

Scorecard User Guide Appendix

Steps 1-2. Hazard Data Search & Classification.

1. To complete the hazard ratings in Step 2, you will need to find hazard data and classify that data according to the parameters in the 'REF. Hazard Data Conversion' tab. The hazard data to collect are: GHS categories, Cradle2Cradle (C2C) rating criteria, degradation half-life, and bioconcentration factor data. Data from Pharos (pharosproject.net) can also be included (Pharos provides hazard data from authoritative lists and uses the GreenScreen methodology for hazard classifications). Other data sources are acceptable, but rating criteria are not provided in this guidance.
2. To find GHS categories, you can look up your CAS # of interest on <https://pubchem.ncbi.nlm.nih.gov/> and obtain the GHS Hazard Statements under 'Safety and Hazards.' With these GHS Hazard Statements, you can look up the corresponding GHS categories in Annex 3 of the GHS Guidelines: https://unece.org/DAM/trans/danger/publi/ghs/ghs_rev05/English/07e_annex3.pdf
3. To convert hazard data to C2C ratings, use the C2C Methodology outlined in the Material Health Assessment Methodology (https://www.c2ccertified.org/resources/detail/material_assessment_methodology) The criteria tables for the applicable toxicity endpoints in the scorecard are included below.
4. To find degradation half-life and bioconcentration factor values, the EPA CompTox Dashboard can be a useful tool: <https://comptox.epa.gov/dashboard>.

C2C Rating Criteria: Carcinogenicity

Green	Yellow	Red	Grey
<p>Not classified as GHS category 1A, 1B, or 2. Not a known, presumed or suspected carcinogen. Negative long-term cancer studies.</p> <p>Listed as: TLV A5, IARC 4</p>	<p>Not classified as GHS category 1A, 1B, or 2. Limited, marginal, equivocal or conflicting evidence of carcinogenicity.</p> <p>Listed as: MAK III 3A, 4, 5</p>	<p>Classified as GHS category 1A, 1B, or 2. Known, presumed or suspected carcinogen.</p> <p>Listed as: MAK III 1, 2, 3B IARC Group 1, 2A, 2B TLV A1, A2, A3 GHS Category 1A, 1B, 2</p> <p>H350: May cause cancer</p> <p>H351: Suspected of causing cancer</p>	<p>No data available for classification.</p> <p>Listed as: IARC Group 3 TLV A4</p>

C2C Rating Criteria: Mutagenicity

Green	Yellow	Red	Grey
<p>Not classified as GHS Category 1A, 1B, or 2. Substance does not induce aberrations of chromosomes OR substance does not induce chromosome segregation errors in <i>in vitro</i> systems. AND substance does not induce point mutations.</p>	<p>Not classified as GHS Category 1A, 1B, or 2. Insufficient data. Substance does not induce point mutations. Data lacking on chromosome aberration and segregation.</p>	<p>Classified as GHS Category 1A, 1B, or 2.</p> <p>or</p> <p>Evidence of mutagenicity supported by positive results <i>in vitro</i> or <i>in vivo</i> (see rating criteria guidance)</p> <p>or</p> <p>Listed as: MAK IX 1, 2, 3A, 3B.</p> <p>H340: May cause genetic defects</p> <p>H341: Suspected of causing genetic defects</p>	<p>No data available for classification.</p>

C2C Rating Criteria: Endocrine Disruption

Green	Yellow	Red	Grey
<p>Not known or suspected of endocrine disruption: Adequate data indicate neither endocrine activity nor adverse health effects that are linked to endocrine activity.</p> <p>or</p> <p>EU list category 3A</p>	<p>Insufficient evidence of endocrine disruption: Data provide evidence of endocrine activity without evidence of linked adverse health effects.</p>	<p>Sufficient evidence of endocrine disruption: Data indicate adverse health effects that are linked to endocrine activity.</p> <p>or</p> <p>Chemical appears on Colborn or EU list (Cat. 1 & 2).</p>	<p>No data available for classification.</p> <p>EU list category 3B</p>

C2C Rating Criteria: Sensitization (Skin and Respiratory)

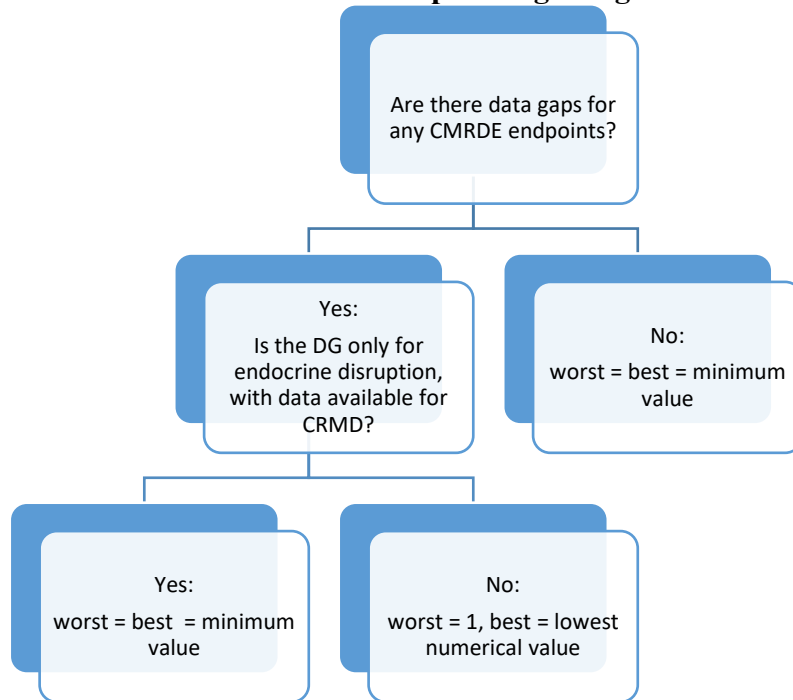
Green	Yellow	Red	Grey
<p>Not classified as GHS Category 1A or 1B. Adequate data available. No evidence of sensitization in human and/ or animal studies.</p> <p>or</p> <p>No data from human or animal studies are available; however, the substance is not classified under GHS, not listed as H334/317 or MAK, and there is a history of safe use (10 years or more) without reported cases of sensitization, as documented by a signed statement from the substance manufacturer.</p>	<p>Not classified as GHS Category 1A or 1B. Non-adjuvant animal studies elicit a response 15% > population > 0%.</p> <p>Adjuvant animal studies elicit a response of 30% > population > 0%.</p> <p>or</p> <p>1 < LLNA SI < 3</p>	<p>Classified as GHS Category 1A or 1B for Sensitization (respiratory and skin):</p> <p>or</p> <p>LLNA SI \geq 3</p> <p>or</p> <p>Listed as: GHS Category 1A or 1B for Sensitization (respiratory and/or skin)</p> <p>MAK skin or airways sensitizer (MAK Sa or Sh).</p> <p>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.</p> <p>H317: May cause an allergic skin reaction.</p>	<p>No relevant data for classification.</p>

C2C Rating Criteria: Bioaccumulation

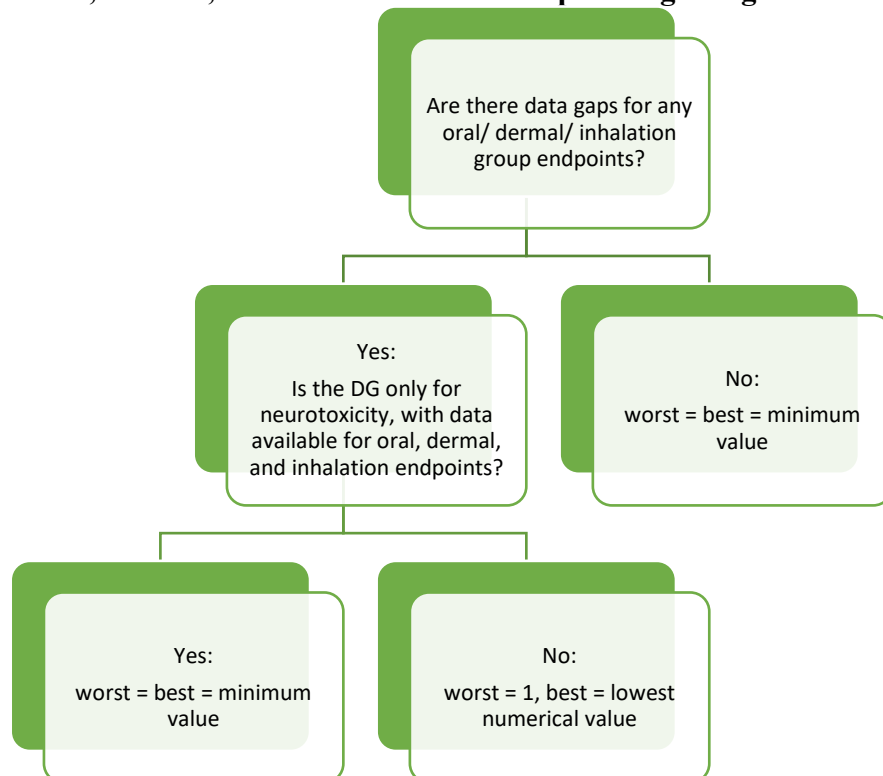
GREEN	YELLOW	RED	PURPLE	GREY
Version 4.0 Bioaccumulation Hazard Rating Criteria:				
<p>BCF/BAF < 500 by experimental or QSAR results if log Kow < 6 or log Kow < 2 or Molecular weight > 1000 (aligned with GHS aquatic tox related values)</p>	<p>500 \leq BCF/BAF \leq 2000 by experimental or QSAR results if log Kow < 6</p>	<p>2000 < BCF/BAF \leq 5000 by experimental or QSAR results if log Kow < 6</p> <p>(aligned with REACH 'B' definition for PBTs)</p>	<p>BCF/BAF > 5000 by experimental or QSAR results if log Kow < 6.</p> <p>(aligned with REACH 'vP' definition for vPvBs)</p>	<p>No relevant data for classification. log Kow > 2 and no additional information</p>

Step 3. Decision trees for determining best and worst chemical roll-up toxicity endpoint group scores.

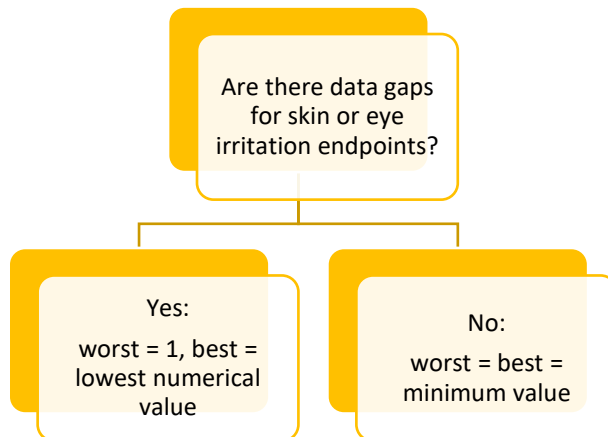
CMRDE Hazard Group Rating Assignment



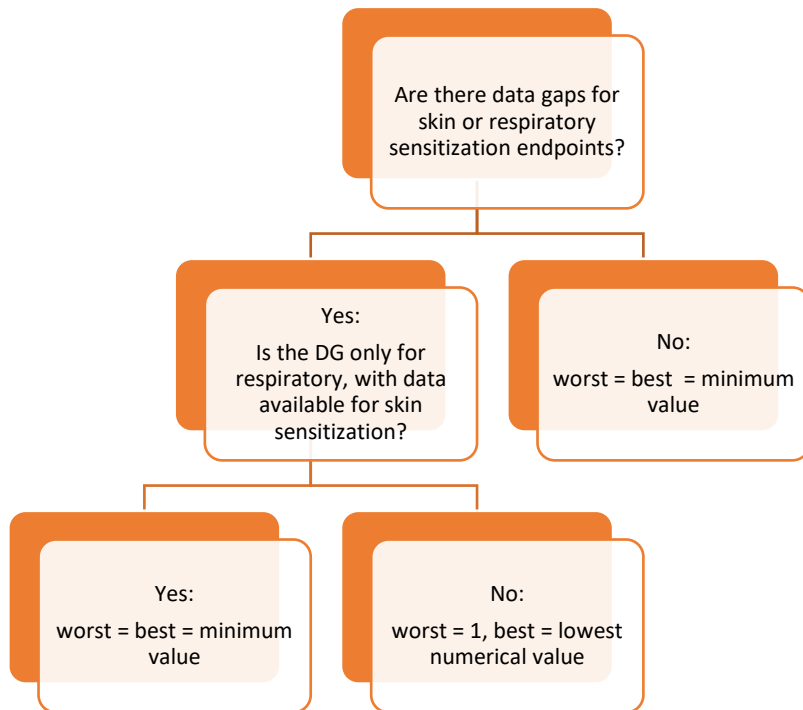
Oral, Dermal, Inhalation Hazard Group Rating Assignment



Irritation Hazard Group Rating Assignment



Sensitizer Hazard Group Rating Assignment



*If all endpoints within any single hazard group are rated “DG”, the score range should be assigned 1-4.

Step 4. Reference table for determining Fate x Toxicity score range.

Justifications and coding are provided in the Scorecard excel sheet (REF. Fate x Tox tab).

Persistence	Bioaccumulation	Toxicity (CMR / OD / Aquatic)	Overall Environmental Hazard Range	
		Worst of 1 > DG > 2 > 3 > 4	Worst case	Best case
1	1	1	1	1
	1	2	1	1
	1	3	1	1
	1	4	1	1
	1	DG	1	1
	2	1	1	1
	2	2	1	1
	2	3	2	2
	2	4	2	2
	2	DG	1	2
	3	1	1	1
	3	2	2	2
	3	3	3	3
	3	4	3	3
	3	DG	1	3
	4	1	1	1
	4	2	2	2
	4	3	3	3
	4	4	3	3
	4	DG	1	3
	DG	1	1	1
	DG	2	1	2
DG	3	1	3	
DG	4	1	3	
DG	DG	1	3	
2	1	1	1	1
	1	2	1	1

	1	3	2	2
	1	4	3	3
	1	DG	1	3
	2	1	1	1
	2	2	2	2
	2	3	2	2
	2	4	3	3
	2	DG	1	3
	3	1	1	1
	3	2	2	2
	3	3	3	3
	3	4	4	4
	3	DG	2	4
	4	1	1	1
	4	2	2	2
	4	3	3	3
	4	4	4	4
	4	DG	2	4
	DG	1	1	1
	DG	2	1	2
DG	3	2	3	
DG	4	3	4	
DG	DG	1	4	
3	1	1	1	1
	1	2	2	2
	1	3	3	3
	1	4	3	3
	1	DG	2	3
	2	1	1	1
	2	2	2	2
	2	3	3	3
	2	4	4	4
	2	DG	2	4
	3	1	2	2
	3	2	2	2

	3	3	3	3
	3	4	4	4
	3	DG	2	4
	4	1	2	2
	4	2	3	3
	4	3	4	4
	4	4	4	4
	4	DG	2	4
	DG	1	2	2
	DG	2	2	3
	DG	3	3	4
	DG	4	3	4
	DG	DG	2	4
	4	1	1	2
1		2	3	3
1		3	4	4
1		4	4	4
1		DG	2	4
2		1	3	3
2		2	3	3
2		3	4	4
2		4	4	4
2		DG	3	4
3		1	3	3
3		2	4	4
3		3	4	4
3		4	4	4
3		DG	3	4
4		1	3	3
4		2	4	4
4		3	4	4
4		4	4	4
4		DG	3	4
DG		1	2	4
DG	2	3	4	

	DG	3	4	4
	DG	4	4	4
	DG	DG	2	4
DG	1	1	1	2
	1	2	1	3
	1	3	1	4
	1	4	1	4
	1	DG	1	4
	2	1	1	3
	2	2	1	3
	2	3	2	4
	2	4	2	4
	2	DG	1	4
	3	1	1	3
	3	2	2	4
	3	3	3	4
	3	4	3	4
	3	DG	1	4
	4	1	1	3
	4	2	2	4
	4	3	3	4
	4	4	3	4
	4	DG	1	4
	DG	1	1	4
	DG	2	1	4
	DG	3	1	4
DG	4	1	4	
DG	DG	1	4	

Step 5. Final calculations.

The overall hazard score gives equal weight to direct human hazard (from Step 3) and environmental hazard (from Step 4). The overall chemical hazard scores are calculated as such:

- (Worst Case Direct Human Hazard score * 50%) + (Worst Case Environmental Hazard score * 50%) = Worst Case Overall Hazard Score
- (Best Case Direct Human Hazard score * 50%) + (Best Case Environmental Hazard score * 50%) = Best Case Overall Hazard Score

A hypothetical comparison is shown below. The red points represent the worst case score for each formulation and the blue points represent the best case scores. In this example, Formulation 1 (F1) has the highest best case score, while PR48 scores the highest among the formulations in the worst case scenario. This reflects the level of uncertainty in the data.

