Pharos in the Classroom – Designing safer spaces and products

Rena Miu - Healthy Building Network
Hanno Erythropel, PhD - Yale University
Bobby Ilg, M. Arch - Algonquin College

HEALTHY BUILDING NETWORK
KNOW BETTER

Agenda

1. Pharos introduction
2. Pharos in the Fundamentals of Green Chemistry & Green Engineering course
3. Using Pharos to investigate building material ingredients and chemical sensitivities
4. Q+A

MISSION

To advance human and environmental health by improving hazardous chemical transparency and inspiring product innovation

About Pharos

146K

Chemicals, polymers, metals & other substances

20K

Chemicals with functional use data

800

Compound Groups

300

Full Green Screen Hazard Assessments

GreenScreen® for Safer Chemicals

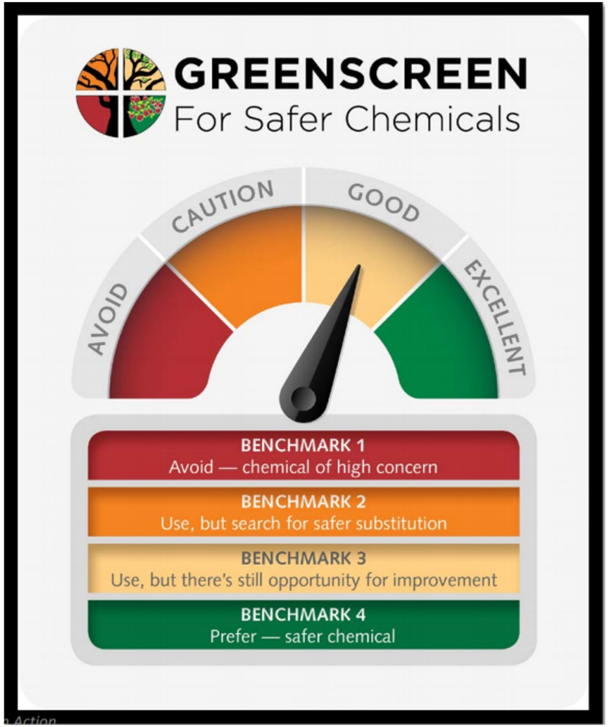
A comparative chemical hazard assessment method.

Provides a simple rating system to help decision makers compare chemicals.

Developed by the nonprofit organization Clean Production Action.

GreenScreen List Translator

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



Save Time Finding Hazard Information

- Screen chemicals for hazards
- Utilize the power of compound groups

Screen Chemicals for Hazards

8001-54-5

Benzalkonium chloride

ALSO CALLED [8045-21-4] ALKYL DIMETHYLBENZYLAMMONIUM CHLORIDE (primary CASRN is 8001-54-5), [12741-06-9] Benzalk...

View all synonyms (10)

Share Profile

Hazards | Properties | Functional Uses | Process Chemistry | Resources

All Hazards View

Show PubMed Results | Request Assessment | Add to Comparison

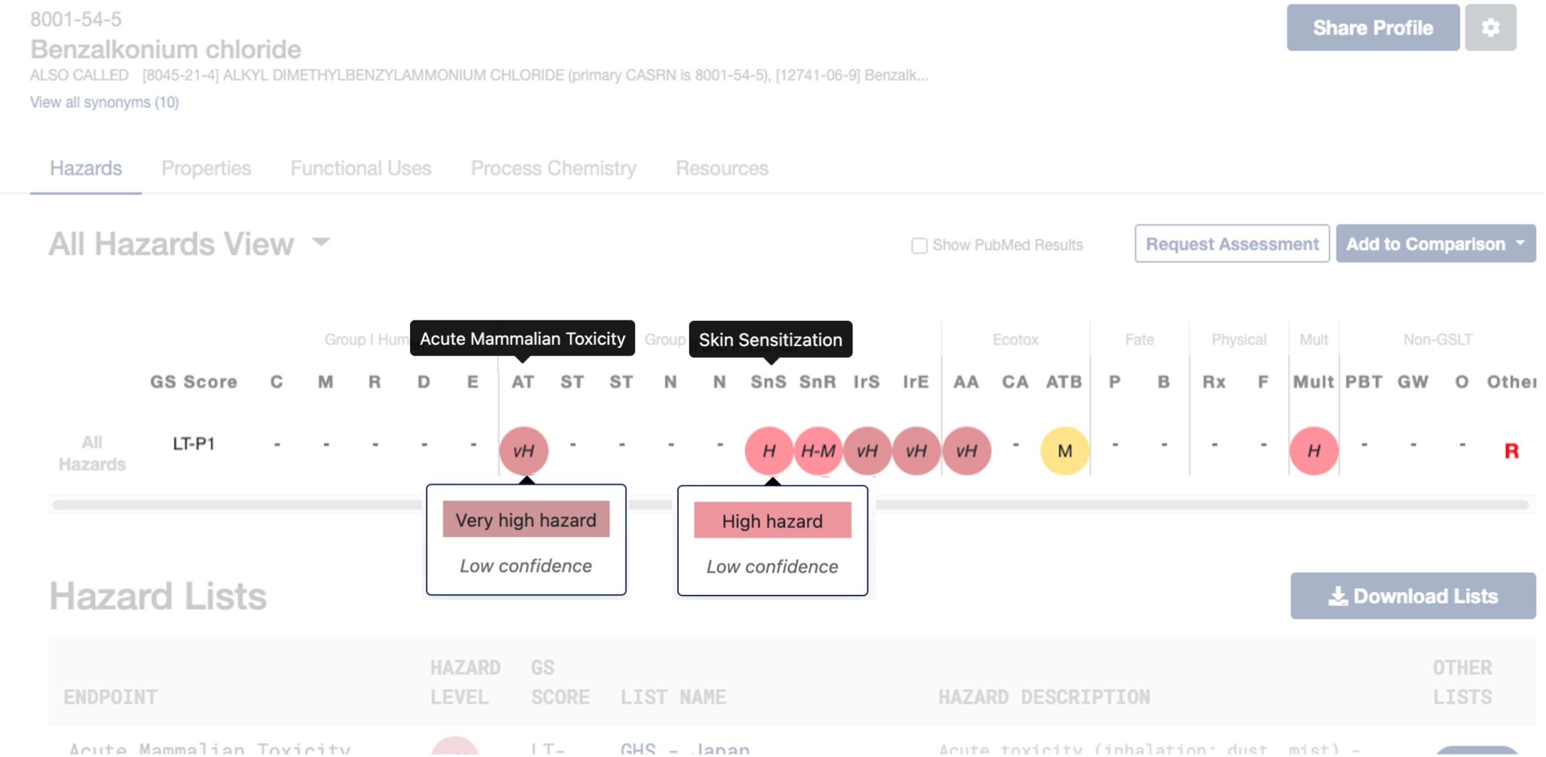
		Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult	Non-GSLT			
	GS Score	C	M	R	D	E	AT	ST	ST	N	N	SnS	SnR	IrS	IrE	AA	CA	ATB	P	B	Rx	F	Mult	PBT	GW	O	Other
All Hazards	LT-P1	-	-	-	-	-	vH	-	-	-	-	H	H-M	vH	vH	vH	-	M	-	-	-	-	H	-	-	-	R

Hazard Lists

Download Lists

ENDPOINT	HAZARD LEVEL	GS SCORE	LIST NAME	HAZARD DESCRIPTION	OTHER LISTS
Acute Mammalian Toxicity	vH	LT-UNK	GHS - Japan	Acute toxicity (inhalation: dust, mist) - Category 2 [H330]	+12

Screen Chemicals for Hazards



Identify chemicals of interest

electronic solvents

Search

Chemicals (0) | Common Products (0) | Functional Uses (22) | Other Resources (0)

Add to Comparison

FAQ

CHEMICAL	FUNCTION	PRODUCT TYPE	PRODUCT NAME	SOURCE
Carbon disulfide 75-15-0	mfr of rayon, carbon tetrachloride, xanthogenates, soil disinfectants, electronic vacuum tubes. solvent for phosphorus, sulfur, selenium, bromine, iodine, fats, resins, rubbers			
PERFLUORO COMPOUNDS, C5-18 86508-42-1	these specialty chemicals are used primarily in the industrial electronics industry ... . the principal applications include industrial heat transfer in semiconductor processing, electronics testing and solvents for computer disc drive lubrication			
TRICHLOROTRIFLUOROETHANE (CFC-113 ISOMER) 354-58-5	used as a solvent for cleaning electronic equipment and degreasing of machinery. /former use/			

Compare chemicals

		Group I Human					Group II and II* Human										Ecotox			Fate		Physical		Mult	Non-GSLT			
Chemical	**GS**	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**	**Rx**	**F**	**Mult**	**PBT**	**GW**	**O**	**Other**
PERFLUORO COMPOUNDS, C5-18 86508-42-1	BM-1	M	DG	DG	DG	DG	L	L	L	DG	DG	DG	DG	L	L	L	L	-	vH	vH	L	L	-	-	-	-	R
Methyl alcohol 67-56-1	BM-1	L	L	L	H	DG	H	L	L	vH	L	L	L	L	M	L	L	-	vL	vL	L	H	-	-	-	-	R
Isopropyl alcohol 67-63-0	BM-2	L	L	M	M	DG	L	vH	L	M	L	M	DG	M	H	L	L	-	vL	vL	H	H	-	-	-	-	R
ACETONE 67-64-1	LT-P1	H-L	-	M	H-M	H-M	pC	pC	-	M-L	vH-M	-	-	-	H	-	-	-	vH-H	-	-	H	H	-	-	-	R
Methylchloroform 71-55-6	LT-1	H	-	M	M-L	-	M	-	pC	-	vH-M	pC	-	H	H	vH	-	-	vH-H	-	pC	pC	vH	-	M	vH	R
BUTYL ACETATE 123-86-4	LT-UNK	-	-	-	M-L	-	M	pC	-	M-L	-	-	-	-	H	M	-	-	vH-H	-	-	M	M	-	-	-	R
Methylene chloride 75-09-2	LT-1	H	pC	M	H-M	H-M	M	pC	pC	M-L	vH-M	-	-	H	H	M	-	-	vH-H	pC	-	-	vH	-	pC	-	R
1,1,2-Trichloro-1,2,2-trifluoroethane 76-13-1	LT-P1	-	-	-	H-L	-	-	-	-	-	-	-	-	-	M	H	-	-	vH-H	-	-	-	vH	-	H	vH	R
Stoddard solvent 8052-41-3	LT-1	H	H	-	-	-	H	pC	H	pC	vH-L	-	-	H	pC	vH	-	-	-	vH	-	M	H	-	-	-	R
Carbon disulfide 75-15-0	BM-1	M	L	H	H	H	vH	vH	H	M	H	L	DG	H	H	H	H	-	vH	vL	L	vH	-	-	-	-	R
TRICHLOROTRIFLUOROETHANE (CFC-113 ISOMER) 354-58-5	LT-UNK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	pC	-	-	vH-H	-	-	-	U	-	-	vH	R
1,1,2,2-TETRACHLORO-1,2-DIFUOROETHANE (CFC-112) 76-12-0	LT-UNK	-	-	-	H-L	-	M	-	-	-	-	-	-	H	M	pC	-	-	-	-	-	-	H	-	-	vH	R
1,2-Propylene oxide 75-56-9	BM-1	H	H	H	M	M	M	M	M	M	M	M	DG	H	H	M	DG	-	vH	vL	M	vH	-	-	-	-	R
2-Amino-2-methylpropanol 124-68-5	LT-UNK	-	-	-	M-L	-	-	-	-	-	-	-	-	H	H	M	-	-	-	-	-	M	H	-	-	-	R
Propylene carbonate 108-32-7	LT-UNK	-	-	-	M-L	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	U	-	-	-	R

Sort by different characteristics

GreenScreen Score → GS

Developmental toxicity → D

Eye irritation → IrE

Flammability → F

		Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult	Non-GSLT			
Chemical	**GS**	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**	**Rx**	**F**	**Mult**	**PBT**	**GW**	**O**	**Other**
PERFLUORO COMPOUNDS, C5-18 86508-42-1	BM-1	M	DG	DG	DG	DG	L	L	L	DG	DG	DG	DG	L	L	L	L	-	vH	vH	L	L	-	-	-	-	R
Methyl alcohol 67-56-1	BM-1	L	L	L	H	DG	H	L	L	vH	L	L	L	L	M	L	L	-	vL	vL	L	H	-	-	-	-	R
Carbon disulfide 75-15-0	BM-1	M	L	H	H	H	vH	vH	H	M	H	L	DG	H	H	H	H	-	vH	vL	L	vH	-	-	-	-	R
1,2-Propylene oxide 75-56-9	BM-1	H	H	H	M	M	M	M	M	M	M	M	DG	H	H	M	DG	-	vH	vL	M	vH	-	-	-	-	R
Methylchloroform 71-55-6	LT-1	H	-	M	M-L	-	M	-	pC	-	vH-M	pC	-	H	H	vH	-	-	vH-H	-	pC	pC	vH	-	M	vH	R
Methylene chloride 75-09-2	LT-1	H	pC	M	H-M	H-M	M	pC	pC	M-L	vH-M	-	-	H	H	M	-	-	vH-H	pC	-	-	vH	-	pC	-	R
Stoddard solvent 8052-41-3	LT-1	H	H	-	-	-	H	pC	H	pC	vH-L	-	-	H	pC	vH	-	-	-	vH	-	M	H	-	-	-	R
ACETONE 67-64-1	LT-P1	H-L	-	M	H-M	H-M	pC	pC	-	M-L	vH-M	-	-	-	H	-	-	-	vH-H	-	-	H	H	-	-	-	R
1,1,2-Trichloro-1,2,2-trifluoroethane 76-13-1	LT-P1	-	-	-	H-L	-	-	-	-	-	-	-	-	-	M	H	-	-	vH-H	-	-	-	vH	-	H	vH	R
BUTYL ACETATE 123-86-4	LT-UNK	-	-	-	M-L	-	M	pC	-	M-L	-	-	-	-	H	M	-	-	vH-H	-	-	M	M	-	-	-	R
TRICHLOROTRIFLUOROETHANE (CFC-113 ISOMER) 354-58-5	LT-UNK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	pC	-	-	vH-H	-	-	-	U	-	-	vH	R
1,1,2,2-TETRACHLORO-1,2-DIFUOROETHANE (CFC-112) 76-12-0	LT-UNK	-	-	-	H-L	-	M	-	-	-	-	-	-	H	M	pC	-	-	-	-	-	-	H	-	-	vH	R
Isopropyl alcohol 67-63-0	BM-2	L	L	M	M	DG	L	vH	L	M	L	M	DG	M	H	L	L	-	vL	vL	H	H	-	-	-	-	R

Access PubMed results

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Benzalkonium chloride

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View all synonyms (93)

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All Hazards	LT-P1	-	-	-	-	-	vH	-	-	-	-	H	H-M	vH	vH	vH	-	H	-	-	-	-	vH	-	-	-	R

Hazard Lists

Download Lists

ENDPOINT	HAZARD LEVEL	GS SCORE	LIST NAME	HAZARD DESCRIPTION	OTHER LISTS
Acute Mammalian Toxicity	vH	LT-UNK	GHS - Japan	H330 - Fatal if inhaled [Acute toxicity (inhalation: dust, mist) - Category 2]	+11

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☑ Show PubMed Results | **Request Assessment** | **Add to Comparison**

		Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult	Non-GSLT			
	GS Score	C	M	R	D	E	AT	ST	ST	N	N	SnS	SnR	IrS	IrE	AA	CA	ATB	P	B	Rx	F	Mult	PBT	GW	O	Other
All Hazards	LT-P1	-	-	-	-	-	vH	-	-	-	-	H	H-M	vH	vH	vH	-	H	-	-	-	-	vH	-	-	-	R
PubMed Results		>2K	430	33	97	23	91	86	86	38	38	19	72	62	25	70	2	-	67	3	0	0	-	0	3	0	-

Hazard Lists

Download Lists

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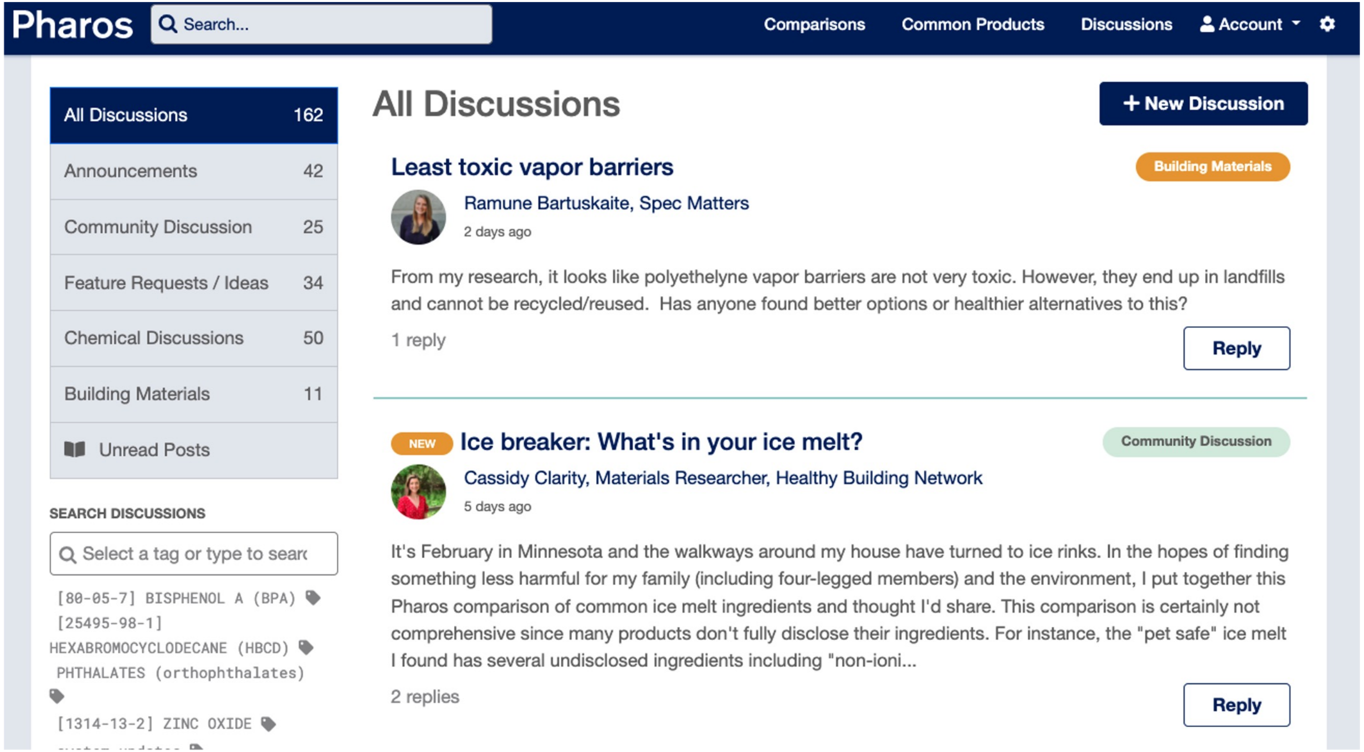
Acute Mammalian Toxicity	vH	LT-UNK	GHS - Japan	H330 - Fatal if inhaled [Acute toxicity (inhalation: dust, mist) - Category 2]	+11

Request a full chemical hazard assessment

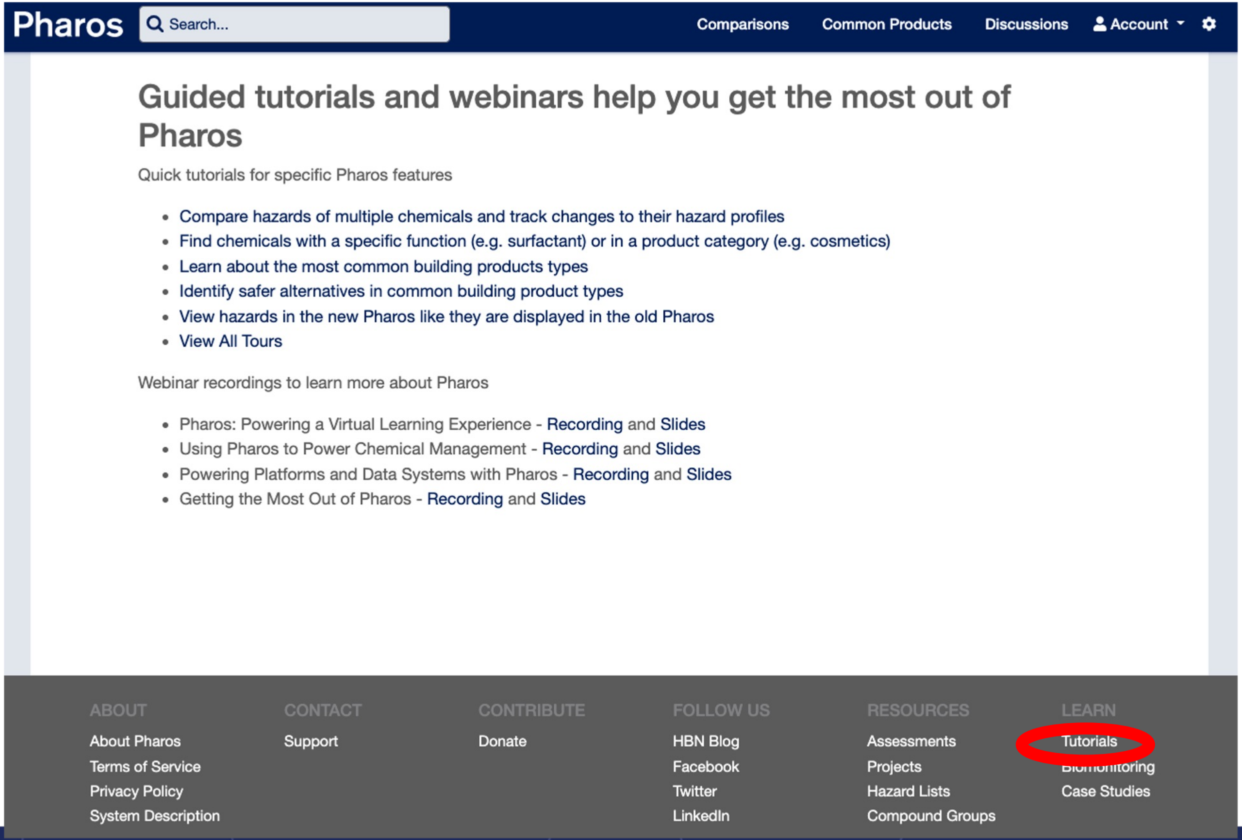
GREENSCREEN® FOR SAFER CHEMICALS

CHEM FORWARD know better chemistry

Access a Community of Experts



Learn More with Tutorials



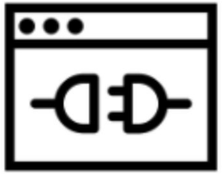
Pricing options

Annual	Monthly	Weekly	Daily	Discussions Only
$500	$75	$30	$10	Free

Discounts available

- Nonprofit, academic, and government users
- Multiple users
- Scholarships for students, classrooms, or other individuals with financial hardship (scholarships@healthybuilding.net)

Data services



Directly connect your company's data to Pharos via an Application Program Interface (API) and always have up to date information.

Generate custom Data Downloads from our system to power your internal chemicals management programs.

Thank you!

support@pharosproject.net

Center for Green Chemistry & Green Engineering at Yale

Pharos in the **Fundamentals of Green Chemistry & Green Engineering** Classroom: Designing Safer Spaces and Products

Dr. Hanno Erythropel
Lecturer & Associate Research Scientist

Fundamentals of Green Chemistry & Green Engineering

- Offered at the Yale School of the Environment
- Class size: 21 (early 2022: Omicron… hybrid)
- Mix of graduate & undergraduate students
- Backgrounds:
  - ➢ Chemical Engineering
  - ➢ Environmental Management
  - ➢ Public Health
  - ➢ Chemistry

Fundamentals of Green Chemistry & Green Engineering

Goals of the class include:

- Approaches and tools to assess the potential hazards of chemical & materials and how to redesign them to eliminate or minimize the hazards
- How chemistry and engineering can help address global human health and environmental issues.
- Students performed **assessments** of chemicals & materials, to inform the **design and innovation** of sustainable solutions alongside an industrial partner

Final

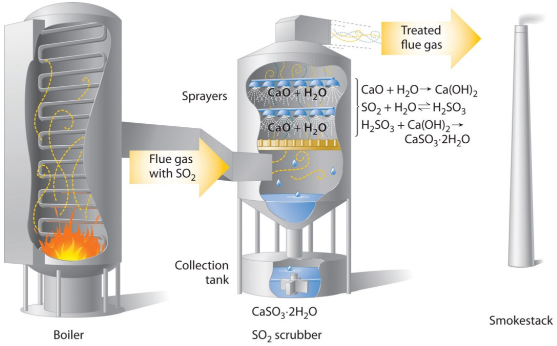
Midterm

Brief Background: Risk: Exposure Control

Risk = *f*(Hazard, Exposure)

<u>Currently</u>: Focus on exposure mitigation (<u>circumstantial</u> vs. inherent)

What if exposure control fails? Risk ↑↑



Here: Scrubbers for sulfur, PPE

Brief Background: Risk: Green Chemistry Approach

Risk = *f*(Hazard, Exposure)

Green chemistry is *"the <u>design</u> of chemical products and processes that <u>reduce or eliminate</u> the use and generation of <u>hazardous</u> substances"*.

– If the **intrinsic** hazard ↓ : risk ↓
– Ideal case: exposure control needed?

Anastas, P. T., & Warner, J. C.: *Green chemistry: Theory and practice*, Oxford University Press, 1998

Types of Hazards

Risk = f(Hazard, Exposure)

Table / 6.1

Hazard Categories and Examples of Potential Hazard Manifestations

Human Toxicity Hazards		Environmental Toxicity Hazards	Physical Hazards	Global Hazards
Carcinogenicity	Immunotoxicity	Aquatic toxicity	Explosivity	Acid rain
Neurotoxicity	Reproductive toxicity	Avian toxicity	Corrosivity	Global warming
Hepatoxicity	Teratogenicity	Amphibian toxicity	Oxidizers	Ozone depletion
Nephrotoxicity	Mutagenicity (DNA toxicity)	Phytotoxicity	Reducers	Security threat
Cardiotoxicity	Dermal toxicity	Mammalian toxicity (nonhuman)	pH (acidic or basic)	Water scarcity/ flooding
Hematological toxicity	Ocular toxicity		Violent reaction with water	Persistence/ bioaccumulation
Endocrine toxicity	Enzyme interactions			Loss of biodiversity

Mihelcic & Zimmerman, Wiley & Sons, 2009

Example of Using Pharos Tool: Homework Assignment

Diacetyl is a compound widely used as flavoring in food and beverages [1]. Diacetyl gives a distinct ‘butter’ flavor, and was extensively added to popcorn. The FDA classifies diacetyl as a generally recognized as safe (GRAS) ingredient, and diacetyl occurs naturally in low concentrations in some foods such as butter, coffee or honey. In 2000, clusters of severe lung disease (bronchiolitis obliterans) in popcorn manufacturing workers occurred and were eventually associated with inhalation of diacetyl. Studies evidenced that popcorn could expose a consumer to 5,700 times the amount of diacetyl present in normal butter [1]. Eventually, manufacturers turned to substitute diacetyl butter flavoring with another compound, 2,3-pentadione. Use the Pharos tool to assess whether you agree with the replacement and justify your reasoning.

[1] Rigler, M. W., & Longo, W. E. (2010). Emission of diacetyl (2, 3 butanedione) from natural butter, microwave popcorn butter flavor powder, paste, and liquid products. International journal of occupational and environmental health, 16(3), 291-302

Link

Example of Using Pharos Tool: Homework Assignment

	Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult
Chemical	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**	**Rx**	**F**	**Mult**
Diacetyl 431-03-8	M	-	-	M-L	-	M	pC	pC	-	-	H	-	H	vH	-	-	-	vH-H	-	-	H	vH
2,3-Pentanedione 600-14-6	-	-	-	H-L	-	pC	pC	pC	-	-	pC	-	H	H	-	-	-	vH-H	-	-	H	U

- Do you agree with the replacement ?
  - No: 14 / Yes: 1 (“Based on provided knowledge and disregarding other options”)
- For students with no toxicology background:
  - “Simple” to grasp and assess knowledge on chemical compounds
  - Not a black box: Sources available, quantifiable + PubMed?!

Link

Example of Using Pharos Tool: Homework Assignment

Since the early 1970s, polybrominated diphenyl ethers (PBDEs) were extensively added to consumer goods, successfully preventing ignition or retarding fire spread [2]. One of these compounds is decabromodiphenyl ether (decaBDE). In 2017, decaBDE was added to the Stockholm convention, with exemptions for uses in building materials or textiles that require anti-flammable characteristics. A wide range of phosphorus based flame retardants, already on the market, were proposed as alternatives for decaBDE, such as tris(2-chloroisopropyl)phosphate (TCIPP), which is an alternative produced in large amounts in the US (50-100 million lbs. in 2015). Use Pharos to assess whether the replacement is a good decision and justify your reasoning.

[2] Blum, A., Behl, M., Birnbaum, L. S., Diamond, M. L., Phillips, A., Singla, V., ... & Venier, M. (2019). Organophosphate ester flame retardants: are they a regrettable substitution for polybrominated diphenyl ethers?. Environmental science & technology letters, 6(11), 638-649. https://doi.org/10.1021/acs.estlett.9b00582

Link

Example of Using Pharos Tool: Homework Assignment

	Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult	Non-GSLT		
Chemical	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**	**Rx**	**F**	**Mult**	**PBT**	**GW**	**O**
Decabromodiphenyl ether 1163-19-5	H-L	M	-	H-M	H-M	pC	-	-	H	vH-M	-	-	M	M	-	-	-	vH-H	pC	-	-	M	U	-	-
Tri-(2-chloroisopropyl)phosphate 13674-84-5	DG	L	M	M	M	L	NA	L	NA	M	L	DG	L	M	H	M	-	vH	vL	L	L	-	-	-	-

- Do you agree with the replacement ?
  - No: 1 / Unsure: 1
- For students with no toxicology background:
  - Often: Not an obvious decision, but trade-offs needed. For example, between
    - Routes of exposure
    - Gaps in knowledge
    - Hazard level
    - …

Link

Fundamentals of Green Chemistry & Green Engineering

Goals of the class include:

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- How chemistry and engineering can help address global human health and environmental issues.
- Students performed **assessments** of chemicals & materials, to inform the **design and innovation** of sustainable solutions alongside an industrial partner

Final

Midterm

Example of Using Pharos Tool: Alternatives Assessment

		Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult	Non-GSLT			
Chemical	**GS**	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**	**Rx**	**F**	**Mult**	**PBT**	**GW**	**O**	**Other**
Ethylene 74-85-1	LT-UNK	**M**	-	-	-	-	pC	pC	-	*M-L*	*vH-M*	-	-	-	-	*M*	-	-	-	-	-	**H**	*M*	-	-	-	**R**
Polyethylene 9002-88-4	LT-UNK	*H-L*	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	*vH-H*	-	-	-	-	-	-	-	**R**
POLYHYDROXYBUTYRATE 26744-04-7	NoGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Poly((R)-3-hydroxybutyric acid-co-(R)-3-hydroxyhexanoic acid) 198007-37-3	NoGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**R**

Figure 3: Pharos Comparison

From a midterm report comparing polyethylene (PE) packaging to polyhydroxy alkanoate (PHA) polymers in collaboration with an industrial partner.

Here: Students based their toxicity/fate/flammability comparison on Pharos data.

* One could have included the monomers (building units) of the bottom 2 polymers

Example of Using Pharos Tool: Alternatives Assessment

		Group I Human					Group II and II* Human									Ecotox			Fate		Physical		Mult	Non-GSLT			
Chemical	**GS**	**C**	**M**	**R**	**D**	**E**	**AT**	**ST**	**ST**	**N**	**N**	**SnS**	**SnR**	**IrS**	**IrE**	**AA**	**CA**	**ATB**	**P**	**B**	**Rx**	**F**	**Mult**	**PBT**	**GW**	**O**	**Other**
Ethylene 74-85-1	LT-UNK	M	-	-	-	-	pC	pC	-	M-L	vH-M	-	-	-	-	M	-	-	-	-	-	H	M	-	-	-	R
Polyethylene 9002-88-4	LT-UNK	H-L	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	vH-H	-	-	-	-	-	-	-	R
POLYHYDROXYBUTYRATE 26744-04-7	NoGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Poly((R)-3-hydroxybutyric acid-co-(R)-3-hydroxyhexanoic acid) 198007-37-3	NoGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R

Figure 3: Pharos Comparison

From a midterm report comparing polyethylene (PE) packaging to polyhydroxy alkanoate (PHA) polymers in collaboration with an industrial partner.

Here: Students based their toxicity/fate/flammability comparison on Pharos data.

* One could have included the monomers (building units) of the bottom 2 polymers

In Conclusion: Pharos

- Easily accessible platform to non-toxicology majors
- Data is aggregated into scores, but sources are transparent (both legislation & academic literature)
- Nuances in evaluating alternatives can be incorporated by carefully selecting non-obvious comparisons (e.g., flame retardant example)
- Very helpful tool for Green Chemistry & Green Engineering, where systems thinking is important to generate truly sustainable solutions

Don’t hesitate to reach out!

Yale School of the Environment

Center for Green Chemistry & Green Engineering at Yale

- Advance Science
- Catalyze Implementation
- Prepare the next generation
- Raise Awareness

Hanno.erythropel@yale.edu

greenchemistry@yale.edu

www.greenchemistry.yale.edu

Twitter: **@YaleGCGE**

Facebook: Center for Green Chemistry & Green Engineering

We’ll get there!

Using Pharos to Investigate Building Material Ingredients and Chemical Sensitivities

Presented by: Bobby Ilg, OAA, MRAIC, BBNC, M.Arch, B.E.D.

Bobby Ilg

Graduated from U of M BED program in 2000
Graduated from Carleton U M. Arch. in 2005
Part-time Professor at Algonquin College
Bachelor of Interior Design
Principal Architect of Build Well to Be Well
Discovered Building Biology and introduced to Algonquin College
First Collaboration between the Building Biology Institute and Academic College
Built his own panelized clay/straw home
Continues to evolve panel system and building with clay based and natural materials

Algonquin College – Bachelor of Interior Design & Building Biology Institute Collaboration

Building Biology Advocate (BBA) Educational Certification:

BBA course material provided by the Building Biology Institute

- IBE 101 Course (300 page course with study manual)
- 7 on-line courses that students complete on BBI website
- Building Biology education integrated into BID curriculum

Building Biology Education Specialist (BBES) Certification for all professors (Educating the Educators)

Yearly Membership for Enrolled Students (Minimum Yearly Fees) with access to BBI on-line library and network connections with the Building Biology Community and Specialists

Building Biology recognizes that

Nature ***is*** the Gold Standard for a healthy human environment ***and*** the ultimate model for perpetual ecological balance.

Building Biology is unique on its emphasis on human health with the perspective that “there is almost always a direct correlation between the biological compatibility of any building material and its ecological performance.” In other words, that which is truly healthy for us will also be healthy for the environment.

Is there a successful history of use?

Humans have always created durable shelter, within the closed circuit of nature, no waste, no pollution, using the natural materials at hand …until very recently

1200AD to 2016+

Accommodating a Growing Segment of the Population

"What is striking about Multiple Chemical Sensitivities (MCS) is its prevalence. The Canadian Community Health Survey shows prevalence figures of 599,000 people in 2005…..and in 2016, just over 1,000,000 people are affected by MCS in Canada"

https://seriouslysensitivetopollution.org/statistics-for-mcses-fm-and-mecfs/

If homes had labels……

How do we decide what makes it healthy?

greenprojectmarketing.com

Foam insulation

www.sheepwoolinsulation.net

Wool batts

Staying Informed – Swiftly Moving Target

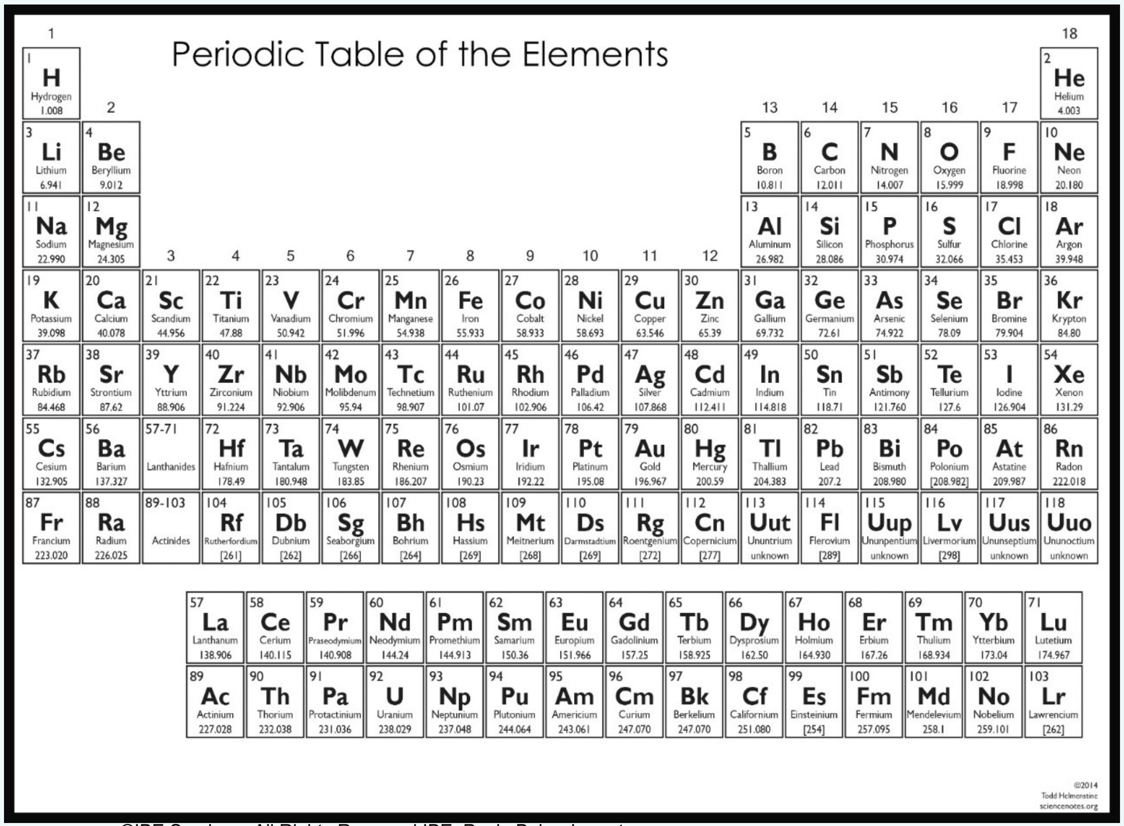
1 + 1 = ?
1 + 1,000 = ??

+

=

Making Sense of Chemicals for the Non-Chemist

We have accessed Pandora's box

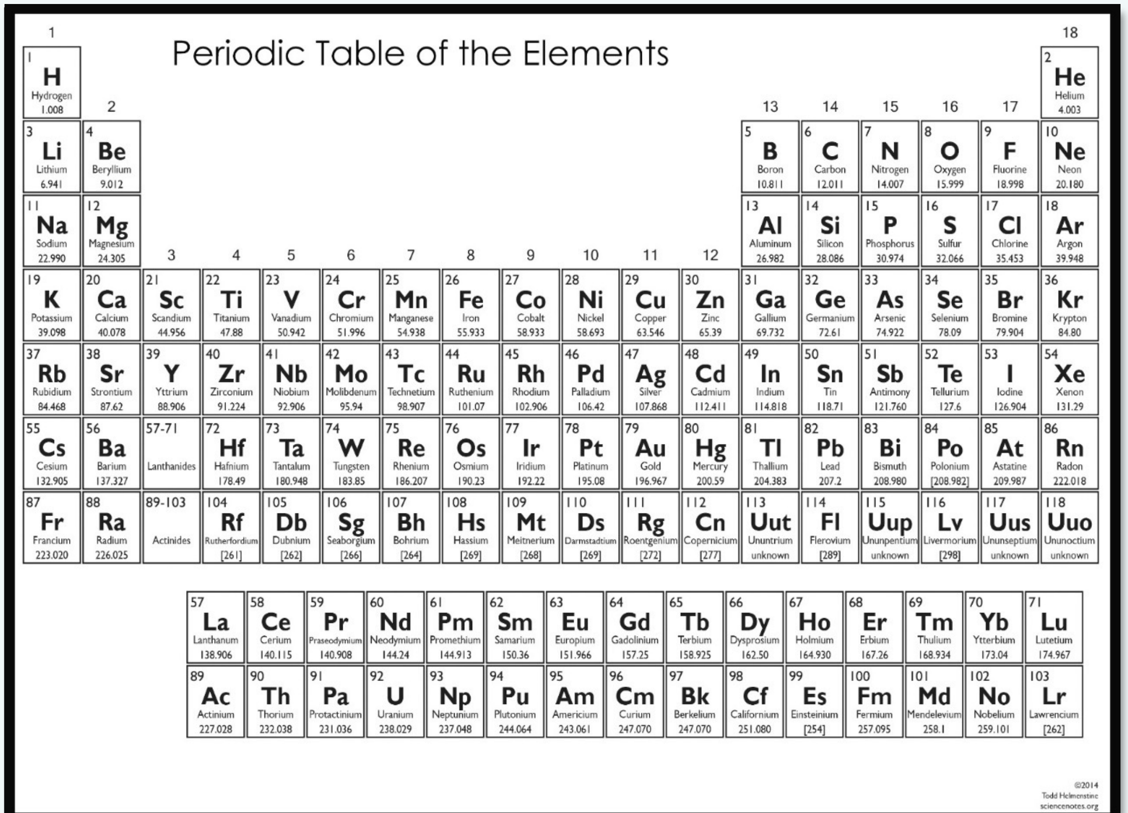


The 85,000+ man-made chemicals approved for commerce derive from roughly 88 of the elements found on the periodic table.

Dr. Robert Peoples

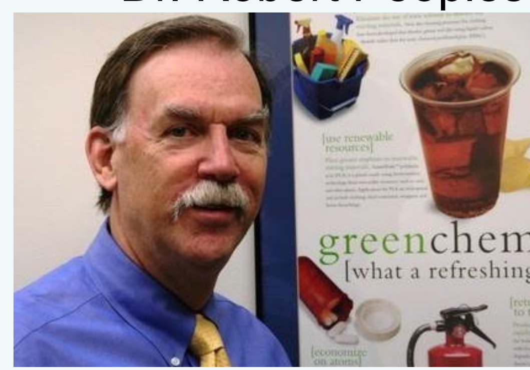
Making Sense of Chemicals for the Non-Chemist

Nature the Gold Standard 5 billion year track record!



All of the functions and services delivered by living systems found in nature in our environment are result of use of these twelve chemicals in periodic table.

Dr. Robert Peoples



The Six Classes Approach

"There are more than 80,000 untested chemicals in use today. Many of the most problematic substances in everyday products are from six families or "classes" of chemicals. When a compound is from one of these classes, we should ask, "Do we really need this chemical? Is it worth the risk?"

The Building Biology Vetting Assignment

Four Step Building Biology Vetting Process:

Step One: Check a manufacturer's information

Step Two: Is the product certified?

Step Three: Find the ingredient list

Step Four: What are the health properties / hazards of ingredients
- research using Pharos database

Pharos

Common Products

- *breakdown of ingredients in common building materials*
- *great database for students and professionals in the building industry*

Hazard List Summary

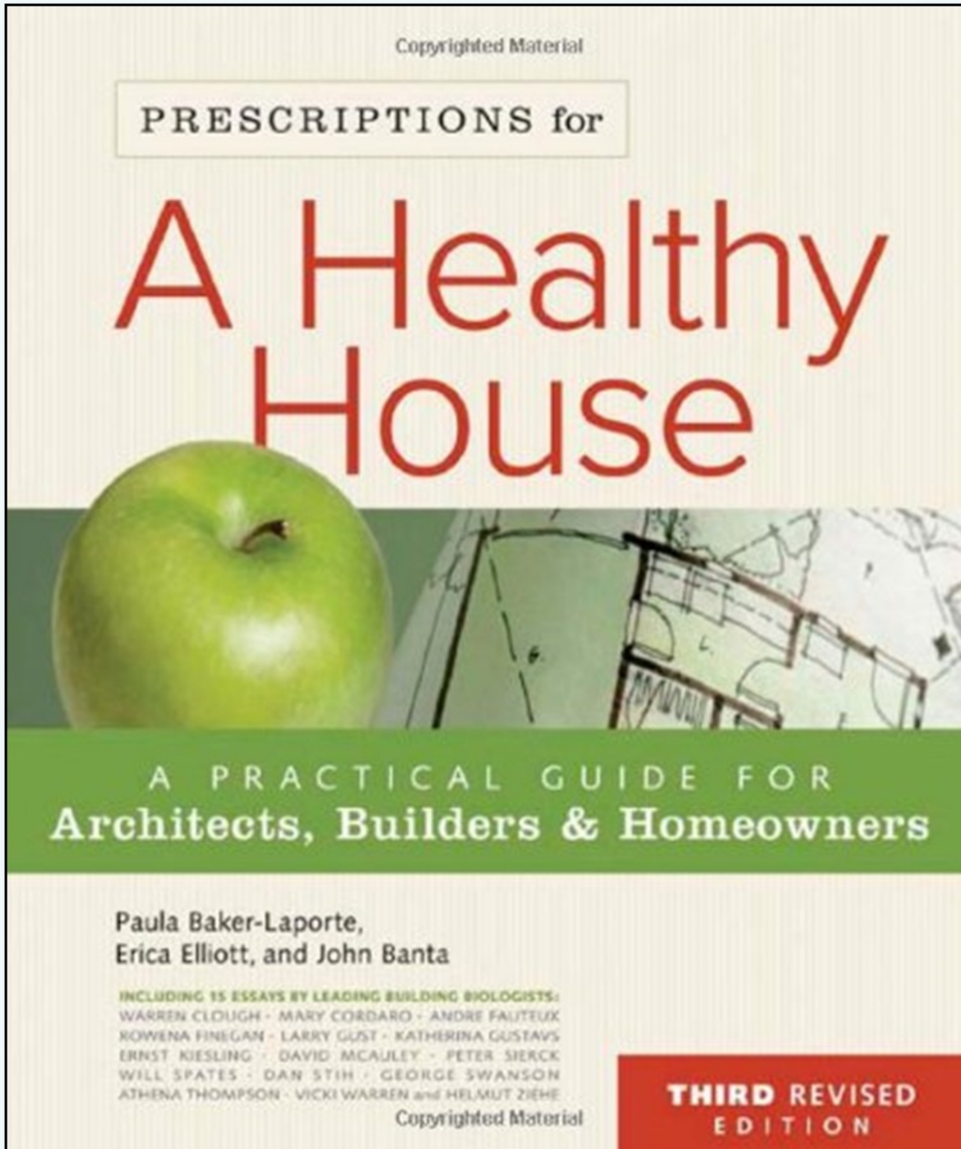
- *overview of potential hazards for individual ingredients*
- *based on global research / databases*
- *includes both human and environmental hazards*
- *important to determine if hazards are during construction or after clients occupy the space*

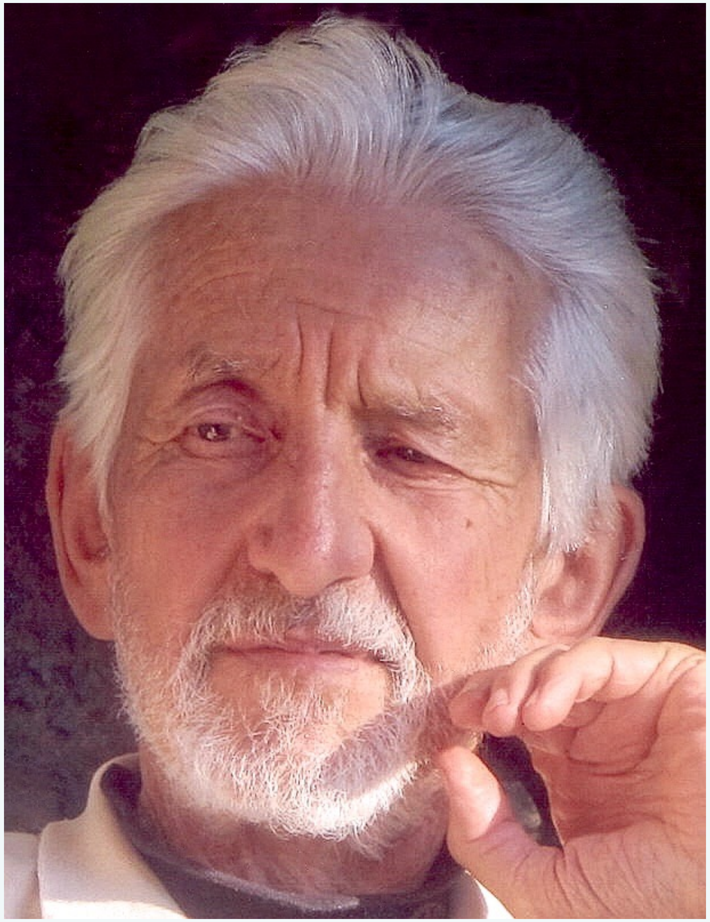
Student Summary

- *students must use the various results from the Pharos investigation to determine possible health risks for the materials they are proposing to use in their associated studio projects.*

Applying Building Biology Principals

Toxin-Free …First Do No Harm!





"A home will be successful to the degree that natural unprocessed building materials are used to create it."

Anton Schneider

Natural Unadulterated Building Materials

Natural Unadulterated Building Materials

Natural Unadulterated Building Materials

Natural self-regulation of humidity, ionization & acoustics using hygroscopic building materials and finishes

Natural Interior Finishes

Thermal Storage Capacity

Natural Daylight

- Multi-directional
- Diffused
- No glare
- Maximize

Natural light at all times of day

Natural Daylight

Lighting

Color and pattern in accordance with nature

Algonquin College
Build Well to Be Well
BuildWise Clay Systems

Bobby Ilg
bobby@buildheatlhy.ca
buildhealthy.ca
613-858-8222

Thank You