SCREENING-LEVEL HAZARD CHARACTERIZATION

Low Benzene Naphthas Category

SPONSORED CHEMICALS

Pyrolysis C7s	**No CASRN**
Pyrolysis C7 – 12 fraction	**No CASRN**
Pyrolysis C7 – 8 fraction	**No CASRN**
C9+ from Xylene Unit	**No CASRN**
Hydrotreated C8 – C10 fraction	**No CASRN**
Hydrotreated C7 – 12 fraction	**No CASRN**
Hydrotreated C7+ fraction	**No CASRN**
Hydrotreated C5/C9 blend	**No CASRN**
Toluene extract	**No CASRN**

SUPPORTING CHEMICALS

Isopentane	**CASRN 78-78-4**
Toluene	**CASRN 108-88-3**
***m*-Xylene**	**CASRN 108-38-3**
Styrene	**CASRN 100-42-5**
Naphthalene	**CASRN 91-20-3**
Tricyclodecane	**CASRN 6004-38-2**
Methyl-naphthalene	**CASRN 90-12-0**
Ethyltoluene (mixed isomers)	**CASRN 25550-14-5**
Xylene (mixed isomers)	**CASRN 1330-20-7**
Heavy Aromatic Distillates	**CASRN 64742-48-9**

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

[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.

chemicals by developing hazard characterizations (HCs). These HCs consist of an evaluation of the quality and completeness of the data set provided in the Challenge Program submissions. They are not intended to be definitive statements regarding the possibility of unreasonable risk of injury to health or the environment.

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

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

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 Table 1** **Supporting Chemicals** **See Table 3**
Chemical Abstract Index Name	**Sponsored Chemicals** **See Table 1** **Supporting Chemicals** **See Table 3**
Structural Formula	**Sponsored Chemicals** **See Appendix** **Supporting Chemicals** **See Appendix**

Summary

The low benzene naphthas category comprises nine hydrocarbon streams. Seven of the category member streams are based on pyrolysis gasoline, which is a byproduct of ethylene manufacturing; two of the member streams are byproducts of aromatic hydrocarbon processing units. The component streams that form this category are complex mixtures composed primarily of C7 to C12 aromatic and cycloaliphatic hydrocarbons.

The members of this category are liquids possessing moderate to high vapor pressure and moderate water solubility. All category members are expected to possess moderate mobility in soil. Volatilization is expected to be high. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is slow to rapid. The members of the low benzene naphthas category are expected to possess low to moderate persistence (P1-P2) and low to moderate bioaccumulation potential (B1-B2).

Human Health Hazard
For the human health endpoints, the nine streams in the low benzene naphthas category have been divided into five subcategories based on similarities and differences in the individual stream components.

Subcategory I: High Toluene Streams
There are no human health data available on the sponsored streams. Subcategory I contains streams with a relatively high concentration of CASRN 108-88-3, which is used as a supporting chemical to address the human health endpoints.

The acute oral and dermal toxicity of CASRN 108-88-3 is low in rats and rabbits, respectively. The acute inhalation toxicity is moderate in rats and mice. In a 13-week oral repeated-dose study

in mice, CASRN 108-88-3 showed increased absolute and relative liver weights in females at 312 mg/kg-day (lowest dose tested) and above; the NOAEL for systemic toxicity is not established. In a 13-week oral repeated-dose study in rats, CASRN 108-88-3 showed increased absolute and relative liver and kidney weights in males at 446 mg/kg-day; the NOAEL for systemic toxicity is 223 mg/kg-day. In a 14-week inhalation repeated-dose study in mice, CASRN 108-88-3 showed mortality and increased relative liver weight in both sexes at 2.4 mg/L/day; the NOAEC for systemic toxicity is 0.38 mg/L/day. In a 14-week inhalation repeated-dose study in rats, CASRN 108-88-3 showed changes in relative liver weights in males at 4.7 mg/L/day; the NOAEC for systemic toxicity is 2.4 mg/L/day. Lifetime inhalation exposure of rats to CASRN 108-88-3 caused degeneration of nasal epithelium and increased incidence of stomach ulcers at 2.4 mg/L/day; ototoxicity was observed at 2.7 mg/L/day. In an inhalation reproductive screening test and a two-generation reproductive toxicity study in rats, CASRN 108-88-3 significantly decreased the sperm count, epididymal weight and pup weights at 7.5 mg/L/day; the NOAEC for reproductive toxicity is 2.3 mg/L/day. In the two-generation inhalation reproductive toxicity study in rats, developmental toxicity included decreased fetal growth and pup weight accompanied by delayed ossification in F1 and F2 offspring at 3.8 mg/L/day; the NOAEC for developmental toxicity is 2.3 mg/L/day and the NOAEC for maternal toxicity is 4.3 mg/L/day (highest concentration tested). CASRN 108-88-3 is not considered genotoxic *in vitro* or *in vivo* or carcinogenic in rats and mice. CASRN 108-88-3 is irritating to the skin and eye, but is not a skin sensitizer. CASRN 108-88-3 exposure leads to neurotoxicity including hearing loss and long lasting (> 6 months) effects on brain neurochemistry in rats. Human exposure to CASRN 108-88-3 has associated the inhalation of high concentrations with chronic effects on the brain and central nervous system, impaired color vision and ototoxicity.

No data gaps were identified under the HPV Challenge Program.

Subcategory II: Mixed Aromatics Streams

There are no human health data available on the sponsored streams. Subcategory II contains streams characterized by a mixture of aromatics. Supporting chemicals for the human health endpoints are CASRN 64742-48-9, a toxicologically similar mixture, and individual component chemicals; CASRNs 108-88-3, 100-41-4 and 1330-20-7. For CASRN 108-88-3, please see summary for subcategory I.

The acute oral toxicity of CASRNs 64742-48-9, 100-41-4 and 1330-20-7 is low in rats. The acute inhalation toxicity of CASRN 64742-48-9 is high in rats and moderate for CASRNs 100-41-4 (rats) and 1330-20-7 (rats and mice). The acute dermal toxicity of CASRN 100-41-4 is low in rabbits. Repeated-dose inhalation exposure of rats to CASRN 100-41-4 for up to two years showed pituitary hyperplasia in females at 1.1 mg/L/day and effects on the lung, liver and thyroid in males at 3.3 mg/L/day; the NOAEC for systemic toxicity is 0.3 (female) and 1.1 (male) mg/L/day. Repeated-dose inhalation exposure of rats to CASRN 1330-20-7 for up to six months showed increased relative liver weights and histopathological changes at 4.0 mg/L/day; the NOAEC for systemic toxicity is 1.5 mg/L/day. In 13-week oral repeated-dose studies in rats and mice, CASRN 1330-20-7 showed decreased body weights (rats) and mortality (mice) at 2000 mg/kg-day; the NOAEL for systemic toxicity is 1000 mg/kg-day. In a two-generation inhalation reproductive toxicity study in rats, CASRN 100-41-4 showed no treatment-

related effects; the NOAEC for reproductive toxicity is 2.2 mg/L/day (highest concentration tested). In a one-generation inhalation reproductive toxicity study in rats, CASRN 1330-20-7 showed no treatment-related effects; the NOAEC for reproductive toxicity is 2.2 mg/L/day (highest concentration tested). In prenatal inhalation developmental toxicity studies in rats and rabbits, CASRN 100-41-4 showed organ weight changes at 4.4 mg/L/day in both species. In rats, skeletal variations were observed in the fetuses at 4.3 mg/L; no developmental effects were observed in rabbits. The NOAEC for maternal toxicity is 4.3 mg/L/day (rats and rabbits) and the NOAEC for developmental toxicity is 0.4 mg/L/day in rats, and 4.4 mg/L/day in rabbits (highest concentration tested). In a prenatal inhalation developmental toxicity study in rats, CASRN 1330-20-7 decreased body weight, weight gain and food consumption in dams at 4.4 mg/L/day and decreased fetal body weight at 2.2 mg/L/day; the NOAEC for maternal toxicity is 2.0 mg/L/day and the NOAEC for developmental toxicity is 0.44 mg/L/day. CASRNs 100-41-4 and 1330-20-7 were not mutagenic in bacteria or mammalian cells *in vitro*. CASRN 100-41-4 induced chromosomal aberrations in mammalian cells *in vitro* but not *in vivo*. CASRN 1330-20-7 did not induce chromosomal aberrations in mammalian cells *in vitro* or *in vivo*. CASRN 1330-20-7 did not increase the incidence of tumors in rats or mice. CASRN 100-41-4 increased the incidence of tumors in rats and mice. CASRNs 64742-48-9, 100-41-4 and 1330-20-7 are irritating to the skin and eyes; CASRNs 64742-48-9 and 100-41-4 are not skin sensitizers. CASRN 1330-20-7 is neurotoxic. CASRN 1330-20-7 causes anxiety, forgetfulness, and concentration problems in chronically exposed humans.

No data gaps were identified under the HPV Challenge Program.

Subcategory III: Pyrolysis C7-C12

There are no human health data available on the sponsored stream. The human health hazard of subcategory III is characterized by data for CASRNs 108-88-3, 1330-20-7, 100-42-5 and 91-20-3. For CASRNs 108-88-3 and 1330-20-7, please see summaries for subcategories I and II above.

The acute oral toxicity of CASRN 100-42-5 is low in rats and moderate in mice. The acute oral toxicity of CASRN 91-20-3 is low in rats and mice. The acute inhalation toxicity in rats is moderate for CASRN 100-42-5 and high for CASRN 91-20-3. The acute dermal toxicity of CASRN 91-20-3 is low in rats and rabbits. In a 13-week oral repeated-dose study in rats, CASRN 91-20-3 showed decreased body weights at 200 mg/kg-day; the NOAEL for systemic toxicity is 100 mg/kg-day. In a similar study in mice, CASRN 91-20-3 showed decreased relative spleen weight and clinical chemistry changes at 133 mg/kg-day; the NOAEL for systemic toxicity is 53 mg/kg-day. Repeated oral exposures in mice for up to two years with CASRN 100-42-5 showed effects on the nose, liver and lung at doses greater than 150 mg/kg-day; the NOAEL for systemic toxicity is 150 mg/kg-day. Repeated inhalation exposures with CASRN 100-42-5 in rats showed neurotoxicity at concentrations greater than 0.9 mg/L and histopathological changes to the olfactory epithelium at 2.1 mg/L/day; the NOAEC for systemic toxicity is 0.9 mg/L/day. In a four-week repeated-inhalation toxicity study in rats, CASRN 100-42-5 showed ototoxicity at concentrations greater than 1.3 mg/L/day; the NOAEC for systemic toxicity is 1.3 mg/L/day. Repeated inhalation exposures to rats for up to two years with CASRN 91-20-3 showed increased incidences in respiratory epithelial adenomas in both sexes; 0.05 mg/L/day in males and 0.15 mg/L/day in females. The NOAEC for systemic toxicity

in males is not established and is 0.05 mg/L/day in females. Repeated dermal dosing of rats with CASRN 91-20-3 showed no adverse effects; the NOAEL for systemic toxicity is 1000 mg/kg/day (highest dose tested). No specific reproductive toxicity studies are available for CASRN 91-20-3; however, in the 13-week oral repeated-dose studies and two-year inhalation studies in rats and mice, no effects or histopathological changes were observed on the reproductive organs. In a two-generation inhalation reproductive toxicity study in rats, CASRN 100-42-5 showed no adverse effects on reproductive parameters; the NOAEC for reproductive toxicity is 2.1 mg/L/day (highest concentration tested). Decreased body weights and decreased fetal body weights and delayed development were observed at 0.64 mg/L/day; the NOAEC for maternal and developmental toxicity is 0.2 mg/L/day. CASRN 100-42-5 was not mutagenic in bacteria and mammalian cells *in vitro*; however, it did induce chromosomal aberrations in mammalian cells *in vitro*. CASRN 100-42-5 was not mutagenic or genotoxic *in vivo*. CASRN 91-20-3 was not mutagenic in bacteria and mammalian cells *in vitro*; however, it did induce chromosomal aberrations in mammalian cells *in vitro*. CASRN 91-20-3 did not induce micronuclei *in vivo*. CASRNs 100-42-5 increased the incidence of tumors in mice but not rats. CASRN 91-20-3 increased the incidence of tumors in female mice. CASRNs 100-42-5 and 91-20-3 are irritating to the skin and eyes, but are not skin sensitizers. CASRN 100-42-5 is neurotoxic in rodents. CASRN 100-42-5 is known to cause central nervous system depression in humans at concentrations above 100 ppm. CASRN 91-20-3 is associated with acute hemolytic anemia in humans.

No data gaps were identified under the HPV Challenge Program.

Subcategory IV: Hydrotreated C5/C9 blend
No supporting chemical data could be used to characterize the human health hazard of subcategory IV.

All SIDS endpoints were identified as data gaps under the HPV Challenge Program.

Subcategory V: C9+ from o-xylene unit
No supporting chemical data could be used to characterize the human health hazard of subcategory V.

All SIDS endpoints were identified as data gaps under the HPV Challenge Program.

Hazard to the Environment
No data are available for the sponsored streams. The 96-h LC_{50} value for fish ranges from 1 – 10 mg/L for CASRN 91-20-3, 5.4 – 26 mg/L for CASRN 108-88-3 and 2.6 – 26.7 mg/L for CASRN 108-38-3. The 48-h EC_{50} value for aquatic invertebrates ranges from 0.22 – 1.96 mg/L for CASRN 91-20-3, is 8.5 mg/L for CASRN 108-88-3 and 11.5 mg/L for CASRN 108-38-3. The 72-h EC_{50} value for toxicity to aquatic plants is 0.4 mg/L for CASRN 91-20-3, 12.5 mg/L for CASRN 108-88-3 and ranges from 3.2 – 4.9 mg/L for CASRN 108-38-3.

No data gaps were identified under the HPV Challenge Program.

The sponsor, American Chemistry Council (ACC) Olefins Panel HPV Work Group, submitted a Test Plan and Robust Summaries to EPA for the low benzene naphthas category on December 19, 2001. EPA posted the submission on the ChemRTK HPV Challenge website on January 30, 2002 (http://www.epa.gov/chemrtk/pubs/summaries/lowbenze/c13437tc.htm). EPA comments on the original submission were posted to the website on August 22, 2002. The sponsor submitted updated/revised documents on August 7, 2003, January 12, 2004, August, 16, 2004, September 22, 2004 and May 5, 2009, which were posted to the ChemRTK website on October 20, 2003, April 27, 2004, September 21, 2004, September 30, 2004 and August 4th, 2009, respectively.

Category Justification

The sponsor proposed grouping nine production streams in the low benzene naphthas category based on reported similarities in (manufacturing process) origin and use. The nine streams are associated with 12 CASRNs (Table 1); some of the production streams are described by only one CASRN, some more than one, and some CASRNs are associated with more than one stream. These process streams are complex mixtures with significant differences in their respective compositions. As noted in the sponsor's test plan, considerable variation may occur between and within manufacturing facilities, depending on feedstock type and operating conditions. Although chemical composition (*i.e.*, relative abundance of major constituents) varies between streams, these substances may be grouped as a category in a broad sense. The proposed grouping of the sponsored process streams into one category is generally supported for physical chemistry, environmental fate and ecotoxicity on the basis of association with ethylene production, similar physical chemistry and predicted environmental fate. Therefore, EPA agrees to use supporting substances in a conservative read-across approach whereby available data exhibiting the highest toxicity will be used for hazard characterization, as appropriate.

For human health hazard, the sponsor did not demonstrate that all of the sponsored streams are of sufficiently similar composition and can be reasonably expected to display similar toxicities, so the category has been subdivided based on the component streams and the individual stream components (see Table 2). Subcategory I contains streams with relatively high concentrations of toluene and Subcategory II contains streams characterized by the component stream CASRN 64742-48-9, and the component chemicals toluene, ethylbenzene, and xylenes. The remaining three streams are considered separately based on the lack of apparent similarity in chemical composition (see Appendix). For ecotoxicity, the category is not divided into subcategories.

Table 1. CASRN[1] and Components of Low Benzene Naphthas Category Members		
Sponsored Stream	**CASRN**	**CA Index Name**
Toluene extract	64741-98-6	Extracts (petroleum), heavy naphtha solvent
Pyrolysis C7s	68527-23-1	Naphtha (petroleum), light steam-cracked arom.
	68478-10-4	Naphtha (petroleum), light steam-cracked debenzenized C8 – 16-cycloalkadiene conc.
Pyrolysis C7 – C8 fraction	68527-23-1	Naphtha (petroleum), light steam-cracked arom.
	68919-15-3	Hydrocarbons, C6 – 12, benzene-recovery
Pyrolysis C7 – C12 fraction	68516-20-1[3]	Naphtha (petroleum), steam-cracked middle arom.
	64742-83-2[4]	Naphtha (petroleum), light steam-cracked
	68476-45-9[4]	Hydrocarbons, C5 – 10 arom. Conc., ethylene manuf.-by-product
Hydrotreated C5/C9 blend	64742-49-0[4]	Naphtha (petroleum), hydrotreated light
Hydrotreated C7+ fraction	64742-48-9[2]	Naphtha (petroleum), hydrotreated heavy
Hydrotreated C8 – C10 fraction	68512-78-7	Solvent naphtha (petroleum), light arom. Hydrotreated
	64742-48-9[2]	Naphtha (petroleum), hydrotreated heavy
Hydrotreated C7 – C12 fraction	64742-48-9[2]	Naphtha (petroleum), hydrotreated heavy
	68516-20-1[3]	Naphtha (petroleum), steam-cracked middle arom.
C9+ from xylene unit	68333-88-0	Aromatic hydrocarbons, C9 – 17
	68553-14-0	Hydrocarbons, C8 – 11

[1]The CAS numbers associated with the corresponding production streams are shown in the above table. In some cases, more than on CAS number is used to represent a specific stream. In those cases, the other CAS numbers are also listed in table 1. The Olefins Industry or others may use these same CAS numbers to represent substances that may, in various degrees, be dissimilar to the category streams. CAS numbers other than those shown in this table may be used to describe these streams.
[2]Robust Summary data for mammalian toxicity provided by sponsor. [3]See also Resin Oils & Cyclodiene Dimer Concentrates Category (http://www.epa.gov/chemrtk/pubs/summaries/resinoil/c13434tc.htm); [4]See also High Benzene Naphthas Category (http://www.epa.gov/chemrtk/pubs/summaries/hibenznp/c13436tc.htm).

Table 2. Subcategories in the Low Benzene Naphthas Category	
Sponsored Stream	**Human Health Hazard**
Pyrolysis C7s	Subcategory I
Toluene extract	
Pyrolysis C7-C8	
Hydrotreated C7+	Subcategory II
Hydrotreated C7-C12	
Hydrotreated C8-C10	
Pyrolysis C7-C12	Subcategory III
Hydrotreated C5/C9 blend	Subcategory IV
C9+ from *o*-xylene unit	Subcategory V

Justification for Supporting Chemicals

No data are available for the sponsored category streams. Supporting chemicals for the Low Benzene Naphthas Category are listed in Table 3.

EPA's *Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures*[4], gives three options for evaluating the hazard of complex streams (either alone or in a category): (1) test data for the stream of concern; (2) test data for a toxicologically similar stream; or (3) test data for individual stream components. No data is available for the sponsored category streams, but the sponsor provided a list of component streams and analysis of the typical chemical constituents for the category streams (See Appendix). The range of responses for the individual chemical components can reasonably be expected to reflect the range of responses for the category or subcategory members and data for these chemicals were used to produce ranges of values for the physicochemical and environmental fate endpoints.

Measured data on individual components of the sponsored streams are used to characterize the physicochemical, environmental fate, human health hazard and ecotoxicity endpoints and to "read across" to the sponsored category members. Data on individual components of the streams are available from ATSDR, IRIS, VCCEP, NIEHS and OECD. These references are summarized in Table 10 (Appendix).

The sponsor provided Robust Summary data for Heavy Aromatic Distillates (CASRN 64742-48-9), one of the component streams, to "read across" to human health hazard endpoints for three sponsored hydrotreated process streams (Hydrotreated C7+ fraction, Hydrotreated C8 – C10 fraction, and Hydrotreated C7 – C12 fraction). While the composition of this stream is not characterized in the Test Plan and its similarity to the sponsored streams cannot be established, the use of this CASRN to describe three of the sponsored streams indicates a degree of similarity and EPA will use data from composite streams as support data for human health endpoints for this subcategory.

The sponsor proposed using data from the gasoline blending streams category to characterize human health hazard of C5 – C6 hydrocarbons. The gasoline blending streams are also volatile liquids with carbon numbers approximately in the range of C4 – C12 (as defined in the API Petroleum HPV Testing Group's test plan, dated 8/21/08). The sponsor claims that some high aromatic streams in the gasoline blending streams category (full range catalytic reformed naphtha, CASRN 68955-35-1 and heavy catalytic reformed naphtha, CASRN 64741-68-0) are similar in composition to some streams in the low benzene naphthas category. The sponsor provides data on carbon range, boiling range, and content of aromatics, (benzene and toluene), but does not compare them to the sponsored streams. Because it is not possible to determine whether these supporting streams are similar to the sponsored streams, the data from the gasoline blending streams cannot be applied to the low benzene naphthas category streams at this time. EPA is preparing a hazard characterization document on the gasoline blending streams category which will be available at: http://iaspub.epa.gov/oppthpv/hpv_hc_characterization.get_report_by_cas?doctype=2. EPA is preparing a hazard characterization document on the high benzene naphthas category which has

[4] Published in 2000 and available at: http://www.epa.gov/raf/publications/sup-guidance-hra-chem-mix.htm

many similarities in approach to the low benzene naphthas category. This document will be available at:
http://iaspub.epa.gov/oppthpv/hpv_hc_characterization.get_report_by_cas?doctype=2.

For ecotoxicity, the supporting chemicals, isopentane (CASRN 78-78-4), toluene (CASRN 108-88-3), *m*-xylene (CASRN 108-38-3) and naphthalene (CASRN 91-20-3) were used to describe the toxicity to aquatic organisms based on physicochemical properties and structure, as well as the following criteria:

(1) These chemicals encompass the carbon range for the low benzene naphthas streams being described (C5-C12).
(2) The components of the low benzene naphthas streams contain one or more of the supporting chemicals in a given percentage (5-80%; see Tables 3 and 7).
(3) The toxicity values (as LL_{50} values) of mixtures from submitted data from the sponsor are within the same order of magnitude as the individual chemical toxicity values for all species tested (as LC_{50} values). The sponsor provided toxicity values for water accommodated fractions (WAF) as loading rates of the chemical mixtures for the C5-C12 hydrocarbon mixtures. EPA does not support the use of WAF testing for submitted compounds however the data from these test streams is informative for purposes of understanding the toxicity to aquatic organisms from the mixtures being characterized.
(4) These chemicals are also appropriate to help support this category based on similar environmental fate and trend in mode of toxic action (narcosis).

Table 3. Supporting Chemicals for Low Benzene Naphthas Category

CASRN	CA Index Name	Physical-Chemical Properties / Environmental Fate	Human Health Hazard	Hazard to the Environment
78-78-4	Butane, 2-methyl-	X		
108-88-3	Benzene, methyl-	X	X	X
108-38-3	Benzene, 1,3-dimethyl-	X		X
100-42-5	Benzene, ethenyl-	X	X	
91-20-3	Naphthalene	X	X	X
6004-38-2	4,7-Methano-1H-indene, octahydro-	X		
1321-94-4	Naphthalene, methyl-	X		
1330-20-7	Benzene, dimethyl-		X	
100-41-4	Benzene, ethyl-		X	
64742-48-9	Naphtha (petroleum), hydrotreated heavy		X	

1. Chemical Identity

1.1 Identification and Purity

The low benzene naphthas category consists of nine related process streams produced during ethylene manufacturing and commonly used as solvents or in the blending of unleaded gasoline and fuel oil (see Table 1). Three of the category member streams are derived from pyrolysis gasoline distillation, a byproduct of ethylene manufacturing, four of the streams result from further processing by hydrotreatment, and two of the member streams are byproducts of aromatic hydrocarbon processing units. The streams are typically complex hydrocarbon mixtures that are isolated by distilling according to boiling point ranges and in some cases further processed. The sponsored streams are predominantly C6-C12 hydrocarbons and show common chemical properties (45-95% aromatics; <5% benzene) and components (toluene, xylenes, icyclopenta). One of the streams (Hydrotreated C5/C9 Blend) contains 40% C5s (paraffins, isoparaffins, olefins and naphthenes).

1.2 Physical-Chemical Properties

The components of this category are liquids that possess moderate to high vapor pressure and moderate water solubility. The nine sponsored production streams are complex hydrocarbon mixtures with varying compositions, and the streams typically contain high percentages of aromatic hydrocarbons with low benzene content.

The physical-chemical properties of the sponsored substances and supporting chemicals contained in the low benzene naphthas category are summarized in Table 4. A description of the complex mixtures used to describe this category, the chemical structures of representative compounds and supporting chemicals, and a summary table showing the compositional data on sponsored streams are provided in the Appendix.

2. General Information on Exposure

2.1 Production Volume and Use Pattern

The Low Benzene Naphthas Category consists of following nine streams with no CASRNs: Pyrolysis C7s, Pyrolysis C7-C12 Fraction, Pyrolysis C7-C8 Fraction, C9+ from xylene unit, Hydrotreated C7+ Fraction, Hydrotreated C8-C10 Fraction, Hydrotreated C7-C12 Fraction, Hydrotreated C5/C9 Blend, and Toluene extract.

For these streams the following twelve constituent chemicals were identified: CASRN 64741-98-6, 64742-48-9, 64742-83-2, 68333-88-0, 68476-45-9, 68478-10-4, 68512-78-7, 68516-20-1, 68527-23-1, 68553-14-0, 68742-49-0, and 68919-15-3. Following is the summary of IUR information for these twelve chemicals.

The twelve chemicals in the Low Benzene Naphthas Category had an aggregated production and/or import volume in the United States greater than 5 billion 950 million pounds in calendar year 2005.

CASRN 64741-98-6:	100 to < 500 million pounds;
CASRN 64742-48-9:	1 billion pounds and greater;
CASRN 64742-83-2:	1 billion pounds and greater;
CASRN 68333-88-0:	100 to < 500 million pounds;
CASRN 68476-45-9:	50 to < 100 million pounds;
CASRN 68478-10-4:	1 billion pounds and greater;
CASRN 68512-78-7:	500 million to < 1 billion pounds;
CASRN 68516-20-1:	100 to < 500 million pounds;
CASRN 68527-23-1:	1 billion pounds and greater;
CASRN 68553-14-0:	100 to < 500 million pounds;
CASRN 68919-15-3:	1 billion pounds and greater;

CASRN 68742-49-0 was not reported in the 2006 IUR.

CASRN 68527-23-1, 68478-10-4, 68516-20-1, 64742-83-2, 68476-45-9, 68919-15-3, 68333-88-0, 68553-14-0, 68512-78-7, and CASRN 64741-98-6:
No industrial processing and uses, and commercial and consumer uses were reported for these chemicals.

CASRN 64742-48-9:
Non-confidential information in the IUR indicated that the industrial processing and uses of the chemical include petroleum refineries as fuels. Non-confidential commercial and consumer uses of this chemical include “other.”

Table 4. Physical-Chemical Properties of Low Benzene Naphthas Category[1]									
Property	**SPONSORED CHEMICAL Pyrolysis C7's[2]**	**SPONSORED CHEMICAL Pyrolysis C7-C12 fraction[2]**	**SPONSORED CHEMICAL Pyrolysis C7-C8 fraction[2]**	**SPONSORED CHEMICAL C9+ from Xylene unit[2]**	**SPONSORED CHEMICAL Hydrotreated C7+ fraction[2]**	**SPONSORED CHEMICAL Hydrotreated C8-C10 fraction[2]**	**SPONSORED CHEMICAL Hydrotreated C7-C12 fraction[2]**	**SPONSORED CHEMICAL Hydrotreated C5/C9 Blend[2]**	**SPONSORED CHEMICAL Toluene Extract[2]**
Molecular Weight	Complex mixture	Complex mixture	Complex mixture	Complex mixture	Complex mixture	Complex mixture	Complex mixture	Complex mixture	Complex mixture
Physical State	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
Melting Point	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)	<25°C (based on physical state)
Boiling Point	95.4–111°C (measured)[3]	110–218°C (measured)[3]	111–139°C (measured)[3]	162–245°C (measured)[3]	111–197°C (measured)[3]	139–189°C (measured)[3]	111–197°C (measured)[3]	27.8–197°C (measured)[3]	111–139°C (measured)[3]
Vapor Pressure	28–54 mm Hg at 25°C (measured)[3]	0.085–28.4 mm Hg at 25°C (measured)[3]	8.29–28.4 mm Hg at 25°C (measured)[3]	0.085–25.8 mm Hg at 25°C (measured)[3]	0.528–28.4 mm Hg at 25°C (measured)[3]	0.84–8.29 mm Hg at 25°C (measured)[3]	0.528–28.4 mm Hg at 25°C (measured)[3]	0.528–689 mm Hg at 25°C (measured)[3]	8.29–28.4 mm Hg at 25°C (measured)[3]
Dissociation Constant (pK_a)	Not applicable								
Henry's Law Constant	0.0066 atm-m^3/mol (measured)[3]	0.00044–0.30 atm-m^3/mol (measured)[3]	0.0066–0.0079 atm-m^3/mol (measured)[3]	0.00044–0.027 atm-m^3/mol (measured)[3]	0.0050–0.27 atm-m^3/mol (measured/estimated)[3,4]	0.00020–0.79 atm-m^3/mol (measured/estimated)[3,4]	0.0050–0.027 atm-m^3/mol (measured/estimated)[3,4]	0.0050–1.40 atm-m^3/mol (measured/estimated)[3,4]	0.0066–0.0079 atm-m^3/mol (measured)[3]
Water Solubility	29–526 mg/L at 25°C (measured)[3]	6.3–526 mg/L at 25°C (measured)[3]	161–526 mg/L at 25°C (measured)[3]	3.48–94.9 mg/L at 25°C (measured)[3]	3.48–526 mg/L at 25°C (measured)[3]	1.32–161 mg/L at 25°C (measured/estimated)[3,4]	3.38–526 mg/L at 25°C (measured)[3]	3.48–203 mg/L at 25°C (measured)[3]	161–526 mg/L at 25°C (measured)[3]
Log K_{ow}	2.73–3.62 (measured)[3]	2.73–4.56 (measured)[3]	2.73–3.20 (measured)[3]	3.30–4.00 (measured)[3]	2.73–4.00 (measured)[3]	3.20–4.99 (measured/estimated)[3,4]	2.73–4.00 (measured)[3]	2.58–4.00 (measured/estimated)[3,4]	2.73–3.20 (measured)[3]

[1] American Chemistry Council (ACC) Olefins Panel HPV Work Group. 2009. Revised Test Plan and Robust Summaries for Low Benzene Naphthas Category. Available online at http://www.epa.gov/oppt/chemrtk/pubs/summaries/lowbenze/c13437tc.htm as of September 28, 2010.

[2] Data range is based upon the compositional data provided by the sponsor in the test plan, from which representative structures were derived; see the Appendix for detailed information on structures and composition.

[3] SRC. The Physical Properties Database (PHYSPROP). Syracuse, NY: Syracuse Research Corporation. Available online at http://www.syrres.com/esc/physprop.htm as of September 28, 2010.

[4] U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of September 28, 2010.

Table 4. Physical-Chemical Properties of the Low Benzene Naphthas Category[1]							
Property	**SUPPORTING CHEMICAL Butane, 2-methyl- (□icyclopen)**	**SUPPORTING CHEMICAL Benzene, methyl- (toluene)**	**SUPPORTING CHEMICAL Benzene, 1,3-dimethyl- (m-xylene)**	**SUPPORTING CHEMICAL Benzene, ethenyl- (styrene)**	**SUPPORTING CHEMICAL Naphthalene**	**SUPPORTING CHEMICAL 4,7-Methano-1H-indene, octahydro- (tricyclodecane)**	**SUPPORTING CHEMICAL Naphthalene, 1-methyl-**
CASRN	78-78-4	108-88-3	108-38-3	100-42-5	91-20-3	6004-38-2	90-12-0
Molecular Weight	72.15	92.14	106.17	104.15	128.18	136.4	142.20
Physical State	Liquid	Liquid	Liquid	Liquid	Solid	Solid	Liquid
Melting Point	-159.9°C (measured)[2]	-94.9°C (measured)[2]	-47.8°C (measured)[2]	-31°C (measured)[2]	80.2°C (measured)[2]	75–84°C (measured)[3]	-30.4°C (measured)[2]
Boiling Point	27.8°C (measured)[2]	110.6°C (measured)[2]	139.1°C (measured)[2]	145°C (measured)[2]	217.9°C (measured)[2]	185–189°C (measured)[3]	244.7°C (measured)[2]
Vapor Pressure	689 mm Hg at 25°C (measured)[2]	28.4 mm Hg at 25°C (measured)[2]	8.29 mm Hg at 25°C (measured)[2]	6.40 mm Hg at 25°C (measured)[2]	0.085 mm Hg at 25°C (measured)[2]	0.293 mm Hg at 25°C (estimated)[4]	0.067 mm Hg at 25°C (measured)[2]
Dissociation Constant (pK_a)	Not applicable						
Henry's Law Constant	1.4 atm-m^3/mol (estimated)[2]	0.00664 atm-m^3/mol (measured)[2]	0.00718 atm-m^3/mol (measured)[2]	0.00275 atm-m^3/mol (measured)[2]	0.00044 atm-m^3/mol (measured)[2]	0.154 atm-m^3/mol (estimated)[4]	0.000514 atm-m^3/mol (measured)[2]
Water Solubility	48 mg/L at 25°C (measured)[2]	526 mg/L at 25°C (measured)[2]	161 mg/L at 25°C (measured)[2]	310 mg/L at 25°C (measured)[2]	31 mg/L at 25°C (measured)[2]	11.2 mg/L (estimated)[4]	25.8 at 25°C (measured)[2]
Log K_{ow}	2.72 (estimated)[4]	2.73 (measured)[2]	3.20 (measured)[2]	2.95 (measured)[2]	3.30 (measured)[2]	3.59 (estimated)[4]	3.87 (measured)[2]

[1] American Chemistry Council (ACC) Olefins Panel HPV Work Group. 2009. Revised Test Plan and Robust Summaries for Low Benzene Naphthas Category. Available online at http://www.epa.gov/oppt/chemrtk/pubs/summaries/lowbenze/c13437tc.htm as of September 28, 2010.

[2] SRC. The Physical Properties Database (PHYSPROP). Syracuse, NY: Syracuse Research Corporation. Available online at http://www.syrres.com/esc/physprop.htm as of September 28, 2010.

[3] Beilstein (citing numerous sources).

[4] U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of September 28, 2010.

2.2 Environmental Exposure and Fate

The environmental fate properties are provided in Table 5.

The representative components of the low benzene naphthas category and the supporting chemicals are expected to possess moderate mobility in soil. No biodegradation test results were provided for the category members; however, ready test results were provided on two similar aromatic hydrocarbon test streams. For the C9+ from Xylene unit category member, a C8–C14 aromatic hydrocarbon stream [CASRN unknown] mostly containing alkyl naphthalenes and naphthalene achieved 61% degradation using a icyclopen icyclopenta test (OECD 301F) over 28 days. For the hydrotreated C7+ fraction, a C8–C10 aromatic hydrocarbon stream, predominantly containing C9 alkylbenzenes [CASRN unknown], showed 78% degradation in the same test. For the supporting chemicals icyclopen (CASRN 78-78-4) and styrene (CASRN 100-42-5), both were readily biodegradable in the icyclopen icyclopenta test (OECD 301F), showing 71% degradation in 28 days and 68% degradation in 7 days, respectively. The supporting chemicals, toluene (CASRN 108-88-3) and m-xylene (CASRN 108-38-3), when tested in the modified MITI test (OECD 301C), were readily biodegradable, both achieving 100% degradation in 28 days. For naphthalene (CASRN 90-12-0), only 0–2% degradation was observed in a MITI inherent test (OECD 302C); in contrast, in an aerobic test incorporating domestic wastewater as an inoculum, 100% degradation by DOC was seen by 7 days. Similar conflicting results have been observed with 1-methylnaphthalene (CASRN 90-12-0) in which this supporting chemical exhibited only 0–2% degradation in a modified MITI ready test (OECD 301C), but was 95% transformed in 6 days in an unspecified inherent biodegradation test.

Volatilization is expected to be moderate to high based on the Henry's Law constants for the sponsored and supporting chemicals. 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 overall weight of experimental evidence and read across from structurally similar compounds suggest that most of the components of the category members are expected to possess low persistence (P1). The exception is the hydrotreated C8–C10 fraction category member, which is expected to have moderate persistence due to the presence of high amounts of the bicyclic tricyclodecane (CASRN 6004-38-2), and so would not be expected to degrade to a significant extent. The members of the low benzene naphthas category are expected to possess low (B1) to moderate (B2) bioaccumulation potential.

Conclusion: The Low Benzene Naphthas Category comprises nine hydrocarbon streams. Seven of the category member streams are based on pyrolysis gasoline, which is a byproduct of ethylene manufacturing; two of the member streams are byproducts of aromatic hydrocarbon processing units. The component streams that form this category are complex mixtures composed primarily of C7 to C12 aromatic and cycloaliphatic hydrocarbons. The members of this category are liquids possessing moderate to high vapor pressure and moderate water solubility. All category members are expected to possess moderate mobility in soil. Volatilization is expected to be high. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is slow to rapid. The members of the low benzene naphthas

category are expected to possess low to moderate persistence (P1-P2) and low to moderate bioaccumulation potential (B1-B2).

Table 5. Environmental Fate Properties of Low Benzene Naphthas Category[1]

Property	SPONSORED CHEMICAL Pyrolysis C7's[2]	SPONSORED CHEMICAL Pyrolysis C7-C12 fraction[2]	SPONSORED CHEMICAL Pyrolysis C7-C8 fraction[2]	SPONSORED CHEMICAL C9+ from Xylene unit[2]	SPONSORED CHEMICAL Hydrotreated C7+ fraction[2]	SPONSORED CHEMICAL Hydrotreated C8-C10 fraction[2]	SPONSORED CHEMICAL Hydrotreated C7-C12 fraction[2]	SPONSORED CHEMICAL Hydrotreated C5/C9 Blend[2]	SPONSORED CHEMICAL Toluene Extract[2]
Photodegradation Half-life	1.4–25 hours (estimated)[3]	4.3–24 hours (estimated)[3]	9.4–24 hours (estimated)[3]	2.3–17 hours (estimated)[3]	6.3–24 hours (estimated)[3]	8.5–15 hours (estimated)[3]	6.3–24 hours (estimated)[3]	1.5–32 hours (estimated)[3]	9.4–24 hours (estimated)[3]
Hydrolysis Half-life	Stable								
Biodegradation	No Data	No Data	No Data	61% in 28 days (readily biodegradable)[4]	78% in 28 days (readily biodegradable)[5]	No Data	No Data	No Data	No Data
Bioaccumulation Factor	BAF = 38–275 (estimated)[3]	BAF = 38–740 (estimated)[3]	BAF = 38–119 (estimated)[3]	BAF =141–500 (estimated)[3]	BAF = 38–220 (estimated)[3]	BAF = 81–1080 (estimated)[3]	BAF = 38–240 (estimated)[3]	BAF = 32–220 (estimated)[3]	BAF =38–119 (estimated)[3]
Log K_{oc}	2.30–2.37 (estimated)[3]	2.37–3.19 (estimated)[3]	2.37–2.65 (estimated)[3]	2.79–3.40 (estimated)[3]	2.37–3.00 (estimated)[3]	2.57–3.18 (estimated)[3]	2.37–3.00 (estimated)[3]	1.78–3.00 (estimated)[3]	2.37–2.65 (estimated)[3]
Fugacity (Level III Model)[3]									
Air (%)	1.2–19	0.9–22.5	6.5–19	0.7–6.6	6.5–19	2.9–19	6.6–19	1.0–39	6.5–19
Water (%)	41–96	12–72	36–41	11–32	36–48	19–73	27–48	32–97	36–41
Soil (%)	2.5–39	4.3–87	39–52	64–87	39–52	4.7–77	39–66	0.7–64	39–52
Sediment (%)	0.4–0.74	0.4–1.3	0.44–0.64	0.7–1.4	0.4–2.7	0.6–3.3	0.4–2.7	0.3–2.7	0.4–0.6
Persistence[6]	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P2 (moderate)	P1 (low)	P1 (low)	P1 (low)
Bioaccumulation[6]	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B2 (moderate)	B1 (low)	B1 (low)	B1 (low)

[1] American Chemistry Council (ACC) Olefins Panel HPV Work Group. 2009. Revised Test Plan and Robust Summaries for Low Benzene Naphthas Category. Available online at http://www.epa.gov/oppt/chemrtk/pubs/summaries/lowbenze/c13437tc.htm as of September 28, 2010.

[2] Data range is based upon the compositional data provided by the sponsor in the test plan, from which representative structures were derived; see the Appendix for detailed information on structures and composition.

[3] U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of September 28, 2010.

[4] On p.43 of the revised test plan, ready biodegradation test data is provided for a C8–14 aromatic hydrocarbon blend that consists mainly of naphthalene and alkylnaphthalenes [no CASRN provided], which is similar in composition to this category member.

[5] On p. 43 of the revised test plan, ready biodegradation test data is provided for a C8-10 aromatic hydrocarbon blend that consists mainly of C9 alkylbenzenes [no CASRN provided], which is similar in composition to this category member.

[6] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–6020

Table 5. Environmental Fate Properties of the Low Benzene Naphthas Category[1]							
Property	**SUPPORTING CHEMICAL Butane, 2-methyl- (isopentane)**	**SUPPORTING CHEMICAL Benzene, methyl- (toluene)**	**SUPPORTING CHEMICAL Benzene, 1,3-dimethyl- (*m*-xylene)**	**SUPPORTING CHEMICAL Benzene, ethenyl- (styrene)**	**SUPPORTING CHEMICAL Naphthalene**	**SUPPORTING CHEMICAL 4,7-Methano-1H-indene, octahydro- (tricyclodecane)**	**SUPPORTING CHEMICAL Naphthalene, 1-methyl-**
CASRN	78-78-4	108-88-3	108-38-3	100-42-5	91-20-3	6004-38-2	90-12-0
Photodegradation Half-life	2.6 days (estimated)[2]	1.9 days (estimated)[2]	8.9 hours (estimated)[2]	4.3 hours (estimated)[2]	5.6 hours (estimated)[2]	11 hours (estimated)[2]	2.1 hours (estimated)[2]
Hydrolysis Half-life	Stable						
Biodegradation	71% in 28 days (readily biodegradable)	100–123% in 14 days (readily biodegradable)[3]	100% in 28 days (readily biodegradable)[3]	100% in 14 days (inherently biodegradable)[3]; 68% in 10 days (readily biodegradable)[4]	0–2% in 28 days (not inherently biodegradable)[3]; 100% in 7 days (inherently biodegradable)[5]	No data	0–2% in 28 days (not readily biodegradable)[3]; 95% in 6 days (inherently biodegradable)[6]
Bioaccumulation Factor	BAF = 43.5 (estimated)[2]	BAF = 37.8 (estimated)[2]	BAF = 119 (estimated)[2]	BAF = 64.6 (estimated)[2]	BCF = 36–168 (measured in carp at 0.15 ppm)[3]; BCF = 23–146 (measured in carp at 0.015 ppm)[3]; BAF = 177 (estimated)[2]	BAF = 316 (estimated)[2]	BCF = 520 (measured in carp at 0.01 ppm)[3]; BCF = 660 (measured in carp at 0.001 ppm)[3]; BAF = 500 (estimated)[2]
Log K_{oc}	1.78 (estimated)[2]	2.07 (measured)[7]	2.57 (estimated)[2]	2.96 (measured)[7]	2.96 (measured)[7]	3.18 (estimated)[2]	3.36 (measured)[7]
Fugacity (Level III Model)[2]							
Air (%)	39.0	18.4	6.1	1.2	0.8	19.1	0.7
Water (%)	60.0	41.5	40.7	27.5	11.5	59.4	17.5
Soil (%)	0.7	39.7	52.5	70.8	86.6	18.4	80.4
Sediment (%)	0.3	0.4	0.6	0.5	1.0	3.0	1.4

Table 5. Environmental Fate Properties of the Low Benzene Naphthas Category[1]							
Property	**SUPPORTING CHEMICAL Butane, 2-methyl- (isopentane)**	**SUPPORTING CHEMICAL Benzene, methyl- (toluene)**	**SUPPORTING CHEMICAL Benzene, 1,3-dimethyl- (*m*-xylene)**	**SUPPORTING CHEMICAL Benzene, ethenyl- (styrene)**	**SUPPORTING CHEMICAL Naphthalene**	**SUPPORTING CHEMICAL 4,7-Methano-1H-indene, octahydro- (tricyclodecane)**	**SUPPORTING CHEMICAL Naphthalene, 1-methyl-**
Persistence[8]	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P2 (moderate)[9]	P1 (low)
Bioaccumulation[8]	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)

[1] American Chemistry Council (ACC) Olefins Panel HPV Work Group. 2009. Revised Test Plan and Robust Summaries for Low Benzene Naphthas Category. Available online at http://www.epa.gov/oppt/chemrtk/pubs/summaries/lowbenze/c13437tc.htm as of September 28, 2010.

[2] U.S. EPA. 2010. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available online at http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm as of September 28, 2010.

[3] National Institute of Technology and Evaluation. 2002. Biodegradation and Bioaccumulation of the Existing Chemical Substances under the Chemical Substances Control Law. Available online at http://www.safe.nite.go.jp/english/kizon/KIZON_start_hazkizon.html as of October 8, 2010.

[4] E.U. European Chemicals Bureau. 2002. European Union Risk Assessment Report on Styrene. Available online at http://ecb.jrc.ec.europa.eu/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/REPORT/styrenereport034.pdf as of September 28, 2010.

[5] Tabak, HH; Quave, SA; Mashni, CI; et al. 1981. Biodegradability studies with organic priority pollutant compounds. J Water Pollut Control Fed 53:1503–1518.

[6] European Commission, European Chemicals Bureau. 2000. IUCLID Dataset on Methylnaphthalene. Available online at http://ecb.jrc.ec.europa.eu/IUCLID-DataSheets/1321944.pdf as of September 28, 2010.

[7] SRC. The Physical Properties Database (PHYSPROP). Syracuse, NY: Syracuse Research Corporation. Available online at http://www.syrres.com/esc/physprop.htm as of September 28, 2010.

[8] Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194–6020.

[9] Based on the 0% degradation over 14 days seen in the modified MITI I test (OECD 301C) of the closely related icyclopentadiene [CASRN 77-73-6] as reported in E.U. European Chemicals Bureau (2002); see footnote #4.

3. Human Health Hazard

A summary of health effects data submitted for SIDS endpoints is provided in Table 6. The table also indicates where data for tested category members are read-across (RA) to untested members of the category.

Acute Oral Toxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ecb.jrc.ec.europa.eu/esis/
Rat LD_{50} = 5500 – 7500 mg/kg

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3 in subcategory I above.

Naphtha (petroleum), hydrotreated heavy (CASRN 64742-48-9)
Fischer 344 rats (5/sex/dose) were administered CASRN 64742-48-9 by gavage at doses of 0, 4500, 5000, 5500, and 6000 mg/kg and observed for 14 days. No mortality occurred.
LD_{50} > 6000 mg/kg

Ethylbenzene (CASRN 100-41-4)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
Rat LD_{50} = 3500 – 4700 mg/kg

Xylenes, mixed (CASRN 1330-20-7)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
Rat LD_{50} = 3523 – 11,000 mg/kg

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRNs 108-88-3 and 1330-20-7in subcategories I and II above..

Styrene (CASRN 100-42-5, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://cerhr.niehs.nih.gov/evals/styrene/Styrene_final.pdf
Rat LD_{50} = 2650 mg/kg
Mouse LD_{50} = 316 mg/kg

Naphthalene (CASRN 91-20-3, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ecb.jrc.ec.europa.eu/esis/
Rat LD_{50} (rat) > 2000 mg/kg
Mouse LD_{50} = 533 mg/kg (male) **– 710 mg/kg** (female)
Note: Rodents are not suitable animal models for the acutely toxic human health effects of naphthalene in relation to haemolytic anaemia. The LD_{50} results from the rat suggest relatively

low acute toxicity in this species, but the available information in humans indicates significant toxicity.

Acute Inhalation Toxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ecb.jrc.ec.europa.eu/DOCUMENTS/Existing-Chemicals/RISK_ASSESSMENT/REPORT/toluenereport032.pdf.
Rat LC_{50} = 22.0 – 45.8 mg/L
Mouse LC_{50} = 19.9 – 27.9 mg/L

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3 in subcategory I above.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
Rat LC_{50} ~ 17.4 mg/L (4000 ppm)

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.
Rat LC_{50} = 18.8 mg/L
Mouse LC_{50} = 16.9 mg/L

Naphtha (petroleum), hydrotreated heavy (CASRN 64742-48-9; Heavy Aromatic Distillates, HAD, supporting chemical)
(1) Male and female Fischer 344 rats (5/sex/dose) were exposed by whole body inhalation to CASRN 64742-48-9 for 4 hours and observed for 14 days. Actual concentrations measured in the chanber were 0, 6.0, 7.6, 8.6, 9.1, and 11.2 g/m^3. Mortality was reported at doses of 8.6 and above
LC_{50} = 8.5 mg/L

(2) CD Albino rats (5/sex/group) were exposed whole-body to CASRN 64742-48-9 (97.35% purity) as an aerosol at mean measured concentrations of 92, 184, 319 or 1014 ppm (~ 0.55, 1.1, 1.9 or 6.1 mg/L) for 4 hours and observed for 14 days following exposure. Mortalities occurred at 319 and 1014 ppm (1.9 and 6.1 mg/L) within the first 3 days post-exposure. No finite LC_{50} was calculated, but the LC_{50} was estimated to be between 184 and 319 ppm (1.1 and 1.9 mg/L). Additional details are available from TSCATS (OTS0537641).
LC_{50} = 1.1 – 1.9 mg/L

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRNs 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://cerhr.niehs.nih.gov/evals/styrene/Styrene_final.pdf
Rat LC_{50} = 11.8 mg/L (2710 ppm)
Rat LC_{50} = 9.5 mg/L (2185 ppm)

Naphthalene (91-20-3, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ecb.jrc.ec.europa.eu/esis/
Rat LC_{50} > 78 ppm

Acute Dermal Toxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ecb.jrc.ec.europa.eu/esis/
Rabbit LD_{50} = 12,400 mg/kg

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
Rabbit LD_{50} = 15,400 mg/kg

Subcategory III: Pyrolysis C7-C12 (No CASRN)

Naphthalene (91-20-3, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ecb.jrc.ec.europa.eu/esis/
Rat LD_{50} > 2500 mg/kg
Rabbit LD_{50} > 2000 mg/kg

Subcategory IV: Hydrotreated C5/C9 blend (No CASRN)
No data available for the acute toxicity endpoint.

Subcategory V: C9+ from o-xylene unit (No CASRN)
No data available for the acute toxicity endpoint.

Repeated-Dose Toxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Several studies are available for repeated exposures of toluene to animals (see references below).

(1) Subchronic 13- week oral rat study:
LOAEL = 446 mg/kg-day (increased relative and absolute liver and kidney weights of male rats)

NOAEL = 223 mg/kg-day

(2) Subchronic 13-week oral mouse study:
LOAEL = 312 mg/kg-day (based on increased absolute and relative liver weights in female mice)
NOAEL = Not established

(3) 14-week inhalation rat study:
LOAEC = 1250 ppm/day (~ 4.7 mg/L/day) (based on changes in relative liver weight in males)
NOAEC = 625 ppm/day (~ 2.4 mg/L/day)

(4) 14-week inhalation mouse study:
LOAEC = 625 ppm/day (~ 2.4 mg/L/day) (based on mortality and relative liver weight in both sexes)
NOAEC = 100 ppm/day (~ 0.38 mg/L/day)

(5) Lifetime inhalation exposure of rats caused degeneration of nasal epithelium and increased incidence of stomach ulcers.
LOAEC = 600 ppm/day (~ 2.4 mg/L/day) (based on increased incidence of stomach ulcers; the LOAEC for hearing loss is 700 ppm/day)
NOAEC = 300 ppm/day (~ 1.1 mg/L/day)

(6) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx, http://www.epa.gov/iris/subst/0118.htm and http://www.epa.gov/oppt/vccep/pubs/chem13a.html

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3 in subcategory I above.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
Repeated-dose studies in several species are available. See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf and Gagnaire et al., 2007.

(1) In 13-week repeated-dose inhalation studies in F344 rats and B6C3F1 mice, no significant treatment-related effects were observed in either specie up to the highest concentration tested.
NOAEC = 1000 ppm/day (~ 4.34 mg/L/day; highest concentration tested**)**

(2) In two-year inhalation chronic toxicity/carcinogenicity studies, F344 rats were treated up to 750 ppm/day. Effects were seen in the kidneys at 750 ppm/day (approximately 3.26 mg/L/day) in both sexes.
LOAEC = 750 ppm/day (~ 3.26 mg/L/day; based on renal tubular hyperplasia)
NOAEC = 250 ppm/day (~ 1.08 mg/L/day)

(3) In two-year inhalation chronic toxicity/carcinogenicity studies, B6C3F1 mice were treated up to 750 ppm/day. Effects were seen in the liver and thyroid (750 ppm/day) and pituitary gland (250 ppm/day) in females and the liver, lung and thyroid in males (750 ppm/day).

LOAEC (female) = 250 ppm/day (~ 1.08 mg/L/day; based on pituitary hyperplasia)
NOAEC (female) = 75 ppm/day (~ 0.33 mg/L)
LOAEC (male) = 750 ppm/day (~ 3.26 mg/L/day; based on effects on lung, liver and thyroid histopathology)
NOAEC (male) = 250 ppm/day (~ 1.08 mg/L/day)

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
Repeated-dose studies in several species are available. See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.

(1) Rats exposed to mixed xylenes by inhalation daily for up to six months showed liver effects at 923 ppm/day (approximately 4.0 mg/L/day). http://webnet.oecd.org/hpv/UI/Search.aspx
LOAEC = 923 ppm/day (~ 4.0 mg/L/day) (based on increased relative liver weight, histopatholgy, and enzyme activity)
NOAEC = 346 ppm/day (~ 1.5 mg/L/day)

(2) In 13-week repeated-dose studies, rats treated with mixed xylenes by the oral route showed decreased body weight gain but no overt signs of toxicity at 2000 mg/kg/day. http://webnet.oecd.org/hpv/UI/Search.aspx
LOAEL = 2000 mg/kg/day (based on decreased body weight gain)
NOAEL = 1000 mg/kg/day

(3) In 13-week repeated-dose studies, mice treated with mixed xylenes by the oral route showed mortality at 2000 mg/kg/day. http://webnet.oecd.org/hpv/UI/Search.aspx
LOAEL = 2000 mg/kg/day (based on mortality)
NOAEL = 1000 mg/kg/day

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
Several repeated-dose studies in rats and mice are available. Mice appear to be more sensitive to inhalation toxicity than rats. Generally, inhalation exposures show histopathological changes in the olfactory epithelium whereas effects on the auditory system are observed at higher concentrations.

(1) Four-week inhalation toxicity study in rats showed ototoxicity at concentrations > 300 ppm. Additional information not provided:
http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_095.pdf
LOAEC > 300 ppm (~1.28 mg/L/day)
NOAEC = 300 ppm (~1.28 mg/L/day)

(2) Two-year oral toxicity study in mice showed effects on nose, liver and lung. Additional information not provided.
http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_095.pdf

LOAEL > 150 mg/kg/day
NOAEL = 150 mg/kg/day

(3) In repeated inhalation exposures with rats, the NOAEC is 200 ppm (approximately 0.85 mg/L/day) based on the observance on neurotoxicity at higher concentrations. Histopathological changes in the olfactory epithelium indicating respiratory tract irritation was observed at 500 ppm (approximately 2.13 mg/L/day) and above and damage to the auditory system (hair cell loss) with associated functional impairment was observed at 800 ppm (approximately 3.41 mg/L/day). Additional information not provided.
http://webnet.oecd.org/hpv/UI/Search.aspx

(4) Long-term studies (120 weeks) in rats and mice showed liver, kidney and stomach lesions in rats (weekly at 500 mg/kg) and no significant effects in mice (weekly with 300 mg/kg). Other subchronic rat feeding studies showed LOAELs in the 350-500 mg/kg-day range and NOAELs in the 100-400 mg/kg-day range.
http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showKeywordResults&maxrows=15&startrow=1&textfield=100-42-5&searchtype=irisdata
LOAEL = 350-500 mg/kg-day (based on systemic effects in rats)
NOAEL = 100-400 mg/kg-day

(5) In a two-year drinking water study, no adverse effects were observed in rats exposed to styrene at 35 mg/kg/day. http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=421&tid=74
NOAEL = 35 mg/kg/day (highest dose tested)

(6) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx, http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_095.pdf and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=421&tid=74

Naphthalene (CASRN 91-20-3, supporting chemical)
(1) In a 13-week study, F344 rats treated with naphthalene in corn oil by gavage. Mortality in males at the high dose and clinical effects were observed; however, decreased body weight was the most sensitive effect noted[5].
LOAEL = 200 mg/kg/day (based on decreased body weight)
NOAEL = 100 mg/kg/day

(2) Albino CD-mice were administered naphthalene in corn oil by gavage. Effects were observed on the organ weights at 133 mg/kg-day.
LOAEL = 133 mg/kg-day (based on decreased relative spleen weight, clinical chemistry)
NOAEL = 53 mg/kg-day

(3) In a 105-week study, F344 rats were exposed to naphthalene vapor via inhalation up to 60 ppm/day (approximately 0.3 mg/L/day). Neuroblastoma of the nasal olfactory epithelium was observed in both sexes. No lung tumors were observed. The incidences of a variety of non-

[5] ATSDR and EPA IRIS: Decreased body weights in rats exposed by gavage to naphthalene 5 days/week for 13 weeks (NTP 1980) are used as a basis for derivation of the MRL and RfD, respectively.

neoplastic lesions of the nasal tract in both sexes were statistically significantly greater in treated animals when compared to controls.
LOAEC (male) = 10 ppm/day (~ 0.05 mg/L/day; based on increased incidence of respiratory epithelial adenomas)
NOAEC (male) = Not established
LOAEC (female) = 30 ppm/day (~0.15 mg/L/day; based on increased incidence of respiratory epithelial adenomas)
NOAEC (female) = 10 ppm/day (~ 0.05 mg/L/day)

(4) In a 104-week study, B6C3F1 mice were exposed to naphthalene vapor via inhalation up to 30 ppm/day (approximately 0.15 mg/L/day). A statistically significant increase in the incidence of alveolar/bronchiolar adenomas in high-exposure females was seen. Non-neoplastic changes were only seen in the lungs and nose where a dose-related increase in alveolar and bronchial inflammation was noted in all groups.
LOAEC = 10 ppm (~ 0.05 mg/L/day; based on nasal and lung lesions)
NOAEC = Not established

(5) Rats treated with up to 1000 mg/kg/day naphthalene via the dermal route showed no adverse effects.
NOAEL = 1000 mg/kg/day (highest dose tested)

(6) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx, http://www.epa.gov/iris/subst/0436.htm, http://ecb.jrc.ec.europa.eu/esis/ and http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=240&tid=43.

Subcategory IV: Hydrotreated C5/C9 blend (No CASRN)
No data available for this endpoint.

Subcategory V: C9+ from o-xylene unit (No CASRN)
No data available for this endpoint.

Reproductive Toxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
(1) In a study designed to examine the effects of toluene on fertility, Sprague-Dawley rats were exposed to toluene up to 2000 ppm/day (approximately 7.5 mg/L/day) via inhalation. Toluene significantly decreased sperm count and epididymal weight at the high dose.
http://www.epa.gov/iris/toxreviews/0118tr.pdf
LOAEC (reproductive toxicity, female) = 2000 ppm/day (~ 7.5 mg/L/day) (highest concentration tested)
LOAEC (reproductive toxicity, male) = 2000 ppm/day (~ 7.5 mg/L/day) (based on decreased sperm count)
NOAEC (reproductive toxicity, male) = 600 ppm/day (~ 2.3 mg/L/day)

(2) In a two-generation inhalation reproductive toxicity study, CD-1 rats were exposed by whole-body inhalation to toluene up to 2000 ppm/day (approximately 7.54 mg/L/day). No differences were observed in male or female fertility indices, length of gestation, mean numbers of viable and nonviable pups at birth, or pup survival indices during lactation in either the F_0 or F_1 generation. A statistically significant ($p<0.05$) decrease in pup weights relative to controls was observed in the first generation offspring (weeks 19-36) and maintained throughout lactation period in the F_1 pups from F_0 dams exposed to 2000 ppm.
LOAEC (reproductive toxicity) = 2000 ppm/day (~ 7.5 mg/L/day) (based on decreased pup weights)
NOAEC (reproductive toxicity) = 600 ppm/day (~ 2.3 mg/L/day)

(3) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx, http://www.epa.gov/iris/toxreviews/0118tr.pdf
and http://www.epa.gov/oppt/vccep/pubs/chem13a.html

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
In a two-generation inhalation reproductive toxicity study, rats were exposed by inhalation to ethylbenzene vapor up to 500 ppm/day (approximately 2.2 mg/L/day). There were no treatment-related deaths or clinical observations. There were no treatment-related effects on reproductive performance. (Faber et al., 2006; http://www.epa.gov/oppt/vccep/pubs/chem8c.html)
NOAEC (reproductive toxicity) = 500 ppm/day (~ 2.2 mg/L/day; highest concentration tested)

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
(1) In a one-generation reproductive toxicity study, rats exposed via inhalation to mixed xylenes showed no dose-related effects on mating indices, mean duration of gestation, mean litter size, or pup survival.
NOAEC (reproductive toxicity) = 500 ppm (~ 2.2 mg/L/day; highest concentration tested)

(2) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
(1) In a 90-day inhalation toxicity study in rats, no evidence of testicular effects were observed up to 1500 ppm (approximately 6.39 mg/L/day).

(2) In a two-generation inhalation reproductive toxicity study, rats were exposed whole-body to 50, 150 or 500 ppm (approximately 0.21, 0.64 or 2.13 mg/L/day) styrene vapor (see reference for details). In addition, a developmental neurotoxicity component was included to assess potential adverse functional and/or morphological effects in the F_2 offspring following F_0 and F_1

generation exposures. No adverse exposure-related effects on survival or clinical observations were noted at any exposure level in the F_0 or F_1 generations. There were no indications of adverse effects on reproductive performance in either the F_0 or F_1 generations. No adverse exposure-related macroscopic pathology was noted at any exposure level in the F_0 or F_1 generations. (8EHQ-0803-15197)
NOAEC (reproductive toxicity) = 500 ppm (~2.13 mg/L/day; highest concentration tested)

(3) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=421&tid=74

Naphthalene (CASRN 91-20-3, supporting chemical)
(1) No specific reproductive toxicity studies are available. However, in the 13-week oral repeated-dose studies in rats and mice, and the two-year inhalation carcinogenicity studies in rats and mice, no effects or histopathological changes were observed on the reproductive organs.

(2) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx, http://www.epa.gov/iris/subst/0436.htm, http://ecb.jrc.ec.europa.eu/esis/ and http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=240&tid=43.

Subcategory IV: Hydrotreated C5/C9 blend (No CASRN)
No data available for this endpoint.

Subcategory V: C9+ from o-xylene unit (No CASRN)
No data available for this endpoint.

Developmental Toxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Generally, rat inhalation studies provide strong evidence of developmental toxicity (lower birth weight and long-lasting developmental neurotoxicity) in the absence of maternal toxicity. See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx
and http://www.epa.gov/oppt/vccep/pubs/chem13a.html

In the two-generation inhalation reproductive toxicity study in rats, described above, effects on the development of fetuses and/or pups were observed in both generations.
NOAEC (maternal toxicity) = 2000 ppm/day (~7.5 mg/L/day; highest concentration tested)
LOAEC (developmental toxicity) = 1000 ppm/day (~ 3.8 mg/L/day; based on decreased fetal growth and pup weight and delayed ossification in F1 and F2 offspring)
NOAEC (developmental toxicity) = 600 ppm/day (~ 2.3 mg/L/day)

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
(1) In an inhalation prenatal developmental toxicity study, pregnant rats were treated with ethylbenzene on days 1-19 gestation. Maternal toxicity observed at 1000 ppm/day (approximately 4.33 mg/L/day) included increased liver, kidney and spleen weight changes. Developmental effects were observed at 1000 ppm/day (skeletal variations).
LOAEC (maternal toxicity) = 1000 ppm/day (~ 4.33 mg/L/day; based organ weight changes)
NOAEC (maternal toxicity) = 100 ppm/day (~ 0.43 mg/L/day)
LOAEC (developmental toxicity) = 1000 ppm/day (~ 4.33 mg/L/day; based on skeletal variations)
NOAEC (developmental toxicity) = 100 ppm/day (~ 0.43 mg/L/day)

(2) In an inhalation prenatal developmental toxicity study, pregnant rabbits were treated with ethylbenzene on days 1-24 gestation. Maternal toxicity observed at 1000 ppm/day (approximately 4.33 mg/L/day) included increased liver weights. No developmental effects were observed.
LOAEC (maternal toxicity) = 1000 ppm/day (~ 4.33 mg/L/day; based organ weight changes)
NOAEC (maternal toxicity) = 100 ppm/day (~ 0.43 mg/L/day)
NOAEC (developmental toxicity) = 1000 ppm/day (~ 4.33 mg/L/day; highest concentration tested)

(3) In the two-generation inhalation reproductive toxicity study previously described, rats exposed to ethylbenzene showed no adverse effects on pup sex ratios, pup body weights and developmental landmarks. (Faber et al., 2006; http://www.epa.gov/oppt/vccep/pubs/chem8c.html)
NOAEC (maternal/developmental toxicity) = 500 ppm (~ 2.2 mg/L/day; highest concentration tested)

(4) See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf and http://www.epa.gov/oppt/vccep/pubs/chem8c.html).

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.

(1) In a prenatal developmental toxicity study, rats were exposed to mixed xylenes via inhation up to 2000 ppm/day (approximately 8.8 mg/L/day) on gestation days 6-20. Dams showed decreased body weight, body weight gain and reduced food consumption at 1000 ppm/day and above. Developmental effects included decreased fetal body weight at 500 ppm. Skeletal variations were increased at 2000 ppm.
LOAEC (maternal toxicity) = 1000 ppm/day (~ 4.4 mg/L/day) (based on decreased body weight, weight gain and food consumption)
NOAEC (maternal toxicity) = 500 ppm/day (~ 2.2 mg/L/day)
LOAEC (developmental toxicity) = 500 ppm/day (~ 2.2 mg/L/day) (based on decreased fetal body weight)
NOAEC (developmental toxicity) = 100 ppm/day (~ 0.44 mg/L/day)

(2) In a developmental neurotoxicity study, rats exposed via inhalation to mixed xylenes on days 4-20 gestation showed impaired performance in a motor ability test.
LOAEC (developmental neurotoxicity) = 200 ppm/day (~ 0.88 mg/L/day) (based on impaired motor ability)
NOAEC (developmental toxicity) < 200 ppm/day (<~ 0.88 mg/L/day)

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5)
(1) In the two-generation reproductive toxicity study described above, clear developmental findings were limited to treatment-related reductions in mean body weights of the F_1 and F_2 offspring at 150 ppm and above. Similarly, body weight decreases were observed for all animals in the mid- and high-dose groups. An overall pattern of delay was evident in the F2 offspring at the high dose and included both statistically significant and non-significant changes (e.g. reduced body weight, delayed appearance of some physical landmarks of development). There were no other alterations in behavioral performance parameters or in brain weight, histology or morphometry to suggest that selective developmental neurotoxicity occurred.
LOAEC (maternal toxicity) = 150 ppm/day (~0.64 mg/L/day) (based on decreased body weight)
NOAEC (maternal toxicity) = 50 ppm/day (~0.21 mg/L/day)
LOAEC (developmental toxicity) = 150 ppm/day (~0.64 mg/L/day) (based on decreased fetal body weight and delayed development)
NOAEC (developmental toxicity) = 50 ppm/day (~0.21 mg/L/day)
NOAEC (developmental neurotoxicity) = 500 ppm/day (~2.13 mg/L/day) (highest concentration tested)

(2) See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=421&tid=74

Subcategory IV: Hydrotreated C5/C9 blend (No CASRN)
No data available for this endpoint.

Subcategory V: C9+ from o-xylene unit (No CASRN)
No data available for this endpoint.

Genetic Toxicity – Gene Mutation

In vitro

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Toluene has been tested for mutagenicity in several assays. See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 was not considered mutagenic.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 was not mutagenic in these assays.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
(1) Mouse lymphoma cells were exposed to mixed xylenes at doses of 0, 5.6-87.0 μg/ml with or without metabolic activation, no mutational events were induced.
CASRN 1330-20-7 was not mutagenic in this assay.

(2) Sister chromatid exchange (SCE) or chromosome aberrations were not observed in Chinese hamster ovary cells with or without activation or in cultured human lymphocytes that retain endogenous metabolic activity.
CASRN 1330-20-7 was not mutagenic in this assay.

(3) See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.

Heavy Aromatic Distillate (CASRN 64742-48-9, supporting chemical)
(1) In a mammalian forward mutation assay, Chinese hamster ovary (CHO) cells heterozygous for hypoxanthine-guanine phophoribosyl transferase (HGPRT) were exposed to CASRN 64742-48-9 at concentrations of 0, 64, 128, 256, 512, 750, and 1024 μg/ml (–S9) and 0, 128, 256, 512, 1024, 1500, and 2048 μg/ml (+S9) in the presence and absence of metabolic activation and induction by Arochlor 1254. Cytotoxicity was noted at 512 μg/ml and higher in the –S9 cultures, but not in the +S9 cultures. Positive and negative controls responded as expected. No significant increase in mutations was observed.
CASRN 64742-48-9 was not mutagenic in this assay.

(2) In an *in vitro* cell transformation assay, BALB/3T3 mouse embryo cells were exposed to CASRN 64742-48-9 at concentrations of 0, 16, 32, 64, and 200 μg/ml for 2 days. Cytotoxicity occurred at concentrations of 32 μg/ml and above. Positive and negative controls gave expected results. No cell transformation occurred.
CASRN 64742-48-9 was not mutagenic in this assay.

(3) In an unscheduled DNA synthesis assay, primary rat hepatocyte cultures were exposed to CASRN 64742-48-9 at concentrations of 0, 10, 40, 100, and 200 μg/ml for 18 hours. Cytotoxicity occurred at concentrations of 32 μg/ml and above. Positive and negative controls gave expected results. Unscheduled DNA synthesis was not observed.
CASRN 64742-48-9 was not mutagenic in this assay.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
Styrene is not genotoxic in the vast majority of *in vitro* standard mutagenicity tests.

See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_095.pdf
CASRN 100-42-5 was not considered mutagenic.

Naphthalene (CASRN 91-20-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 91-20-3 was not mutagenic in these assays.

Subcategory IV: Hydrotreated C5/C9 blend (No CASRN)
No data available for this endpoint.

Subcategory V: C9+ from o-xylene unit (No CASRN)
No data available for this endpoint.

Genetic Toxicity – Chromosomal Aberrations

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Toluene has been tested for genotoxicity in several assays. See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 did not induce chromosomal aberrations in these assays.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 induced chromosomal aberrations in these assays.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.
CASRN 1330-20-7 did not induce chromosomal aberrations in these assays.

Heavy Aromatic Distillate (CASRN 64742-48-9, supporting chemical)
Mice (2/sex/dose) were exposed to CASRN 64742-48-9 at doses of 0, 0.625, 1.25, and 2.5 g/kg in corn oil for 1-2 days to examine micronucleus formation in bone marrow erythrocytes. One female died in the 2.5 g/kg dose group and body weight was not different from controls. No changes in micronucleus formation or polychromatic erythrocytes occurred at any dose.
CASRN 64742-48-9 did not induce chromosomal aberrations in this assay.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
Styrene tested positive for SCEs, DNA strand breaks and DNA adducts *in vitro*. See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_095.pdf

CASRN 100-42-5 induced chromosomal aberrations in these assays.

Naphthalene (CASRN 91-20-3, supporting chemical)
Naphthalene has been tested in Chinese Hamster Ovary (CHO) cells and in sister chromatid exchange assays. See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 91-20-3 induced chromosomal aberrations in these assays.

Subcategory IV: Hydrotreated C5/C9 blend (No CASRN)
No data available for this endpoint.

Subcategory V: C9+ from o-xylene unit (No CASRN)
No data available for this endpoint.

In vivo

Genetic Toxicity – Gene Mutation

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Toluene has been tested for mutagenicity in several assays. See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 was not considered mutagenic.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
Styrene is not genotoxic in the vast majority of *in vivo* standard mutagenicity tests. See human health data at: http://webnet.oecd.org/hpv/UI/Search.aspx and http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_095.pdf
CASRN 100-42-5 was not considered mutagenic.

Genetic Toxicity – Chromosomal Aberrations

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Toluene has been tested for genotoxicity in several assays. See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 did not induce chromosomal aberrations in these assays.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 did not induce chromosomal aberrations in these assays.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
Mouse lymphoma cells were exposed to mixed xylenes at doses of 0, 5.6-87.0 µg/mL with or without metabolic activation, no mutational events were induced. See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.
CASRN 1330-20-7 did not induce chromosomal aberrations in this assay.

Heavy Aromatic Distillate (CASRN 64742-48-9, supporting chemical)
Mice (2/sex/dose) were exposed to CASRN 64742-48-9 at doses of 0, 0.625, 1.25, and 2.5 g/kg in corn oil for 1-2 days to examine micronucleus formation in bone marrow erythrocytes. One female died in the 2.5 g/kg dose group and body weight was not different from controls. No changes in micronucleus formation or polychromatic erythrocytes occurred at any dose.
CASRN 64742-48-9 did not induce chromosomal aberrations in this assay.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 100-42-5 did not induce chromosomal aberrations *in vivo*.

Naphthalene (CASRN 91-20-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 91-20-3 did not induce micronuclei these assays.

Additional Information

Skin Irritation

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 is irritating to the skin.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 is irritating to the skin.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53, http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=64572a9c-b517-4f0a-a9c0-8953539bf5c9&idx=0.
CASRN 1330-20-7 is irritating to the skin.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 100-42-5 is irritating to the skin.

Naphthalene (CASRN 91-20-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 91-20-3 is irritating to the skin.

Eye Irritation

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 is irritating to the eye.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 is irritating to the eye.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53, http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=64572a9c-b517-4f0a-a9c0-8953539bf5c9&idx=0.
CASRN 1330-20-7 is irritating to the eye.

Sensitization

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 is negative in skin sensitization assays.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.
Ethylbenzene (CASRN 100-41-4, supporting chemical)
See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 is negative in skin sensitization assays.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 100-42-5 is negative in skin sensitization assays.

Naphthalene (CASRN 91-20-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
CASRN 91-20-3 is negative in skin sensitization assays.

Carcinogenicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
Toluene has been evaluated for carcinogenicity via the inhalation route of exposure in rats and mice. The rat study was negative and non-malignant tumors were observed in the pituitary gland in mice. In a skin painting study in mice, malignant skin tumors occurred at concentrations causing skin irritation; however, the effects were not considered statistically significant. See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 is not considered to be carcinogenic.

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Ethylbenzene (CASRN 100-41-4, supporting chemical)
Ethylbenzene has been evaluated for carcinogenicity via the inhalation route of exposure in rats and mice. Lung tumors were observed in male mice, liver tumors in female mice and an increased incidence of kidney tumors in rats (both sexes). See human health data at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
CASRN 100-41-4 is considered carcinogenic.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
Mixed xylenes has been evaluated for carcinogenicity via the oral route in rats and mice. There was no increased incidence of tumors in either specie. See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53, http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=64572a9c-b517-4f0a-a9c0-8953539bf5c9&idx=0.
CASRN 1330-20-7 is negative in carcinogenicity studies.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
An agreement on the interpretation of available information on the genotoxicity and carcinogenicity of styrene was not made at SIAM (1996; http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=96240163-414e-4da4-8f1f-82dce4c16be2&idx=0). The National Toxicology Program (NTP) found that styrene was negative for carcinogenicity in rats and female mice (oral route) but there was an increased incidence of lung adenomas and carcinomas in male mice, which was considered equivocal

(http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?fuseaction=abstracts.abstract&chemical_name=Styrene&cas_no=100-42-5&study_no=C02200A&study_length=2%20Years&abstract_url=07059C3F-BEA9-487F-F6B78FB485DFE06F&next=longtermbioassaydata.datasearch). The carcinogenic potential of styrene has not been evaluated by EPA and DHHS (http://www.epa.gov/iris/subst/0104.htm and http://www.atsdr.cdc.gov/ToxProfiles/tp53.pdf)
CASRN 100-42-5 shows increased incidence of tumors in mice but not rats.

Naphthalene (CASRN 91-20-3, supporting chemical)
Naphthalene has been evaluated for carcinogenicity via the inhalation route in mice. A statistically significant tumorigenic response was found in female B6C3F1 mice. See human health data at: http://ecb.jrc.ec.europa.eu/esis/ and http://www.epa.gov/iris/toxreviews/0436tr.pdf.
CASRN 91-20-3 shows an increased incidence in tumors in female mice.

Neurotoxicity

Subcategory I: High Toluene Streams
Toluene (CASRN 108-88-3, supporting chemical)
(1) See human health data at: http://ecb.jrc.ec.europa.eu/esis/index
CASRN 108-88-3 is neurotoxic.

(2) There is a considerable database on the effects of repeated exposure to styrene in humans (http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=e1315e8d-6a51-4a59-b4da-a3d24baade0d&idx=0).

See human health data at: http://www.epa.gov/iris/subst/0118.htm and http://www.epa.gov/oppt/vccep/pubs/chem13a.html.
LOAEC = 132 ppm (~ 0.5 mg/L/day) (based on neurological effects in occupationally exposed workers)
NOAEC = 32 ppm (~ 0.12 mg/L/day)

Subcategory II: Mixed Aromatics Streams
See data for CASRN 108-88-3.

Xylenes, mixed (CASRN 1330-20-7, supporting chemical)
(1) Signs of neurotoxicity observed in rats, mice, dogs, cats, and gerbils following acute and intermediate inhalation and gavage exposure to the various xylene isomers include narcosis, prostration, incoordination, tremors, muscular spasms, labored breathing, behavioral changes, hyperreactivity to stimuli, altered visual evoked potentials, elevated auditory thresholds, hearing loss, and decreased acetylcholine in midbrain and norepinephrine in hypothalamus. See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.
CASRN 1330-20-7 is neurotoxic.

(2) See human health data at: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53.

LOAEC = 14 ppm (used to derive a chronic-duration minimal risk level (MRL) for mixed xylenes)
CASRN 1330-20-7 increased prevalence of anxiety, forgetfulness, inability to concentrate and other subjective symptoms in chronically exposed humans.

Subcategory III: Pyrolysis C7-C12 (No CASRN)
See data for CASRN 108-88-3 and 1330-20-7.

Styrene (CASRN 100-42-5, supporting chemical)
(1) Neurotoxicity is a key issue with styrene; however, no agreement was reached at SIAM on the interpretation of neurotoxicity studies (1996; http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=96240163-414e-4da4-8f1f-82dce4c16be2&idx=0).

(2) In the workplace, irritation is reported at styrene levels exceeding 0.105 mg/L. CNS depression is reported in workers exposed to styrene. Styrene-induced symptoms of acute CNS depression (similar to those observed with many solvents) include drowsiness, dizziness, headache, and impaired balance. See human health data at: http://ecb.jrc.ec.europa.eu/esis/
LOAEC >100 ppm (~ 0.43 mg/L)
NOAEC ≤ 100 ppm (~0.43 mg/L)

(3) See human health data at: http://www.epa.gov/iris/subst/0104.htm and http://www.atsdr.cdc.gov/ToxProfiles/tp53.pdf
CASRN 100-42-5 is neurotoxic.

Other

Subcategory III: Pyrolysis C7-C12 (No CASRN)
Naphthalene (CASRN 91-20-3, supporting chemical)
See human health data at: http://ecb.jrc.ec.europa.eu/esis/
Acute hemolytic anemia has been reported in children, teenagers, and adults with accidental or intentional exposure to CASRN 91-20-3 but the dose-response relationship is not known. Individuals who are deficient in glucose-6-phosphate dehydrogenase (G-6-PD) are particularly sensitive to hemolytic anemia produced by CASRN 91-20-3. An *in vivo* study in rabbits demonstrated that the anemia is caused by the naphthalene metabolite, 1-naphthol.

Conclusion: For human health endpoints, the nine streams in the low benzene naphthas category have been divided into five subcategories based on similarities and differences in the individual stream components.

Subcategory I: High Toluene Streams
There are no human health data available on the sponsored streams. Subcategory I contains streams with a relatively high concentration of CASRN 108-88-3, which is used as a supporting chemical to address the human health endpoints.

The acute oral and dermal toxicity of CASRN 108-88-3 is low in rats and rabbits, respectively. The acute inhalation toxicity is moderate in rats and mice. In a 13-week oral repeated-dose study

in mice, CASRN 108-88-3 showed increased absolute and relative liver weights in females at 312 mg/kg-day (lowest dose tested) and above; the NOAEL for systemic toxicity is not established. In a 13-week oral repeated-dose study in rats, CASRN 108-88-3 showed increased absolute and relative liver and kidney weights in males at 446 mg/kg-day; the NOAEL for systemic toxicity is 223 mg/kg-day. In a 14-week inhalation repeated-dose study in mice, CASRN 108-88-3 showed mortality and increased relative liver weight in both sexes at 2.4 mg/L/day; the NOAEC for systemic toxicity is 0.38 mg/L/day. In a 14-week inhalation repeated-dose study in rats, CASRN 108-88-3 showed changes in relative liver weights in males at 4.7 mg/L/day; the NOAEC for systemic toxicity is 2.4 mg/L/day. Lifetime inhalation exposure of rats to CASRN 108-88-3 caused degeneration of nasal epithelium and increased incidence of stomach ulcers at 2.4 mg/L/day; ototoxicity was observed at 2.7 mg/L/day. In an inhalation reproductive screening test and a two-generation reproductive toxicity study in rats, CASRN 108-88-3 significantly decreased the sperm count, epididymal weight and pup weights at 7.5 mg/L/day; the NOAEC for reproductive toxicity is 2.3 mg/L/day. In the two-generation inhalation reproductive toxicity study in rats, developmental toxicity included decreased fetal growth and pup weight accompanied by delayed ossification in F1 and F2 offspring at 3.8 mg/L/day; the NOAEC for developmental toxicity is 2.3 mg/L/day and the NOAEC for maternal toxicity is 4.3 mg/L/day (highest concentration tested). CASRN 108-88-3 is not considered genotoxic *in vitro* or *in vivo* or carcinogenic in rats and mice. CASRN 108-88-3 is irritating to the skin and eye, but is not a skin sensitizer. CASRN 108-88-3 exposure leads to neurotoxicity including hearing loss and long lasting (> 6 months) effects on brain neurochemistry in rats. Human exposure to CASRN 108-88-3 has associated the inhalation of high concentrations with chronic effects on the brain and central nervous system, impaired color vision and ototoxicity.

Subcategory II: Mixed Aromatics Streams

There are no human health data available on the sponsored streams. Subcategory II contains streams characterized by a mixture of aromatics. Supporting chemicals for the human health endpoints are CASRN 64742-48-9, a toxicologically similar mixture, and individual component chemicals; CASRNs 108-88-3, 100-41-4 and 1330-20-7. For CASRN 108-88-3, please see summary for subcategory I.

The acute oral toxicity of CASRNs 64742-48-9, 100-41-4 and 1330-20-7 is low in rats. The acute inhalation toxicity of CASRN 64742-48-9 is high in rats and moderate for CASRNs 100-41-4 (rats) and 1330-20-7 (rats and mice). The acute dermal toxicity of CASRN 100-41-4 is low in rabbits. Repeated-dose inhalation exposure of rats to CASRN 100-41-4 for up to two years showed pituitary hyperplasia in females at 1.1 mg/L/day and effects on the lung, liver and thyroid in males at 3.3 mg/L/day; the NOAEC for systemic toxicity is 0.3 (female) and 1.1 (male) mg/L/day. Repeated-dose inhalation exposure of rats to CASRN 1330-20-7 for up to six months showed increased relative liver weights and histopathological changes at 4.0 mg/L/day; the NOAEC for systemic toxicity is 1.5 mg/L/day. In 13-week oral repeated-dose studies in rats and mice, CASRN 1330-20-7 showed decreased body weights (rats) and mortality (mice) at 2000 mg/kg-day; the NOAEL for systemic toxicity is 1000 mg/kg-day. In a two-generation inhalation reproductive toxicity study in rats, CASRN 100-41-4 showed no treatment-related effects; the NOAEC for reproductive toxicity is 2.2 mg/L/day (highest concentration tested). In a one-generation inhalation reproductive toxicity study in rats, CASRN 1330-20-7

showed no treatment-related effects; the NOAEC for reproductive toxicity is 2.2 mg/L/day (highest concentration tested). In prenatal inhalation developmental toxicity studies in rats and rabbits, CASRN 100-41-4 showed organ weight changes at 4.4 mg/L/day in both species. In rats, skeletal variations were observed in the fetuses at 4.3 mg/L; no developmental effects were observed in rabbits. The NOAEC for maternal toxicity is 4.3 mg/L/day (rats and rabbits) and the NOAEC for developmental toxicity is 0.4 mg/L/day in rats, and 4.4 mg/L/day in rabbits (highest concentration tested). In a prenatal inhalation developmental toxicity study in rats, CASRN 1330-20-7 decreased body weight, weight gain and food consumption in dams at 4.4 mg/L/day and decreased fetal body weight at 2.2 mg/L/day; the NOAEC for maternal toxicity is 2.0 mg/L/day and the NOAEC for developmental toxicity is 0.44 mg/L/day. CASRNs 100-41-4 and 1330-20-7 were not mutagenic in bacteria or mammalian cells *in vitro*. CASRN 100-41-4 induced chromosomal aberrations in mammalian cells *in vitro* but not *in vivo*. CASRN 1330-20-7 did not induce chromosomal aberrations in mammalian cells *in vitro* or *in vivo*. CASRN 1330-20-7 did not increase the incidence of tumors in rats or mice. CASRN 100-41-4 increased the incidence of tumors in rats and mice. CASRNs 64742-48-9, 100-41-4 and 1330-20-7 are irritating to the skin and eyes; CASRNs 64742-48-9 and 100-41-4 are not skin sensitizers. CASRN 1330-20-7 is neurotoxic. CASRN 1330-20-7 causes anxiety, forgetfulness, and concentration problems in chronically exposed humans.

Subcategory III: Pyrolysis C7-C12

There are no human health data available on the sponsored stream. The human health hazard of subcategory III is characterized by data for CASRNs 108-88-3, 1330-20-7, 100-42-5 and 91-20-3. For CASRNs 108-88-3 and 1330-20-7, please see summaries for subcategories I and II above.

The acute oral toxicity of CASRN 100-42-5 is low in rats and moderate in mice. The acute oral toxicity of CASRN 91-20-3 is low in rats and mice. The acute inhalation toxicity in rats is moderate for CASRN 100-42-5 and high for CASRN 91-20-3. The acute dermal toxicity of CASRN 91-20-3 is low in rats and rabbits. In a 13-week oral repeated-dose study in rats, CASRN 91-20-3 showed decreased body weights at 200 mg/kg-day; the NOAEL for systemic toxicity is 100 mg/kg-day. In a similar study in mice, CASRN 91-20-3 showed decreased relative spleen weight and clinical chemistry changes at 133 mg/kg-day; the NOAEL for systemic toxicity is 53 mg/kg-day. Repeated oral exposures in mice for up to two years with CASRN 100-42-5 showed effects on the nose, liver and lung at doses greater than 150 mg/kg-day; the NOAEL for systemic toxicity is 150 mg/kg-day. Repeated inhalation exposures with CASRN 100-42-5 in rats showed neurotoxicity at concentrations greater than 0.9 mg/L/day and histopathological changes to the olfactory epithelium at 2.1 mg/L/day; the NOAEC for systemic toxicity is 0.9 mg/L. In a four-week repeated-inhalation toxicity study in rats, CASRN 100-42-5 showed ototoxicity at concentrations greater than 1.3 mg/L/day; the NOAEC for systemic toxicity is 1.3 mg/L/day. Repeated inhalation exposures to rats for up to two years with CASRN 91-20-3 showed increased incidences in respiratory epithelial adenomas in both sexes; 0.05 mg/L/day in males and 0.15 mg/L/day in females. The NOAEC for systemic toxicity in males is not established and is 0.05 mg/L/day in females. Repeated dermal dosing of rats with CASRN 91-20-3 showed no adverse effects; the NOAEL for systemic toxicity is 1000 mg/kg/day (highest dose tested). No specific reproductive toxicity studies are available for CASRN 91-20-3; however, in the 13-week oral repeated-dose studies and two-year inhalation

studies in rats and mice, no effects or histopathological changes were observed on the reproductive organs. In a two-generation inhalation reproductive toxicity study in rats, CASRN 100-42-5 showed no adverse effects on reproductive parameters; the NOAEC for reproductive toxicity is 2.1 mg/L/day (highest concentration tested). Decreased body weights and decreased fetal body weights and delayed development were observed at 0.64 mg/L/day; the NOAEC for maternal and developmental toxicity is 0.2 mg/L/day. CASRN 100-42-5 was not mutagenic in bacteria and mammalian cells *in vitro*; however, it did induce chromosomal aberrations in mammalian cells *in vitro*. CASRN 100-42-5 was not mutagenic or genotoxic *in vivo*. CASRN 91-20-3 was not mutagenic in bacteria and mammalian cells *in vitro*; however, it did induce chromosomal aberrations in mammalian cells *in vitro*. CASRN 91-20-3 did not induce micronuclei *in vivo*. CASRNs 100-42-5 increased the incidence of tumors in mice but not rats. CASRN 91-20-3 increased the incidence of tumors in female mice. CASRNs 100-42-5 and 91-20-3 are irritating to the skin and eyes, but are not skin sensitizers. CASRN 100-42-5 is neurotoxic in rodents. CASRN 100-42-5 is known to cause central nervous system depression in humans at concentrations above 100 ppm. CASRN 91-20-3 is associated with acute hemolytic anemia in humans.

Subcategory IV: Hydrotreated C5/C9 blend

No supporting chemical data could be used to characterize the human health hazard of subcategory IV.

Subcategory V: C9+ from o-xylene unit

No supporting chemical data could be used to characterize the human health hazard of subcategory V.

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

Endpoints	Subcategory I: High Toluene Streams			Subcategory II: Mixed Aromatic Streams			Subcategory III	Subcategory IV	Subcategory V
	Pyrolysis C7s (No CASRN)	Toluene extract (No CASRN)	Pyrolysis C7 – C8 fraction (No CASRN)	Hydro-treated C7+ fraction (No CASRN)	Hydro-treated C8-C10 fraction (No CASRN)	Hydro-treated C7–C12 fraction (No CASRN)	Pyrolysis C7 –C12 fraction (No CASRN)	Hydro-treated C5/C9 blend (No CASRN)	C9+ from xylene unit (No CASRN)
Acute Oral Toxicity LD_{50} (mg/kg)	No Data 5500 (RA)	No Data 5500 (RA)	No Data 5500 (RA)	No Data 3500 (RA)	No Data 3500 (RA)	No Data 3500 (RA)	No Data 533 (RA)	–	–
Acute Inhalation Toxicity 6-hr LC_{50} (mg/L)	No Data 22.0 (RA)	No Data 22.0 (RA)	No Data 22.0 (RA)	No Data 1.1 (RA)	No Data 1.1 (RA)	No Data 1.1 (RA)	No Data 1.2 (RA)	No Data	No Data
Repeated-Dose Toxicity NOAEL/LOAEL Oral (mg/kg/day)	No Data NOAEL = Not established LOAEL = 312 (RA)	No Data NOAEL = Not established LOAEL = 312 (RA)	No Data NOAEL = Not established LOAEL = 312 (RA)	No Data NOAEL = Not established LOAEL = 312 (RA)	No Data NOAEL = Not established LOAEL = 312 (RA)	No Data NOAEL = Not established LOAEL = 312 (RA)	No Data NOAEL = 100 LOAEL = 200 (RA)	–	–
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No Data (13-week) NOAEC ~ 4.3 (2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC ~ 0.3-1.1 LOAEC ~ 1.1-3.3 (RA)	No Data (13-week) NOAEC ~ 4.3 (2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC ~ 0.3-1.1 LOAEC ~ 1.1-3.3 (RA)	No Data (13-week) NOAEC ~ 4.3 (2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC ~ 0.3-1.1 LOAEC ~ 1.1-3.3 (RA)	No Data (13-week) NOAEC ~ 4.3 (2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC ~ 0.3-1.1 LOAEC ~ 1.1-3.3 (RA)	No Data (13-week) NOAEC ~ 4.3 (2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC ~ 0.3-1.1 LOAEC ~ 1.1-3.3 (RA)	No Data (13-week) NOAEC ~ 4.3 (2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC ~ 0.3-1.1 LOAEC ~ 1.1-3.3 (RA)	No Data (2-y, rat) NOAEC ~ Not established LOAEC ~ 0.05-0.15 (2-y, mouse) NOAEC = Not established LOAEC ~ 0.05 (RA)	No Data	No Data

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

Endpoints	Subcategory I: High Toluene Streams			Subcategory II: Mixed Aromatic Streams			Subcategory III	Subcategory IV	Subcategory V
	Pyrolysis C7s (No CASRN)	Toluene extract (No CASRN)	Pyrolysis C7 – C8 fraction (No CASRN)	Hydro-treated C7+ fraction (No CASRN)	Hydro-treated C8-C10 fraction (No CASRN)	Hydro-treated C7–C12 fraction (No CASRN)	Pyrolysis C7 –C12 fraction (No CASRN)	Hydro-treated C5/C9 blend (No CASRN)	C9+ from xylene unit (No CASRN)
Reproductive Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data NOAEC = 2.3 LOAEC = 7.5 (RA)	No Data	No Data
Reproductive Toxicity									
Developmental Toxicity NOAEC/LOAEC Inhalation (mg/L/day)									
Maternal Toxicity	No Data NOAEC = 7.5	No Data NOAEC = 7.5	No Data NOAEC = 7.5	No Data (rat) NOAEC = 0.43 LOAEC = 4.3	No Data (rat) NOAEC = 0.43 LOAEC = 4.3	No Data (rat) NOAEC = 0.43 LOAEC = 4.3	No Data (rat) NOAEC = 0.43 LOAEC = 4.3	No Data	No Data
Developmental Toxicity	NOAEC = 2.3 LOAEC = 3.8 (RA)	NOAEC = 2.3 LOAEC = 3.8 (RA)	NOAEC = 2.3 LOAEC = 3.8 (RA)	NOAEC = 0.44 LOAEC = 4.3	NOAEC = 0.44 LOAEC = 4.3	NOAEC = 0.44 LOAEC = 4.3	NOAEC = 0.44 LOAEC = 4.3		
Maternal Toxicity				(rabbit) NOAEC = 0.43 LOAEC = 4.3	(rabbit) NOAEC = 0.43 LOAEC = 4.3	(rabbit) NOAEC = 0.43 LOAEC = 4.3	(rabbit) NOAEC = 0.43 LOAEC = 4.3		
Developmental Toxicity				NOAEC = 0.44 LOAEC = 4.3 (RA)	NOAEC = 0.44 LOAEC = 4.3 (RA)	NOAEC = 0.44 LOAEC = 4.3 (RA)	NOAEC = 0.44 LOAEC = 4.3 (RA)		

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

Endpoints	Subcategory I: High Toluene Streams			Subcategory II: Mixed Aromatic Streams			Subcategory III	Subcategory IV	Subcategory V
	Pyrolysis C7s (No CASRN)	Toluene extract (No CASRN)	Pyrolysis C7 – C8 fraction (No CASRN)	Hydro-treated C7+ fraction (No CASRN)	Hydro-treated C8-C10 fraction (No CASRN)	Hydro-treated C7–C12 fraction (No CASRN)	Pyrolysis C7 –C12 fraction (No CASRN)	Hydro-treated C5/C9 blend (No CASRN)	C9+ from xylene unit (No CASRN)
Genetic Toxicity – Gene Mutation *In vitro*	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data	No Data
Genetic Toxicity – Chromosomal Aberrations *In vitro*	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data	No Data
Genetic Toxicity – Gene Mutation *In vivo*	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	–	–	–
Genetic Toxicity – Chromosomal Aberrations *In vivo*	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)	No Data Positive (RA)	–	–

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

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

Endpoints	SUPPORTING CHEMICAL Toluene (108-88-3)	SUPPORTING CHEMICAL Ethylbenzene (100-41-4)	SUPPORTING CHEMICAL Xylenes, mixed (1330-20-7)	SUPPORTING CHEMICAL Styrene (100-42-5)	SUPPORTING CHEMICAL Naphthalene (91-20-3)	SUPPORTING CHEMICAL Heavy Aromatic Distillates (64742-48-9)
Acute Oral Toxicity LD_{50} (mg/kg)	5500-7500	3500-4700	3523-11,000	(rat) 2650 (mouse) 316	(rat) >2000 (mouse) 533 – 710	>6000
Acute Inhalation Toxicity LC_{50} (mg/L)	(rat) 22.0 – 45.8 (mouse) 19.9 – 27.9	17.4	(rat) 18.8 (mouse) 16.9	9.5-11.8	1.2-1.9	1.1 – 8.5
Acute Dermal Toxicity LD_{50} (mg/kg)	12,400	15,400	–	–	(rat) >2500 (rabbit) >2000	–
Repeated-Dose Toxicity NOAEL/LOAEL Oral (mg/kg/day)	(rat) NOAEL = 223 LOAEL = 446 (mouse) NOAEL = Not established LOAEL = 312	–	NOAEL = 150 LOAEL = 750	(2-y, mouse) NOAEL = 150 LOAEL > 150	(rat) NOAEL = 100 LOAEL = 200 (mouse) NOAEL = 53 LOAEL = 133	–
Repeated-Dose Toxicity NOAEC/LOAEC Inhalation (mg/L/day)	(rat) NOAEC ~ 2.4 LOAEC ~ 4.7 (mouse) NOAEC ~ 2.4 LOAEC ~ 0.38	(13-week, rat & mouse) NOAEC ~ 4.3 (highest concentration tested)	(6-month) NOAEC ~ 1.5 LOAEC ~ 4.0	(4-week) NOAEC ~ 1.3 LOAEC > 1.3	(2-y, rat) NOAEC(f) ~ 0.05 LOAEC(f) ~ 0.15 NOAEC (m) ~ Not established LOAEC (m) ~ 0.05	–

Table 6. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program – Human Health Data						
Endpoints	**SUPPORTING CHEMICAL Toluene (108-88-3)**	**SUPPORTING CHEMICAL Ethylbenzene (100-41-4)**	**SUPPORTING CHEMICAL Xylenes, mixed (1330-20-7)**	**SUPPORTING CHEMICAL Styrene (100-42-5)**	**SUPPORTING CHEMICAL Naphthalene (91-20-3)**	**SUPPORTING CHEMICAL Heavy Aromatic Distillates (64742-48-9)**
		(2-y, rat) NOAEC ~ 1.1 LOAEC ~ 3.3 (2-y, mouse) NOAEC(f) ~ 0.3 LOAEC(f) ~ 1.1 NOAEC (m) ~ 1.1 LOAEC (m) ~ 3.3			**(2-y, mouse) NOAEC = Not established LOAEC ~ 0.05**	
Repeated-Dose Toxicity NOAEL/LOAEL Dermal (mg/kg/day)	–	–	–	–	**NOAEL = 1000 (highest dose tested)**	–
Reproductive Toxicity NOAEC/LOAEC Inhalation (mg/L/day) Reproductive Toxicity	**NOAEC = 2.3 LOAEC = 7.5**	**NOAEC = 2.2 (highest concentration tested)**	**NOAEC = 2.2 (highest concentration tested)**	**NOAEC = 2.1 (highest concentration tested)**	No effects or histopathological changes in reproductive organs in 13-week oral and 2-y inhalation studies in rats and mice.	–
Developmental Toxicity NOAEC/LOAEC Inhalation (mg/L/day) Maternal Toxicity Developmental Toxicity Maternal Toxicity Developmental Toxicity	**NOAEC = 7.5 (highest concentration tested) NOAEC = 2.3 LOAEC = 3.8**	**(rat) NOAEC = 0.43 LOAEC = 4.3 NOAEC = 0.44 LOAEC = 4.3 (rabbit) NOAEC = 0.43 LOAEC = 4.3 NOAEC = 0.44 LOAEC = 4.3**	**NOAEC = 2.2 LOAEC = 4.4 NOAEC = 0.44 LOAEC = 2.2**	**NOAEC = 0.2 LOAEC = 0.64 NOAEC = 0.2 LOAEC = 0.64**	– –	– –

Table 6. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program – Human Health Data						
Endpoints	**SUPPORTING CHEMICAL Toluene (108-88-3)**	**SUPPORTING CHEMICAL Ethylbenzene (100-41-4)**	**SUPPORTING CHEMICAL Xylenes, mixed (1330-20-7)**	**SUPPORTING CHEMICAL Styrene (100-42-5)**	**SUPPORTING CHEMICAL Naphthalene (91-20-3)**	**SUPPORTING CHEMICAL Heavy Aromatic Distillates (64742-48-9)**
Genetic Toxicity – Gene Mutation *In vitro*	**Negative**	**Negative**	**Negative**	**Negative**	**Negative**	**Negative**
Genetic Toxicity – Chromosomal Aberrations *In vitro*	**Negative**	**Positive**	**Negative**	**Positive**	**Positive**	**Negative**
Genetic Toxicity – Gene Mutation *In vivo*	**Negative**	–	–	**Negative**	–	–
Genetic Toxicity – Chromosomal Aberrations *In vivo*	**Negative**	**Negative**	**Negative**	**Negative**	**Negative**	**Negative**
Additional Information **Skin Irritation** **Eye Irritation** **Skin Sensitization** **Carcinogenicity** **Neurotoxicity**	 **Irritating** **Irritating** **Negative** **Negative** **Positive**	 **Irritating** **Irritating** **Negative** **Positive** –	 **Irritating** **Irritating** - **Negative** **Positive**	 **Irritating** **Irritating** **Negative** **Positive** **Positive**	 **Slightly irritating** **Not irritating** **Negative** **Positive** –	 **Irritating** **Irritating** **Negative** – –

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

4. Hazard to the Environment

A summary of aquatic toxicity data submitted for SIDS endpoints is provided in Table 7. The table also indicates where data for tested category members are read-across (RA) to untested members of the category.

Acute Toxicity to Fish

Naphthalene (CASRN 91-20-3, supporting chemical)
http://ecb.jrc.it/DOCUMENTS/ExistingChemicals/RISK_ASSESSMENT/REPORT/naphthalenereport020.pdf
96-h LC_{50} = 1- 10 mg/L

(1) Pink salmon *(Oncorhynchus gorbuscha*) were exposed to CASRN 91-20-3 for 96 hours.
96-h LC_{50} = 1.2 mg/L (Moles and Rice 1983).

(2) Rainbow trout (*Oncorhynchus mykiss*) juveniles were exposed to CASRN 91-20-3 for 96 hours.
96-h LC_{50} = 1.6 mg/L (DeGraeve et al. 1982).

(3) Fathead minnow (*Pimephales promelas*) fry (120 dph) were exposed to CASRN 91-20-3 for 96 hours at the following concentrations: 0.73, 1.95, 4.29, 10.71, and 24.74 mg/L.
96-h LC_{50} = 9.9 mg/L (Biodynamics, Inc. 1987).

Toluene (CASRN 108-88-3, supporting chemical)
(1)http://webnet.oecd.org/hpv/UI/handler.axd?id=78848f77-7cae-4745-a30e-8eb6ec7a4df7.
96-h LC_{50} = 5.4 - 26 mg/L

(2) Coho salmon (*Oncorhynchus kisutch*) fry were exposed to CASRN 108-88-3 for 96 hours.
96-h LC_{50} = 9.36 mg/L (Korn and Rice 1981).

(3) Rainbow trout (*Oncorhynchus mykiss)* juveniles were exposed to CASRN 108-88-3 for 96 hours.
96-h LC_{50} = 6.78 mg/L (Brooke et al. 1986).

m-Xylene (CASRN 108-38-3, supporting chemical)
(1) Rainbow trout (*Oncorhynchus mykiss)* were exposed to CASRN 108-38-3 for 96 hours. No other information was given: http://webnet.oecd.org/hpv/UI/handler.axd?id=7f6b4807-5217-4626-b47c-e139327a412b.
96-h LC_{50} = 2.6 mg/L

(2) Fathead minnow (*Pimephales promelas)* were exposed to CASRN 108-38-3 for 96 hours. No other information was given: http://webnet.oecd.org/hpv/UI/handler.axd?id=7f6b4807-5217-4626-b47c-e139327a412b.
96-h LC_{50} = 26.7 mg/L

Acute Toxicity to Aquatic Invertebrates

Naphthalene (CASRN 91-20-3, supporting chemical)
(1)http://webnet.oecd.org/hpv/UI/handler.axd?id=663663d9-02b2-4469-8df2-d98919ac0aa9.
48-h NOEC = 0.22 – 0.6 mg/L

(2)*Daphnia magna* were exposed to CASRN 91-20-3 for 48 hours under flow through conditions. *D. magna* were exposed to a control, 0.25, 0.27, 1.96, and 5.15 mg/L of 100% purity.
96-h EC_{50} = 1.96 mg/L (Bio Dynamics Inc. 1987).

Toluene (CASRN 108-88-3, supporting chemical)
Daphnia magna were exposed to CASRN 108-88-3 for 48 hours. No other information was given: http://webnet.oecd.org/hpv/UI/handler.axd?id=78848f77-7cae-4745-a30e-8eb6ec7a4df7
48-h EC_{50} = 11.5 mg/L

m-Xylene (CASRN 108-38-3, supporting chemical)
Daphnia magna were exposed to CASRN 108-88-3 for 48 hours. No other information was given: http://webnet.oecd.org/hpv/UI/handler.axd?id=7f6b4807-5217-4626-b47c-e139327a412b
48-h EC_{50} = 8.5 mg/L

Toxicity to Aquatic Plants

Naphthalene (CASRN 91-20-3, supporting chemical)
http://webnet.oecd.org/hpv/UI/handler.axd?id=663663d9-02b2-4469-8df2-d98919ac0aa9
72-h EC_{50} = 0.4 mg/L

Toluene (CASRN 108-88-3, supporting chemical)
(1) Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 108-38-3 for 72 hours. No other information was given.
72-h EC_{50} = 12.5 mg/ L (Galassi et al. 1988).

m-Xylene (CASRN 108-38-3, supporting chemical)
(1) Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 108-38-3 for 72 hours. No other information was given:
http://webnet.oecd.org/hpv/UI/handler.axd?id=7f6b4807-5217-4626-b47c-e139327a412b
72-h EC_{50} = 3.2 mg/L (Herman et al. 1990).

(2) Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 108-38-3 for 72 hours. No other information was given.
72-h EC_{50} = 4.9 mg/ L (Galassi et al. 1988).

(3) Green algae (*Pseudokirchneriella subcapitata*) were exposed to CASRN 108-88-3 for 72 hours. No other information was given.
72-h EC_{50} = 3.9 mg/ L (Herman et al. 1990).

Conclusion: No data are available for the sponsored streams. The 96-h LC_{50} value for fish ranges from 1 – 10 mg/L for CASRN 91-20-3, 5.4 – 26 mg/L for CASRN 108-88-3 and 2.6 – 26.7 mg/L for CASRN 108-38-3. The 48-h EC_{50} value for aquatic invertebrates ranges from 0.22 – 1.96 mg/L for CASRN 91-20-3, is 8.5 mg/L for CASRN 108-88-3 and 11.5 mg/L for CASRN 108-38-3. The 72-h EC_{50} value for toxicity to aquatic plants is 0.4 mg/L for CASRN 91-20-3, 12.5 mg/L for CASRN 108-88-3 and ranges from 3.2 – 4.9 mg/L for CASRN 108-38-3.

5. References

Brooke, L.T., D.J. Call, S.H. Poirier, and S.L. Harting. 1986. Toxicity of Toluene to Several Freshwater Species. Center for Lake Superior Environmental Stud., Univ.of Wisconsin-Superior, Superior, WI (Report to Battelle Memorial Research Institute, Columbus, OH) :10 p.

Biodynamics, Inc. 1987. A Flow-Through Acute Fish Toxicity Test of Naphthalene. EPA/OTS Doc.#86-870000910 :26 p. (NTIS/OTS 0515348).

DeGraeve, G.M., Elder, R.G., Woods, D.C. and Bergman, H.L. 1982. Effects of Naphthalene and Benzene on Fathead minnows and Rainbow trout. Archives of Environmental Contamination and Toxicology 11(4): 487-490.

Faber, WD, Roberts LS, Stump DG, Tardif R, Krishnan K, Tort M, Dimond S, Dutton D, Moran E, Lawrence W. 2006. Two-generation reproduction study of ethylbenzene by inhalation in Crl-CD rats. Birth Defects Res B 77:10-21.

Galassi, S., Mingazzini, M., Vigano, L., Cesareo, D., and Tosato, M.L. 1988. Approaches to Modeling Toxic Responses of Aquatic Organisms to Aromatic Hydrocarbons. Ecotoxicology and Environmental Safety. 16(2):158-169.

Herman, D.C., Inniss, W.E., and Mayfield, C.I. 1990. Impact of Volatile Aromatic Hydrocarbons, Alone and in Combination, on Growth of the Freshwater Alga *Selenastrum capricornutum.* Aquatic Toxicology. 18(2):87-100.

Korn, S. and Rice, S.D. 1981. Sensitivity to, and Accumulation and Depuration of, Aromatic Petroleum Components by Early Life Stages of Coho Salmon (*Oncorhynchus kisutch*) Rapp. P.V.Reun.Comm.Int.Explor.Sci.Mer Mediterr. 178:87-92.

Moles, A. and Rice, S.D. 1983. Effects of Crude Oil and Naphthalene on Growth, Caloric Content, and Fat Content of Pink Salmon Juveniles in Seawater. Transactions of the American Fisheries Society. 112 (2A): 205-211.

Table 7. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program – Aquatic Toxicity Data									
Endpoints	**SPONSORED CHEMICAL Pyrolysis C7s (No CASRN)**	**SPONSORED CHEMICAL Pyrolysis C7 –C12 fraction (No CASRN)**	**SPONSORED CHEMICAL Pyrolysis C7 – C8 fraction (No CASRN)**	**SPONSORED CHEMICAL C9+ from xylene unit (No CASRN)**	**SPONSORED CHEMICAL Hydro-treated C7+ fraction (No CASRN)**	**SPONSORED CHEMICAL Hydro-treated C8-C10 fraction (No CASRN)**	**SPONSORED CHEMICAL Hydro-treated C7–C12 fraction (No CASRN)**	**SPONSORED CHEMICAL Hydro-treated C5/C9 blend (No CASRN)**	**SPONSORED CHEMICAL Toluene extract (No CASRN)**
Fish 96-h LC_{50} (mg/L)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)	No Data 1-26.7 (RA)
Aquatic Invertebrates 48-h EC_{50} (mg/L)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)	No Data 0.22-11.5 (RA)
Aquatic Plants 72-h EC_{50} (mg/L)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)	No Data 0.4-12.5 (RA)

(RA) = Read Across

Table 7. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program – Aquatic Toxicity Data			
Endpoints	**SUPPORTING CHEMICAL Toluene (108-88-3, C7)**	**SUPPORTING CHEMICAL *m*-Xylene (108-38-3, C8)**	**SUPPORTING CHEMICAL Naphthalene (91-20-3, C10)**
Fish 96-h LC_{50} (mg/L)	**5.4 - 26**	**2.6-26.7**	**1-10**
Aquatic Invertebrates 48-h EC_{50} (mg/L)	**11.5**	**8.5**	**0.22 – 1.96**
Aquatic Plants 72-h LC_{50} (mg/L)	**12.5**	**3.2-4.9**	**0.4**

bold = experimental data (i.e., derived from testing)

APPENDIX

The following pages show:

- Table 8 with typical stream constituents
- Table 9 with representative structures of the sponsored substances and the supporting chemicals
- Table 10 with Reference Sources for Supporting Chemical Data
- Description of origin of the low benzene naphthas category members and the associated diagram are taken from the sponsor's original final 2009 Category Summary (identified as "Revised Summaries" under the Final Revision posted on August 4, 2009 at: http://www.epa.gov/oppt/chemrtk/pubs/summaries/hibenznp/c13436tc.htm).

Table 8. Typical Compositions (wt%) of the Process Streams in the Low Benzene Naphthas Category[a]

Component Name	CASRN	Pyrolysis C7s	Toluene extract	Pyrolysis C7 – C8 fraction	Hydrotreated C7+	Hydrotreated C7 – C12	Hydrotreated C8 – C10	Pyrolysis C7 – C12	Hydrotreated C5/C9 blend	C9+ from *o*-xylene unit
Toluene	108-88-3	75	75 – 80	45 – 80	15 – 30	20.25	2.4	22 – 23		
Ethyltoluenes	622-96-8; 611-14-3				1 – 5		6			52.82
Benzene	71-43-2		<0.1	5		1	0 – 0.4	1.5 – 2	3	
Ethylbenzene	100-41-4		5 – 20	7 – 25	10 – 20	10 – 15	2.4 – 10.7	3 – 5	9	
Xylenes, mixed	1330-20-7		5 – 20	3.5 – 45	10 – 20	10 – 15	3.3 – 17.9	9 – 17		
Styrene	100-42-5			0.5	1 – 3			10 – 11	0.5 – 5	
Naphthalene	91-20-3				2		0.2 – 7.8	7 – 9	0.2 – 4	11.5
Tricyclodecane (Tetrahydrodicyclo-pentadiene, JP-10?)	6004-38-2; 2825-82-3?						44			
2-Pentene (isomer mix)	109-68-2; 627-20-3; 646-04-8								7 – 15	
Remaining C6 – C7 non-aromatic hydrocarbons	-			0.2 – 12						
C8 Paraffins & naphthenes	-						0.1	35		
C9 Aromatics	-					10 – 20	4.6		19	
C9's	-							10	25	
C9+ Aromatics	-									96.18
C10 Aromatics	-					10 – 20	1.8			
C – 11 Isoparaffins	-						18			
C10 – C11 Alkylbenzenes	-				13 – 35					
C11+ Aromatics	-					10 – 15				
Heavy hydrocarbons and polycyclic aromatics	-									22.4
Nonaromatics	-			10 – 20						
Other components		C7 Olefins 25%					1,4-Methyl-ethylbenzene 9.4%; indane 8.5%; sec-butyl-cyclohexane 8.8%	C6 Hydrocarbons 9%; C10+ 17%	Isopentane 3–7%; cyclopentene 4 – 8%; 2-methyl-2-butene 4 – 8%; C10+ 25%	2-Methyl-naphthalene 8.7%

[a]Several of the lower percentage (< 6%) components of these streams have not been included in this table.

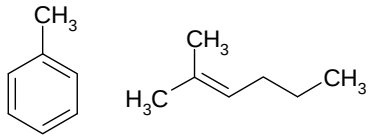
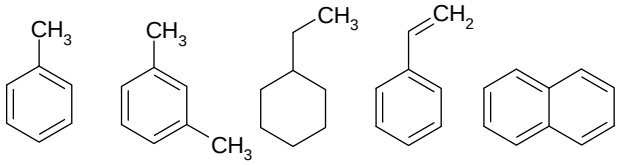
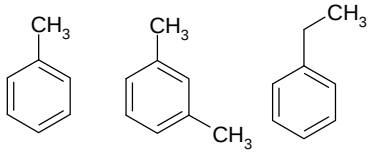
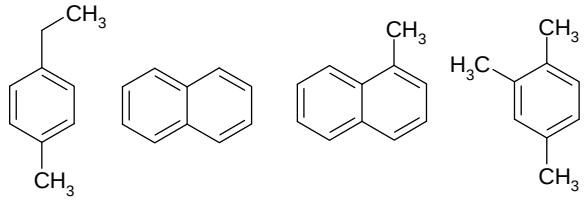
Table 9. Representative Chemical Structures of Low Benzene Naphthas Category stream constituents and supporting chemicals[1]		
Name	**CASRN**	**Representative Structures and Description**
Sponsored Chemicals		
Pyrolysis C7s	68527-23-1; 68478-10-4[2]	 A distillate fraction of pyrolysis gasoline that mainly contains C7 hydrocarbons; a typical composition is 75% toluene, 25% unspecified C7 olefins, with <1% benzene.
Pyrolysis C7–C12 fraction	68516-20-1; 64742-83-2[3]; 68476-45-9[3]	 A distillate fraction of pyrolysis gasoline that mainly contains C7–12 hydrocarbons; a typical composition is 23% toluene, 9–17% xylenes, 35% unspecified C8 paraffins and cycloparaffins, 10–11% styrene, 7–9% naphalene, with 1.5–2% benzene.
Pyrolysis C7–C8 fraction	68527-23-1; 68919-15-3	 A distallate fraction of pyrolysis gasoline that mainly contains C7–8 hydrocarbons; a typical composition is 45–80% toluene, 3.5–45% xylenes, 7–25% ethylbenzene, with 2–5% benzene.
C9+ from Xylene unit	68333-88-0; 68553-14-0	 A byproduct of *o*- or *p*-xylene production containing predominantly aromatic hydrocarbons with carbon number of C9+; a typical composition is 58% methylethylbenzenes, 11% naphthalene, 9% methylnaphthalene, 4% trimethylbenzenes, 22% other heavy hydrocarbons and polycyclic aromatics, with <1% benzene

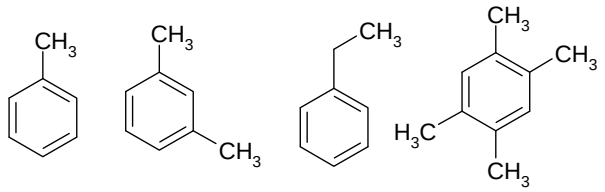
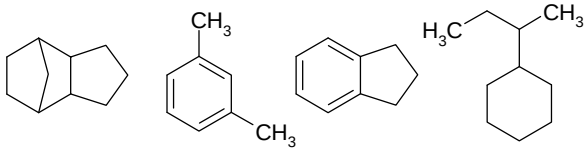
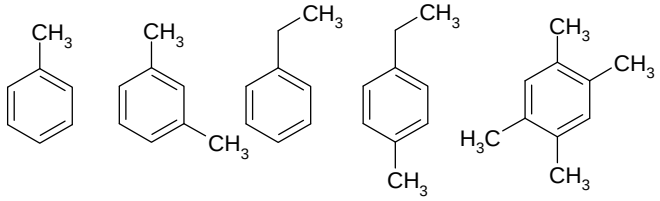
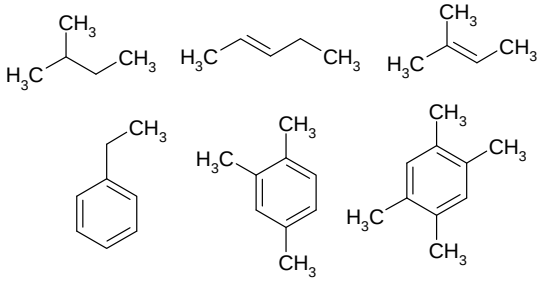
Table 9. Representative Chemical Structures of Low Benzene Naphthas Category stream constituents and supporting chemicals[1]		
Name	**CASRN**	**Representative Structures and Description**
Hydrotreated C7+ fraction	64742-48-9	 A distillate fraction from the hydrogenation of a pyrolysis gasoline stream; a typical composition is 15–30% toluene, 10–20% xylenes, 10–20% ethylbenzene, 13–35% C10–11 alkylbenzene, with <1% benzene.
Hydrotreated C8–C10 fraction	68512-78-7; 64742-48-9	 A distillate fraction from the hydrogenation of a pyrolysis gasoline stream, with hydrocarbons predominantly in the range of C8–10; a typical composition is 44% tricyclodecane, 3–8% xylenes, 8% indane, 9% sec-butylcyclohexane, with 0–0.4% benzene.
Hydrotreated C7–C12 fraction	64742-48-9; 68516-20-1	 A distillate fraction from the hydrogenation of a pyrolysis gasoline stream, with hydrocarbons predominantly in the range of C7–12; a typical composition is 2–25% toluene, 10–15% xylenes, 10–15% ethylbenzene, 10–20% C9 aromatics, 10–20% C10 aromatics, 10–15% C11+ aromatics, with <1% benzene.
Hydrotreated C5/C9 Blend	64742-49-0;	 A blend of hydrogenated C5 and C9 pyrolysis gasoline

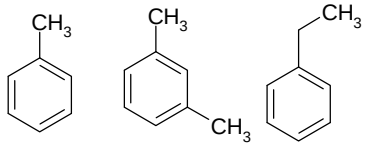
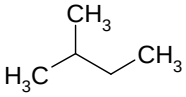
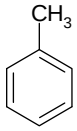
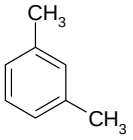
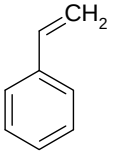
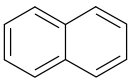
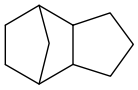
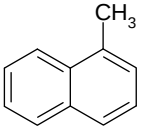
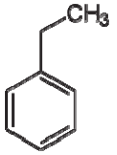
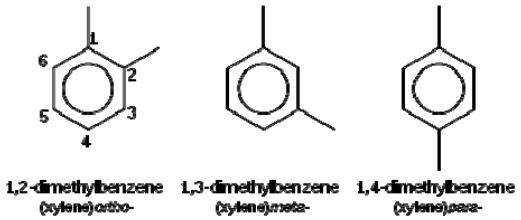
Table 9. Representative Chemical Structures of Low Benzene Naphthas Category stream constituents and supporting chemicals[1]		
Name	**CASRN**	**Representative Structures and Description**
		fractions; a typical compostion is 3–7% isopentane, 7–15% 2-pentenes, 4–8% 2-methyl-2-butene, 9% ethylbenzene, 19% C9 aromatics, 25% C10 aromatics, with 3% benzene.
Toluene Extract	64741-98-6	 Byproduct of a benzene extraction unit; a typical composition is 75–80% toluene, 5–20% xylenes, 5–20% ethylbenzene, with <0.1% benzene.
Supporting Chemicals		
Butane, 2-methyl- (isopentane)	78-78-4	
Benzene, methyl- (toluene)	108-88-3	
Benzene, 1,3-dimethyl (m-xylene)	108-38-3	
Benzene, ethenyl- (styrene)	100-42-5	
Naphthalene	91-20-3	
4,7-Methano-1H-indene, octahydro- (tricyclodecane)	6004-38-2	
Naphthalene, 1-methyl-	90-12-0	
Benzene, ethyl-	100-41-4	

Table 9. Representative Chemical Structures of Low Benzene Naphthas Category stream constituents and supporting chemicals[1]

Name	CASRN	Representative Structures and Description
Xylene, mixed isomers[4]	1330-20-7	
Naphtha, Hydrotreated Heavy (Heavy Aromatic Distillates)	64742-48-9	A mixture of C9-C13 naphthenes, iso- and n-paraffins. Neither the concentration of aromatics nor of hexane is greater than 0.1% by volume. Depending on the raw material and the production processes, the composition and physical properties of this solvent can vary considerably.[5]

[1]Note on representative structures: The structures chosen for each category stream were largely based on the compositional data presented on p.40–42 of the revised test plan. It should be understood that each category stream consists of numerous hydrocarbon substances, well beyond the two to six compounds shown here for most streams. Moreover, the component process streams designated by the CASRNs above can be blended in various proportions when manufacturing each category stream, which accounts for the wide range of compositions stated for several of the constituent compounds. For xylenes, m-xylene was chosen as the representative structure, as it is a supporting chemical for physicochemical properties and environmental hazard.

[2]The component stream (CASRN 68478-10-4) has a CAS definition stating that it consists predominantly of cyclic olefinic and aromatic hydrocarbons in the C8 to C16 range. This is inconsistent with the compositional data provided on pp. 41–43 of the test plan, which shows that the category member Pyrolysis C7s consists predominantly of C7 hydrocarbons, and so is unlikely to be made up from a component which is based on C8 to C16 hydrocarbons.

[3]The compositional data on pp. 41–43 of the test plan states that a typical composition for the Pyrolysis C7-C12 category member contains 1.5–2% benzene. However, the CAS definitions for two of the component streams making up this category member are inconsistent with this low level of benzene. CASRN 64742-83-2, by its CAS definition, can contain 10% or more benzene by volume; CASRN 68476-45-9 has a CAS definition that states it consists predominantly of benzene. Hence, there is an inconsistency between the compositions of the component streams and the final composition of this category member.

[4]Techincal grade mixed xylenes (xylol) is a mixture of all three isomers of xylene (*m*-, *o*-, and *p*-xylene) in varying concentrations and also typically contains 6-15% ethylbenzene (CASRN 100-41-4).

[5]NIOSH International Chemical Safety Card: http://www.cdc.gov/niosh/ipcsneng/neng1380.html. Information on the composition of CASRN 64742-48-9 was not provided by the sponsor.

Table 10. Reference Sources for Supporting Chemical Data		
CASRN	**CHEMICAL**	**SOURCE**
78-78-4	Isopentane	HPV submission for Petroleum Gases Category: http://www.epa.gov/chemrtk/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 Assessed as OECD HPV at SIAM 26 in the C5 aliphatic hydrocarbon solvents category: http://webnet.oecd.org/hpv/ui/handler.axd?id=b2243087-cb08-4f47-bd24-9df8ca840c7d
108-88-3	Toluene	2000 ATSDR Tox Profile: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=161&tid=29 2005 EPA IRIS toxicological review: http://www.epa.gov/iris/subst/0118.htm EPA VCCEP Program: http://www.epa.gov/oppt/vccep/pubs/chemmain.html Assessed as OECD HPV at SIAM 11: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=e1315e8d-6a51-4a59-b4da-a3d24baade0d&idx=0 2003 EU Risk Assessment Report: http://ecb.jrc.ec.europa.eu/esis/
108-38-3	*m*-Xylene	Assessed as OECD HPV at SIAM 16 in the xylenes category: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=64572a9c-b517-4f0a-a9c0-8953539bf5c9&idx=0
100-42-5	Styrene	2010 ATSDR draft Tox Profile: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=421&tid=74 NIEHS CERHR review: http://cerhr.niehs.nih.gov/evals/styrene/Styrene_final.pdf EPA IRIS assessment: http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showKeywordResults&maxrows=15&startrow=1&textfield=100-42-5&searchtype=irisdata Assessed as OECD HPV at SIAM 4: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=96240163-414e-4da4-8f1f-82dce4c16be2&idx=0 2002 EU Risk Assessment Report: http://ecb.jrc.ec.europa.eu/esis/
91-20-3	Naphthalene	2005 ATSDR Tox Profile: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=240&tid=43 EPA IRIS assessment: http://www.epa.gov/iris/toxreviews/0436tr.pdf Assessed as OECD HPV at SIAM 5: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=6e0025b7-e1b2-459d-b61e-54db1a4016b4&idx=0

Table 10. Reference Sources for Supporting Chemical Data		
CASRN	**CHEMICAL**	**SOURCE**
6004-38-2	Tricyclodecane	Discussed at SIAM 31 in OECD in C10-C12 aromatic hydrocarbons solvents category but the assessment has not been finalized: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=6e0025b7-e1b2-459d-b61e-54db1a4016b4&idx=0
1321-94-4	Methylnaphthalene	Discussed at SIAM 31 in OECD in C10-C12 aromatic hydrocarbons solvents category but the assessment has not been finalized: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=6e0025b7-e1b2-459d-b61e-54db1a4016b4&idx=0
1330-20-7	Xylenes, mixed	2007 ATSDR Tox Profile: http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=296&tid=53 Assessed as OECD HPV at SIAM 16 in xylenes category: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=64572a9c-b517-4f0a-a9c0-8953539bf5c9&idx=0 2003 EPA IRIS assessment: http://www.epa.gov/ncea/iris/toxreviews/0270tr.pdf EPA VCCEP Program: http://www.epa.gov/oppt/vccep/pubs/chemmain.html
100-41-4	Ethylbenzene	2010 ATSDR Tox Profile: http://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=383&tid=66#bookmark07 EPA IRIS assessment: http://www.epa.gov/iris/subst/0051.htm#noncar EPA VCCEP Program: http://www.epa.gov/oppt/vccep/pubs/chem8c.html Assessed as OECD HPV at SIAM 4: http://www.chem.unep.ch/irptc/sids/OECDSIDS/100414.pdf
64742-48-9	Heavy aromatic distillates (HAD)	Assessed as OECD HPV at SIAM 31 in C7-C9 aliphatic hydrocarbon solvents category: http://webnet.oecd.org/hpv/UI/SIDS_Details.aspx?Key=3d7729d4-6a7e-4c3a-9507-83b0c20f24cb&idx=0

Origin of Low Benzene Naphtha Streams

The following diagram from the sponsor can be found on page 39 of the final 2009 Category Summary (identified as "Revised Summaries" under the Final Revision posted on August 4, 2009 at: http://www.epa.gov/oppt/chemrtk/pubs/summaries/hibenznp/c13436tc.htm).

Figure A1-1. Chemical Process Operations Associated with Process Streams in the Low Benzene Naphthas Category.