

SCREENING-LEVEL HAZARD CHARACTERIZATION

SPONSORED CHEMICAL

Thiodiethylene bis(3,5-di-*tert*-butyl-4-hydroxyhydrocinnamate)
(CASRN 41484-35-9)

SUPPORTING CHEMICAL

1,2-Bis(3,5-di-*tert*-butyl-4-hydroxyhydrocinnamoyl)hydrazine
(CASRN 32687-78-8)

The High Production Volume (HPV) Challenge Program¹ was conceived as a voluntary initiative aimed at developing and making publicly available screening-level health and environmental effects information on chemicals manufactured in or imported into the United States in quantities greater than one million pounds per year. In the Challenge Program, producers and importers of HPV chemicals voluntarily sponsored chemicals; sponsorship entailed the identification and initial assessment of the adequacy of existing toxicity data/information, conducting new testing if adequate data did not exist, and making both new and existing data and information available to the public. Each complete data submission contains data on 18 internationally agreed to “SIDS” (Screening Information Data Set^{1,2}) endpoints that are screening-level indicators of potential hazards (toxicity) for humans or the environment.

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

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

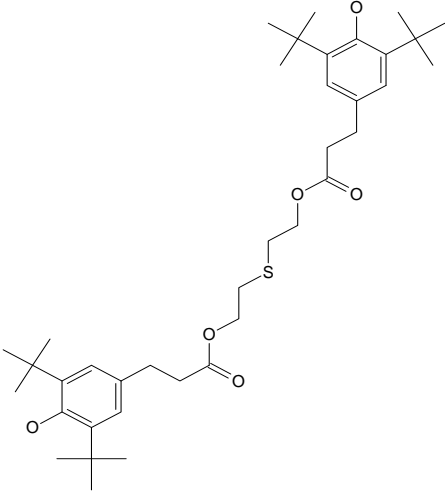
¹ U.S. EPA. High Production Volume (HPV) Challenge Program; <http://www.epa.gov/chemrtk/index.htm>.

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

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

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 information previously not readily available to the public.

<p>Chemical Abstract Service Registry Number (CASRN)</p>	<p>41484-35-9</p>
<p>Chemical Abstracts Index Name</p>	<p>Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, 1,1'-(thiodi-2,1-ethanediyl) ester</p>
<p>Structural Formula</p>	
<p style="text-align: center;">Summary</p> <p>CASRN 41484-35-9 is a white powder with low water solubility and negligible vapor pressure. It is expected to have low mobility in soil. Volatilization of this chemical from water and moist soils is considered low based on its Henry's Law constant. The rate of hydrolysis is considered negligible. The rate of atmospheric photooxidation is considered moderate. It is expected to have high persistence (P3) and low bioaccumulation potential (B1).</p> <p>The acute oral toxicity of CASRN 41484-35-9 is low in rats. An oral repeated-dose toxicity study showed significant increases in relative liver weight in male and female rats at 39 mg/kg-bw/day, respectively. The NOAEL for systemic toxicity was 12.5 mg/kg-bw/day. A reproductive toxicity study was not available; however, no adverse effects on male or female reproductive organs were observed in the repeated-dose toxicity study in rats. A prenatal developmental toxicity study in rats that was conducted with the supporting chemical, CASRN 32687-78-8 showed no maternal or developmental toxicity; the NOAEL values for maternal and developmental toxicity were 3000 mg/kg-bw/day. The sponsored chemical, CASRN 41484-35-9 did not induce gene mutations <i>in vitro</i>. The supporting chemical, CASRN 32687-78-8 did not induce micronuclei <i>in vivo</i>.</p> <p>For CASRN 41484-35-9, the 96-hour LC₅₀ for fish, 48-hour EC₅₀ for aquatic invertebrates, and 72-hour EC₅₀ for aquatic plants indicate "no effects at saturation."</p> <p>No data gaps were identified for this chemical under the HPV Challenge Program.</p>	

The sponsor, Ciba Specialty Chemicals Corporation, submitted a Test Plan and Robust Summaries to EPA for thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), (CASRN 41484-35-9) on August 8, 2003. EPA posted the submission on the ChemRTK HPV Challenge website on August 28, 2003 (<http://www.epa.gov/chemrtk/pubs/summaries/thiotbhy/c14690tc.htm>). EPA comments on the original submission were posted to the website on January 22, 2004. Public comments were also posted to the website. The sponsor submitted updated/revised documents on July 11, 2007 which were posted to the ChemRTK website on August 29, 2007.

Justification for Supporting Chemicals

The sponsor proposed use of 1,2-bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyl)hydrazine (CASRN 32687-78-8), to address reproductive/developmental toxicity and chromosomal aberrations endpoints. The Agency concluded that CASRN 32687-78-8 is a reasonable supporting chemical to address these endpoints, based on its similar structural and physical-chemical properties.

1. Chemical Identity

1.1 Identification and Purity

Test plans indicated > 98% purity for the sponsored chemical (CASRN 41484-35-9) and the supporting chemical (CASRN 32687-78-8).

1.2 Physical-Chemical Properties

The physical-chemical are summarized in Table 1. The sponsored chemical (CASRN 41484-35-9) is a white powder with low water solubility and negligible vapor pressure.

Table 1. Physical-Chemical Properties of Thiodiethylene bis(3,5-di-<i>tert</i>-butyl-4-hydroxyhydrocinnamate) (CASRN 41484-35-9)¹ and 1,2-Bis(3,5-di-<i>tert</i>-butyl-4-hydroxyhydrocinnamoyl)hydrazine (CASRN 32687-78-8)²		
Property	CASRN 41484-35-9	CASRN 32687-78-8
Molecular Weight	642.94	552.8
Physical State	White to off-white powder	White to off-white powder
Melting Point	63–68°C (measured); 71.5°C (measured) ³	227–232°C (measured)
Boiling Point	664.94°C (estimated)	741.68°C (estimated)
Vapor Pressure	2.9×10 ⁻¹⁵ mm Hg at 25°C (estimated) ⁵	1.8×10 ⁻¹⁹ mm Hg at 25°C (estimated) ⁵
Water Solubility	0.005–0.007 mg/L (measured); 1.4×10 ⁻⁵ mg/L (estimated) ⁵	<1 mg/L at 20°C (measured limit value); 2.1×10 ⁻⁴ mg/L (estimated) ⁵
Dissociation Constant (pK _a)	12.05 (estimated for the phenol moiety) ⁴	8.29 (estimated for amide moiety) ⁴ ; 11.92 (estimated for phenol moiety) ⁴
Henry's Law Constant	4.3×10 ⁻¹⁷ atm·m ³ /mole (estimated)	1.3×10 ⁻¹⁸ atm·m ³ /mole (estimated)
Log K _{ow}	>10.36 (estimated)	7.79 (estimated)

¹Ciba Specialty Chemicals Corporation. July 16, 2007. Revised Test Plan and Robust Summary for Thiodiethylene Bis(3,5-Di-*tert*-Butyl-4-Hydroxyhydrocinnamate) (IRGANOX 1035).

<http://www.epa.gov/chemrtk/pubs/summaries/thiotbhy/c14690tc.htm>.

²Ciba Specialty Chemicals Corporation. December 15, 2003. Test Plan and Robust Summary for 1,2-Bis(3,5-di-*tert*-butyl-4-hydroxyhydrocinnamoyl)hydrazine (IRGANOX MD 1024).

<http://www.epa.gov/chemrtk/pubs/summaries/irganox/c14894tc.htm>.

³Patent: Ciba-Geigy FR 2212323 1974 DE 2364126. Chem. Abstr. 81(120260).

⁴SPARC, 2008. Online pK_a and Property Calculator v. 4.2.1405-s4.2.1408. Accessed September 17, 2008.

<http://ibmlc2.chem.uga.edu/sparc/>.

⁵U.S. EPA. 2008. Estimation Programs Interface Suite™ for Microsoft® Windows, v 3.20. United States Environmental Protection Agency, Washington, DC, USA entering measured data where applicable.

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

2. General Information on Exposure

2.1 Production Volume and Use Pattern

CASRN 41484-35-9 had an aggregated production volume in the United States of 1 million to 10 million pounds during calendar year 2005.

Some of the IUR processing and use information and IUR commercial or consumer product uses were claimed as confidential. The HPV submission for this chemical states that the chemical is used as a stabilizer for polyolefins, elastomers, and other polymeric substances, as well as an additive for synthetic and partially synthetic lubricants for engine oils. The HPV submission also states that the chemical has been cleared by the FDA for use in polymers, resins or adhesives intended for food contact applications at concentrations up to 0.5% of the article.

2.2 Environmental Exposure and Fate

No quantitative information is available on releases of this chemical to the environment.

The environmental fate properties are provided in Table 2. CASRN 41484-35-9 is expected to have low mobility in soil. The rate of volatilization is considered low based on its estimated Henry's Law constant. The rate of hydrolysis is considered negligible. CASRN 41484-35-9 is expected to have high persistence (P3) and low bioaccumulation potential (B1).

Table 2. Environmental Fate Characteristics of Thiodiethylene bis(3,5-di-<i>tert</i>-butyl-4-hydroxyhydrocinnamate (CASRN 41484-35-9)¹ and 1,2-Bis(3,5-di-<i>tert</i>-butyl-4-hydroxyhydrocinnamoyl)hydrazine (CASRN 32687-78-8)²		
Property	CASRN 41484-35-9	CASRN 32687-78-8
Photodegradation Half-life	2.103 hours (estimated)	2.3 hours (estimated)
Hydrolysis Half-life	50 days at pH 8 ³ ; 1.4 years at pH 7 ³	>1 year (estimated)
Biodegradation	2–7% in 28 days (not readily biodegradable)	1–6% in 28 days (not readily biodegradable)
Bioconcentration	BCF = 3.1 (estimated) ³	BCF = 1,881 (estimated) ³
Log K _{oc}	8.9 (estimated) ³	7.4 (estimated) ³
Fugacity (Level III Model)	Air = 0.00046% Water = 1.04% Soil = 44.4% Sediment = 54.6%	Air = 0.0271% Water = 1.23% Soil = 35.6% Sediment = 63.2%
Persistence ⁴	P3 (high)	P3 (high)
Bioaccumulation ⁴	B1 (low)	B2 (low)

¹Ciba Specialty Chemicals Corporation. July 16, 2007. Revised Test Plan and Robust Summary for Thiodiethylene Bis(3,5-Di-*tert*-Butyl-4-Hydroxyhydrocinnamate (IRGANOX 1035).

<http://www.epa.gov/chemrtk/pubs/summaries/thiotbhy/c14690tc.htm>

²Ciba Specialty Chemicals Corporation. August 28, 2008. Test Plan and Robust Summary for benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, -[3-[3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl]-1-oxopropyl]hydrazide, (IRGANOX MD 1024) <http://www.epa.gov/chemrtk/pubs/summaries/irganox/c14894tc.htm>.

³U.S. EPA. 2008. Estimation Programs Interface Suite™ for Microsoft® Windows, v 3.20. United States Environmental Protection Agency, Washington, DC, USA. <http://www.epa.gov/opptintr/exposure/pubs/episuite.htm>.

⁴Federal 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

Acute Oral Toxicity

Thiodiethylene bis(3,5-di-*tert*-butyl-4-hydroxyhydrocinnamate) (CASRN 41484-35-9)

Tif:RAIf (SPF) rats (5/sex/dose) were administered CASRN 41484-35-9 (suspended in 0.5% carboxymethylcellulose and 0.1% polysorbate 80) via oral gavage at 5000 mg/kg-bw. No mortality occurred.

LD₅₀ > 5000 mg/kg-bw

Repeated-Dose Toxicity

Thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate) (CASRN 41484-35-9)

In a repeated dose toxicity study, Tif: RAIf (SPF) rats (20/sex/dose) were administered CASRN 41484-35-9 orally via the diet at 0, 60, 200, 600 and 2000 ppm (~ 0, 4.4, 12.5, 39 and 138 mg/kg-bw/day in males and 0, 4.5, 13, 40, and 140 mg/kg bw/day in females) for 93 - 103 days. No mortality occurred. Hematological findings were unremarkable. Absolute and relative liver weight was significantly increased ($p < 0.01$) in males at 60, 200, 600 and 2000 ppm. Relative thyroid weight was significantly increased in males at 200 and 600 ppm. Relative liver weight was also increased at 600 and 2000 ppm in females. No histopathological changes were reported other than minimal hypertrophy in the centrilobular region of the liver at 600 and 2000 ppm.

LOAEL = 39 mg/kg-bw/day (based on increased relative liver weight and liver hypertrophy in males and females)

NOAEL = 12.5 mg/kg-bw/day

Reproductive Toxicity

A reproductive toxicity test was not submitted. An evaluation of reproductive organs from a 90-day repeated-dose toxicity study and availability of a developmental toxicity study for the supporting chemical CASRN 32687-78-8 may address the reproductive toxicity endpoint for the purposes of the HPV Challenge Program.

Thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate) (CASRN 41484-35-9)

In the 90-day repeated-dose toxicity study described above, Tif: RAIf (SPF) rats (20/sex/dose) were administered CASRN 41484-35-9 orally via the diet at 0, 60, 200, 600 and 2000 ppm (~ 0, 4.4, 12.5, 39 and 138 mg/kg-bw/day in males and 0, 4.5, 13, 40, and 140 mg/kg bw/day in females) for 93 - 103 days. Reproductive organs (testes, prostate, uterus, fallopian tubes and ovaries) were examined grossly and microscopically. A significant increase ($p < 0.05$) in absolute testes weight was seen in males at 200, 600 and 2000 ppm. No macroscopic or microscopic histopathological changes were observed in male or female reproductive organs.

Developmental Toxicity

1,2-Bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyl)hydrazine (CASRN 32687-78-8, supporting chemical)

Pregnant Sprague-Dawley rats (24 animals/dose) were administered CASRN 32687-78-8 (suspended in polyethylene glycol) via oral gavage at doses of 0, 500, 1500 and 3000 mg/kg-bw/day on days 6 – 15 of gestation. Offspring were removed via caesarean section and examined on gestation day 21. Implantation rate, embryo lethality and the male to female sex ratios were comparable for all groups. Fusion of placentas, embryonic resorptions and a poorly developed male fetus was noted for one female treated at 500 mg/kg-bw/day. Gross inspection of live offspring revealed one fetus with omphalocele in the 500 mg/kg-bw/day dose group. Skeletal assessment revealed instances of irregular sternebral ossification both in treated and control animals. An abnormally wide suture was found in one fetus in the high dose group. The incidence of delayed ossification of hind-limb phalangeal nuclei (55.4%) was also increased at

the highest dose. This value is slightly higher than the vehicle control value (37 – 54.4%), but is not considered to be toxicologically significant in the absence of other signs of toxicity.

LOAEL (developmental toxicity) = 3000 mg/kg-bw/day (based on delayed ossification)

NOAEL (developmental toxicity) = 3000 mg/kg-bw/day (based on no effects at the highest dose tested)

NOAEL (maternal toxicity) = 3000 mg/kg-bw/day

Genetic Toxicity – Gene Mutation

In vitro

Thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate (CASRN 41484-35-9)

In a bacterial reverse mutation assay, *Salmonella typhimurium* strains TA98, TA100, TA1535 and TA1537 were exposed to CASRN 41484-35-9 at concentrations of 20, 80, 320, 1280 and 5120 µg/plate both with and without metabolic activation. The test chemical precipitated at 320 µg/0.1 ml and higher. No mutagenic effects were reported. No other details were provided for this assay in the robust summary.

CASRN 41484-35-9 was not mutagenic in this assay.

Genetic Toxicity – Chromosomal Aberrations

In vivo

1,2-Bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyl)hydrazine (CASRN 32687-78-8, supporting chemical)

In a nucleus anomaly test, Chinese hamsters (6/sex/dose) were administered CASRN 32687-78-8 via oral gavage at doses of 0, 1250, 2500 or 5000 mg/kg-bw/day once per day for 2 consecutive days. Animals were sacrificed 24 hours after the second application and bone marrow was harvested from the shafts of both femurs. The percent of micronuclei in the bone marrow erythroblasts from treated animals showed no significant difference from the negative control. The positive control, cyclophosphamide, responded as expected. Positive and negative controls induced a 43.05% and 1.0% incidence of nuclear anomalies, respectively. No other details were provided in the robust summary.

CASRN 32687-78-8 did not induce micronuclei in this assay.

Thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate (CASRN 41484-35-9)

Chinese hamsters (6 males and 6 females) were exposed to CASRN 41484-35-9 (suspended in 0.5% aqueous sodium-carboxymethylcellulose) via oral gavage at doses of 825, 1750 and 3500 mg/kg-bw/day for 2 consecutive days. Animals were sacrificed 24 hours after the second application and bone marrow was harvested from the shafts of both femurs. No evidence of clastogenic effects were observed in Chinese hamster bone marrow cells at any tested concentration. Positive and negative controls induced a 12.5% and 0.5% incidence of nuclear anomalies, respectively. No other details were provided in the robust summary.

CASRN 41484-35-9 did not induce nuclear anomalies in this assay.

Conclusion: The acute oral toxicity of CASRN 41484-35-9 is low in rats. An oral repeated-dose toxicity study showed significant increases in relative liver weight and associated

histopathology at 39 mg/kg-bw/day, respectively. The NOAEL for systemic toxicity was 12.5 mg/kg-bw/day. A reproductive toxicity study was not available; however, no adverse effects on male or female reproductive organs were observed in the repeated-dose toxicity study in rats. A prenatal developmental toxicity study in rats that was conducted with the supporting chemical, CASRN 32687-78-8 showed no maternal or developmental toxicity; the NOAEL values for maternal and developmental toxicity were 3000 mg/kg-bw/day. The sponsored chemical, CASRN 41484-35-9 did not induce gene mutations *in vitro*. The supporting chemical, CASRN 32687-78-8 did not induce micronuclei *in vivo*.

4. Hazards to the Environment

In comments on the original test plan, EPA recognized the inadequacies in the acute toxicity tests submitted and recommended that if the water solubility of CASRN 41484-35-9 was determined to be > 0.001 mg/L, that either a fish early life stage test or a chronic invertebrate test be conducted. The type of test recommended would depend on which type of organism is determined to be more sensitive to CASRN 41484-35-9. The results of the water solubility test indicate the water solubility of CASRN 41484-35-9 is 0.005 mg/L.

Upon further review, given the chemical's low water solubility and high log K_{ow} , EPA has determined that no further acute or chronic testing is necessary.

Acute Toxicity to Fish

(1) Rainbow trout (*Salmo gairdneri*) were exposed to CASRN 41484-35-9, at nominal concentrations of 0 and 100 mg/L (measured concentration = 61 mg/L) under static conditions for 96 hours. DMF and MARLOPON AT50 solvents were used. There were no mortalities and the sponsor reported a 96-h LC_{50} of > 61 mg/L. The substance was tested above its water solubility limit and in the presence of solvent. Therefore, EPA considers the no effect concentration to be the water solubility limit (saturation), which for CASRN 41484-35-9 would be 0.005 mg/L (measured).

No effects at saturation

(2) Zebrafish (*Danio rerio*) were exposed to CASRN 41484-35-9, at nominal concentrations of 0 and 100 mg/L (measured concentration = 57 mg/L) under static conditions for 96 hours. DMF and MARLOPON AT50 solvents were used. There were no mortalities and the sponsor reported a 96-h LC_{50} of > 57 mg/L. The substance was tested above its water solubility limit and in the presence of solvent. Therefore, EPA considers the no effect concentration to be the water solubility limit (saturation), which for CASRN 41484-35-9 would be 0.005 mg/L (measured).

No effects at saturation

Acute Toxicity to Aquatic Invertebrates

Daphnia magna Straus 1820 were exposed to CASRN 41484-35-9 as water accommodated fractions (WAF) under static conditions for 48 hours. The loading rate was 100 mg/L and no analytical measurements were made on the WAF. No effects were seen. Therefore, the sponsor concluded that there are no effects at the maximum loading rate of 100 mg/L. EPA does not

consider the loading rate as the no effect concentration when the concentration exceeds the water solubility of the substance. Assuming the exposure concentration is the water solubility limit (saturation), the no effect concentration would be approximately 0.005 mg/L.

No effects at saturation

Toxicity to Aquatic Plants

Freshwater green algae (*Scenedesmus subspicatus*) was exposed to 0, 1.23, 3.7, 11, 33 and 100 mg/L (nominal) of CASRN 41484-35-9 under static conditions for 72 hours. Lecithin vehicle was used at concentrations exceeding the lowest nominal CASRN 41484-35-9 concentration. Undissolved test substance was observed in the exposure flasks. The robust summary reports an EC₅₀ of > 41 mg/L and a NOEC of 11 mg/L, both of which indicate there were effects observed. The substance was tested above its water solubility limit and in the presence of solvent. Therefore, EPA considers the no effect concentration to be the water solubility limit (saturation), which for CASRN 41484-35-9 would be 0.005 mg/L (measured).

No effects at saturation

Conclusion: For CASRN 41484-35-9, the 96-hour LC₅₀ for fish, 48-hour EC₅₀ for aquatic invertebrates, and 72-hour EC₅₀ for aquatic plants indicate “no effects at saturation.”

Table 3. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program		
Endpoints	SPONSORED CHEMICAL (Thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)) (CASRN 41484-35-9)	SUPPORTING CHEMICAL 1,2-Bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyl) hydrazine (CASRN 32687-78-8)
Structure		
Summary of Human Health Data		
Acute Toxicity Oral LD ₅₀ (mg/kg-bw)	> 5000	*
Repeated-Dose Toxicity NOAEL/LOAEL Oral (mg/kg-bw/day)	LOAEL= 39.0 NOAEL = 12.5	*
Reproductive Toxicity NOAEL/LOAEL (mg/kg-bw/day)	No effects were seen on reproductive organs during a 90-day repeated-dose toxicity study in rats.	

Table 3. Summary of the Screening Information Data Set as Submitted under the U.S. HPV Challenge Program		
Endpoints	SPONSORED CHEMICAL (Thiodiethylene bis(3,5-di-tert-butyl-4-ydroxyhydrocinnamate)) (CASRN 41484-35-9)	SUPPORTING CHEMICAL 1,2-Bis(3,5-di-tert-butyl-4-hydroxy hydrocinnamoyl) hydrazine (CASRN 32687-78-8)
Developmental Toxicity NOAEL/LOAEL (mg/kg-bw/day)	No Data	
Maternal	NOAEL = 3000 (hdt)	NOAEL = 3000 (hdt)
Developmental	LOAEL = 3000 NOAEL = 3000 (RA)	LOAEL = 3000 NOAEL = 3000
Genetic Toxicity		
Gene Mutation <i>In vitro</i>	Negative	*
Genetic Toxicity	No data	
Chromosome Aberrations <i>In vivo</i>	Negative (RA)	Negative
Summary of Environmental Effects – Aquatic Toxicity Data		
Fish 96-h LC₅₀ (mg/L)	No effects at saturation	—*
Aquatic Invertebrates 48-h EC₅₀ (mg/L)	No effects at saturation	—*
Aquatic Plants 72-h EC₅₀ (mg/L) (growth) (biomass)	No effects at saturation	—*

Measured data in bold text; — indicates endpoint was not addressed for this chemical;

* indicates endpoint not used in this assessment; (RA) = Read Across; hdt = highest dose tested