

## SCREENING-LEVEL HAZARD CHARACTERIZATION

### SPONSORED CHEMICAL

**C.I. Pigment Yellow 14 (CASRN 5468-75-7)**

### SUPPORTING CHEMICALS

**C.I. Pigment Yellow 13 (CASRN 5102-83-0)**

**C.I. Pigment Yellow 83 (CASRN 5567-15-7)**

**C.I. Pigment Yellow 12 (CASRN 6358-85-6)**

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 or OECD HPV 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.

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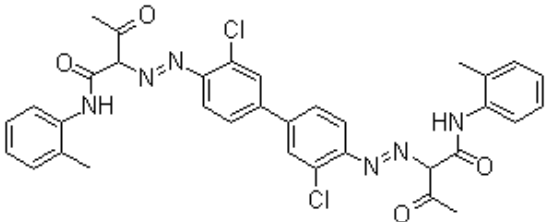
<sup>1</sup> U.S. EPA. High Production Volume (HPV) Challenge Program; <http://www.epa.gov/chemrtk/index.htm>.

<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 CHEMICAL</b> <b>5468-75-7</b></p> <p><b>SUPPORTING CHEMICALS</b> <b>5102-83-0</b> <b>5567-15-7</b> <b>6358-85-6</b></p>
<p><b>Chemical Abstract Index Name</b></p>	<p><b>SPONSORED CHEMICAL</b> <b>Butanamide, 2,2'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(2,1-diazenediyl)]bis[N-(2-methylphenyl)-3-oxo-</b></p> <p><b>SUPPORTING CHEMICALS</b> <b>See Table 1.</b></p>
<p><b>Structural Formula</b></p>	<p><b>SPONSORED CHEMICAL</b></p>  <p><b>SUPPORTING CHEMICALS</b> <b>See Table 1.</b></p>
<p style="text-align: center;"><b>Summary</b></p> <p>CASRN 5468-75-7 is a solid substance with low water solubility and negligible vapor pressure. It is expected to have low mobility in soil. Volatilization is considered low based on the Henry's Law constant. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is considered moderate; however, this substance is not expected to exist in the vapor phase in the atmosphere. CASRN 5468-75-7 is expected to have high persistence (P3) and low bioaccumulation potential (B1).</p> <p>The acute oral toxicity of CASRN 5468-75-7 and the supporting chemicals, CASRNs 5102-83-0, 5567-15-7 and 6358-85-6, to rats was low. Repeated inhalation exposures of rats to the supporting chemical, CASRN 5102-83-0, showed pigment deposition in the lungs at all concentrations tested. The LOAEC for effects of pigment particles in the lung was 0.054 mg/L. However, systemic effects were not observed at concentrations up to and including 0.41 mg/L; the NOAEC for systemic toxicity was 0.41 mg/L (highest concentration tested). In several repeated dietary exposure studies, the supporting chemical, CASRN 6358-85-6, caused no adverse systemic effects at doses up to and including 2500 and 6500 mg/kg-bw/day in rats and mice, respectively. The NOAELs for systemic toxicity in rats and mice were 2500 and 6500 mg/kg-bw/day, respectively (highest concentrations tested). In a combined oral gavage repeated-dose/reproductive/developmental toxicity screening test in rats, the supporting chemical,</p>	

CASRN 6358-85-6, showed no systemic, reproductive, or developmental toxicity up to and including 1000 mg/kg-day. The NOAEL for systemic/reproductive/developmental toxicity was 1000 mg/kg-day (highest dose tested). The supporting chemical, CASRN 5567-15-7, did not induce gene mutations in bacterial cells *in vitro* and the supporting chemical, CASRN 6358-85-6, did not induce chromosomal aberrations in mammalian cells *in vitro*. CASRN 5102-83-0 was irritating to rabbit skin and CASRN 5567-15-7 was slightly irritating to rabbit skin and eyes. The supporting chemical, CASRN 6358-85-6, was not a skin sensitizer in guinea pigs. The supporting chemicals were not carcinogenic in rats (CASRNs 5567-15-7 and 6358-86-6) or mice (CASRN 6358-86-6).

No data are available on CASRN 5468-75-7 for the ecotoxicity endpoints. Data for the supporting chemicals show that there is no acute toxicity to fish (CASRN 5567-15-7), aquatic invertebrates (CASRN 6358-85-6), and aquatic plants (CASRN 5567-15-7), or chronic toxicity to aquatic invertebrates (CASRN 5102-83-0) at 100 mg/L (highest concentration tested), which is above the water solubility limit of this chemical.

No data gaps were identified under the HPV Challenge Program.

The sponsor, Color Pigments Manufacturers Association, Inc., submitted a Test Plan and Robust Summaries to EPA for C.I. Pigment Yellow 14 (CASRN 5468-75-7) on August 15, 2006. EPA posted the submission on the ChemRTK HPV Challenge website on August 25, 2006 (<http://www.epa.gov/hpv/pubs/summaries/ciyelo14/c16300tc.htm>). EPA comments on the original submission were posted to the website on March 10, 2009. Public comments were also received and posted to the website. The sponsor submitted updated/revised documents on May 4, 2009, which were posted to the ChemRTK website on November 10, 2009.

### **Justification for Supporting Chemicals**

The sponsor proposed using data from three supporting chemicals, C.I. Pigment Yellow 13 (CASRN 5102-83-0), C.I. Pigment Yellow 12 (CASRN 6358-85-6) and C.I. Pigment Yellow 83 (CASRN 5567-15-7), to satisfy endpoints for aquatic toxicity and health effects. The sponsor based the use of these supporting chemicals on their structural similarity to the sponsored chemical and on similar acute toxicities among this group of pigments. The sponsored and supporting chemicals differ only by the substitution of the outer aniline rings (e.g., methyl-, chloro- and methoxy- groups). Furthermore, the three supporting chemicals were accepted as a category in the OECD HPV Program as “Diarylide Yellow Pigments.” The SIAP is available at the following link: <http://webnet.oecd.org/hpv/ui/Search.aspx>. As stated in the SIAP, “Standard single exposure toxicokinetics studies indicate essentially no potential uptake via the oral and dermal routes.” The bioavailability of the sponsored substance is expected to be similar to that of the supporting chemicals. EPA agrees that the use of data for the supporting chemicals is appropriate for both the human health and ecological endpoints for the sponsored substance.

## **1. Chemical Identity**

### **1.1. Identification and Purity**

CASRN 5468-75-7 is a solid substance with low water solubility and negligible vapor pressure. The purity of the test substance in the robust summaries was generally  $\geq 94.5\%$ . The chemical structures of the sponsored substance and the supporting chemicals are depicted in Table 1.

<b>Table 1. Chemical Structures</b>		
<b>Chemical Abstract Index Name</b>	<b>CASRN</b>	<b>Structure</b>
<b>SPONSORED CHEMICAL</b>		
Butanamide, 2,2'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(2,1-diazenediyl)]bis[N-(2-methylphenyl)-3-oxo-	5468-75-7	
<b>SUPPORTING CHEMICALS</b>		
Butanamide, 2,2'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(2,1-diazenediyl)]bis[N-(2,4-dimethylphenyl)-3-oxo-	5102-83-0	
Butanamide, 2,2'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(2,1-diazenediyl)]bis[N-(4-chloro-2,5-dimethoxyphenyl)-3-oxo-	5567-15-7	
Butanamide, 2,2'-[(3,3'-dichloro[1,1'-biphenyl]-4,4'-diyl)bis(2,1-diazenediyl)]bis[3-oxo-N-phenyl-	6358-86-6	

## 1.2. Physical-Chemical Properties

The physical-chemical properties of CASRN 5468-75-7 and the supporting chemicals are summarized in Table 2.

<b>Table 2. Physical-Chemical Properties of C.I. Pigment Yellow 14 and Supporting Chemicals<sup>1</sup></b>				
<b>Property</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 12</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 83</b>
CASRN	5468-75-7	5102-83-0	6358-85-6	5567-15-7
Molecular Weight	657.56	685.6	629.5	818.5
Physical State	Solid	Solid	Solid	Solid
Melting Point	360°C (measured) <sup>1,2</sup> Decomposition begins around 200°C (by analog). Therefore, measured melting point may not be true melting point, but rather be the final decomposition temperature.	Decomposition begins around 200°C	320°C (measured) <sup>1,2</sup> Decomposition begins around 200°C (by analog). Therefore, measured melting point may not be true melting point, but rather be the final decomposition temperature.	400°C (measured) <sup>1,2</sup> Decomposition begins around 200°C (by analog). Therefore, measured melting point may not be true melting point, but rather be the final decomposition temperature.
Boiling Point	High melting point solid that decomposes before boiling.	High melting point solid that decomposes before boiling.	High melting point solid that decomposes before boiling.	High melting point solid that decomposes before boiling.
Vapor Pressure	<1×10 <sup>-10</sup> mm Hg (estimated) <sup>3</sup>	<1×10 <sup>-10</sup> mm Hg (estimated) <sup>3</sup>	<1×10 <sup>-10</sup> mm Hg (estimated) <sup>3</sup>	<1×10 <sup>-10</sup> mm Hg (estimated) <sup>3</sup>
Water Solubility	<0.020 mg/L (measured) <sup>4</sup>	<0.020 mg/L (measured) <sup>4</sup>	<0.020 mg/L (measured) <sup>4</sup>	< 0.02 mg/L (measured) <sup>5</sup>
Dissociation Constant (pK <sub>a</sub> )	Not applicable	Not applicable	Not applicable	Not applicable
Henry's Law Constant	<1.0×10 <sup>-10</sup> atm-m <sup>3</sup> /mole (estimated) <sup>3</sup>	<1.0×10 <sup>-10</sup> atm-m <sup>3</sup> /mole (estimated) <sup>3</sup>	<1.0×10 <sup>-10</sup> atm-m <sup>3</sup> /mole (estimated) <sup>3</sup>	<1.0×10 <sup>-10</sup> atm-m <sup>3</sup> /mole (estimated) <sup>3</sup>

<b>Property</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 12</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 83</b>
CASRN	5468-75-7	5102-83-0	6358-85-6	5567-15-7
Log K <sub>ow</sub>	7.02 (estimated) <sup>3</sup>	7.11(estimated) <sup>3</sup>	7.05 (estimated) <sup>3</sup>	7.54 (estimated) <sup>3</sup>

<sup>1</sup> Diarylide Pigments Committee of the Color Pigment Manufacturers Association. August 15, 2006. Revised Test Plan and Robust Summary for CI Pigment 14. Available from:

<http://www.epa.gov/chemrtk/pubs/summaries/ciyelo14/c16300tc.htm> as of December 9, 2009.

<sup>2</sup> Azo dyes tend to thermally decompose rather than melt; if they did melt the melting point would most likely be above 300°C. Similarly any boiling point data for C.I. Pigment Yellow 14 or for any analogs, they would most likely boil above 300°C.

<sup>3</sup> U.S. EPA. 2009. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available from:

<http://www.epa.gov/opptintr/exposure/pubs/episuitedi.htm> as of June 29, 2009.

<sup>4</sup> OECD SIDS Initial Assessment Profile for Pigment Yellow 12, Pigment Yellow 13 and Pigment Yellow 83. May 27–30, 2003. Available from: <http://webnet.oecd.org/hpv/ui/Search.aspx> as of December 9, 2009.

<sup>5</sup> Water solubility of green alga EC50 toxicity testing OECD Fact Sheet PBT List #8

## **2. General Information on Exposure**

### **2.1. Production Volume and Use Pattern**

According to the 2006 IUR submissions, CASRN 5468-75-7 had aggregated production and/or import volume(s) in the United States between 1 million and 10 million pounds

Non-confidential industrial processing and uses reported in the 2006 IUR submissions for this chemical include adhesive manufacturing, all other wood product manufacturing, other plastics product manufacturing, paint and coating manufacturing, pesticide and other agricultural chemical manufacturing, photofinishing, printing, paint and coating manufacturing, printing ink manufacturing and synthetic dye and pigment manufacturing. Non-confidential commercial and consumer uses include adhesives and sealants, non-pesticidal agricultural products, glass and ceramic products, rubber and plastics products, paints and coatings, paper products, photographic supplies, wood and wood furniture, and other.

### **2.2. Environmental Exposure and Fate**

The environmental fate properties are provided in Table 3. CASRN 5468-75-7 is expected to have low mobility in soil. It was not readily biodegradable using the modified MITI test (OECD 301C). In addition, structurally similar pigments, CASRNs 5102-83-0, 5567-15-7 and 6358-85-6, are also not readily biodegradable using the same test. While water soluble azo dye compounds containing benzidine substructures are expected to undergo biodegradation by azo reduction under anaerobic conditions at moderate to rapid rates to form the corresponding benzidine related metabolites, CASRN 5468-75-7, due to its extremely low water solubility and physical form as a tightly packed solid, does not appear to be as susceptible to azo reduction, but

no direct evidence on the rates of anaerobic biodegradation of CASRN 5468-75-7 in the environment could be found. Overall, the results of the screening studies and its low water solubility suggest these substances may biodegrade at negligible to slow rates in the environment. CASRN 5468-75-7 is stable to hydrolysis and is considered to possess low volatility based on an estimated Henry's Law constant. The rate of atmospheric photooxidation is considered moderate; however, this substance is not expected to exist in the vapor phase in the atmosphere. CASRN 5468-75-7 is expected to have high persistence (P3) and low bioaccumulation potential (B1).

<b>Table 3. Environmental Fate Characteristics of C.I. Pigment Yellow 14 and Supporting Chemicals<sup>1</sup></b>				
<b>Property</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 12</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 83</b>
CASRN	5468-75-7	5102-83-0	6358-85-6	5567-15-7
Photodegradation Half-life	3.7 hours (estimated)	3.1 hours (estimated) <sup>2</sup>	4.5 hours (estimated) <sup>2</sup>	1.7 hours (estimated) <sup>2</sup>
Hydrolysis Half-life	Stable	Stable	Stable	Stable
Biodegradation	2% after 4 weeks by BOD (not readily biodegradable) <sup>3</sup>	Over 28 days (not readily biodegradable)	0% in 14 days (not readily biodegradable) <sup>3</sup>	6% in 28 days (not readily biodegradable) <sup>3</sup>
Bioconcentration	BCF = <0.5–0.6 (measured in carp at 1 ppm) <sup>3</sup> ; BCF = <4.9 (measured in carp at 0.1 ppm) <sup>3</sup>	BCF = 10 (estimated) <sup>2</sup>	BCF = 0.38–3.2 (measured in carp at 0.1 ppm) <sup>3</sup> ; BCF = 2.4–5.4 (measured in carp at 0.01 ppm) <sup>3</sup>	BCF = 10 (estimated) <sup>2</sup>
Bioaccumulation factor	BAF = 140 (estimated) <sup>2</sup>	BAF = 18 (estimated) <sup>2</sup>	BAF = 18 (estimated) <sup>2</sup>	BAF = 3.6×10 <sup>5</sup> (estimated) <sup>2</sup>
Log K <sub>oc</sub>	5.4 (estimated) <sup>2</sup>	5.8 (estimated) <sup>2</sup>	5.0 (estimated) <sup>2</sup>	6.3 (estimated) <sup>2</sup>
Fugacity (Level III Model) <sup>2</sup>				
Air	<0.1	<0.1	<0.1	<0.1
Water	1.8	2.3	2.6	0.9
Soil	68.5	75.2	79.5	56.9
Sediment	29.7	22.5	17.9	42.2
Persistence <sup>4</sup>	P3 (high)	P3 (high)	P3 (high)	P3 (high)
Bioaccumulation <sup>4</sup>	B1 (low)	B1 (low)	B1 (low)	B1 (low)

<b>Table 3. Environmental Fate Characteristics of C.I. Pigment Yellow 14 and Supporting Chemicals<sup>1</sup></b>				
<b>Property</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 12</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 83</b>
CASRN	5468-75-7	5102-83-0	6358-85-6	5567-15-7

<sup>1</sup> Diarylide Pigments Committee of the Color Pigment Manufacturers Association. August 15, 2006. Revised Test Plan and Robust Summary for CI Pigment 14. Available at:

<http://www.epa.gov/chemrtk/pubs/summaries/ciyelo14/c16300tc.htm> as of December 9, 2009.

<sup>2</sup> U.S. EPA. 2009. Estimation Programs Interface Suite™ for Microsoft® Windows, v4.00. U.S. Environmental Protection Agency, Washington, DC, USA. Available from:

<http://www.epa.gov/opptintr/exposure/pubs/episuitedi.htm> as of June 29, 2009.

<sup>3</sup> National Institute of Technology and Evaluation. 2002. Biodegradation and Bioconcentration of Existing Chemical Substances under the Chemical Substances Control Law. Available from:

[http://www.safe.nite.go.jp/english/kizon/KIZON\\_start\\_hazkizon.html](http://www.safe.nite.go.jp/english/kizon/KIZON_start_hazkizon.html) as of June 24, 2009.

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

**Conclusion:** CASRN 5468-75-7 is a solid substance with low water solubility and negligible vapor pressure. It is expected to have low mobility in soil. Volatilization is considered low based on the Henry's Law constant. The rate of hydrolysis is negligible. The rate of atmospheric photooxidation is considered moderate; however, this substance is not expected to exist in the vapor phase in the atmosphere. CASRN 5468-75-7 is expected to have high persistence (P3) and low bioaccumulation potential (B1).

### **3. Human Health Hazard**

A summary of health effects data submitted for SIDS endpoints is provided in Table 4.

#### ***Acute Oral Toxicity***

##### ***C.I. Pigment Yellow 14 (CASRN 5468-75-7)***

CD rats (10 male/dose) were administered CASRN 5468-75-7 via intragastric intubation as a suspension in peanut oil at 11,000 or 17,000 mg/kg-bw and observed for 14 days. No mortality was observed. For a few days post-dosing, feces were pigment-colored.

<http://www.srcinc.com/what-we-do/databaseforms.aspx?id=384>

**LD<sub>50</sub> > 17,000 mg/kg-bw**

##### ***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

Sprague-Dawley rats (10/sex/dose) were administered CASRN 5102-83-0 via gavage at a single dose of 3000 mg/kg-bw. No mortality, clinical signs of toxicity or macroscopic abnormalities were observed.

**LD<sub>50</sub> > 3000 mg/kg-bw**

***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

Wistar rats (5/sex/dose) were administered CASRN 5567-15-7 formulation (35% pigment) via gavage at a single dose of 5000 mg/kg-bw. No mortality was observed. The only clinical sign was the yellow discoloration of the feces from both sexes after 24 hours. No adverse effects were observed at necropsy.

**LD<sub>50</sub> > 1750 mg/kg-bw** (active ingredient)

***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

CD rats (10 male/dose) were administered CASRN 5468-75-7 via intragastric intubation as a suspension in peanut oil at 11,000 or 17,000 mg/kg-bw and observed for 14 days. No mortality was observed. For a few days post-dosing, feces were pigment-colored.

<http://www.srcinc.com/what-we-do/databaseforms.aspx?id=384>

**LD<sub>50</sub> > 17,000 mg/kg-bw**

***Acute Dermal Toxicity***

***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

Sprague-Dawley rats (5/sex/dose) were treated with 400 mg/L CASRN 5102-83-0 in polyethylene glycol/water (50:50). No mortality, clinical signs of toxicity or macroscopic abnormalities were observed.

**LD<sub>50</sub> > 3000 mg/kg-bw**

***Acute Inhalation Toxicity***

***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

Tif:Ralf (SPF) rats (10/sex/concentration) were administered CASRN 5102-83-0 via nose only inhalation at 2237 or 4448 mg/m<sup>3</sup> for four hours and observed for 14 days post exposure. No mortality was observed. Clinical signs included dyspnea, exophthalmos, ruffled fur and curved or ventral position at 3-4 hours following start of exposure. Animals recovered within 7-9 days.

**LC<sub>50</sub> > 4448 mg/m<sup>3</sup> (4.448 mg/L)**

***Repeated-Dose Toxicity***

***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

In a 21-day study, RAI f SPF rats (10/sex/concentration) were exposed to dust of CASRN 5102-83-0 at 0, 54,157 and 410 mg/m<sup>3</sup> (approximately 0, 0.054, 0.157 and 0.410 mg/L), 6 hours/day, 5 days/week. In controls and the high concentration group, 5 additional rats/sex were included for a 21 day recovery period. No mortality was observed. In both sexes lung weights (absolute and relative to body weight) were increased at day 21 and after the recovery period. In all treated animals lungs were discoloured (yellow). Histopathologically this was accompanied by accumulation of brown yellow particles in the macrophages in the interstitium, alveoli, bronchi and lymphatic tissues. At 410 mg/m<sup>3</sup> foamy pneumocytes in the alveoli and focal lymphohistiocytic infiltrations were reported in all animals. After the recovery period lung effects did not disappear. Even at the lowest dose of 54 mg/m<sup>3</sup> effects related to the deposition of pigment particles were observed in the lung. The lowest concentration of 54 mg/m<sup>3</sup> is

considered to be an effect level for the lung. No systematic effects were seen at the highest concentration tested, 410 mg/m<sup>3</sup>.

**NOAEL (systemic toxicity) = 410 mg/m<sup>3</sup> (0.410 mg/L; highest concentration tested)**

***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

(1) In a combined repeated-dose, reproductive and developmental toxicity screening test, male and female Wistar rats (number/dose not stated) were administered CASRN 6358-85-6 via gavage at 0, 50, 200 or 1000 mg/kg-day. Males were exposed for 4 weeks and females were exposed for 6 – 7 weeks. No effects were observed on mortality, body weight, food consumption, organ weight, mating success, abortion rate, gestation duration or number of litters.  
**NOAEL (systemic toxicity) = 1000 mg/kg-day (highest dose tested)**

(2) In a 30-day feeding study, rats were fed CASRN 6358-85-6 in the diet at 0.2, 1.0 and 5.0%. No findings on blood and urine parameters were reported and histopathology did not yield any abnormalities at any concentration in the diet.

**NOAEL (systemic toxicity) = 2000 mg/kg-bw/day (highest concentration tested)**

(3) In a 78-week feeding study, Fischer 344 rats (50/sex/concentration) were fed CASRN 6358-85-6, technical grade material with unknown amount of impurities, at 2.5 and 5.0% (equivalent to 1000 and 2000 mg/kg-bw/day for males; 1250 and 2500 mg/kg-bw/day for females) in their diet. After treatment, animals were allowed to recover for 28 weeks. Mortality among males was 18/50, 8/50 and 13/50 at 0, 1000 and 2000 mg/kg-bw/day, respectively. For females 14/50, 10/50 and 17/50 died at 0, 1250 and 2500 mg/kg-bw/day, respectively. Limited yellow coloration of the exterior, most organs and internal mucosal surfaces for all treated animals were observed; however, contamination during necropsy could not be excluded. The 8 week range finding study of the same report revealed no organ discoloration other than mucosal surface of the intestinal tract due to direct contact with the test compound. No clinical signs were observed. In the liver of all treated rats basophilic changes of the cytoplasm were observed.

**NOAEL (systemic toxicity) = 2500 mg/kg-bw/day (highest concentration tested)**

(4) In a 78-week feeding study, B6C3F1 mice (50/sex/concentration) were fed CASRN 6358-85-6, technical grade material with unknown amount of impurities, at 2.5 and 5.0% (equivalent to 3000 and 6000 mg/kg-bw/day for males; 3250 and 6500 mg/kg-bw/day for females) in their diet. Mortality among males was 8/50, 6/50 and 12/50 at 0, 3000 and 6000 mg/kg-bw/day, respectively. In females, 10/50, 7/50 and 16/50 mice died at 0, 3250 and 6500 mg/kg-bw/day, respectively. No clinical signs were reported. All treated animals showed yellow appearance of the hair coat, most organs and internal mucosal surfaces (contamination during necropsy cannot be excluded). The 8 week range finding study of the same report revealed no organ discoloration other than mucosal surface of the intestinal tract due to direct contact with the test compound. No hematology and clinical chemistry data were reported.

**NOAEL (systemic toxicity) = 6500 mg/kg-bw/day (highest concentration tested)**

### ***Reproductive and Developmental Toxicity***

#### ***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

In a combined repeated-dose, reproductive and developmental toxicity screening test, male and female Wistar rats (number/dose not stated) were administered C.I. Pigment Yellow 12 via gavage at 0, 50, 200 or 1000 mg/kg-day. Males were exposed for 4 weeks and females were exposed for 6 – 7 weeks. No effects were observed on mortality, body weight, food consumption, organ weight, mating success, abortion rate, gestation duration or number of litters. Because data provided on maternal toxicity were incomplete, a maternal NOAEL could not be determined.

**NOAEL (developmental toxicity) = 1000 mg/kg-day**

**NOAEL (reproductive toxicity) = 1000 mg/kg-day**

### ***Genetic Toxicity – Gene Mutation***

#### ***In vitro***

#### ***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

*Salmonella typhimurium* strains TA98, TA100, TA1535 and TA1537 were exposed to CASRN 5567-15-7 at concentrations ranging from 0 to 2500 µg/plate with and without metabolic activation. No cytotoxicity was observed. CASRN 5102-83-0 did not induce gene mutations with or without activation.

**CASRN 5567-15-7 was not mutagenic in this assay.**

#### ***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

*Salmonella typhimurium* strains TA98, TA100, TA102, TA1535 and TA1537 were exposed to CASRN 5567-15-7 at 50, 60, 500, 1600 or 5000 µg/plate with and without metabolic activation. C.I. Pigment Yellow 83 did not induce gene mutations with or without activation.

**CASRN 5567-15-7 was not mutagenic in this assay.**

#### ***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

(1) In a National Toxicology Program (NTP) bacterial reverse mutation assay, *Salmonella typhimurium* strains TA98, TA100, TA1535 and TA1537 were exposed to CASRN 6358-85-6 at concentrations ranging from 100 to 10,000 µg/plate with and without metabolic activation. A precipitate was observed at all concentrations. CASRN 6358-85-6 did not induce gene mutations with or without activation. [http://ntp-apps.niehs.nih.gov/ntp\\_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults](http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults)

**CASRN 6358-85-6 was not mutagenic in this assay.**

(2) In a NTP assay, L5178Y mouse lymphoma cells were exposed to CASRN 6358-85-6 at concentrations ranging from 0 to 0.5 µg/mL with and without metabolic activation. No cytotoxicity was observed. CASRN 6358-85-6 did not induce gene mutations with or without activation. [http://ntp-apps.niehs.nih.gov/ntp\\_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults](http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults)

**CASRN 6358-85-6 was not mutagenic in this assay.**

### *Genetic Toxicity – Chromosomal Aberrations*

#### *In vitro*

##### ***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

In a NTP chromosomal aberrations study, Chinese hamster ovary (CHO) cells were exposed to CASRN 6358-85-6 at concentrations ranging from 0 to 160 µg/mL without metabolic activation and 0 to 50 µg/mL with metabolic activation. CASRN 6358-85-6 did not induce chromosomal aberrations with or without activation. [http://ntp-apps.niehs.nih.gov/ntp\\_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults](http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults)

**CASRN 6358-85-6 did not induce chromosomal aberrations in this assay.**

#### *Genetic Toxicity - Other*

##### ***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

In a NTP Sister Chromatid Exchange (SCE) assay, CHO cells were exposed to CASRN 6358-85-6 at concentrations ranging from 0 to 250 µg/mL with and without metabolic activation. No cytotoxicity was observed. CASRN 6358-85-6 showed a ~20% increase after incubation in presence of metabolic activation in one of two experiments. The chemical did not induce SCE without activation. [http://ntp-apps.niehs.nih.gov/ntp\\_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults](http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults)

**CASRN 6358-85-6 was equivocal in this assay.**

### *Additional Information*

#### *Skin Irritation*

##### ***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

CASRN 5102-83-0 was applied (1.0 mL of 1g/mL in 66 OP solvent) to the intact and abraded skin of New Zealand White rabbits (3/sex/dose) under occlusive conditions. After 24 hours, the dressing was removed and application sites assessed for edema and erythema. The application sites were further assessed at 72 hours. Histopathological evaluation was also done at 72 hours. Necrosis was observed in the histopathological examination. <http://www.srcinc.com/what-we-do/databaseforms.aspx?id=384>

**CASRN 5102-83-0 was irritating to rabbit skin in this assay.**

##### ***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

CASRN 5567-15-7 (500 mg in polyethylene glycol 400) was applied to the skin of three male New Zealand albino rabbits under semi-occlusive conditions and observed at 30-60 min

**CASRN 5567-15-7 was slightly irritating to rabbit skin in this assay.**

### *Eye Irritation*

#### ***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

CASRN 5567-15-7 (100 mg of 79.1% in formulation) was applied to the left eye of three male New Zealand albino (Chbb:NZW) rabbits and observed at 1 h, 24 h, 48 h, 72 h, 7 d and 14 d post exposure. The right eye served as control.

**CASRN 5567-15-7 was slightly irritating to rabbit eyes in this assay.**

### *Skin Sensitization*

#### ***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

(1) Female Dunkin/Hartley guinea pigs (20/concentration) were induced by skin application with 64 - 67% CASRN 5102-83-0 (purity 70%) in corn oil on days 0, 7 and 14. They were then challenged on day 28 with 0.1, 1 or 10% w/v CASRN 6358-85-6 in corn oil. Skin reactions were examined at 24 and 48 hours after the challenge exposure. The positive control reacted appropriately. Histopathological skin evaluation showed similar effects in treated and negative control animals, indicative of skin irritation. No evidence of sensitization was observed in the treated animals.

**CASRN 5102-83-0 was not a skin sensitizer in guinea pigs in this assay.**

(2) Female Dunkin/Hartley guinea pigs (20/concentration) were induced, by skin application, with 75% CASRN 5102-83-0 (purity 90%) in corn oil on days 0, 7 and 14. They were then challenged on day 28 with 3, 10, 30 or 75% CASRN 6358-85-6 in corn oil. Skin reactions were observed 24 and 48 hours after the challenge exposure. The positive control reacted appropriately. Histopathological skin evaluation showed similar effects in treated and negative control animals, indicative of skin irritation. No evidence of sensitization was observed in the treated animals.

**CASRN 5102-83-0 was not a skin sensitizer in guinea pigs in this assay.**

#### ***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

Female Dunkin/Hartley guinea pigs (20/concentration) were induced, by skin application, with 60% CASRN 6358-85-6 (purity 92%) in corn oil on days 0, 7 and 14. They were then challenged on day 28 with 3, 10, 30 or 60% CASRN 6358-85-6 in corn oil. Skin reactions were observed 24 and 48 hours after the challenge exposure. The positive control reacted appropriately. Histopathological skin evaluation showed similar effects in treated and negative control animals, indicative of skin irritation. No evidence of sensitization was observed in the treated animals.

**CASRN 6358-85-6 was not a skin sensitizer in guinea pigs in this assay.**

### *Carcinogenicity*

#### ***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

Male and female Sprague-Dawley rats were administered C.I. Pigment Yellow 83 via gavage at 0, 0.1, 0.3 or 0.9% for 104 weeks to test for carcinogenicity. No evidence of carcinogenicity was observed.

**CASRN 5567-15-7 was not carcinogenic to rats in this assay.**

***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

(1) In a NTP carcinogenicity study, Fischer 344 rats (50/sex/concentration) were administered CASRN 6358-85-6 in the feed at 2.5 and 5.0% (equivalent to 1000 and 2000 mg/kg-bw/day for males; 1250 and 2500 mg/kg-bw/day for females), as described above. There was no significant effect on survival or body weight gain. Except for yellow staining and some isolated neoplasms, the only adverse clinical sign or pathologic lesion observed in treated rats was basophilic cytoplasm changes in hepatocytes of treated rats. No treatment-related increase in the incidence of neoplasms or nonneoplastic lesions was evident. A single case of metastatic chordoma and osteogenic sarcoma was observed. [http://ntp-apps.niehs.nih.gov/ntp\\_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults](http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults)

**CASRN 6358-85-6 was not carcinogenic to rats in this assay.**

(2) In a NTP carcinogenicity study, B6C3F1 mice (50/sex/concentration) were administered CASRN 6358-85-6 in the feed at 2.5 and 5.0% (equivalent to 3000 and 6000 mg/kg-bw/day for males; 3250 and 6500 mg/kg-bw/day for females), as described above. There was no significant effect on survival or body weight gain. Except for yellow staining and some isolated neoplasms, no adverse clinical signs or pathologic lesions were observed in treated mice. No treatment-related increase in the incidence of neoplasms or nonneoplastic lesions was evident. Single cases of squamous-cell carcinoma of the ear, infiltrating duct carcinoma of the mammary gland, and subcutaneous mastocytoma were observed. [http://ntp-apps.niehs.nih.gov/ntp\\_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults](http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?searchterm=6358-85-6&fuseaction=ntpsearch.searchresults)

**CASRN 6358-85-6 was not carcinogenic to mice in this assay.**

**Conclusion:** The acute oral toxicity of CASRN 5468-75-7 and the supporting chemicals, CASRNs 5102-83-0, 5567-15-7 and 6358-85-6, to rats was low. Repeated inhalation exposures of rats to the supporting chemical, CASRN 5102-83-0, showed pigment deposition in the lungs at all concentrations tested. The LOAEL for effects of pigment particles in the lung was 0.054 mg/L. However, systemic effects were not observed at concentrations up to and including 0.41 mg/L; the NOAEC for systemic toxicity was 0.41 mg/L (highest concentration tested). In several repeated dietary exposure studies, the supporting chemical, CASRN 6358-85-6, caused no adverse systemic effects at doses up to and including 2500 and 6500 mg/kg-bw/day in rats and mice, respectively. The NOAELs for systemic toxicity in rats and mice were 2500 and 6500 mg/kg-bw/day, respectively (highest concentrations tested). In a combined oral gavage repeated-dose/reproductive/developmental toxicity screening test in rats, the supporting chemical, CASRN 6358-85-6, showed no systemic, reproductive or developmental toxicity up to and including 1000 mg/kg-day. The NOAEL for systemic/reproductive/developmental toxicity was 1000 mg/kg-day (highest dose tested). The supporting chemical, CASRN 5567-15-7, did not induce gene mutations in bacterial cells *in vitro* and the supporting chemical, CASRN 6358-85-6, did not induce chromosomal aberrations in mammalian cells *in vitro*. CASRN 5102-83-0 was irritating to rabbit skin and CASRN 5567-15-7 was slightly irritating to rabbit skin and eyes. The supporting chemical, CASRN 6358-85-6, was not a skin sensitizer in guinea pigs. The supporting chemicals were not carcinogenic in rats (CASRNs 5567-15-7 and 6358-86-6) or mice (CASRN 6358-86-6).

<b>Table 4. Summary Table of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program: Human Health Data</b>				
<b>Endpoints</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14 (5468-75-7)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13 (5102-83-0)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 83 (5567-15-7)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 12 (6358-86-6)</b>
<b>Acute Oral Toxicity rat LD50 (mg/kg-bw)</b>	<b>&gt;17,000</b>	<b>&gt; 3000</b>	<b>&gt;1,750</b>	<b>&gt; 17,000</b>
<b>Acute Dermal Toxicity LD50 (mg/kg-bw)</b>	–	<b>&gt; 3000</b>	–	–
<b>Acute Inhalation Toxicity LC50 (mg/L)</b>	–	<b>&gt;4.448</b>	–	–
<b>Repeated-Dose Toxicity NOAEL/LOAEL Oral (mg/kg-day)</b>	No Data NOAEL = 1000 (highest dose tested) (RA)	–	–	<b>NOAEL = 1000 (highest dose tested)</b>
<b>Repeated-Dose Toxicity NOAEL/LOAEL Inhalation (mg/L)</b>	No Data NOAEL = 0.41 (highest concentration tested) (RA)	<b>NOAEL = 0.41 (highest concentration tested)</b>	–	–
<b>Reproductive Toxicity NOAEL/LOAEL Oral (mg/kg-day)  Reproductive Toxicity</b>	No Data NOAEL = 1000 (highest dose tested) (RA)	–	–	<b>NOAEL = 1000 (highest dose tested)</b>

<b>Table 4. Summary Table of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program: Human Health Data</b>				
<b>Endpoints</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14 (5468-75-7)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13 (5102-83-0)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 83 (5567-15-7)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 12 (6358-86-6)</b>
<b>Developmental Toxicity NOAEL/LOAEL Oral (mg/kg-day) Maternal Toxicity</b>	No Data NOAEL = 1000 (highest dose tested) (RA)	–	–	<b>NOAEL = 1000 (highest dose tested)</b>
<b>Developmental Toxicity</b>	No Data NOAEL = 1000 (highest dose tested) (RA)	–	–	<b>NOAEL = 1000 (highest dose tested)</b>
<b>Genetic Toxicity – Gene Mutation <i>In vitro</i></b>	No Data Negative (RA)	<b>Negative</b>	<b>Negative</b>	<b>Negative</b>
<b>Genetic Toxicity – Chromosomal Aberrations <i>In vitro</i></b>	No Data Negative (RA)	–	–	<b>Negative</b>
<b>Additional Information</b>				
<b>Skin Irritation</b>	–	<b>Irritating</b>	–	<b>Slightly irritating</b>
<b>Eye Irritation</b>	–	–	–	<b>Slightly irritating</b>
<b>Skin Sensitizer</b>	–	<b>Negative</b>	–	<b>Negative</b>
<b>Carcinogenicity</b>	–	–	<b>Negative (rats)</b>	<b>Negative (rats and mice)</b>

RA = read-across; – indicates that endpoint was not addressed for this chemical

#### 4. Hazard to the Environment

A summary of aquatic toxicity data submitted for SIDS endpoints is provided in Table 5.

##### *Acute Toxicity to Fish*

###### ***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

Zebrafish (*Brachydanio rerio*) were exposed to C.I. Pigment Yellow 83 at nominal concentrations of 0 or 100 mg/L under flow-through conditions for 96 hours. No lethal effects were observed. The study was conducted at a test concentration that exceeded the water solubility limit of the test chemical. However, the physicochemical properties suggest that further testing is not necessary.

**No effects at saturation.**

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

###### ***C.I. Pigment Yellow 12 (CASRN 6358-85-6, supporting chemical)***

*Daphnia magna* were exposed to C.I. Pigment Yellow 12 at a nominal concentration of 100 mg/L under static conditions for 72 hours. No treatment-related mortality was observed. The study was conducted at a test concentration that exceeded the water solubility limit of the test chemical. However, the physicochemical properties suggest that further testing is not necessary.

**No effects at saturation.**

##### *Toxicity to Aquatic Plants*

###### ***C.I. Pigment Yellow 83 (CASRN 5567-15-7, supporting chemical)***

Green algae (*Pseudokirchneriella subcapitata*) were exposed to C.I. Pigment Yellow 83 at a nominal concentration of 100 mg/L under static conditions for 72 hours. No significant inhibition of biomass or growth rate was observed. The study was conducted at a test concentration that exceeded the water solubility limit of the test chemical. However, the physicochemical properties suggest that further testing is not necessary.

**No effects at saturation.**

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

###### ***C.I. Pigment Yellow 13 (CASRN 5102-83-0, supporting chemical)***

*Daphnia magna* were exposed to C.I. Pigment Yellow 13 at nominal concentrations of 0 or 100 mg/L under semi-static conditions for 21 days. No treatment-related effects on survival or number of offspring were observed. The study was conducted at a test concentration that exceeded the water solubility limit of the test chemical. However, the physicochemical properties suggest that further testing is not necessary.

**No effects at saturation.**

**Conclusion:** No data are available on CASRN 5468-75-7 for the ecotoxicity endpoints. Data for the supporting chemicals show that there is no acute toxicity to fish (CASRN 5567-15-7), aquatic invertebrates (CASRN 6358-85-6) and aquatic plants (CASRN 5567-15-7), or chronic

toxicity to aquatic invertebrates (CASRN 5102-83-0) at 100 mg/L (highest concentration tested), which is above the water solubility limit of this chemical. No data gaps were identified under the HPV Challenge Program.

<b>Table 5. Summary Table of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program: Aquatic Toxicity Data</b>				
<b>Endpoints</b>	<b>SPONSORED CHEMICAL C.I. Pigment Yellow 14 (5468-75-7)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 13 (5102-83-0)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 83 (5567-15-7)</b>	<b>SUPPORTING CHEMICAL C.I. Pigment Yellow 12 (6358-86-6)</b>
<b>Fish 96-h LC<sub>50</sub> (mg/L)</b>	No Data NES (RA)	–	NES	–
<b>Aquatic Invertebrates 48-h EC<sub>50</sub> (mg/L)</b>	No Data NES (RA)	–	–	NES
<b>Aquatic Plants 72-h EC<sub>50</sub> (mg/L)</b>	No Data NES (RA)	–	NES	–
<b>Chronic Toxicity to Invertebrates 21-d EC<sub>50</sub> (mg/L)</b>	No Data NES (RA)	NES	–	–

NES = no effects at saturation (water solubility limit); RA = read-across; – indicates that endpoint was not addressed for this chemical