

## SCREENING-LEVEL HAZARD CHARACTERIZATION Trimellitate Category

### SPONSORED CHEMICALS

**1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester (CASRN 3319-31-1)**

**1,2,4-Benzenetricarboxylic acid, triisooctyl ester (CASRN 27251-75-8)**

**1,2,4-Benzenetricarboxylic acid, triisononyl ester (CASRN 53894-23-8)**

**1,2,4-Benzenetricarboxylic acid, decyl octyl ester (CASRN 67989-23-5)**

### SUPPORTING CHEMICAL

**1,2,4-Benzenetricarboxylic acid, mixed decyl, hexyl and octyl esters  
(CASRN 68130-50-7)**

The High Production Volume (HPV) Challenge Program<sup>1</sup> 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<sup>1,2</sup>) endpoints that are screening-level indicators of potential hazards (toxicity) for humans or the environment.

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

The evaluation is performed according to established EPA guidance<sup>2,3</sup> 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.

<sup>1</sup> U.S. EPA. High Production Volume (HPV) Challenge Program; <http://www.epa.gov/chemrtk/index.htm>.

<sup>2</sup> U.S. EPA. HPV Challenge Program – Information Sources; <http://www.epa.gov/chemrtk/pubs/general/guidocs.htm>.

<sup>3</sup> U.S. EPA. Risk Assessment Guidelines; <http://cfpub.epa.gov/ncea/raf/rafguid.cfm>.

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.

<p><b>Chemical Abstract Service Registry Number (CASRN)</b></p>	<p><b>Sponsored Chemicals</b> 3319-31-1 27251-75-8 53894-23-8 67989-23-5</p> <p><b>Supporting Chemical</b> 68130-50-7</p>
<p><b>Chemical Abstract Index Name</b></p>	<p><b>Sponsored Chemicals</b> 1,2,4-Benzenetricarboxylic acid, 1,2,4-tris(2-ethylhexyl) ester 1,2,4-Benzenetricarboxylic acid, 1,2,4-triisooctyl ester] 1,2,4-Benzenetricarboxylic acid, 1,2,4-triisononyl ester 1,2,4-Benzenetricarboxylic acid, decyl octyl ester</p> <p><b>Supporting Chemical</b> 1,2,4-Benzenetricarboxylic acid, mixed decyl and hexyl and octyl esters</p>
<p><b>Structural Formula</b></p>	<p><b>see Table 1</b></p>
<p style="text-align: center;"><b>Summary</b></p> <p>The trimellitate category consists of colorless to slightly yellow liquid chemical substances which have negligible water solubilities and negligible vapor pressures. The trimellitates are expected to have low mobility in soil. Volatilization of the trimellitates is expected to be moderate. The rate of hydrolysis is negligible to slow. The rate of atmospheric photooxidation is considered moderate. The trimellitates are expected to have low persistence (P1) and low bioaccumulation potential (B1).</p> <p>Acute oral toxicity of CASRNs 3319-31-1 and 53894-23-8 to rats and acute dermal toxicity of CASRN 3319-31-1 to rabbits is low. CASRN 3319-31-1 was slightly irritating to rabbit skin or eyes and was not a skin sensitizer in guinea pigs. Repeated exposures to CASRN 3319-31-1 via the oral route in rats showed changes in organ weights, clinical chemistry, hematology and histopathology at 650 mg/kg-bw/day with a NOAEL of 184 mg/kg-bw/day for systemic toxicity. A combined oral reproductive/developmental toxicity screening test in rats using CASRN 3319-31-1 showed decreased numbers of spermatocytes and spermatids in the testes at 300 mg/kg-bw/day; the NOAEL for reproductive toxicity was 100 mg/kg-bw/day. No evidence of developmental toxicity was seen in this study with a NOAEL of 1000 mg/kg-bw/day for maternal and developmental toxicity. CASRN 3319-31-1 did not induce gene mutations or chromosomal aberrations <i>in vitro</i>.</p> <p>The measured acute and chronic toxicity values of CASRN 3319-31-1 to fish aquatic invertebrate and aquatic plants indicate no effects at the saturation limit (<math>3.9 \times 10^{-4}</math> mg/L).</p> <p>No data gaps have been identified under the HPV Challenge Program.</p>	

The sponsor, American Chemistry Council (ACC) Phthalate Esters (PE) Panel HPV Testing Group, submitted a Test Plan and Robust Summaries to EPA for the trimellitate category on December 14, 2001. EPA posted the submission on the ChemRTK HPV Challenge website on February 20, 2002 (<http://www.epa.gov/chemrtk/pubs/summaries/trime/c13468tc.htm>). EPA comments on the original submission were posted to the website on December 4, 2002. Public comments were also received and posted to the website. The sponsor submitted updated/ revised documents on March 14, 2002 and July 31, 2007, which were posted to the ChemRTK website on December 4, 2002 and August 30, 2007, respectively. The sponsor submitted a response to EPA comments on October 2, 2007, which was posted to the website on January 7, 2008. The trimellitate category consists of the following substances:

Sponsored Chemicals

1,2,4-Benzenetricarboxylic acid, tris (2-ethylhexyl) ester	CASRN 3319-31-1
1,2,4-Benzenetricarboxylic acid, triisooctyl ester	CASRN 27251-75-8
1,2,4-Benzenetricarboxylic acid, triisononyl ester	CASRN 53894-23-8
1,2,4-Benzenetricarboxylic acid, decyl octyl ester	CASRN 67989-23-5

Supporting Chemical

1,2,4-benzenetricarboxylic acid, mixed decyl, hexyl and octyl esters	CASRN 68130-50-7
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EPA used data submitted to the OECD HPV (SIDS) program for CASRN 3319-31-1 in the preparation of the hazard and risk characterization for this category. OECD SIDS Initial Assessment Profiles (SIAP) and SIDS Initial Assessment Reports (SIAR) are publicly available. These documents are presented in an international forum that involves review and endorsement by governmental authorities from OECD member countries. The U.S. EPA is an active participant in these meetings and accepts these documents as reliable screening-level hazard assessments for the purpose of the U.S. HPV Challenge qualitative risk characterization process. The SIAP and SIAR on CASRN 3319-31-1 are available at: <http://www.chem.unep.ch/irptc/sids/OECDSIDS/3319311.pdf>.

**Category Justification**

The category consists of four chemicals containing individual trimellitate triesters or mixed trimellitate esters, which are defined as esters of 1,2,4-benzenetricarboxylic acids that have branched or branched and linear alkyl groups ranging in carbon number from C8 to C10. The sponsor grouped the members in this category on the basis of a common functionality (trimellitate esters) and the premise that a narrow range of ester carbon numbers (C8 – C10) will produce trends in the physicochemical, environmental and toxicological properties of the four category members. For environmental and health effects endpoints, the category member CASRN 3319-31-1 is used as a representative compound to conservatively estimate the properties of the other members because it is the lowest molecular weight chemical and would likely be the most toxic of the category members. EPA considered the chemical grouping acceptable for the purposes of the HPV Challenge Program.

## Supporting Chemical Justification

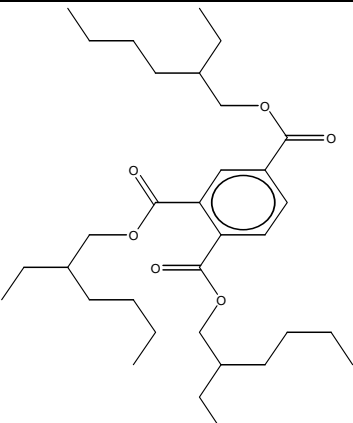
The sponsor provided measured biodegradation data for the supporting chemical, CASRN 68130-50-7, to be read-across for the biodegradation endpoint of CASRN 67989-23-5. The biodegradability of these two substances will depend on the degree of branching present in their respective ester chains. The degree of branching of the supporting chemical, CASRN 68130-50-7, is not specified in the test plan and its name implies that the esters are linear. In contrast, the sponsored substance, CASRN 67989-23-5, is described by the sponsor to be branched and linear. The uncertainty surrounding the structure of the supporting chemical limits its applicability for evaluating this endpoint. However, the biodegradation data provided for CASRN 68130-50-7 indicate that it is not readily biodegradable. This result is not likely to under-represent the persistence of the sponsored substance. Therefore, EPA accepts the use of CASRN 68130-50-7 as a supporting chemical for the biodegradation endpoint of CASRN 67989-23-5.

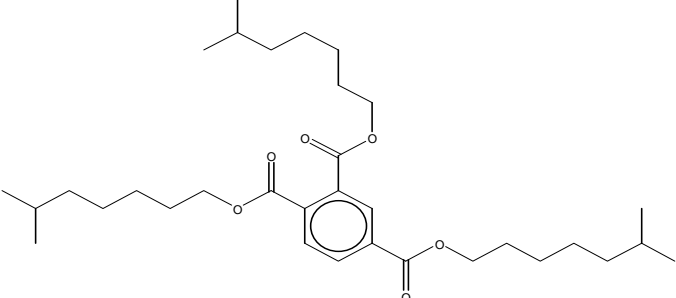
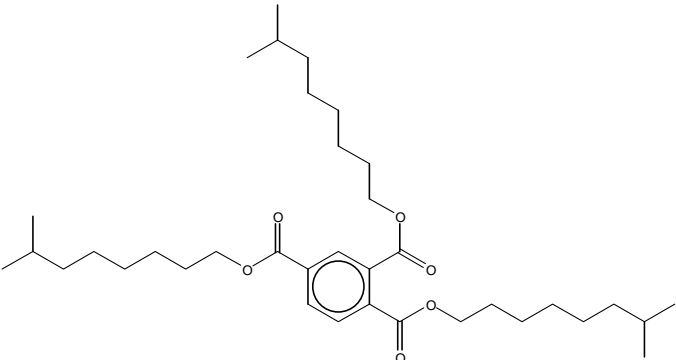
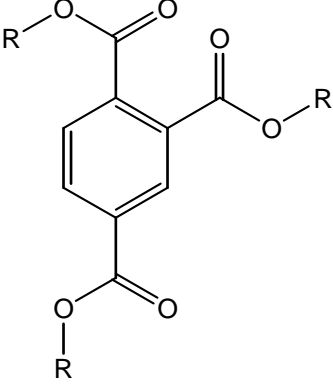
### 1 Chemical Identity

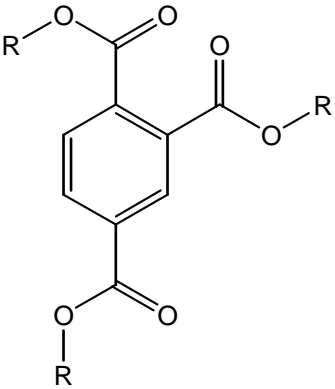
#### 1.1 Identification and Purity

The purity of the test substance was not included in the Test Plan (2007); however, the Robust Summaries indicate it to be typically greater than 98%.

The chemical structures are provided in Table 1.

<b>Table 1. Chemical Structures for Trimellitate Category</b>		
<b>Sponsored Chemicals</b>		
<b>Chemical Name</b>	<b>CASRN</b>	<b>Chemical Structure</b>
1,2,4-Benzenetricarboxylic acid, 1,2,4-tris(2-ethylhexyl) ester	3319-31-1	

<p>1,2,4- Benzenetricarboxylic acid, 1,2,4-triisooctyl ester</p>	<p>27251-75-8</p>	
<p>1,2,4- Benzenetricarboxylic acid, 1,2,4-triisononyl ester</p>	<p>53894-23-8</p>	
<p><b>Sponsored Chemicals</b></p>		
<p><b>Chemical Name</b></p>	<p><b>CASRN</b></p>	<p><b>Chemical Structure</b></p>
<p>1,2,4- Benzenetricarboxylic acid, decyl octyl ester</p>	<p>67989-23-5</p>	 <p>R=linear or branched decyl (40%) or octyl (60%)</p>
<p><b>Supporting Chemical</b></p>		

1,2,4-Benzene-tricarboxylic acid, mixed decyl, hexyl and octyl esters	68130-50-7	 <p>R=decyl, hexyl, or octyl</p>
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## 1.2 Physical-Chemical Properties

The physical-chemical properties of the compounds in the trimellitate category are summarized in Table 2. The trimellitate category consists of colorless to slightly yellow liquid chemical substances which have negligible water solubilities and negligible vapor pressures.

Table 2. Physical-Chemical Properties the Trimellitate Category<sup>1</sup>

Property	1,2,4-Benzenetricarboxylic acid, 1,2,4-tris(2-ethylhexyl) ester	1,2,4-Benzenetricarboxylic acid, 1,2,4-triisooctyl ester	1,2,4-Benzenetricarboxylic acid, 1,2,4-triisononyl ester	1,2,4-Benzenetricarboxylic acid, decyl octyl ester	1,2,4-Benzene-tricarboxylic acid, mixed decyl, hexyl and octyl esters (Supporting Chemical)
CASRN	3319-31-1	27251-75-8	53894-23-8	67989-23-5	68130-50-7
Molecular Weight	547	547	589	575	547
Physical State	Colorless to slightly yellow liquid	Colorless to slightly yellow liquid	Colorless to slightly yellow liquid	Colorless to slightly yellow liquid	Colorless to slightly yellow liquid
Melting Point	<b>-46 °C;</b> 197 °C (e)	<b>&lt;0 °C;</b> 197 °C (e)	<b>&lt;0 °C;</b> 224 °C (e)	<b>&lt;0 °C;</b> 234 °C (e)	<b>&lt;0 °C;</b> 226 °C (e)
Boiling Point	541 °C (e); <b>414 °C<sup>1,2</sup></b>	541 °C (e)	575 °C (e)	585 °C (e)	561 °C (e) <sup>3</sup>
Vapor Pressure	5.9×10 <sup>-8</sup> mm Hg at 25 °C (e); <b>&lt;2.1×10<sup>-6</sup> mm Hg at 100°C;</b> <b>0.1 mm Hg at 200 °C</b>	4×10 <sup>-11</sup> mm Hg at 25 °C (e)	2.4×10 <sup>-12</sup> mm Hg at 25 °C (e)	1.0×10 <sup>-12</sup> mm Hg at 25 °C (e)	5.2×10 <sup>-12</sup> mm Hg at 25 °C (e) <sup>3</sup>
Water Solubility	4.5×10 <sup>-8</sup> mg/L at 25 °C (e); <b>0.13 mg/L at 25 °C;</b> <b>3.9×10<sup>-4</sup> mg/L at 25 °C</b>	5×10 <sup>-8</sup> mg/L at 25 °C (e)	1.3×10 <sup>-9</sup> mg/L at 25 °C (e)	2.8×10 <sup>-9</sup> mg/L at 25 °C (e)	2.9×10 <sup>-8</sup> mg/L at 25 °C (e) <sup>3</sup>
Dissociation Constant (pK <sub>a</sub> )	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Henry's Law Constant	5.5×10 <sup>-7</sup> atm-m <sup>3</sup> /mole (e) <sup>3</sup>	5.5×10 <sup>-7</sup> atm-m <sup>3</sup> /mole (e) <sup>3</sup>	1.3×10 <sup>-6</sup> atm-m <sup>3</sup> /mole (e) <sup>3</sup>	9.3×10 <sup>-7</sup> atm-m <sup>3</sup> /mole (e) <sup>3</sup>	5.5×10 <sup>-7</sup> atm-m <sup>3</sup> /mole (e) <sup>3</sup>
Log K <sub>ow</sub>	11.59 (e) <sup>3</sup> <b>4.35; 5.94</b>	11.59 (e)	13.06 (e)	12.79 (e)	11.81 (e) <sup>3</sup>

Measured data in bold text; (e) = estimated data

<sup>1</sup>ExxonMobil Biomedical Sciences. August 2, 2007. Revised Robust Summary and Test Plan for the Trimellitate Category.

<http://www.epa.gov/chemrtk/pubs/summaries/trime/c13468tc.htm>.

<sup>2</sup>SRC. The Physical Properties Database (PHYSPROP). Syracuse, NY: Syracuse Research Corporation. Available from <http://www.syrres.com/esc/physprop.htm> as of November 13, 2008.

<sup>3</sup>U.S. EPA. 2008. Estimation Programs Interface Suite™ for Microsoft® Windows, v3.20. United States Environmental Protection Agency, Washington, DC, USA.

<http://www.epa.gov/opptintr/exposure/pubs/episuite.htm>.

## 2 General Information on Exposure

### 2.1 Production Volume and Use Pattern

The trimellitate category chemicals had an aggregated production and/or volume in the United States of 21.5 million to 111 million pounds during the calendar year 2005. Production volume ranges for each chemical are as follows:

- CASRN 3319-31-1 10 million to 50 million pounds
- CASRN 27251-75-8 500,000 to 1 million pounds
- CASRN 53894-23-8 10 million to 50 million pounds
- CASRN 67989-23-5 1 million to 10 million pounds

Non-confidential information in the IUR indicated that the industrial processing and uses of these chemicals include processing as lubricant and “other” in chemical product and preparation manufacturing, plastics product manufacturing, and basic organic chemical manufacturing. The IUR also reports industrial use as a viscosity adjustor in plastics packaging materials and unlaminated film and sheet manufacturing. Non-confidential information in the IUR indicated that the commercial and consumer products containing the chemicals include electrical and electronic products and rubber and plastic products. The HSDB for CASRN 3319-31-1 and the HPV submission for the trimellitate category state that these chemicals are primarily used as plasticizers for production of flexible PVC.<sup>4,5</sup>

### 2.2 Environmental Exposure and Fate

No quantitative information is available on releases of these chemicals to the environment.

The environmental fate properties are provided in Table 3. The trimellitites are expected to have low mobility in soil. None of the compounds in this category were determined to be readily biodegradable using both modified MITI (OECD 301C) and manometric respirometry (OECD 301F) tests; however, as a class aromatic esters are generally not extremely persistent in the environment. Volatilization is expected to be moderate based on the estimated Henry's Law constants. The rate of hydrolysis is slow to negligible. The trimellitites are expected to have low persistence (P1) and low bioaccumulation potential (B1).

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<sup>4</sup> HSDB, 2008. Hazardous Substances Data Bank. Accessed, 11/24/08, 1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester. <http://toxnet.nlm.nih.gov/>

<sup>5</sup> ExxonMobil Biomedical Sciences, Inc., December 18, 2006. High Production Volume Chemical Challenge Program Test Plan for the Trimellitate Category. Accessed: November 24, 2008. <http://www.epa.gov/chemrtk/pubs/summaries/trime/c13468tc.htm>.

**Table 3. Environmental Fate Characteristics of the Trimellitate Category<sup>1</sup>**

Property	1,2,4-Benzenetricarboxylic acid, 1,2,4-tris(2-ethylhexyl) ester	1,2,4-Benzenetricarboxylic acid, 1,2,4-triisooctyl ester	1,2,4-Benzenetricarboxylic acid, 1,2,4-trisononyl ester	1,2,4-Benzenetricarboxylic acid, decyl octyl ester	1,2,4-Benzene-tricarboxylic acid, mixed decyl, hexyl and octyl esters (Supporting Chemical)
CASRN	3319-31-1	27251-75-8	53894-23-8	67989-23-5	68130-50-7
Photodegradation Half-life	3.9 hours (e)	4.2 hours (e)	3.7 hours (e)	3.8 hours (e)	4.2 hours (e) <sup>2</sup>
Hydrolysis Half-life	<b>Stable at pH 4 and 50°C;</b> <b>17.5 days at pH 7 and 25°C;</b> <b>11.9 days at pH 9 and 25°C</b>	158.8 days at pH 7 (e); 15.8 days at pH 8 (e)	313 days at pH 7 (e) <sup>2</sup> ; 31 days at pH 8 (e) <sup>2</sup>	355.8 days at pH 7 (e) <sup>2</sup> ; 35.6 days at pH 8 (e) <sup>2</sup>	241 days at pH 7 (e) <sup>2</sup> ; 24 days at pH 8 (e) <sup>2</sup>
Biodegradation	<b>4.2% after 28 days (not readily biodegradable);</b> <b>46.8 after 28 days (not readily biodegradable)</b>	<b>5.36% after 28 days (not readily biodegradable);</b> <b>5.36% after 39 days (not readily biodegradable)</b>	<b>4.19% after 28 days (not readily biodegradable);</b> <b>4.5% after 39 days (not readily biodegradable)</b>	33.7% after 28 days (not readily biodegradable); 56.2% after 39 days (not readily biodegradable) <sup>3</sup>	<b>33.7% after 28 days (not readily biodegradable);</b> <b>56.2% after 39 days (not readily biodegradable)</b>
Bioconcentration	<b>BCF = 1-2.7 (in carp)</b>	BCF = 3.2 (e) <sup>2</sup>	BCF = 3.2 (e) <sup>2</sup>	BCF = 3.2 (e) <sup>2</sup>	BCF = 3.2 (e) <sup>2</sup>
Log K <sub>oc</sub>	1 (e) <sup>2</sup>	7.9 (e) <sup>2</sup>	8.7 (e) <sup>2</sup>	8.7 (e) <sup>2</sup>	8.1 (e) <sup>2</sup>
Fugacity (Level III Model)	Air = 0% Water = 0% Soil = 99.3% Sediment = 0.7% (e)	Air = 0% Water = 0% Soil = 99.3% Sediment = 0.7% (e)	Air = 0% Water = 0% Soil = 99.3% Sediment = 0.7% (e)	Air = 0% Water = 0% Soil = 99.3% Sediment = 0.7% (e)	Air = 0.3% Water = 5.4% Soil = 33.6% Sediment = 60.7% (e)
Persistence <sup>4</sup>	P1 (low)	P1 (low)	P1 (low)	P1 (low)	P1 (low)
Bioaccumulation <sup>4</sup>	B1 (low)	B1 (low)	B1 (low)	B1 (low)	B1 (low)

Measured data in bold text; (e) = estimated data

<sup>1</sup>ExxonMobil Biomedical Sciences. August 2, 2007. Revised Robust Summary and Test Plan for the Trimellitate Category. <http://www.epa.gov/chemrtk/pubs/summaries/trime/c13468tc.htm>.

<sup>2</sup>U.S. EPA. 2008. Estimation Programs Interface Suite™ for Microsoft® Windows, v3.20. United States Environmental Protection Agency, Washington, DC, USA.

<http://www.epa.gov/opptintr/exposure/pubs/episuite.htm>.

<sup>3</sup>Data from supporting chemical, CASRN 68130-50-7

<sup>4</sup>Federal Register. 1999. Category for Persistent, Bioaccumulative, and Toxic New Chemical Substances. *Federal Register* 64, Number 213 (November 4, 1999) pp. 60194-60204.

### 3. Human Health Hazard

A summary of health effects data submitted for SIDS endpoints is provided in Table 4. The table also indicates where data for tested category members are read-across (RA) to untested members of the category. Most data are contained in the OECD HPV documents, and are available at: <http://www.chem.unep.ch/irptc/sids/OECDsids/3319311.pdf>. However, two acute toxicity studies not included in the OECD documents are discussed below.

#### *Acute Oral Toxicity*

##### ***1,2,4-Benzenetricarboxylic acid, triisononyl ester (CASRN 53894-23-8)***

Sprague-Dawley rats (5 males/dose) were administered CASRN 53894-23-8 via gavage at 417, 1450, 5000 or 10,000 mg/kg-bw and observed for 14 days. No mortalities were observed.

**LD<sub>50</sub> > 10,000 mg/kg-bw**

#### *Acute Inhalation Toxicity*

##### ***1,2,4-Benzenetricarboxylic acid, tris (2-ethylhexyl) ester (CASRN 3319-31-1)***

Rats (strain, sex and number not stated) were exposed to the test substance at 230, 2640 and 4170 mg/m<sup>3</sup> (equivalent to 0.230, 2.640, and 4.170 mg/L) for 6 hours, primarily as a mist.

Mortality was seen at 2 higher concentrations but number of deaths per dose was not reported.

**LC<sub>50</sub> > 0.23 mg/L**

**Table 4. Summary of Human Health Data**

<b>Endpoints</b>	<b>1,2,4-Benzenetricarboxylic acid, tris (2-ethylhexyl) ester (3319-31-1)</b>	<b>1,2,4-Benzenetricarboxylic acid, triisooctyl ester (27251-75-8)</b>	<b>1,2,4 Benzenetricarboxylic acid, triisononyl ester (53894-23-8)</b>	<b>1,2,4-Benzenetricarboxylic acid, decyl octyl ester (67989-23-5)</b>
<b>Acute Oral Toxicity LD<sub>50</sub> (mg/kg-bw)</b>	<b>&gt; 2000</b>	No Data > 2000 (RA)	<b>&gt; 10,000</b>	No Data > 10,000 (RA)
<b>Acute Inhalation Toxicity LC<sub>50</sub> (mg/L)</b>	<b>&gt; 0.23</b>	No Data > 0.23 (RA)	No Data > 0.23 (RA)	No Data > 0.23 (RA)
<b>Acute Dermal Toxicity LD<sub>50</sub> (mg/kg-bw)</b>	<b>&gt; 2000</b>	No Data > 2000 (RA)	No Data > 2000 (RA)	No Data > 2000 (RA)
<b>Repeated-Dose Toxicity Oral (mg/kg-bw/day)</b>	<b>NOAEL = 184 LOAEL = 650</b>	No Data NOAEL = 184 LOAEL = 650 (RA)	No Data NOAEL = 184 LOAEL = 650 (RA)	No Data NOAEL = 184 LOAEL = 650 (RA)

Table 4. Summary of Human Health Data				
Endpoints	1,2,4-Benzene-tricarboxylic acid, tris (2-ethylhexyl) ester (3319-31-1)	1,2,4-Benzene-tricarboxylic acid, triisooctyl ester (27251-75-8)	1,2,4 Benzene-tricarboxylic acid, triisononyl ester (53894-23-8)	1,2,4-Benzene-tricarboxylic acid, decyl octyl ester (67989-23-5)
<b>Reproductive/ Developmental Toxicity</b> <b>Oral (mg/kg-bw/day)</b> <b>Systemic/Reproductive Toxicity</b>	<b>NOAEL = 100</b> <b>LOAEL = 300</b>	No Data NOAEL = 100 LOAEL = 300	No Data NOAEL = 100 LOAEL = 300	No Data NOAEL = 100 LOAEL = 300
<b>Developmental Toxicity</b>	<b>NOAEL = 1000 (hdt)</b>	NOAEL = 1000 (hdt) (RA)	NOAEL = 1000 (hdt) (RA)	NOAEL = 1000 (hdt) (RA)
<b>Genetic Toxicity – Gene Mutations</b> <i>In vitro</i>	<b>Negative</b>	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)
<b>Genetic Toxicity – Chromosomal Aberrations</b> <i>In vitro</i>	<b>Negative</b>	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)
<b>Genetic Toxicity – Other UDS (<i>In vitro</i>)</b>	<b>Negative</b>	No Data Negative (RA)	No Data Negative (RA)	No Data Negative (RA)
<b>Additional Information</b>		—**	—**	—**
<b>Skin Irritation</b> <b>Eye Irritation</b> <b>Dermal Sensitization</b>	<b>Not irritating</b> <b>Not irritating</b> <b>Not a sensitizer</b>			

Measured data in bold text; (RA) = Read Across; hdt = Highest dose tested;  
—\*\* Indicates that no data are available and the endpoint is not needed

**Conclusion:** Acute oral toxicity of CASRN 3319-31-1 and 53894-23-8 to rats and acute dermal toxicity of CASRN 3319-31-1 to rabbits is low. CASRN 3319-31-1 was slightly irritating to rabbit skin or eyes and was not a skin sensitizer in guinea pigs. Repeated exposures to CASRN 3319-31-1 via the oral route in rats showed changes in organ weights, clinical chemistry, hematology and histopathology at 650 mg/kg-bw/day with a NOAEL of 184 mg/kg-bw/day for systemic toxicity. A combined oral reproductive/developmental toxicity screening test in rats using CASRN 3319-31-1 showed decreased numbers of spermatocytes and spermatids in the testes at 300 mg/kg-bw/day; the NOAEL for reproductive toxicity was 100 mg/kg-bw/day. No evidence of developmental toxicity was seen in this study with a NOAEL of 1000 mg/kg-bw/day

for maternal and developmental toxicity. CASRN 3319-31-1 did not induce gene mutations or chromosomal aberrations *in vitro*.

## **2. Hazard to the Environment**

A summary of aquatic toxicity data submitted by the sponsor for SIDS endpoints is provided in Table 5. The table also indicates where data for tested category members are read-across (RA) to untested members of the category.

### ***Acute Toxicity to Fish***

#### ***1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester (CASRN 3319-31-1)***

Medaka (*Oryzias latipes*, 10/concentration) were exposed to the test substance at nominal concentrations of 0 or 100 mg/L under semi-static conditions for 24 hours. Measured concentrations were <1 or 103, and <1 or 102 mg/L, respectively, at 0 and 24-hours. One fish from the control (96 hours) and treated groups (48 hours) died. EPA does not consider 100 mg/L as the no-effect concentration because this concentration exceeds the water solubility of the chemical. Assuming the exposure concentration is the water solubility limit (saturation) for CASRN 3319-31-1, the no-effect concentration would be approximately  $3.9 \times 10^{-4}$  mg/L.

**No effects at saturation**

### ***Acute Toxicity to Aquatic Invertebrates***

#### ***1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester (CASRN 3319-31-1)***

Water fleas (*Daphnia magna*, 20/concentration) were exposed to the test substance at nominal concentrations of 0, 17.1, 30.9, 55.6, 100 or 180 mg/L under static conditions for 48 hours. Measured concentrations were within 90 – 99% of the nominal concentrations. One daphnid was immobilized at 17.1 mg/L; no immobility was seen at the other concentrations. EPA does not consider 180 mg/L as the no effect concentration because this concentration exceeds the water solubility of the chemical. Assuming the exposure concentration is the water solubility limit (saturation) for CASRN 3319-31-1, the no effect concentration would be approximately  $3.9 \times 10^{-4}$  mg/L.

**No effects at saturation**

### ***Toxicity to Aquatic Plants***

#### ***1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester (CASRN 3319-31-1)***

Green algae (*Pseudokirchneriella subcapitata*) were exposed to the test substance at nominal concentrations of 0 or 100 mg/L under static conditions for 72 hours. Measured concentrations were <1 or 80.6, and <1 or 68.7 mg/L, respectively, at 0 and 72-hour intervals. There was no effect on growth and biomass. EPA does not consider 100 mg/L as the no effect concentration because this concentration exceeds the water solubility of the chemical. Assuming the exposure concentration is the water solubility limit (saturation) for CASRN 3319-31-1, the no effect concentration would be approximately  $3.9 \times 10^{-4}$  mg/L.

**No effects at saturation**

### ***Chronic Toxicity to Aquatic Invertebrates***

***1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester (CASRN 3319-31-1)***

Water fleas (*Daphnia magna*) were exposed to the test substance at nominal concentrations of 0, 0.0074, 0.012, 0.027, 0.048 or 0.100 mg/L under flow-through conditions for 21 days. The mean measured concentration was 0.0040, 0.0069, 0.0159, 0.029 or 0.82 mg/L. No significant effects were seen on survival, mean adult length or mean young/adult reproduction. Assuming the exposure concentration is the water solubility limit (saturation) for CASRN 3319-31-1, the no effect concentration would be approximately  $3.9 \times 10^{-4}$  mg/L.

**No effects at saturation**

**Conclusion:** The measured acute and chronic toxicity values of CASRN 3319-31-1 to fish, aquatic invertebrates and aquatic plants indicate no effects at the saturation limit ( $3.9 \times 10^{-4}$  mg/L).

<b>Table 5. Summary of Environmental Effects – Aquatic Toxicity Data</b>				
<b>Endpoints</b>	<b>1,2,4-Benzene-tricarboxylic acid, tris (2-ethylhexyl) ester (3319-31-1)</b>	<b>1,2,4-Benzene-tricarboxylic acid, triisooctyl ester (27251-75-8)</b>	<b>1,2,4-Benzene-tricarboxylic acid, triisononyl ester (53894-23-8)</b>	<b>1,2,4-Benzene-tricarboxylic acid, decyl octyl ester (67989-23-5)</b>
<b>Fish 96-h LC<sub>50</sub> (mg/L)</b>	<b>NES</b>	No Data NES (RA)	No Data NES (RA)	No Data NES (RA)
<b>Aquatic Invertebrates 48-h EC<sub>50</sub> (mg/L)</b>	<b>NES</b>	No Data NES (RA)	No Data NES (RA)	No Data NES (RA)
<b>Aquatic Plants 72-h EC<sub>50</sub> (mg/L)</b>	<b>NES</b>	No Data NES (RA)	No Data NES (RA)	No Data NES (RA)
<b>Aquatic Invertebrates Chronic Toxicity 21-d NOEC (mg/L)</b>	<b>NES</b>	No Data NES (RA)	No Data NES (RA)	No Data NES (RA)

NES = No effects at saturation; **Measured data (i.e., derived from testing) in bold text**; in test plan comments EPA indicated that if no effects were seen in the fish test with CASRN 3319-31-1 at the limit of solubility, no further aquatic toxicity testing would be needed.