DCOIT (CAS# 64359-81-5)
Certified GreenScreen® Assessment

Prepared for
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GreenScreen® Assessment for DCOIT (CAS# 64359-81-5)

Method Version: GreenScreen® Version 1.3[1]

Assessment Type:[2] Certified

Chemical Name: DCOIT

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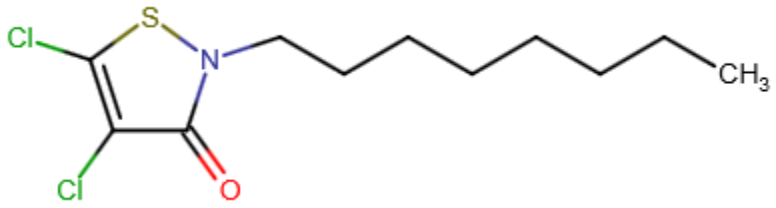
Organization: Gradient	Organization: Gradient
Date: September 30, 2016	Date: September 30, 2016
Assessor Type (Licensed GreenScreen Profiler, Authorized GreenScreen Practitioner or Unaccredited):	Licensed GreenScreen Profiler

Confirm Application of the Disclosure and Assessment Rules and Best Practice:[3] Applied; all impurities disclosed.

Chemical Name (CAS#[4]): 4,5-Dichloro-2-octyl-2H-isothiazol-3-one (CAS# 64359-81-5)

Also Called: DCOIT, Kathon™ 287T Biocide, RH-5287, XB3ER1

Chemical Structure:

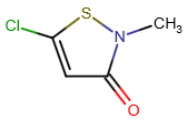
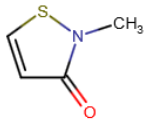
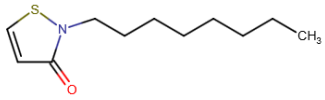


[1] Use GreenScreen® Assessment Procedure (Guidance) V1.3 (March 2016).
[2] GreenScreen reports are either "UNACCREDITED" (by unaccredited person), "AUTHORIZED" (by Authorized GreenScreen Practitioner), "CERTIFIED" (by Licensed GreenScreen Profiler or equivalent) or "CERTIFIED WITH VERIFICATION" (Certified or Authorized assessment that has passed GreenScreen Verification Program).
[3] See GreenScreen Guidance V1.3.
[4] Chemical Abstracts Service Number.

Suitable Analogs or Moieties Used in This Assessment (CAS #): 5-Chloro-2-methyl-4-isothiazolin-3-one (CMI) (CAS# 26172-55-4), 2-Methyl-4-isothiazolin-3-one (MI) (CAS# 2682-20-4), and 2-Octyl-3(2H)-isothiazolone (OIT) (CAS# 26530-20-1).

Several surrogates were identified to assist in filling data gaps for carcinogenicity (Norway, 2010). The surrogates include 5-Chloro-2-methyl-4-isothiazolin-3-one (CAS# 26172-55-4), 2-Methyl-4-isothiazolin-3-one (CAS# 2682-20-4), and 2-Octyl-3(2H)-isothiazolone (CAS# 26530-20-1), which demonstrate similar structure and function to DCOIT (Norway, 2010). Additionally, data for the surrogate 2-Methyl-4-isothiazolin-3-one were used to evaluate the endocrine activity and neurotoxicity endpoints. These compounds are considered appropriate and relevant surrogates because, like DCOIT, they are characterized by the isothiazolone ring, which plays a key role in the biocidal activity of compounds including DCOIT. Biocides containing the isothiazolone ring share a common reactivity pathway: cleavage of the S-N bond and formation of disulfide (S-S) bonds with thiol groups on enzymes, eventually leading to the inhibition of cell respiration (Organisation for Economic Co-operation and Development [OECD] QSAR Guidance 2015 p. 79H; NAFTA TWG QSAR Guidance p. 183-184). The surrogates used to assess the carcinogenicity potential of DCOIT retain the isothiazolone moiety, and differ from DCOIT only in the substitution around the ring.

Chemical Structure(s):

CAS# 26172-55-4 5-Chloro-2-methyl-4-isothiazolin-3-one (CMI)	CAS# 2682-20-4 2-Methyl-4-isothiazolin-3-one (MI)	CAS# 26530-20-1 2-Octyl-3(2H)-isothiazolone (OIT)
		

Notes Related to Production Specific Attributes:[5] N/A

For Inorganic Chemicals and Relevant Particulate Organics

Define Properties:

1. Particle size: N/A
2. Structure: N/A
3. Mobility (*e.g.*, water solubility, volatility): DCOIT is only slightly soluble in water, exhibiting solubilities of 2.26 mg/L, 3.47 mg/L, and 5.67 mg/L at 10°C, 20°C, and 30°C, respectively (at pH 7).
4. Bioavailability: DCOIT has a log K_{ow} of 2.8 at pH 7 and 23°C and a K_{oc} of about 6.6 x 10^3 kg/L for soil and 1.6 x 10^4 kg/L for aquatic sediments (Norway, 2010). These K_{oc} values suggest that

[5] Note any composition or hazard attributes of the chemical product relevant to how it is manufactured. For example, certain synthetic pathways or processes result in typical contaminants, by-products or transformation products. Explain any differences between the manufactured chemical product and the GreenScreen assessment of the generic chemical by CAS#.

DCOIT will bind essentially irreversibly to soil and/or sediment. In soils and sediments, DCOIT degrades rapidly, with half lives of less than 5 days in both media (Norway, 2010; Thomas 2010).

Identify Applications/Functional Uses:

1. Broad-spectrum antifungal biocide used for paints
2. Masonry and other construction product preservative
3. Wood preservative
4. Marine antifoulant paints for commercial use/application only
5. Fungicide/fungistat; bactericide/bacteristat; or algicide/algistat

GreenScreen® Benchmark Score and Hazard Summary Table:[6,7,8,9]

DCOIT is assigned a **Benchmark Score of 2** based on high skin sensitization, very high skin and eye irritation, and very high acute and chronic aquatic toxicity. Although data gaps were evident for respiratory sensitization, all data requirements were met for Benchmark 2 classification.

If we consider the worst case benchmarking scenario based on the reported data gaps, respiratory sensitization would be designated a high hazard (H). Even under this worst case scenario, DCOIT would still receive a Benchmark 2 classification.

Table 1 GreenScreen (v.1.3) Hazard Profile Summary Table – DCOIT

Exposure Route	Group I Human					Group II and II* Human							Ecotox		Fate		Phys	
	C	M	R	D	E	AT	ST		N	SnS*	SnR	IrS	IrE	AA	CA	P	B	Rx	F
							sgl	rpt*	rpt*										
Oral	*L*	**L**	**L**	**L**	*M*	**M**	**L**	**L**	*L*	**H**	dg	**vH**	**vH**	**vH**	**vH**	**L**	*vL*	*L*	**L**
Dermal	*L*		dg	dg		*M*	*L*	*L*	dg										
Inhalation	dg		dg	dg		**vH**	**M**	*L*	dg										

Notes:
Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect estimated values, authoritative B lists, screening lists, weak analogues, and lower confidence. Hazard levels in **BOLD** font are used with good quality data, authoritative A lists, or strong analogues. Group II Human Health endpoints differ from Group II* Human Health endpoints in that they have four hazard scores (i.e., vH, H, M and L) instead of three (*i.e.*, H, M and L), and are based on single exposures instead of repeated exposures.

[6] See Appendix A for a glossary of hazard endpoint acronyms .
[7] See Appendix B for the PHAROS results for DCOIT and its transformation products.
[8] For inorganic chemicals only, see GreenScreen Guidance v1.3 Section 13. (Exceptions for Persistence).
[9] For Systemic Toxicity and Neurotoxicity, repeated exposure data are preferred. Lack of single exposure data is not a Data Gap when repeated exposure data are available. In that case, lack of single exposure data may be represented as NA instead of DG. See GreenScreen Guidance V1.3 Section 8.2.1.

Impurities

DCOIT contains a number of impurities which are Confidential Business Information (CBI) and are not listed in this section. Gradient has obtained information on the chemical identities of the impurities under a Non-disclosure agreement and has evaluated them *via* the GreenScreen List Translator. The GS List Translator outputs ranged from "not applicable" (*i.e.*, not included in list translator) to LT-1. For the purposes of this assessment, we have relied on List Translator, but recommend that full assessments be performed to verify the accuracy of the List Translator assignments.

Table 2 Known DCOIT Impurities Present at Concentrations > 100 ppm

Chemical	CAS#	% by Weight/ppm	GreenScreen List Translator Result or Benchmark
Information on specific DCOIT impurities is confidential business information			Ranged from "not applicable" to LT-1

Environmental Transformation Products and Ratings:[10] See below.

Identify feasible and relevant environmental transformation products (*i.e.*, dissociation products, transformation products, valence states) and/or moieties of concern:[11]

[10] See GreenScreen Guidance V1.3 Section 12

[11] A moiety is a discrete chemical entity that is a constituent part or component of a substance. A moiety of concern is often the parent substance itself for organic compounds. For inorganic compounds, the moiety of concern is typically a dissociated component of the substance or a transformation product.

Table 3 Environmental Transformation Products and Ratings

Functional Use	Life Cycle Stage	Transformation Pathway	Environmental Transformation Products	CAS#	Feasible and Relevant?	GreenScreen List Translator Score
N/A	End	- Photolysis (aqueous, biotic)	n-octanal	124-13-0	Yes	LT-P1
N/A	End	- Photolysis (aqueous, biotic)	n-octyl isocycanate	3158-26-7	No	Not listed
N/A	End	- Photolysis (aqueous, biotic)	n-octyl amine	111-86-4	Yes	LT-P1
N/A	End	- Photolysis (aqueous, biotic) - Biodegradation (freshwater-sediment) - Biodegradation (seawater-sediment)	N-n-octyl acetamide	7462-62-6	No	Not listed
N/A	End	- Photolysis (aqueous, biotic) - Photolysis (aqueous, abiotic) - Biodegradation (estuarine surface water)	N-n-octyl oxamic acid	No CAS	No	Not listed
N/A	End	- Photolysis (aqueous, biotic)	4,5-dichloro-3-n-octyl-thizaolin-2-one	No CAS	Yes	Not listed
N/A	End	- Hydrolysis (abiotic) - Biodegradation (estuarine surface water)	2-chloro-2-(n-octylcarbamoyl)-1-ethene sulfonic acid	No CAS	Yes	Not listed
N/A	End	- Hydrolysis (abiotic) - Biodegradation (estuarine surface water)	1-chloro-2-(n-octylcarbamoyl)-1-ethene sulfonic acid	No CAS	Yes	Not listed
N/A	End	- Biodegradation (estuarine surface water)	1,2-dichloro-2(n-octylcarbamoyl)-1-ethene sulfonic acid	No CAS	Yes	Not listed
N/A	End	- Biodegradation (freshwater-sediment) - Biodegradation (seawater-sediment)	N-(n-octyl) malonamic acid	No CAS	No	Not listed
N/A	End	- Biodegradation (freshwater-sediment)	3,3'-dithiobis-(n-octyl)-3-chloropropenamide	No CAS	Yes	Not listed
N/A	End	- Biodegradation (freshwater-sediment)	2-chloro-3-(formyldithio)-N-octylpropenamide	No CAS	Yes	Not listed
N/A	End	- Biodegradation (seawater-sediment)	N-(n-octyl)-β-hydroxypropionamide	No CAS	No	Not listed

Note:
(a) Compounds were determined to be not relevant based on their identification as intermediates in the transformation pathway of DCOIT to n-octyl amine (Sakkas, 2002 p. 11).

Table 3 lists some of the possible feasible and relevant transformation products identified for DCOIT. The degradation of DCOIT was extensively discussed in the Competent Authority Report (Norway, 2010); additional literature sources examining the degradation of DCOIT were also consulted. According to these sources, the degradation/metabolism of DCOIT involves cleavage of the isothiazolone ring, followed by oxidation (Norway, 2010, p. 76; Sakkas, 2002, p. 7-8). DCOIT is degraded primarily through biodegradation, but chemical degradation (*e.g.*, hydrolysis) may also contribute. In media containing sediment and/or soil, the degradation products are incorporated into the non-extractable residue fragments; this strong adsorption may be due to nucleophilic reaction of organic matter with the intermediate degradation products (Norway, 2010, p. 76, 78).

A review of the degradation behavior of DCOIT in different environmental media, based on information from the documents reviewed, is outlined below:

- Degradation in water
  - In an aqueous hydrolysis study performed in accordance with OECD 111 and 40 Code of Federal Regulations (CFR) § 158 Subdivision N § 161-1, DCOIT exhibited a half-life between 178 and 201 days at pH 7 and 12°C. The half-lives at pH 7 and 25°C and 40°C were 71 and 19 days, respectively. The primary products identified after hydrolysis at pH 7 were 2-chloro-2-(n-octylcarbamoyl)-1-ethene sulfonic acid and 1-chloro-2-(n-octylcarbamoyl)-1-ethene sulfonic acid (Norway, 2010, p. 61-62).
  - In an aqueous photolysis study performed in accordance with 40 CFR § 158 Subdivision N § 161-2, DCOIT exhibited a half life of 13.4 days upon exposure to natural sunlight at 25°C. The primary product identified after photolysis was N-(n-octyl) oxamic acid (Norway, 2010, pp. 62-63).
  - In another aqueous photolysis study, DCOIT exhibited half-lives of 315 h, 154 h, and 131 h in sea water, river water, and lake water, respectively, upon exposure to natural sunlight. Degradation products identified after 23 days of exposure to natural sunlight in lake water included n-octanal, n-octyl isocyanate, n-octyl amine, N-n-octyl acetamide, N-n-octyl oxamic acid, and 4,5-dichloro-3-n-octyl-thiazolin-2-one. Biodegradation may have also contributed to the breakdown of DCOIT in this study, as the natural water samples were not sterilized (Sakkas, 2002).
  - The two hydrolysis products, 2-chloro-2-(n-octylcarbamoyl)-1-ethene sulfonic acid and 1-chloro-2-(n-octylcarbamoyl)-1-ethene sulfonic acid, were also identified in a study of DCOIT biodegradation in estuarine surface water, performed according to OECD Draft Guideline 309. Two additional compounds, N-(n-octyl axamic acid) and 1,2-dichloro-2(n-octylcarbamoyl)-1-ethene sulfonic acid, were also detected in this biodegradation study (Norway, 2010, pp. 66-68).
- Degradation in water-sediment systems
  - In an aerobic freshwater-sediment biodegradation study performed following OECD Draft Guideline 308, at least 11 non-CO_2 metabolites were detected; at least 9 metabolites were detected in the anaerobic freshwater-sediment biodegradation study. Four of these metabolites were identified as: N-(n-octyl) malonamic acid, N-(n-octyl) acetamide, 3,3'-dithiobis-(n-octyl)-3-chloropropenamide, and 2-chloro-3-(formyldithio)-N-octylpropenamide. Disappearance of DCOIT in the sterile, abiotic control sample indicated that chemical processes also contributed to its degradation (Norway, 2010, pp. 69-71).
  - In aerobic and anaerobic seawater-sediment biodegradation studies, carried out according to 40 CFR § 158 Subdivision N §§ 162-4 and 162-3 (respectively), DCOIT disappeared almost

immediately. N-(n-octyl) malonamic acid and N-(n-octyl) acetamide were identified as being likely metabolites. A supplemental study concentrated on identifying metabolites following biodegradation in marine sediment also identified N-(n-octyl)-β-hydroxypropionamide as a metabolite (Norway, 2010, pp. 71-74).

- Degradation in soil
  - In an aerobic soil simulation study performed according to 40 CFR § 158 Subdivision N §§ 162-1, 16 non-CO_2 metabolites were detected, but none were identified. The chromatographic behavior indicated that the metabolites were mostly the same compounds as those generated by the water-sediment studies (Norway, 2010, pp. 75-76).
- Degradation in air
  - The EPA AOPWIN program estimates the atmospheric half-life for DCOIT to be 0.359 days (Norway, 2010, p. 63). However, degradation in air is not expected to be significant, based on DCOIT's low vapor pressure (9.8×10^{-4} Pa at 25°C) and Henry's Law Constant (3.30×10^{-2} Pa m^3 mol^{-1} at 20°C and pH 7) (Norway, 2010, p. 7).

Summary

Multiple DCOIT degradation products have been identified in the regulatory and scientific literature (see Table 3 above). Based on our review, the most commonly detected degradation products are N-n-octyl acetamide (CAS 7462-62-6) and N-n-octyl oxamic acid; these compounds have been identified as intermediates in the transformation of DCOIT to N-octyl amine (CAS 11-86-4) (Sakkas, 2002, p. 11).

Based on information in the Pharos List Translator, two degradation products (n-octanal, CAS 124-13-0, and n-octyl amine, CAS 111-86-4) both have GreenScreen List Translator scores of LT-P1 (List Translator Potential Benchmark 1). The other degradation products identified for DCOIT are not listed in the Pharos List Translator or the ChemAdvisor's List of Lists (LOLI) database. Full GreenScreen assessments of these compounds would be needed to better understand the hazards associated with products of DCOIT degradation and their impact on DCOIT's Benchmark 2 score.

Introduction

DCOIT is an industrial chemical that is used as an anti-fouling agent/biocide. It is also intended to be used in wood preservative products to treat and protect timber in use classes 2, 3, 4A, and 4B (siding, cladding, decks, doors, window frames, constructional timber, pallets, transmission poles, railway sleepers, *etc.*) (Norway, 2010, p. 20). Table 4 summarizes the physical and chemical properties obtained for DCOIT:

Table 4 Physical and Chemical Properties of DCOIT (CAS# 64359-81-5)

Property	Value	Reference
Molecular Formula	$C_{11}H_{17}Cl_2NOS$	Norway, 2010
SMILES Notation	C1(=O)C(Cl)=C(Cl)SN1CCCCCCCC	Professional judgment
Molecular Weight	282.2	Norway, 2010
Physical State	Solid at 20°C	Norway, 2010
Appearance	Off-white solid	Norway, 2010
Melting Point	41.1-41.7°C	Norway, 2010
Vapor Pressure	9.8×10^{-4} Pa at 25°C 2.2×10^{-3} Pa at 30°C 4.6×10^{-3} Pa at 35°C	Norway, 2010
Water Solubility	2.26 mg/L at pH 7 and 10°C 3.47 mg/L at pH 7 and 20°C 5.67 mg/L at pH 7 and 30°C	Norway, 2010
Dissociation Constant	N/A, does not dissociate	Norway, 2010
Density/Specific Gravity	1.27 g/cm^3 at 25°C	Norway, 2010
Partition Coefficient, Log K_{ow}	2.8 at pH 7 and 23°C	Norway, 2010

Notes:
Gradient assessed DCOIT against GreenScreen® version 1.3 (CPA, 2016).

Hazard Classification Summary Section[12]

Hazard classifications for the GreenScreen endpoints evaluated are provided below. Note that for some human health endpoints, we have elected to implement the optional GreenScreen hazard summary table format and report the oral, dermal, and inhalation routes separately to better distinguish their hazard differences. The endpoints include: Carcinogenicity, Acute Mammalian Toxicity, and Systemic Toxicity (single and repeated dose).

Group I Human Health Effects (Group I Human)

Carcinogenicity – Oral, Dermal, And Inhalation Exposure Routes

Oral Carcinogenicity (C) Score (H, M, or L): *L*

DCOIT is assigned a score of *Low (L)* for carcinogenicity *via* the oral route based on results from two carcinogenicity studies conducted in two different species using surrogates. The confidence level associated with this score is low because no study was identified that was conducted with DCOIT technical.

Authoritative and Screening Lists

- *Authoritative:* Not listed
- *Screening:* Not listed

The Dow Chemical Company, 2008

- The Dow Chemical Company (2008) authored a document justifying the use of specific surrogates to evaluate the carcinogenicity endpoint for DCOIT. The document provided information regarding the chronic toxicity and carcinogenicity of DCOIT because data gaps exist for both of these endpoints for DCOIT. Surrogates were selected based on their toxicity profiles and chemical structures. The study authors then identified and summarized previously conducted studies for the selected surrogates. The surrogates selected for the oral route were: 5-chloro-2-methyl-2H-isothiazolin-3-one (CMI), 2-methyl-2H-isothiazolin-3-one (MI), and 2-Octyl-3(2H)-isothiazolone (OIT). The Dow Chemical Company (2008) identified two carcinogenicity studies using these surrogates and provided detailed study summaries in their publication. The study summary results are described below.
- Rats were exposed to Kathon™ 886 (a mixture of DCOIT surrogates CMI and MI in the ratio of 3:1) in an OECD 453 drinking water study, in which animals were exposed to 30, 100, or 300 ppm for 25 months. Concentrations were equivalent to 0, 2.0, 6.6, 17.2 mg/kg bw/day for males and 0, 3.1, 9.8, 25.7 mg/kg bw/day for females. There were no treatment-related effects on survival or on hematological, clinical chemistry, or urinalysis parameters. There were no

[12] Many of the studies presented below involved administering a preformulation of DCOIT to animals. Please note that all doses presented have been converted to represent the active ingredient of DCOIT.

increases of the incidences of neoplasms. Like DCOIT, Kathon™ 866 is irritating, and gastric irritation was the primary effect observed. Other than local effects, no adverse systemic histopathological changes were observed for any tissues or organs.

- In a chronic dietary study, mice were exposed to OIT Technical for 78 weeks (18 months) at concentrations of 0, 500 or 1,000 ppm OIT. A dose conversion from ppm to mg/kg bw/day was not provided. Treatment-related effects were limited to decreases in body weight and increases in liver-to-body weight ratios. There was no effect on survival and no increases in the incidence of any tumor type in the male or female mice administered doses up to and including 1000 ppm. Based on these findings, OIT was considered by the authors to be non-carcinogenic in this study. While this study pre-dates Good Laboratory Practice (GLP) or other current authoritative study guidelines, it was noted by The Dow Chemical Company (2008) that the study provided sufficient information to conclude that OIT is not carcinogenic and support the lack of carcinogenicity classification.

Norway, 2010

- In their evaluation of the oral carcinogenicity endpoint for DCOIT, Norway relied upon the studies for the surrogates (CMI, MI, and OIT) suggested by The Dow Chemical Company (2008). Norway concluded that DCOIT is not carcinogenic by the oral route of exposure based on their evaluation.

Summary

DCOIT is assigned a score of *Low (L)* for carcinogenicity *via* the oral route of exposure based on a Globally Harmonized System (GHS) weight-of-evidence evaluation of results from two carcinogenicity studies (one in rats, one in mice) conducted with surrogates. However, because data were not identified for DCOIT itself, a low confidence is assigned to this score.

The surrogates selected by The Dow Chemical Company (2008) were considered acceptable by Norway (2010) in their review of the carcinogenicity studies; Gradient agrees with Norway's conclusion that the surrogates used for DCOIT appear to be suitable based on their similar toxicity profiles and similar chemical structure (Norway, 2010). Support for surrogate selection was further corroborated by OECD and EPA QSAR documents where DCOIT was used as a case example (OECD QSAR Guidance, 2015; NAFTA TWG QSAR Guidance, 2012).

Based on our review, we agree with the conclusions of The Dow Chemical Company (2008) and Norway (2010) that DCOIT is not carcinogenic *via* the oral route of exposure. Offering additional support for the conclusion that DCOIT is not carcinogenic, DCOIT was not mutagenic or genotoxic in both *in vitro* and *in vivo* assays (Norway, 2010). Additionally, DCOIT is not listed by any GreenScreen-specified list as a carcinogen.

Dermal Carcinogenicity (C) Score (H, M, or L): *L*

DCOIT is assigned a score of *Low (L)* for carcinogenicity *via* the dermal route based on the lack of effect from a carcinogenicity study conducted with a surrogate. The confidence level associated with this score is low because no dermal carcinogenicity study using DCOIT technical was identified. Additionally, because only one study was identified, only one species was evaluated for carcinogenicity *via* the dermal exposure route.

Authoritative and Screening Lists

- *Authoritative:* Not listed
- *Screening:* Not listed

The Dow Chemical Company, 2008

- The Dow Chemical Company (2008) authored a document justifying the use of specific surrogates to evaluate the carcinogenicity endpoint for DCOIT. The document provided information regarding the chronic toxicity and carcinogenicity of DCOIT because data gaps exist for both of these endpoints for DCOIT. Surrogates were selected based on their toxicity profiles and chemical structures. The study authors then identified and summarized previously conducted studies for the selected surrogates. The surrogates selected for the dermal route were 5-chloro-2-methyl-2H-isothiazolin-3-one (CMI) and 2-methyl-2H-isothiazolin-3-one (MI). A single dermal carcinogenicity study was identified in which animals were exposed to a mixture of CMI and MI, and The Dow Chemical Company (2008) provided a detailed study summary in their publication. The results of that study are presented and described below.
- In a dermal carcinogenicity study conducted in 1983 (prior to GLP), mice were exposed to Kathon™ CG (1.5% a.i.; 75%:25 % CMI:MI), diluted in water for 30 months. Animals were exposed to 0 or 400 ppm a.i. (0.04 %, maximum tolerated dose) by applying 25 µL (10 µg/animal) of the test substance, 3 times per week. Survival was lower in treated animals with 7/10 animals surviving, as compared to all 10 control animals surviving. The reason for this decrease in survival was not clear according to the study authors. There was an increased incidence of skin lesions (very slight to moderate epidermal hyperplasia and hyperkeratosis) in treated animals as compared to control mice; however, there were no treatment-related increases in non-neoplastic and neoplastic lesions. Based on these results, the authors concluded that DCOIT was not carcinogenic *via* the dermal route.

Norway, 2010

- In their evaluation of the dermal carcinogenicity endpoint for DCOIT, Norway relied upon the study using surrogates (CMI and MI) suggested by The Dow Chemical Company (2008). Norway concluded that DCOIT is not carcinogenic by the dermal route of exposure based on their evaluation.

Summary

DCOIT is assigned a score of *Low (L)* for carcinogenicity *via* the dermal route based on based on a GHS weight-of-evidence evaluation of results from a carcinogenicity study conducted with a surrogate. However, low confidence is assigned because no data were identified for DCOIT technical and only one study was identified, evaluating one species.

Based on our evaluation, we concur that the surrogates used in the dermal carcinogenicity study appear to be suitable based on their similar toxicity profile and similar chemical structure. (Norway, 2010). Support for surrogate selection was further corroborated in OECD and EPA QSAR documents where DCOIT was used as a case example (OECD QSAR Guidance, 2015; NAFTA TWG QSAR Guidance, 2012). We agree with the conclusions of The Dow Chemical Company (2008) and Norway (2010) that DCOIT is not carcinogenic *via* the dermal route of exposure. Providing further support that DCOIT is not a carcinogen,

DCOIT is not mutagenic or genotoxic based on results from *in vitro* and *in vivo* assays (Norway, 2010). Finally, DCOIT is not listed by any GreenScreen-specified list as a carcinogen.

Inhalation Carcinogenicity (C) Score (H, M, or L): dg

DCOIT is assigned a data gap (dg) for carcinogenicity *via* the inhalation route of exposure. While DCOIT was not demonstrated to be mutagenic or genotoxic in both *in vitro* and *in vivo* assays and is not a known carcinogen *via* inhalation, appropriate studies have not been performed for DCOIT or an appropriate surrogate.

Mutagenicity/Genotoxicity (M) Score (H, M or L): L

DCOIT is assigned a score of **Low** (**L**) for mutagenicity/genotoxicity based on a demonstrated lack of mutagenic or genotoxic effects in *in vitro* and *in vivo* studies. The level of confidence in the score is high because the studies were considered to be high quality and were conducted in accordance with GLP and OECD equivalent guidelines.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

In Vitro Assays

The Dow Chemical Company, 1994a

- DCOIT was negative in an Ames test (OECD 471) conducted with DCOIT technical, with or without metabolic activation. The strains used in the study were *Salmonella typhimurium* strains TA98, TAl00, TA1535, and TA1537, as well as appropriate solvent and positive controls. DCOIT was tested at concentrations ranging from 0.3 to 300 µg/plate. DCOIT did not induce an increase in revertants at any dose level. Similar results were observed in an independent confirmatory assay that used doses ranging from 0.1 to 75 µg/plate. Control groups responded appropriately, validating the study results.

The Dow Chemical Company, 1994b

- DCOIT was negative in a Mammalian Chromosome Aberration Test (OECD 473) conducted with Chinese hamster ovary cells, with or without metabolic activation. This assay was performed in two independent trials. The concentrations evaluated were 0.1, 0.2, 0.3, 0.4, 0.5, 0.6 and 0.7 µg/mL, without activation and at 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0 µg/mL with activation. Duplicate cultures using the same concentrations were evaluated 24 hours after the first assay. Appropriate negative and positive controls were evaluated concurrently. DCOIT did not induce a statistically significant increase in chromosomal aberrations at any of the dose levels examined, both with and without metabolic activation.

The Dow Chemical Company, 1994c

- DCOIT was negative in a Mammalian Cell Gene Mutation test (OECD 476) conducted with Chinese hamster ovary cells, with or without metabolic activation. This assay was performed in two independent trials. For the main assay, the concentrations evaluated were 0.005, 0.025, 0.05, 0.1 and 0.5 µg/mL without activation and 0.5, 1.0, 2.5, 5.0, 10 and 25 µg/mL with activation. For the confirmatory assay, the concentrations evaluated were 0.025, 0.05, 0.1, 0.2, 0.4, 0.5 and 0.75 µg/mL without activation and at 2.5, 5.0, 6.0, 8.0, 9.0, 10 and 15 µg/mL with activation. Appropriate negative and positive controls were evaluated concurrently. After treatment, cells were given an 8-9 day expression period and then cultures were cloned in medium containing 6-thioguanine. DCOIT did not cause a significant increase in the mutant frequency at the HGPRT locus.

In Vivo Assay

The Dow Chemical Company, 2001a

- DCOIT was negative in an OECD 474 Mammalian Erythrocyte Micronucleus test. In the study, male and female mice were administered a single oral dose at a concentration of 60, 300, 600 mg/kg. Appropriate positive and negative controls were evaluated concurrently. Animals were sacrificed 24 or 48 hours after treatment. DCOIT did not increase levels of micronucleated mouse bone marrow cells in treated mice. Control groups responded appropriately, validating the study results.

Norway, 2010

- Norway (2010) evaluated the same *in vitro* and *in vivo* studies listed above, considering them to be the key studies to inform this endpoint. Additional supporting *in vitro* studies were included in their evaluation, consisting of three additional Ames assays; one additional chromosome aberration assay; and two additional gene mutation assays. The majority of these studies were considered by Norway to be non-key studies because they lacked study detail or were older studies conducted without compliance to current guidelines. Regardless, all of the additional *in vitro* assays were also negative for DCOIT. One additional *in vivo* assay also was evaluated by Norway. This study was considered to be supportive because maximum tolerable dose was not established and the highest tested dose did not show signs of cytotoxicity. As with the *in vitro* assays, all *in vivo* assays (key or supportive) were negative.

Summary

DCOIT is assigned a score of **Low** (**L**) for mutagenicity/genotoxicity based on a demonstrated lack of mutagenic or genotoxic effects in several *in vitro* and *in vivo* studies. Our confidence in the score is high because: 1) there is consistency in results across studies; 2) all key studies were conducted with DCOIT technical; and 3) all key studies were conducted in accordance with GLP guidelines and OECD or OECD equivalent guidelines. Additionally, DCOIT is not listed by any GreenScreen-specified list as a mutagen.

Reproductive Toxicity (R) Score (H, M, or L): L

DCOIT is assigned a score of **Low (L)** for reproductive toxicity based on the lack of reproductive effects observed in a two-generation study. The level of confidence in the score is high because the study was conducted in accordance to GLP guidelines and adhered to United States Environmental Protection Agency (US EPA) Office of Prevention, Pesticides and Toxic Substances (OPPTS) 870.3800 guidelines. Only one reproductive study was identified and was conducted orally. Therefore, this section is not separated out by exposure route as the dermal and inhalation routes could not be evaluated.

Authoritative and Screening Lists

- *Authoritative:* Not listed
- *Screening:* Not listed

The Dow Chemical Company, 2001b[13]

- In a 2-generation reproduction study (US EPA OPPTS 870.3800), rats were exposed to dietary concentrations of 0, 200, 400, 800 and 3200 ppm DCOIT Technical; these concentrations were equivalent to doses of 0, 16-21, 30-41, 62-93 and 235-259 mg/kg bw/day. At 3200 ppm, mortality, clinical signs of toxicity and reduced body weights were observed in parental animals and/or offspring. Due to a significant increase in mortality in F1 offspring, this dose level was not administered to the second generation.
- For the P1/F1 generations, no signs of toxicity were observed at doses up to 800 ppm. No changes occurred at any dose level up to 800 ppm in reproductive performance (mating or fertility); gestational, lactational or viability indices; offspring viability; estrus cycle or sperm parameters. Delays in vaginal opening and preputial separation were observed in females and males, respectively. These changes are discussed in further detail below in the endocrine activity section of this report. Systemic effects observed in pups (including body weight changes, changes to organ weights, and corresponding histopathological changes) also were observed and are discussed in further detail below in the developmental section of this report.
- The study report presented a parental and reproductive No Observed Effect Level (NOEL) of 200 ppm, but did not provide No Observed Adverse Effect Level (NOAEL) values for these endpoints. Data suggest that the NOAEL for parental toxicity is 400 ppm based on clinical signs and body weight changes at higher doses. No signs of reproductive toxicity were observed, therefore, data suggest a reproductive NOAEL of > 800 ppm.

Norway, 2010

- In its assessment, Norway evaluated the 2-generation study conducted by The Dow Chemical Company (2001b). Norway concluded DCOIT was not associated with any adverse reproductive outcomes .

[13] The study authored by The Dow Chemical Company (2001b) also appears in the developmental and endocrine activity sections of this report.

Summary

DCOIT is assigned a **Low (L)** score for reproductive toxicity based on the lack of adverse effect on the reproductive performance (mating or fertility); gestational, lactational or viability indices; offspring viability; estrus cycle; or sperm parameters. Therefore, we agree with the conclusions of The Dow Chemical Company (2001b) and Norway (2010) that DCOIT is not a reproductive hazard. Finally, DCOIT is not listed by any GreenScreen Specified List as a reproductive toxicant. Confidence in the low score is high because the study was conducted in accordance with US EPA OPPTS 870.3800.

Developmental Toxicity Incl. Developmental Neurotoxicity (D) Score (H, M or L): L

DCOIT is assigned a score of **Low (L)** for developmental toxicity based on the lack of developmental effects in two developmental studies that showed no teratogenicity after DCOIT exposure. Additionally, a high-quality (GLP compliant; US EPA OPPTS 870.3800) two-generation study was identified. While this study showed a minor developmental delay (*i.e.*, decreased thymus weight), this delay is not considered clinically relevant because of its transient nature. There is high confidence in this score because the key developmental study conducted in 1994 followed GLP guidelines and adhered to OECD 414 principals. The 2-generation toxicity study also followed GLP guidelines, as well as US EPA OPPTS 870.3800 guidelines. Both of these studies were conducted with DCOIT and not a preformulation. All studies were conducted via oral exposure (*i.e.*, *via* gavage or feed). Therefore, this section is not separated out by exposure route as the dermal and inhalation routes could not be evaluated.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

The Dow Chemical Company, 1994d

- Rats were administered DCOIT technical at 0, 10, 30, 100, or 300 mg/kg bw/day *via* gavage on days 6-15 of gestation. The 300 mg/kg bw/day group was terminated due to severe maternal toxicity. Effects observed at 100 mg/kg bw/day included maternal toxicity (i.e., scant/soft feces, diarrhea, decreased food consumption, decreased weight gain), and an increased number of litters with wavy ribs. Maternal toxicity also was observed at the 30 mg/kg bw/day dose, with signs of toxicity including scant feces, soft feces, and/or diarrhea. Based on these results, the NOAELs for maternal and fetal toxicity in rats were determined to be 10 and 30 mg/kg bw/day, respectively.

The Dow Chemical Company, 1983a

- Pregnant rats were administered a preformulation of DCOIT (preformulation C-9211M, 48.9% a.i. in xylene with 1.0% MgO) *via* gavage at 0, 11.2, 33.7, or 112.4 mg/kg bw/day from days 6-15 of gestation. Control groups consisted of both a vehicle control group, as well as a solvent control group that received xylene and MgO in the same proportion as in the 112.4 mg/kg bw/day group in aqueous 0.5% methylcellulose. Significant mortality (6/25) was observed at 112.4 mg/kg bw/day. Maternal toxicity (i.e., decreased body weight) was observed at 33.7 and 112.4 mg/kg bw/day; fetal body weights at 112.4 mg/kg bw/day also were decreased. At 112.4 mg/kg bw/day, there was an increased incidence of all skeletal variations in fetuses, but only when

compared to the vehicle control group, suggesting a solvent effect on the skeletal ossification. There also was an increased incidence of bent ribs and bent limbs at 33.7 and 112.4 mg/kg bw/day, which was likely influenced by maternal toxicity. Based on these results, the preformulation, C-9211M, was associated with a maternal and fetal Lowest Observed Adverse Effect Level (LOAEL) of 33.7 mg/kg bw/day.

The Dow Chemical Company, 1986

- Rabbits were administered antifoulant preformulation C-9211 (40% DCOIT in xylene) *via* gavage at 0, 5, 25, or 70 mg/kg bw/day during gestation days 7-19. Control groups consisted of both a vehicle control group, as well as a solvent control group. High mortality was observed with a total of 10 dams dying (1, 1, 3 and 5 in the vehicle control, the xylene control, and the 25.0 and 70.0 mg/kg bw/day groups, respectively). Also, dams from almost all groups aborted (0, 2, 1, 2 and 6 in the vehicle control, xylene control, 5.0, 25.0 and 70.0 mg/kg bw/day groups, respectively). While the high rate of abortion at the high dose was considered treatment-related, the study authors noted that it was unclear why this effect was occurring in the other treatment groups, including the solvent control. No teratogenic effects were noted at 5 or 25 mg/kg bw/day. Because of the high co-incidence of mortality and spontaneous abortion at 70 mg/kg bw/day, a sufficient number of animals were not available for a proper evaluation. Fetal loss in the presence of such extreme maternal toxicity would not be considered a selectively developmental effect which would support GHS classification. Based on the results observed at 5 and 25 mg/kg bw/day, the study author concluded that DCOIT was not to be associated with developmental toxicity.

The Dow Chemical Company, 2001b[14]

- In a 2-generation reproduction study (US EPA OPPTS 870.3800), rats were exposed to dietary concentrations of 0, 200, 400, 800, and 3,200 ppm DCOIT Technical; these concentrations were equivalent to doses of 0, 16-21, 30-41, 62-93 and 235-259 mg/kg bw/day. At 3,200 ppm, mortality, clinical signs of toxicity and reduced body weights were observed in parental animals and/or offspring. Due to a significant increase in mortality in F1 offspring, this dose level was not administered into the second generation.
- With regard to the developmental observations, F1 effects included a decrease in pup body weight that was observed at 800 ppm beginning on Postnatal Day (PND) 14. A corresponding decrease in maternal body weight was not observed at this dose level. Decreases in offspring body weight were accompanied by a decrease in absolute and relative thymus weight for animals treated with 800 or 3,200 ppm. A decrease in relative and absolute spleen weight also was observed in offspring starting at 400 ppm. Changes in thymus and spleen weight were accompanied by a decrease in cellularity observed at 800 ppm. Histopathological changes in spleen cellularity were not observed at 400 ppm. These effects occurred in the absence of maternal toxicity. According to the study report, decreases in terminal body weights and decreased body weights observed at 800 ppm may be contributing factors to the decreases observed in spleen and thymus weight, as well as the corresponding histopathological changes.

[14] The study authored by The Dow Chemical Company (2001b) also appears in the reproductive and endocrine activity sections of this report.

- F2 offspring, like F1 offspring, showed a decrease in pup weight at 800 ppm beginning on PND 14. A corresponding decrease in maternal body weight was not observed. A decrease in absolute and relative thymus weight in F2 offspring also was observed starting at 400 ppm. This decrease in thymus weight was again accompanied by a decrease in thyroid cellularity, which was observed at 800 ppm. This effect occurred in the absence of maternal toxicity. Again, the study report noted that changes in thyroid cellularity may be related to decreased body weights. No other treatment-related effects were observed.
- The study report presented a parental and developmental NOEL of 200 ppm, but did not provide NOAEL values for these endpoints. Data suggest that the NOAEL for systemic toxicity to offspring should be 200 ppm based reduced thymic weight at 400 ppm in the F2 generation.

Norway, 2010

- In its assessment, Norway evaluated the 2-generation study conducted by The Dow Chemical Company (2001b). Norway's conclusions were very similar to those of The Dow Chemical Company (2001b); however, Norway linked the decreased thymus weight observed in offspring more strongly to decreased pup body weight. The Norway document (2010) states "The NOAEL for systemic toxicity to offspring was 200 ppm (16-21 mg/kg bw/day) based on reduced body weight at PND21 at 400 ppm and reduced thymic weight in the F2 generation." Based on the review of this study, Norway concluded that DCOIT did not warrant classification as a developmental toxicant.
- After our review of the study report, a decrease at 400 ppm was observed in F2 offspring but this decrease did not reach statistical significance. It should also be noted a statistically significant decrease in terminal body weight was observed in F2 males; however, a similar effect was not observed in females. Statistically significant decreases were observed in the study report starting at 800 ppm close to weaning (*i.e.*, PND14). These decreases corresponded to decreases in thymus cellularity. Additional detail regarding our evaluation of these effects are presented below in the summary section.

Summary

DCOIT is assigned a score of **Low (L)** for developmental toxicity based on the lack of developmental effects observed in multiple studies, including several high-quality developmental studies in rats. While one of these key studies, The Dow Chemical Company (1983a) predates GLP, the study appears to generally adhere to current toxicological practices and is considered to be well-conducted. The other study evaluated, by The Dow Chemical Company (1994d), was conducted in accordance with GLP guidelines and adheres to OECD 414 principals. This study was also conducted with technical DCOIT, providing greater confidence in the study results. In our opinion, the remaining study by The Dow Chemical Company (1986) should be discounted due to high mortality at the high dose causing an overall concern regarding study quality. Thus, we agree with Norway's conclusion that DCOIT is not considered a teratogen with high confidence based on the developmental rat studies by The Dow Chemical Company (1983a; 1994d).

The most recent study by The Dow Chemical Company (2001b) was a 2-generation study conducted in accordance with US EPA guidelines. In this study, decreased absolute and relative thymus weight were observed at 800 ppm in offspring from both generations. In F2 offspring, decreased absolute and relative thymus weight was also observed at 800 ppm. While decreases in thymus weight for both generations at 800 ppm occurred with a decrease in cellularity and body weight, the decrease in absolute and relative

thymus weight at 400 ppm occurring in F2 pups was observed without a decrease in cellularity or body weight.

In our opinion, decreases observed in absolute and relative thymus weight are most likely transient in nature and, therefore, would not meet classification criteria under the GHS. This is because F1 pups selected for the P2 generation continued to thrive and mate and did not show a decrease in these organ weights at study termination. In fact, P2 males showed a significant increase in absolute and relative thymus weight, while P2 females showed no significant changes in thymus weight. Therefore, decreased thymus weight in offspring appears to be transient in nature. Additionally, decreases in body weights observed in 800-ppm offspring adds further support that these changes are not clinically relevant. The Dow Chemical Company (2001b) referenced a paper by Holsapple *et al*. (1998) that demonstrated that offspring with reductions in relative spleen and thymus weights immediately after weaning could be related to decreased body weights caused by feed restrictions. While pup body weight gains were not presented by The Dow Chemical Company (2001b), significant decreases in body weights at 800 ppm were observed at the time of weaning when the pups start to depend on the intake of DCOIT treated foods (*i.e.*, PND14). Additionally, a non-significant decrease in body weight was also observed at 400 ppm. This data provides further support that the decreases in thymus weight are transient.

Overall, we agree that DCOIT is not considered a developmental toxicant in offspring based on the 2-generation toxicity study by The Dow Chemical Company (2001b). We have high confidence in this score because the study followed GLP guidelines, as well as US EPA OPPTS 870.3800 guidelines, and the effects appear to be transient in nature.

Finally, DCOIT is not listed by any GreenScreen Specified List as a developmental toxicant.

Endocrine Activity (E) Score (H, M or L): *M*

DCOIT is assigned a score of *Moderate (M)* for endocrine activity based on studies indicating weak but positive effects on hormone changes in fish. Under GreenScreen, a moderate score is assigned "if there is an indication of endocrine activity in the scientific literature" and a low score requires negative study data across multiple endocrine pathways. While studies in rats indicate delayed vaginal opening and preputial separation in offspring exposed to DCOIT, these effects occur at doses producing body weight reduction which can also negatively impact sexual maturation. Thus it is uncertain whether the mammalian effects observed are endocrine mediated or related to general toxicity. Because the relevance of the fish studies to human endocrine effects is unclear, the confidence in this score is low.

DCOIT is not listed on any GreenScreen Authoritative or Screening lists (version 1.3) as an endocrine disruptor:

- Not listed as a potential endocrine disruptor on the EU ED list.
- Not listed as a potential endocrine disruptor on the EU SVHC list.
- Not listed as a potential endocrine disruptor on OSPAR lists.
- Not listed as a potential endocrine disruptor in the SIN database.
- Not listed as a potential endocrine disruptor on the TEDX list.

The Dow Chemical Company, 2001b[15]

- In a 2-generation reproduction study (US EPA OPPTS 870.3800), rats were exposed to dietary concentrations of 0, 200, 400, 800 and 3200 ppm DCOIT technical; these concentrations were equivalent to doses of 0, 16-21, 30-41, 62-93 and 235-259 mg/kg bw/day. At 3200 ppm, mortality, clinical signs of toxicity and reduced body weights were observed in parental animals and/or offspring. Due to a significant increase in mortality in F1 offspring, this dose level was not administered to the second generation.
- At 800 ppm a dose-dependent statistically significant delay in vaginal opening was reported in the F1 generation (not measured in the F2 generation) at a dose that also resulted in a decrease in pup body weight. This delay in vaginal opening occurred without a change in ano-genital distance. A delay was also observed at 400 ppm, but the length of delay was less than 2 days, the recommended minimum for a positive result (O'Connor *et al*., 2002). Body weight gain was also delayed at this dose and treated animals experienced vaginal opening when they attained body weights equivalent to those of the controls experiencing this developmental stage. There was also a delay in preputial separation in males at 800 ppm but not at any lower doses, a dose which likewise also resulted in a decreased body weight. The study authors reported there were no adverse effects observed in any other measured reproductive parameters. Additionally, the study authors stated that these effects should not be considered estrogenic or androgenic. This is because an estrogenic response would accelerate vaginal opening while causing a delay in preputial separation; an androgenic response would accelerate preputial separation while causing a delay in vaginal opening.

The Dow Chemical Company, 2008

- The Dow Chemical Company (2008) authored a document justifying the use of specific surrogates to fulfill data gaps identified for DCOIT. The study authors then identified and summarized previously conducted studies for the selected surrogates. Included in this document was a 2-generation study authored by The Dow Chemical Company (2003) that was conducted with 2-methyl-2H-isothiazolin-3-one (MI). The study summary results are described below.
- In a 2-generation reproduction study (US EPA OPPTS 870.3800; OECD 416), rats were exposed to MI *via* drinking water at concentrations of 0, 50, 200, or 1000 ppm; these concentrations were equivalent to doses of 0, 4-7, 15-19, and 69-86 mg/kg bw/day for males 0, 6-13, 22-26, and 93-115 mg/kg bw/day for females. At the high dose for the F1 generation, there was a statistically significant delay in vaginal opening in females and preputial separation in males. These endpoints were not measured for the F2 generation. The study authors indicated that these changes were a result of decreases in mean body weight (which is related to the timing of sexual maturation) and were not attributable to an endocrine mechanism.

Norway, 2010

- Norway did not evaluate endocrine activity for DCOIT.

Studies in Fish

[15] The study authored by The Dow Chemical Company (2001) also appears in the reproductive and developmental sections of this report.

Several studies conducted in fish have shown that DCOIT exposure produced weak increases in vitellogenin expression in males as well as decreased hatching rates overall. Estradiol/testosterone ratios were also increased in male fish although there were no effects on gonadal histopathology or germ cell maturation (Chen *et al*., 2016). Further detail is provided below under Chronic Aquatic Toxicity.

Summary

DCOIT is assigned a *Moderate (M)* score for endocrine activity based on studies indicating weak but positive effects on hormone changes in fish. Under GreenScreen, a moderate score is assigned "if there is an indication of endocrine activity in the scientific literature" while a low score requires consistently negative study data addressing multiple endocrine pathways. While studies in rats indicate delayed vaginal opening and preputial separation in offspring exposed to DCOIT, these effects occur at doses producing body weight reduction which by itself can delay sexual maturation. No adverse effect on reproductive performance were observed (see Reproductive Toxicity section) thus not qualifying for a high score. Because of questionable connection of the rat data to an endocrine mechanism and the unknown relevance of the fish studies to human endocrine effects, the confidence in this score is low.

Group II and II* Human Health Effects (Group II and II* Human)

Note: Group II and Group II endpoints are distinguished in the v 1.3 Benchmark system (the asterisk indicates repeated exposure). For Systemic Toxicity and Neurotoxicity, Group II and II* are considered sub-endpoints. When classifying hazard for Systemic Toxicity/Organ Effects and Neurotoxicity endpoints, repeated exposure results are required and preferred. Lacking repeated exposure results in a data gap. Lacking single exposure data does not result in a data gap when repeated exposure data are present (shade out the cell in the hazard table and make a note). If data are available for both single and repeated exposures, then the more conservative value is used.*

Acute Mammalian Toxicity – Oral, Dermal and Inhalation Routes

This endpoint was evaluated for the oral, dermal, and inhalation routes as described below.

Acute Oral Mammalian Toxicity (AT) Group II Score (vH, H, M or L): M

DCOIT is assigned a score of **Moderate (M)** for acute oral mammalian toxicity based on an LD_{50} of 1,636 mg/kg in male and female rats. The level of confidence in this score is high because the studies adhered to GLP and OECD equivalent guidelines and were conducted with DCOIT technical. In addition, the Competent Authority Report for Norway (2010) assigned the studies a Klimisch score of 1, indicating they are reliable and can be used without restriction.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

The Dow Chemical Company, 1992a

- In an acute oral toxicity study, an oral LD_{50} of 1,636 mg/kg in male and female rats was established. No signs of systemic toxicity were noted throughout the study.

The Dow Chemical Company, 1994e

- In an acute oral toxicity study, an oral LD_{50} of 567 mg/kg in male and female mice was established. No signs of systemic toxicity were noted throughout the study.

Norway, 2010

- Norway (2010) evaluated the acute oral toxicity studies by The Dow Chemical Company (1992a, 1994e) described above and assigned the studies a Klimisch score of 1 (reliable without restriction).

Summary

DCOIT is assigned a score of **Moderate** (**M**) for acute oral mammalian toxicity. This score is based on a LD_{50} value of 1636 mg/kg in rats, which is equivalent to GHS Category 4. While a lower LD_{50} value was identified in mice, rats are the preferred species for this endpoint according to GHS guidance. Additionally, using the LD_{50} value identified from the mouse study would not change the moderate score. Our confidence in this score is high because the study was conducted in accordance to GLP and OECD equivalent guidelines, indicating that the study is reliable and of good quality. The study also was conducted with DCOIT technical. The moderate score is also consistent with the proposed classification according to the Classification, Labelling and Packaging (CLP) regulation under Norway (2014).

Acute Dermal Mammalian Toxicity (AT) Group II Score (vH, H, M or L): *M*

DCOIT is assigned a score of *Moderate (M)* for acute dermal mammalian toxicity based on a LD_{50} of > 652 mg/kg in rabbits. The level of confidence is low because the studies, which were not conducted with DCOIT technical, required conversion to modified LD_{50} values based on the percent active ingredient. This created some ambiguity with respect to hazard level assignment.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

The Dow Chemical Company, 1989

- In an acute dermal toxicity study, a dermal LD_{50} of > 2,000 mg/kg in rabbits was established for Antifoulant C-9211 HQ (a preformulation of DCOIT). This is equivalent to > 652 mg/kg DCOIT. No mortalities were observed in this study. No signs of systemic toxicity were noted.

The Dow Chemical Company, 2005

- In an acute dermal toxicity study (OECD 402), a dermal LD_{50} of > 2,000 mg/kg (equivalent to 500 mg/kg DCOIT) in rats was established for a preformulation. No mortalities were observed in this study and no signs of toxicity were noted.

Norway, 2010

- Norway (2010) evaluated the acute dermal toxicity studies conducted by The Dow Chemical Company (1989, 2005) presented above, and assigned the studies a Klimisch score of 1 (reliable without restriction).

Summary

DCOIT is assigned a score of *Moderate (M)* for acute dermal mammalian toxicity. This score is based on findings reported in The Dow Chemical Company's study in rabbits. This study is selected as the key study because rabbits are the preferred species for this endpoint according to GHS guidelines, however, we are assigning low confidence to the acute dermal toxicity score because the study was conducted with a preformulation of DCOIT. This resulted in an LD_{50} of > 652 mg/kg in rabbits based on the percent active ingredient. Therefore, it is unclear whether the actual LD_{50} value for DCOIT reported in the study would fall into GHS Acute Toxicity Category 3, Category 4, Category 5, or fall outside classification since the LD_{50} value is greater than a value falling within Category 3. Norway's (2014) proposed GHS CLP classification for acute mammalian dermal toxicity is Category 4 based on their evaluation of the available study data; we would agree with this classification because no mortalities occurred in the preformulation studies at doses up to 2,000 mg/kg in either rabbits or rats. GHS Category 4 corresponds to a moderate hazard assignment, and there is low confidence in this score based on the use of preformulated DCOIT, resulting in a score of *M*.

Acute Mammalian Toxicity (AT) for Inhalation Group II Score (vH, H, M or L): vH

- DCOIT is assigned a score of **very high (vH)** for acute mammalian toxicity *via* inhalation based on a LC_{50} of 0.26 mg/L in male and female rats. The level of confidence is high because the study adhered to GLP and OECD equivalent guidelines and was conducted with DCOIT technical.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening:* New Zealand GHS lists DCOIT as 6.1B (equivalent to Category 2) for acute inhalation toxicity

The Dow Chemical Company, 1994f

- In an acute inhalation toxicity study, an inhalation LC_{50} of 0.26 mg/L in male and female rats was established after animals were exposed for a 4 hour period in an aerosol atmosphere. For the study, animals were exposed to 0.23, 0.12, 0.46 or 0.20 mg/L for the treatment period. At

necropsy (day 14), all treated animals showed slight to severe redness in lobes of the lung, consistent with respiratory irritation.

Norway, 2010

- Norway evaluated The Dow Chemical Company (1994f) study for acute toxicity *via* inhalation presented above and assigned the study a Klimisch score of 1 (reliable without restriction).

Summary

DCOIT is assigned a score of **very High (vH)** for acute mammalian toxicity *via* inhalation. This score is based on an LC_{50} of 0.26 mg/L for rats after a 4 hour exposure in an aerosol atmosphere, which equates to a GHS Category 1 and corresponds to a very high classification. While not explicitly stated by the study authors, based on our review, mortality after inhalation appears to be due to the corrosive nature of DCOIT. The proposed classification according to the CLP regulation for DCOIT by Norway (2014) is Category 1 for acute exposure *via* inhalation based on the LC_{50} value, which is consistent with our conclusion. Our confidence in this score is high because the inhalation study was conducted in accordance to GLP guidelines and OECD equivalent guidelines, indicating that the study is reliable and of good quality. DCOIT was also present on a GreenScreen screening list; New Zealand's classification of 6.1B (equivalent to Category 2) is based on the LC_{50} value of 0.26 mg/L for rats as noted above.

Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST) – Oral, Dermal, and Inhalation Routes

As with the carcinogenicity and acute toxicity endpoints, systemic toxicity involved an assessment of the oral, dermal, and inhalation exposure routes, as described below.

(ST-Single) Group II Score – Oral, Dermal, and Inhalation Routes

(ST-Single) Group II Score (single dose oral: vH, H, M or L): L

DCOIT is assigned a score of **Low (L)** for single exposure systemic toxicity/organ effects *via* the oral route based on the lack of systemic toxicity in two acute toxicity studies conducted with DCOIT technical. The confidence for the acute systemic oral toxicity score is high because the studies adhered to GLP and OECD equivalent guidelines and were conducted with DCOIT technical.

Authoritative and Screening Lists

- *Authoritative:* Not listed
- *Screening:* Not listed

The Dow Chemical Company, 1992a

- In an acute oral toxicity study, an oral LD_{50} of 1636 mg/kg in male and female rats was established. Clinical signs of toxicity were observed only in those animals that died prior to study termination. These signs included somnolence, ptosis, labored breathing, tremors and ataxia; the study authors considered these signs of toxicity to be secondary to dying. Necropsy results

included a high incidence of viscous material in the cecum, intestines, and stomach; black material or black foci adhered to stomach mucosa; reddened stomach mucosa; and thickened stomach walls. The study report states that DCOIT is slightly toxic according to the criteria defined by the Rohm and Haas Company.

The Dow Chemical Company, 1994e

- In an acute oral toxicity study, an oral LD_{50} of 567 mg/kg in male and female mice was established. Clinical signs of toxicity observed included soft and/or scant feces, passiveness, ataxia and tremors. For those who died prior to study termination, necropsy showed a reddened glandular portion of the stomach, black material in the stomach, reddened intestines, a mottled liver. The study report states that DCOIT is slightly toxic according to the criteria defined by the Rohm and Haas Company.

Norway, 2010

- Norway did not evaluate the systemic toxicity/organ effects *via* the oral route of exposure after a single exposure.

Summary

DCOIT is assigned a score of **Low (L)** for single exposure systemic toxicity/organ effects *via* the oral route based on the lack of systemic effects observed in two acute oral toxicity studies conducted by The Dow Chemical Company (1992a, 1994e) with DCOIT technical. Our confidence in the oral toxicity score is high because the studies were conducted in accordance to GLP and OECD equivalent guidelines, indicating reliability and good quality.

(ST-Single) Group II Score (single dose dermal: vH, H, M or L): *L*

DCOIT is assigned a score of *Low (L)* for single exposure *s*ystemic toxicity/organ effects *via* the dermal route based on the lack of systemic effects observed in two acute dermal toxicity studies. The confidence for the oral toxicity score is low because both studies were conducted with a preformulation of DCOIT.

Authoritative and Screening Lists

- Authoritative: Not listed
- Screening: Not listed

The Dow Chemical Company, 1989

- In an acute dermal toxicity study, a dermal LD_{50} of > 2,000 mg/kg in rabbits was established for Antifoulant C-9211 HQ (a preformulation of DCOIT). This is equivalent to > 652 mg/kg DCOIT. No mortalities were observed in this study. Necropsy revealed red-fluid filled thoracic cavity and clear-fluid filled abdominal cavity. The study report states that Antifoulant C-9211 HQ is not more than slightly toxic to rabbits according to toxicity criteria defined by the Rohm - and Haas Company.

The Dow Chemical Company, 2005

- In an acute oral toxicity study (OECD 402), a dermal LD_{50} of > 2,000 mg/kg in rats was established for a preformulation of DCOIT. This is equivalent to 500 mg/kg DCOIT. No mortalities were observed in this study. No signs of gross toxicity or gross abnormalities after necropsy were observed. The study report states that the test material is considered practically non-toxic according to Rohm and Haas Company criteria.

Norway, 2010

- Norway did not evaluate the systemic toxicity/organ effects *via* the dermal route of exposure after a single exposure.

Summary

DCOIT is assigned a score of *Low (L)* for single exposure systemic toxicity/organ effects *via* the dermal route based on the lack of systemic effects observed in two acute dermal toxicity studies conducted by The Dow Chemical Company (1989; 2005) using preformulations of DCOIT. Both studies were conducted in accordance with GLP and OECD or OECD equivalent guidelines. Low confidence is assigned to this score because both studies were conducted with a preformulation of DCOIT.

(ST-Single) Group II Score (vH, H, M or L): M

DCOIT is assigned a score of **Moderate (M)** for single exposure systemic toxicity/organ effects based on the transient inflammatory response observed in rats in multiple studies. Confidence in this finding is high because similar effects were observed across numerous studies and the overall quality of the studies is good.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

The Dow Chemical Company, 1994f

- In an acute inhalation toxicity study, an inhalation LC_{50} of 0.26 mg/L in male and female rats was established after animals were exposed for a 4 hour period in an aerosol atmosphere. For the study, animals were exposed to 0.23, 0.12, 0.46, or 0.20 mg/L for the treatment period. At necropsy (day 14), all treated animals showed slight to severe redness in lobes of the lung, consistent with respiratory irritation.

The Dow Chemical Company, 1994g

- The results of the 13-week inhalation study also supports respiratory irritation classifications. Details of this study are presented below in (ST-Repeated) Group II* Score (Repeated Dose).

The Dow Chemical Company, 1993

- In a sensory irritation study with preformulation Kathon™ 930 (containing 30% DCOIT in xylene), male mice were exposed for 10 minutes, head only, to 0.032, 0.075, 0.086, 0.112, 0.167, 0.184, and 0.198 mg/L of the test material formulation. A control group exposed to xylene only was evaluated concurrently. A maximum decrease in respiratory rate was achieved at 0.112 mg/L and greater. The RD50 was greater than 0.198 mg/L, the highest concentration tested. No respiratory rate depression was observed in the xylene control group.

Norway, 2010

- Norway used the 13-week repeated dose inhalation study (The Dow Chemical Company, 1994) and the sensory irritation study (The Dow Chemical Company, 1993) to evaluate this endpoint. Based on their review, Norway concluded that DCOIT was a potent respiratory irritant based on the results of The Dow Chemical Company (1994f) study. Norway reported that the 1993 study (The Dow Chemical Company, 1993) showed a moderate respiratory rate depression, indicating that DCOIT is a moderate upper airway irritant. Based on the results of these two studies, Norway concluded that the combined findings trigger a respiratory irritation classification.

Summary

DCOIT is assigned a score of **Moderate (M)** for single exposure systemic toxicity/organ effects based on GHS weight-of-evidence analysis of respiratory irritation results observed in two acute inhalation studies and one repeated dose toxicity study. The moderate score is equivalent to GHS classification of STOT SE3. The reliance on repeated dose inhalation studies to inform potential respiratory effects under the single dose category is consistent with GHS guidance. The moderate score is further supported by Norway's proposed GHS CLP classification of STOT SE 3 for respiratory irritation (2014). Note that the respiratory irritation observed is a point of contact target organ effect rather than a systemic effect. We have high confidence in this score because the effects were similar across multiple high-quality studies and the effect of respiratory irritation aligns with DCOIT's irritative nature. Additionally, one of the acute inhalation studies (The Dow Chemical Company, 1994g) was conducted with DCOIT technical. This study clearly showed signs of respiratory irritation at necropsy.

(ST-Repeated) Group II* Score – Oral, Dermal, and Inhalation Routes

As with the carcinogenicity, acute toxicity, and systemic toxicity – single dose endpoints, systemic toxicity - repeated dose involved an assessment of the oral, dermal, and inhalation exposure routes, as described below.

(ST-Repeated) Group II* Score (Repeated Dose Oral: H, M, L): L

DCOIT is assigned a score of **Low** (**L**) for systemic toxicity/organ effects – repeated dose based on lack of significant adverse systemic effects observed when animals were exposed to the test substance orally. The level of confidence in this score is high because 90-day studies were identified using two different species and studies were conducted in accordance with GLP and appropriate guidelines.

Authoritative and Screening Lists

- *Authoritative:* Not listed

- *Screening:* Not listed

The Dow Chemical Company, 1994h

- In a 90-day dietary study, rats were administered 0, 100, 500, 1,000, or 4,000 ppm of DCOIT technical. Concentrations were equivalent to 6.2-7.2, 32.5-36.7, 60.7-74.7, and 248.2-278.4 mg/kg bw/day. Signs of toxicity were observed at 4,000 and 1,000 ppm and included: decreased body weight gain; decreased feed consumption; histopathological indications of irritation to the forestomach; and slight changes in clinical chemistry and hematology parameters.

The Dow Chemical Company, 2002a[16]

- In a 90-day dietary study, dogs were administered concentrations of 100, 300, or 1,500 ppm technical DCOIT for 2 hours per day in the morning. At 1,500 ppm, body weight and food consumption were decreased. Minor changes in hematology and clinical chemistry parameters also were noted but were considered secondary to decreases in body weight changes. The NOAEL of 300 ppm (10.2/10.1 mg/kg bw/day in males and females respectively) and a LOAEL of 1,500 ppm (47.5/45.9 mg/kg bw/day in males and females respectively) were established based on decreasing body weight and food consumption and changes in some hematologic and clinical chemistry parameters seen at 1,500 ppm.

The Dow Chemical Company, 1991

- In a 28-day oral toxicity study, rats were administered 0, 20, 100 or 500 mg/kg bw/day of DCOIT technical *via* gavage. Most signs of toxicity observed were due to the irritative nature of the test substance causing alterations to the gastrointestinal tract and stomach. Other signs of toxicity occurred at 500 and/or 100 mg/kg bw/day and included: decreased body weight; decreased food consumption; minor changes to organ weight; changes in the urine analysis; and slight changes in clinical chemistry and hematology parameters. Based on these findings, the NOAEL was established at 20 mg/kg bw/day and the LOAEL was established at 100 mg/kg bw/day.

Norway, 2010

- Norway evaluated the repeated dose oral toxicity studies presented above. Norway concluded that, in general, local toxicity (*i.e.*, histopathology of stomach and lower intestinal track) was observed with minimal systemic toxicity.

Summary

DCOIT is assigned a score of **Low** (**L**) score for systemic toxicity/organ effects - repeated dose *via* the oral route based on lack of clinically significant effects (*i.e.*, effects that do not meet GHS classification for having specific target organ toxicity) in multiple subchronic oral toxicity studies. We concur with Norway's (2010) findings that there is minimal systemic toxicity and believe that the local response observed was due to DCOIT's irritative nature, but occurred without corresponding systemic toxicity. Some minor effects (*i.e.*, decreased body weight, changes in hematologic and clinical chemistry parameters; changes in organ weights) were noted; however, none of the observed effects would support

[16] This study also appears in the neurotoxicity section of this report.

classification for repeated oral dose toxicity. Confidence in this score is high, due to the quality of the overall studies conducted and the use of DCOIT technical in a 90-day study.

(ST-Repeated) Group II* Score (Repeated Dose Dermal: H, M, L): *L*

DCOIT is assigned a score of *Low (L)* score for repeated dose systemic toxicity/organ effects *via* the dermal route based on lack of systemic adverse effects observed when animals were dermally exposed to the test substance. The level of confidence in this score is low because only a subacute study was identified that administered a preformulation of DCOIT.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

The Dow Chemical Company, 1983b

- In a 21-day dermal toxicity study pre-dating GLP, rabbits were exposed to 0, 1, or 5 mg/kg bw/day of preformulation DCOIT in xylene. These doses were equivalent to 0.35 and 1.75 mg/kg bw/day, and animals were exposed 5 days/week. Skin irritation, which was observed at all dose levels, was the only toxic response observed. The LOAEL was 1 mg/kg bw/day for the local response and the NOAEL was 5 mg/kg bw/day for systemic effects.

Norway, 2010

- Norway evaluated the Dow Chemical Company (1983b) repeated dose dermal toxicity study presented above. Norway concluded that, in general, local toxicity (skin irritation) was observed with minimal systemic toxicity.

Summary

DCOIT is assigned a score of *Low (L)* score for systemic toxicity/organ effects - repeated dose *via* the dermal route. This score is based on lack of adverse effects observed in The Dow Chemical Company (1983b) subacute dermal toxicity study. We agree with Norway's conclusions and believe that the local response observed was due to DCOIT's irritative nature but occurred without corresponding systemic toxicity. The Dow Chemical Company (1983b) study appears to be well-conducted based on a review of the methodology used and data reported; however, the study date pre-dates GLP. Confidence in this score is low because the study was not conducted with DCOIT technical and the treatment period was only 21 days. However, due to the lack of systemic toxicity observed, we believe that a classification of low is justified.

(ST-Repeated) Group II* Score (Repeated Dose Inhalation: H, M, L): *L*

- DCOIT is assigned a score of *Low (L)* score for systemic toxicity/organ effects – repeated dose *via* inhalation based on lack of systemic adverse effects observed when animals were exposed to the test substance *via* inhalation exposure. The level of confidence in this score is low because the study was conducted using a preformulation of DCOIT.

Authoritative and Screening Lists

- *Authoritative:* Not listed
- Screening: Not listed

The Dow Chemical Company, 1994g

- In a 13-week inhalation study, rats were exposed to 0.02, 0.63, or 6.72 mg/m^3 (*i.e.*, 0.00002, 0.00063, or 0.00672 mg/L) of preformulation DCOIT in xylene. Four males and 15 females died during the treatment period due to over-restraint of the nose-only tubes. An additional 2-6 deaths/dose group occurred during the recovery period; these deaths were not considered by the authors to be treatment-related. Decreased body weights were considered to be related to xylene exposure. Increased absolute lung weights in high-dose females due to respiratory irritation causing lung edema. Other irritative effects on the nose, larynx, and lungs were observed at the histopathological evaluation. Irritant effects cleared during the recovery period. Based on these effects, a Lowest Observed Adverse Effect Concentration (LOAEC) was established at 0.63 mg/m^3 (*i.e.*, 0.00063 mg/L) based on the histopathological changes observed in the nose and larynx.

Norway, 2010

- Norway evaluated the repeated dose inhalation toxicity study by The Dow Chemical Company (1994g) presented above. Norway concluded that, in general, local toxicity (respiratory irritation) was observed with minimal systemic toxicity.

Summary

DCOIT is assigned a score of *Low (L)* for systemic toxicity/organ effects - repeated dose *via* inhalation based on lack of adverse effects observed when animals were exposed for 90 days to a preformulation of the test material *via* inhalation exposure. We agree with Norway's conclusion and believe that the local response observed was due to DCOIT's irritative nature but occurred without corresponding systemic toxicity. Although The Dow Chemical Company (1994g) study was performed in accordance with GLP guidelines, confidence in this score is low because the study was conducted with a preformulation of DCOIT.

Neurotoxicity (N) Group II* Score (Repeated Dose: vH, H, M or L): *L*

DCOIT is assigned a score of *Low (L)* for neurotoxicity based on a lack of neurobehavioral effects observed in a 90-day dietary study conducted with dogs, as well as the lack of neurotoxicity observed in a surrogate, 2-methyl-4-isothiazolin-3-one (MI; CAS# 2682-20-4). There is low confidence in this score because some of the data identified for this endpoint were associated with a surrogate (2-Methyl-4-isothiazolin-3-one), and although the study conducted with DCOIT followed study requirements for a subchronic study, it did not meet neurotoxicity guideline study requirements.

Authoritative and Screening Lists

- *Authoritative*: Not listed

- *Screening*: Not listed

The Dow Chemical Company, 2002a[17]

- In a 90-day dietary study, dogs were administered concentrations of 100, 300, or 1,500 ppm technical DCOIT for 2 hours per day in the morning. Neurobehavioral observations were conducted once prior to the start of treatment and weekly thereafter. Observations included: changes in level of activity, gait, posture, altered strength, and response to handling, as well as the presence of clonic or tonic movements, stereotypies (*e.g.*, excessive grooming, repetitive circling), or bizarre behavior (*e.g.*, self-mutilation). No abnormal neurobehavior changes were observed at any dose level. The NOAEL of 300 ppm (10.2/10.1 mg/kg bw/day in males and females respectively) and a LOAEL of 1,500 ppm (47.5/45.9 mg/kg bw/day in males and females respectively) were established based on decreasing body weight and food consumption and changes in some hematologic and clinical chemistry parameters seen at 1,500 ppm.

Burnett *et al.*, 2010

- In a review article discussing the safety of a surrogate, 2-methyl-4-isothiazolin-3-one, neurotoxicity data were identified that supported a low benchmark score for this endpoint. The authors state that a lack of neurotoxicity was observed in the several *in vivo* rodent and nonrodent subchronic studies through detailed clinical observations, functional observation battery tests, motor activity measurements, and histopathological evaluations. Reproductive and developmental studies conducted with the surrogate in rats and rabbits also showed a lack of neurotoxicity. This was evident through a lack of clinical signs of neurotoxicity and the lack of neurotoxicity in parental animals or their offspring.

Norway, 2010

- According to Norway, no neurotoxicity studies were identified for DCOIT. However, the document states that the toxicological information identified indicates that DCOIT does not have neurotoxic properties. Additionally, Norway also states that DCOIT has no structural alerts for neurotoxicity.

Summary

DCOIT is assigned a score of *Low (L)* for neurotoxicity based on a lack of neurobehavioral effects observed in a 90-day dietary study conducted with dogs, as well as the lack of neurotoxicity observed in a surrogate. We also agree with Norway's conclusion that the toxicological information identified indicates that DCOIT does not have neurotoxic properties. There is low confidence in this score because the neurotoxicity data identified in Burnett *et al*. (2010) were associated with MI, a surrogate of DCOIT. Additionally, although the study conducted by The Dow Chemical Company (2002a) used DCOIT and followed subchronic study requirements, the study did not meet the requirements of a neurotoxicity guideline study.

[17] This study also appears in the repeated dose oral section of this report.

Skin Sensitization (SnS) Group II* Score (H, M or L): H

DCOIT is assigned a score of **High (H)** for skin sensitization based on clear evidence of skin sensitization observed in both animals and humans. There is high confidence in this score because the effect was observed in multiple studies of high quality in both humans and animals

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening:* New Zealand GHS lists DCOIT as 6.5B (equivalent to GHS Category 1) for skin sensitization.

Animal Data

The Dow Chemical Company, 2003

- A positive response was observed in a guinea pig maximization assay (OECD 406) using DCOIT technical. Sensitization was observed during the challenge period at 4.4 μg/cm^2, with 75% of the animals showing sensitization at 24 hours and 55% showing sensitization at 48 hours. At 8.8 μg/cm^2, 95% were positive and at 12.12 μg/cm^2 100% were positive at both time points. Because sensitization occurred at all exposure levels, the study did not fully comply with OECD 406 guidelines.

The Dow Chemical Company, 2006

- The major metabolite of DCOIT, N-(n-octyl) malonamic acid (NNOMA), was not a skin sensitizer in a local lymph node assay when evaluated at concentrations of 3%, 10% or 30%. Exposure did not result in a stimulation index of three or above for any of the tested concentrations.

The Dow Chemical Company, 1984

- In a Buehler study that was not conducted in accordance with OECD 406 guidelines, a positive response was observed at a challenge concentration of 25 ppm DCOIT (2.5 μg/cm^2). However, this study tested an insufficient number of animals and there was a lack of documentation regarding a positive control.

Human Data

The Dow Chemical Company, 1992b

- In a human patch test, two panels consisting of 37 and 38 subjects were exposed to RH-287 (*i.e.*, DCOIT technical). In each panel, only 34 subjects completed the patch test. Subjects were induced with either 250 or 350 ppm of the test material, which was applied three times a week for 3 weeks under occlusive conditions. A negative control group was evaluated concurrently. After a 2 week rest period, subjects were challenged with 100, 250 or 350 ppm for 24 hours.

Sensitization was observed in 4/34 (12%) subjects induced with 250 ppm and a total of 14/34 (41%) subjects induced with 350 ppm.

- Six months after the initial patch test study, 8 of the subjects who responded positively to 350 ppm during induction were re-evaluated. Subjects were exposed to 250 ppm for 24 hours under occlusive conditions. Observations were made at 24, 48, and 96 hours after patch application. Only 3 of the 8 subjects showed sensitization. Study authors noted that this decrease may be the result of the initial study showing irritation not sensitization or that the intensity of sensitization to DCOIT decreases over time.

K. Kawai, M. Nakagawa, Y. Sasaki, *et al.*, 1993

- Human studies have shown dermatitis after occupational exposure to DCOIT. For example, at a textile finishing factory in Japan, dermatitis was reported in 8 of 19 workers exposed to a formulation of DCOIT (30 % in xylene, Kathon 930). Patch tests also were positive for 5 out of 6 workers exposed to 0.2% Kathon 930. A false negative response may have occurred for one worker who had taken corticosteroids orally two days prior to the tests because of severe dermatitis.

Norway, 2010

- Norway evaluated the animal and human skin sensitization studies presented above. Norway concluded that DCOIT should be considered an extreme sensitizer based on the guinea pig maximization test (GPMT) assay with a specific concentration of 0.001%.

Summary

DCOIT is assigned a score of **High (H)** for skin sensitization based on positive results in both animals and humans. This score is equivalent to GHS Category 1 for skin sensitization. There is high confidence in this score because although some of the animal studies presented above exhibited some study deficiencies, the overall results were consistent with results from a human patch test conducted with DCOIT technical, as well as numerous documented human case reports. Therefore, based on the overall weight of evidence, we believe that there is high confidence that DCOIT is a skin sensitizer. Norway's proposed GHS CLP classification for skin sensitization is skin sensitization Category 1 based on their evaluation of the available positive animal and human study data, and also supports our assignment. Note also that New Zealand GHS, a GreenScreen screening list, classifies DCOIT as 6.5B (equivalent to GHS Category 1) for skin sensitization.

Respiratory Sensitization (SnR) Group II* Score (H, M or L): dg

DCOIT has been assigned a data gap (dg) for respiratory sensitization because no relevant data were identified for this endpoint. It should be noted, however, that the Competent Authority Report from Norway (2010) stated that DCOIT may be a respiratory sensitizer due to its high skin sensitizing potential and mode of action (binding to nucleophilic sites in proteins). On the other hand, two recent studies of the surrogates methylisothiazolinone and chloromethylisothiazolinone have indicated these are unlikely to be respiratory sensitizers because they elicit immune system responses that are characteristic of dermal sensitizers but not respiratory sensitizers (Devos *et al.*, 2015; Dearman *et al.,* 2015). Since neither is a study of DCOIT itself (and the latter is a conference presentation abstract), we believe assigning a data gap for this endpoint is most appropriate.

Skin Irritation/Corrosivity (IrS) Group II Score (vH, H, M or L): Very High (vH)

DCOIT is assigned a score of **Very High (vH)** for skin irritation/corrosivity based on results of several skin irritation studies where severe irritation and signs of corrosivity were observed. There is high confidence in this score because similar effects were observed in two *in vivo* skin irritation studies conducted in accordance to GLP guidelines.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening:* New Zealand GHS lists DCOIT as 8.2C (equivalent to GHS Category 1C) for skin irritation.

The Dow Chemical Company, 1989

- In a skin irritation study, severe irritation was observed after one rabbit was exposed to 20% DCOIT in phenoxypropanol (propylene glycol phenyl ether) for 4 hours. Mean erythema and edema scores for the 24-72 hour period were 4.0 and 3.3, respectively. Signs of corrosivity (i.e., concave eschar) was evident by 48 hours. Based on these results, DCOIT was considered by the study authors to be corrosive.

The Dow Chemical Company, 1997

- In a skin irritation study, severe irritation was observed after 6 rabbits were exposed to an antifoulant preformulation of DCOIT, C-9211 HQ (32.6% DCOIT in xylene), for 4 hours. Mean erythema and edema scores for the 24-72 hour period were 4.0 and 3.9, respectively. At 14 days edema was resolved but slight to severe erythema still persisted. Eschar was observed at 72 hours and persisted until 14 days. Based on these results, the study authors stated that DCOIT met the criteria to be classified as a corrosive substance.

The Dow Chemical Company, 2007a

- In an EPIDERM™ (EPI-200) *in vitro* skin corrosion test, 25 mg of DCOIT was applied to the tissue constructs and 25 µL water was applied directly on top. Following 3 min or 60 min exposures, DCOIT only marginally reduced the viability of the tissue (less than 10%) and was judged non-corrosive.

Norway, 2010

- Norway evaluated the skin irritation studies presented above. Norway agreed with the study conclusions and recognized that DCOIT is a corrosive substance to the skin. They also noted that in the study conducted by The Dow Chemical Company (1997) xylene may have also aggravated the skin reactions. Additionally, they stated that the negative response observed in the *in vitro* skin irritation assay conducted by The Dow Chemical Company (2007a) may be a false negative.

Summary

DCOIT is assigned a **Very High (vH)** score for skin irritation/corrosivity based on the results of several skin irritation studies where rabbits were exposed to the test material for up to 4 hours and showed severe skin irritation. This score is equivalent to GHS Category 1C because the exposure time in the *in vivo* rabbit skin irritation studies was greater than one hour but less than or equal to 4 hours. There is high confidence in this score because the studies used for classification include a key skin irritation study that was conducted in accordance to GLP guidelines and follows OECD guidelines. We also agree with the overall conclusions presented in the Competent Authority Report (Norway, 2010). Norway's proposed GHS CLP classification is Category 1C irritation (2014), which further supports the assigned score; note that this classification is largely based on the eschar observed in both *in vivo* skin irritation studies. Additionally, New Zealand GHS, a GreenScreen screening list, classifies DCOIT as 8.2C (equivalent to GHS Category 1C) for skin irritation.

Eye Irritation/Corrosivity (IrE) Group II Score (vH, H, M or L): vH

DCOIT is assigned a score of **Very High (vH)** for eye irritation/corrosivity based on the conclusive evidence that DCOIT is corrosive to the skin. There is high confidence in this score because the corrosive nature of DCOIT has been observed in multiple studies evaluating skin corrosion potential.

DCOIT was not tested in the eyes of rabbits due to it corrosive nature observed in skin irritation studies.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening:* New Zealand GHS lists DCOIT as 8.3A (equivalent to GHS Category 1) for eye irritation.

Norway, 2010

- No eye irritation studies were included in the Competent Authority Report (Norway, 2010). The document, however, did state that based on the irritative nature of DCOIT, it should be considered as corrosive to the eyes. The document also states that this conclusion is supported by the corrosive properties of three structurally related isothiazolinones.

Summary

DCOIT is assigned a score of **Very High (vH)** for eye irritation/corrosivity based on the irritative nature of DCOIT demonstrated in numerous skin irritation studies and multiple inhalation studies. There is high confidence in this score because the corrosive nature of DCOIT was well established through skin irritation studies, as well as repeated dose toxicity studies. Additionally, New Zealand GHS, a GreenScreen screening list, classifies DCOIT as 8.3A (equivalent to GHS Category 1) for eye irritation.

Ecotoxicity (Ecotox)

Acute Aquatic Toxicity (AA) Score (vH, H, M or L): vH

DCOIT is assigned a score of **Very High** (**vH)** for acute aquatic toxicity based on the results of multiple aquatic toxicity studies (summarized below in Table 5). This score is assigned high confidence based on the measured aquatic toxicity values, obtained from guideline studies, as shown in Table 5, and is supported by DCOIT's classification as a Category 1 (H400) acute aquatic hazard for algae, crustaceans, and fish by New Zealand GHS. Table 5 presents a summary of fish, invertebrate, and algae acute aquatic toxicity data, as reported in the Competent Authority Report (Norway, 2010)[18]. Measured Median Effect (EC_{50}) and Median Lethal Concentration (LC_{50}) values below 1 mg/L indicate that DCOIT exhibits very high acute aquatic toxicity in accordance with the GreenScreen guidance for the acute aquatic toxicity endpoint.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening:* New Zealand GHS lists DCOIT as Acute Aquatic Toxicity Category 1 (H400)

[18] The algae values presented in Table 5 for *Navicula* and *Skeletonema* were incorrectly reported in Norway (2010). Norway reported the first 96h E_rC_{50} *Navicula* value as 0.59 µg/L, while in the actual study report it appears as 0.585 µg/L (The Dow Chemical Company, 2002b). Norway reported the second *Navicula* value for the 96h E_rC_{50} as 1.6 µg/L, while the actual laboratory study report indicates 3.4 µg/L (The Dow Chemical Company, 2007b). Additionally, Norway reported the 96h E_rC_{50} *Skeletonema* value as 0.48 µg/L, while in the actual study report, that value represents the 96h NOEC for the area under the growth curve (The Dow Chemical Company, 2002c). The actual 96h E_rC_{50} value for *Skeletonema* is >3.58 µg/L.

Table 5 Acute Ecotoxicity Data for DCOIT (CAS# 64359-81-5)

Test Species	Endpoint	Value (µg a.i./L)[a]	Method
Fish			
Rainbow trout (*Salmo gairdneri*)	96h LC_{50}	2.7	US EPA 72-1
Bluegill sunfish (*Lepomis macrochirus*)		14	
Sheepshead minnow (*Cyprinodon variegatus*)		20.5	US EPA 72-3
Japanese Blowfish (*Takifugu rubripes*)		5.66 (nominal concentration)	OECD 203
Invertebrate			
Water flea (*Daphnia magna*)	48h EC_{50}	5.2	US EPA FIFRA 72-2
American oyster embryo (*Crassostrea virginica*)		2.1 (synthetic seawater) 3.2 (natural seawater)	US EPA FIFRA 72-3
Bay mussel embryo (*Mytilus edulis*)		411	US EPA OPPTS 850.1055
Mysid (*Mysidopsis bahia*)	96h LC_{50}	4.7	US EPA FIFRA 72-3
Algae			
Navicula pelliculosa	96h E_rC_{50}	0.585[b]	US EPA FIFRA 123-2
		3.4[c]	US EPA OPPTS 850.5400 and OECD 201
Selenastrum capricornutum		89	OECD 201, US EPA FIFRA 122-2 and 123-2 OPPTS 850.5400
Skeletonema costatum		>3.58[d]	US EPA FIFRA 123-2

Notes:
EC_{50} = Median Effect Concentration; E_rC_{50} = Median Growth Rate Effect Concentration; h = hours; LC_{50} = Median Lethal Concentration.
(a) Mean measured concentration, as cited in Norway (2010), unless otherwise noted.
(b) Mean measured concentration, as cited in The Dow Chemical Company (2002b).
(c) Mean measured concentration, as cited in The Dow Chemical Company (2007b).
(d) Mean measured concentration, as cited in The Dow Chemical Company (2002c).

Chronic Aquatic Toxicity (CA) Score (vH, H, M or L): vH

DCOIT is assigned a score of **Very High** (**vH)** for chronic aquatic toxicity based on the results of multiple chronic aquatic toxicity studies (summarized below in Table 6). This score is assigned high confidence based on the measured aquatic toxicity values, obtained from guideline studies, as listed in Table 6. DCOIT was not present on any screening or authoritative lists for chronic aquatic toxicity. Table 6 presents a summary of fish and invertebrate chronic aquatic toxicity data, as reported in the Competent Authority Report (Norway, 2010). Also included on Table 6 (as a combined record), are data from more recent studies conducted in Medaka fish (Chen *et al*., 2016, 2014). These more recent studies suggest some reproductive related effects. The measured No Observed Effect Concentration (NOEC) values below 0.1 mg/L across all of these studies indicate that DCOIT exhibits very high chronic aquatic toxicity in accordance with the GreenScreen guidance for the chronic aquatic toxicity category.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

Table 6 Chronic Aquatic Toxicity Data for DCOIT (CAS# 64359-81-5)

Test Species	Endpoint	Value (µg a.i./L)*	Method
Fish			
Rainbow trout (*Oncorhynchus mykiss*)	97d ELS NOEC	1.2 (egg hatch, survival) 0.56 (growth)	OECD 210, US EPA OPPTS 850.1400, US EPA FIFRA 72-4, US EPA TSCA 797.1600, EC 91/414/EEC
Sheepshead minnow (*Cyprinodon variegatus*)	35d ELS NOEC	6.0 (egg hatch, survival)	US EPA FIFRA 72-4
Medaka (*Oryzias melastigma*)	28d ELS LOEC	0.76 (egg hatch)	Non-guideline
Invertebrate			
Water flea (*Daphnia magna*)	21d NOEC	0.63 (survival of first generation)	US EPA FIFRA 72-4
Saltwater mysid (*Americamysis bahia*)	28d NOEC	0.63 (survival of first generation)	US EPA OPPTS 850.1350

Note:
d = day; ELS NOEC = Early Life Stage No Observed Effect Concentration; *mean measured concentration

Environmental Fate (Fate)

Persistence (P) Score (vH, H, M, L, or vL): L

DCOIT is assigned a score of **Low** (**L)** for persistence. This score is assigned high confidence since it is based on half-life data, obtained from guideline studies, as listed in Table 7. DCOIT was not present on any screening or authoritative lists for persistence in the environment. Table 7 presents a summary of degradation studies and half-life values in different environmental compartments, as reported in the Competent Authority Report (Norway, 2010). The modeled and measured half-lives indicate that DCOIT biodegrades rapidly in aquatic and terrestrial environments and in the atmosphere. Abiotic degradation of DCOIT is slower than biodegradation (Norway, 2010). Although a ready biodegradation study found no biodegradation of DCOIT after 28 days, the toxicity control in that study showed that DCOIT inhibited the bacteria at the tested concentration. Therefore, the study concluded that "no information on the biodegradability of DCOIT in a [sewage treatment plant] can therefore be obtained from this test" (Norway, 2010). DCOIT can be classified as having low persistence in the environment based on the half-life values listed in Table 7 (*i.e.*, half-live <16 days in soil/sediment/water and <2 in air) in accordance with the GreenScreen guidance for the persistence endpoint.

Table 7 Degradation Data for DCOIT (CAS# 64359-81-5)

Test Medium	Endpoint (Units)	Value	Method
Air	Half-Life (days)	≤1.1	Structure Activity Relationship Model
Waste Water Treatment Plant activated sludge	28d degradation (%)	0	OECD 301B
Estuarine water	Half-Life (days)	0.18-1.48	OECD 309
Freshwater Water-Sediment System	Half-Life (days)	2.0 (in water) 0.21 (in water)	OECD 308 Aerobic OECD 308 Anaerobic
Seawater-Sediment System	Half-Life (days)	<0.042 (in sediment) <0.042 (in sediment)	US EPA 162-4 (Aerobic) US EPA 162-3 (Anaerobic)
Soil (Silt loam)	Half-Life (days)	0.13-2.01	U.S. EPA 161-1 and Canada T-1255

Bioaccumulation (B) Score (vH, H, M, L, or vL): *vL*

DCOIT is assigned a score of *very low* (*vL)* for bioaccumulation based on the studies summarized in Table 8, as reported in the Competent Authority Report (Norway, 2010). Although measured data were available from guideline studies for the octanol-water partition coefficient (log K_{ow}) and the bioconcentration factor (BCF), the bioaccumulation score is assigned low confidence because of the significant difference in BCF estimates based only on the active substance (*i.e.*, DCOIT) *versus* BCF estimates based on total ^{14}C-residues (*i.e.*, DCOIT and metabolites), as presented in Table 8. BCF estimates based only on the active substance indicate that DCOIT has a very low potential to bioaccumulate (*i.e.*, BCF < 100). However, BCF estimates based on total ^{14}C-residues were much higher (*i.e.*, >500) and indicated that the majority of detected radioactivity was associated with metabolites and very little DCOIT was detected in tissue (~1%). As a result, DCOIT can be classified as having a moderate (*M*) bioaccumulation based on the higher BCF values (>500 – 1,000) reported in fish studies and calculated using total ^{14}C-residues (*i.e.*, DCOIT + metabolites). However, DCOIT can also be classified as having a very low (*vL*) bioaccumulation potential based on its log Kow (<4) and BCF values (<100) for the active substance only (DCOIT). Given that additional environmental fate and ecotoxicity studies of the major metabolites of DCOIT have found much lower ecotoxicity (*i.e.*, 2-5 orders of magnitude less toxic to aquatic organisms than DCOIT; Norway, 2014), given that the residues formed in the BCF studies are primarily a cysteine adduct with a ring cleaved DCOIT metabolite, and given that DCOIT was not present on any screening or authoritative lists regarding its potential to bioaccumulate, DCOIT is assigned a very low (*vL*) bioaccumulation potential using professional judgment. However, the score has been given a low confidence because of the uncertainties associated with BCF estimates based on total residues.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

Table 8 Bioaccumulation Data for DCOIT (CAS# 64359-81-5)

Parameter	Test Species	Endpoint	Value	Method
Octanol-water partition coefficient (dimensionless)	Not applicable	Log K_{ow}	2.8	OECD 107; EECA18
Bioconcentration Factor (L/kg)	*Lepomis macrochirus*	BCF_k (DCOIT)	< 13	US EPA 165-4
		BCF_k (Total ^{14}C-residue)	750	
	Cyprinus carpio	BCF_k (High Dose; Total ^{14}C-residue)	713	MITI
		BCF_k (Low Dose; Total ^{14}C-residue)	735	
	Crassostrea virginica	BCF_k (High Dose)	19	US EPA OPPTS 850.1710 & OECD 305E
		BCF_k (Low Dose)	44	

Notes:
BCF_k = Kinetic Bioconcentration Factor; BCF_k = Kinetic Bioconcentration Factor, estimated as the ratio of the uptake rate constant and the depuration rate constant (BCF_k can be estimated for the active substance only [DCOIT] or using total ^{14}C-residues [DCOIT and metabolites]); MITI = Japan's Ministry of International Trade and Industry

Physical Hazards (Physical)

Reactivity (Rx) Score (vH, H, M or L): *L*

DCOIT is assigned a score of *Low (L)* for reactivity based on professional judgment, using the information below. Low confidence has been assigned to this score.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

Norway, 2010

- DCOIT is thermally stable; in a thermal stability test carried out according to OECD 113, 98.9% of active substance remained following storage at 54°C for two weeks (compared to initial amount of 99.2% active substance). DCOIT does not self-ignite, lacks of functional groups associated with explosive properties, and lacks of functional groups associated with oxidizing properties (Norway, 2010, p. 9, 120).

Dow Product Safety Assessment, 2012

- DCOIT is reported to be stable under recommended storage and use conditions; however, it may be incompatible with oxidizing agents, reducing agents, mercaptans, and amines (Dow Product Safety Assessment, 2012).

Summary

While no specific data or information were identified regarding reactivity for DCOIT, available information suggests that DCOIT does not present a reactivity hazard and has been assigned a score of *Low* (*L*). Low confidence has been assigned to this score due to the lack of supporting data.

Flammability (F) Score (vH, H, M or L): *L*

DCOIT is assigned a score of *Low (L)* for flammability based on professional judgment, using the information below. Low confidence has been assigned to this score due to the lack of supporting data.

Authoritative and Screening Lists

- *Authoritative*: Not listed
- *Screening*: Not listed

Norway, 2010

- DCOIT is not highly flammable.

Dow Product Safety Assessment, 2012

- DCOIT is reported to decompose at elevated temperatures (Dow Product Safety Assessment, 2012).

Summary

DCOIT is assigned a score of *Low (L)* for flammability based on professional judgment, using the information described above. Low confidence has been assigned to this score due to the lack of supporting data.

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Appendix A

Hazard Benchmark Acronyms

Hazard Benchmark Acronyms

AA	Acute Aquatic Toxicity
AT	Acute Mammalian Toxicity
B	Bioaccumulation
C	Carcinogenicity
CA	Chronic Aquatic Toxicity
Cr	Corrosion/ Irritation (Skin/ Eye)
D	Developmental Toxicity
E	Endocrine Activity
F	Flammability
IrE	Eye Irritation/Corrosivity
IrS	Skin Irritation/Corrosivity
M	Mutagenicity and Genotoxicity
N	Neurotoxicity
P	Persistence
R	Reproductive Toxicity
Rx	Reactivity
SnS	Sensitization - Skin
SnR	Sensitization - Respiratory
ST	Systemic/Organ Toxicity

Appendix B

PHAROS Results – DCOIT and Associated Transformation Products

Toggle navigation

- Building Products
- Chemicals and Materials
- Certifications
- CompAIR
- Dashboard
- Logout

1. Dashboard
2. Chemicals and Materials

Chemicals and Materials

- About the CML
- Search Chemicals and Materials (1)
- Search Hazard Lists (69)

The Chemical and Material Library (CML) is an online catalog of 38,282 chemicals, polymers, metals, and other substances. It identifies key health and environmental information using:

- 42 authoritative scientific lists for specific human and environmental health hazards
- 20 restricted substance lists
- GreenScreen List Translator scores based on the most current GreenScreen version (1.3)

The CML also characterizes the process chemistry used to produce 1,174 substances and screens woods against 5 endangered species lists.

Hazard Levels and Endpoints

What is the purpose of the Pharos Chemical and Material Library?

What hazard endpoints does Pharos track?

What do the hazard and priority levels mean?

Are exposure and risk included?

GreenScreen

What is the GreenScreen?

What is a GreenScreen Assessment?

Where do I find GreenScreen Assessments?

How does Pharos use the GreenScreen List Translator?

Key

Hazard color indicators show the highest level of concern for chemical hazards. Hazards are differentiated between those associated with the substance, likely residuals, and chemicals used in the manufacturing process. Hover over any of these indicators to view the health endpoint and level of

concern, or click on the chemical name for details.
Wood species which are listed as endangered or threatened will also receive a color indicator indicating the level of concern for the species.

LT-1 These abbreviations in the GreenScreen column indicate the chemical's GreenScreen® for Safer Chemicals score.

Within a chemical profile's hazard tab, the GreenScreen logo indicates that the hazard listed has been evaluated by the GreenScreen List Translator. Hover over this icon to view List Translator details.

Within a chemical profile's hazard tab, the HPD logo indicates that the hazard listed is from an HPD Priority List, meaning the hazard is required to be disclosed on an HPD.

View the full Chemical and Material Library description

chemicals:
36,090

variants:
137

biobased materials:
1,475

unregistered materials:
104

compound groups:
476

Showing 1 - 1 of 1 results

CAS RN	Material Name	Hazard			GreenScreen
		Substance	Residual	Manufacturing	
64359-81-5	3(2H)-ISOTHIAZOLONE, 4,5-DICHLORO-2-OCTYL-				LT-P1

Search term 64359-81-5
Type Any type
Used in Product Category Any category
Has a full GreenScreen assessment
Restricted lists include Add
Restricted lists do not include Add
Include residuals in selected filters above
Apply Filters

Showing 1 - 69 of 69 results

AOEC - Asthmagens

AOEC Exposure Codes - Asthmagen List

Abbreviation: AOEC

Agency: Association of Occupational and Environmental Clinics (AOEC)

Type: Chemical Hazard List

Australia - GHS

Australia - GHS

Abbreviation: GHS AU

Agency: Safe Work Australia

Type: Chemical Hazard List

BIFMA - e3/level Annex B list of chemicals

BIFMA - e3/level Annex B list of chemicals

Abbreviation: BIFMA

Agency: Business and Institutional Furniture Manufacturers Association (BIFMA)

Type: Restricted Substance List

Boyes - Neurotoxicants

Chemicals with occupational exposure standards based on nervous system effects (Boyes 2001)

Abbreviation: Boyes-N

Agency: Pattys Toxicology: author William K Boyes

Type: Chemical Hazard List

C2C - Banned Chemicals

Banned Lists of Chemicals in the Cradle to Cradle Certified Product Standard – Version 3.0

Abbreviation: C2C Banned Chemicals

Agency: Cradle to Cradle Products Innovation Institute (C2CPII)

Type: Restricted Substance List

CA EPA - Prop 65

Chemicals Known to the State to Cause Cancer or Reproductive Toxicity - California Proposition 65 -

Safe Drinking Water and Toxic Enforcement Act Of 1986

Abbreviation: Prop 65

Agency: California Environmental Protection Agency (CA EPA)

Type: Chemical Hazard List

CA SCP - Candidate Chemicals

Safer Consumer Product Candidate Chemicals

Abbreviation: CA SCP Candidate Chemicals

Agency: California Department of Toxic Substance Control (CA DTSC)

Type: Restricted Substance List

CHE - Toxicant Database

Toxicant and Disease Database

Abbreviation: CHETox

Agency: Collaborative on Health and the Environment (CHE)

Type: Chemical Hazard List

ChemSec - SIN List

SIN (Substitute It Now) List

Abbreviation: SIN

Agency: ChemSec, The International Chemical Secretariat

Type: Chemical Hazard List

EC - CEPA DSL

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Domestic Substances List (DSL)

Abbreviation: DSL

Agency: Environment Canada & Health Canada (EC)

Type: Chemical Hazard List

EC - CEPA Toxic Substances (Sched 1)

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Toxic Substances List (Schedule 1)

Abbreviation: CEPA

Agency: Environment Canada & Health Canada (EC)

Type: Restricted Substance List

EC - Virtual Elimination List

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Virtual Elimination List

Abbreviation: CEPA VEL

Agency: Environment Canada & Health Canada (EC)

Type: Restricted Substance List

EHP - San Antonio Statement on BFRs & CFRs

San Antonio Statement on Brominated and Chlorinated Flame Retardants

Abbreviation: San Antonio

Agency: Environmental Health Perspectives

Type: Chemical Hazard List

EU - Annex VI CMRs

Classification, Labelling and Packaging Regulation (CLP) - Classification and Labelling Inventory - CMRs

Abbreviation: EU CMR (2)

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - ESIS PBT

European chemical Substances Information System (ESIS) - PBT List

Abbreviation: EU PBT

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - GHS (H-Statements)

Regulation on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) Annex 6 Table 3-1 - GHS Hazard code criteria

Abbreviation: EU H-Statements

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - Ozone depletion substances

Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer - Controlled substances and new substances

Abbreviation: EU Ozone

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - PACT-RMOA Substances

Public Activities Coordination Tool for Risk Management Option Analysis

Abbreviation: EU PACT

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - Priority Endocrine Disrupters

EU Community Strategy for Endocrine Disrupters - Priority List

Abbreviation: EU ED

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - R-phrases

Substances with EU Risk & Safety Phrases (Commission Directive 67-548-EEC)

Abbreviation: EU R-Phrases

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - REACH Annex XVII CMRs

Restrictions On The Manufacture, Placing On The Market And Use Of Certain Dangerous Substances, Preparations And Articles - Carcinogens, Mutagens & Reproductive Toxicants

Abbreviation: EU CMR (1)

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - REACH Exemptions

Commission Regulation (EC) No 987/2008 Annex I & 2 Exemptions from the Obligation to Register in acccordance with REACH article 2(7)a

Abbreviation: EC - REACH Exemptions

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - ROHS

Directive on the Restriction Of the use of certain Hazardous Substances in electrical and electronic equipment ANNEX II

Abbreviation: EC - ROHS

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - SVHC Authorisation List

Substances of Very High Concern for REACH Annex XIV authorisation (Article 59)

Abbreviation: EU SVHC

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

FOE - Good Wood Guide

Good Wood Guide

Abbreviation: FOE - Good Wood Guide

Agency: Friends of the Earth (FOE)

Type: Endangered Species List

G&L - Neurotoxic Chemicals

Developmental neurotoxicity of industrial chemicals, List of 201 Chemicals known to be neurotoxic in man

Abbreviation: G&L Neuro

Agency: Lancet: authors Philippe Grandjean & Phil Landrigan

Type: Chemical Hazard List

German FEA - Substances Hazardous to Waters

Administrative Regulation on the Classification of Substances hazardous to waters into Water Hazard Classes (Verwaltungsvorschrift wassergefahrdende Stoffe - VwVwS)

Abbreviation: VwVwS

Agency: German Federal Environment Agency (FEA)

Type: Restricted Substance List

HBN - Priority Asthmagens

HBN Priority Building Material Asthmagens List

Abbreviation: HBN - Priority Asthmagens

Agency: Healthy Building Network (HBN)

Type: Restricted Substance List

IARC

Monographs On the Evaluation of Carcinogenic Risks to Humans

Abbreviation: IARC

Agency: International Agency for Research on Cancer, World Health Organization (IARC)

Type: Chemical Hazard List

IPCC Global Warming Chemicals

Intergovernmental Panel for Climate Change (IPCC) Third Assessment Report, 2001

Abbreviation: IPCC Global Warming Chemicals

Agency: Intergovernmental Panel for Climate Change (IPCC)

Type: Chemical Hazard List

IUCN - Red List

IUCN Red List of Threatened Species

Abbreviation: IUCN - Red List

Agency: International Union for Conservation of Nature and Natural Resources (IUCN)

Type: Endangered Species List

Japan - GHS

GHS Classifications

Abbreviation: GHS-Japan

Agency: Government of Japan

Type: Chemical Hazard List

Korea - GHS

GHS Classification and Labelling for Toxic Chemicals

Abbreviation: GHS-Korea

Agency: Republic of Korea - National Institute of Environmental Research (NIER)

Type: Chemical Hazard List

Living Future - Living Building Red List

Living Building Challenge 2.1 - Red List of Materials & Chemicals

Abbreviation: ILFI Red

Agency: International Living Future Institute (ILFI)

Type: Restricted Substance List

Living Future - Living Building Red List

Living Building Challenge 3.0 - Red List of Materials & Chemicals

Abbreviation: ILFI Red

Agency: International Living Future Institute (ILFI)

Type: Restricted Substance List

MAK

List of Substances with MAK & BAT Values & Categories

Abbreviation: MAK

Agency: MAK Commission of Germany (Deutsche Forschungsgemeinschaft)

Type: Chemical Hazard List

Malaysia - GHS

Malaysia - GHS

Abbreviation: Malaysia - GHS

Agency: Malaysia Department of Occupational Safety and Health

Type: Chemical Hazard List

New Zealand - GHS

New Zealand HSNO Chemical Classifications

Abbreviation: GHS-New Zealand

Agency: New Zealand Environmental Protection Authority (NZ EPA)

Type: Chemical Hazard List

OR DEQ - Priority Persistent Pollutants

Priority Persistent Pollutant (P3) List

Abbreviation: OR P3

Agency: Oregon Department of Environmental Quality (ORDEQ)

Type: Chemical Hazard List

OSPAR - Priority PBTs & EDs & equivalent concern

Chemical Lists of Priority Action & Possible Concern

Abbreviation: OSPAR

Agency: Oslo-Paris Convention Commission (OSPAR)

Type: Chemical Hazard List

P+W - Precautionary List

Precautionary List

Abbreviation: P+W - Precautionary List

Agency: Perkins+Will (P+W)

Type: Restricted Substance List

Quebec CSST - Asthma Agents

Agents Causing Occupational Asthma With Key References

Abbreviation: Quebec Asthma

Agency: Québec Workplace Health and Safety Commission (Commission de la santé et de la securite du travail (CSST))

Type: Chemical Hazard List

Québec CSST - WHMIS 1998

WHMIS-SIMDUT: Controlled Products Classifications

Abbreviation: WHMIS

Agency: Québec Workplace Health and Safety Commission (Commission de la santé et de la securite du travail (CSST))

Type: Chemical Hazard List

SCHF - Hazardous 100

Hazardous 100+ List of Chemicals of High Concern

Abbreviation: SCHF

Agency: Safer Chemicals, Healthy Families (SCHF)

Type: Restricted Substance List

Silent Spring - Breast Cancer Chemicals

Mammary Carcinogens Review Database

Abbreviation: SSI-BC

Agency: Silent Spring Institute

Type: Chemical Hazard List

TEDX - Potential Endocrine Disruptors

TEDX (The Endocrine Disruption eXchange) List of Potential Endocrine Disruptors

Abbreviation: TEDX

Agency: The Endocrine Disruption Exchange (TEDX)

Type: Chemical Hazard List

UNEP - PIC Annex III

Rotterdam Convention Prior Informed Consent (PIC) Annex III Chemicals

Abbreviation: PIC

Agency: United Nations Environment Programme (UNEP)

Type: Restricted Substance List

UNEP Stockholm Conv - Persistent Organic Pollutants

Stockholm Convention on Persistent Organic Pollutants (POPs) - Annex A, B & C and under Review

Abbreviation: Stockholm

Agency: United Nations Environment Programme (UNEP)

Type: Chemical Hazard List

UNEP WCMC - CITES-listed Trees

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) - Listed

Trees

Abbreviation: UNEP WCMC - CITES-listed Trees

Agency: United Nations Environment Programme (UNEP)

Type: Endangered Species List

US CDC - Occupational Carcinogens

NIOSH Carcinogen List

Abbreviation: NIOSH-C

Agency: US Centers for Disease Control (US CDC)

Type: Chemical Hazard List

US EPA - DfE SCIL

Safer Chemical Ingredients List (Positive List)

Abbreviation: US EPA - DfE SCIL

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - EPCRA Extremely Hazardous Substances

Extremely Hazardous Substances - EPCRA Section 302

Abbreviation: EPA-AMT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Exempt VOCs

VOCs exempt from smog regulation because of negligible photochemical reactivity

Abbreviation: US EPA - Exempt VOCs

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - Global Warming Potentials

Global Warming Potentials of Ozone Depletors and Substitutes

Abbreviation: EPA-GW

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Hazardous Air Pollutants

Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants

Abbreviation: HAPs

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - IRIS Carcinogens

Integrated Risk Information System Database (IRIS)

Abbreviation: EPA-C

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - OPP - Registered Pesticides

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Registered Pesticides (Selections)

Abbreviation: EPA-FIFRA

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Ozone Depleting Substances

Ozone-Depleting Substances (ODS) Class I & Class II

Abbreviation: EPA-ODS

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - PPT Chemical Action Plans

Risk Management Actions & TSCA Work Plans

Abbreviation: EPA Action

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Priority PBTs (NWMP)

Priority Chemicals List

Abbreviation: NWMP Priority

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Priority PBTs (PPT)

Priority PBT Profiles (Pollution Prevention and Toxics)

Abbreviation: EPA PBT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Toxics Release Inventory PBTs

TRI PBT Chemical List

Abbreviation: TRI PBT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US NIH - Report on Carcinogens

Report on Carcinogens

Abbreviation: NTP-RoC

Agency: US Department of Health & Human Services - National Institutes of Health (US NIH)

Type: Chemical Hazard List

US NIH - Reproductive & Developmental Monographs

Expert Panel Reports & Monographs on Reproductive and Developmental Toxicity

Abbreviation: NTP-OHAaT

Agency: US Department of Health & Human Services - National Institutes of Health (US NIH)

Type: Chemical Hazard List

US OSHA - Carcinogens

TRI Carcinogens

Abbreviation: US OSHA - Carcinogens

Agency: US Department of Labor

Type: Restricted Substance List

USDA - US Threatened & Endangered Trees

Threatened & Endangered Plants, Growth Habit = Tree, US Federal & State Jurisdictions

Abbreviation: USDA - US Threatened & Endangered Trees

Agency: US Department of Agriculture

Type: Endangered Species List

USGBC - LEED Credits

LEED Credits: Chemical Avoidance in Building Materials

Abbreviation: LEED

Agency: US Green Building Council (USGBC)

Type: Restricted Substance List

WA DoE - PBT

Chapter 173-333 WAC Persistent Bioaccumulative Toxins

Abbreviation: WA PBT

Agency: Washington State Department of Ecology (WA DOE)

Type: Chemical Hazard List

WWF - Tropical Wood Guide

Photographic Guide to Identify Your Timber - Tropical Timber Guide

Abbreviation: WWF - Tropical Wood Guide

Agency: World Wildlife Federation (WWF)

Type: Endangered Species List

Search term

List Type Any Type

Authoritative Agency

Any Agency

Apply Filters

×

What Is the Purpose of the Pharos Chemical and Material Library?

There is currently no single, comprehensive governmental list or database that assesses and rates all chemicals across all human and environmental health hazard endpoints. The Pharos CML begins to address this problem by combining many single hazard endpoint lists into one combined database that provides a view across multiple endpoints. These endpoints include human health problems, such as cancer or asthma, and ecotoxicity problems, such as persistence, bioaccumulation, and aquatic toxicity. The CML then supports users in establishing priorities for substitution and identifying inherently safer substitutes through a two part ranking system where each chemical hazard is assigned a hazard level and priority level.

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What Hazard Endpoints Does Pharos Track?

Pharos addresses each of the human health and ecotoxicity endpoints used in the GreenScreen for Safer Chemicals and the US EPA's Design for the Environment program (DfE). The GreenScreen and DfE include all of the endpoints required for assessment by the Globally Harmonized System (GHS) plus several additional critical endpoints that are currently missing from the GHS. Pharos includes all of these endpoints plus several additional important environmental endpoints.

- **Human Health**
  - **Carcinogenicity** – ability to cause or increase the risk of cancer
  - **Mutagenicity/Genotoxicity** – ability to cause or increase the rate of mutations, which are changes in genetic material in cells.
  - **Reproductive Toxicity** – ability to disrupt the male or female reproductive systems, changing sexual development, behavior or functions, decreasing fertility, or resulting in loss of the fetus during pregnancy.
  - **Developmental Toxicity** incl. developmental neurotoxicity – ability to cause harm to the developing child including birth defects, low birth weight and biological or behavioral problems that appear as the child grows.
  - **Endocrine Activity** – ability to interfere with hormone communication between cells which controls metabolism, development, growth, reproduction and behavior (the endocrine system). *Not currently included in GHS.*
  - **Acute Mammalian Toxicity** – ability to be fatal on contact, ingestion, or inhalation for humans and other mammals.
  - **Systemic Toxicity/Organ Effects** incl. immunotoxicity-single exposure – ability to cause specific,

non lethal but serious damage on contact or ingestion or inhalation, to one or more organs, such as the heart, lungs, liver, etc. distant from the point of entry of the toxicant.
    - **Neurotoxicity** - single exposure – ability to cause damage to the nervous system including the brain. *Not currently included in GHS.*
    - **Eye Irritation/Corrosivity** – ability to cause irritation or serious damage to the eye.
    - **Skin Irritation/Corrosivity** – ability to irritation or serious damage to the skin.
    - **Systemic Toxicity/Organ Effects** incl. immunotoxicity-repeated exposure - ability to cause specific, non lethal but serious damage on contact or ingestion or inhalation, to one or more organs, such as the heart, lungs, liver, etc. distant from the point of entry of the toxicant on long term repeated exposures.
    - **Neurotoxicity** - repeated exposure - ability to cause serious damage to the nervous system on long term repeated exposures.
    - **Respiratory Sensitization** – ability to result in high sensitivity such that small quantities trigger asthma, rhinitis or other allergic reactions in the respiratory system.
    - **Skin Sensitization** – ability to trigger allergic reactions on the skin.
- **Ecotoxicity**
    - **Acute Aquatic Toxicity** - a single exposure in a day may result in severe biological harm or death to fish or other aquatic organisms.
    - **Chronic Aquatic Toxicity** - long term exposure of months or years may result in irreversible harm to fish or other aquatic organisms.
    - **Terrestrial Ecotoxicity** – ability to cause harm to land based plants, animals or microorganisms.
- **Physical Hazard**
    - **Flammability** - easily ignited and capable of burning rapidly.
    - **Reactivity** - may spontaneously ignite or explode on its own or in contact with water.
- **Environmental fate**
    - **Persistent** - does not break down readily from natural processes. *Not currently included in GHS.*
    - **Bioaccumulative** - accumulates in organisms concentrating as it moves up the food chain. *Not currently included in GHS.*
    - **Persistent Bioaccumulative Toxicant (PBT)** – Having characteristics of persistence, and bioaccumulation and is harmful in small quantities. *Not currently included in GHS.*
    - **Global Warming** – ability to absorb thermal radiation, increasing the temperature of the atmosphere and contributing to climate change. *Not currently included in GreenScreen or GHS.*
    - **Ozone Depletion** – ability to contribute to chemical reactions that destroy ozone in the earth's upper atmosphere. *Not currently included in GreenScreen or GHS.*
- **Multiple** - list specifies more than one of the above endpoints.

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What Do the Hazard and Priority Levels Mean?

Pharos ranks hazard on a five step scale from Very High to Very Low. The criteria for each endpoint vary, and are based largely on the protocol of the GreenScreen for Safer Chemicals.

Pharos ranks priority on a five step color coded scale from Urgent (purple) to Low (green) and indicates the relative urgency to avoid use of this chemical and substitute for an inherently safer one. Chemicals that cause irreversible damage either because they are persistent and/or bioaccumulative or because they are associated with chronic systemic problems such as cancer, mutagenicity, reproductive and developmental toxicity and endocrine activity are prioritized highest.

For more information, see the Chemical and Material Library description.

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Are Exposure and Risk Included?

The Pharos hazard levels and color coded priority levels are based on hazard assessment. They do not represent a characterization of level of exposure or a risk assessment. Rather, this categorization reflects current trends in chemical hazard management policy work that prioritizes replacement of high hazard chemicals with lower hazard chemicals. It is informed by collaborative work that HBN has engaged in for over ten years with Clean Production Action (CPA), members of Health Care Without Harm (HCWH) and the Business–NGO Working Group on chemical hazard analysis. It is specifically informed by the GreenScreen for Safer Chemicals, which uses benchmarks to rank the safety of chemicals and encourage progress toward safer alternatives.

See CPA's GreenScreen for Safer Chemicals at http://www.greenscreenchemicals.org and HBN and CPA's Chemicals of High Concern Red List of Lists at http://www.bizngo.org/.

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What is the GreenScreen?

The GreenScreen® for Safer Chemicals is a benchmarking system to rank the relative hazard level of chemicals and encourage progress toward safer alternatives. The benchmark is based on a set of health endpoints and measures of environmental fate. GreenScreen was developed by and is a project of Clean Production Action. The Pharos Chemical and Material Library (CML) uses the GreenScreen in three ways:

1. The CML serves as a repository for full GreenScreen assessments that are in the public domain.
2. The CML serves as a tool to determine the GreenScreen List Translator score for a chemical or product.
3. The CML's Hazard and Priority Levels are informed by the GreenScreen methodology.

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What is a GreenScreen Assessment?

A GreenScreen Assessment is a report that establishes a benchmark score for a chemical using the GreenScreen protocol. These benchmarks can be used to help prioritize chemicals for replacement. From the highest concern to the lowest concern these are:

- Benchmark 1: Avoid - Chemical of High Concern
- Benchmark U: Unspecified Due to Insufficient Data
- Benchmark 2: Use but Search for Safer Substitutes
- Benchmark 3: Use but Still Opportunity for Improvement
- Benchmark 4: Prefer - Safer Chemical

The protocol includes use of authoritative hazard lists, toxicological and epidemiological studies, modelling and analogues to assess hazard across eighteen health endpoints and measures of environmental fate. The protocol is public, free, and transparent, and can be performed by anyone. For an assessment to be Certified, however, it must be produced by a Licensed GreenScreen Profiler. Less than a hundred public domain GreenScreen assessments are currently available.

For more information visit www.greenscreenchemicals.org.

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Where Do I Find GreenScreen Assessments?

Public GreenScreen Assessments are available in Pharos. These assessments can be found in a chemicals and

materials search by checking the "Has a full GreenScreen assessment" box. They can then be viewed in the GreenScreen tab of each Chemical Profile.

Non-public GreenScreen Assessments can be purchased from the GreenScreen store or TechStreet.

For more information visit www.greenscreenchemicals.org.

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How does Pharos use the GreenScreen List Translator?

The GreenScreen List Translator rates authoritative hazard lists for the level of hazard for a health endpoint. All chemicals in the Pharos database are automatically screened against these hazard lists by a protocol that results in a GreenScreen List Translator score. GreenScreen List Translator scores in order from highest concern to lowest concern are:

- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown

The List Translator cannot be used to assign scores higher (better) than 1 because of the data gaps inherent in the list based approach. If the chemical is not on a list included in the GreenScreen List Translator, the GreenScreen field is left blank.

Full GreenScreen assessments trump results from List Translator scoring. These scores can be viewed in the GreenScreen tab of the Chemical Profile for chemicals which have a public assessment.

Products in the Building Product Library (BPL) often contain multiple substances with different Benchmarks and List Translator scores. The highest concern score is selected for display in the summary. GreenScreen scores in order from highest to lowest concern are:

- Benchmark 1
- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown
- Benchmark U
- Benchmark 2
- Benchmark 3
- Benchmark 4

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Substance Hazard

This color reflects the highest hazard associated directly with this substance by an authoritative hazard list.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the authoritative hazard list that is the source of this hazard color, see the "Hazard" tab on the chemical / material's page.

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Residual Hazard

This color reflects the highest hazard associated with residual chemicals that our research indicates may be present with the chemical. These residuals consist of all process chemicals in the following categories:

- Monomers
- Catalysts
- Non-reactive Additives
- Pollutants and Contaminants
- Other known residuals

Hazards are drawn from process chemicals far upstream in the manufacturing process as well as the immediate precursors to this chemical.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the source of this hazard, see the "Process Chemistry Research" tab on the chemical's page.

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Manufacturing Hazard

This color reflects the highest hazard associated with chemicals that our research categorizes as “frequent” or “integral” to the production of a chemical. The manufacturing score is included to surface potential hazards upstream in the manufacturing process that may or may not be present as residuals. Hazards are drawn from process chemicals far upstream in the manufacturing process as well as the immediate precursors to this chemical.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the source of this hazard, see the "Process Chemistry Research" tab on the chemical's page.

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GreenScreen

The Pharos scoring system is informed by the GreenScreen® for Safer Chemicals, a benchmarking system to rank the safety of chemicals on a 4 point hazard scale and encourage progress toward safer alternatives. Chemicals that have undergone a full GreenScreen assessment by Licensed GreenScreen Profilers are given a Benchmark score, which is the most authoritative. Chemicals that have been assessed using an automated comparison to hazard lists are given a List Translator score, which is less authoritative. Full GreenScreen assessments trump results from List Translator scoring.

GreenScreen Scores in order from highest concern to lowest concern are:

- Benchmark 1
- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown
- Benchmark U
- Benchmark 2
- Benchmark 3
- Benchmark 4

For more information, see the "GreenScreen" tab on the chemical's page or visit www.greenscreenchemicals.org.

Toggle navigation

- Building Products
- Chemicals and Materials
- Certifications
- CompAIR
- Dashboard
- Logout

1. Dashboard
2. Chemicals and Materials

Chemicals and Materials

- About the CML
- Search Chemicals and Materials (1)
- Search Hazard Lists (69)

The Chemical and Material Library (CML) is an online catalog of 38,282 chemicals, polymers, metals, and other substances. It identifies key health and environmental information using:

- 42 authoritative scientific lists for specific human and environmental health hazards
- 20 restricted substance lists
- GreenScreen List Translator scores based on the most current GreenScreen version (1.3)

The CML also characterizes the process chemistry used to produce 1,174 substances and screens woods against 5 endangered species lists.

Hazard Levels and Endpoints

What is the purpose of the Pharos Chemical and Material Library?

What hazard endpoints does Pharos track?

What do the hazard and priority levels mean?

Are exposure and risk included?

GreenScreen

What is the GreenScreen?

What is a GreenScreen Assessment?

Where do I find GreenScreen Assessments?

How does Pharos use the GreenScreen List Translator?

Key

Hazard color indicators show the highest level of concern for chemical hazards. Hazards are differentiated between those associated with the substance, likely residuals, and chemicals used in the manufacturing process. Hover over any of these indicators to view the health endpoint and level of

concern, or click on the chemical name for details.
Wood species which are listed as endangered or threatened will also receive a color indicator indicating the level of concern for the species.

LT-1 These abbreviations in the GreenScreen column indicate the chemical's GreenScreen® for Safer Chemicals score.

Within a chemical profile's hazard tab, the GreenScreen logo indicates that the hazard listed has been evaluated by the GreenScreen List Translator. Hover over this icon to view List Translator details.

Within a chemical profile's hazard tab, the HPD logo indicates that the hazard listed is from an HPD Priority List, meaning the hazard is required to be disclosed on an HPD.

View the full Chemical and Material Library description

chemicals:
36,090

variants:
137

biobased materials:
1,475

unregistered materials:
104

compound groups:
476

Showing 1 - 1 of 1 results

CAS RN	Material Name	Hazard			GreenScreen
		Substance	Residual	Manufacturing	
111-86-4	1-AMINOOCTANE				LT-P1

Search term 111-86-4
Type Any type
Used in Product Category Any category
Has a full GreenScreen assessment
Restricted lists include Add
Restricted lists do not include Add
Include residuals in selected filters above
Apply Filters

Showing 1 - 69 of 69 results

AOEC - Asthmagens

AOEC Exposure Codes - Asthmagen List

Abbreviation: AOEC

Agency: Association of Occupational and Environmental Clinics (AOEC)

Type: Chemical Hazard List

Australia - GHS

Australia - GHS

Abbreviation: GHS AU

Agency: Safe Work Australia

Type: Chemical Hazard List

BIFMA - e3/level Annex B list of chemicals

BIFMA - e3/level Annex B list of chemicals

Abbreviation: BIFMA

Agency: Business and Institutional Furniture Manufacturers Association (BIFMA)

Type: Restricted Substance List

Boyes - Neurotoxicants

Chemicals with occupational exposure standards based on nervous system effects (Boyes 2001)

Abbreviation: Boyes-N

Agency: Pattys Toxicology: author William K Boyes

Type: Chemical Hazard List

C2C - Banned Chemicals

Banned Lists of Chemicals in the Cradle to Cradle Certified Product Standard – Version 3.0

Abbreviation: C2C Banned Chemicals

Agency: Cradle to Cradle Products Innovation Institute (C2CPII)

Type: Restricted Substance List

CA EPA - Prop 65

Chemicals Known to the State to Cause Cancer or Reproductive Toxicity - California Proposition 65 - Safe Drinking Water and Toxic Enforcement Act Of 1986

Abbreviation: Prop 65

Agency: California Environmental Protection Agency (CA EPA)

Type: Chemical Hazard List

CA SCP - Candidate Chemicals

Safer Consumer Product Candidate Chemicals

Abbreviation: CA SCP Candidate Chemicals

Agency: California Department of Toxic Substance Control (CA DTSC)

Type: Restricted Substance List

CHE - Toxicant Database

Toxicant and Disease Database

Abbreviation: CHETox

Agency: Collaborative on Health and the Environment (CHE)

Type: Chemical Hazard List

ChemSec - SIN List

SIN (Substitute It Now) List

Abbreviation: SIN

Agency: ChemSec, The International Chemical Secretariat

Type: Chemical Hazard List

EC - CEPA DSL

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Domestic Substances List (DSL)

Abbreviation: DSL

Agency: Environment Canada & Health Canada (EC)

Type: Chemical Hazard List

EC - CEPA Toxic Substances (Sched 1)

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Toxic Substances List (Schedule 1)

Abbreviation: CEPA

Agency: Environment Canada & Health Canada (EC)

Type: Restricted Substance List

EC - Virtual Elimination List

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Virtual Elimination List

Abbreviation: CEPA VEL

Agency: Environment Canada & Health Canada (EC)

Type: Restricted Substance List

EHP - San Antonio Statement on BFRs & CFRs

San Antonio Statement on Brominated and Chlorinated Flame Retardants

Abbreviation: San Antonio

Agency: Environmental Health Perspectives

Type: Chemical Hazard List

EU - Annex VI CMRs

Classification, Labelling and Packaging Regulation (CLP) - Classification and Labelling Inventory - CMRs

Abbreviation: EU CMR (2)

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - ESIS PBT

European chemical Substances Information System (ESIS) - PBT List

Abbreviation: EU PBT

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - GHS (H-Statements)

Regulation on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) Annex 6 Table 3-1 - GHS Hazard code criteria

Abbreviation: EU H-Statements

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - Ozone depletion substances

Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer - Controlled substances and new substances

Abbreviation: EU Ozone

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - PACT-RMOA Substances

Public Activities Coordination Tool for Risk Management Option Analysis

Abbreviation: EU PACT

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - Priority Endocrine Disrupters

EU Community Strategy for Endocrine Disrupters - Priority List

Abbreviation: EU ED

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - R-phrases

Substances with EU Risk & Safety Phrases (Commission Directive 67-548-EEC)

Abbreviation: EU R-Phrases

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - REACH Annex XVII CMRs

Restrictions On The Manufacture, Placing On The Market And Use Of Certain Dangerous Substances, Preparations And Articles - Carcinogens, Mutagens & Reproductive Toxicants

Abbreviation: EU CMR (1)

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - REACH Exemptions

Commission Regulation (EC) No 987/2008 Annex I & 2 Exemptions from the Obligation to Register in acccordance with REACH article 2(7)a

Abbreviation: EC - REACH Exemptions

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - ROHS

Directive on the Restriction Of the use of certain Hazardous Substances in electrical and electronic equipment ANNEX II

Abbreviation: EC - ROHS

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - SVHC Authorisation List

Substances of Very High Concern for REACH Annex XIV authorisation (Article 59)

Abbreviation: EU SVHC

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

FOE - Good Wood Guide

Good Wood Guide

Abbreviation: FOE - Good Wood Guide

Agency: Friends of the Earth (FOE)

Type: Endangered Species List

G&L - Neurotoxic Chemicals

Developmental neurotoxicity of industrial chemicals, List of 201 Chemicals known to be neurotoxic in man

Abbreviation: G&L Neuro

Agency: Lancet: authors Philippe Grandjean & Phil Landrigan

Type: Chemical Hazard List

German FEA - Substances Hazardous to Waters

Administrative Regulation on the Classification of Substances hazardous to waters into Water Hazard Classes (Verwaltungsvorschrift wassergefahrdende Stoffe - VwVwS)

Abbreviation: VwVwS

Agency: German Federal Environment Agency (FEA)

Type: Restricted Substance List

HBN - Priority Asthmagens

HBN Priority Building Material Asthmagens List

Abbreviation: HBN - Priority Asthmagens

Agency: Healthy Building Network (HBN)

Type: Restricted Substance List

IARC

Monographs On the Evaluation of Carcinogenic Risks to Humans

Abbreviation: IARC

Agency: International Agency for Research on Cancer, World Health Organization (IARC)

Type: Chemical Hazard List

IPCC Global Warming Chemicals

Intergovernmental Panel for Climate Change (IPCC) Third Assessment Report, 2001

Abbreviation: IPCC Global Warming Chemicals

Agency: Intergovernmental Panel for Climate Change (IPCC)

Type: Chemical Hazard List

IUCN - Red List

IUCN Red List of Threatened Species

Abbreviation: IUCN - Red List

Agency: International Union for Conservation of Nature and Natural Resources (IUCN)

Type: Endangered Species List

Japan - GHS

GHS Classifications

Abbreviation: GHS-Japan

Agency: Government of Japan

Type: Chemical Hazard List

Korea - GHS

GHS Classification and Labelling for Toxic Chemicals

Abbreviation: GHS-Korea

Agency: Republic of Korea - National Institute of Environmental Research (NIER)

Type: Chemical Hazard List

Living Future - Living Building Red List

Living Building Challenge 2.1 - Red List of Materials & Chemicals

Abbreviation: ILFI Red

Agency: International Living Future Institute (ILFI)

Type: Restricted Substance List

Living Future - Living Building Red List

Living Building Challenge 3.0 - Red List of Materials & Chemicals

Abbreviation: ILFI Red

Agency: International Living Future Institute (ILFI)

Type: Restricted Substance List

MAK

List of Substances with MAK & BAT Values & Categories

Abbreviation: MAK

Agency: MAK Commission of Germany (Deutsche Forschungsgemeinschaft)

Type: Chemical Hazard List

Malaysia - GHS

Malaysia - GHS

Abbreviation: Malaysia - GHS

Agency: Malaysia Department of Occupational Safety and Health

Type: Chemical Hazard List

New Zealand - GHS

New Zealand HSNO Chemical Classifications

Abbreviation: GHS-New Zealand

Agency: New Zealand Environmental Protection Authority (NZ EPA)

Type: Chemical Hazard List

OR DEQ - Priority Persistent Pollutants

Priority Persistent Pollutant (P3) List

Abbreviation: OR P3

Agency: Oregon Department of Environmental Quality (ORDEQ)

Type: Chemical Hazard List

OSPAR - Priority PBTs & EDs & equivalent concern

Chemical Lists of Priority Action & Possible Concern

Abbreviation: OSPAR

Agency: Oslo-Paris Convention Commission (OSPAR)

Type: Chemical Hazard List

P+W - Precautionary List

Precautionary List

Abbreviation: P+W - Precautionary List

Agency: Perkins+Will (P+W)

Type: Restricted Substance List

Quebec CSST - Asthma Agents

Agents Causing Occupational Asthma With Key References

Abbreviation: Quebec Asthma

Agency: Québec Workplace Health and Safety Commission (Commission de la santé et de la securite du travail (CSST))

Type: Chemical Hazard List

Québec CSST - WHMIS 1998

WHMIS-SIMDUT: Controlled Products Classifications

Abbreviation: WHMIS

Agency: Québec Workplace Health and Safety Commission (Commission de la santé et de la securite du travail (CSST))

Type: Chemical Hazard List

SCHF - Hazardous 100

Hazardous 100+ List of Chemicals of High Concern

Abbreviation: SCHF

Agency: Safer Chemicals, Healthy Families (SCHF)

Type: Restricted Substance List

Silent Spring - Breast Cancer Chemicals

Mammary Carcinogens Review Database

Abbreviation: SSI-BC

Agency: Silent Spring Institute

Type: Chemical Hazard List

TEDX - Potential Endocrine Disruptors

TEDX (The Endocrine Disruption eXchange) List of Potential Endocrine Disruptors

Abbreviation: TEDX

Agency: The Endocrine Disruption Exchange (TEDX)

Type: Chemical Hazard List

UNEP - PIC Annex III

Rotterdam Convention Prior Informed Consent (PIC) Annex III Chemicals

Abbreviation: PIC

Agency: United Nations Environment Programme (UNEP)

Type: Restricted Substance List

UNEP Stockholm Conv - Persistent Organic Pollutants

Stockholm Convention on Persistent Organic Pollutants (POPs) - Annex A, B & C and under Review

Abbreviation: Stockholm

Agency: United Nations Environment Programme (UNEP)

Type: Chemical Hazard List

UNEP WCMC - CITES-listed Trees

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) - Listed Trees

Abbreviation: UNEP WCMC - CITES-listed Trees

Agency: United Nations Environment Programme (UNEP)

Type: Endangered Species List

US CDC - Occupational Carcinogens

NIOSH Carcinogen List

Abbreviation: NIOSH-C

Agency: US Centers for Disease Control (US CDC)

Type: Chemical Hazard List

US EPA - DfE SCIL

Safer Chemical Ingredients List (Positive List)

Abbreviation: US EPA - DfE SCIL

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - EPCRA Extremely Hazardous Substances

Extremely Hazardous Substances - EPCRA Section 302

Abbreviation: EPA-AMT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Exempt VOCs

VOCs exempt from smog regulation because of negligible photochemical reactivity

Abbreviation: US EPA - Exempt VOCs

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - Global Warming Potentials

Global Warming Potentials of Ozone Depletors and Substitutes

Abbreviation: EPA-GW

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Hazardous Air Pollutants

Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants

Abbreviation: HAPs

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - IRIS Carcinogens

Integrated Risk Information System Database (IRIS)

Abbreviation: EPA-C

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - OPP - Registered Pesticides

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Registered Pesticides (Selections)

Abbreviation: EPA-FIFRA

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Ozone Depleting Substances

Ozone-Depleting Substances (ODS) Class I & Class II

Abbreviation: EPA-ODS

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - PPT Chemical Action Plans

Risk Management Actions & TSCA Work Plans

Abbreviation: EPA Action

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Priority PBTs (NWMP)

Priority Chemicals List

Abbreviation: NWMP Priority

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Priority PBTs (PPT)

Priority PBT Profiles (Pollution Prevention and Toxics)

Abbreviation: EPA PBT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Toxics Release Inventory PBTs

TRI PBT Chemical List

Abbreviation: TRI PBT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US NIH - Report on Carcinogens

Report on Carcinogens

Abbreviation: NTP-RoC

Agency: US Department of Health & Human Services - National Institutes of Health (US NIH)

Type: Chemical Hazard List

US NIH - Reproductive & Developmental Monographs

Expert Panel Reports & Monographs on Reproductive and Developmental Toxicity

Abbreviation: NTP-OHAaT

Agency: US Department of Health & Human Services - National Institutes of Health (US NIH)

Type: Chemical Hazard List

US OSHA - Carcinogens

TRI Carcinogens

Abbreviation: US OSHA - Carcinogens

Agency: US Department of Labor

Type: Restricted Substance List

USDA - US Threatened & Endangered Trees

Threatened & Endangered Plants, Growth Habit = Tree, US Federal & State Jurisdictions

Abbreviation: USDA - US Threatened & Endangered Trees

Agency: US Department of Agriculture

Type: Endangered Species List

USGBC - LEED Credits

LEED Credits: Chemical Avoidance in Building Materials

Abbreviation: LEED

Agency: US Green Building Council (USGBC)

Type: Restricted Substance List

WA DoE - PBT

Chapter 173-333 WAC Persistent Bioaccumulative Toxins

Abbreviation: WA PBT

Agency: Washington State Department of Ecology (WA DOE)

Type: Chemical Hazard List

WWF - Tropical Wood Guide

Photographic Guide to Identify Your Timber - Tropical Timber Guide

Abbreviation: WWF - Tropical Wood Guide

Agency: World Wildlife Federation (WWF)

Type: Endangered Species List

Search term
List Type Any Type
Authoritative Agency
Any Agency
Apply Filters

×

What Is the Purpose of the Pharos Chemical and Material Library?

There is currently no single, comprehensive governmental list or database that assesses and rates all chemicals across all human and environmental health hazard endpoints. The Pharos CML begins to address this problem by combining many single hazard endpoint lists into one combined database that provides a view across multiple endpoints. These endpoints include human health problems, such as cancer or asthma, and ecotoxicity problems, such as persistence, bioaccumulation, and aquatic toxicity. The CML then supports users in establishing priorities for substitution and identifying inherently safer substitutes through a two part ranking system where each chemical hazard is assigned a hazard level and priority level.

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What Hazard Endpoints Does Pharos Track?

Pharos addresses each of the human health and ecotoxicity endpoints used in the GreenScreen for Safer Chemicals and the US EPA's Design for the Environment program (DfE). The GreenScreen and DfE include all of the endpoints required for assessment by the Globally Harmonized System (GHS) plus several additional critical endpoints that are currently missing from the GHS. Pharos includes all of these endpoints plus several additional important environmental endpoints.

- **Human Health**
  - **Carcinogenicity** – ability to cause or increase the risk of cancer
  - **Mutagenicity/Genotoxicity** – ability to cause or increase the rate of mutations, which are changes in genetic material in cells.
  - **Reproductive Toxicity** – ability to disrupt the male or female reproductive systems, changing sexual development, behavior or functions, decreasing fertility, or resulting in loss of the fetus during pregnancy.
  - **Developmental Toxicity** incl. developmental neurotoxicity – ability to cause harm to the developing child including birth defects, low birth weight and biological or behavioral problems that appear as the child grows.
  - **Endocrine Activity** – ability to interfere with hormone communication between cells which controls metabolism, development, growth, reproduction and behavior (the endocrine system). *Not currently included in GHS.*
  - **Acute Mammalian Toxicity** – ability to be fatal on contact, ingestion, or inhalation for humans and other mammals.
  - **Systemic Toxicity/Organ Effects** incl. immunotoxicity-single exposure – ability to cause specific, non lethal but serious damage on contact or ingestion or inhalation, to one or more organs, such as the heart, lungs, liver, etc. distant from the point of entry of the toxicant.
  - **Neurotoxicity** - single exposure – ability to cause damage to the nervous system including the brain. *Not currently included in GHS.*
  - **Eye Irritation/Corrosivity** – ability to cause irritation or serious damage to the eye.
  - **Skin Irritation/Corrosivity** – ability to irritation or serious damage to the skin.
  - **Systemic Toxicity/Organ Effects** incl. immunotoxicity-repeated exposure - ability to cause specific, non lethal but serious damage on contact or ingestion or inhalation, to one or more organs,

such as the heart, lungs, liver, etc. distant from the point of entry of the toxicant on long term repeated exposures.
    - **Neurotoxicity** - repeated exposure - ability to cause serious damage to the nervous system on long term repeated exposures.
    - **Respiratory Sensitization** – ability to result in high sensitivity such that small quantities trigger asthma, rhinitis or other allergic reactions in the respiratory system.
    - **Skin Sensitization** – ability to trigger allergic reactions on the skin.
- **Ecotoxicity**
    - **Acute Aquatic Toxicity** - a single exposure in a day may result in severe biological harm or death to fish or other aquatic organisms.
    - **Chronic Aquatic Toxicity** - long term exposure of months or years may result in irreversible harm to fish or other aquatic organisms.
    - **Terrestrial Ecotoxicity** – ability to cause harm to land based plants, animals or microorganisms.
- **Physical Hazard**
    - **Flammability** - easily ignited and capable of burning rapidly.
    - **Reactivity** - may spontaneously ignite or explode on its own or in contact with water.
- **Environmental fate**
    - **Persistent** - does not break down readily from natural processes. *Not currently included in GHS.*
    - **Bioaccumulative** - accumulates in organisms concentrating as it moves up the food chain. *Not currently included in GHS.*
    - **Persistent Bioaccumulative Toxicant (PBT)** – Having characteristics of persistence, and bioaccumulation and is harmful in small quantities. *Not currently included in GHS.*
    - **Global Warming** – ability to absorb thermal radiation, increasing the temperature of the atmosphere and contributing to climate change. *Not currently included in GreenScreen or GHS.*
    - **Ozone Depletion** – ability to contribute to chemical reactions that destroy ozone in the earth's upper atmosphere. *Not currently included in GreenScreen or GHS.*
- **Multiple** - list specifies more than one of the above endpoints.

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What Do the Hazard and Priority Levels Mean?

Pharos ranks hazard on a five step scale from Very High to Very Low. The criteria for each endpoint vary, and are based largely on the protocol of the GreenScreen for Safer Chemicals.

Pharos ranks priority on a five step color coded scale from Urgent (purple) to Low (green) and indicates the relative urgency to avoid use of this chemical and substitute for an inherently safer one. Chemicals that cause irreversible damage either because they are persistent and/or bioaccumulative or because they are associated with chronic systemic problems such as cancer, mutagenicity, reproductive and developmental toxicity and endocrine activity are prioritized highest.

For more information, see the Chemical and Material Library description.

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Are Exposure and Risk Included?

The Pharos hazard levels and color coded priority levels are based on hazard assessment. They do not represent a characterization of level of exposure or a risk assessment. Rather, this categorization reflects current trends in chemical hazard management policy work that prioritizes replacement of high hazard chemicals with lower hazard chemicals. It is informed by collaborative work that HBN has engaged in for over ten years with Clean Production Action (CPA), members of Health Care Without Harm (HCWH) and the Business–NGO Working Group on chemical hazard analysis. It is specifically informed by the GreenScreen for Safer Chemicals, which

uses benchmarks to rank the safety of chemicals and encourage progress toward safer alternatives.

See CPA's GreenScreen for Safer Chemicals at http://www.greenscreenchemicals.org and HBN and CPA's Chemicals of High Concern Red List of Lists at http://www.bizngo.org/.

×

What is the GreenScreen?

The GreenScreen® for Safer Chemicals is a benchmarking system to rank the relative hazard level of chemicals and encourage progress toward safer alternatives. The benchmark is based on a set of health endpoints and measures of environmental fate. GreenScreen was developed by and is a project of Clean Production Action. The Pharos Chemical and Material Library (CML) uses the GreenScreen in three ways:

1. The CML serves as a repository for full GreenScreen assessments that are in the public domain.
2. The CML serves as a tool to determine the GreenScreen List Translator score for a chemical or product.
3. The CML's Hazard and Priority Levels are informed by the GreenScreen methodology.

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What is a GreenScreen Assessment?

A GreenScreen Assessment is a report that establishes a benchmark score for a chemical using the GreenScreen protocol. These benchmarks can be used to help prioritize chemicals for replacement. From the highest concern to the lowest concern these are:

- Benchmark 1: Avoid - Chemical of High Concern
- Benchmark U: Unspecified Due to Insufficient Data
- Benchmark 2: Use but Search for Safer Substitutes
- Benchmark 3: Use but Still Opportunity for Improvement
- Benchmark 4: Prefer - Safer Chemical

The protocol includes use of authoritative hazard lists, toxicological and epidemiological studies, modelling and analogues to assess hazard across eighteen health endpoints and measures of environmental fate. The protocol is public, free, and transparent, and can be performed by anyone. For an assessment to be Certified, however, it must be produced by a Licensed GreenScreen Profiler. Less than a hundred public domain GreenScreen assessments are currently available.

For more information visit www.greenscreenchemicals.org.

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Where Do I Find GreenScreen Assessments?

Public GreenScreen Assessments are available in Pharos. These assessments can be found in a chemicals and materials search by checking the "Has a full GreenScreen assessment" box. They can then be viewed in the GreenScreen tab of each Chemical Profile.

Non-public GreenScreen Assessments can be purchased from the GreenScreen store or TechStreet.

For more information visit www.greenscreenchemicals.org.

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How does Pharos use the GreenScreen List Translator?

The GreenScreen List Translator rates authoritative hazard lists for the level of hazard for a health endpoint. All chemicals in the Pharos database are automatically screened against these hazard lists by a protocol that results in a GreenScreen List Translator score. GreenScreen List Translator scores in order from highest concern to lowest concern are:

- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown

The List Translator cannot be used to assign scores higher (better) than 1 because of the data gaps inherent in the list based approach. If the chemical is not on a list included in the GreenScreen List Translator, the GreenScreen field is left blank.

Full GreenScreen assessments trump results from List Translator scoring. These scores can be viewed in the GreenScreen tab of the Chemical Profile for chemicals which have a public assessment.

Products in the Building Product Library (BPL) often contain multiple substances with different Benchmarks and List Translator scores. The highest concern score is selected for display in the summary. GreenScreen scores in order from highest to lowest concern are:

- Benchmark 1
- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown
- Benchmark U
- Benchmark 2
- Benchmark 3
- Benchmark 4

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Substance Hazard

This color reflects the highest hazard associated directly with this substance by an authoritative hazard list.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the authoritative hazard list that is the source of this hazard color, see the "Hazard" tab on the chemical / material's page.

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Residual Hazard

This color reflects the highest hazard associated with residual chemicals that our research indicates may be present with the chemical. These residuals consist of all process chemicals in the following categories:

- Monomers
- Catalysts
- Non-reactive Additives
- Pollutants and Contaminants
- Other known residuals

Hazards are drawn from process chemicals far upstream in the manufacturing process as well as the immediate precursors to this chemical.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the source of this hazard, see the "Process Chemistry Research" tab on the chemical's page.

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Manufacturing Hazard

This color reflects the highest hazard associated with chemicals that our research categorizes as “frequent” or “integral” to the production of a chemical. The manufacturing score is included to surface potential hazards upstream in the manufacturing process that may or may not be present as residuals. Hazards are drawn from process chemicals far upstream in the manufacturing process as well as the immediate precursors to this chemical.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the source of this hazard, see the "Process Chemistry Research" tab on the chemical's page.

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GreenScreen

The Pharos scoring system is informed by the GreenScreen® for Safer Chemicals, a benchmarking system to rank the safety of chemicals on a 4 point hazard scale and encourage progress toward safer alternatives. Chemicals that have undergone a full GreenScreen assessment by Licensed GreenScreen Profilers are given a Benchmark score, which is the most authoritative. Chemicals that have been assessed using an automated comparison to hazard lists are given a List Translator score, which is less authoritative. Full GreenScreen assessments trump results from List Translator scoring.

GreenScreen Scores in order from highest concern to lowest concern are:

- Benchmark 1
- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown
- Benchmark U
- Benchmark 2
- Benchmark 3
- Benchmark 4

For more information, see the "GreenScreen" tab on the chemical's page or visit www.greenscreenchemicals.org.

GreenScreen LT-P1 (Possible Benchmark 1)

Toggle navigation

- Building Products
- Chemicals and Materials
- Certifications
- CompAIR
- Dashboard
- Logout

1. Dashboard
2. Chemicals and Materials

Chemicals and Materials

- About the CML
- Search Chemicals and Materials (1)
- Search Hazard Lists (69)

The Chemical and Material Library (CML) is an online catalog of 38,282 chemicals, polymers, metals, and other substances. It identifies key health and environmental information using:

- 42 authoritative scientific lists for specific human and environmental health hazards
- 20 restricted substance lists
- GreenScreen List Translator scores based on the most current GreenScreen version (1.3)

The CML also characterizes the process chemistry used to produce 1,174 substances and screens woods against 5 endangered species lists.

Hazard Levels and Endpoints

What is the purpose of the Pharos Chemical and Material Library?

What hazard endpoints does Pharos track?

What do the hazard and priority levels mean?

Are exposure and risk included?
GreenScreen

What is the GreenScreen?

What is a GreenScreen Assessment?

Where do I find GreenScreen Assessments?

How does Pharos use the GreenScreen List Translator?

Key

Hazard color indicators show the highest level of concern for chemical hazards. Hazards are differentiated between those associated with the substance, likely residuals, and chemicals used in the manufacturing process. Hover over any of these indicators to view the health endpoint and level of concern, or click on the chemical name for details.
Wood species which are listed as endangered or threatened will also receive a color indicator indicating the level of concern for the species.

LT-1 These abbreviations in the GreenScreen column indicate the chemical's GreenScreen® for Safer Chemicals score.

Within a chemical profile's hazard tab, the GreenScreen logo indicates that the hazard listed has been evaluated by the GreenScreen List Translator. Hover over this icon to view List Translator details.

Within a chemical profile's hazard tab, the HPD logo indicates that the hazard listed is from an HPD Priority List, meaning the hazard is required to be disclosed on an HPD.

View the full Chemical and Material Library description

chemicals:
36,090

variants:
137

biobased materials:
1,475

unregistered materials:
104

compound groups:
476

Showing 1 - 1 of 1 results

CAS RN	Material Name	Hazard			GreenScreen
		Substance	Residual	Manufacturing	
124-13-0	1-OCTANAL				LT-P1

Search term 124-13-0
Type Any type
Used in Product Category Any category
☐ Has a full GreenScreen assessment
Restricted lists include Add
Restricted lists do not include Add
☑ Include residuals in selected filters above
Apply Filters

Showing 1 - 69 of 69 results

AOEC - Asthmagens

AOEC Exposure Codes - Asthmagen List

Abbreviation: AOEC

Agency: Association of Occupational and Environmental Clinics (AOEC)

Type: Chemical Hazard List

Australia - GHS

Australia - GHS

Abbreviation: GHS AU

Agency: Safe Work Australia

Type: Chemical Hazard List

BIFMA - e3/level Annex B list of chemicals

BIFMA - e3/level Annex B list of chemicals

Abbreviation: BIFMA

Agency: Business and Institutional Furniture Manufacturers Association (BIFMA)

Type: Restricted Substance List

Boyes - Neurotoxicants

Chemicals with occupational exposure standards based on nervous system effects (Boyes 2001)

Abbreviation: Boyes-N

Agency: Pattys Toxicology: author William K Boyes

Type: Chemical Hazard List

C2C - Banned Chemicals

Banned Lists of Chemicals in the Cradle to Cradle Certified Product Standard – Version 3.0

Abbreviation: C2C Banned Chemicals

Agency: Cradle to Cradle Products Innovation Institute (C2CPII)

Type: Restricted Substance List

CA EPA - Prop 65

Chemicals Known to the State to Cause Cancer or Reproductive Toxicity - California Proposition 65 - Safe Drinking Water and Toxic Enforcement Act Of 1986

Abbreviation: Prop 65

Agency: California Environmental Protection Agency (CA EPA)

Type: Chemical Hazard List

CA SCP - Candidate Chemicals

Safer Consumer Product Candidate Chemicals

Abbreviation: CA SCP Candidate Chemicals

Agency: California Department of Toxic Substance Control (CA DTSC)

Type: Restricted Substance List

CHE - Toxicant Database

Toxicant and Disease Database

Abbreviation: CHETox

Agency: Collaborative on Health and the Environment (CHE)

Type: Chemical Hazard List

ChemSec - SIN List

SIN (Substitute It Now) List

Abbreviation: SIN

Agency: ChemSec, The International Chemical Secretariat

Type: Chemical Hazard List

EC - CEPA DSL

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Domestic Substances List (DSL)

Abbreviation: DSL

Agency: Environment Canada & Health Canada (EC)

Type: Chemical Hazard List

EC - CEPA Toxic Substances (Sched 1)

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Toxic Substances List (Schedule 1)

Abbreviation: CEPA

Agency: Environment Canada & Health Canada (EC)

Type: Restricted Substance List

EC - Virtual Elimination List

Canadian Environmental Protection Act (CEPA) - Environmental Registry - Virtual Elimination List

Abbreviation: CEPA VEL

Agency: Environment Canada & Health Canada (EC)

Type: Restricted Substance List

EHP - San Antonio Statement on BFRs & CFRs

San Antonio Statement on Brominated and Chlorinated Flame Retardants

Abbreviation: San Antonio

Agency: Environmental Health Perspectives

Type: Chemical Hazard List

EU - Annex VI CMRs

Classification, Labelling and Packaging Regulation (CLP) - Classification and Labelling Inventory - CMRs

Abbreviation: EU CMR (2)

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - ESIS PBT

European chemical Substances Information System (ESIS) - PBT List

Abbreviation: EU PBT

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - GHS (H-Statements)

Regulation on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) Annex 6 Table 3-1 - GHS Hazard code criteria

Abbreviation: EU H-Statements

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - Ozone depletion substances

Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009

on substances that deplete the ozone layer - Controlled substances and new substances

Abbreviation: EU Ozone

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - PACT-RMOA Substances

Public Activities Coordination Tool for Risk Management Option Analysis

Abbreviation: EU PACT

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - Priority Endocrine Disrupters

EU Community Strategy for Endocrine Disrupters - Priority List

Abbreviation: EU ED

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - R-phrases

Substances with EU Risk & Safety Phrases (Commission Directive 67-548-EEC)

Abbreviation: EU R-Phrases

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - REACH Annex XVII CMRs

Restrictions On The Manufacture, Placing On The Market And Use Of Certain Dangerous Substances, Preparations And Articles - Carcinogens, Mutagens & Reproductive Toxicants

Abbreviation: EU CMR (1)

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

EU - REACH Exemptions

Commission Regulation (EC) No 987/2008 Annex I & 2 Exemptions from the Obligation to Register in acccordance with REACH article 2(7)a

Abbreviation: EC - REACH Exemptions

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - ROHS

Directive on the Restriction Of the use of certain Hazardous Substances in electrical and electronic equipment ANNEX II

Abbreviation: EC - ROHS

Agency: European Union / European Commission (EU EC)

Type: Restricted Substance List

EU - SVHC Authorisation List

Substances of Very High Concern for REACH Annex XIV authorisation (Article 59)

Abbreviation: EU SVHC

Agency: European Union / European Commission (EU EC)

Type: Chemical Hazard List

FOE - Good Wood Guide

Good Wood Guide

Abbreviation: FOE - Good Wood Guide

Agency: Friends of the Earth (FOE)

Type: Endangered Species List

G&L - Neurotoxic Chemicals

Developmental neurotoxicity of industrial chemicals, List of 201 Chemicals known to be neurotoxic in man

Abbreviation: G&L Neuro

Agency: Lancet: authors Philippe Grandjean & Phil Landrigan

Type: Chemical Hazard List

German FEA - Substances Hazardous to Waters

Administrative Regulation on the Classification of Substances hazardous to waters into Water Hazard Classes (Verwaltungsvorschrift wassergefahrdende Stoffe - VwVwS)

Abbreviation: VwVwS

Agency: German Federal Environment Agency (FEA)

Type: Restricted Substance List

HBN - Priority Asthmagens

HBN Priority Building Material Asthmagens List

Abbreviation: HBN - Priority Asthmagens

Agency: Healthy Building Network (HBN)

Type: Restricted Substance List

IARC

Monographs On the Evaluation of Carcinogenic Risks to Humans

Abbreviation: IARC

Agency: International Agency for Research on Cancer, World Health Organization (IARC)

Type: Chemical Hazard List

IPCC Global Warming Chemicals

Intergovernmental Panel for Climate Change (IPCC) Third Assessment Report, 2001

Abbreviation: IPCC Global Warming Chemicals

Agency: Intergovernmental Panel for Climate Change (IPCC)

Type: Chemical Hazard List

IUCN - Red List

IUCN Red List of Threatened Species

Abbreviation: IUCN - Red List

Agency: International Union for Conservation of Nature and Natural Resources (IUCN)

Type: Endangered Species List

Japan - GHS

GHS Classifications

Abbreviation: GHS-Japan

Agency: Government of Japan

Type: Chemical Hazard List

Korea - GHS

GHS Classification and Labelling for Toxic Chemicals

Abbreviation: GHS-Korea

Agency: Republic of Korea - National Institute of Environmental Research (NIER)

Type: Chemical Hazard List

Living Future - Living Building Red List

Living Building Challenge 2.1 - Red List of Materials & Chemicals

Abbreviation: ILFI Red

Agency: International Living Future Institute (ILFI)

Type: Restricted Substance List

Living Future - Living Building Red List

Living Building Challenge 3.0 - Red List of Materials & Chemicals

Abbreviation: ILFI Red

Agency: International Living Future Institute (ILFI)

Type: Restricted Substance List

MAK

List of Substances with MAK & BAT Values & Categories

Abbreviation: MAK

Agency: MAK Commission of Germany (Deutsche Forschungsgemeinschaft)

Type: Chemical Hazard List

Malaysia - GHS

Malaysia - GHS

Abbreviation: Malaysia - GHS

Agency: Malaysia Department of Occupational Safety and Health

Type: Chemical Hazard List

New Zealand - GHS

New Zealand HSNO Chemical Classifications

Abbreviation: GHS-New Zealand

Agency: **New Zealand Environmental Protection Authority (NZ EPA)**

Type: Chemical Hazard List

OR DEQ - Priority Persistent Pollutants

Priority Persistent Pollutant (P3) List

Abbreviation: OR P3

Agency: **Oregon Department of Environmental Quality (ORDEQ)**

Type: Chemical Hazard List

OSPAR - Priority PBTs & EDs & equivalent concern

Chemical Lists of Priority Action & Possible Concern

Abbreviation: OSPAR

Agency: **Oslo-Paris Convention Commission (OSPAR)**

Type: Chemical Hazard List

P+W - Precautionary List

Precautionary List

Abbreviation: P+W - Precautionary List

Agency: **Perkins+Will (P+W)**

Type: Restricted Substance List

Quebec CSST - Asthma Agents

Agents Causing Occupational Asthma With Key References

Abbreviation: Quebec Asthma

Agency: **Québec Workplace Health and Safety Commission (Commission de la santé et de la securite**

du travail (CSST))

Type: Chemical Hazard List

Québec CSST - WHMIS 1998

WHMIS-SIMDUT: Controlled Products Classifications

Abbreviation: WHMIS

Agency: Québec Workplace Health and Safety Commission (Commission de la santé et de la securite du travail (CSST))

Type: Chemical Hazard List

SCHF - Hazardous 100

Hazardous 100+ List of Chemicals of High Concern

Abbreviation: SCHF

Agency: Safer Chemicals, Healthy Families (SCHF)

Type: Restricted Substance List

Silent Spring - Breast Cancer Chemicals

Mammary Carcinogens Review Database

Abbreviation: SSI-BC

Agency: Silent Spring Institute

Type: Chemical Hazard List

TEDX - Potential Endocrine Disruptors

TEDX (The Endocrine Disruption eXchange) List of Potential Endocrine Disruptors

Abbreviation: TEDX

Agency: The Endocrine Disruption Exchange (TEDX)

Type: Chemical Hazard List

UNEP - PIC Annex III

Rotterdam Convention Prior Informed Consent (PIC) Annex III Chemicals

Abbreviation: PIC

Agency: United Nations Environment Programme (UNEP)

Type: Restricted Substance List

UNEP Stockholm Conv - Persistent Organic Pollutants

Stockholm Convention on Persistent Organic Pollutants (POPs) - Annex A, B & C and under Review

Abbreviation: Stockholm

Agency: United Nations Environment Programme (UNEP)

Type: Chemical Hazard List

UNEP WCMC - CITES-listed Trees

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) - Listed Trees

Abbreviation: UNEP WCMC - CITES-listed Trees

Agency: United Nations Environment Programme (UNEP)

Type: Endangered Species List

US CDC - Occupational Carcinogens

NIOSH Carcinogen List

Abbreviation: NIOSH-C

Agency: US Centers for Disease Control (US CDC)

Type: Chemical Hazard List

US EPA - DfE SCIL

Safer Chemical Ingredients List (Positive List)

Abbreviation: US EPA - DfE SCIL

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - EPCRA Extremely Hazardous Substances

Extremely Hazardous Substances - EPCRA Section 302

Abbreviation: EPA-AMT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Exempt VOCs

VOCs exempt from smog regulation because of negligible photochemical reactivity

Abbreviation: US EPA - Exempt VOCs

Agency: US Environmental Protection Agency (US EPA)

Type: Restricted Substance List

US EPA - Global Warming Potentials

Global Warming Potentials of Ozone Depletors and Substitutes

Abbreviation: EPA-GW

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Hazardous Air Pollutants

Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants

Abbreviation: HAPs

Agency: **US Environmental Protection Agency (US EPA)**

Type: Restricted Substance List

US EPA - IRIS Carcinogens

Integrated Risk Information System Database (IRIS)

Abbreviation: EPA-C

Agency: **US Environmental Protection Agency (US EPA)**

Type: Chemical Hazard List

US EPA - OPP - Registered Pesticides

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Registered Pesticides (Selections)

Abbreviation: EPA-FIFRA

Agency: **US Environmental Protection Agency (US EPA)**

Type: Chemical Hazard List

US EPA - Ozone Depleting Substances

Ozone-Depleting Substances (ODS) Class I & Class II

Abbreviation: EPA-ODS

Agency: **US Environmental Protection Agency (US EPA)**

Type: Chemical Hazard List

US EPA - PPT Chemical Action Plans

Risk Management Actions & TSCA Work Plans

Abbreviation: EPA Action

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Priority PBTs (NWMP)

Priority Chemicals List

Abbreviation: NWMP Priority

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Priority PBTs (PPT)

Priority PBT Profiles (Pollution Prevention and Toxics)

Abbreviation: EPA PBT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US EPA - Toxics Release Inventory PBTs

TRI PBT Chemical List

Abbreviation: TRI PBT

Agency: US Environmental Protection Agency (US EPA)

Type: Chemical Hazard List

US NIH - Report on Carcinogens

Report on Carcinogens

Abbreviation: NTP-RoC

Agency: US Department of Health & Human Services - National Institutes of Health (US NIH)

Type: Chemical Hazard List

US NIH - Reproductive & Developmental Monographs

Expert Panel Reports & Monographs on Reproductive and Developmental Toxicity

Abbreviation: NTP-OHAaT

Agency: US Department of Health & Human Services - National Institutes of Health (US NIH)

Type: Chemical Hazard List

US OSHA - Carcinogens

TRI Carcinogens

Abbreviation: US OSHA - Carcinogens

Agency: US Department of Labor

Type: Restricted Substance List

USDA - US Threatened & Endangered Trees

Threatened & Endangered Plants, Growth Habit = Tree, US Federal & State Jurisdictions

Abbreviation: USDA - US Threatened & Endangered Trees

Agency: US Department of Agriculture

Type: Endangered Species List

USGBC - LEED Credits

LEED Credits: Chemical Avoidance in Building Materials

Abbreviation: LEED

Agency: US Green Building Council (USGBC)

Type: Restricted Substance List

WA DoE - PBT

Chapter 173-333 WAC Persistent Bioaccumulative Toxins

Abbreviation: WA PBT

Agency: Washington State Department of Ecology (WA DOE)

Type: Chemical Hazard List

WWF - Tropical Wood Guide

Photographic Guide to Identify Your Timber - Tropical Timber Guide

Abbreviation: WWF - Tropical Wood Guide

Agency: World Wildlife Federation (WWF)

Type: Endangered Species List

Search term
List Type Any Type
Authoritative Agency
Any Agency
Apply Filters

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What Is the Purpose of the Pharos Chemical and Material Library?

There is currently no single, comprehensive governmental list or database that assesses and rates all chemicals across all human and environmental health hazard endpoints. The Pharos CML begins to address this problem by combining many single hazard endpoint lists into one combined database that provides a view across multiple endpoints. These endpoints include human health problems, such as cancer or asthma, and ecotoxicity problems, such as persistence, bioaccumulation, and aquatic toxicity. The CML then supports users in establishing priorities for substitution and identifying inherently safer substitutes through a two part ranking system where each chemical hazard is assigned a hazard level and priority level.

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What Hazard Endpoints Does Pharos Track?

Pharos addresses each of the human health and ecotoxicity endpoints used in the GreenScreen for Safer Chemicals and the US EPA's Design for the Environment program (DfE). The GreenScreen and DfE include all of the endpoints required for assessment by the Globally Harmonized System (GHS) plus several additional critical endpoints that are currently missing from the GHS. Pharos includes all of these endpoints plus several additional important environmental endpoints.

- **Human Health**
  - **Carcinogenicity** – ability to cause or increase the risk of cancer
  - **Mutagenicity/Genotoxicity** – ability to cause or increase the rate of mutations, which are changes in genetic material in cells.
  - **Reproductive Toxicity** – ability to disrupt the male or female reproductive systems, changing sexual development, behavior or functions, decreasing fertility, or resulting in loss of the fetus during pregnancy.
  - **Developmental Toxicity** incl. developmental neurotoxicity – ability to cause harm to the developing child including birth defects, low birth weight and biological or behavioral problems that appear as the child grows.
  - **Endocrine Activity** – ability to interfere with hormone communication between cells which controls metabolism, development, growth, reproduction and behavior (the endocrine system). *Not currently included in GHS.*
  - **Acute Mammalian Toxicity** – ability to be fatal on contact, ingestion, or inhalation for humans and other mammals.
  - **Systemic Toxicity/Organ Effects** incl. immunotoxicity-single exposure – ability to cause specific, non lethal but serious damage on contact or ingestion or inhalation, to one or more organs, such as the heart, lungs, liver, etc. distant from the point of entry of the toxicant.
  - **Neurotoxicity** - single exposure – ability to cause damage to the nervous system including the brain. *Not currently included in GHS.*
  - **Eye Irritation/Corrosivity** – ability to cause irritation or serious damage to the eye.
  - **Skin Irritation/Corrosivity** – ability to irritation or serious damage to the skin.
  - **Systemic Toxicity/Organ Effects** incl. immunotoxicity-repeated exposure - ability to cause specific, non lethal but serious damage on contact or ingestion or inhalation, to one or more organs, such as the heart, lungs, liver, etc. distant from the point of entry of the toxicant on long term repeated exposures.
  - **Neurotoxicity** - repeated exposure - ability to cause serious damage to the nervous system on long term repeated exposures.
  - **Respiratory Sensitization** – ability to result in high sensitivity such that small quantities trigger asthma, rhinitis or other allergic reactions in the respiratory system.
  - **Skin Sensitization** – ability to trigger allergic reactions on the skin.
- **Ecotoxicity**
  - **Acute Aquatic Toxicity** - a single exposure in a day may result in severe biological harm or death to fish or other aquatic organisms.
  - **Chronic Aquatic Toxicity** - long term exposure of months or years may result in irreversible harm to fish or other aquatic organisms.
  - **Terrestrial Ecotoxicity** – ability to cause harm to land based plants, animals or microorganisms.
- **Physical Hazard**
  - **Flammability** - easily ignited and capable of burning rapidly.
  - **Reactivity** - may spontaneously ignite or explode on its own or in contact with water.
- **Environmental fate**
  - **Persistent** - does not break down readily from natural processes. *Not currently included in GHS.*
  - **Bioaccumulative** - accumulates in organisms concentrating as it moves up the food chain. *Not currently included in GHS.*
  - **Persistent Bioaccumulative Toxicant (PBT)** – Having characteristics of persistence, and bioaccumulation and is harmful in small quantities. *Not currently included in GHS.*
  - **Global Warming** – ability to absorb thermal radiation, increasing the temperature of the atmosphere and contributing to climate change. *Not currently included in GreenScreen or GHS.*

- **Ozone Depletion** – ability to contribute to chemical reactions that destroy ozone in the earth's upper atmosphere. *Not currently included in GreenScreen or GHS.*

- **Multiple** - list specifies more than one of the above endpoints.

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What Do the Hazard and Priority Levels Mean?

Pharos ranks hazard on a five step scale from Very High to Very Low. The criteria for each endpoint vary, and are based largely on the protocol of the GreenScreen for Safer Chemicals.

Pharos ranks priority on a five step color coded scale from Urgent (purple) to Low (green) and indicates the relative urgency to avoid use of this chemical and substitute for an inherently safer one. Chemicals that cause irreversible damage either because they are persistent and/or bioaccumulative or because they are associated with chronic systemic problems such as cancer, mutagenicity, reproductive and developmental toxicity and endocrine activity are prioritized highest.

For more information, see the Chemical and Material Library description.

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Are Exposure and Risk Included?

The Pharos hazard levels and color coded priority levels are based on hazard assessment. They do not represent a characterization of level of exposure or a risk assessment. Rather, this categorization reflects current trends in chemical hazard management policy work that prioritizes replacement of high hazard chemicals with lower hazard chemicals. It is informed by collaborative work that HBN has engaged in for over ten years with Clean Production Action (CPA), members of Health Care Without Harm (HCWH) and the Business–NGO Working Group on chemical hazard analysis. It is specifically informed by the GreenScreen for Safer Chemicals, which uses benchmarks to rank the safety of chemicals and encourage progress toward safer alternatives.

See CPA's GreenScreen for Safer Chemicals at http://www.greenscreenchemicals.org and HBN and CPA's Chemicals of High Concern Red List of Lists at http://www.bizngo.org/.

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What is the GreenScreen?

The GreenScreen® for Safer Chemicals is a benchmarking system to rank the relative hazard level of chemicals and encourage progress toward safer alternatives. The benchmark is based on a set of health endpoints and measures of environmental fate. GreenScreen was developed by and is a project of Clean Production Action. The Pharos Chemical and Material Library (CML) uses the GreenScreen in three ways:

1. The CML serves as a repository for full GreenScreen assessments that are in the public domain.
2. The CML serves as a tool to determine the GreenScreen List Translator score for a chemical or product.
3. The CML's Hazard and Priority Levels are informed by the GreenScreen methodology.

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What is a GreenScreen Assessment?

A GreenScreen Assessment is a report that establishes a benchmark score for a chemical using the GreenScreen protocol. These benchmarks can be used to help prioritize chemicals for replacement. From the highest concern to the lowest concern these are:

- Benchmark 1: Avoid - Chemical of High Concern
- Benchmark U: Unspecified Due to Insufficient Data
- Benchmark 2: Use but Search for Safer Substitutes
- Benchmark 3: Use but Still Opportunity for Improvement
- Benchmark 4: Prefer - Safer Chemical

The protocol includes use of authoritative hazard lists, toxicological and epidemiological studies, modelling and analogues to assess hazard across eighteen health endpoints and measures of environmental fate. The protocol is public, free, and transparent, and can be performed by anyone. For an assessment to be Certified, however, it must be produced by a Licensed GreenScreen Profiler. Less than a hundred public domain GreenScreen assessments are currently available.

For more information visit www.greenscreenchemicals.org.

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Where Do I Find GreenScreen Assessments?

Public GreenScreen Assessments are available in Pharos. These assessments can be found in a chemicals and materials search by checking the "Has a full GreenScreen assessment" box. They can then be viewed in the GreenScreen tab of each Chemical Profile.

Non-public GreenScreen Assessments can be purchased from the GreenScreen store or TechStreet.

For more information visit www.greenscreenchemicals.org.

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How does Pharos use the GreenScreen List Translator?

The GreenScreen List Translator rates authoritative hazard lists for the level of hazard for a health endpoint. All chemicals in the Pharos database are automatically screened against these hazard lists by a protocol that results in a GreenScreen List Translator score. GreenScreen List Translator scores in order from highest concern to lowest concern are:

- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown

The List Translator cannot be used to assign scores higher (better) than 1 because of the data gaps inherent in the list based approach. If the chemical is not on a list included in the GreenScreen List Translator, the GreenScreen field is left blank.

Full GreenScreen assessments trump results from List Translator scoring. These scores can be viewed in the GreenScreen tab of the Chemical Profile for chemicals which have a public assessment.

Products in the Building Product Library (BPL) often contain multiple substances with different Benchmarks and List Translator scores. The highest concern score is selected for display in the summary. GreenScreen scores in order from highest to lowest concern are:

- Benchmark 1
- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown
- Benchmark U
- Benchmark 2
- Benchmark 3
- Benchmark 4

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Substance Hazard

This color reflects the highest hazard associated directly with this substance by an authoritative hazard list.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the authoritative hazard list that is the source of this hazard color, see the "Hazard" tab on the chemical / material's page.

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Residual Hazard

This color reflects the highest hazard associated with residual chemicals that our research indicates may be present with the chemical. These residuals consist of all process chemicals in the following categories:

- Monomers
- Catalysts
- Non-reactive Additives
- Pollutants and Contaminants
- Other known residuals

Hazards are drawn from process chemicals far upstream in the manufacturing process as well as the immediate precursors to this chemical.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the source of this hazard, see the "Process Chemistry Research" tab on the chemical's page.

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Manufacturing Hazard

This color reflects the highest hazard associated with chemicals that our research categorizes as “frequent” or “integral” to the production of a chemical. The manufacturing score is included to surface potential hazards upstream in the manufacturing process that may or may not be present as residuals. Hazards are drawn from process chemicals far upstream in the manufacturing process as well as the immediate precursors to this chemical.

The colors represent the relative level of hazard, ranging from **purple** (highest concern) through **red**, **orange**, and **yellow** to **green** (lowest concern).

Grey indicates that the authoritative hazard listing is ambiguous and covers a wide range of possible hazard levels.

Blue indicates that the substance is referenced on a restricted substance list (RSL) rather than an authoritative hazard list.

For a full description of authoritative hazard lists used in Pharos and of the derivation of the hazard level indicators, see the complete Pharos Chemical and Material Library Description.

For the source of this hazard, see the "Process Chemistry Research" tab on the chemical's page.

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GreenScreen

The Pharos scoring system is informed by the GreenScreen® for Safer Chemicals, a benchmarking system to rank the safety of chemicals on a 4 point hazard scale and encourage progress toward safer alternatives. Chemicals that have undergone a full GreenScreen assessment by Licensed GreenScreen Profilers are given a Benchmark score, which is the most authoritative. Chemicals that have been assessed using an automated comparison to hazard lists are given a List Translator score, which is less authoritative. Full GreenScreen

assessments trump results from List Translator scoring.

GreenScreen Scores in order from highest concern to lowest concern are:

- Benchmark 1
- LT-1 - List Translator Likely Benchmark 1
- LT-P1 - List Translator Possible Benchmark 1
- LT-UNK - List Translator Benchmark Unknown
- Benchmark U
- Benchmark 2
- Benchmark 3
- Benchmark 4

For more information, see the "GreenScreen" tab on the chemical's page or visit www.greenscreenchemicals.org.
