7. Process Streams, CASRN, and TSCA Description of the Propylene Streams Category

Name	CASRN	TSCA Description
1-Propene polymer grade stream	115-07-1	 A high purity (typically >99% 1-propene) product of the ethylene unit. It is obtained by fractionation of a portion of the condensed cracking furnace effluent and other processing steps (e.g., C3 acetylene removal). The final polymer grade propylene is produced as the distillate from the C3 splitter and can contain a small amount of propane.
1-Propene chemical grade stream	115-07-1	 A C3 product with typical propylene content of 93 to 95%. Propane accounts for most of the balance of the composition. An ethylene process using a scheme similar to that used for polymer grade propylene, but with fewer or less rigorous purification steps, produces this grade.
Propylene stream	68606-26-8; 115-07-1; 74-84-0; 74-98-6	 Representative structures C3 stream prior to separation into propylene and propane. Typically, this stream is produced as the overhead from the depropanizer in an ethylene unit. It is a narrow boiling-range mixture that consists predominantly of C3 hydrocarbons. A typical composition is 85% propylene, 12% propane, and 3% C3 acetylenes.
Light ends from butadiene plant stream	68606-26-8	 Representative structures Stream produced by fractionation of the C4 crude butadiene stream to remove relatively low levels of propane and propylene that may be contained in the stream. The carbon number distribution for the stream is predominantly C3.

ETHYLENE PROCESS DESCRIPTION

A. The Ethylene Process

1. Steam Cracking

Steam cracking is the predominant process used to produce ethylene. Various hydrocarbon feedstocks are used in the production of ethylene by steam cracking, including ethane, propane, butane, and liquid petroleum fractions such as condensate, naphtha, and gas oils. The feedstocks are normally saturated hydrocarbons but may contain minor amounts of unsaturates. These feedstocks are charged to the coils of a cracking furnace. Heat is transferred through the metal walls of the coils to the feedstock from hot flue gas, which is generated by combustion of fuels in the furnace firebox. The outlet of the cracking coil is usually maintained at relatively low pressure in order to obtain good yields to the desired products. Steam is also added to the coil and serves as a diluent to improve yields and to control coke formation. This step of the ethylene process is commonly referred to as "steam cracking" or simply "cracking" and the furnaces are frequently referred to as "crackers".

Subjecting the feedstocks to high temperatures results in the partial conversion of the feedstock to olefins. In the simplest example, feedstock ethane is partially converted to ethylene and hydrogen. Similarly, propane, butane, or the liquid feedstocks are also converted to ethylene. While the predominant products produced are ethylene and propylene, a wide range of additional products are also formed. These products range from methane (C1) through fuel oil (C12 and higher) and include other olefins, diolefins, aromatics and saturates (naphthenes and paraffins).

2. Refinery Gas Separation

Ethylene and propylene are also produced by separation of these olefins from refinery gas streams, such as from the light ends product of a catalytic cracking process or from coker offgas. This separation is similar to that used in steam crackers, and in some cases both refinery gas streams and steam cracking furnace effluents are combined and processed in a single finishing section. These refinery gas streams differ from cracked gas in that the refinery streams have a much narrower carbon number distribution, predominantly C2 and/or C3. Thus the finishing of these refinery gas streams yields primary ethylene and ethane, and/or propylene and propane.

B. Products of the Ethylene Process

The intermediate stream that exits the cracking furnaces (i.e., the furnace effluent) is forwarded to the finishing section of the ethylene plant. The furnace effluent is commonly referred to as "cracked gas" and consists of a mixture of hydrogen, methane, and various hydrocarbon compounds with two or more carbon atoms per molecule (C2+). The relative amount of each component in the cracked gas varies depending on what feedstocks are cracked and cracking process variables. Cracked gas may also contain relatively small concentrations of organic sulfur compounds that were present as impurities in the feedstock or were added to the feedstock to

control coke formation. The cracked gas stream is cooled, compressed and then separated into the individual streams of the ethylene process. These streams can be sold commercially and/or put into further steps of the process to produce additional materials. In some ethylene processes, a liquid fuel oil product is produced when the cracked gas is initially cooled. The ethylene process is a closed process and the products are contained in pressure systems.

The final products of the ethylene process include hydrogen, methane (frequently used as fuel), and the high purity products ethylene and propylene. Other products of the ethylene process are typically mixed streams that are isolated by distillation according to boiling point ranges and then further processed. Product propylene and propylene streams from the ethylene unit and from down stream processing make up the Propylene Streams category.

The chemical process operations that are associated with the process streams in the Propylene Streams category are shown in Figure 1.

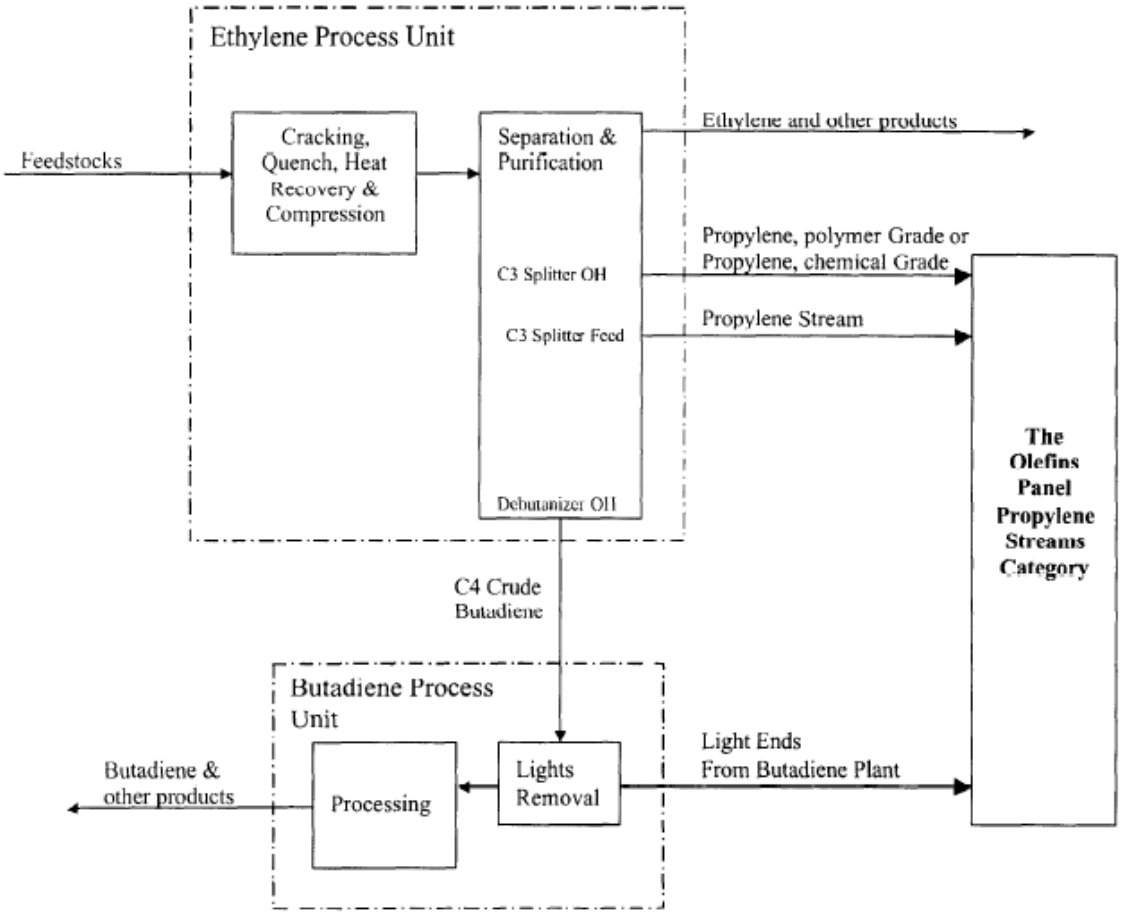


Figure 1. Chemical Process Operations Associated with Process Streams in the Propylene Streams Category