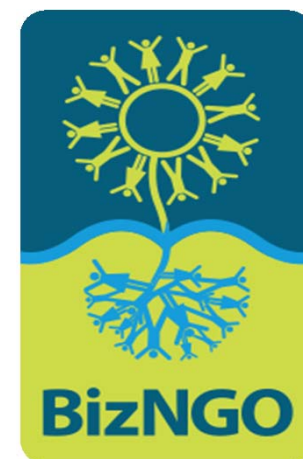


GreenScreen[®] for Safer Chemicals



July 23, 2019

Clean Production Action – solutions for a safer & healthier tomorrow



GreenScreen® for Safer Chemicals Speakers



Shari Franjevic
Clean Production Action



Brian Penttila
Wash. State
Dept. of Ecology



Cory Robertson
HP Inc.



Paul Ashford
Anthesis

Outline

- Introduction to GreenScreen® for Safer Chemicals
- Washington State Department of Ecology use of GreenScreen
- Hewlett-Packard use of GreenScreen
- GreenScreen from a European perspective



Hazard Assessment

GreenScreen is a hazard assessment tool, not a Risk Assessment tool.

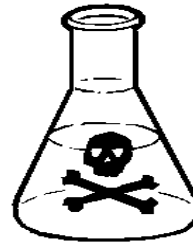
You can attempt to reduce impacts of a hazardous chemical by controlling or limiting exposure to it by using:

- engineering controls (e.g., vents),
- administrative controls (e.g., limit working hours) and/or
- personal protective equipment (e.g., face masks)

OR you can find inherently safer chemical substitutes

It is better to **first** reduce or eliminate the hazards of a chemical to reduce risk to people and the environment

$$\text{RISK} = f(\text{Hazard, Exposure})$$



Reduce Hazard as a Priority

Alternative Assessment Guides featuring GreenScreen

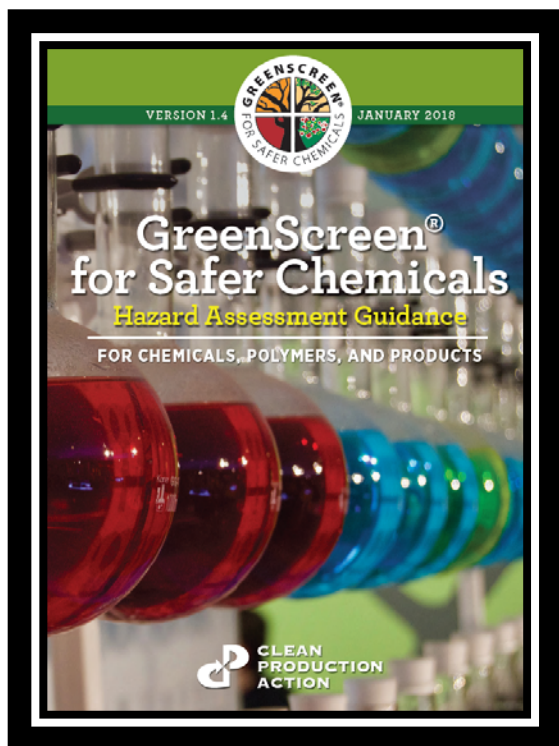


The National Academies of
SCIENCES • ENGINEERING • MEDICINE



INTERSTATE CHEMICALS
IC₂
CLEARINGHOUSE

- OECD Substitution and Alternatives Assessment Toolkit
- National Research Council: Framework to Guide Selection of Chemical Alternatives
- Transitioning to Safer Chemicals: A Toolkit for Employers and Workers
- Interstate Chemicals Clearing House: Alternatives Assessment Guide



Two metrics

- GreenScreen® for Safer Chemicals – chemical hazard method
- GreenScreen® List Translator – rapid screening tool that identifies known chemicals of concern



GreenScreen[®] for Safer Chemicals: Hazard Assessment Methodology



Why GreenScreen® for Safer Chemicals?

It simplifies complex information.

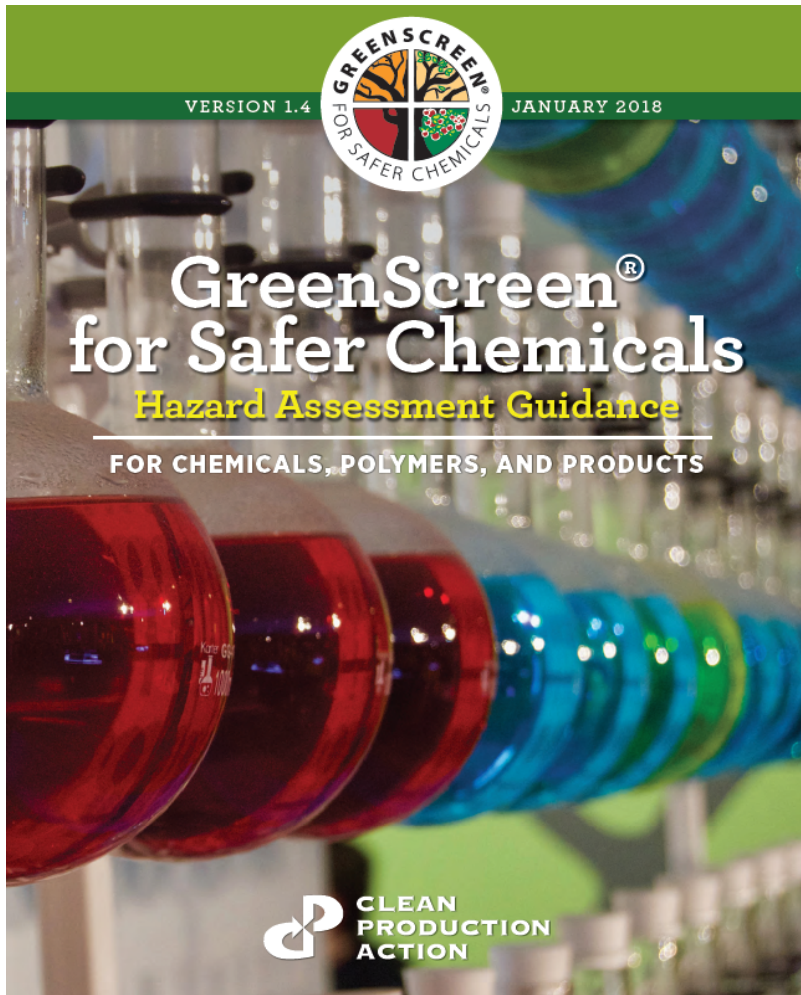
- It is designed to effectively identify and communicate the overall hazard profile of chemicals in a product or raw material.

It charts a path to safer chemicals economy.

- The information output from this tool offers a clear pathway for assessing and decision making with respect to substituting safer chemicals and mitigating risk.

It builds confidence and collaboration in the supply chain.

- This tool helps ensure the trust and confidence paramount to customer expectations for the safest products and materials.



GreenScreen v1.4

released January 2018

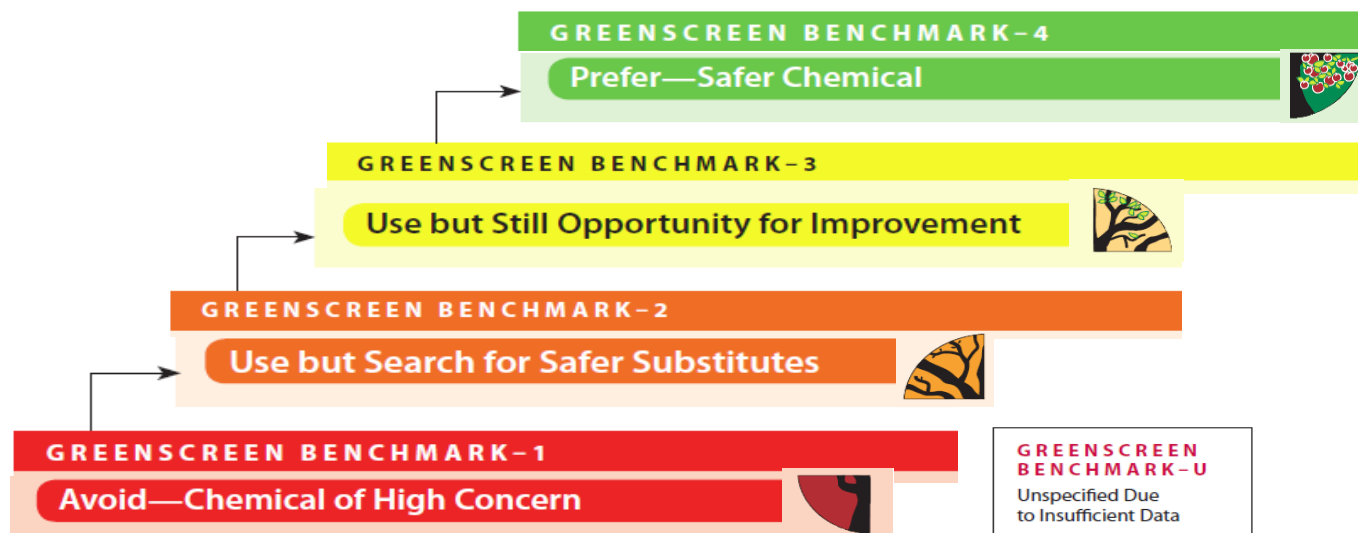
- Section I – Chemicals
- Section II – Polymers*
 - * Major revision to evaluation of polymers
- Section III - Products



GreenScreen[®] for Safer Chemicals

Hazard assessment method to identify chemicals of concern and safer alternatives.

- Transparent method
- Hazard-based
- Scientifically robust
- Comprehensive
- Developed by independent NGO

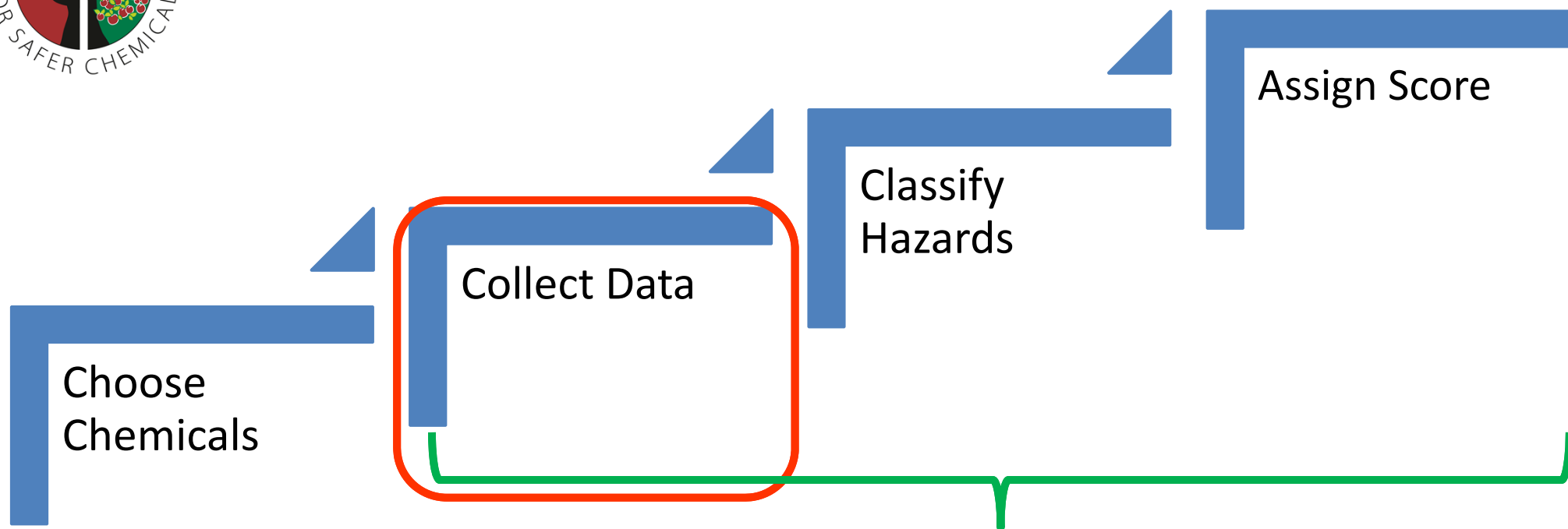


Download methodology:

<https://www.greenscreenchemicals.org/method/method-documents>



GreenScreen Assessment Process



Can hire Licensed GreenScreen Profiler to do this!



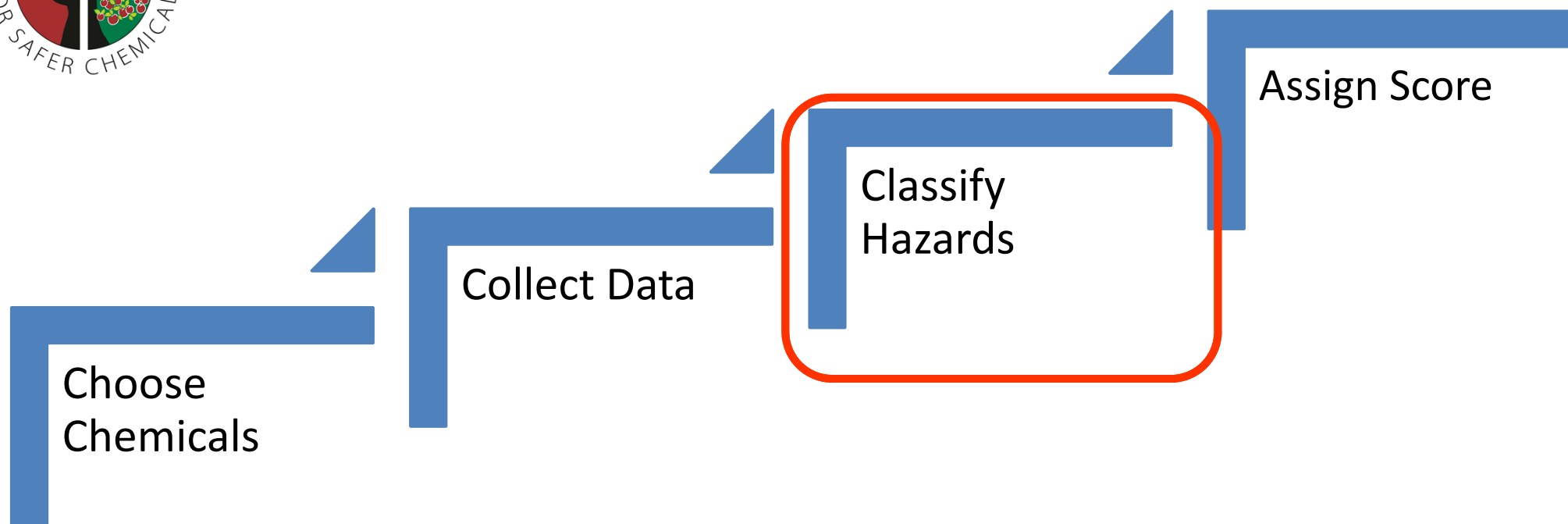
GreenScreen Hazard Endpoints

Human Health Group I	Human Health Group II and II*	Environmental Toxicity & Fate	Physical Hazards
Carcinogenicity	Acute Toxicity	Acute Aquatic Toxicity	Reactivity
Mutagenicity & Genotoxicity	Systemic Toxicity & Organ Effects	Chronic Aquatic Toxicity	Flammability
Reproductive Toxicity	Neurotoxicity	<i>Other Ecotoxicity studies when available</i>	
Developmental Toxicity	Skin Sensitization	Persistence	
	Respiratory Sensitization		
Endocrine Activity	Skin Irritation	Bioaccumulation	
	Eye Irritation		

Collect all available data and information including measured and estimated data



GreenScreen Assessment Process





GreenScreen Hazard Criteria

Carcinogenicity Hazard Criteria Excerpt:

Information type	Information Source	List Type	High (H)	Moderate (M)	Low (L)
Data	GHS Category & Guidance	N/A	1A (Known) or 1B (Presumed) for any route of exposure	2 (Suspected) for any route of exposure or limited or marginal evidence of carcinogenicity in animals	Adequate data available, and negative studies, no structural alerts, and GHS not classified.
List (*Sample included here)	US EPA – IRIS Carcinogens (1986)	Authoritative	Group A, B1 or B2	Group C	Group E
	IARC	Authoritative	Group 1 or 2A	Group 2B	Group 4
	CA EPA - Prop 65	Authoritative	Carcinogen		



GreenScreen Hazard Summary Table

Group I Human					Group II and II* Human							Ecotox		Fate		Physical			
Carcinogenicity	Mutagenicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity		Neurotoxicity	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability	
						single	repeated*												single
<i>L</i>	<i>L</i>	<i>L</i>	M	<i>M</i>	L	L	L	vH	H	L	DG	L	L	H	H	vL	L	M	<i>L</i>

1. Hazard Classification

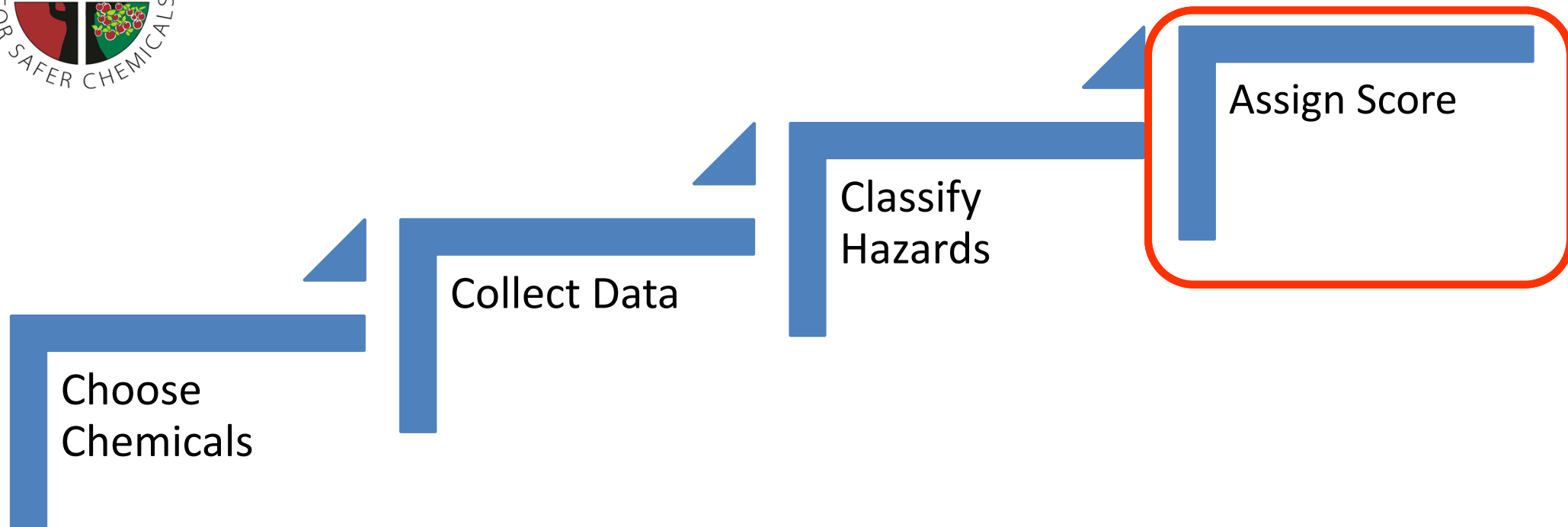
- **vH** = very High
- **H** = High
- **M** = Moderate
- **L** = Low
- **vL** = very Low
- **DG** = Data Gap

2. Level of Confidence:

- **Bold** = High confidence
- *Italics* = Low confidence



GreenScreen Assessment Process





Value of Benchmark Score

Standard metric and communication for chemical hazard

1. Simple:

- Integer Score from Benchmark-1 to -4

2. Comprehensive:

- Transparent, detailed documentation

Green Screen Assessments of Similar Function Chemical			
Common Name	CAS #	Full Name	Benchmark
Preferred			
Design	none	Design material out, dematerialize	4
Substance 0	#####-##-#	Chemical name	4
Use but still opportunity for improvement			
Substance 1	#####-##-#	Chemical name	3
Substance 2	#####-##-#	Chemical name	3
Use but search for alternatives			
Substance 3	#####-##-#	Chemical name	2
Substance 4	#####-##-#	Chemical name	2
Substance 5	#####-##-#	Chemical name	2
Substance 6	#####-##-#	Chemical name	2
DO NOT USE			
Substance 7	#####-##-#	Chemical name	1
Substance 8	#####-##-#	Chemical name	1
Substance 9	#####-##-#	Chemical name	1
Substance 10	#####-##-#	Chemical name	1
Substance 11	#####-##-#	Chemical name	1
Substance 12	#####-##-#	Chemical name	1



Criteria for Benchmark Scores

ABBREVIATIONS

- P** Persistence
- B** Bioaccumulation
- T** Human Toxicity and Ecotoxicity

GREENSCREEN BENCHMARK-4

Low P* + Low B + Low T (Ecotoxicity, Group I, II and II* Human) + Low Physical Hazards (Flammability and Reactivity) + Low (additional ecotoxicity endpoints when available)



Prefer—Safer Chemical

GREENSCREEN BENCHMARK-3

- a. Moderate P or Moderate B
- b. Moderate Ecotoxicity
- c. Moderate T (Group II or II* Human)
- d. Moderate Flammability or Moderate Reactivity



Use but Still Opportunity for Improvement

GREENSCREEN BENCHMARK-2

- a. Moderate P + Moderate B + Moderate T (Ecotoxicity or Group I, II, or II* Human)
- b. High P + High B
- c. High P + Moderate T (Ecotoxicity or Group I, II, or II* Human)
- d. High B + Moderate T (Ecotoxicity or Group I, II, or II* Human)
- e. Moderate T (Group I Human)
- f. Very High T (Ecotoxicity or Group II Human) or High T (Group II* Human)
- g. High Flammability or High Reactivity



Use but Search for Safer Substitutes

GREENSCREEN BENCHMARK-1

- a. PBT = High P + High B + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II* Human)]
- b. vPvB = very High P + very High B
- c. vPT = very High P + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II* Human)]
- d. vBT = very High B + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II* Human)]
- e. High T (Group I Human)



Avoid—Chemical of High Concern

GREENSCREEN BENCHMARK-U

Unspecified Due to Insufficient Data

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See GreenScreen® Benchmark Criteria and GreenScreen® Guidance for a complete set of Benchmark Criteria and how to apply them. <http://www.greenscreenchemicals.org/method/method-documents>



Benchmark 1

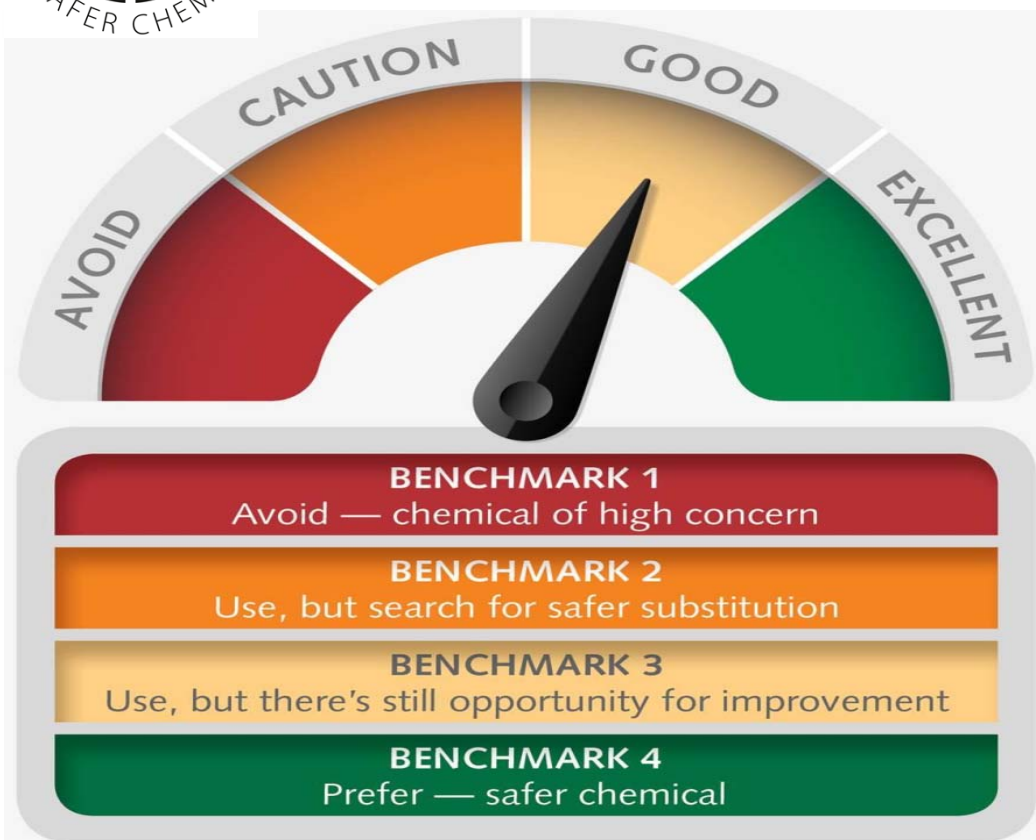
Chemicals of High Concern



- **CMRs =**
 - Carcinogens,
 - Mutagens, or
 - Reproductive / Developmental Toxicants
- **PBTs =**
 - Persistent, and
 - Bioaccumulative, and
 - Toxic
- **Equivalent Concern =**
 - Endocrine Disruptors



Assign a Benchmark Score



Consider:

1. Known hazards
2. Data availability and gaps
3. Transformation Products

GreenScreen[®] Evaluation of Methylene Chloride and Alternatives

Chemical Name	CASRN	Group I Human						Group II & II Human						Ecotox		Fate		Physical			
		C	M	R	D	E	AT	ST		N		SnS	SnR	IrS	IrE	AA	CA	P	B	RX	F
								Single	repeated	Single	repeated										
Methylene chloride	75-09-2	H	NE	DG	DG	M	M	vH	H	vH	vH	L	DG	H	H	M	L	vH	vL	L	L

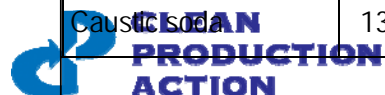


GreenScreen® Evaluation of Methylene Chloride and Alternatives

Chemical	CASRN	Benchmark Score
Methylene chloride	75-09-2	1
Benzyl alcohol	100-51-6	2
2-(2-butoxyethoxy) ethanol	112-34-5	2
Dimethyl sulfoxide (DMSO)	67-68-5	3
1,3-dioxolane	646-06-0	2
Estasol (dibasic esters mixture)l	95481-62-2	2
d-Limonene	5989-27-5	2
Acetone	67-64-1	2
Methanol	67-56-1	1
Toluene	108-88-3	1
Formic acid	64-18-6	2
Caustic soda	1310-73-2	2

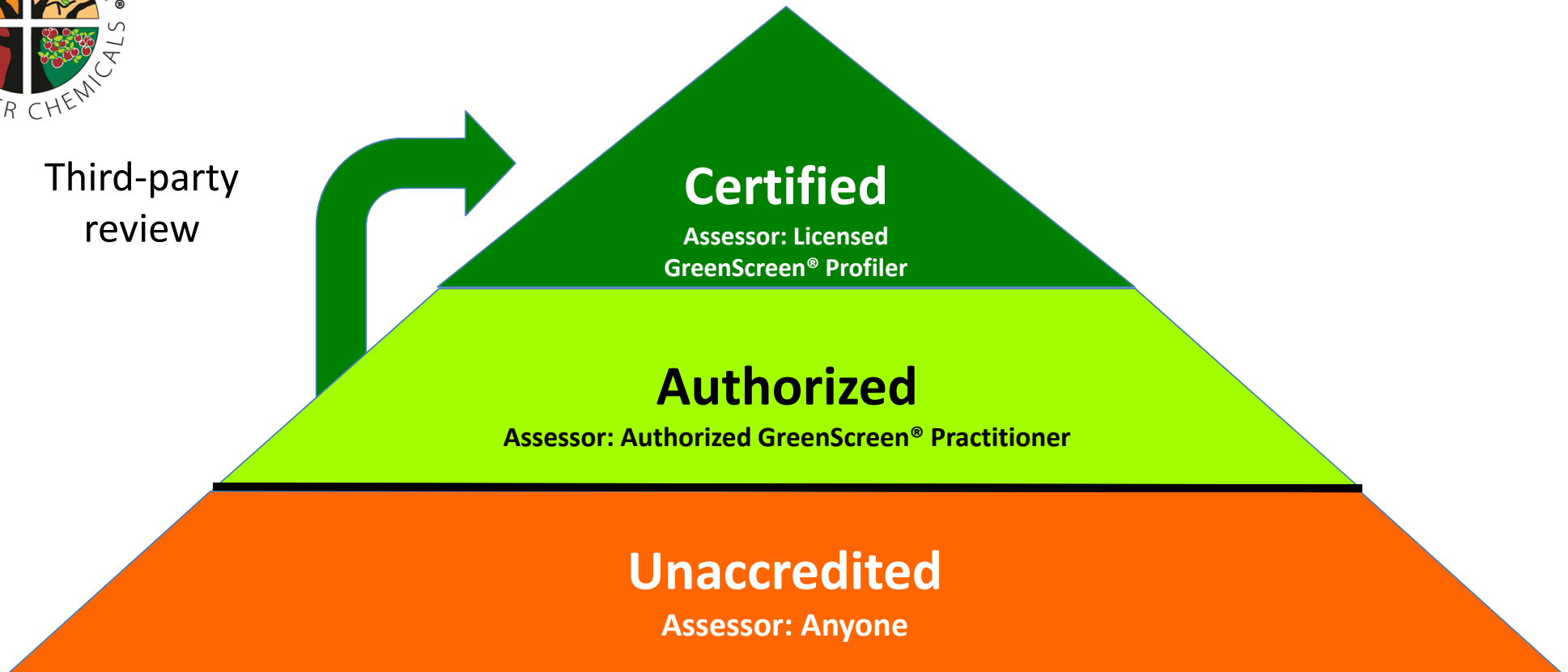
GreenScreen® Evaluation of Methylene Chloride and Alternatives

Chemical Name	CASRN	Group I Human					Group II & II Human								Ecotox		Fate		Physical		
		C	M	R	D	E	AT	ST		N		SnS	SnR	IrS	IrE	AA	CA	P	B	RX	F
								Single	repeated	Single	repeated										
Methylene chloride	75-09-2	H	NE	DG	DG	M	M	vH	H	vH	vH	L	DG	H	H	M	L	vH	vL	L	L
Benzyl alcohol	100-51-6	L	L	L	M	DG	M	L	L	M	H	H	L	L	H	L	L	vL	vL	L	L
2-(2-butoxyethoxy) ethanol	112-34-5	L	L	L	L	DG	L	L	H	DG	L	L	DG	M	H	L	L	vL	vL	L	M
Dimethyl sulfoxide	67-68-5	L	L	L	L	DG	L	L	L	L	L	L	L	M	M	L	L	L	vL	L	M
1,3-dioxolane	646-06-0	L	M	M	M	DG	L	M	M	M	L	L	DG	M	H	L	L	M	vL	L	H
Estasol (dibasic esters mixture)	95481-62-2	L	L	L	M	M	L	M	M	M	DG	L	DG	L	M	M	L	vL	vL	M	L
d-Limonene	5989-27-5	L	L	DG	L	DG	L	L	L	DG	DG	H	DG	H	H	vH	H	vL	M	L	M
Acetone	67-64-1	L	L	M	M	DG	L	M	M	M	M	L	DG	L	H	L	L	vL	vL	L	H
Methanol	67-56-1	NA	NA	NA	H	NA	H	vH	NA	NA	NA	NA	NA	NA	NA	L	L	vL	vL	NA	H
Toluene	108-88-3	DG	L	H	H	M	L	M	H	M	H	L	DG	H	L	H	H	H	vL	L	H
Formic acid	64-18-6	L	L	L	L	DG	H	vH	H	vH	DG	L	DG	vH	vH	M	M	vL	vL	L	M
Caustic soda	1310-73-2	L	L	L	L	L	H	vH	L	L	L	L	DG	vH	vH	M	DG	L	vL	M	L





Types of GreenScreen Assessments



Note: GreenScreen List Translator assessments are another type of assessment, are significantly less comprehensive than a full GreenScreen assessment, and are not depicted here.



Obtaining GreenScreen Assessments

1. Certified Assessments

- Existing: Download from [GreenScreen Store](#) or [Pharos, Toxnot, Data Commons](#)
- Purchase from a Licensed Profiler or commission new

2. Authorized & Unaccredited Assessments

- Existing: Download from Interstate Chemicals Clearinghouse [Chemical Hazard Assessment Database](#)



Free Publicly Available Assessments from the GreenScreen Store

<https://www.greenscreenchemicals.org/gs-assessments>

GreenScreen® Store

You are here: Home / GreenScreen® Assessment Store

CAUTION GOOD EXCELLENT AVOID

Find GreenScreen Assessment Reports:

- ...by CAS Registry Number**
CAS Registry Numbers are unique numerical identifiers assigned by Chemical Abstract Service.
[Learn More](#)
- ...by Chemical Name**
Many chemicals have multiple names. If you don't see the chemical name you are most familiar with, search with tags or use our search function.
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About the GreenScreen® Store

Welcome to the GreenScreen® store. Here you can download GreenScreen assessments that have been performed by others. Some are freely available; others are available for a fee. Search for assessments by functional use or by keyword.

GreenScreen® Store

- The GreenScreen® Store
- Chemicals by CAS #
- Chemicals by Name
- Login

You might also like

- Who Uses GreenScreen®?
- GreenScreen® Method

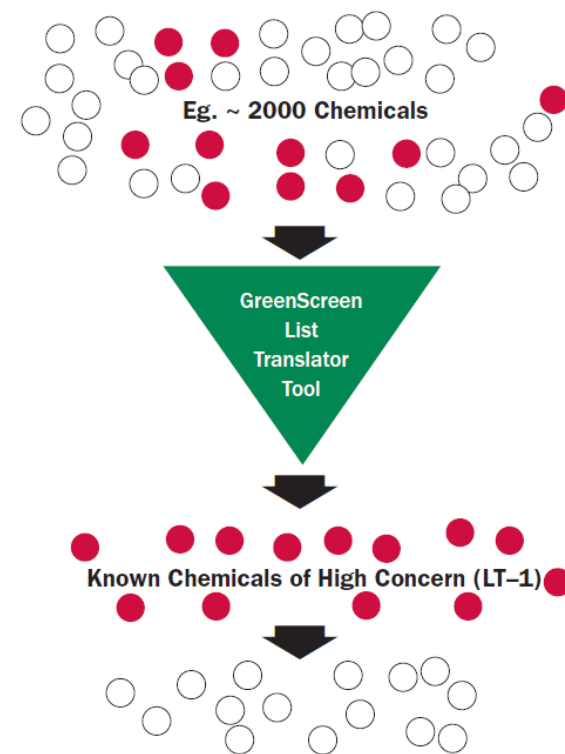
GreenScreen[®] for Safer Chemicals: List Translator Tool



GreenScreen[®] List Translator[™]

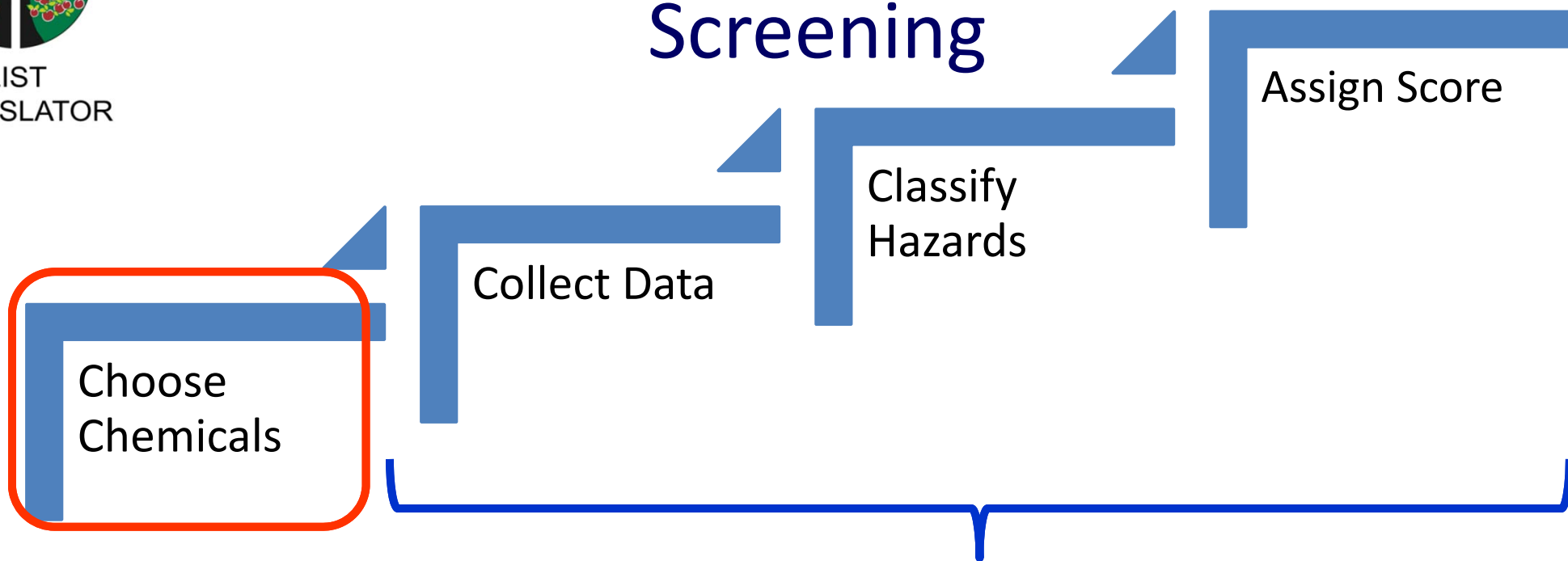
Screening tool designed to quickly identify chemicals of high concern:

- Built from GreenScreen – translates lists based on Benchmark 1 criteria
- Aligned with authoritative scientific bodies and regulatory precedent
- Comprehensive list
- Automated and Scalable





GreenScreen List Translator Screening



**Our software partners have
automated this whole process!**



LIST
TRANSLATOR

GreenScreen List Translator

GreenScreen Hazard Endpoints and Criteria



GreenScreen Benchmark 1 Criteria

GREENSCREEN BENCHMARK-1

- a. PBT = High P + High B + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II* Human)]
- b. vPvB = very High P + very High B
- c. vPT = very High P + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II* Human)]
- d. vBT = very High B + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II* Human)]
- e. High T (Group I Human)

Avoid—Chemical of High Concern

GreenScreen
List Translator (LT)
Score



Authoritative Lists –
eg REACH SVHCs,
IARC, etc.



GreenScreen List Translator:
Is Chemical X a known chemical of concern based on an authoritative or screening list that aligns with GreenScreen criteria?



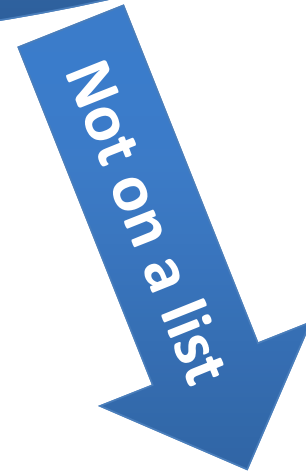
LT-1



LT-P1



LT-UNK



No GSLT

GreenScreen Specified Lists

42 Lists from Authoritative Scientific Bodies & NGO Screening Lists

- Government Agencies
 - EU REACH Substances of Very High Concern (SVHCs)
 - US EPA Priority PBT List
 - California Proposition 65 List
- Intergovernmental Agencies / Internationally Recognized NGOs
 - United Nations – Stockholm Persistent Organic Pollutants
 - International Agency for the Research on Cancer (IARC)
- Screening Lists
 - ChemSec SIN List
 - TEDX Potential Endocrine Disruptors





List Translator Automated Tools



- Search
- Products
- Materials
- Surveys
- Data Templates
- Suppliers
- Questionnaires
- Portfolio
- Decision Tools

[84-74-2]

LT-1

Views: 210

Share

Compare

Di-n-butyl phthalate (DBP)

GreenScreen List Translator™ Score - LT-1

GreenScreen List Translator™ Score - LT-1																					
Group I Human					Group II and II* Human										Ecotox		Fate		Physical		Mult*
C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F		
						single	repeated*	single	repeated*												
M		H	H	H	L	H	H	UNK		H		M	H or M	vH	M					Mult	

> General Information

> Transformation Products and Impurities

> Regulation and Hazard Lists

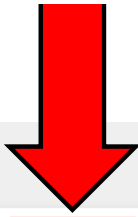
> Restricted Substance Lists

Quick Chemical Assessment Tool (QCAT)

GreenScreen® Assessment

> GreenScreen® Specified Lists

List Translator Score = LT-1



Users

Standards with safer chemical requirements



Ø ZDHC
Zero Discharge of
Hazardous Chemicals



**LIVING
PRODUCT
CHALLENGESM**



TM
the BIFMA sustainability standard





GreenScreen Applications

<https://www.greenscreenchemicals.org/learn/learn-about-greenscreen>

LEVI STRAUSS & CO.



Thank You!

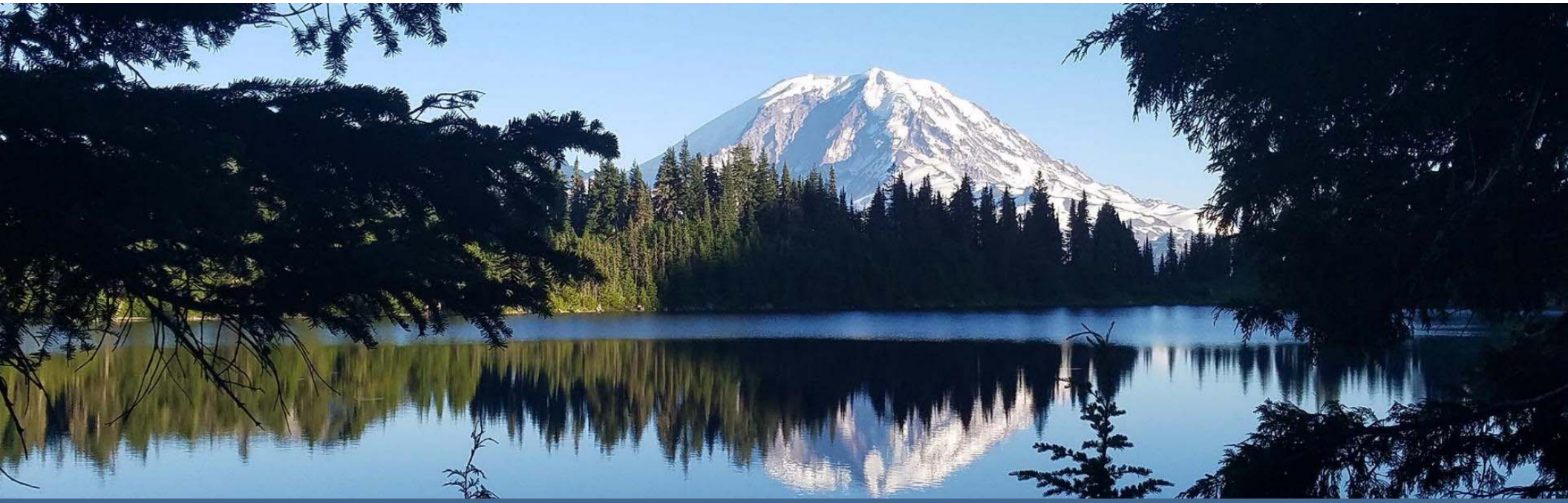
Shari Franjevic

GreenScreen Program Manager

Clean Production Action

shari@cleanproduction.org





GreenScreen™ in Government



Brian Penttila

Safer Alternatives Chemist

Washington State Department of Ecology



Founded February 1970

Evolution of Substitution in Washington

Realization that bans on hazardous substances would not be effective without an effort to identify what should replace them.

2000-2006

PBT Rule → Chemical Action Plans

- Created a process to identify PBTs for action
- Directed investigation of substitutes &
- Promotion of safer alternatives

2004-2007

PBDE Chemical Action Plan

- State's 2nd Chemical Action Plan
- Completed in 2006
- 2007 law passed to ban Penta- & Octa-BDE for all uses, Deca-BDE for mattresses

2007-2008

Deca-BDE Alternatives Assessment

- Deca-BDE in electronic enclosures?
- Law enacted banning decaBDE **providing that safer, effective, affordable** alternatives available



Hazard Assessment – Deca-BDE & Alts

- Need for tools to assess and compare alternatives
- Translate toxicology jargon to more comprehensible language
- Employ a technically defensible, comprehensive, *living* system

- Benchmark 1:
Avoid—Chemical of high concern
- Benchmark 2:
Use but search for safer substitutes
- Benchmark 3:
Use but still opportunity for improvement
- Benchmark 4:
Prefer—Safer chemical

Before

Table 7. Lowest observed effect levels in PBDE animal toxicity studies.

Associated PBDE product	PBDE congener or product	Endpoint	Duration/time of exposure (animal)	Lowest Observed Effects Level (mg/kg/day)	Ref.
Penta-BDE	BDE-47	Developmental neurotoxicity	1 day/post-natal day 10 (rat)	0.8	175
	Penta product	Decreased thyroid hormone (exposure during development)	15 days/gestational days 6-20 (rat)	1.0	176
	BDE-99	Developmental reproductive effects	1 day/gestational day 6 (rat)	0.06	177
Octa-BDE	Saytex 111 (Octa-BDE commercial product)	Fetotoxicity	13 days/gestational days 7-19 (rat)	2-5	178
	Octa-BDE product	Liver changes	28 days and 13 weeks (rabbit)	10	179,180
Deca-BDE	BDE-209	Developmental neurotoxicity	1 day/post-natal day 3 (mouse)	20.1	181
	Deca-BDE	Thyroid changes, liver and kidney effects and fetal death	30 days (rat)	80	182
	Deca-BDE	Cancer	103 weeks (rat and mouse)	1120 - 3200	183

Notes: mg/kg/day = milligram of PBDE per kilogram of bodyweight per day; Ref = Reference.

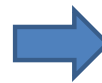


Table 3: Excerpted from Table 5 in The Green Screen, Evaluating Flame Retardants for TV Enclosures (Clean Production Action, 2007).

Chemical (Flame retardants)	CAS #	Human health effects														
		% in formulation	carcinogen	mutagen	reproductive toxicity	developmental toxicity	endocrine disruption	neurotoxicity	acute toxicity	systemic toxicity	skin sensitivity	respiratory sensitivity	skin irritation	eye irritation	immune system	
RDP Mixture (mixture of following 3 components)	125997-21-9															
RDP (Resorcinol bis(diphenylphosphate))	65-80 57583-54-7		L	L	L	L	ND	L	L	M	L	ND	L	M	L	
Phosphoric acid, bis [3-[(diphenoxyphosphoryl)oxy]phenyl] phenyl ester	13-30 98165-92-3		L	L	L	L	ND	L	L	M	L	ND	L	M	L	
TPP (Triphenylphosphate)	<5 115-86-6		L	L	L	L	ND	L	L	M	L	ND	L	M	L	
Breakdown products:																
Phenol	108-95-2		L	M	L	L	L	M	M	R	L	L	R	R	M	
Resorcinol	108-46-3		L	L	L	L	M	M	M	ND	M	ND	M	M	ND	
Diphenylphosphate (DPP)	838-83-7															
			Insufficient Data													
deca-BDE	97 1163-19-5		M	L	L	M	M	M	L	L	L	ND	L	L	ND	
penta-BDE	32534-81-9		ND	L	M	M	H	M	L	R	L	L	M	M	ND	
octa-BDE	32536-52-0		ND	L	M	H	M	M	L	H	L	ND	L	L	ND	

After

Various *ad hoc* assessments of hazard

GreenScreen (Clean Production Action 2008)



Ongoing development of substitution practice

2011-2014

Development of the IC2 AA Guide v1.0

- Framework for alternatives assessment
- Collaborative multi-state effort
- Version 1.1 released 2017

2015-2017

Alternatives to Copper Antifouling Paint

- Non-regulatory advisory assessment
- Contract to Northwest Green Chemistry
- Tiered assessment with GreenScreen system

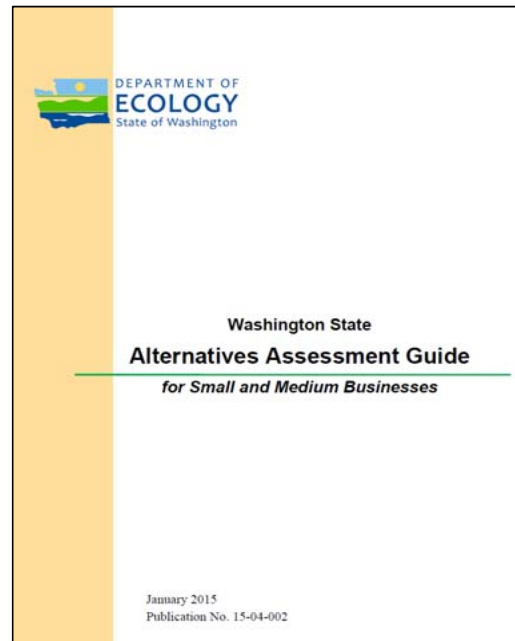
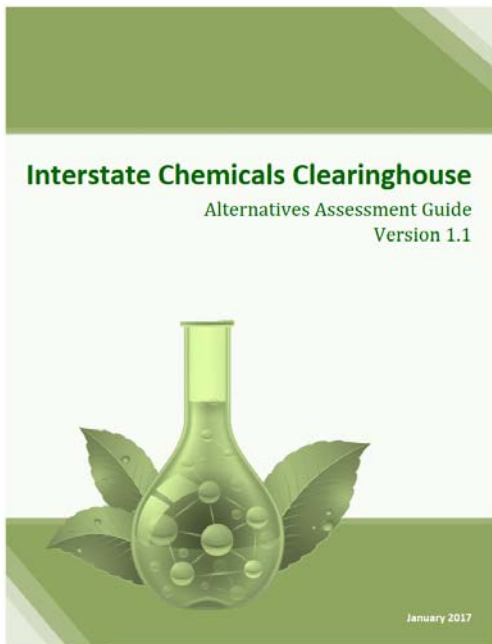
2018-?

Regulatory Alternatives Assessment

- Alternatives to PFAS in Food Packaging
- The Pollution Prevention for Healthy People and Puget Sound Act (2020-?)
 - Addresses 5 priority chemical classes



AA Method Development



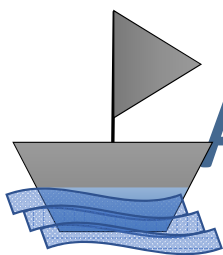
Both methods recommend GreenScreen

- IC2 AA Guide v1.1
 - GreenScreen for Hazard Module (L2)
 - GS List Translator as initial screen
- Washington State AA Guide
 - Based on the IC2 Guide
 - Primarily for SMEs
 - GreenScreen recommended for government assessments

IC2: http://theic2.org/article/download-pdf/file_name/IC2_AA_Guide_Version_1.1.pdf (2017)

WA: <https://fortress.wa.gov/ecy/publications/documents/1504002.pdf> (2015)





Alternatives to Copper AF Paint

Northwest Green Chemistry Approach

- Followed WA State and IC2 guidance
- Large number of formulated products
 - GreenScreen List Translator as initial screen
 - Biocides and select substances evaluated using GreenScreen

Washington State Antifouling Boat Paint
 Alternatives Assessment Report
 FINAL REPORT
 October 1, 2017



CAS #	Name	GreenScreen Benchmark	Carcinogenicity	Mutagenicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity	Systemic Toxicity, repeated *	Neurotoxicity	Neurotoxicity, repeated *	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability
1317-39-1	CuO	1	L	L	L	M	DG	M	DG	M	DG	DG	L	DG	L	M	vH	vH	vH	M	L	L
13463-41-7	ZnPy	1 _{TP}	L	L	L	M	M	vH	vH	H	M	H	L	H	L	vH	vH	vH	H	vL	L	L



https://www.northwestgreenchemistry.org/s/Washington-CuBPAA_Final_2017.pdf (2017)



Quickly assess impacts of updated science

Zinc pyrithione RAC CLH opinion adopted – Repr 1B (2017)

CAS #	Name	GreenScreen Benchmark	Carcinogenicity	Mutagenicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity	Systemic Toxicity, repeated *	Neurotoxicity	Neurotoxicity, repeated *	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability
1317-39-1	CuO	1	L	L	L	M	DG	M	DG	M	DG	DG	L	DG	L	M	vH	vH	vH	M	L	L
13463-41-7	ZnPy	1 _{TP}	L	L	X	M	M	vH	vH	H	M	H	L	H	L	vH	vH	vH	H	vL	L	L

- Not yet published in Official Journal
- Repr 1B translates to GreenScreen **High** level-of-concern

H

Requires an assessment update; while not DIY, implications are immediately clear!

IC2 Chemical Hazard Assessment Database

GreenScreens® (97)

[50-21-5] Lactic acid
[50-99-7] Glucose
[57-55-6] Propylene glycol
[64-17-5] Ethanol in alcoholic beverages
[64-19-7] Acetic acid

Submit | Reset

GreenScreen List Translators (8)

[67-56-1] Methanol
[91-20-3] Naphthalene
[96-29-7] Methylenechloride
[8052-41-3] Stoddard solvent
[64742-49-0] Naphtha (petroleum), hydrotreated light

Submit | Reset

Search by Benchmark Score - Hold *Control* while you click to select multiple values

Benchmark 4
Benchmark 3
Benchmark 2
Benchmark 1
Unspecified

Submit

IC2: <https://www.theic2.org/hazard-assessment>

- Free resource for completed GreenScreen assessments
- Cooperative venture of the member states, counties, cities
- Fosters disclosure of chemical hazard data
- Focus now on assessing safer alternative chemicals






Increasing Awareness & Adoption through Tools, Training & Technical Assistance



- Agency Toxics Reduction staff trained to use GreenScreen tools
- Recurring training available for businesses (recorded webinars)
- Tools filtering down now to city- & county-level staff



CHEMICALS OF CONCERN				
Product	Picture	Chemical Name	GreenScreen Benchmark/ GreenScreen List Translator Score	Most Concerning Health Hazards to Discuss
O'Reilly Brake Parts Cleaner Part Numbers: 05084, 00482, 46580, or 72408		Toluene	LT-1	Loss of consciousness, respiratory depression, and death. Inhaling toluene while pregnant associated with developmental toxicity
		Methanol	BM-1	Chance of harm to a developing fetus (developmental toxicity); central nervous system damage, death
Gunk Brake Parts Cleaner Part Numbers: M705 and M720		Methanol	E	Chance of harm to a developing fetus (developmental toxicity); damage, death
		Perchloroethylene	L	Chance of harm to humans; can cause impaired cognitive function; some evidence of developmental toxicity
CRC Brake Parts Cleaner Part Number: 05089 (PS)		Perchloroethylene	LT-1	Likely to be carcinogenic to humans; can cause impaired cognitive and motor performance; some evidence of developmental toxicity

Draft

Product table courtesy of Ecology Northwest Regional Office

It takes a village!



Clean Production Action



Together, we're creating a safer
and healthier future

The Business Case for Alternatives Assessment

Cory Robertson

Sustainable Impact

HP Inc.'s vision is to create technology that makes life better for everyone, everywhere.



www.hp.com/sustainableimpact

How do we get to there?

- Regulations, RoHS, REACH, CA Safer Consumer Products-market access requirements
- Strategic substitutions, phthalates
- Voluntary initiatives, low-halogen, Zero Discharge of Hazardous Chemicals (ZDHC)
- Eco-label requirements-customer driven force

History: Hazard Table

U.S. EPA Alternatives Assessment:

- Partnership to Evaluate Flame Retardants in Printed Circuit Boards
- Partnership to Evaluate Flame Retardant Alternatives to DecaBDE

- Data
- i.e. LD-50

- GHS Criteria
- R-phrases
- H-phrases

Chemical	CASRN	Human Health Effects									Aquatic Toxicity		Environmental	
		Acute Toxicity	Skin Sensitizer	Cancer Hazard	Immunotoxicity	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Acute	Chronic	Persistence	Bioaccumulation
Additive Flame Retardants³														
Aluminum hydroxide														
Aluminum hydroxide	21645-51-2	L	L	L	M	L	L	M	L	L	H	M	H ^R	L
Exolit OP 930 (phosphoric acid, diethyl-, aluminum salt) (Clariant)														
Exolit OP 930	225789-38-8	L	L	L	M	L	M	M	L	L	M	M	H ^R	L
Melapox 200 (Melamine polyphosphate) (Ciba)⁴														
Melapox 200	218768-84-4	L	L	L	L	L	L	L	M	M	L	L	L	L
Phosphoric acid	8017-16-1	L	L	L	L	L	L	L	L	L	L	L	L	L
Melamine	108-78-1	L	L	L	L	L	L	L	M	M	L	L	M	L
Silicon dioxide amorphous⁵														
Silicon dioxide amorphous	7631-86-9	L	L	L	L	L	L	L	H ^S	L	L	L	H ^R	L
Silicon dioxide crystalline⁵														
Silicon dioxide crystalline	1317-95-9	L	L	H ⁺	H ^S	L	L	L	H ^S	H ^S	L	L	H ^R	L

- IARC
- Prop 65
- Proxy Chemicals
- QSAR
- Expert Judgment

52

Simple 1-4 score (1=bad, 4=good)

- Expert knowledge is required to generate and peer review the score
- Once generated, the simple score can be used by others even if they have no technical training

GS Benchmark		Fate		Ecotoxicity	
		P	B	AA	CA
Chem #1	2	H	L	L	H
Chem #2	4	L	L	L	H
Chem #3	2	L	L	H	M
Chem #4	1	L	L	H	dg
Chem #5	3	L	M	M	dg



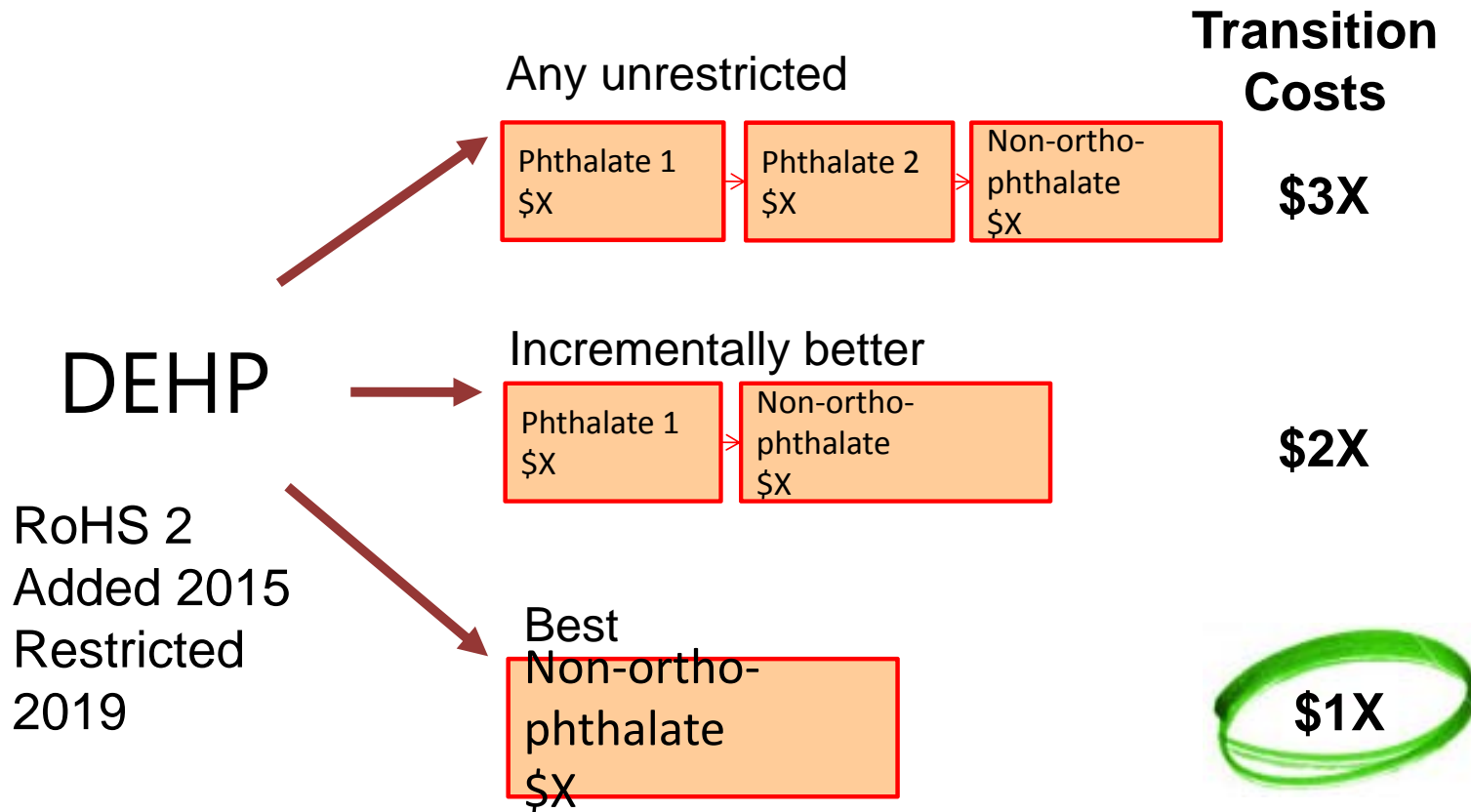
Normalizes Stakeholder Inputs

Green Chemistry

Risk = Hazard x Exposure

Avoiding Multiple Substitutions

How the GreenScreen® is used



Guidance Documents

How the GreenScreen® is used



Green Screen Assessments of Similar Function Chemical		
Common Name	CAS #	Full Name
Preferred		
Design	none	Design material out, dematerialize
Substance 0	#####-##-#	Chemical name
Use but still opportunity for improvement		
Substance 1	#####-##-#	Chemical name
Substance 2	#####-##-#	Chemical name
Use but search for alternatives		
Substance 3	#####-##-#	Chemical name
Substance 4	#####-##-#	Chemical name
Substance 5	#####-##-#	Chemical name
Substance 6	#####-##-#	Chemical name
DO NOT USE		
Substance 7	#####-##-#	Chemical name
Substance 8	#####-##-#	Chemical name
Substance 9	#####-##-#	Chemical name
Substance 10	#####-##-#	Chemical name
Substance 11	#####-##-#	Chemical name
Substance 12	#####-##-#	Chemical name

Presented with other material selection data

How the GreenScreen® is used

Supplier	Supplier Material ID	Composition	Recycled Content	Risk Phase Assessment for the FRs	Green Screen of Additives <u>HP Confidential</u>	HP GSE Rev. O	RoHS 2.0 Rev. F	BFR/PVC Free	Meets TCO DT 3.0 and AiO 1.0 R50/R53, based on FR	Eligible for EPEAT 4.1.6.2 optional point?	FR eligible for EU Ecolabel?
	Notes	ABS, PC, PC+ABS, PC+20GF, etc. generic resin composition	Virgn or Recycled with XX% post consumer r content	Directive 67/548/EC	Benchmarks shown have been reviewed by HP Green Screen Team	Table 1 Page 7-9	Spec for Plastics	Spec for Plastics	R40, R45, R46, R48, R50/R53, R60, R61; only for parts > 25 g	R40, 45, 46, 50, 51, 52, 53, 60, 61, 62, 63 and their combinations; only for parts > 25 g	Numerous Risk Phrases--Refer to Declaration Letter only for parts > 25 g
Supplier 1	Plastic 111	PC/ABS	Virgin	none	2	Yes	Yes	Yes	Yes - FR's meet req.	Yes	Yes - FR's meet req.
Supplier 1	Plastic 222	PC/ABS	Virgin	R53	1	Yes	Yes	Yes	No	No	Yes
Supplier 2	Polymer 9099	PC	65%	none	Unknown	Yes	Yes	Yes	Yes	Yes	Yes

Eco-labels

Beyond Regulatory Compliance

Eco-labels across our portfolio
% models, for products shipped in 2017*

Products	EPEAT® identifies high-performance, environmentally preferable products				ENERGY STAR® 7.0 or 6.1 certified recognizes products with superior energy efficiency	China SEPA recognizes energy-saving and environmentally preferable models	TCO recognizes various ergonomic and environmental features related to visual displays	Blue Angel recognizes criteria in product design, energy consumption, chemical emissions, noise, recyclable design, and take-back programs
	EPEAT (all categories)	EPEAT Gold registered	EPEAT Silver registered	EPEAT Bronze registered				
Personal systems	90%	57%	33%	0%	82%	72%	44%	NA
Printers	68%	3%	50%	15%	93%	96%	NA	53%

*EPEAT data for personal systems is for models registered worldwide and for printers is for models registered in the United States. ENERGY STAR data is worldwide. China SEPA data applies only to products registered in China. TCO data is for commercial desktops, notebooks, all-in-ones, and displays shipped in Europe. Blue Angel applies only to products registered in Germany. All data is for models shipped anytime during fiscal year 2017.

- Drives sustainability performance across the industry
- Drives transparency, extensive environmental information online
- Provides comprehensive (multi-attribute) information
- Enables customers to make more sustainable product choices



Source: www.hp.com/sustainableimpact



TCO Certified Accepted Substance List

You can filter the list by clicking on the green header bar, or by using the search field to the right.



Search:

Substance name	CAS	Type	Benchmark	Assessed	Profiler	Comments
Aluminum diethylphosphinate	225789-38-8	FR	3	Oct, 2016	Toxservices	3
Aluminum Hydroxide	21645-51-2	FR	2	Apr, 2019	Rosenblum	2
Red Phosphorus	7723-14-0	FR	2	Apr, 2019	Rosenblum	2
Bisphenol A diphosphate	181028-79-5; 5945-33-5	FR, PL	3			
Substituted Amine Phosphate mixture	66034-17-1	FR	2			
Triphenyl Phosphate	115-86-6	FR	2			
Tetrakis (2,6-dimethylphenyl)-m-phenylene biphosphate	139189-30-3	FR	3			
Siloxanes and silicones, di-Me, di-Ph, polymers with Ph silsesquioxanes	68648-59-9	FR	2			
Magnesium Hydroxide	1309-42-8	FR	3			
Phenoxyphosphazene	890525-36-7, 2791-22-2,	FR	3			

Plasticizers used in product housing and cable insulations must have been assigned a GreenScreen benchmark score of 2, 3 or 4 by a licensed GreenScreen profiler and appear on the public TCO Certified Accepted Substance List.

Source: <https://tco certified.com/accepted-substance-list/>

EPEAT

Electronic Product Environmental Assessment Tool

Product criterion: Manufacturer shall demonstrate that all substances used in the following materials and applications are assessed in accordance with the GreenScreen® for Safer Chemicals method and assigned a GreenScreen® Benchmark™ score.

- Flame retardants in plastic parts > 25 g. The assessment may exclude printed circuit boards, wires and cables, connectors, fans and power supplies.
- Plasticizers in plastic parts > 25 g

Performance	Total Points
All assessed substances are benchmark 2, 3 or 4	1
All assessed substances are benchmark 3 or 4	2

Excerpt



Value Judgements

EPEAT Criteria Development

- GreenScreen® is based on GHS hazard classifications, why can't we use them instead of the GreenScreen®?

Which is better?

Substance 1
GHS Category 2
Carcinogen

Substance 2
GHS Category 1 Chronic Aquatic
GHS Category 2 Eye irritant

Thank you!



keep reinventing

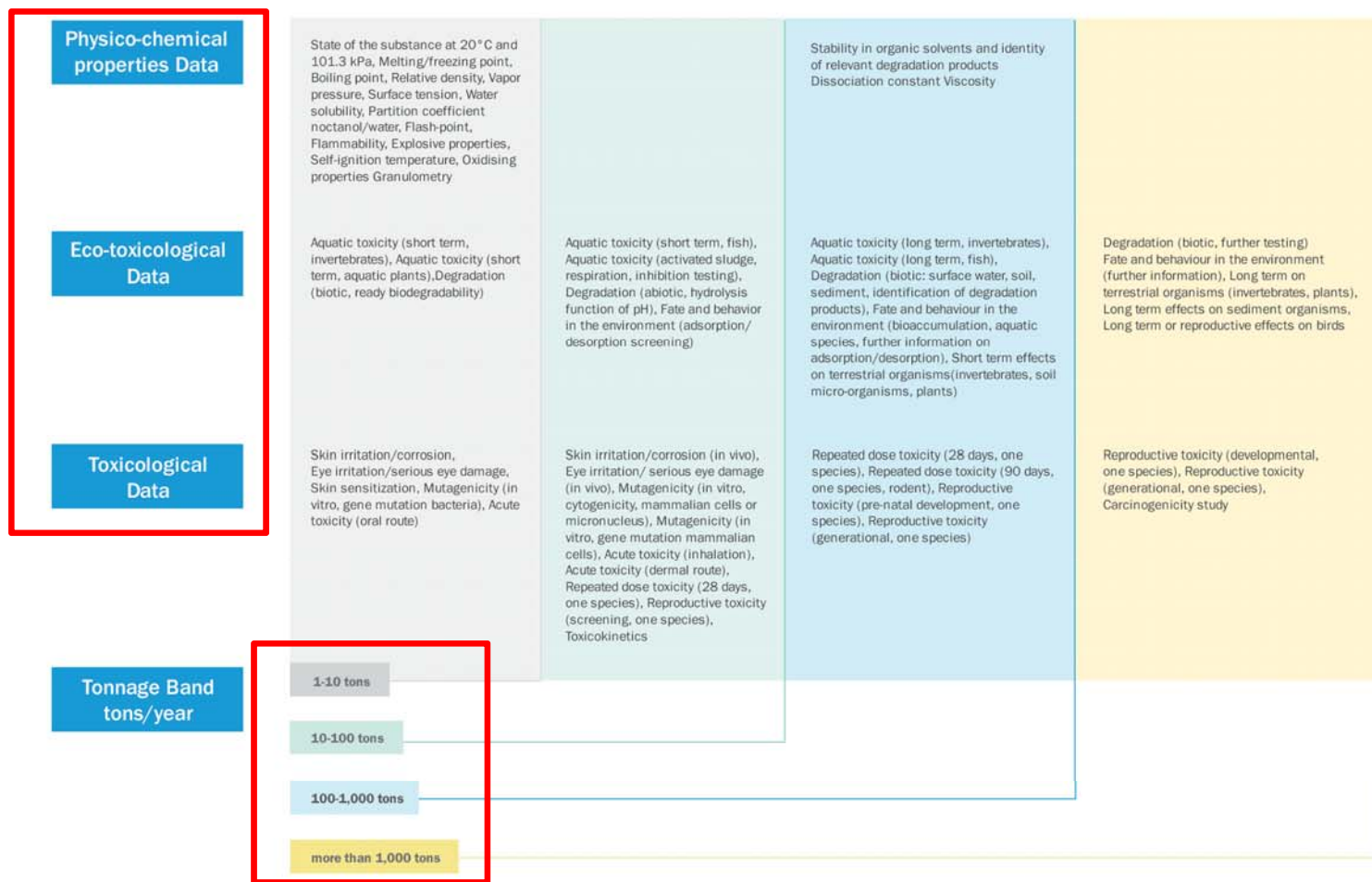
cory.robertson@hp.com

Anthesis Group

Applying GreenScreen in the European context



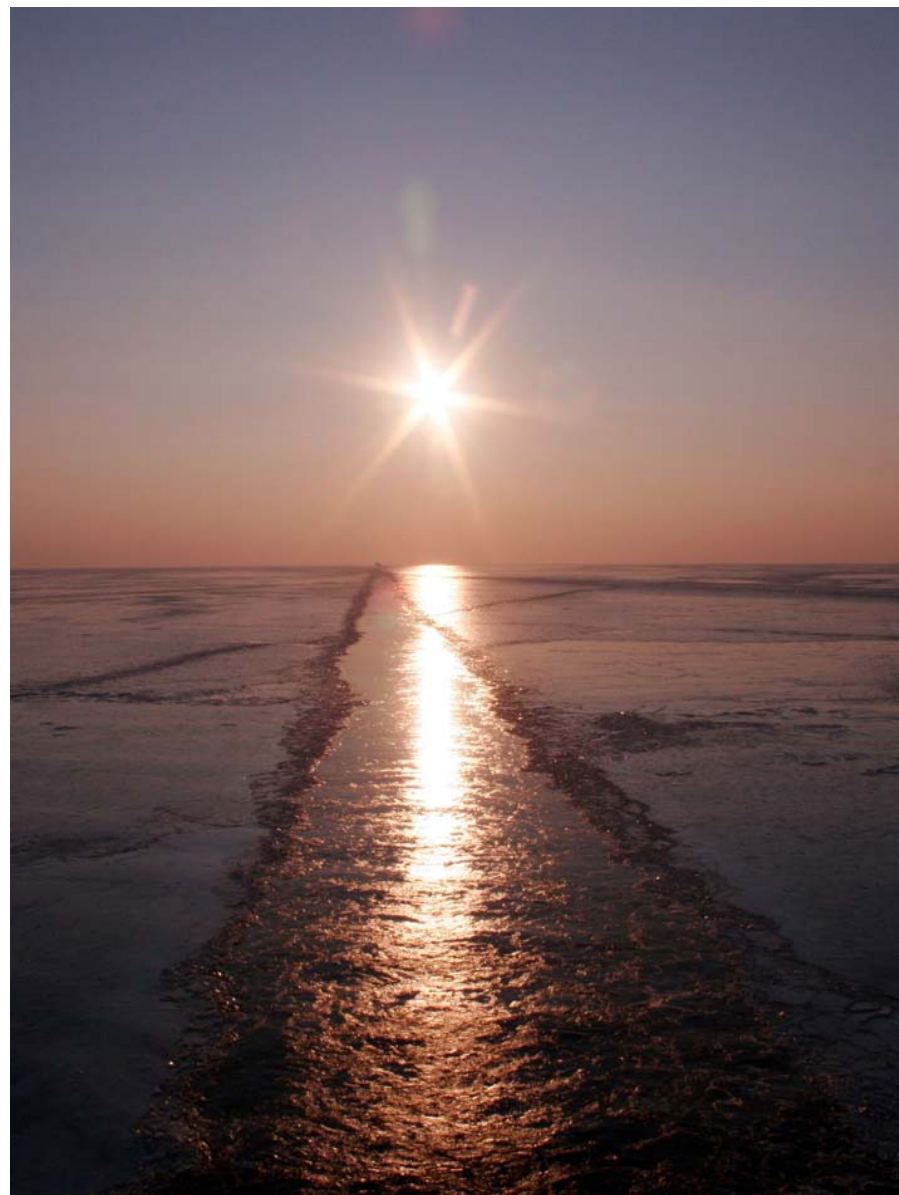
General REACH Substance Registration Data Requirements



- Minimum data-set depends on tonnage-band (Annex VII-X)
- Follows the major GHS end-points
- Provides considerable input to GreenScreen Assessments
- Provides an insight into data-gaps at the substance level
- Allows for ECHA to consider next steps in terms of data needs

Processes within REACH to fill data-gaps/establish CLHs

- **Initial registrations only require Annex VII and VIII data, although pre-existing Annex IX and X data can be included where appropriate.**
- **In order to avoid unnecessary animal testing, Annex IX and X data-gaps are set out in a Test Plan which needs ECHA approval before commencement**
- **The Test Plan is selective in study requests and may lead subsequently to further identification of test requirements which need to be triggered by a Substance Evaluation**
- **In some cases, the data is sufficient to already develop harmonised classification proposals amongst registrants**
- **The Substance Evaluation process involves individual Member State Competent Authorities (MSCAs) taking responsibility for specific chemicals of interest (CoRAP)**



Comparing Substance Evaluations within REACH against GreenScreen Assessments

REACH Substance Evaluations (SEv)

- The substance needs to be nominated by an MSCA and included by agreement on the CoRAP
- Has a prescribed process which oscillates between agreed Member State Committee Conclusions/Decisions and the required actions of Registrants to respond in a timely manner
- Each complete oscillation can take 2-3 years or more
- The primary purpose of the SEv is to derive a set of Risk Management Measures (RMMs) for the continued safe use of the substance
- Only exceptionally is the substance identified for listing as a Substance of Very High Concern (SVHC) and potentially subject to Authorisation or Restriction .This may happen in parallel through an Annex XV dossier .

GreenScreen Assessments

- GreenScreen Assessment is a much more rapid process allowing for substance hazard profiling at any point in time
- Data-gaps are recognised and where Assessments cannot be conclusive, there is a recognition of 'possible' issues
- The key difference between REACH regulatory outputs (e.g. the SEv Report) and GreenScreen is the basic simplicity of the GreenScreen outputs (Benchmarks 1 to 4)
- Regular review is triggered by the time-limited validity of any GreenScreen Assessment and allows for the updating of an Assessment based on additional data from REACH or elsewhere
- For those stakeholders recognising GreenScreen Assessments, they provide a consistent approach across the various jurisdictions

Areas for alignment between REACH and Greenscreen

- **Since GreenScreen represents a robust methodology that is based on a common dataset, it can be used to provide a reliable hazard profile during the REACH process**
- **Whereas, RMMs arising out of SEVs will take some time to emerge and be applied under a regulatory framework, GreenScreen can be used to compare alternatives at an earlier stage**
- **The simple GreenScreen Benchmarking system allows for easier hazard comparisons to be made within the relevant supply-chains**
- **Existing REACH Consortia may find it useful to include a GreenScreen Assessment as an adjunct to the more formal REACH SEv process**
- **It must be recognised that GreenScreen is primarily a hazard assessment tool and exposure parameters may still be relevant**



GreenScreen Resources

- [GreenScreen Overview](#)
- [GreenScreen List Translator Overview](#)
- [GreenScreen for Safer Chemicals Hazard Assessment Guidance v1.4](#)
- [Alternatives to Methylene Chloride in Paint and Varnish Strippers Report](#)
- [Online GreenScreen Introductory Training](#)

Licensed GreenScreen Profilers

<https://www.greenscreenchemicals.org/professionals/profilers>

NSF International

www.nsf.org



WAP Sustainability Consulting

<http://www.wapsustainability.com/>



SciVera LLC

www.scivera.com/services.php



Gradient

<https://gradientcorp.com/>



ToxServices LLC

www.toxservices.com



Licensed GreenScreen Consultants

<https://www.greenscreenchemicals.org/assess/greenscreen-consultants>

Anthesis (North America and UK)

<https://www.thesisgroup.com/>



WAP Sustainability Consulting

<http://www.wapsustainability.com/>



Pure Strategies

<https://purestrategies.com/>

