



PROGRAM

DESCRIPTION

v 2.0

2024\_02

## ChemFORWARD: A Centralized Repository of Chemical Hazard Assessments for Safer Alternatives

ChemFORWARD manages a globally harmonized repository of chemical hazard assessments (CHAs) with a focus on safer alternative chemicals. We have fundamentally changed the way that chemical hazard data are created, maintained, distributed and financed. Through our work, we enable trusted communication throughout the supply chain from buyer/retailer to raw materials supplier. ChemFORWARD is an independent, science-based non-profit creating broad access to chemical hazard data through a unique cost-sharing, benefit sharing model.

Informed decision making and rapid adoption of safer alternatives is our aim. We are scaling access to CHAs in a cloud-based platform that is cost-effective and user friendly to enable informed decisions for product design and development, to substitute chemicals of concern in products with safer alternatives, to support claims, and to provide pre-screening for certification programs. Our goal is to ensure that these CHAs are based on the best available science and professional judgment.

The chemical hazard data trust, managed by ChemFORWARD, allows users to search for chemicals by sector, function, chemical class, application, and more. Users can find functional alternatives that are 1) fully assessed by an accredited toxicology firm and verified by an independent toxicologist and 2) identified as safer based on their inherent hazard properties. ChemFORWARD streamlines the search for safer alternatives based on robust CHAs that are the core of the ChemFORWARD offering.

Because ChemFORWARD is a centralized repository, users benefit from having one CHA per chemical CAS number/form specific criteria (e.g. “non-nano”). This is a policy that ensures CHAs remain current and helps to prevent different and conflicting versions of CHAs from circulating and confusing users in the value chain. No other publicly accessible repository of CHAs can boast this level of responsible curation.

### Overview

**ChemFORWARD does not have its own chemical hazard assessment methodology for assessing endpoints.** Rather, each CHA comprises a comprehensive evaluation and classification of human health hazards, physical chemical properties, and environmental fate and toxicity endpoints based on an enhanced GHS-based approach that are presented as Hazard Summary Tables per each methodology (See below.) To date, ChemFORWARD includes and combines criteria from the following two methodologies:

1. [Cradle to Cradle Material Health Assessment Methodology](#) (Current version: V4.0, February 2022.))
2. [Globally Harmonized System of Classification and Labelling of Chemicals \(GHS\) \(Current version: Rev 10, July 2023. \)](#)

It is the goal that additional methodologies will be added to the ChemFORWARD repository, and additional Hazard Summary Table views will be made available corresponding to each new methodology.

While ChemFORWARD does not have its own CHA method, our novel hazard banding system allows users to compare results across different existing CHA methods while demonstrating equivalency for use in standards and certification programs. Hazard banding is a simple summary score on an A-F scale and is described in more detail below.

In the ChemFORWARD platform, the same underlying data and information entries are used to classify chemicals which are then interpreted through the lenses of various CHA methodologies, resulting in Summary Hazard Tables. This is analogous to sharing the same information in different languages. CHA methods lie on a spectrum ranging from pragmatic to precautionary. Because endpoint criteria vary among different methods, visualizing Summary Hazard Tables with hazard classification results from these different methods allows users to make more informed and appropriate selections for their applications.

To date, ChemFORWARD uses all of the endpoints specified in both GHS and C2CC and also presents results by oral, dermal, and inhalation exposure routes. When stratified by exposure route, the total number of hazard endpoints expands to more than 50 different endpoint classifications and sub-endpoint classifications for which Assessors provide written rationales and data summaries to support conclusions and hazard classifications. This approach boasts more endpoint-level evaluations than any other single CHA method. We believe it is necessary for a central repository to be comprehensive so that the data are portable to meet multiple user needs. Table 1 provides a comparison of endpoints in leading CHA methods. All of the endpoints identified are included in ChemFORWARD.

**Table 1. Endpoints included in GHS, GreenScreen and C2CC in ChemFORWARD**

<b>Globally Harmonized System for Classification and Labeling of Chemicals (GHS)</b>	<b>GreenScreen for Safer Chemicals (GreenScreen)</b>	<b>Cradle to Cradle Certified (C2CC) Material Health Methodology as presented in ChemFORWARD</b>
Carcinogenicity	<b>All endpoints found in column 1 (GHS) plus the following endpoints:</b>	<b>All endpoints found in column 1 (GHS) (with the exception of physical hazards) plus the following endpoints:</b>
Germ Cell Mutagenicity	Persistence	Endocrine activity/disruption
Reproductive Toxicity	Environmental transformation products (end of life)	Terrestrial toxicity (avian, earthworm)
Developmental Toxicity	Bioaccumulation potential	Persistence
Acute mammalian toxicity		Bioaccumulation potential
Specific Target Organ Toxicity following Single Exposure (STOT-Repeated)		Climatic Relevance
Specific target organ toxicity following repeated exposure		Other human (i.e. skin penetration, phototoxicity, VOCs)
Specific Target Organ (Neurotoxicity) Toxicity following Single Exposure (STOT-Neurotoxicity-Single)*		Organohalogens
Specific Target Organ (Neurotoxicity) Toxicity following Repeated Exposure (STOT-Neurotoxicity-Repeated)*		Toxic metals
Skin Sensitizer		Other environmental (i.e. mobilization of metals, other aquatic impacts)
Respiratory Sensitizer		Environmental transformation products (end of life)***
Skin Corrosion/Irritation		
Hazardous to the Aquatic Environment, Short-Term (Acute)		

Aquatic Toxicity)		
Hazardous to the Aquatic Environment, Long-Term (Chronic Aquatic Toxicity)		
Hazard to the Ozone Layer (Ozone Depletion)		
Aspiration hazard		
Lactation Toxicity		
Flammability		
Reactivity**		

\*Note Neurotoxicity is not an individual endpoint under GHS, but Neurotoxicity STOT Single and Repeated Exposure are presented as discrete endpoints in ChemFORWARD given cross-methodological relevance (i.e. it is a discrete endpoint in C2CC) & scoring implications.

\*\*Reactivity includes several endpoints, including: aerosols, oxidizing gases/liquids/solids, self-reactive substances and mixtures, pyrophoric solids/liquids, self-heating substances and mixtures, substances and mixtures which in contact with water emit flammable gases, organic peroxides, corrosive to metals, and desensitized explosives

\*\*\*Environmental Transformation Products are not presented in the Hazard Table. Information can be found under the "Properties" tab.

Additional endpoints will be added over time, including those that are not specifically cited in one of the aforementioned CHA methodologies, such as Mobility in the environment.

## Process for Creating a ChemFORWARD CHA

**Step 1: Assessment.** Creation of a chemical hazard assessment (CHA) begins with approved Assessors. See details and requirements in the document: "Assessor Qualifications" under "Our Approach" on ChemFORWARD's website [HERE](#). Assessors from professional toxicology firms are contracted to enter detailed physical-chemical, human health and environmental toxicity and fate data for chemical(s) into the 'universal input' template in the ChemFORWARD application. This is the 'back-end' of the system. The back-end is accessible to ChemFORWARD Assessors, Verifiers, and administrators.

Assessors use all available data and information including but not limited to:

1. National and international governmental databases
2. Scientific literature
3. Authoritative and screening hazard lists

4. New approach methods for toxicology including but not limited to read-across, computational methods, *in vitro* studies, high-throughput screening and more.

**Step 2: Verification.** The data and associated hazard classifications are then reviewed by an approved ChemFORWARD Verifier for completeness, consistency and quality of professional judgment. Verifiers are independent toxicology experts not associated with the Assessor firm. See details in the document: “ChemFORWARD Verification Program” under “Our Approach” on ChemFORWARD’s website [HERE](#). While quality assurance begins with well qualified Assessors (including their own internal QA processes) the ChemFORWARD Verification Program ensures that the CHAs contained in the ChemFORWARD repository are:

- Complete. The universal input includes data requirements for all fields; all of which must be summarized and referenced;
- Current. CHAs are updated regularly according to ChemFORWARD program requirements (eligible for review every five years);
- Based on data that are relevant, reliable, and adequate;
- Reasonably and justifiably applying classification or rating criteria to existing data;
- Transparent and appropriate in applying expert judgment in the evaluation of existing data, especially when using multiple data streams.

Verifiers conduct peer review and engage in dialogue with the authoring Assessment firm. Any discrepancies between the Assessor and the Verifier must be resolved during the Verification process. Differences or disputes between the assessor and verifier are mediated by ChemFORWARD’s in-house toxicologist. See a description of the full verification process and procedures in the document: “ChemFORWARD Verification Program” under “Our Approach” on ChemFORWARD’s website [HERE](#).

Once resolved, the CHA is labeled “Verified” and assigned a verification date. Certain “Provisional” scores may be made available in ChemFORWARD before the verification process is completed. CHAs for which the endpoint classifications, and therefore final Hazard Band, is not anticipated to change during verification are eligible for “Provisional” status.

**Step 3. Scoring.** ChemFORWARD assigns a Chemical Rating and Hazard Band based on the totality of the hazards as entered by the assessor and verified by the verifier. See detailed information on Chemical Rating in the document: “Chemical Hazard Rating Guidance” under “Our Approach” ChemFORWARD’s website [HERE](#)

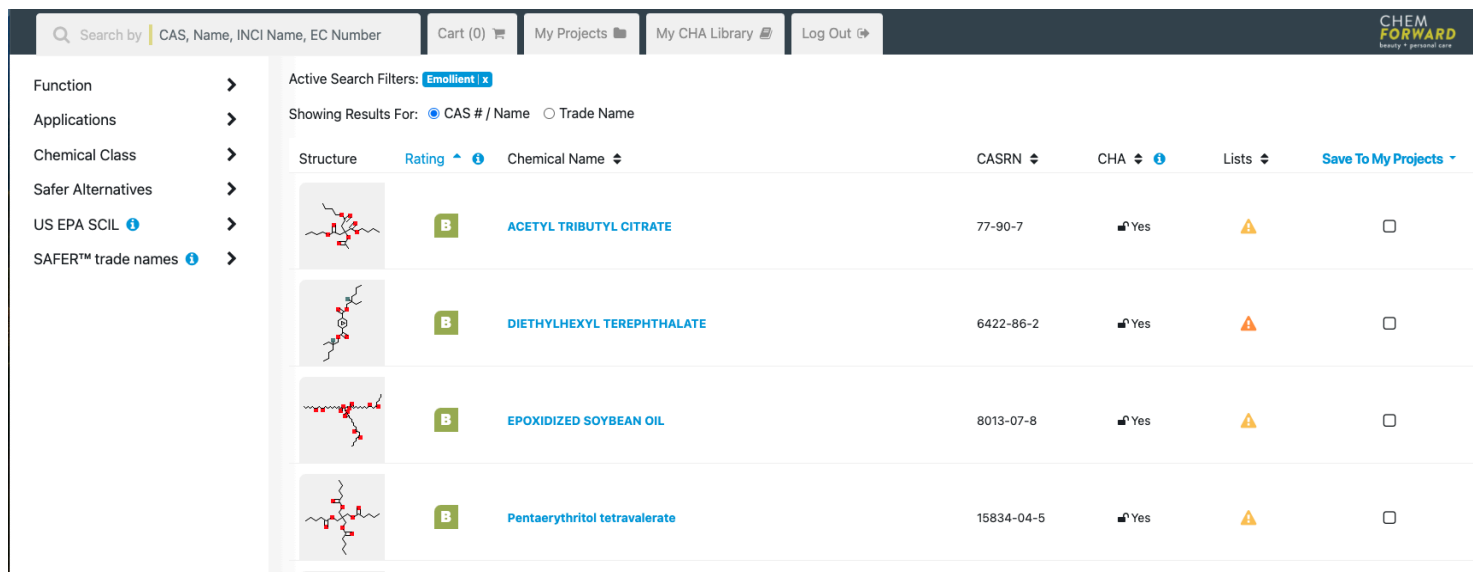
**Step 4: User Views.** The resulting hazard information is then translated into multiple output views at the ‘front-end’ of the ChemFORWARD application, also called the user view. The user view displays Summary Hazard Tables and chemical-specific information based on CHA methodology criteria. Users can toggle between Hazard Summary Table displays associated with C2CC or GHS (and any future CHA methodologies that are adopted) as illustrated in Figures 3 and 4 accessed via the hazard display tab. They can also see associated nomenclature, functional use, physical chemical, regulatory and non-regulatory information lists, and other relevant information in the other tabs associated with each chemical CHA.





**Step 5: Continual improvement.** ChemFORWARD is committed to reviewing and updating outdated information/adding missing information in CHAs. Currently, this review process occurs every five years from the initial CHA verification date. In addition, our Continual Improvement Technical Challenge process allows any ChemFORWARD stakeholder to challenge any hazard classification or other technical element of a CHA. See a description of the full technical challenge process in the document: “ChemFORWARD Challenge and Continuous Improvement Process” under “Our Approach” on the ChemFORWARD website [HERE](#). Challenges promote continual improvement because they accommodate new data and information not yet available at the time of the initial assessment, such as information in articles that were in press but not yet formally published. The process also accommodates review of internal data, i.e., data that were generated by private organizations and not publicly available in accordance with our Use of Private Data Policy. See more information in the document, “Policy on use of Private Data” under “Our Approach” on ChemFORWARD’s website [HERE](#). This policy is designed to optimize transparency while protecting proprietary studies and information.

Future development will allow ChemFORWARD to label CHAs that are undergoing Technical Challenges as “Challenged” and to identify the specific endpoint(s) or other items being challenged. A challenge history is recorded with each CHA and will be made available under a CHA’s Update History.

## Presenting Search Results

Version 1 of search results display the initial search results returning chemicals and associated ChemFORWARD Hazard Bands when using the left-hand navigation to search by function, product type, or curated lists of safer alternatives. For example, Figure 1 illustrates search results for emollients in the Beauty and Personal Care sector.



Structure	Rating	Chemical Name	CASRN	CHA	Lists	Save To My Projects
	B	ACETYL TRIBUTYL CITRATE	77-90-7	Yes	⚠	<input type="checkbox"/>
	B	DIETHYLHEXYL TEREPHTHALATE	6422-86-2	Yes	⚠	<input type="checkbox"/>
	B	EPOXIDIZED SOYBEAN OIL	8013-07-8	Yes	⚠	<input type="checkbox"/>
	B	Pentaerythritol tetravalerate	15834-04-5	Yes	⚠	<input type="checkbox"/>

**Figure 1. Initial search results in ChemFORWARD for the function, chemical emollients used in the beauty and personal care sector**

*Looking ahead:* Advancements to the initial search function are forthcoming and will allow for “advanced search” of CHAs in the system. Additional physical/chemical properties and other useful properties that help qualify the efficacy of an alternative will be included in query fields, such as solubility, boiling point, compatibility, and more. From the search results, users can then click on the chemical name to open each single chemical page and to access the hazard summary tables and other information presented under each information tab. See example in Figure 2. From left to right:

1. “Summary” Tab: summary tab that includes an executive summary and other high level information such as the identity of the Assessor, CHA assessment date, and verification status.
2. “Hazards” Tab: includes the hazard summary tables.
3. “Identifiers” Tab: provides a range of chemical identifiers such as SMILES notation, EINECs, synonyms, etc.
4. “Properties” Tab: includes chemical and physical chemical properties
5. “Functions & Tags” Tab: functional uses, applications, and other applicable taxonomy information
6. “Regulatory Lists” Tab: regulatory summary information
7. “Non-Regulatory Lists” Tab: relevant restricted, precautionary and positive lists.





661-19-8

### BEHENYL ALCOHOL

Potential Synonyms [View all synonyms \(14\)](#)

**B** Hazard Band [i](#)

[Save To My Projects](#) ▾

Summary	Hazards	Identifiers	Properties	Functions & Tags	Regulatory Lists	Non-Regulatory Lists
<p>Chemical Rating <a href="#">i</a></p> <p></p>	<p>GHS Health <a href="#">i</a></p> <p>N/A</p>	<p>GHS Enviro <a href="#">i</a></p> <p>N/A</p>	<p>GHS Harmonized <a href="#">i</a></p> <p>N/A</p>	<p>US EPA SCIL <a href="#">i</a></p> <p></p>	<p><b>Assessed by</b></p> <ul style="list-style-type: none"> <li>U.S. EPA Low Priority Chemical report.</li> </ul> <p><b>Verification Status</b> <a href="#">i</a></p> <ul style="list-style-type: none"> <li>Verified</li> </ul>	
<p>1-Docosanol is a long-chain, saturated fatty alcohol that is a water-insoluble, waxy solid. Fatty alcohols are usually high-molecular-weight, straight-chain primary alcohols derived from natural fats and oils. Saturated fatty alcohols have no carbon-carbon double bonds, and have the formula – CH<sub>3</sub>(CH<sub>2</sub>)<sub>n</sub>OH – with variations in “n.” Specifically, 1-docosanol is a saturated aliphatic alcohol with a 22-carbon chain, known as docosane, with a hydroxy group (-OH) at the terminal carbon and the formula CH<sub>3</sub>(CH<sub>2</sub>)<sub>21</sub>OH. This chemical has uses in consumer and industrial products, as well as in pharmaceutical products. 1-Docosanol functions as a thickener, emulsifier, emollient, and binder in a variety of applications and product sectors. NOTE: The data provided in this assessment came primarily from the US EPA final designation report, Supporting Information for Low-Priority Substance 1-Docosanol (Brassica Alcohol) (<a href="https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0114-0009">https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0114-0009</a>). According to US EPA, “low-priority substance designations give the public notice of chemical substances for which the hazard and/or exposure potential is anticipated to be low or nonexistent and provides some insight into which chemical substances are likely not to need additional evaluation and risk management under TSCA.”</p>						

**Figure 2. A single chemical page for a chemical with a chemical hazard assessment in ChemFORWARD**

*Looking ahead: advancements to the CHA landing page are forthcoming and will include information on CHA update history, under which version of each methodology the chemical was assessed (GHS, C2CC, ChemFORWARD Rating Guidance, etc.,) and more. A new tab will be established to identify regulatory and non-regulatory lists which influence CHA scoring per the document, “ChemFORWARD Chemical Rating Guidance Version 2.0”, available on the ChemFORWARD website under “Our Approach” [HERE](#).*

## Hazard Classification Results

Hazard classification results are presented in easy to interpret hazard summary tables by endpoint and exposure route under the “Hazard” tab in the chemical view. Users can click and unclick on cells in the hazard summary tables to access the rationale provided by the Assessor justifying each classification. Note: rationales for all endpoints shared by GHS and C2CC view are only clickable on “GHS” tab; rationales for endpoints not in GHS are clickable on “C2CC” tab.

Figure 3 provides an example of a Summary Hazard Table with classification results using the GHS system. Figure 4 provides an example of a summary hazard table with classification

results using the C2CC system.

661-19-8  
**1-DOCOSANOL**  
Also Called - Abreva, Behenic alcoh... [View all synonyms \(12\)](#)  
B Hazard Band [Save To My Projects](#)

Summary **Hazards** Identifiers Properties Functional Uses Regulatory Lists

GHS C2CC

[How to read the C2C Hazard Summary Table](#)

Human Health										Environmental							Other				
	Carcinogenicity	Mutagenicity	Reproductive & Developmental Toxicity	Endocrine Disruption	Oral Toxicity	Dermal Toxicity	Inhalation Toxicity	Neurotoxicity	Skin, Eye, and Respiratory Corrosion/Irritation	Sensitization of Skin and Airways	Fish Toxicity	Daphnia Toxicity	Algae Toxicity	Terrestrial Toxicity	Persistence	Bioaccumulation	Climatic Relevance	Other (Human Health)	Organohalogen	Toxic Metals	Other (Environmental Health)
Oral	NC	G	G	NC	G	NC	NC	G	NC	G	G	G	G	NC	G	G	G	G	G	G	G
Dermal	NC	G	NC	NC	NC	G	NC	NC	Y	G	G	G	G	NC	G	G	G	G	G	G	G
Inhalation	NC	G	NC	NC	NC	NC	G	NC	NC	G	G	G	G	NC	G	G	G	G	G	G	G

661-19-8  
**1-DOCOSANOL**  
Also Called - Abreva, Behenic alcoh... [View all synonyms \(12\)](#)  
B Hazard Band

Summary **Hazards** Identifiers Properties Functional Uses Regulatory Lists

GHS C2CC

[How to read the GHS Hazard Summary Table](#)

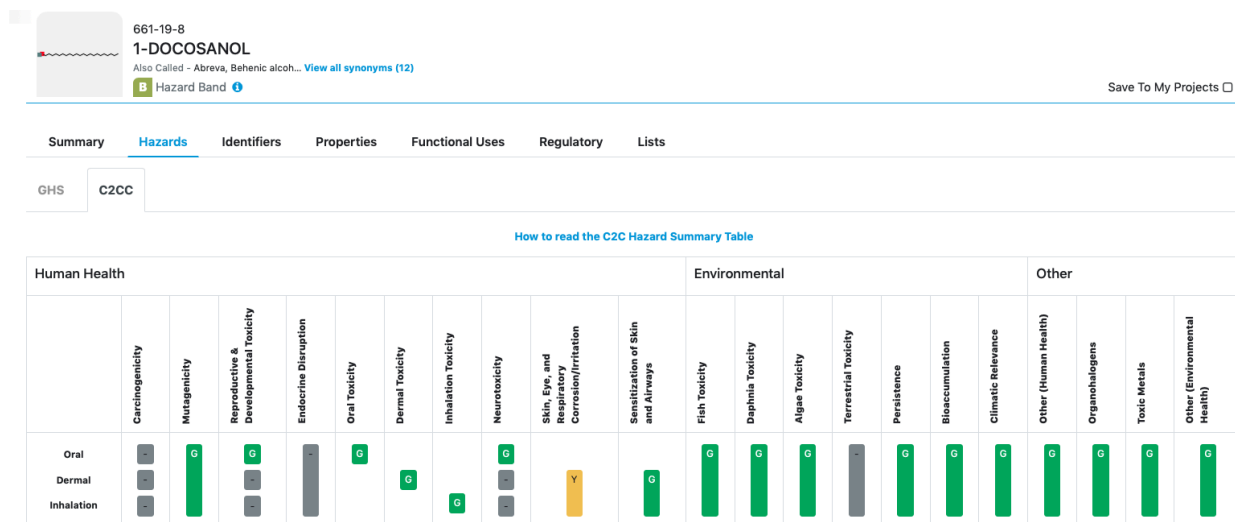
	Carcinogenicity	Mutagenicity	Reproductive Toxicity	Developmental Toxicity	Acute Toxicity	STOT- Single	STOT- Repeated	STOT- Neurotoxicity- Single	STOT- Neurotoxicity- Repeated	Skin Sensitizer	Respiratory Sensitizer	Skin Corrosion/Irritation	Serious Eye Damage/Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Ozone Depletion
Oral	(NC)	NC	NC	NC	NC	CNP	NC	(NC)	(NC)					(NC)	(NC)	NC
Dermal	(NC)	NC	CNP	CNP	(NC)	CNP	CNP	CNP	CNP	(NC)		NC	Cat 2B	(NC)	(NC)	NC
Inhalation	(NC)	NC	CNP	CNP	(NC)	CNP	CNP	CNP	CNP		(NC)			(NC)	(NC)	NC

**OTHER**

- Explosives: **Not classified**
- Flammable Gases: **Not classified**
- Aerosols: **Not classified**

Figure 3. Summary Hazard Table for a chemical using the GHS view.

Key: NC = not classified (low hazard), CNP = classification not possible (data gap), Cat = Category



**Figure 4. Summary Hazard Table for a chemical using the C2CC view.**

**Key: Red = high hazard, Yellow = moderate/equivocal hazard, Green = low hazard, and Grey = insufficient data.**

## Overall Chemical Ratings and Hazard Bands

See the document: “Chemical Hazard Rating Guidance Version 2.0” on ChemFORWARD’s website under “Our Approach” [HERE](#) for more information on the assignment of Chemical Ratings and Hazard Bands.

Summary Hazard Tables and rationales provide a level of detail that may not be universally applicable to users. To ease interpretation of results and create an actionable level of information for the majority of users, overall Chemical Ratings along with equivalency/classification for leading programs (SCIL listing, TCO ASL status, etc.) are also provided, along with a ChemFORWARD hazard band. An example is provided in Figure 5.

Harmonized hazard statements assigned via Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation) are provided for all chemicals in the system, including screening chemicals, under “GHS Harmonized”. Assessors are required to include all Harmonized H-statements PLUS any additional hazard statements identified as a result of their evaluation, under “GHS Health” and “GHS Enviro” when completing a CHA. However, if the Harmonized classification is form-specific and therefore the hazards are clearly not applicable to the chemical being assessed, an assessor may not include the H-statements in the “GHS Health” or “GHS environmental” sections. For example, a chemical for which the harmonized classification is based on  $\geq X\%$  impurity, an assessor reviewing that chemical with impurity levels below the threshold

referenced in Annex VI (i.e. <X%) may not cross-reference the harmonized classification. See Figures 6a and 6b.

661-19-8  
**1-Docosanol**  
Potential Synonyms 1 - 211-546-6, ...[View all synonyms \(13\)](#)  
**B** Hazard Band [Save To My Projects](#)

Summary	Hazards	Identifiers	Properties	Functions & Tags	Regulatory Lists	Non-Regulatory Lists
Chemical Rating <a href="#">i</a> 			GHS Health <a href="#">i</a> N/A		GHS Enviro <a href="#">i</a> N/A	GHS Harmonized <a href="#">i</a> N/A
TCO Certified <a href="#">i</a> N/A			US EPA SCIL <a href="#">i</a> 			

**Figure 5. Summary information for leading programs and the ChemFORWARD Chemical Rating and Hazard Band**

[< Back](#)  
8030-30-6  
**Naphtha Containing < 0.1% Benzene, < 0.1% 1,3-Butadiene, and < 1% Isoprene**  
Potential Synonyms 1 - 116010-52-...[View all synonyms \(49\)](#)  
**C** Hazard Band [Save To My Projects](#)

Summary	Hazards	Identifiers	Properties	Functions & Tags	Regulatory Lists
<b>Non-Regulatory Lists</b>					
Chemical Rating <a href="#">i</a> 			GHS Health <a href="#">i</a> N/A	GHS Enviro <a href="#">i</a> N/A	GHS Harmonized <a href="#">i</a> H340, H350
TCO Certified <a href="#">i</a> N/A			US EPA SCIL <a href="#">i</a> N/A		

**Figure 6a. Form Specific CHA H-Statements**

Index No	►MIB Chemical name ◀	EC No	CAS No	Classification		Labelling			►MIB Specific GHS Limits, M-factors and ATEs (*) ◀	Notes
				Hazard Class and Category Code(s)	Hazard statement Code(s)	Program, Signal Word Code(s)	Hazard statement Code(s)	Suppl. Hazard statement Code(s)		
649-262-00-3	Naphtha; Low boiling point naphtha; [Refined, partly refined, or unrefined petroleum products produced by the distillation of natural gas. It consists of hydrocarbons having carbon numbers predominantly in the range of C <sub>3</sub> through C <sub>6</sub> and boiling in the range of approximately 100° C to 200° C. (12)(F to 392)(7).]	232-443-2	<del>8030-30-6</del>	Carc. 1B Mut. 1B Exp. Tox. 1	H350 H340 H304	GHS08 Dgr	H350 H340 H304			P

Note P:

The harmonised classification as a carcinogen or mutagen applies unless it can be shown that the substance contains less than 0.1 % w/w benzene (Einecs No 200-753-7), in which case a classification in accordance with Title II of this Regulation shall be performed also for those hazard classes.

Where the substance is not classified as a carcinogen or mutagen, at least the precautionary statements (P102-)P260-P262-P301 + P310-P331 shall apply.

**Figure 6b. Regulatory Rationale for Form Specific CHA**

As a means of harmonizing results from different CHA systems, ChemFORWARD has created a system of Hazard Bands that facilitate comparing results across CHA methods and demonstrating equivalency. Hazard Bands may be used as a prescreening tool for certification programs and standards, with A, B, and C Hazard Bands being considered verified safer chemistry, while Ds and Fs are not; Us and ?s need more information before a determination can be made. ChemFORWARD hazard bands and rating equivalencies are summarized in Table 2.

**Table 2. ChemFORWARD Hazard Bands**

Harmonized Hazard Band	Implications	Program Equivalency		
		Chemical Rating	US EPA SCIL	GreenScreen Benchmark
<b>A</b>	Low hazard and low risk	a	--	4
<b>B</b>	Some moderate hazards but low risk	b or c/b	green full circle	3 (3tp, 3dg)
<b>C</b>	Moderate hazard, moderate risk or uncertainty that could result in moderate risk	x/c, x/c-CMR(Cat 2), grey/c, c/b-CRE	green half circle, yellow triangle	2 (2tp, 2dg)
<b>D</b>	Moderate to high hazard; emerging regulatory risk <small>(classification may be based on a chemical class/grouping approach)</small>	x*	-	
<b>F</b>	High hazards and high risk in most scenarios	x-Reg, x/c-CMR(Cat 1), x/c-E, x-PBT, x-vPvB, x-vPT	grey square	1 (1tp), LT-1
<b>U</b>	CHA completed but with excessive data gaps, rating is not possible	grey/c, grey	--	BM U
<b>?</b>	Request a CHA to inform a decision	No CHA	No CHA	No GS, , LT-UNK, LT-P1

The ChemFORWARD A Hazard Band is health-conservatively assigned to only chemicals with both low hazard across all endpoints which are subsequently presumed to be low risk. Chemicals receiving an A hazard band have few or no data gaps, including adequate data to classify carcinogenicity and endocrine disruption/activity. The A hazard band is considered equivalent to the C2CC "a" rating and GreenScreen Benchmark 4.

The ChemFORWARD B Hazard Band includes chemicals with some moderate hazards which are subsequently presumed to be low risk. To address key data gaps which influence the overall hazard profile of a chemical, chemicals in the B Hazard Band include those with data gaps for carcinogenicity or endocrine disruption/activity. The B hazard band is considered equivalent to the C2CC "b" and "c/b" ratings, and GreenScreen Benchmark 3 (and Benchmarks 3dg and 3 tp). It also includes chemicals on the US EPA Safer Chemical Ingredients List (SCIL) that are rated with a green full circle.

The ChemFORWARD C Hazard Band is the most broad-ranging band, similar to GreenScreen Benchmark 2; see the following paragraph for additional information. It includes chemicals that are Category 2 Carcinogens, Mutagens and Reproductive/Developmental (CMR) toxicants, chemicals that are moderate for endocrine activity or reproductive/developmental toxicity, as well as other high non-CMR hazards. It also includes USE EPA SCIL chemicals that are rated with a half green circle or yellow triangle. C hazard band chemicals may still be viable options as safer alternatives but they have hazard trade offs that must be managed, either due to moderate hazards or data gaps.

The ChemFORWARD D Hazard Band was introduced to address concerns surrounding the wide range of the C Hazard Band. This has enabled ChemFORWARD to identify chemicals that do not meet common definitions for safer chemistry but that do not meet F Hazard Band Criteria by assigning such chemicals to the D Hazard Band. It includes chemicals that are Category 2 Reproductive/Developmental toxicants under the C2CC MHAM which also have endocrine activity, Per- and poly-fluorinated alkyl substances (PFAS,) chlorinated and brominated organic substances, chemicals with climatic relevance, and certain chemicals listed on ECHA's Candidate List of Substances of Very High Concern (SVHCs). With the addition of the D Hazard Band, equivalent scores in other CHA methodologies may vary; for example, some BM-2s, such as PFAS chemicals, will be assigned a ChemFORWARD D. The D Hazard Band allows for increased transparency with regard to chemicals and chemical classes which may not meet criteria for safer chemistry. The ChemFORWARD F Hazard Band includes a number of Chemical Ratings, including chemicals of regulatory concern, Category 1 CMRs, chemicals classified as "RED" for endocrine disruption under C2CC view, persistent, bioaccumulative and toxic substances (PBTs,) very persistent and very bioaccumulative substances (vPvBs,) and very persistent and toxic substances (vPT). Detailed information on chemicals of regulatory concern can be found in the document: "Chemical Hazard Rating Guidance" on ChemFORWARD's website under "Our Approach" [HERE](#). The F hazard band includes US EPA SCIL chemicals that are rated with a grey square (or are unlisted on the SCIL) and is equivalent to GreenScreen Benchmark 1.

If a search result presents a ChemFORWARD "?" Hazard Band, then there is no CHA or proxy score available for that chemical and we encourage users to procure a CHA before using the substance. If a CHA search results in a grey U Hazard Band, then a full CHA was performed but available data for that chemical are insufficient to assign a rating. This is equivalent to GreenScreen Benchmark U.

## Populating ChemFORWARD with Safer Alternatives

ChemFORWARD populates a shared repository of comprehensive chemical hazard assessments (CHA) produced by qualified toxicology firms and peer-reviewed by independent

toxicology experts. This interface allows users to search for chemicals by function and other properties. ChemFORWARD has sector-specific subscriptions which house all available CHAs, but curate the user experience with the sector in mind. Currently, subscriptions are available for: electronics, beauty & personal care, and solvents. Free access is available to the plastic additives vertical and all other open-source CHAs are available under “Safer Alternatives” on the ChemFORWARD website [HERE](#). We believe that better information on chemical hazards will enable informed decisions for product design and development and for substituting chemicals of concern in products with safer alternatives.

CHAs in the ChemFORWARD repository may be sponsored by those who supply them or by those who demand them. Each sector has different drivers. Retailers may sponsor CHAs in ChemFORWARD to support their suppliers in finding alternatives to chemicals on retailer restricted substances lists. Industry sector consortia may decide to pool resources to find and assess alternatives to common chemicals of concern. Suppliers who manufacture safer alternatives may sponsor ChemFORWARD CHAs of their chemicals in order to provide independent 3rd party reviews in support of marketing claims. Certification bodies may specify chemicals with CHAs in ChemFORWARD to meet certification requirements. CHAs may be commissioned directly by contacting licensed ChemFORWARD Assessors or indirectly by sponsoring CHAs by working with staff at ChemFORWARD.