Chemical Hazard Assessments, Safer Ingredients, and Alternative Assessments: Three Tools for Reducing Toxics in Our Lives

Craig Manahan

Washington Department of Ecology

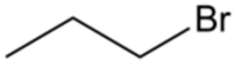
Hazardous Waste and Toxics Reduction

DEPARTMENT OF ECOLOGY
State of Washington

2013 NYT Video

Video here:
https://vp.nyt.com/video/2013/03/31/20021_1_cushion-makers_wg_480p.mp4

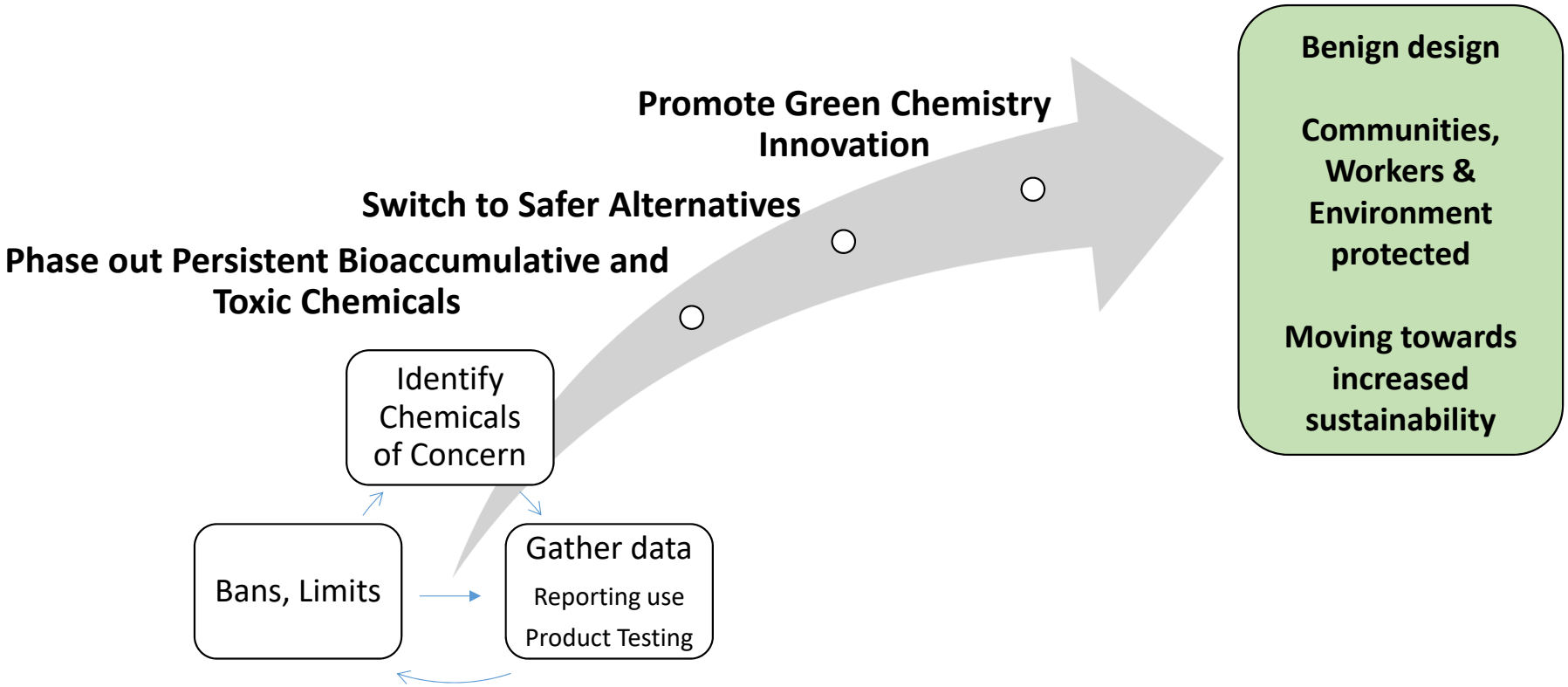
1-Bromopropane/N-propylbromide



- Colorless liquid solvent
- Also used in asphalt production and cleaning products for auto body shops, dry cleaners, and electronics manufacturing
- Sheri worked for 5 years from 2007-2012 without adequate ventilation or respirators
- n-PB damaged nerve endings causing a “dead foot”
- Recommendations by ACGIH that fumes at workplace stay below 10 ppm (now 0.1 ppm), EPA recommends <25 ppm. Royale tested as “equal or greater than 100 ppm”
- OSHA still has no workplace limit for n-PB

Prevent and Reduce Toxic Threats

Averting toxic exposure is the smartest, cheapest, and healthiest approach.



WA Product Laws

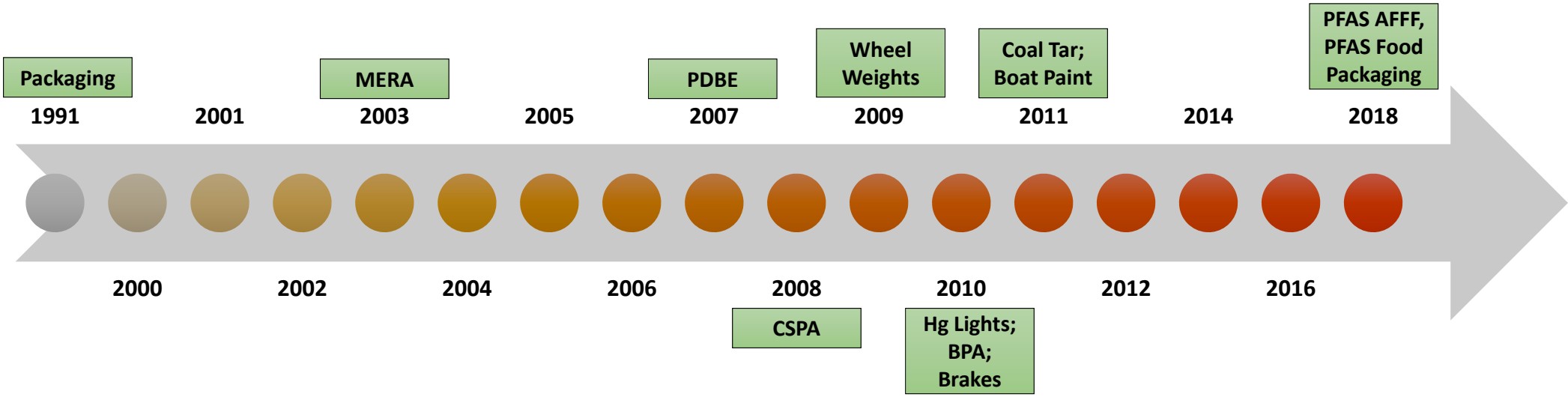
LAW Title	Passed	RCW	Effective
Packages containing metals	1991	70.95G	July 1993
Mercury	2003	70.95M	Jan 2006
PBDE flame retardants	2007	70.76	Jan 2008/2011
Children's safe products	2008	70.240	July 2011/2017
Replacement of lead wheel weights	2009	70.270	Jan 2011
Bisphenol-A restrictions on sale	2010	70.280	July 2011/2012
Brake friction material	2010	70.285	Jan 2015
Stormwater pollution – Coal tar	2011	70.295	Jan 2012
Recreational water vessels - anti-fouling paint	2011	70.300	Jan 2018/2020
PFAS Aqueous Fire Fighting Foam	2018	70.75A	Jul. 2018/2020
PFAS Food Contact Material	2018	70.95G	Jan 2022

WA Chemicals Regulated

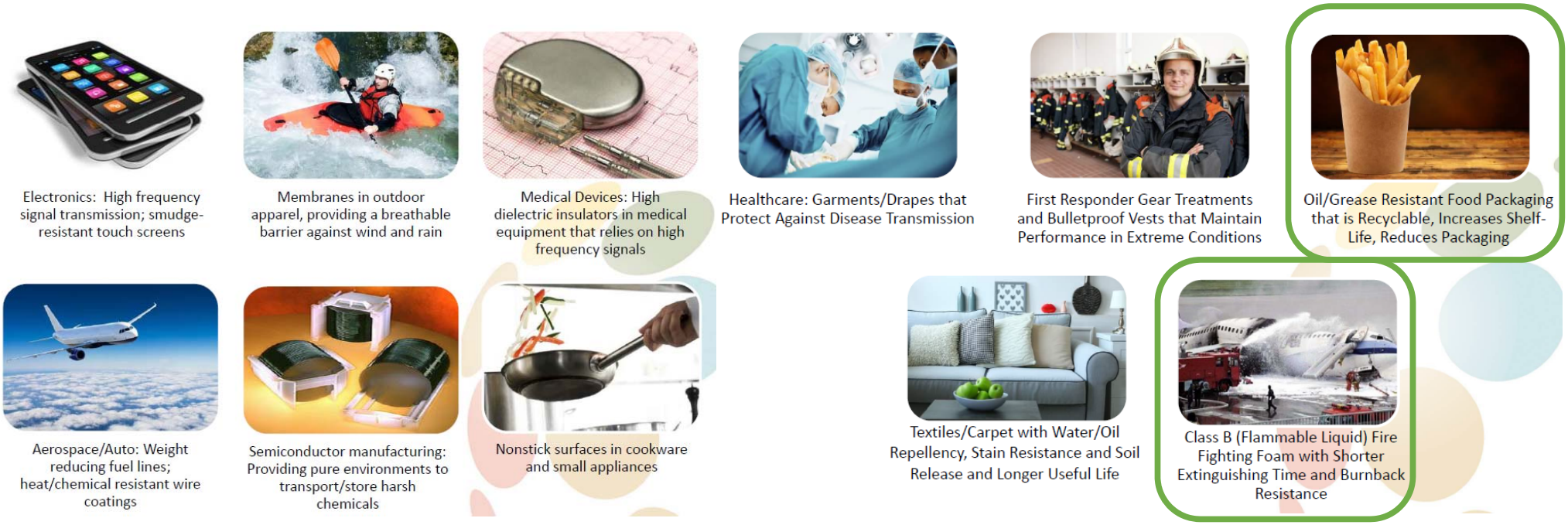
LAW Title	Chemicals
Packages containing metals	Lead, Mercury, Cadmium, Hex Chromium
Mercury	Mercury
PBDE flame retardants	Penta-, Octa-, and Deca-brominated diphenyl ethers
Children's safe products	Lead, cadmium, 6 phthalates, 5 flame retardants
Replacement of lead wheel weights	Lead
Bisphenol-A restrictions on sale	Bisphenol A
Brake friction material	Asbestos, Cadmium, Hex Chromium, Lead, Mercury, Copper
Stormwater pollution – Coal tar	Coal tar pitch, PAH
Recreational water vessels - anti-fouling paint	Copper
PFAS Aqueous Fire Fighting Foam	PFAS
PFAS Food Contact Material	PFAS

PAH: polycyclic aromatic hydrocarbons
PCB: polychlorinated biphenyls

Timeline


Packaging
1991
2001
MERA
2003
2005
PDBE
2007
Wheel Weights
2009
Coal Tar; Boat Paint
2011
2014
PFAS AFFF, PFAS Food Packaging
2018
2000
2002
2004
2006
2008
CSPA
2010
Hg Lights; BPA; Brakes
2012
2016

PFAS-Containing Products

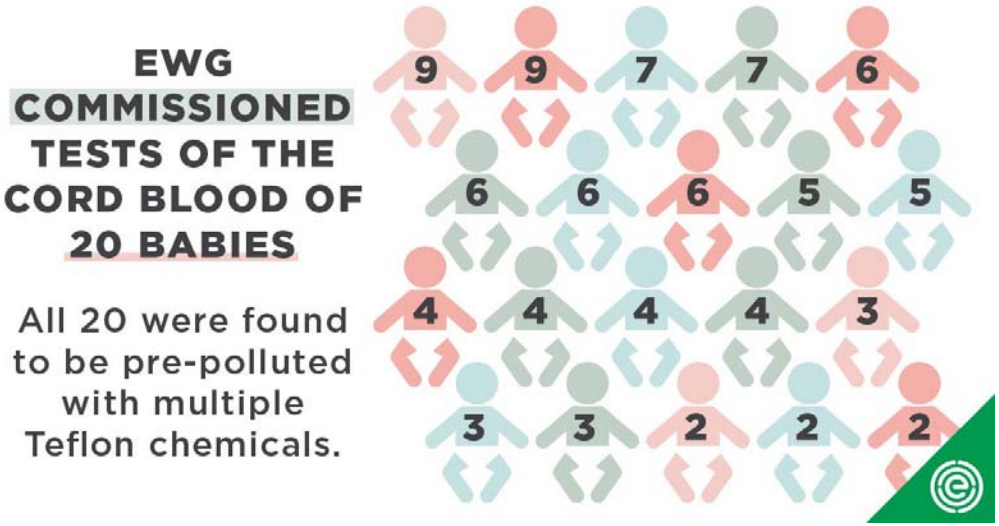


https://fluorocouncil.com/fluorocouncil/about/
https://pfas-1.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_naming_conventions__3_16_18.pdf

*Buck, Robert C., et al. "Perfluoroalkyl and polyfluoroalkyl substances in the environment: terminology, classification, and origins." *IEA&M* 7.4 (2011): 513-541.

PFAS Concerns

- Cancer, Kidney and Liver Disease
- Weakened Childhood Immunity
- Low birth weight
- Altered development
- Food and drinking water most likely sources of exposure
- Persistent “Forever Chemical”



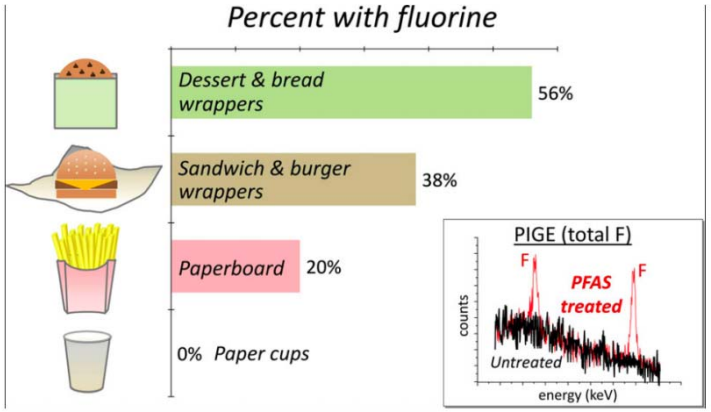
www.ewg.org

Why Food Packaging?

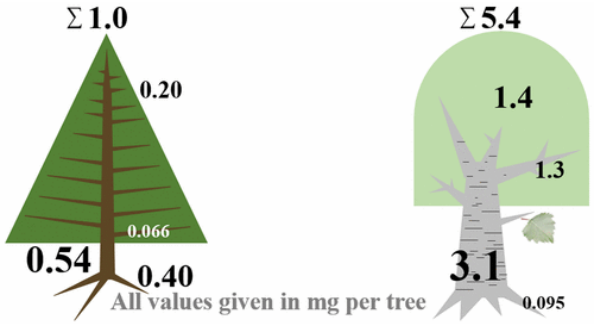
Not addressed by FDA approvals.

Some Potential Food-related PFAS Exposure Routes

- Food via PFAS in food-contact materials.
- Food/packaging to compost/biosolids to food.
  - Beneficial reuse of manufacturing waste.
  - Home recycling (e.g., Seattle), composting.
- Releases from manufacturing operations.



Percent of food packaging with fluorine from nationwide study (Schaider et al., 2017 p. 105).



PFAS accumulate in plants

Food Packaging Restrictions

Revised Code of Washington 70.95G

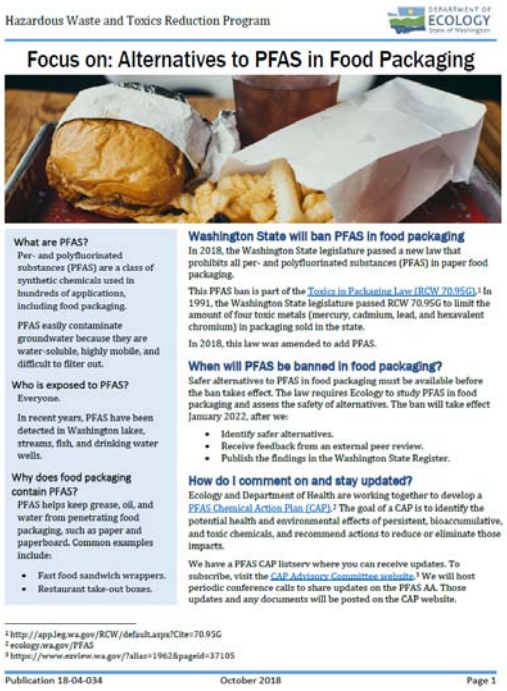
January 2022

- No manufacture, sale or distribution of PFAS containing food packaging.

BUT first:

- "Identifies that **safer alternatives** are available, and the safer alternative determination is supported by feedback from an **external peer review of the department's alternatives assessment"**:

http://app.leg.wa.gov/rcw/default.aspx?cite=70.95G
https://fortress.wa.gov/ecy/publications/documents/1804034.pdf



Hazardous Waste and Toxics Reduction Program

DEPARTMENT OF ECOLOGY State of Washington

Focus on: Alternatives to PFAS in Food Packaging

What are PFAS?
Per- and polyfluorinated substances (PFAS) are a class of synthetic chemicals used in hundreds of applications, including food packaging.

PFAS easily contaminate groundwater because they are water-soluble, highly mobile, and difficult to filter out.

Who is exposed to PFAS?
Everyone.

In recent years, PFAS have been detected in Washington lakes, streams, fish, and drinking water wells.

Why does food packaging contain PFAS?
PFAS helps keep grease, oil, and water from penetrating food packaging, such as paper and paperboard. Common examples include:

- Fast food sandwich wrappers.
- Restaurant take-out boxes.

Washington State will ban PFAS in food packaging
In 2018, the Washington State legislature passed a new law that prohibits all per- and polyfluorinated substances (PFAS) in paper food packaging.

This PFAS ban is part of the Toxics in Packaging Law (RCW 70.95G).[1] In 1991, the Washington State legislature passed RCW 70.95G to limit the amount of four toxic metals (mercury, cadmium, lead, and hexavalent chromium) in packaging sold in the state.

In 2018, this law was amended to add PFAS.

When will PFAS be banned in food packaging?
Safer alternatives to PFAS in food packaging must be available before the ban takes effect. The law requires Ecology to study PFAS in food packaging and assess the safety of alternatives. The ban will take effect January 2022, after we:

- Identify safer alternatives.
- Receive feedback from an external peer review.
- Publish the findings in the Washington State Register.

How do I comment on and stay updated?
Ecology and Department of Health are working together to develop a PFAS Chemical Action Plan (CAP).[2] The goal of a CAP is to identify the potential health and environmental effects of persistent, bioaccumulative, and toxic chemicals, and recommend actions to reduce or eliminate those impacts.

We have a PFAS CAP listserv where you can receive updates. To subscribe, visit the CAP Advisory Committee website.[3] We will host periodic conference calls to share updates on the PFAS AA. Those updates and any documents will be posted on the CAP website.

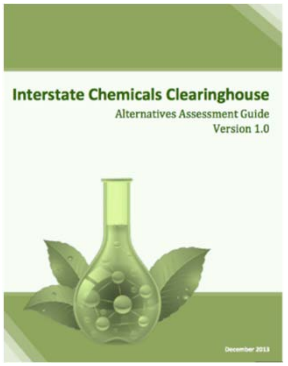
[1] http://app.leg.wa.gov/RCW/default.aspx?Cite=70.95G
[2] ecology.wa.gov/PFAS
[3] https://www.ezview.wa.gov/?alias=1962&pageid=37105

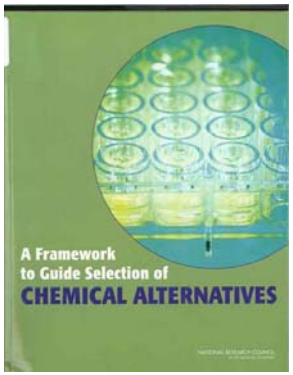
Publication 18-04-034 October 2018 Page 1

Assess Viable Alternatives

Alternatives Assessment- Process for identifying and comparing potential chemical and non-chemical existing alternatives used as substitutes to replace chemicals or technologies of high concern.

Look at **Hazard**, Exposure, Performance, Cost/Availability, Materials Management, Social Impact, Life Cycle





Phase out hazardous chemicals? YES!

But what about the alternatives?

Frying Pan

Fire!

Regrettable Substitution

Process example- Glue Spray Adhesives

The New York Times

U.S.

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POLITICS EDUCATION TEXAS

Sotheby's
INTERNATIONAL REALTY
PROPERTIES

As OSHA Emphasizes Safety, Long-Term Health Risks Fester

New York Times, March 30, 2013

1,1,1-trichloroethane (TCE)

-damages ozone

-Neurotoxin

Methylene Chloride

(OSHA PEL)

-Safe for ozone

-Carcinogen/Neurotoxin

n- Propyl bromide

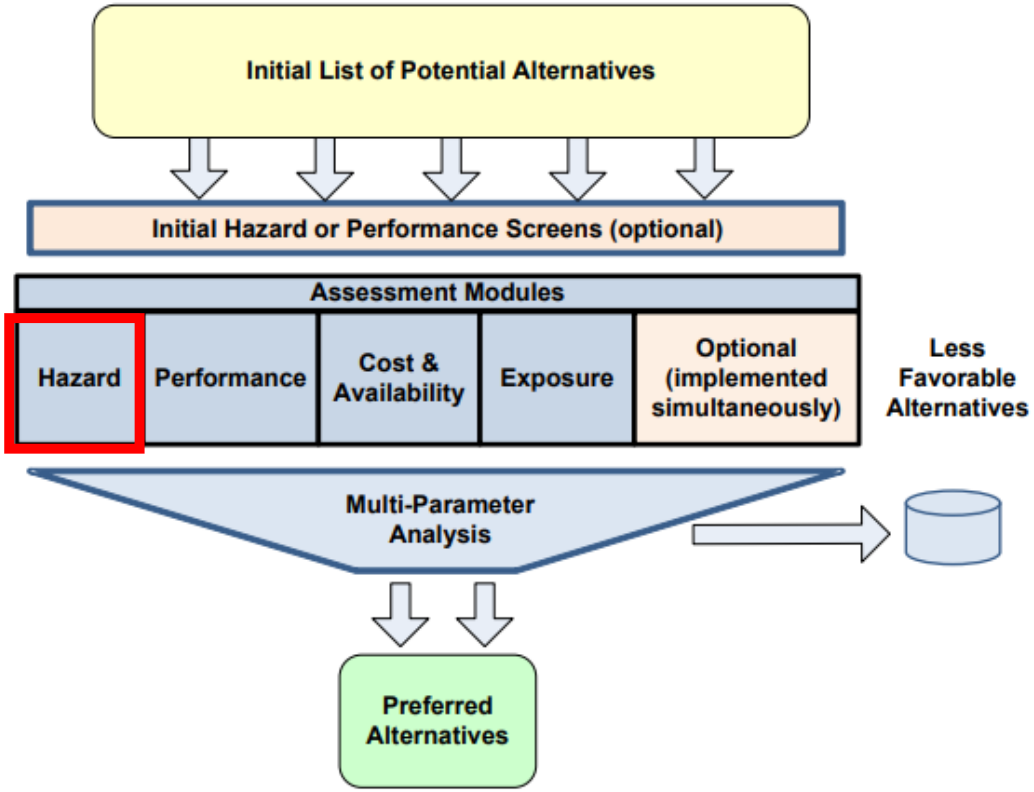
(no OSHA PEL)

-Safe for ozone

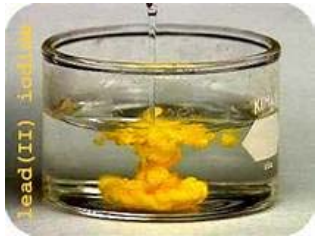
-Carcinogen/CNS

Video here:
https://vp.nyt.com/video/2013/03/31/20021_1_cushion-makers_wg_480p.mp4

Example Frameworks for AA

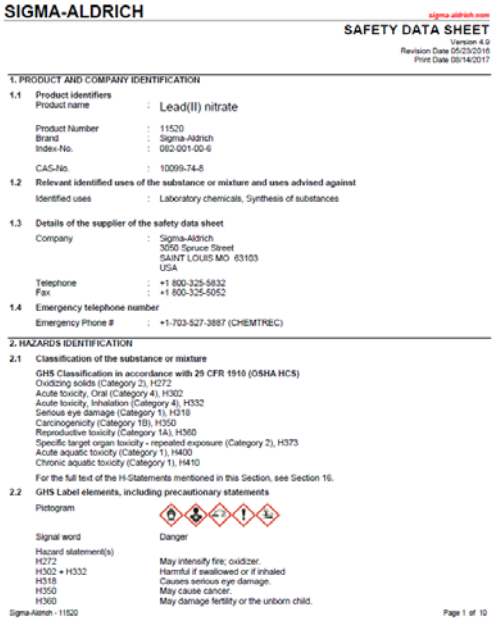


What are the Chemical Hazards?



How would you find out?

SDS



SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.9
Revision Date 05/23/2016
Print Date 08/14/2017

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Lead(II) nitrate

Product Number : 11520
Brand : Sigma-Aldrich
Index-No. : 082-001-00-6

CAS-No. : 10099-74-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Oxidizing solids (Category 2), H272
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Serious eye damage (Category 1), H318
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 1A), H360
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H272 May intensify fire; oxidizer.
H302 + H332 Harmful if swallowed or if inhaled
H318 Causes serious eye damage.
H350 May cause cancer.
H360 May damage fertility or the unborn child.

Sigma-Aldrich - 11520 Page 1 of 10

DEPARTMENT OF ECOLOGY State of Washington

Example Chemical Hazards

Human Health		Environmental Toxicity & Fate	Physical Hazards
Carcinogenicity	Acute Mammalian Toxicity	Acute/Chronic Aquatic Toxicity	Reactivity
Mutagenicity & Genotoxicity	Systemic Toxicity & Organ Effects	Terrestrial Toxicity	Flammability
Reproductive Toxicity	Neurotoxicity	Bioaccumulation	Eutrophication
Developmental Toxicity	Skin Sensitization	Persistence/ Biodegredation	
	Respiratory Sensitization		
Endocrine Activity	Skin Irritation	Ozone Depletion	
	Eye Irritation		

Scorecard

High

Medium

✓Low

Authoritative Lists

International Agency for Research on Cancer

World Health Organization

IARC Monographs on the Identification of Carcinogenic Hazards to Humans

AGENTS CLASSIFIED BY THE IARC MONOGRAPHS, VOLUMES 1–123

Group 1	*Carcinogenic to humans*	120 agents
Group 2A	*Probably carcinogenic to humans*	82
Group 2B	*Possibly carcinogenic to humans*	311
Group 3	*Not classifiable as to its carcinogenicity to humans*	500

CAS No.	Agent	Group	Volume	Year
989-38-8	Rhodamine 6G	3	16, Sup 7	1987
1071-83-6	Glyphosate	2A	112	2017
1072-52-2	2-(1-Aziridinyl)ethanol	3	9, Sup 7	1987
1116-54-7	*N*-Nitrosodiethanolamine	2B	17, Sup 7, 77	2000
1120-71-4	1,3-Propane sultone	2A	4, Sup 7, 71, 110	2017
1143-38-0	Dithranol	3	13; Sup 7	1987

GLYPHOSATE

1. Exposure Data

1.1 Identification of the agent

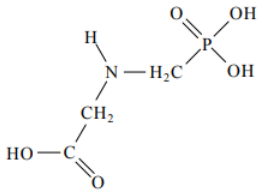
1.1.1 Nomenclature

Chem. Abstr. Serv. Reg. No.: 1071-83-6 (acid); also relevant:
38641-94-0 (glyphosate-isopropylamine salt)
40465-66-5 (monoammonium salt)
69254-40-6 (diammonium salt)
34494-03-6 (glyphosate-sodium)
81591-81-3 (glyphosate-trimesium)

Chem. Abstr. Serv. Name: *N*-(phosphonomethyl)glycine

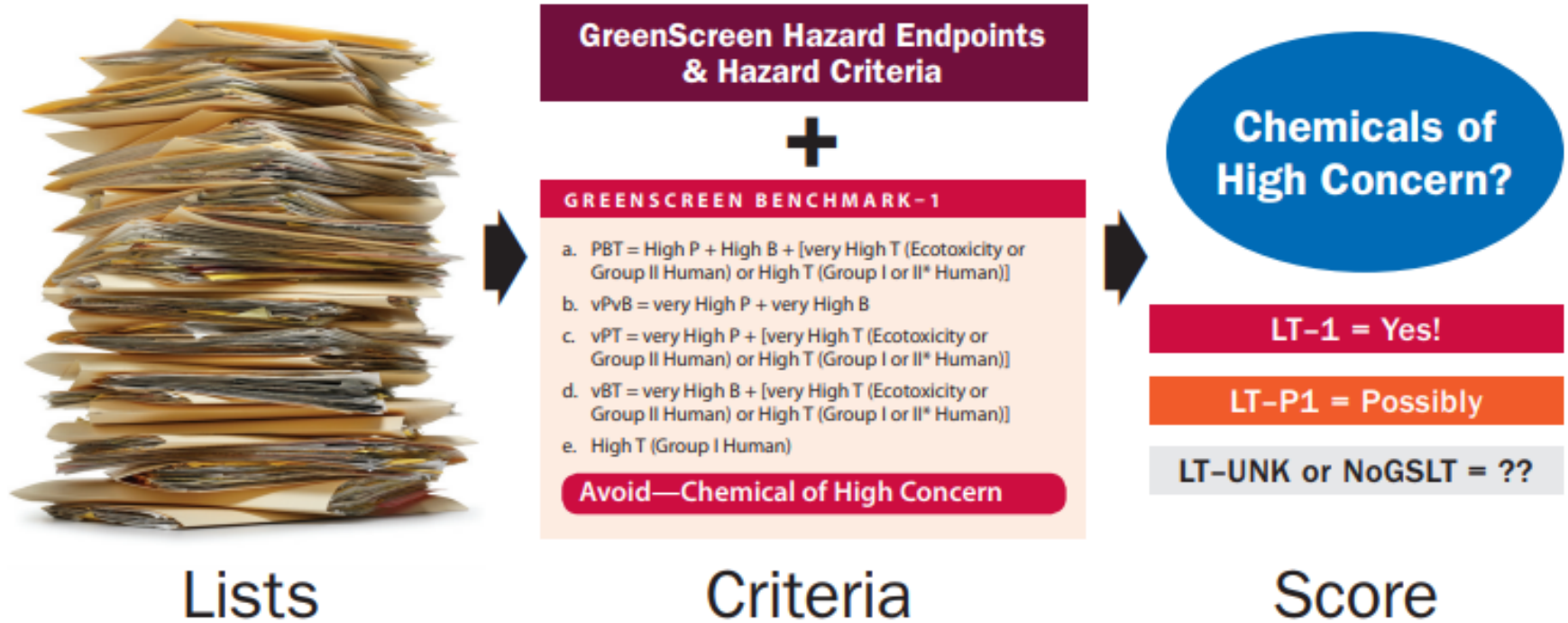
Preferred IUPAC Name: *N*-(phosphonomethyl)glycine

1.1.2 Structural and molecular formulae and relative molecular mass



Molecular formula: $C_3H_8NO_5P$
Relative molecular mass: 169.07
Additional information on chemical structure is also available in the PubChem Compound database (NCBI, 2015).

GreenScreen List Translator



From https://www.greenscreenchemicals.org

GreenScreen List Translator Published Method

SECTION V — ANNEX 12

GreenScreen List Translator™ Map

TABLE A12.1: **Human Health and Ecotox Lists (Single Hazard Endpoints)**

	GreenScreen Supporting List Information		GreenScreen List Translator					
ID	List	Sublist Category	GreenScreen Hazard	List Type	A or B	Hazard Range	Display in Hazard Box	List Translator Score
211	IARC	Group 1 – Agent is Carcinogenic to humans	Carcinogenicity	Authoritative	A	H	**H**	**1**
212	IARC	Group 2a – Agent is probably Carcinogenic to	Carcinogenicity	Authoritative	A	H	**H**	**1**
213	IARC	Group 2b – Possibly carcinogenic to humans	Carcinogenicity	Authoritative	A	M	**M**	**UNK**
214	IARC	Group 3 – Agent is not classifiable as to its carcinogenicity to humans	Carcinogenicity	Authoritative	B	H, M, or L	*UNK*	**UNK**

From https://www.greenscreenchemicals.org

GreenScreen List Translator Example

DICHLOROMETHANE aka Methylene Chloride

75-09-2

Hazard Summary

		Group I Human					Group II and II* Human									Ecotox			Fate	
	Score	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**
All List Hazards (show GreenScreen only)	LT-1	**H**	pC	*M*	*H-M*	*H-M*	*M*	pC	pC	*M-L*	*vH-M*			*H*	*H*	*M*		M	*vH-H*	pC
PubMed hits		>1K	466	29	20	42	131	68	68	41	41	0	43	20	7	4	8	-	28	9

Hazard Lists: 51

View More	Endpoint	Hazard Level	GSLT Score	GSLT List Type	List Name
>	Carcinogenicity	H	LT-1	Authoritative A	CA EPA - Prop 65: Carcinogen
	Mutagenicity/Genotoxicity	pC	NoGS	Not included in GreenScreen	EU - Manufacturer REACH hazard submissions: H341 - Suspected of causing genetic defects (unverified)
	Reproductive Toxicity	M	LT-UNK	Screening A	Japan - GHS: Toxic to reproduction - Category 2
	Developmental Toxicity incl. developmental neurotoxicity	H-M	LT-P1	Authoritative B	MAK: Pregnancy Risk Group B
	Endocrine Activity	H-M	LT-P1	Screening B	TEDX - Potential Endocrine Disruptors: Potential Endocrine Disruptor

GreenScreen List Translator Example

DataCommons

DICHLOROMETH

75-09-2

Hazard Summary

	Score	C
All List Hazards (show GreenScreen only)	LT-1	H
PubMed hits		>1K

Hazard Lists: 51

View More	Endpoint	Hazard Level	GSLT Score	GSLT List Type	List Name
>	Carcinogenicity	H	LT-1	Authoritative A	CA EPA - Prop 65: Carcinogen
	Mutagenicity/Genotoxicity	pC	NoGS	Not included in GreenScreen	EU - Manufacturer REACH hazard submissions: H341 - Suspected of causing genetic defects (unverified)
	Reproductive Toxicity	M	LT-UNK	Screening A	Japan - GHS: Toxic to reproduction - Category 2
	Developmental Toxicity incl. developmental neurotoxicity	H-M	LT-P1	Authoritative B	MAK: Pregnancy Risk Group B
	Endocrine Activity	H-M	LT-P1	Screening B	TEDX - Potential Endocrine Disruptors: Potential Endocrine Disruptor

Hazard Level	GSLT Score	GSLT List Type	List Name
H	LT-1	Authoritative A	CA EPA - Prop 65: Carcinogen
H	LT-1	Authoritative A	IARC: Group 2A - Agent is probably Carcinogenic to humans
H	LT-1	Authoritative A	US CDC - Occupational Carcinogens: Occupational Carcinogen
H	LT-1	Authoritative A	US EPA - IRIS Carcinogens: (2005) Likely to be Carcinogenic to humans
H	LT-1	Authoritative A	US NIH - Report on Carcinogens: Reasonably Anticipated to be Human Carcinogen
M	LT-UNK	Authoritative A	EU - Annex VI CMRs: Carcinogen Category 2 - Suspected human Carcinogen
M	LT-UNK	Authoritative A	EU - GHS (H-Statements): H351 - Suspected of causing cancer
M	LT-UNK	Authoritative A	MAK: Carcinogen Group 5 - Genotoxic carcinogen with very slight risk under MAK/BAT levels
H	LT-P1	Screening A	Japan - GHS: Carcinogenicity - Category 1A
M	LT-UNK	Screening A	Australia - GHS: H351 - Suspected of causing cancer
M	LT-UNK	Screening A	Malaysia - GHS: H351 - Suspected of causing cancer
M	LT-UNK	Screening A	New Zealand - GHS: 6.7B - Suspected human carcinogens

Compare Chemical Hazards

LT - P1 [71-55-6] 1,1,1-Trichloroethane

GreenScreen List Translator™ Score - LT-P1																				
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		M	M or L		M	H	H	UNK				H	H	vH	M	vH or H				Mult

LT - 1 [75-09-2] Dichloromethane

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*											
H		M	H or M	H or M	M	H	H	UNK				H	H	M	M	vH or H				Mult

LT - 1 [106-94-5] 1-Bromopropane

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*											
H		H	H		M	M	H	M or L				H	H	M	M	vH or H			H	Mult

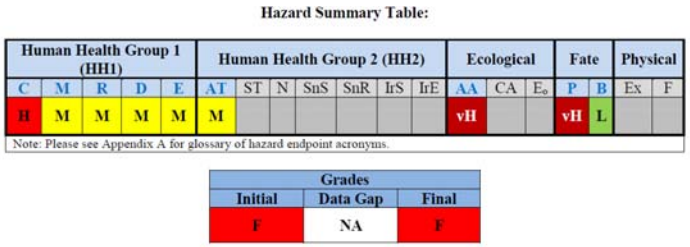
SOME Concern for adverse effects
MINIMAL Concern for adverse effects
NEGLIGIBLE Concern for adverse effects

Assess and Prioritize Chemical Hazards

Example Tools

- ChemHAT
- GreenScreen ® List Translator Tools +
  - Chemical Hazard Data Commons
  - ToxNot
  - Pharos
- Quick Chemical Assessment Tool (QCAT)
- GreenScreen®

Complexity

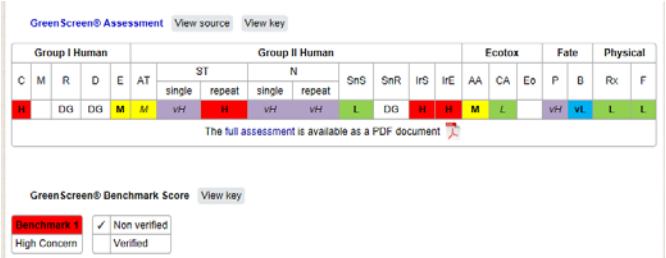


Hazard Summary Table:

Human Health Group 1 (HH1)					Human Health Group 2 (HH2)							Ecological			Fate		Physical	
C	M	R	D	E	AT	ST	N	SnS	SnR	IrS	IrE	AA	CA	E_o	P	B	Ex	F
H	M	M	M	M	M							vH			vH	L		

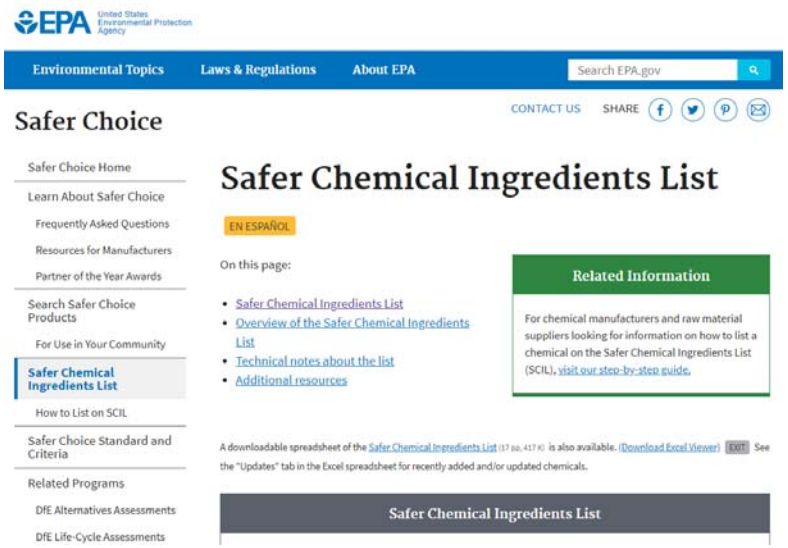
Note: Please see Appendix A for glossary of hazard endpoint acronyms.

Grades		
Initial	Data Gap	Final
F	NA	F



EPA Safer Choice

Safer Chemical Ingredient List



- **Please Select:** All Functional Use Classes
- **or Select a Functional Use Class:**
  - Antimicrobial Actives
  - Chelating Agents
  - Colorants
  - Defoamers
  - Emollients
  - Enzymes and Enzyme Stabilizers
  - Fragrances
  - Oxidants and Oxidant Stabilizers
  - Polymers
  - Preservatives and Antioxidants
  - Processing Aids and Additives
  - Skin Conditioning Agents
  - Solvents
  - Specialized Industrial Chemicals
  - Surfactants
  - Uncategorized

- Chemicals are marked as a green circle, green half-circle, yellow triangle

CLEANGREDIENTS

Safer Choice Approved Ingredients:

- Product Name
- Company
- Functional Class
- Max use %
- Direct Release Criteria

https://cleangredients.org/database/

www.epa.gov/saferchoice/safer-ingredients

EPA Safer Choice Product Labeling Program

SAFER CHOICE
Meets U.S. EPA Safer Product Standards
epa.gov/saferchoice

Fragrance Free
SAFER CHOICE
Meets U.S. EPA Safer Product Standards
epa.gov/saferchoice

SAFER CHOICE
Meets U.S. EPA Safer Product Standards
epa.gov/dfesaferchoice

Search Products that Meet the Safer Choice Standard

EN ESPAÑOL

Looking for safer cleaning and other products? Use the search box below to find products that meet the Safer Choice Standard.

Search Products

Product or Company Name (Optional)

Home or Business Use (Optional)

Show only:

- ☐ Fragrance-free products[1]
- ☐ Products with outdoor uses[2]

Product Type (Optional)

Note: in the product listing, the notation ("‡") means that the partner company is overdue for their yearly partnership review with Safer Choice.

Some product types:

- All Purpose Cleaners
- Floor Strippers
- HVAC Maintenance
- Medical Instrument Cleaners
- Odor Removers
- "Other Business Products"

https://www.epa.gov/saferchoice/products

Regrettable Substitution

Alternatives

- 2001 EPA Alternatives Assessment
  - Best! Water-based Latex Adhesives
  - Acetone-based Adhesives
    - On Safer Chemical Ingredient List

⚠	Acetone	67-64-1	Specialized Industrial Chemicals

GreenScreen List Translator™ Score - LT-P1

Group I Human					Group II and II* Human									Ecotox		Fate	
C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B
						single	repeated*	single	repeated*								
		M	H or M	H or M		H or M		M or L				M	H			vH or H	

[67-64-1] LT - P1
Acetone

GreenScreen List Translator™ Score - LT-1

Group I Human					Group II and II* Human									Ecotox		Fate	
C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B
						single	repeated*	single	repeated*								
H		H	H		M	M	M	M or L				H	H	M		vH or H	

[106-94-5] LT - 1
1-Bromopropane

Regrettable Substitution

Alternatives

- 2011 DTSC Alternatives Assessment
  - Water-based Latex Adhesives
  - Acetone-based Adhesives
    - On Safer Chemical Ingredient List

Figure 1: GreenScreen® Hazard Ratings for Acetone

Group I Human					Group II and 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*										
L	L	M	M	M	L	M	M	M	M	L	L	M	H	L	L	vL	vL	L	H

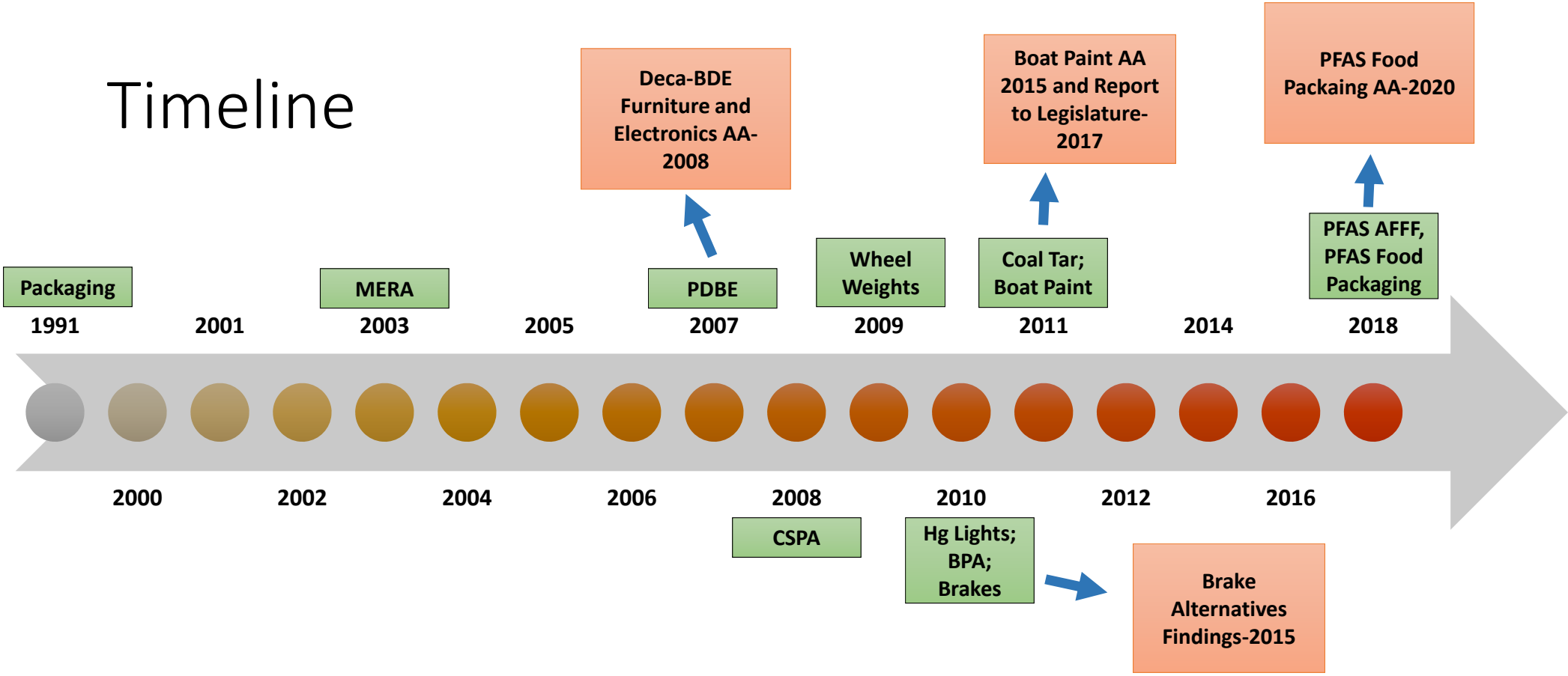
BM-2

[67-64-1]
Acetone

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

[106-94-5] LT - 1
1-Bromopropane

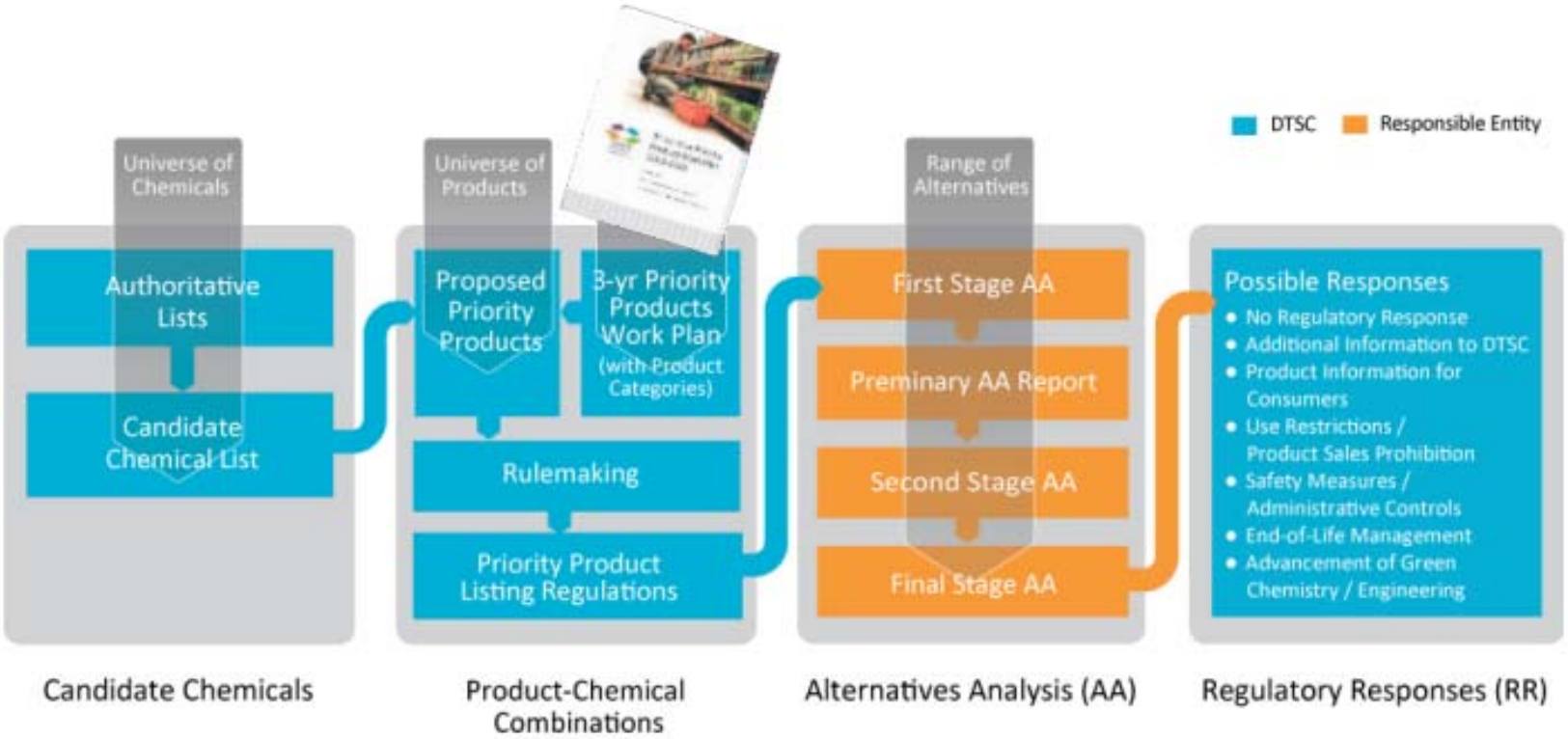
Timeline

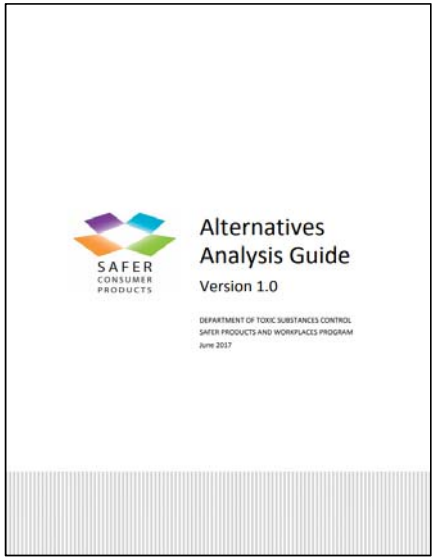

Deca-BDE Furniture and Electronics AA-2008
Boat Paint AA 2015 and Report to Legislature-2017
PFAS Food Packaing AA-2020
Packaging
MERA
PDBE
Wheel Weights
Coal Tar; Boat Paint
PFAS AFFF, PFAS Food Packaging
1991
2001
2003
2005
2007
2009
2011
2014
2018
2000
2002
2004
2006
2008
2010
2012
2016
CSPA
Hg Lights; BPA; Brakes
Brake Alternatives Findings-2015

Senate Bill 5135-Pollution Prevention For Our Future Act

- Every 5 years Ecology must
  - Identify 5 priority chemicals
  - Priority consumer products that are a source of priority chemicals
  - Determine regulatory actions on use of priority chemicals in priority consumer products
    - No action, provide notice, restrict or prohibit, require information.
  - To restrict or prohibit-the agency must determine “safer alternatives are feasible and available”

California DTSC Priority Products





OSHA Training Institute Education Centers
University of Washington

CONTINUING EDUCATION PROGRAMS
NORTHWEST CENTER FOR OCCUPATIONAL HEALTH AND SAFETY

Training Opportunity: OSHA 7225-Transitioning to Safer Chemicals

- OSHA's seven-step substitution planning process
- Hands-on activities connect to:
  - Case Studies
- Tools, related resources and databases

https://osha.washington.edu/osha/course/transitioning-safer-chemicals

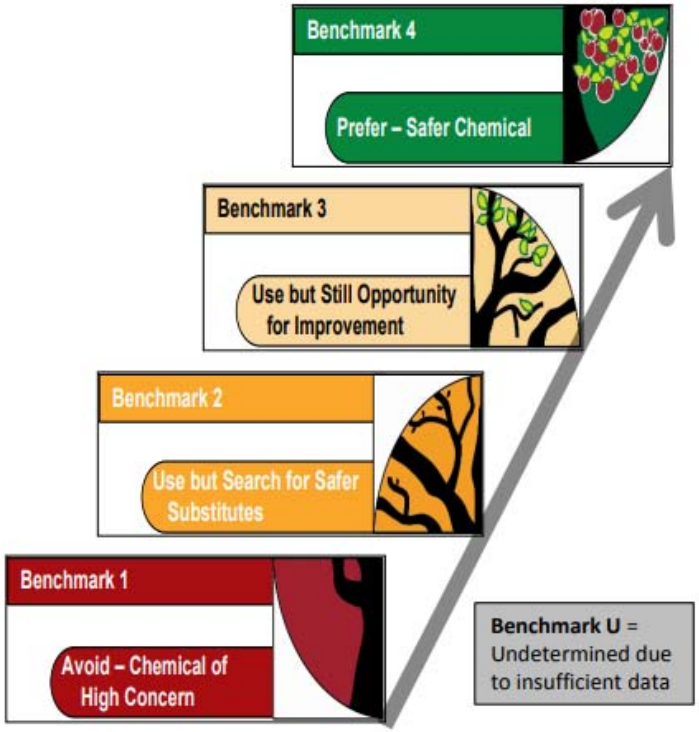
2019 dates posted!

DEPARTMENT OF ECOLOGY State of Washington

Thank You
Any Questions?

Craig Manahan
Craig.Manahan@ecy.wa.gov

Overall Chemical Grading System: GreenScreen®



From https://www.greenscreenchemicals.org

Benchmark 1 (BM-1) criteria	
PBT	Persistent and Bioaccumulative and Toxic (human or environment)
vPvB	Very Persistent and very Bioaccumulative
vPT	Very Persistent and Toxic (human or environment)
vBT	Very Bioaccumulative and Toxic (human or environment)
CMRDE	Carcinogen, and/or mutagen, and/or reproductive or developmental toxicant, and/or endocrine disruptor

Make More Informed Decisions: Which Chemical Would YOU Use?

The chemical of concern is a solvent used in cleaning products

Chemical Name	Score	C	M	R	D	E	AT	ST	ST*	N	N*	SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
		Carcinogenicity	Mutagenicity	Reproductive	Developmental	Endocrine	Acute Toxicity	Systemic Toxicity	Systemic Toxicity	Neurotoxicity	Neurotoxicity*	Skin Sensitization	Respiratory Sensitization	Skin Irritation	Eye Irritation	Acute Aquatic	Chronic Aquatic	Persistence	Bioaccumulation	Reactivity	Flammability
Chemical of Concern	GS BM 1	H	H	*M*	M	DG	vH	L	M	L	*M*	*H*	H	*H*	H	vH	vH	vH	*vH*	*L*	*L*
Alternative Alpha	GS BM 2	L	M	*L*	*L*	DG	*L*	*M*	*M*	*M*	*M*	*M*	L	*M*	M	M	L	L	*M*	M	M
Alternative Beta	GS BM 2	M	DG	*L*	*L*	*M*	*H*	DG	DG	*M*	*M*	*M*	*M*	*M*	*H*	*M*	*M*	*H*	*M*	M	M

Paint Strippers- Unintended Consequences

2010- male 52, co-owner of a bathtub refinishing company, - refinishing a bathtub in an apartment bathroom that was approximately 5 feet by 8 feet with an 8-foot ceiling. He was using a product that contained 60%–100% methylene chloride. The bathroom ceiling had a 50 cubic feet per minute ventilation fan; however, **the fan was off**. The man wore **latex gloves and did not wear respiratory protection or use engineering controls** (e.g., a local exhaust ventilation system) to vent the methylene chloride vapor.

……

An apartment maintenance man entered the apartment to look for the man and found him behind the closed bathroom door, unresponsive, and slumped over the tub.

…..

The man was declared dead at the hospital.

References- https://www.youtube.com/watch?v=8lG6dAZE52k&feature=youtu.be&list=PL43A44D61109073BC
https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6107a2.htm?s_cid=mm6107a2_w

OSHA Toolkit for Transitioning to Safer Chemicals

UNITED STATES DEPARTMENT OF LABOR

Find it in OSHA

Occupational Safety and Health Administration

ABOUT OSHA | WORKERS | EMPLOYERS | REGULATIONS | ENFORCEMENT | TOPICS | NEWS & PUBLICATIONS | DATA | TRAINING

Transitioning to Safer Chemicals: A Toolkit for Employers and Workers

- Home
- Why Transition to Safer Alternatives?
- Basics of Informed Substitution and Alternatives Assessment
- Success Stories
- Explore the Steps

Welcome.

American workers use tens of thousands of chemicals every day. While many of these chemicals are suspected of being harmful, only a small number are regulated in the workplace.

As a result, workers suffer more than 190,000 illnesses and 50,000 deaths annually related to chemical exposures.[i] Workplace chemical exposures have been linked to cancers, and other lung, kidney, skin, heart, stomach, brain, nerve, and reproductive diseases.

Establishing a chemical management system that goes beyond simply complying with OSHA standards and strives to reduce or eliminate chemical hazards at the source through informed substitution best protects workers. Transitioning to safer alternatives can be a complex undertaking, but a variety of existing resources make it easier. OSHA has developed this step-by-step toolkit to provide employers and workers with information, methods, tools, and guidance on using informed substitution in the workplace.

By using this toolkit, businesses can improve worker well-being through eliminating or reducing hazardous chemicals, while creating other benefits, including:

- Cost Savings — Reduce expenses and future risks.
- Efficiency — Improve performance.
- Industry Leadership — Invest in innovation to stay competitive.
- Corporate Stewardship — Advance socially responsible practices.

This toolkit can be used by all types of businesses—it is for manufacturers using chemicals in their production processes as well as for businesses that use products containing chemicals in their everyday operations. For example, service-oriented workplaces (such as janitorial companies, auto body repair shops, and pathology labs) and construction work sites often use products containing chemicals that could present hazards to workers.

Workers also can use this toolkit to better understand chemical use in their workplace, find opportunities for using safer chemicals, and engage with their employers throughout the process of identifying, evaluating, and transitioning to safer alternatives.

OSHA wants to help businesses thrive safely by asking them to look at their chemical use and adopt ways to reduce the use of hazardous chemicals. Together, OSHA, employers, and workers can protect America's workforce and strengthen America's businesses.

OSHA

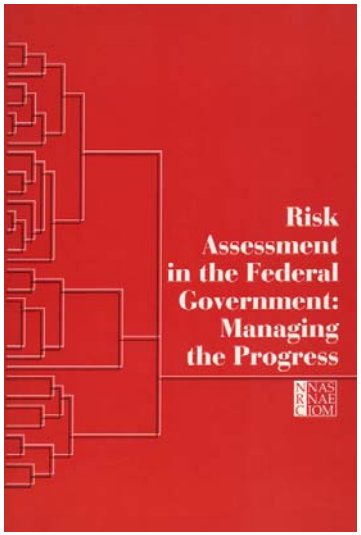
www.osha.gov/dsg/safer_chemicals/

Common Question

Is the Chemical or material safe enough for its intended use?

Risk Assessment

- Evaluates whether products on the market impact human health and the environment
  - Determine hazard(s)
  - Estimate exposure
  - Decide does the product cause harm during intended use?



Online Green Chemistry and Chemical Stewardship Certificate Program

CONTINUING EDUCATION PROGRAMS
NORTHWEST CENTER FOR OCCUPATIONAL HEALTH AND SAFETY

*67% of global executives agree that sustainability strategies are necessary to be competitive.**

PROGRAM DATES
Sept 27, 2017–June 8, 2018

COMPLIMENTARY INFORMATION SESSIONS
April 18, 2017 10:00–11:00 am
May 23, 2017 12:00–1:00 pm
July 11, 2017 5:30–6:30 pm
Sessions hosted via Adobe Connect
All times are PST.

To sign up for an online information session, visit the eLearning page of our website, **osha.washington.edu**

REGISTRATION
Registration opens March 1, 2017
$910 per course
Successful completion of all three courses is required to receive a certificate.

Register online at **osha.washington.edu,**

Businesses are facing increasing market and regulatory pressures to use less toxic chemicals in their manufacturing processes and products, and are in need of professionals who can provide innovative solutions and more sustainable substitutes.

WHAT YOU WILL LEARN
During this 3-course program, we will explore:
- The 12 guiding principles of green chemistry
- Business drivers and barriers to implementing sustainable practices
- Frameworks for incorporating chemical toxicity and human health considerations into product design, material selections, and supply chain decision-making
- Environmental, economic, and societal benefits of green chemistry
- The latest research and regulatory developments in the field
- New tools for chemical design and methods for comparative chemical hazard assessments

THIS PROGRAM IS FOR **YOU**
- Engineers, chemists, and materials scientists
- Environmental product managers
- Supply chain decision-makers
- Risk management researchers
- Product stewardship professionals
- Safety and health professionals
- Graduate level students in related fields
- High School teachers and academic faculty
- Legal professionals
- Building designers and architects

Designed for:
Professionals interested in learning and applying the principles of alternative chemistries and green toxicology in their work

First Certificate started in 2015

2019 Enrollment information available now.

Three-course online certificate program

1. Sustainability, Toxicology & Human Health
2. Principles of Green Chemistry
3. Assessment Tools for Safer Chemical Decisions

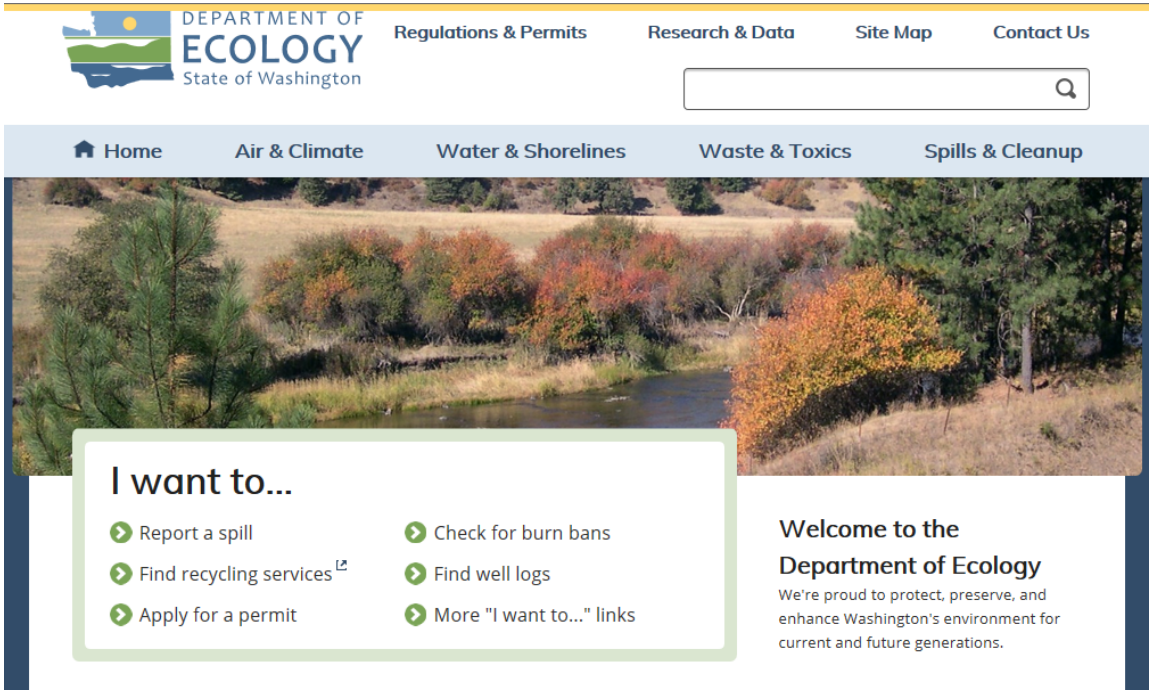
https://osha.washington.edu/pages/green-chemistry-chemical-stewardship-online-certificate-program

DEPARTMENT OF ECOLOGY State of Washington

Washington Department of Ecology

Do we regulate PFAS?

- Dangerous waste rule.
- Children's safe products reporting rule.
- Chemical action plan under PBT rule.
- Firefighting foam law.
- Food contact paper law.



https://ecology.wa.gov/

What if Safer Alternatives don't Exist?

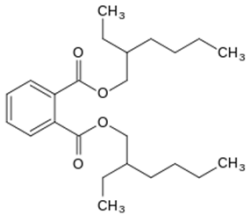
Green Chemistry: The **design** of chemical products and processes that **reduce or eliminate** the use and generation of hazardous substances.

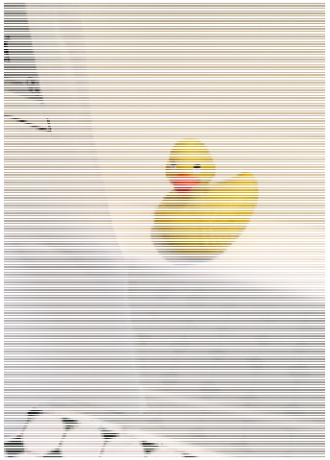
- **What is the function of the product?**
- **How can I meet this function using Green Chemistry Principles?**

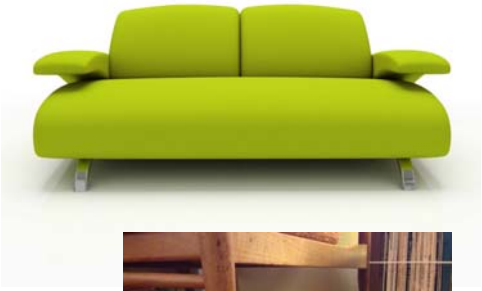
Hazard **Exposure**

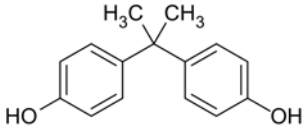
*Anastas, P.T.; Warner, J.C., Green Chemistry: Theory and Practice, Oxford University Press, 1998.

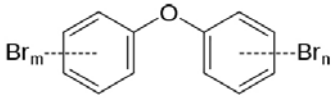
What do a duck, a couch, and thermal receipts have in common?

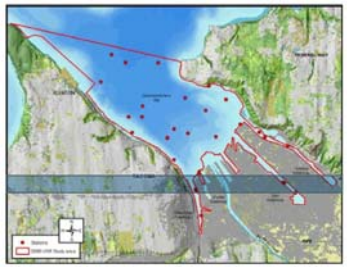


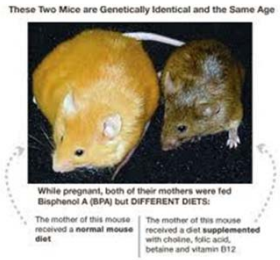


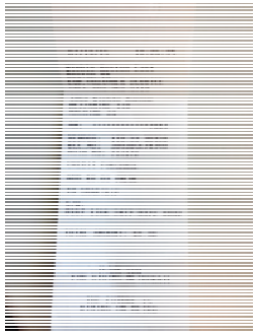


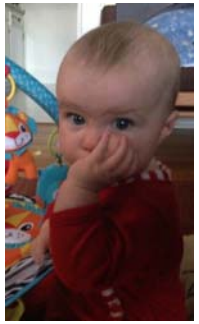












Life Cycle of a Product

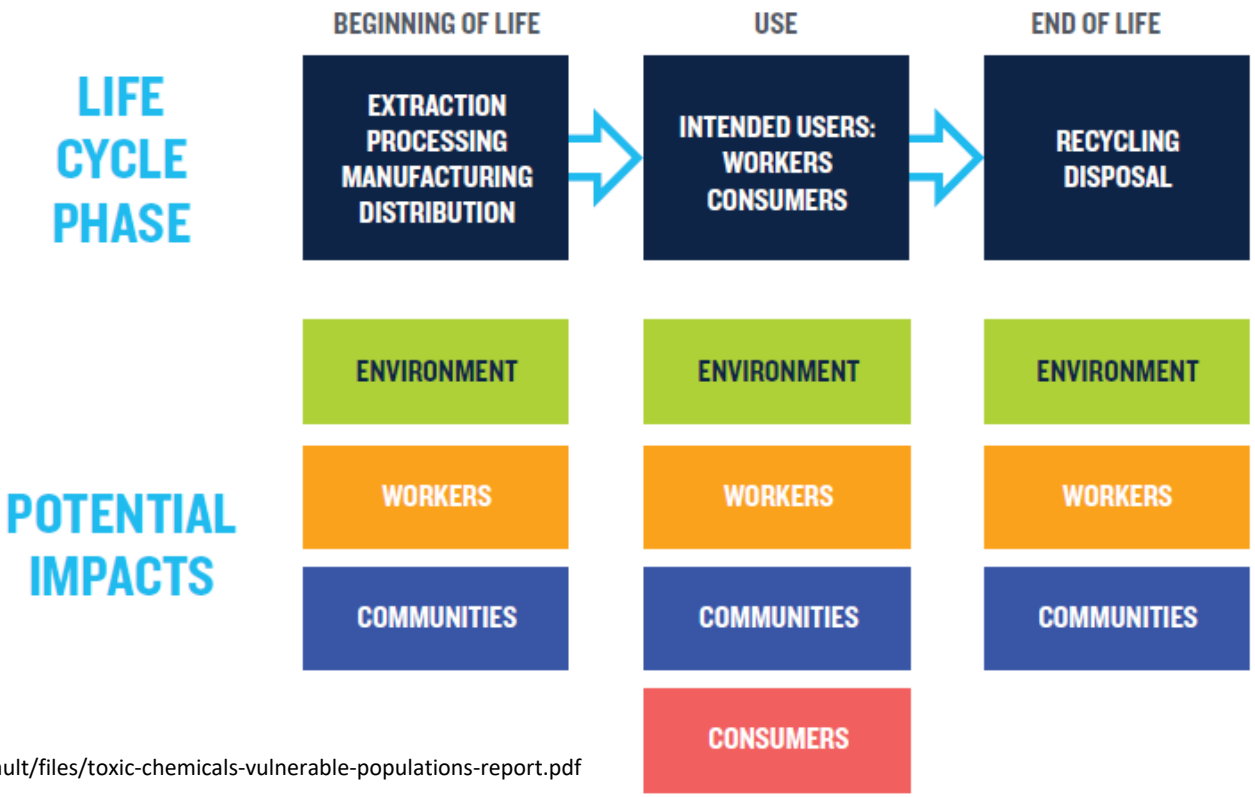
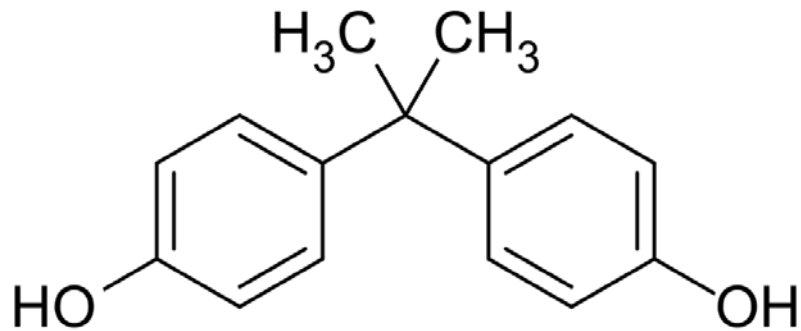


Figure 1 from:
https://www.nrdc.org/sites/default/files/toxic-chemicals-vulnerable-populations-report.pdf

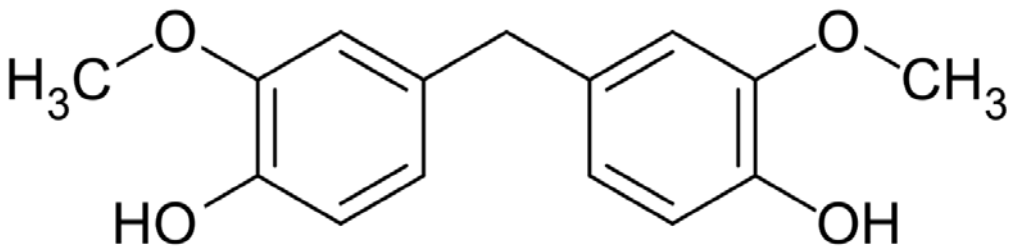
Bisguaiacol F (BGF)

Innovation- new Chemical



BPA

- Thermosets
- Thermoplastics

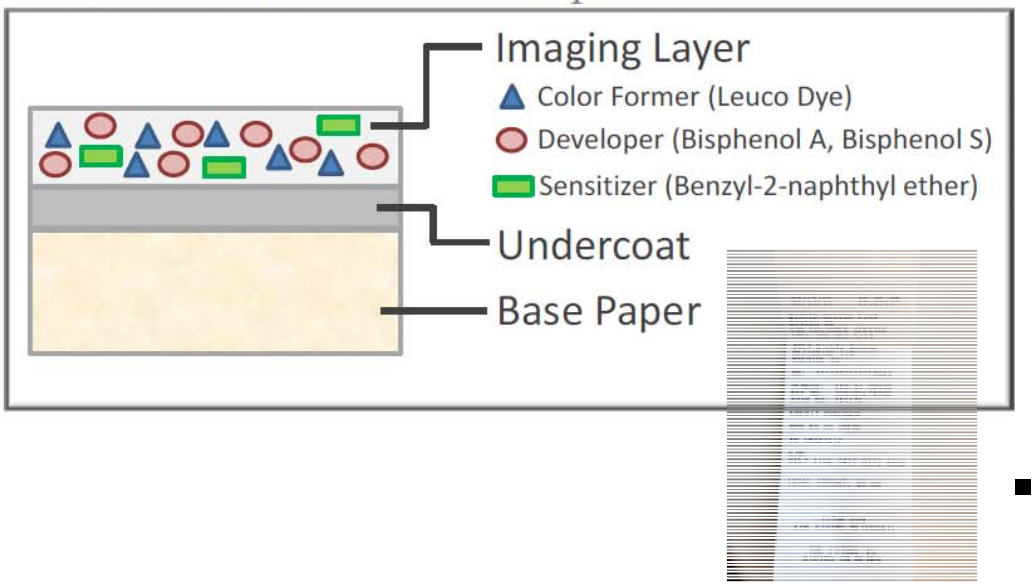


BGF

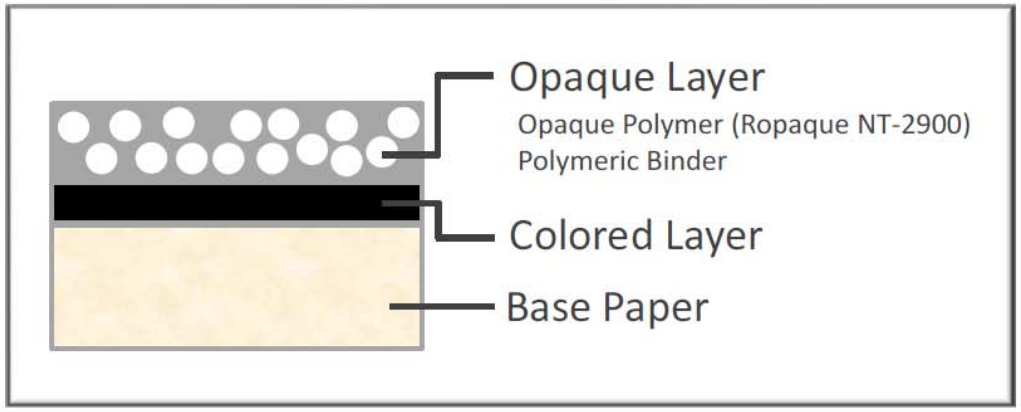
Thermal Papers

2017 Presidential Green Chemistry Challenge Award Winner

Traditional Thermal Paper Structure



New Voided Thermal Paper Structure



- Complete elimination of chemical developer

Thermal Paper Figure from:
Dow and Koehler's joint Presidential Green Chemistry Nomination Application

https://www.epa.gov/greenchemistry/presidential-green-chemistry-challenge-winners

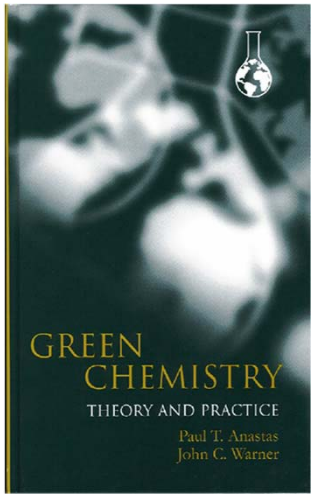
12 Principles of Green Chemistry

Eliminate/Reduce Hazard
(3,4,5,10,12)

Minimize Material, Waste and Energy use
(1,2,6,8,9,11)

Renewable Feedstock
(7)

1. Prevention
2. Atom Economy
3. **Less Hazardous Chemical Synthesis**
4. **Designing Safer Chemicals**
5. **Safer Solvents and Auxiliaries**
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis
10. **Design for Degradation**
11. Real-time Analysis for Pollution Prevention
12. **Inherently Safer Chemistry for Accident Prevention**



Some other trainings/webinars

DEPARTMENT OF ECOLOGY State of Washington

Regulations & Permits | Research & Data | Site Map | Contact Us | Search

Home | Air & Climate | Water & Shorelines | Waste & Toxics | Spills & Cleanup

Training and events

Ecology works with other organizations to offer webinars, in-person training, and other opportunities to build the skills you need to explore safer chemicals.

- **Safer Chemistry Training for Businesses**
  This collection of webinars introduces basic green chemistry concepts but also teaches advanced lessons in specific tools and applications of green chemistry.
- **Transitioning to Safer Chemicals training**
  This 1.5-day course from the University of Washington School of Public Health and the U.S. Occupational Safety and Health Administration teaches participants about transitioning to safer chemicals and the key methods, tools, and databases that can assist in that process.
- **University of Washington's Green Chemistry & Chemical Stewardship Online Certificate Program**
  This 8-month online program teaches participants fundamental principles of green chemistry and frameworks for incorporating toxicity and human health into product design, material selections, and supply chain decision-making.
- **GreenScreen® hazard assessment trainings**
  Find a wide range of training options for all levels of expertise ranges from free introductory online webinars to in-depth training to assess chemical hazards as an Authorized GreenScreen® Practitioner™.
- **Online Summer Green Chemistry Courses for High School teachers**
  Introductory and Advanced online summer courses are offered each year to provide educators tools to integrate green chemistry principles and practices into their classroom. These courses are online and structured in an interactive go-at-your-own-pace format. Optional graduate education credits available.
- **YouTube playlist of training videos**
  Check out past Safer Choice webinars, an OSHA 7225 training, and more on our YouTube channel.

Ecology.wa.gov/SaferAlternatives

GreenScreen List Translator:
https://www.greenscreenchemicals.org/resources/entry/webinar-a-dive-into-greenscreen-list-translator

Data Commons:
https://www.greenscreenchemicals.org/resources/entry/webinar-chemical-hazard-data-commons

Green Chemistry - Finding Safer Alternatives for Occupational Applications
https://youtu.be/_F5t10ZgPlI

Safer Choice:
https://www.beyondbenign.org/webinar/epa-safer-choice-program/

Toxics in Packaging Law (RCW 70.95G)

- Amended in 2018 to include PFAS in food packaging
- (1) Beginning January 1, 2022, no person may manufacture, knowingly sell, offer for sale, distribute for sale, or distribute for use in this state **food packaging to which PFAS chemicals have been intentionally added** in any amount. This prohibition may not take effect until the department of ecology completes the following: (a) Identifies that **safer alternatives** are available, and the safer alternative determination is supported by feedback from an **external peer review of the department's alternatives assessment**; and (b) **publishes findings**, as required under subsection (3) of this section.

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- (2) To determine whether safer alternatives to PFAS chemicals exist, the department of ecology must conduct an alternatives assessment as part of the PFAS chemical action plan that:
  - (a) Evaluates less toxic chemicals and nonchemical alternatives to replace the use of a chemical;
  - (b) Follows the guidelines for alternatives assessments issued by the interstate chemicals clearinghouse; and
  - (c) Includes, at a minimum, an evaluation of chemical hazards, exposure, performance, cost, and availability.
- (3) By January 1, 2020, the department of ecology must publish its findings in the Washington State Register on whether safer alternatives to PFAS chemicals in specific applications of food packaging are available for each assessed application and submit a report with the findings and the feedback from the peer review of the department's alternatives assessment to the appropriate committees of the legislature. In order to determine that safer alternatives are available, the safer alternatives must be readily available in sufficient quantity and at a comparable cost, and perform as well as or better than PFAS chemicals in a specific food packaging application. If an alternative is a chemical, it must have previously been approved for food contact by the United States food and drug administration, such as through the issuance of a determination that the chemical has a reasonable certainty of causing no harm.

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- 4) The prohibition on the use of PFAS chemicals in food packaging:
  - (a) Becomes effective January 1, 2022, if the report required under subsection (3) of this section finds that safer alternatives are available for specific food packaging applications;
  - (b) Does not take effect January 1, 2022, if the report required under subsection (3) of this section does not find that safer alternatives are available for specific food packaging applications.
- (5) If the department of ecology does not find that a safer alternative is available for some or all categories of food packaging applications, beginning January 1, 2021, **and each year following, the department of ecology must review and report on alternatives** as described in subsection (2) of this section. The prohibition in this section for specific food packaging applications **takes effect two years after a report** submitted to the legislature required under subsection (3) of this section finds that safer alternatives are available.