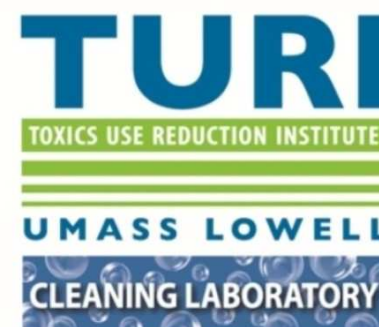


Expanding the P2OASys Hazard Assessment Tool to Include Updated GHS Classification

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EPAs Definition of an Alternatives Assessment

- ◆ “Alternatives assessments characterize chemical hazards based on a full range of human health and environmental information. Chemical choices made based on these assessments can minimize the potential for unintended consequences that might occur in moving from a potentially problematic chemical to a poorly understood alternative, which could be more hazardous” - Environmental Protection Agency (2016)

Hazard Assessment

- ◆ This is the first step in an alternatives assessment
- ◆ Evaluations may include:
 - ◆ Chemical (solvents, corrosives, fumes, etc.)
 - ◆ Burns (thermal, chemical)
 - ◆ Dust (heavy metals, silica)
 - ◆ Heat/Cold (burning, environmental temperatures, etc.)
 - ◆ Vibration
 - ◆ Excessive noise
 - ◆ Impact (falling objects, struck-by hazards, etc.)

Toxics Use Reduction Institute

- ◆ Founded by the Toxics Use Reduction Act (TURA) of 1989
 - ◆ Mass DEP, Mass OTA, and TURI
- ◆ TURI
 - ◆ Is a multi-disciplinary research, policy and education center
 - ◆ Created to protect public health and the environment, while promoting Massachusetts businesses
 - ◆ Provides resources and tools to reduce the use of toxic chemicals
 - ◆ Collaborates with businesses, community organizations, and government agencies

Business Benefits

- ◆ Achieve compliance with laws and regulations
- ◆ Improve worker health and safety
- ◆ Reduce costs
- ◆ Reduce the potential for regrettable substitutions
- ◆ Create safer products for consumers and the environment

TURI Laboratory

◆ Mission:

- ◆ To test and evaluate the effectiveness of greener cleaning chemicals and related equipment

◆ Goals:

- ◆ To identify, develop and promote safer alternatives to hazardous solvents
- ◆ This investigative work involves surface preparation, cleaning, rinsing, drying and analysis

History of P2OASys

- ◆ Created by TURI in the mid 1990s to analyze chemical and equipment alternatives
- ◆ One of the first hazard analysis tools to help businesses compare several chemicals and hazards
- ◆ Can be used by small and medium-sized businesses
 - ◆ Designed to help non-experts compare alternatives
 - ◆ Can be done very quickly, which allows the businesses to begin testing the alternatives faster
- ◆ Evaluates the chemical/process by ranking it from 2 (good) to 10 (bad)
- ◆ Free to use

P2OAS vs Hazard Analysis Categories

Acute Human Hazards	Disposal Hazards
Chronic Human Hazards	Chemical Hazards
Physical Hazards	Energy and Resource Use
Aquatic Hazards	Product Hazards
Persistence / Bioaccumulation	Exposure Potential
Atmospheric Hazards	

P2OAS ys Data Endpoints

Current Technology							Atmospheric hazard					
Category	Units	Cert.	Score	Component			greenhouse gas	Y/N	Cert	Score	Score	Cert
				Type name here			ozone depletor	ODP units				
				% 100			acid rain formation	Y/N				
Acute human effects							NESHAP					
Inhalation LCS0	ppm			Val	Score	Cert	Disposal hazard					
PEL/TLV	ppm						landfill	L/M/H	Cert <td>Score</td> <td>Score</td> <td>Cert</td>	Score	Score	Cert
PEL/TLV (dusts/particles)	mg/m3						EPCRA reportable quantity	lbs				
IDLH	ppm						incineration	L/M/H				
Respiratory irritation	L/M/H						recycling	L/M/H				
Oral LD50	mg/kg						Chemical hazard					
dermal irritation	L/M/H						vapor pressure	mm Hg	Cert <td>Score</td> <td>Score</td> <td>Cert</td>	Score	Score	Cert
skin absorption	L/M/H						solubility in water	mg/L				
dermal LD50	mg/kg						specific gravity	N/A				
ocular irritation	L/M/H						flammability	0,1,2,3,4				
Chronic human effects							High pressure system					
Reference Dose RfD	mg/kg/day						High temperature system	L/M/H				
carcinogen	IARC/EPA Class						mixture/reaction potential	L/M/H				
mutagen	L/M/H						odor threshold	L/M/H				
reproductive effects	L/M/H						volatile organic compound	g/l				
neurotoxicity	L/M/H						Energy & resource use					
developmental effects	L/M/H						non renewable resource	L/M/H	Cert <td>Score</td> <td>Score</td> <td>Cert</td>	Score	Score	Cert
respir. sensitivty/disease	L/M/H						water use	L/M/H				
other chronic organ effects	L/M/H						energy use	L/M/H				
Physical hazards							Product hazard					
heat	WBGT, °C						upstream effects	L/M/H	Cert <td>Score</td> <td>Score</td> <td>Cert</td>	Score	Score	Cert
noise generation	dBA						consumer hazard	L/M/H				
vibration	m/S2						disposal hazard	L/M/H				
ergonomic hazard	L/M/H						Exposure potential					
psychosocial hazard	L/M/H						Exposure potential	L/M/H	Cert <td>Score</td> <td>Score</td> <td>Cert</td>	Score	Score	Cert
Aquatic hazards							Exposure potential					
Water Quality Criteria (HWQC)	mg/l						Exposure potential	L/M/H				
aquatic LCS0	mg/l											
fish NOAEC	mg/l											
plant EC 50	mg/l											
observed ecological effects	L/M/H											
Persistence/bioaccumulation							Exposure potential					
persistence	L/M/H											
BOD half-life	days											
hydrolysis half-life	days											
bioconcentration	log kow											
bioconcentration factor (BCF)	kg/l											

11 Categories
61 Endpoints

Aquatic Hazards

Standardized Hazard Score Data Base						
		2.00	4.00	6.00	8.00	10.00
Aquatic hazards						
Water Quality Criteria (HWQC)	mg/l	>10	6-8	4-6	1-4	<1
aquatic LC50	mg/l	1000.00	50.00	1.00	0.10	<0.10
fish NOAEC	mg/l	0.20	0.02	0.0020	0.0002	<0.0002
plant EC 50	mg/l	100.00	10.00	1.00	0.10	<0.1
observed ecological effects	L/M/H	L	L/M	M	M/H	H

Research Purpose

- ◆ To update the P2OASys system to include the GHS labels
 - ◆ P2OASys endpoints were from 1995
- ◆ Validating the data points for each hazard classification
 - ◆ Comparing it to the GHS system

Methods: Reviewed GHS Documents

P2OASys Categories	GHS Categories
Acute Human Effects	Health Hazard (Part 3)
Chronic Human Effects	Health Hazard (Part 3)
Physical Hazards	
Aquatic Hazards	Environmental Hazard (Part 4)
Persistence/Bioaccumulation	
Atmospheric Hazards	
Disposal Hazards	
Chemical Hazards	Physical Hazard (Part 2)
Energy & Resource Use	
Product Hazard	
Exposure Potential	

Methods: Utilized the Current P2OASys Criteria Table

- ◆ Evaluated Current Hazard Endpoints
- ◆ Referred back to the GHS components to compare P2OASys values
- ◆ Will update P2OASys with GHS values and phrasing

Updates to P2OASys

- ◆ Added Key Words from the GHS to P2OASys
- ◆ Considered the worst case scenario for hazard endpoints
- ◆ All units listed within GHS Standards were considered

Evaluation

- ◆ In many cases, P2OASys endpoints provided more restrictive values than GHS Standards
- ◆ Updates only made if GHS standards had more stringent values than current P2OASys values

Evaluation

◆ Changes Made:

- ◆ Four new hazard endpoints were added to the P2OASys document
- ◆ Added key words that were used to define carcinogens, reproductive effects, and respiratory sensitivity/diseases
- ◆ The most restrictive data source is what was used in the hazard analysis of PEL, Aquatic LC50 and Flash Point

Aquatic Hazards

Standardized Hazard Score Data Base						
		2.00	4.00	6.00	8.00	10.00
Aquatic hazards						
Water Quality Criteria (HWQC)	mg/l	>10	6-8	4-6	1-4	<1
aquatic LC50	mg/l	48 hr EC50 (Crustacca) >10-≤100mg/l	50.00	48 hr EC50 (Crustacca) ≥1-10 mg/l	0.10	<0.10
fish NOAEC	mg/l	0.20	0.02	0.0020	0.0002	<0.0002
plant EC 50	mg/l	100.00	10.00	1.00	0.10	<0.1
observed ecological effects	L/M/H	L	L/M	M	M/H	H

- P2OASys had more restrictive values
- P2OASys and GHS have the same value
- P2OASys was changed to reflect the more restrictive GHS value

Limitations

- ◆ Short time period to do the evaluations of GHS and P2OASys
- ◆ P2OASys has more variety of hazard evaluation endpoints, when compared to what GHS requires

Next Steps

- ◆ Update P2OASys
 - ◆ Add new subcategories and values to hazard endpoints using GHS standards
 - ◆ Make P2OASys available on its own website for public use
 - ◆ Reformat P2OASys to have an integrative drop-down menu
- ◆ Investigate other chemical assessment tools by using additional sources of chemical hazards endpoints

Future of P2OASys

Pollution Prevention Options Assessment System

Menu Analysis Help

Alternative 1

Components Management

Add Rename Delete

Component 1

Select category: Aquatic Hazards

Water Quality Criteria (HWQC)	<input type="text"/>	<input type="text"/>	mg/l	100
Aquatic LC50	<input type="text"/>	<input type="text"/>	mg/l	100
Fish NOAEC	<input type="text"/>	<input type="text"/>	mg/l	100
Plant EC50	<input type="text"/>	<input type="text"/>	mg/l	100
Observed Ecological Effects	<input type="text"/>	<input type="text"/>		100

Resources

- ◆ Design for the Safer Environmental Alternatives Assessments:
<https://www.epa.gov/saferchoice/design-environment-alternatives-assessments>
- ◆ Conducting a Hazard Assessment:
https://www.osha.gov/SLTC/tools/shipyard/standard/ppe/hazard_assessment.html
- ◆ Who We Are: http://www.turi.org/About/Who_We_Are
- ◆ Cleaning Laboratory:
http://www.turi.org/Our_Work/Cleaning_Laboratory
- ◆ P2OASys Tool to Compare Materials:
http://www.turi.org/Our_Work/Research/Alternatives_Assessment/Chemical_Hazard_Comparison_Tools/P2OASys_Tool_to_Compare_Materials

For More Information

- ◆ <http://www.turi.org/p2oasys>
- ◆ <http://guides.turi.org/beyondmsds>
- ◆ Jason Marshall, Sc.D.
- ◆ Jason_Marshall@uml.edu

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