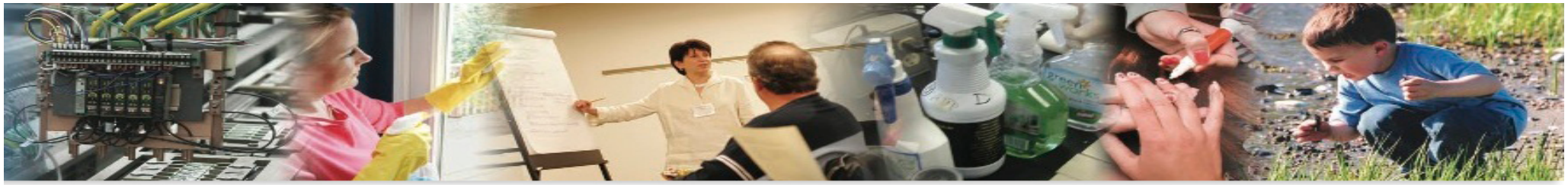


Chemical Hazard Resources:

Where and How to Use Them

Finding Information to Inform Decision Making About Chemical Hazards

Alicia McCarthy
Toxics Use Reduction Institute Laboratory
June 20th, 2018

TURI
TOXICS USE REDUCTION INSTITUTE
UMASS LOWELL

Overview

- Introduction to GHS
  - Categories
  - Hazard (H) Phrases
- Safety Data Sheets
- Beyond the (M)SDS.
  - Overview of the Endpoints and Resources
- Pollution Prevention Options Analysis System (P2OASys) Hazard Assessment Tool
  - P2OASys in Practice
- Questions

The Big Picture:
Hazard Characterization

Human Health

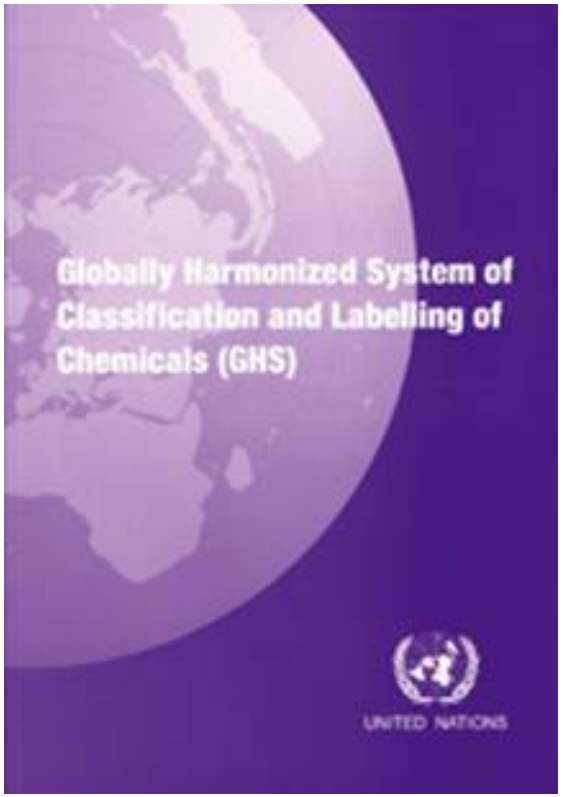
Safety / Physical

Environmental

Examples of Health Hazards to search for …

- Carcinogenicity
- Asthmagens
- Neurotoxicity
- Reproductive Toxicity
- Developmental Toxicity
- Endocrine disruption
- Sensitization
- Irritation

Globally Harmonized System of Classification & Labeling of Chemicals



- Agreed hazard classification
- Reduces inconsistent protection, regulatory burdens, and need for evaluation against multiple classification systems
- Increase awareness and simplified communications

GHS Pictograms

Health Hazard •Carcinogen •Mutagenicity •Reproductive Toxicity •Respiratory Sensitizer •Target Organ Toxicity •Aspiration Toxicity	**Flame** •Flammables •Pyrophorics •Self-Heating •Emits Flammable Gas •Self-Reactives •Organic Peroxides	**Exclamation Mark** •Irritant (skin and eye) •Skin Sensitizer •Acute Toxicity •Narcotic Effects •Respiratory Tract Irritant •Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder •Gases Under Pressure	**Corrosion** •Skin Corrosion/Burns •Eye Damage •Corrosive to Metals	**Exploding Bomb** •Explosives •Self-Reactives •Organic Peroxides
Flame Over Circle Oxidizers	**Skull and Crossbones** Acute Toxicity (fatal or toxic)	**Environment (OSHA Non-Mandatory)** Aquatic Toxicity

GHS Categories

- A single harmonized hazard statement for each level of hazard within each hazard class
  - Example: Flammable liquids
    - Category 1: Extremely flammable liquid and vapour
    - Category 2: Highly flammable liquid and vapour
    - Category 3: Flammable liquid and vapour
    - Category 4: Combustible liquid
- 5 Categories

  - Category 1 = Most Hazardous
  - Category 5 = Least Hazardous

Hazard Statements & Phrases

- Statements that describe a physical, health, or environmental hazard:
  - Causes skin irritation
  - May cause drowsiness or dizziness.
- Phrases (H Phrases) are codes that correlate with the hazard statements:
  - Physical Hazard: H2xx
  - Health Hazard: H3xx
  - Environmental Hazard: H4xx

Sources of Chemical Hazard Data

Material Safety Data Sheet (MSDS)

- Manufacturers required to produce under "Right to Know" law (OSHA: Hazard Communication Standard)
  - *PROVIDES:*
    - Allowable Exposure Levels
    - Health effects if exposed
    - Physical properties
    - How to protect from exposure
    - How to respond to an accident

Safety Data Sheet (SDS)

- *ADDS* Toxicological and physical characteristics
  - Transition to Globally Harmonized System (GHS) for Classification and Labeling of Chemicals (SDS)

Safety Data Sheet Sections

Section 1	Identification	**Section 9**	Physical and chemical properties
Section 2	Hazard(s) identification		
Section 3	Composition/information on ingredients	**Section 10**	Stability and reactivity
		Section 11	Toxicological information
Section 4	First-Aid measures	**Section 12**	Ecological information
Section 5	Fire-fighting measures	**Section 13**	Disposal considerations
Section 6	Accidental release measures	**Section 14**	Transport information
Section 7	Handling and storage	**Section 15**	Regulatory information
Section 8	Exposure controls/personal protection	**Section 16**	Other information

Limitations of the SDS

- Age
- Quality
- Consistency
- Completeness
- Proprietary Ingredients

guides.turi.org/beyondmsds

TURI - Toxics Use Reduction Institute

TURI Library » Guides » Environmental, Health and Safety Data Resources mary@turi.org » Guide Admin » Dashboard » Sign Out

Environmental, Health and Safety Data Resources

This guide has been created to assist in researching environmental, health and safety information for chemicals.

Last Updated: Dec 4, 2015 | URL: http://guides.turi.org/beyondmsds | Print Guide | RSS Updates

Home | Health | Safety | Environmental | Regulatory/Government/NGO | Sustainable Futures | Other Resources

Home Print Page Search: This Guide Search

General Information for Chemicals

These links take you to various pages for finding general, and sometimes detailed, information on chemicals including but not limited to physical properties, health effects, and environmental fate information. Links for finding general 'use' information are also included.

- Hazardous Substances Data Bank (HSDB)
  Site includes: Physical/Chemical information, exposure limits, animal and human toxicity information. This is also a good place to find information on Metabolism/Pharmacokinetics.
- United States National Library of Medicine - ChemIDplus Advanced
  ChemIDplus is a free, web-based search system that provides access to structure and nomenclature authority files used for the identification of chemical substances cited in National Library of Medicine (NLM) databases, including the TOXNET® system. ChemIDplus also provides structure searching and direct links to many biomedical resources at NLM and on the Internet for chemicals of interest. The database contains over 390,000 chemical records, of which over 300,000 include chemical structures, and is searchable by Name, Synonym, CAS Registry Number, Molecular Formula, Classification Code, Locator Code, Structure, Toxicity, and/or Physical properties.
- Chemical Hazard and Alternatives Toolbox (ChemHAT)
  The chemical information provided by ChemHAT allows you to rapidly understand the types of health effects related to a chemical and the strength of those effects. This information can help you examine your chemical use and identify which hazards you should eliminate or reduce first. ChemHAT also provides information on existing case studies of safer alternatives. This information can help you quickly understand where the potential for substitution exists and what alternatives you should consider evaluating further.
- ECHA - REACH Registration Database
  This is unique source of information on the chemicals manufactured and imported in Europe. It covers their hazardous properties, classification and labelling, and information on how to use them safely. This information is a valuable resource for advancing the safe use of chemicals and for the replacement of the most hazardous ones by safer alternatives.

Comments (0)

Accessing Library Resources: Books, Journal Articles, Reports, etc...

- TURI Library Catalog

Comments (0)

Subject Guide

Mary Butow

Contact Info
Toxics Use Reduction Institute
University of Massachusetts Lowell
600 Suffolk Street - Wannalancit Mills
Lowell, MA 01854
978-934-4365
Send Email

Links:
Profile & Guides

Webinar: Searching for Information Using This Library Guide

- Access recording of webinar on using this Library Guide

Comments (0)

Environmental, Health and Safety Data Resources: Home

Search this Guide | Search

This guide has been created to assist in researching environmental, health and safety information for chemicals.

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- ECHA - REACH Registration Database

Accessing Library Resources: Books, Journal Articles, Reports, etc...

- TURI Library Catalog

Tools for using this Library Guide

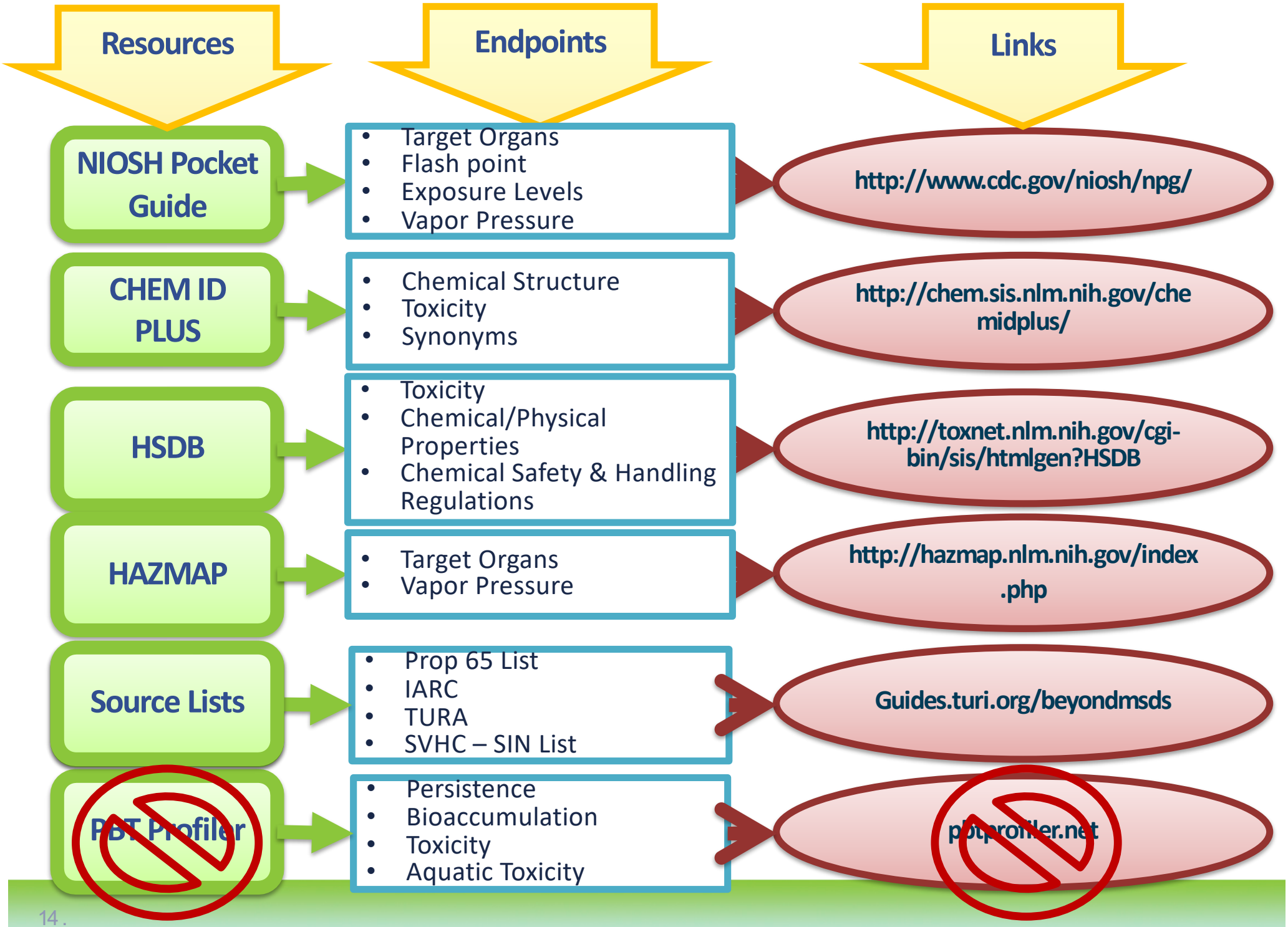
- Chemical Hazard Evaluation Template - Updated September 2017
  This document can be used as a template for your research. The sources (located in the guide) for each endpoint are indicated in brackets.
- Roadmap
- Roadmap - Landscape Version
- Master Key of Abbreviations and Terms found in Library Guide

Subject Guide

Mary Butow

Webinar: Searching for Information Using This Library Guide

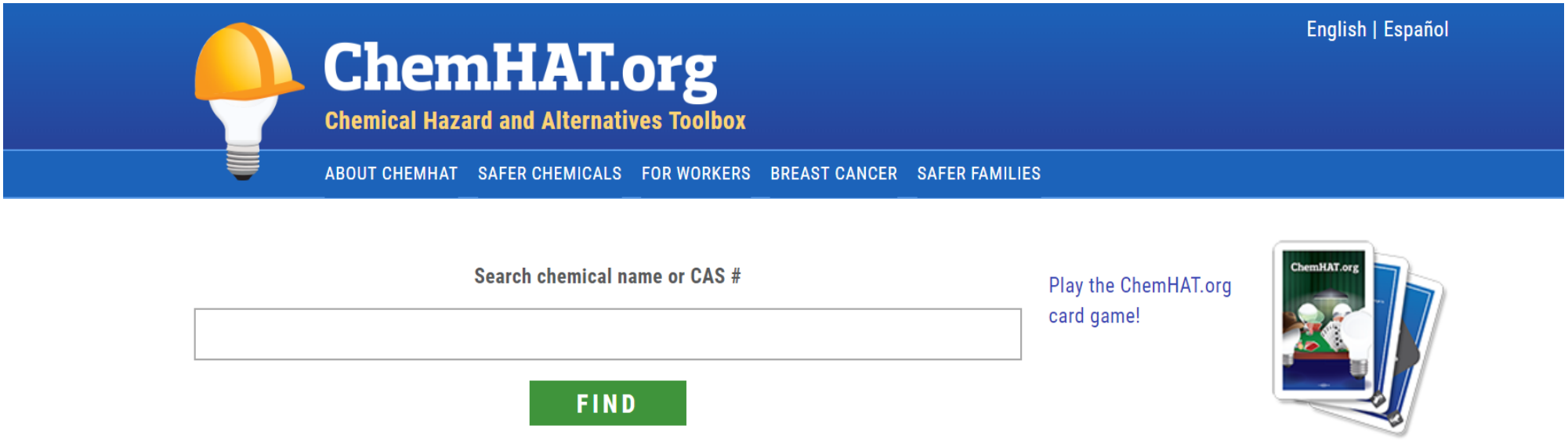
- Access recording of webinar on using this Library Guide


Resources
Endpoints
Links
NIOSH Pocket Guide
Target Organs
Flash point
Exposure Levels
Vapor Pressure
http://www.cdc.gov/niosh/npg/
CHEM ID PLUS
Chemical Structure
Toxicity
Synonyms
http://chem.sis.nlm.nih.gov/chemidplus/
HSDB
Toxicity
Chemical/Physical Properties
Chemical Safety & Handling Regulations
http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
HAZMAP
Target Organs
Vapor Pressure
http://hazmap.nlm.nih.gov/index.php
Source Lists
Prop 65 List
IARC
TURA
SVHC – SIN List
Guides.turi.org/beyondmsds
PBT Profiler
Persistence
Bioaccumulation
Toxicity
Aquatic Toxicity
pbtprofiler.net

Quick Check

- ChemHat.org
  - Designed for workers
  - Simplified format for usability
  - Has limitations

ChemHAT.org


ChemHAT.org
Chemical Hazard and Alternatives Toolbox
English | Español
ABOUT CHEMHAT
SAFER CHEMICALS
FOR WORKERS
BREAST CANCER
SAFER FAMILIES
Search chemical name or CAS #
FIND
Play the ChemHAT.org card game!
ChemHAT.org
Search suggestions
Type the name or CAS number into the box and touch Find or Enter to begin search.
If you don't know exactly what you are looking for, try searching on part of the chemical name, e.g. "methyl". You can then select the best match from the results list.
To search by CAS number, be sure to include the dashes, e.g., 50-00-0.

Dichloromethane (methylene chloride)

CAS: 75-09-2

Stronger effect / evidence Weaker effect / evidence

Inherent Hazards Data sources

Restricted List – This chemical is on a list from an authoritative body recommending that its use be avoided.

How does this chemical impact the environment? Data sources

Persistent – Does not break down readily from natural processes.

Immediate Harm to Aquatic Ecosystems – A single exposure may result in severe biological harm or death to fish or other aquatic organisms.

Harmful to Land Ecosystems – Can cause harm to land based plants, animals or microorganisms.

Climate Change – Contributes to the greenhouse effect or traps heat in the atmosphere, causing temperature changes and contributing to climate change.

Bioaccumulative – Accumulates in organisms, concentrating as it moves up the food chain.

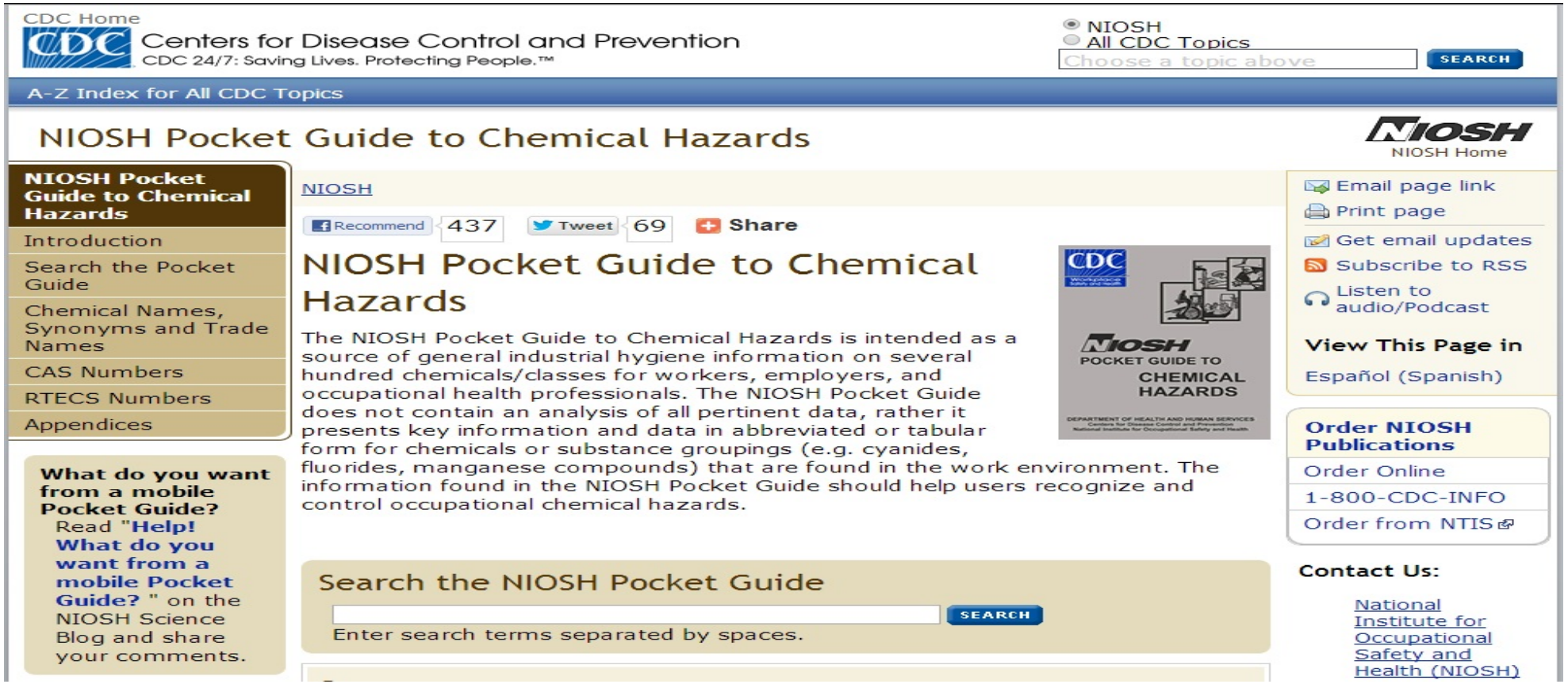
What safer alternatives are available for this chemical?

Find case studies related to substitutions for this chemical in SubsPORT, the substitution support portal.

From ChemHAT

Carcinogen	• IARC Group 2A • Prop 65 listed • NIOSH occupational carcinogen • EPA likely carcinogenic to humans (IRIS); Probable human carcinogen – TSCA criteria met • R40, H351
Neurotoxicity	• Known neurotoxic (Grandjean & Landrigan)
Endocrine Disruption	• Listed in TEDX as potential endocrine disruptor

NIOSH Pocket Guide

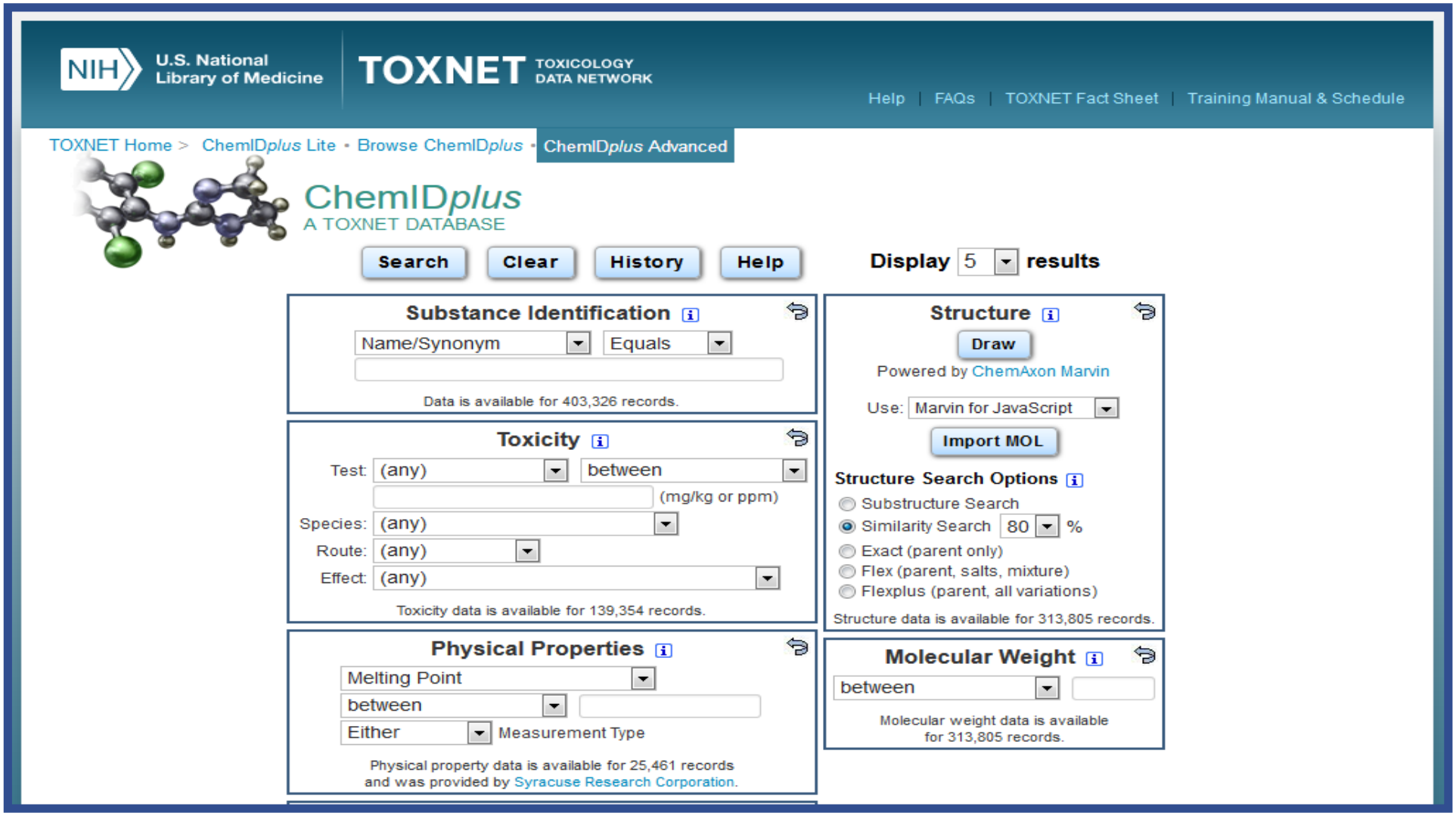


http://www.cdc.gov/niosh/npg/

Methylene chloride

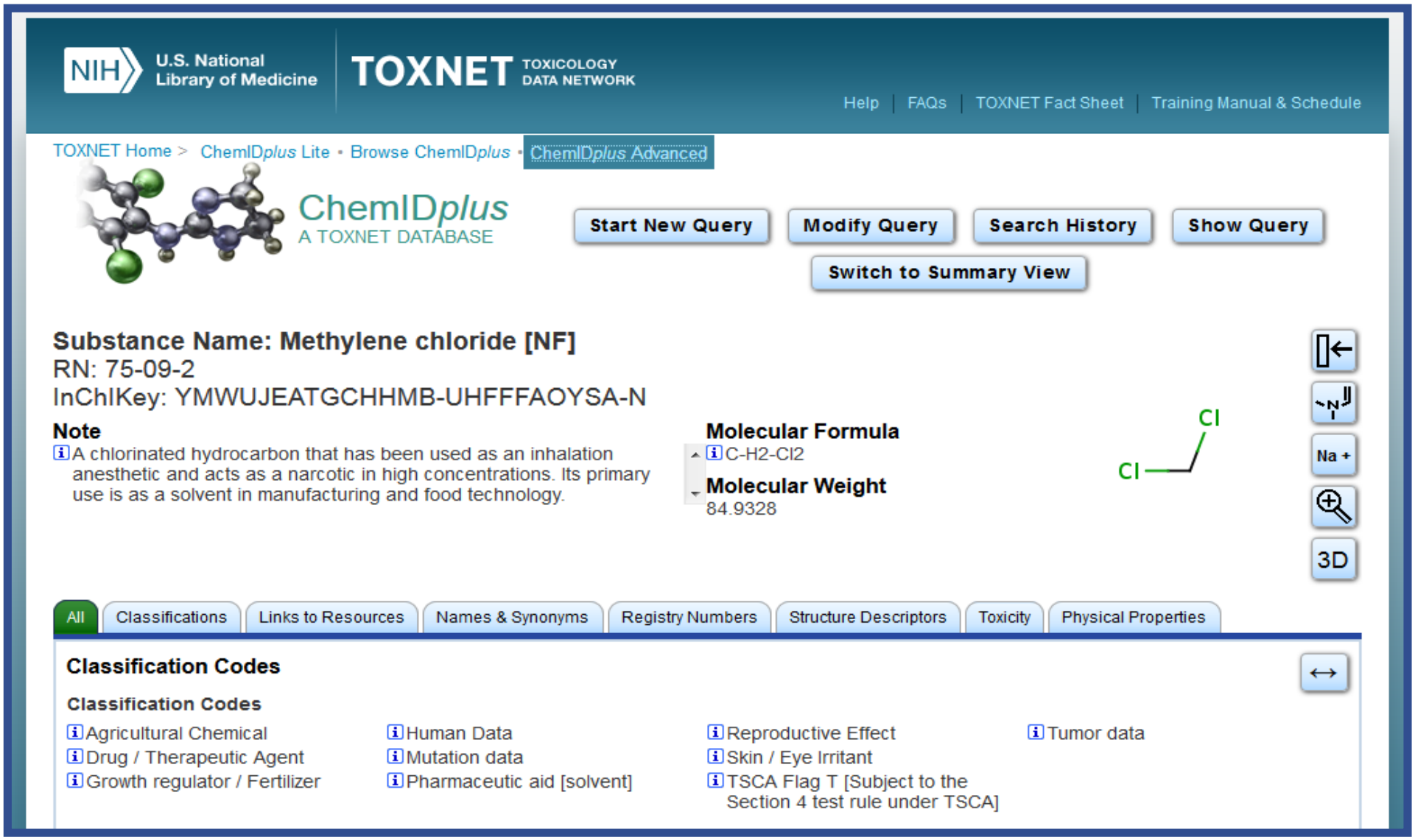
Synonyms & Trade Names Dichloromethane, Methylene dichloride					
CAS No. 75-09-2	**RTECS No.** PA8050000			**DOT ID & Guide** 1593 160	
Formula CH_2Cl_2	**Conversion** 1 ppm = 3.47 mg/m^3			**IDLH** Ca [2300 ppm] See: 75092	
Exposure Limits **NIOSH REL** : Ca See Appendix A **OSHA PEL** : [1910.1052] TWA 25 ppm ST 125 ppm				**Measurement Methods** **NIOSH** 1005 , 3800 ; **OSHA** 59 , 80 See: NMAM or OSHA Methods	
Physical Description Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.]					
MW: 84.9	**BP:** 104°F	**FRZ:** -139°F	**Sol:** 2%	**VP:** 350 mmHg	**IP:** 11.32 eV
Sp.Gr: 1.33	**Fl.P:** ?	**UEL:** 23%	**LEL:** 13%		
Combustible Liquid					
Incompatibilities & Reactivities Strong oxidizers; caustics; chemically-active metals such as aluminum, magnesium powders, potassium & sodium; concentrated nitric acid					
Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact					
Symptoms irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]					
Target Organs Eyes, skin, cardiovascular system, central nervous system					
Cancer Site [in animals: lung, liver, salivary & mammary gland tumors]					
Personal Protection/Sanitation (See protection codes) **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contaminated **Remove:** When wet or contaminated **Change:** No recommendation **Provide:** Eyewash, Quick drench				**First Aid** (See procedures) **Eye:** Irrigate immediately **Skin:** Soap wash promptly **Breathing:** Respiratory support **Swallow:** Medical attention immediately	

ChemIDPlus



http://chem.sis.nlm.nih.gov/chemidplus/

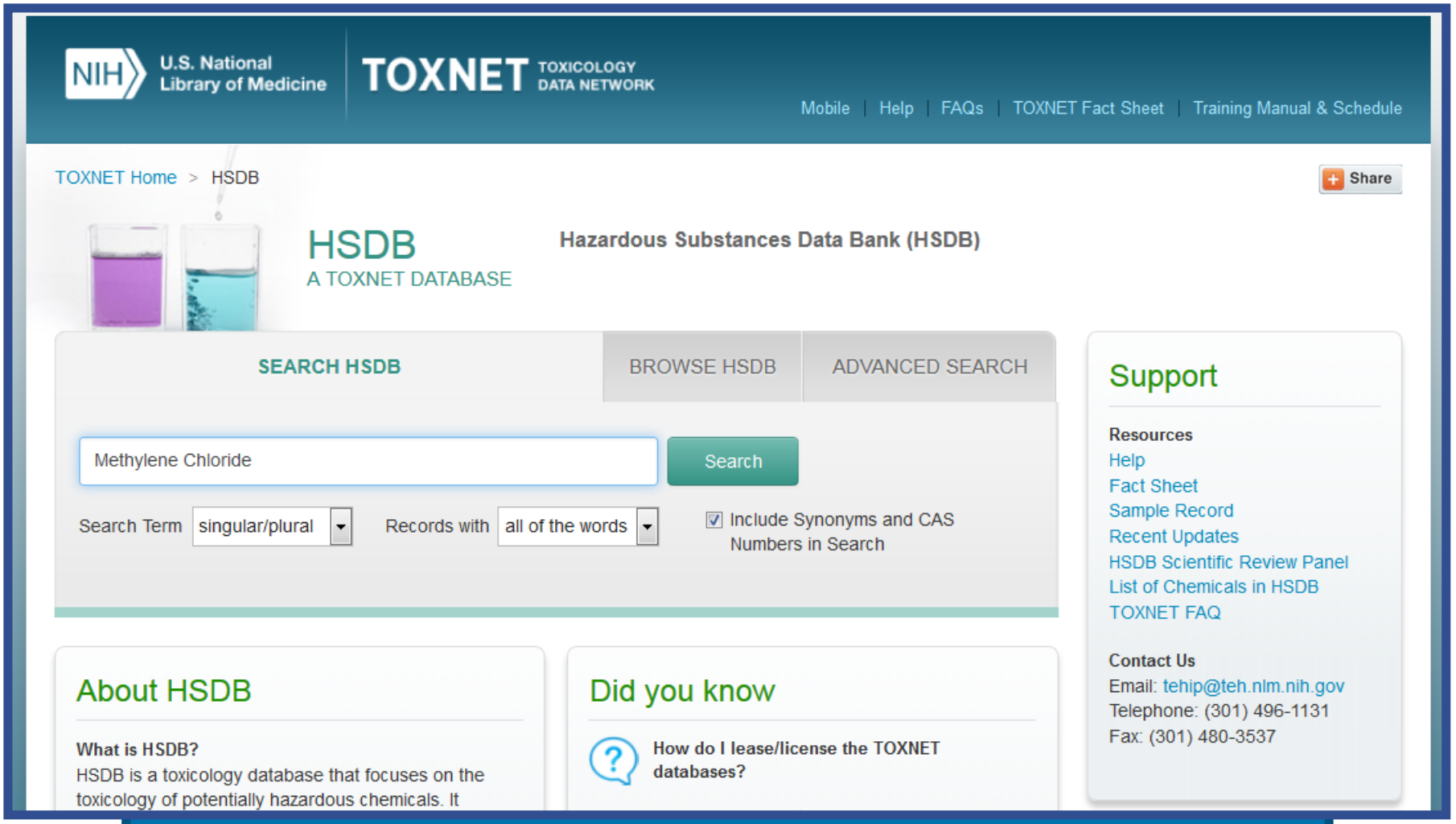
ChemIDPlus


NIH U.S. National Library of Medicine
TOXNET TOXICOLOGY DATA NETWORK
Help | FAQs | TOXNET Fact Sheet | Training Manual & Schedule
TOXNET Home > ChemIDplus Lite • Browse ChemIDplus • ChemIDplus Advanced
ChemIDplus
A TOXNET DATABASE
Start New Query
Modify Query
Search History
Show Query
Switch to Summary View
Substance Name: Methylene chloride [NF]
RN: 75-09-2
InChIKey: YMWUJEATGCHHMB-UHFFFAOYSA-N
Note
A chlorinated hydrocarbon that has been used as an inhalation anesthetic and acts as a narcotic in high concentrations. Its primary use is as a solvent in manufacturing and food technology.
Molecular Formula
C-H2-Cl2
Molecular Weight
84.9328
Cl
Cl
Na +
3D
All
Classifications
Links to Resources
Names & Synonyms
Registry Numbers
Structure Descriptors
Toxicity
Physical Properties
Classification Codes
Classification Codes
Agricultural Chemical
Drug / Therapeutic Agent
Growth regulator / Fertilizer
Human Data
Mutation data
Pharmaceutic aid [solvent]
Reproductive Effect
Skin / Eye Irritant
TSCA Flag T [Subject to the Section 4 test rule under TSCA]
Tumor data

From ChemIDPlus

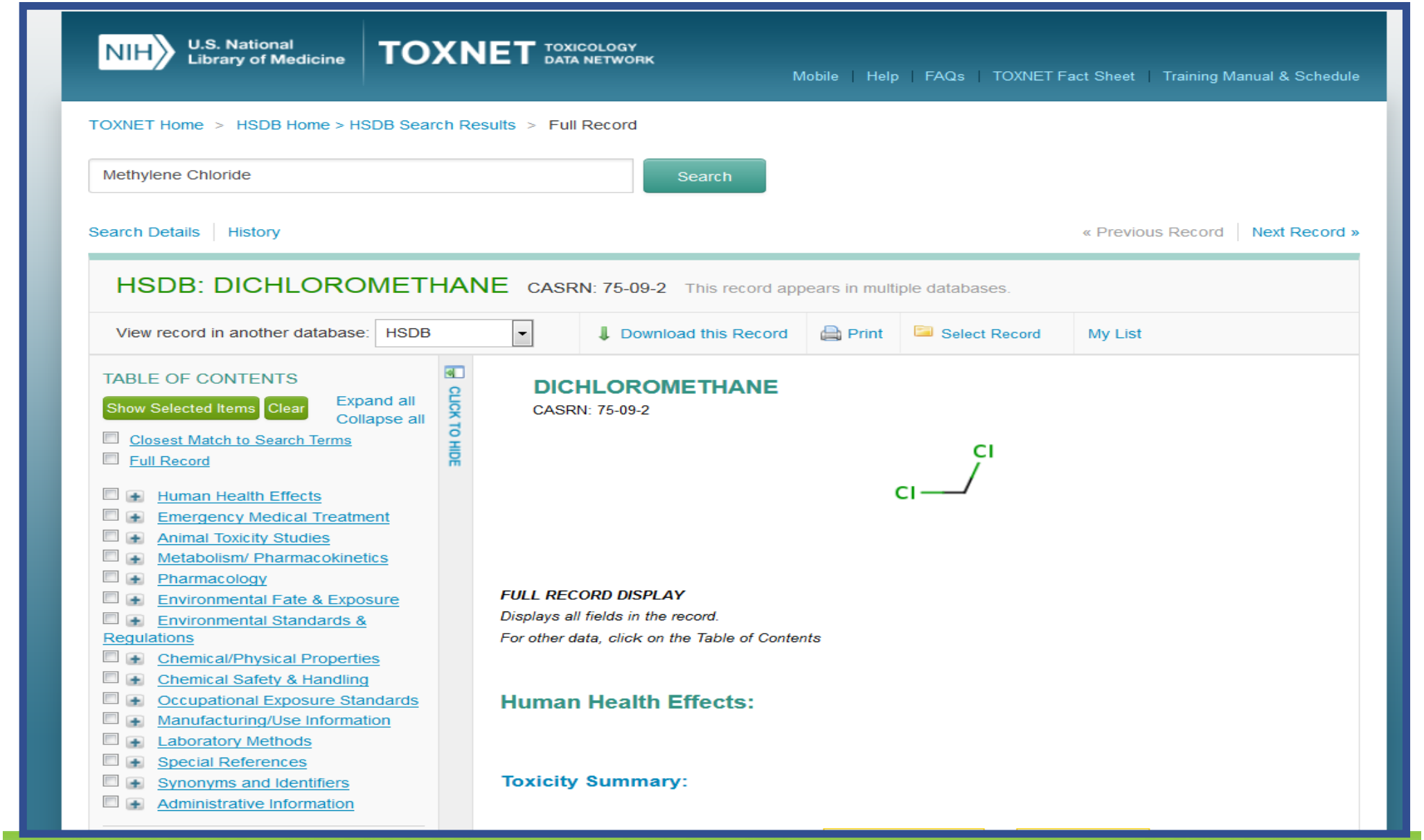
Acute Mammalian Toxicity	• LD_{50} (oral, rat) = 1,600 mg/kg • LC_{50} = 52,000 mg/m^3 (inh, rat)
Vapor Pressure	• 435 mm Hg at 25°C
Boiling Point	• 40°C

Hazardous Substances Data Bank



http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

HSDB Table of Contents



From HSDB

Exposure Indicators

- OSHA PEL ≤ 25 ppm as 8 hr TWA
- TLV-TWA = 50 ppm

Safety

- Ignition is difficult
- Normally stable
- LEL = 15.5% in O_2
- UEL = 66.4% in O_2
- Vapor Density = 2.93

Haz-Map

http://hazmap.nlm.nih.gov/index.php

From Haz-Map

	Adverse Effects
Neurotoxin	CNS Solvent Syndrome
Hepatotoxin	Hepatotoxin, Secondary
IARC Carcinogen	Possible Carcinogen
NTP Carcinogen	Anticipated Human Carcinogen
ACGIH Carcinogen	Confirmed Animal

Source Lists

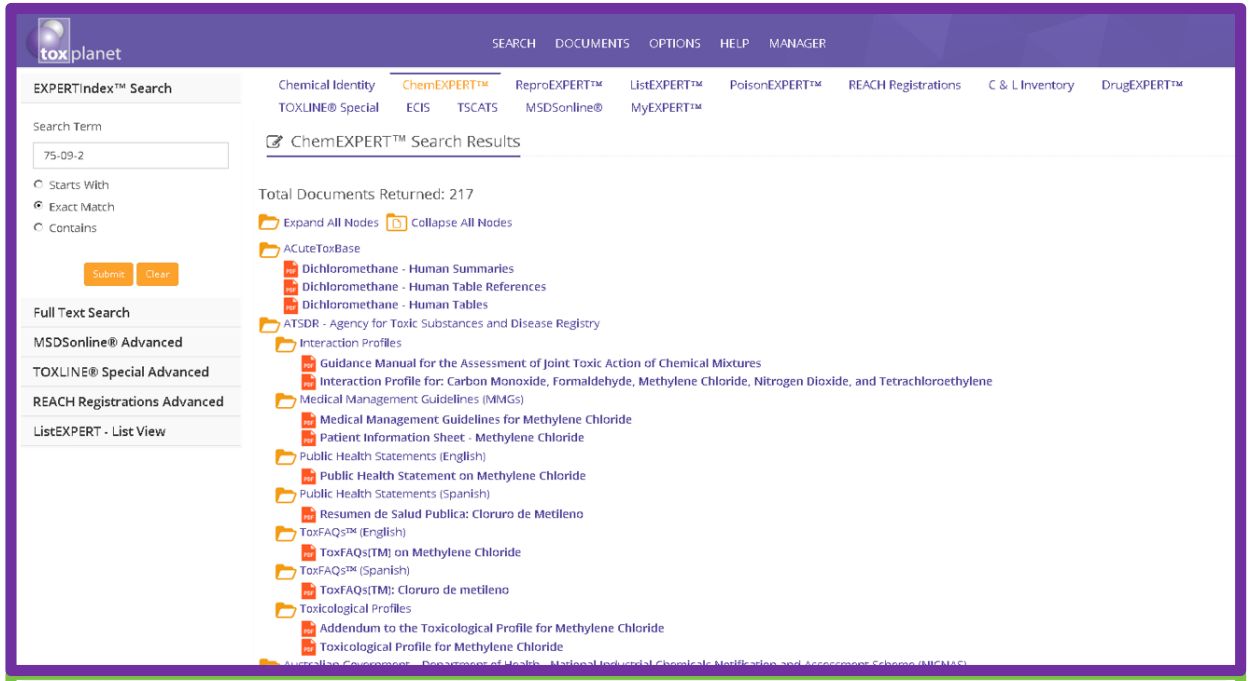
http://guides.turi.org/beyondmsds

From Library Guide For EH&S Data Resources

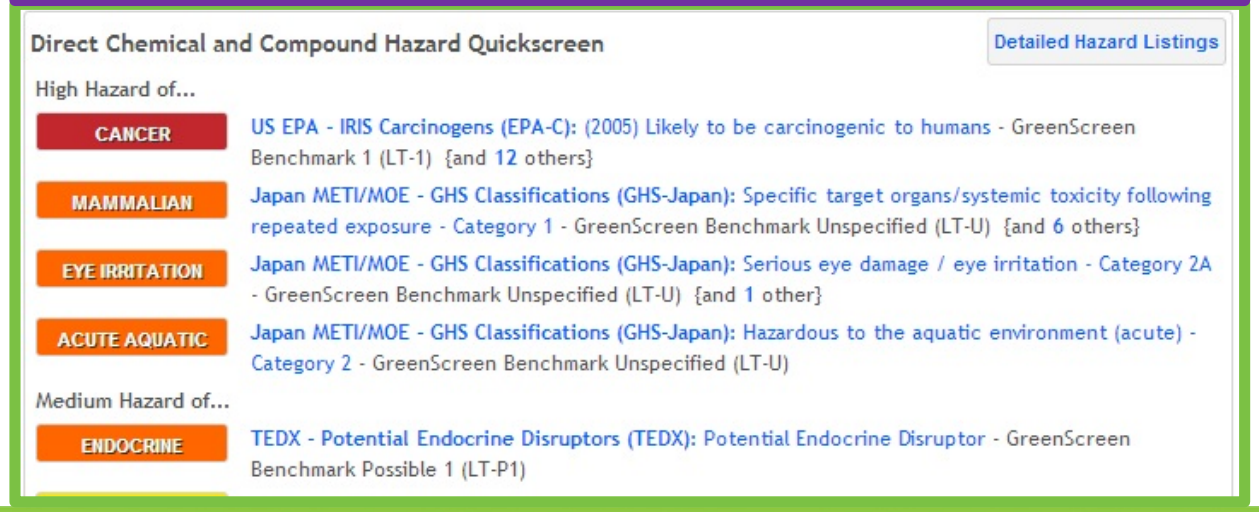
Not	• Asthmagen • Sensitizer • Mutagen • Irritant
IRIS	• RfD = 0.006 mg/kg-day • RfC = 0.6 mg/m^3
GHS Phrases	• H303, H313, H315, H319, H335, H336, H351, H373
Other Target Organ(s)	• Pancreas • Kidney • Lungs

Subscription Databases

toxplanet



Pharos



What is P2OASys?

P2OASys allows companies to assess the potential environmental, worker, and public health impacts of alternative technologies aimed at reducing toxics use. The goal is more comprehensive and systematic thinking about the potential hazards posed by current and alternative processes identified during the TUR planning process. The tool can assist companies:

Systematically examine the potential environmental and worker impacts of options, examining the total impacts of process changes, rather than simply those of chemical changes

Compare options with current processes based on quantitative and qualitative factors.

Embedded formulae in P2OASys provide a numerical hazard score for the company's current process and identified options, which can then be combined with other information sources and professional expertise to make decisions on adoption of alternatives. Companies input both quantitative and qualitative data on the chemical toxicity, ecological effects, physical properties, and changes in work organization likely as a result of the proposed option.

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TOXICS USE REDUCTION INSTITUTE
UMASS LOWELL
CLEANING LABORATORY

Any question or comments can be directed at Jason Marshall by phone or by email.

Jason Marshall:
Tel:(978) 934-3133
Email: Jason@turi.org

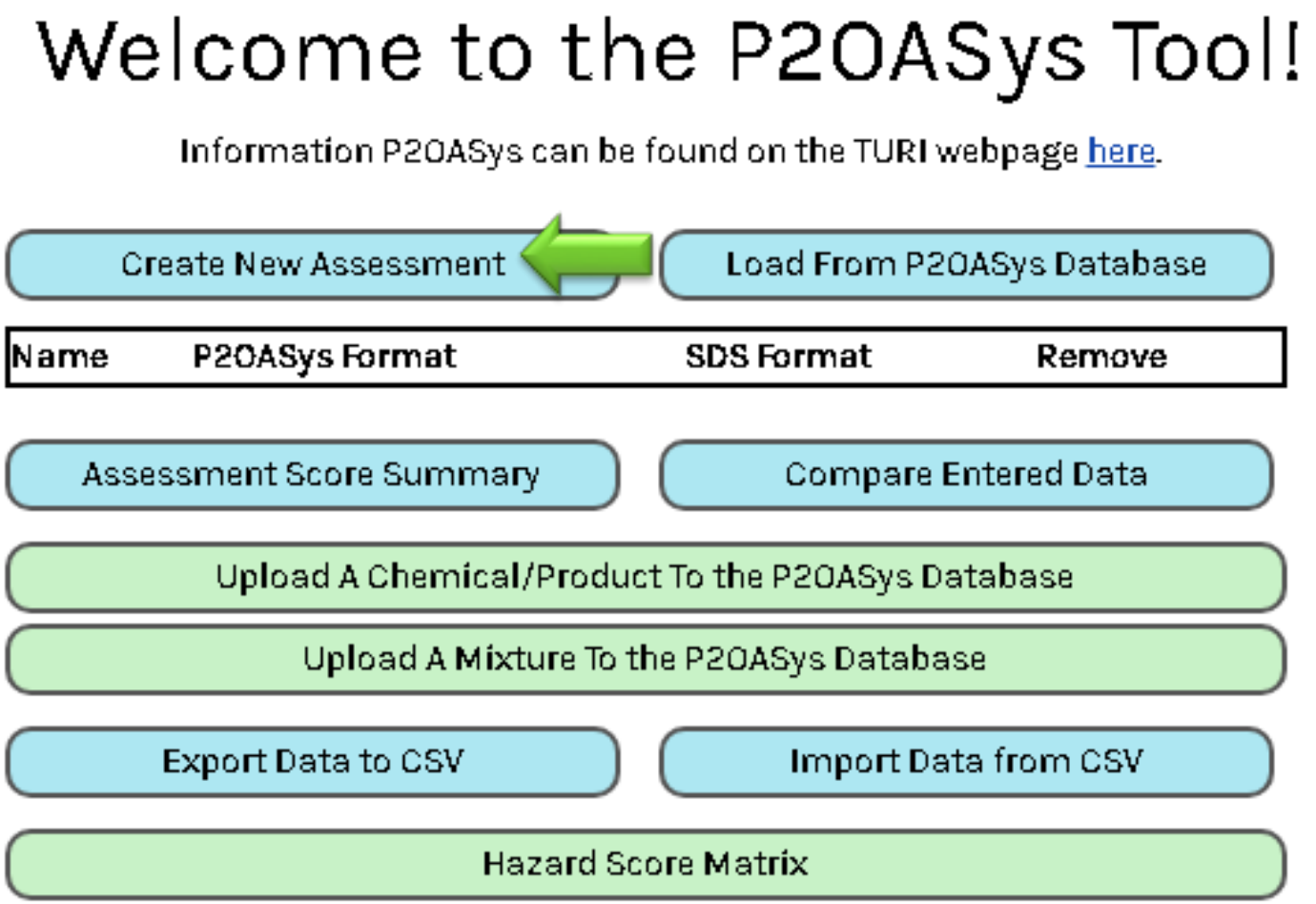
This web site is maintained by the Toxics Use Reduction Institute at the University of Massachusetts, Lowell.

The Massachusetts Toxics Use Reduction Institute
University of Massachusetts Lowell
600 Suffolk Street
Lowell, Massachusetts 01854-2866
Tel: 978-934-3275 Fax: 978-934-3050

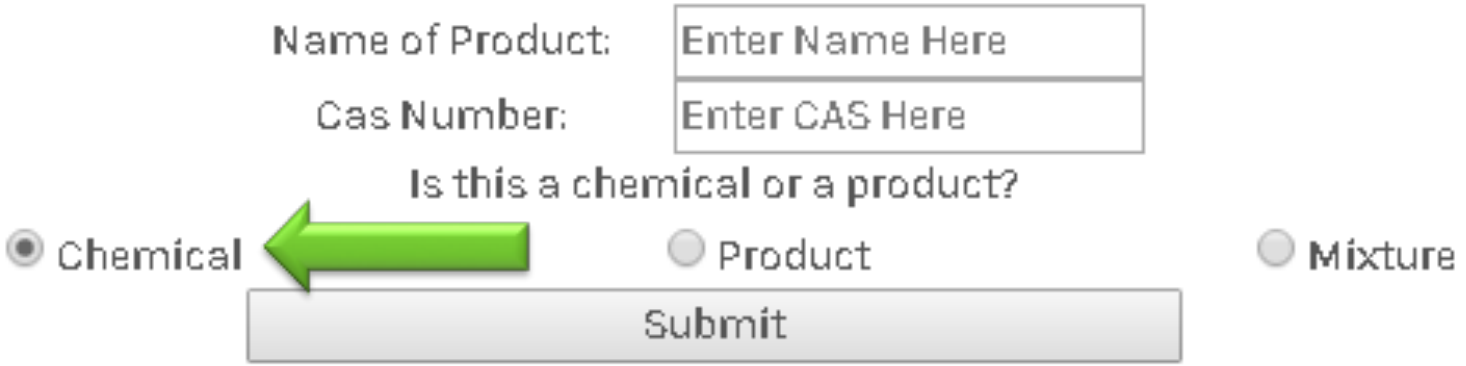
What Does P2OASys Do?

- Allows user to assess potential impacts of alternative chemistries/technologies
  - Environmental
  - Worker
  - Public health
- Help users use a more comprehensive and systematic way of thinking about
  - Current and alternative processes
    - Based on quantitative and qualitative factors

http://p2oasys.turi.org/



Getting Started



Chemical
individual chemical using a single SDS. Must enter chemical name and CAS

Product
evaluating a product with multiple chemicals but only using one SDS

Mixture
combined previously entered Chemicals to create your own product

Majority of Data Found on SDS

Chemical Sample 102 was added

Sample 102

Click here to add another product

Click here to return to the P2OASys Tool

Click here to enter data using the P2OASys Format

Click here to enter data using the SDS Format

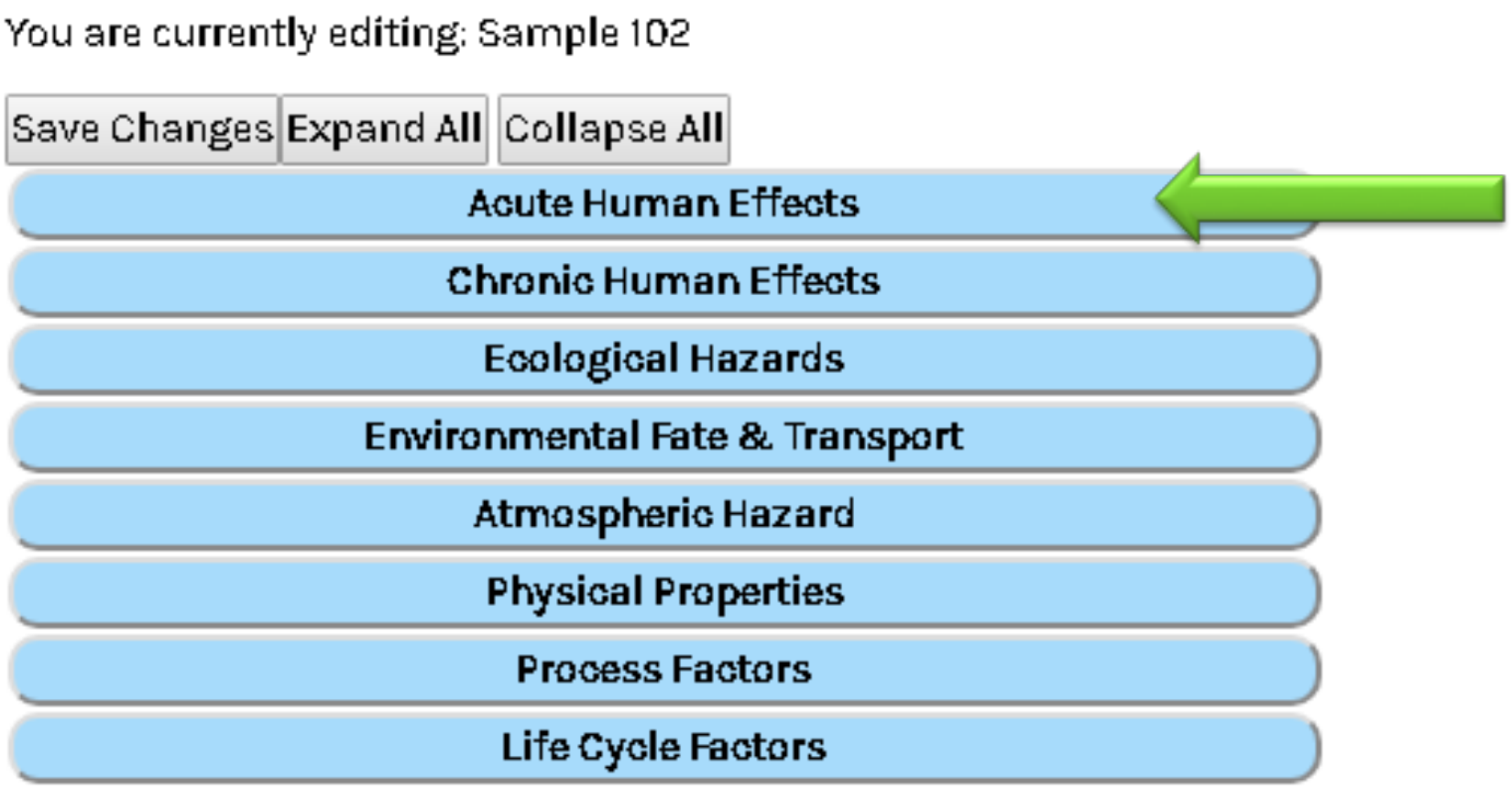
P2OASys Format:

Enter data in the order of the P2OASys categories

SDS Format:

Enter data in the order the where values would be likely found on an SDS or external resources

Main Categories



Subcategories

You are currently editing: Trichloroethylene

CAS: 79-01-6

Save Changes | Expand All | Collapse All

- Acute Human Effects
- Inhalation Toxicity
- Oral Toxicity
- Dermal Toxicity
- Respiratory Irritation
- Dermal Irritation
- Eye Irritation
- Exposure Limits
- IDLH
- Health

Dermal Irritation

Units	Value	Score
Key Phrases	Evidence in humans or anim ▼	8
GHS Category Level	1C, 2 ▼	6
GHS H Phrases	H315 ▼	8

- Eye Irritation
- Exposure Limits
- IDLH
- Health

Established in 1981
megaloid laboratories limited
2221 Ninth Line | Oakville, ON L6H 7G7
Phone: 905-337-7411 | Fax: 905-337-1686
megaloid.ca

Safety Data Sheet

1. PRODUCT IDENTIFICATION

Name	**Trichloroethylene**
Synonyms	**1,1,2-trichloroethylene, acetylene trichloride, TCE & trade names**
CAS#	**79-01-6**
Europe EC#	**201-167-4**
Product Uses	**cleaning solvent for vapour degreasing**

EMERGENCY INFORMATION

Canada	**Call CANUTEC (collect)**	**(613) 996-6666**
U.S.A.	**Call CHEMTREC**	**(800) 424-9300**

2. HAZARDS

GHS Class	*skin irritant*	*eye irritant*	*STOT*	*carcinogen*	*aquatic chronic*
(Category)	*(2)*	*(2)*	*(3)*	*(1B)*	*(2)*
Signal Words	*WARNING*	*WARNING*	*WARNING*	*DANGER*	*no Signal Word*
Hazard Statements	*causes skin irritation (H315)*	*causes serious eye irritation (H319)*	*may cause drowsiness or dizziness (H336)*	*may cause cancer (H350)*	*toxic to aquatic life with long-lasting effects (H411)*

GHS Precautionary Statements for Labelling

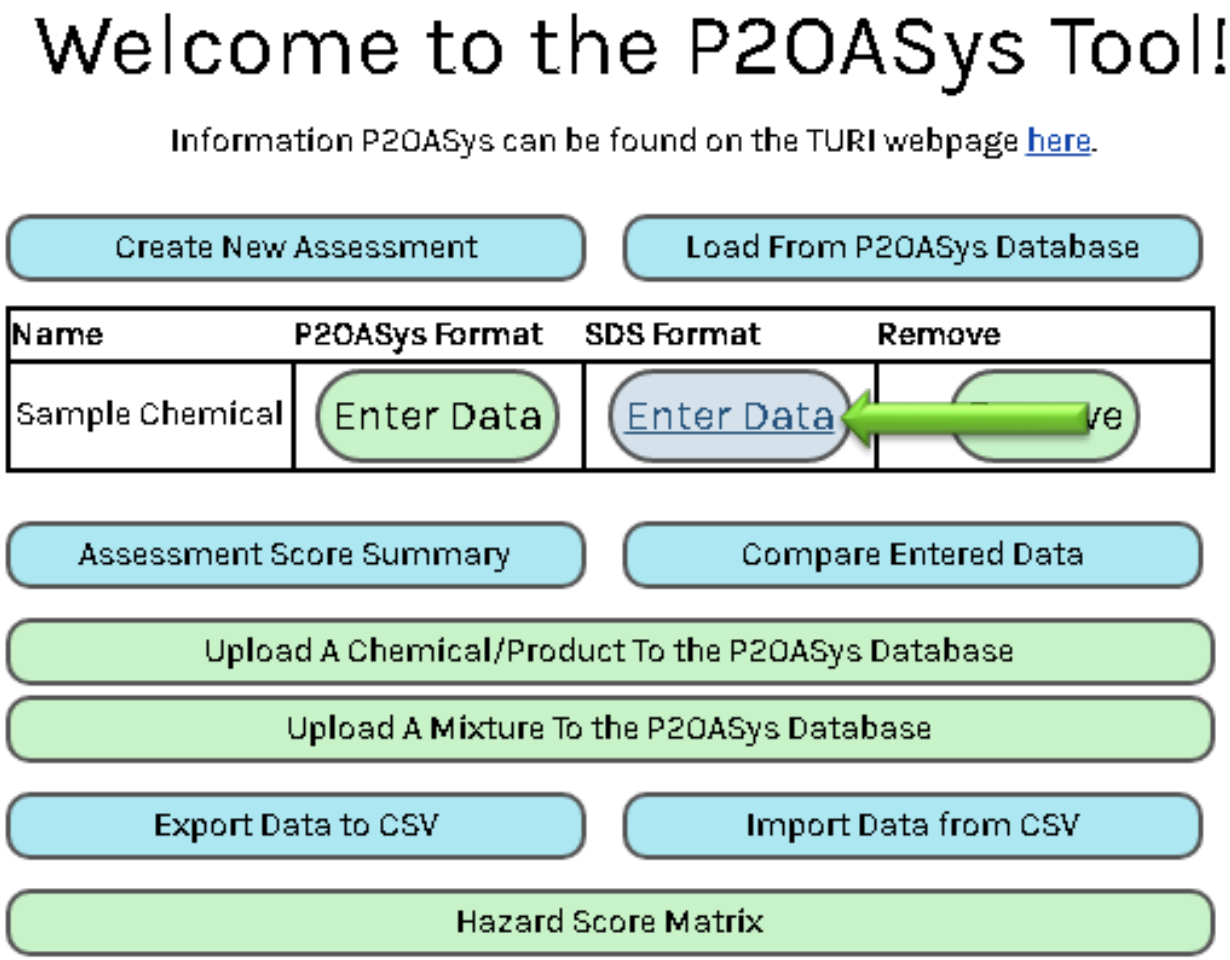
P261 P271	**Avoid breathing vapour. Use only in a well ventilated area**
P262 P264	**Do not get in eyes, on skin or on clothing. Wash thoroughly after handling.**
P270	**Do not eat, drink or smoke when using this product.**
P280	**Wear eye protection, protective gloves and clothing of butyl or "Viton".**
P273 P391	**Avoid release to the environment. Collect spillage.**

Canada – WHMIS	**D 1B, D 2A, D 2B**
Key:	*B 2 – Flash Point <38°C, B 3 – Flash Point >38°C & <93°C*
	D 1 – Immediately Toxic, D 2 – Chronic Toxicity
	C – Oxidising Substance, E – Corrosive, F – Reactive Substance

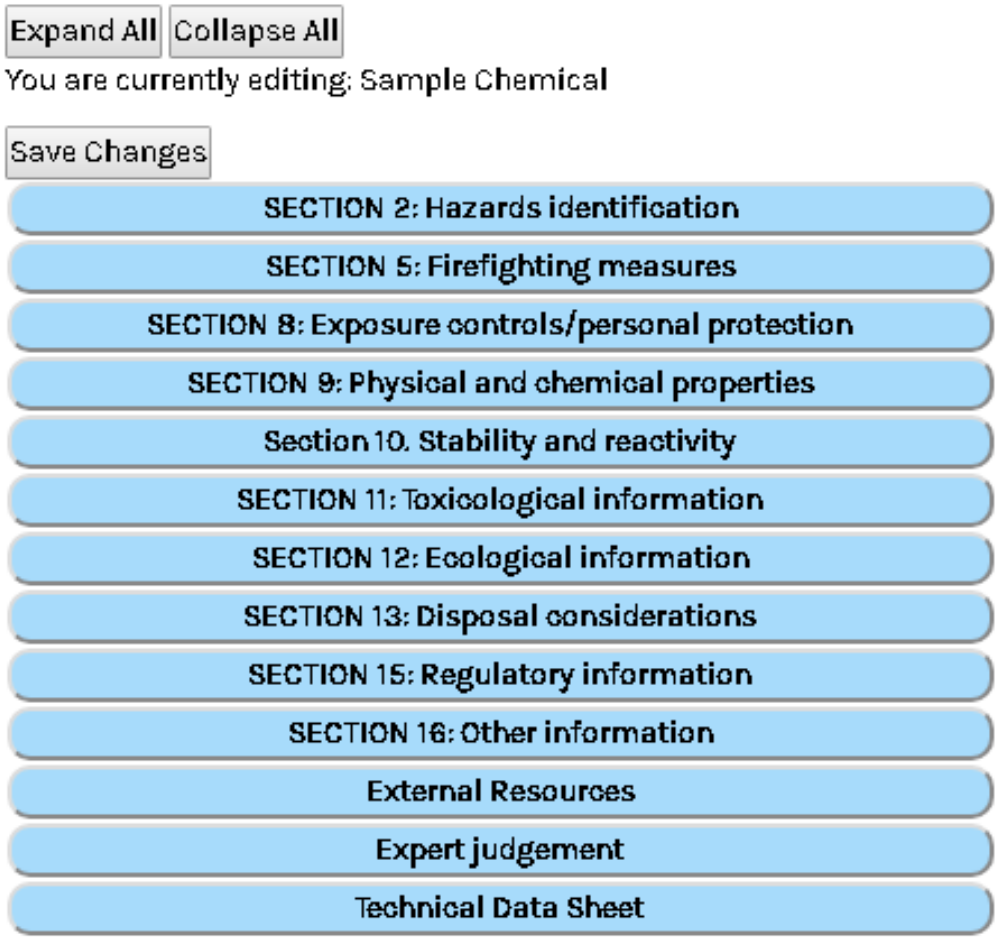
3. COMPOSITION

	%	TWAEV / TLV ppm / mg/m^3	LD_{50} (mg/kg) ORAL	LD_{50} (mg/kg) SKIN	LC_{50} ppm INHALATION
1,1,2-trichloroethylene	100%	10 / 55	2400	29,280	7175

Enter Data Using SDS Setup



Categories By SDS Location



The 16 sections of the new SDS cover:

1. Identification;
2. Hazard(s) Identification;
3. Composition/Information on Ingredients;
4. First-Aid Measures;
5. Fire-Fighting Measures;
6. Accidental Release Measures;
7. Handling and Storage;
8. Exposure Controls/Personal Protection;
9. Physical and Chemical Properties;
10. Stability and Reactivity;
11. Toxicological Information;
12. Ecological Information;
13. Disposal Considerations;
14. Transport Information;
15. Regulatory Information; and
16. Other Information.

Expand All | Collapse All

You are currently editing: Sample Chemical

Save Changes

- SECTION 2: Hazards identification
- SECTION 5: Firefighting measures
- SECTION 8: Exposure controls/personal protection
- SECTION 9: Physical and chemical properties
- pH
- Corrosivity
- Odor
- Volatile organic compound
- Vapor pressure
- Flash point: liquid
- Section 10. Stability and reactivity
- SECTION 11: Toxicological information
- SECTION 12: Ecological information
- SECTION 13: Disposal considerations
- SECTION 15: Regulatory information
- SECTION 16: Other information
- External Resources
- Expert judgement
- Technical Data Sheet

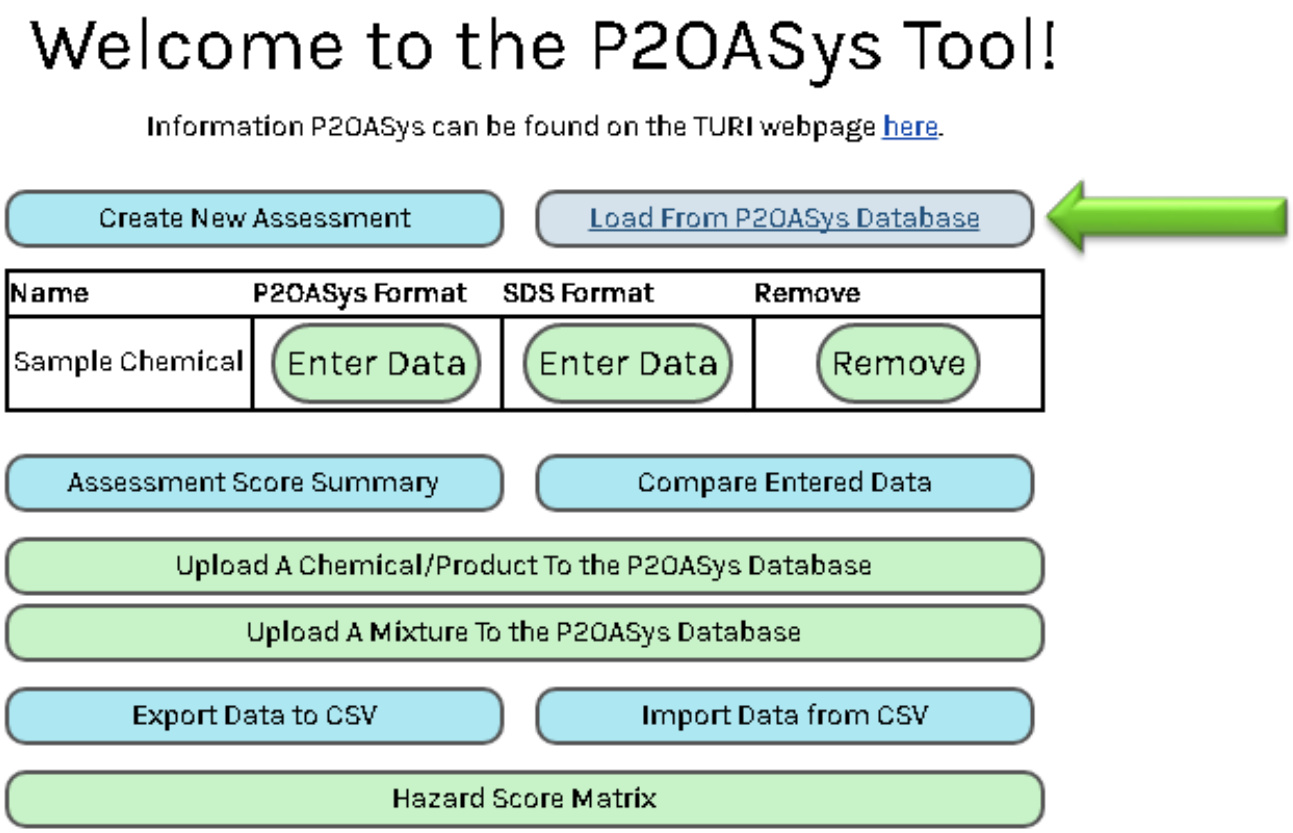
SECTION 9: Physical and chemical properties

pH

Units	Value	Score
pH units		
Key Phrases		

- Corrosivity
- Odor
- Volatile organic compound
- Vapor pressure
- Flash point: liquid

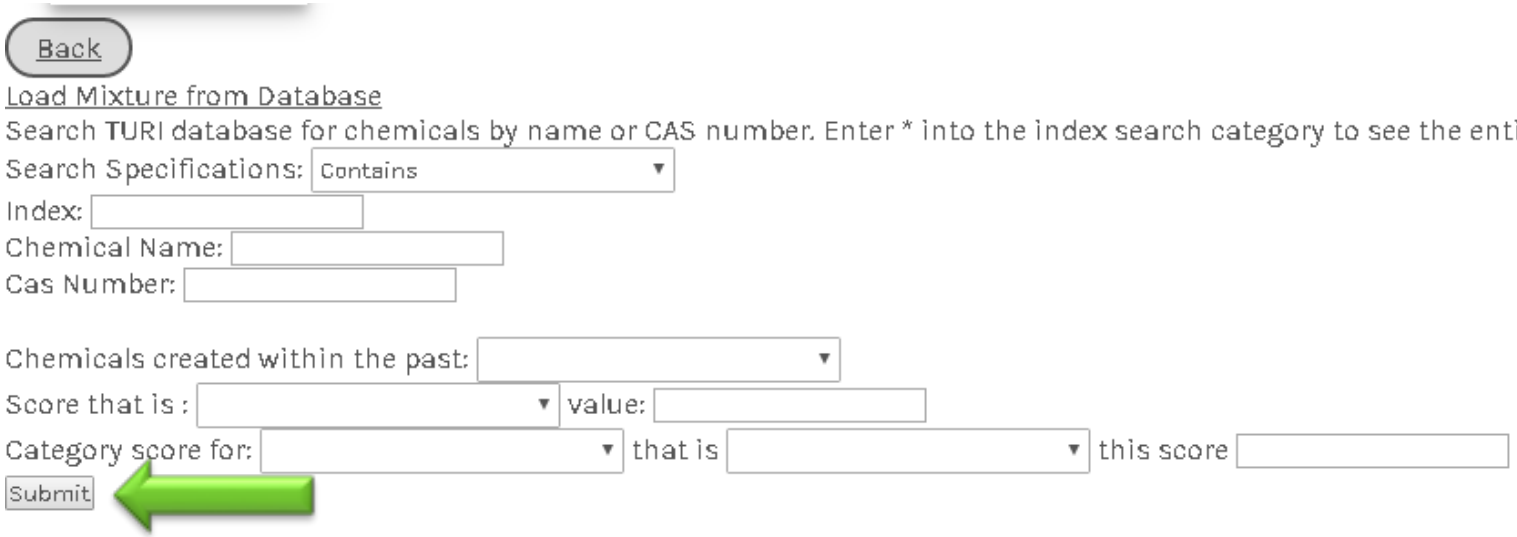
Adding a Chemical/Product



Load From Database:

allows you to use a chemical, product or mixture that has been reviewed by TURI and available to be used in session Search TURI database for chemicals by name or CAS number. Check the chemical and click on the submit button to add to current evaluation session

Select From List of TURI Entered Chemicals/Products



Select Chemical to Evaluate

Add	Index	Name	CAS	Date Created	Reviewed	Entries	Score	AHE	CHE	EH	EF&T	AH	PP	PF	LCF
☐	14	Trichloroethylene	79-01-6	2017-09-19	No	59	8.0	8	9	8	7	6	10	6	10
☐	15	Methylene Chloride	75-09-2	2017-09-19	No	48	7.3	8	9	2	6	6	9	8	10
☐	16	Acetone	67-64-1	2017-09-19	No	43	5.8	5	7	2	10	2	9	5	6
☐	9	Potassium Hydroxide	1310-58-3	2017-08-31	No	40	6.0	10	5	4	3	2	10	8	6
☐	10	Sodium Hydroxide	1310-73-2	2017-08-31	No	38	6.3	10	4	6	3	2	10	7	8
☐	11	1,1,1,3,3-pentafluorobutane	406-58-6	2017-08-31	No	43	5.9	6	2	2	10	6	10	5	6
☐	17	Benzyl Alcohol	100-51-6	2017-09-19	No	43	5.0	8	4	8	4	2	4	4	6
☐	18	n Propyl Bromide	106-94-5	2017-09-19	No	59	8.1	9	8	7	10	3	10	8	10
☐	19	N-methyl-2-pyrrolidone	872-50-4	2017-09-19	No	47	5.8	8	8	2	5	2	8	5	8
☐	20	Trans-1,2-Dichloroethylene	156-60-5	2017-09-19	No	39	5.8	6	6	2	6	2	10	6	8
☐	21	trans-1-Chloro-3,3,3-trifluoro	2730-43-0	2017-09-19	No	37	5.6	4	4	6	10	4	7	4	6
☐	22	2-Butoxyethanol	111-76-2	2017-09-19	No	49	5.1	9	6	2	4	3	5	6	6

Back | Expand All | Collapse All

You are currently viewing: Trichloroethylene

CAS: 79-01-6

Index: 14

Created on: 2017-09-19

Add Trichloroethylene To Session

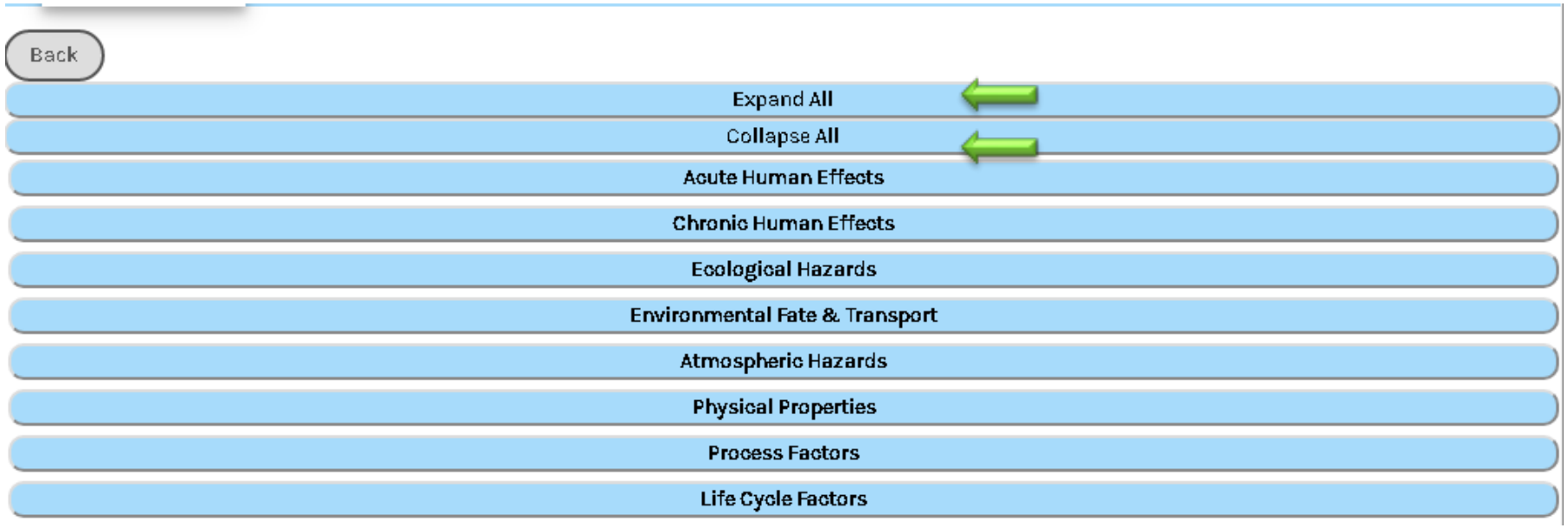
- Acute Human Effects
- Chronic Human Effects
- Ecological Hazards
- Environmental Fate & Transport
- Atmospheric Hazard
- Physical Properties
- Process Factors
- Life Cycle Factors

Database Matrix of Endpoints

Endpoints

Hazard Score Database:

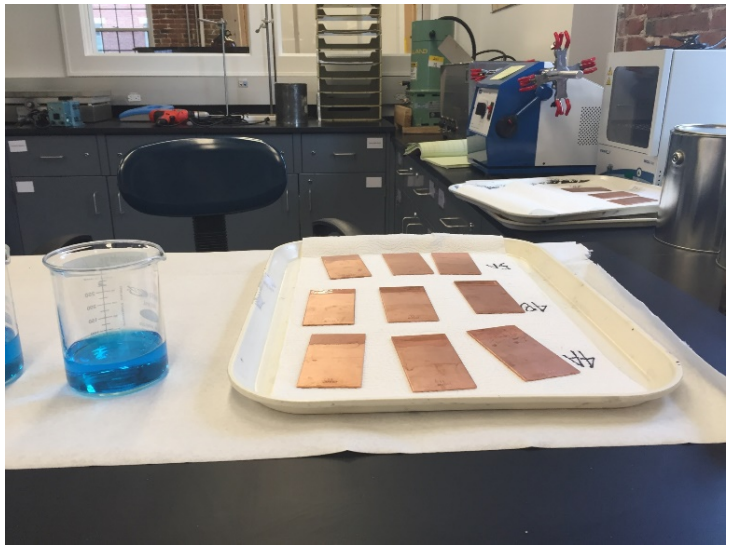
Table contains values and end points for each of the categories that are used to assess scores to entered data. Maintained by TURI.

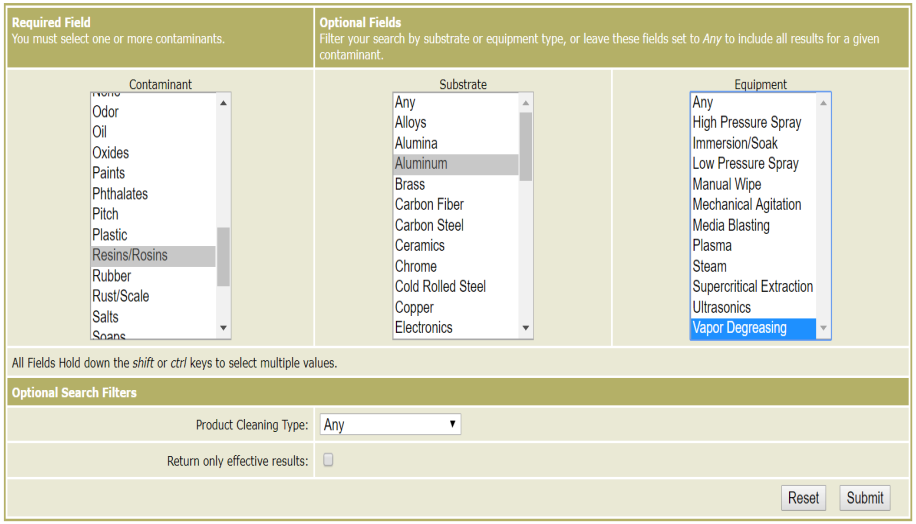


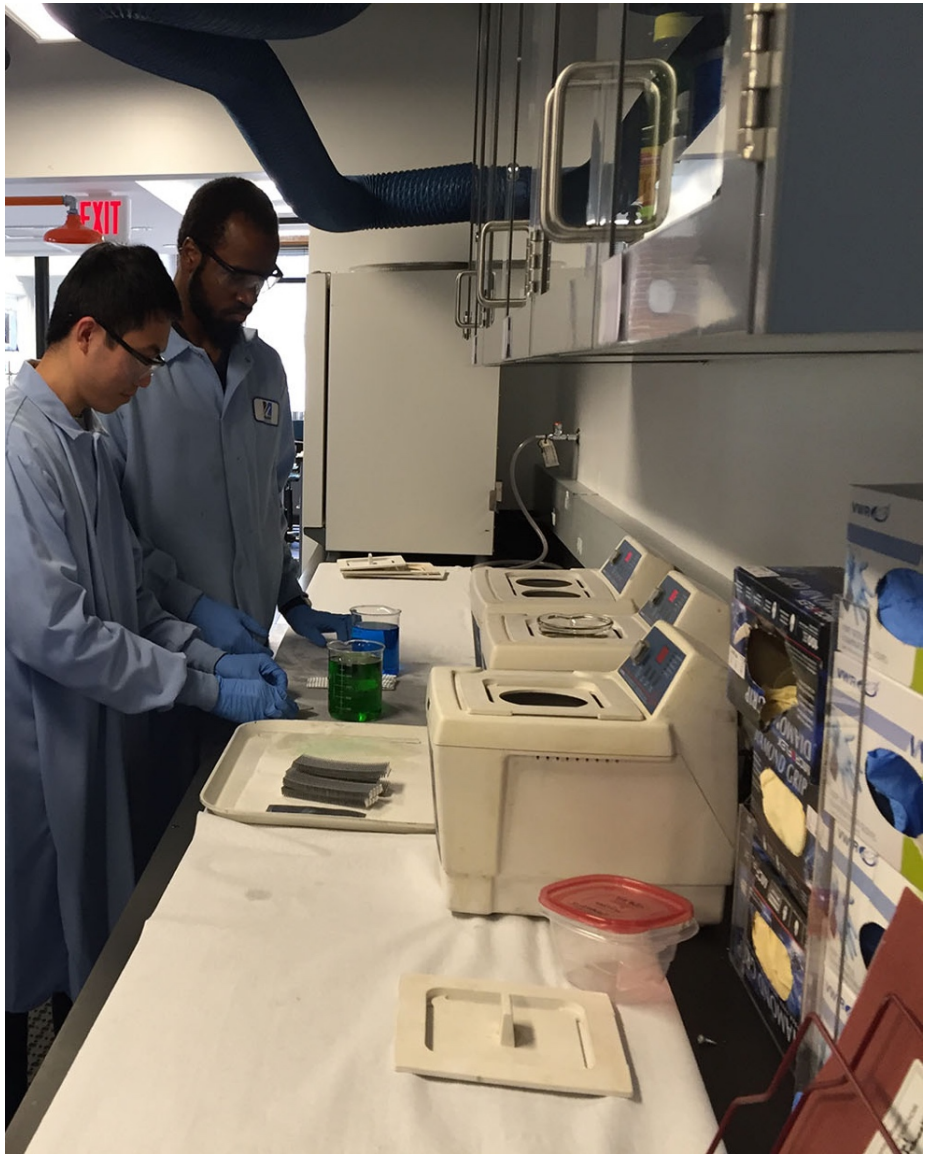
Acute Human Effects						
Sub Item	Units	2.00	4.00	6.00	8.00	10.00
Inhalation Toxicity	LC50 ppm	20000	2500	500	100	<100
Inhalation Toxicity	Vapor GHS Category Level	5	4	3	2	1
Inhalation Toxicity	mg/l gas/vapor	20	15	10	2	<2
Inhalation Toxicity	mg/l dust/mist/fume	5	1	0.5	0.05	<.05
Inhalation Toxicity	Key Phrases	Not considered harmful	May cause breathing difficulties if inhaled	Harmful if inhaled	Toxic if inhaled	Fatal if inhaled
Inhalation Toxicity	Solid GHS Category Level		4	3	2	1
Inhalation Toxicity	GHS H Phrases		H333	H332	H331	H330
Oral Toxicity	LD50 mg/kg	5000	2000	1000	200	<200
Oral Toxicity	Key Phrases	Not harmful if swallowed	May be fatal if swallowed and enters airways	Harmful if swallowed	Toxic if swallowed	Fatal if swallowed
Oral Toxicity	GHS H Phrases		H303	H302, H305	H301, H304	H300
Oral Toxicity	GHS Category Level	5	4	3	2	1
Dermal Toxicity	LD50 mg/kg	5000	2000	300	200	50
Dermal Toxicity	Key Phrases	Not harmful if comes in contact with skin	May be harmful	Harmful in contact with skin	Toxic in contact with skin	Fatal in contact with skin
Dermal Toxicity	GHS H Phrases		H313	H312	H311	H310
Dermal Toxicity	GHS Category Level	5	4	3	2	1
Respiratory Irritation	Key Phrases	Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified.	Evidence in humans and animals shows slight or minor reversible respiratory irritation effects	Evidence in humans or animals shows mild reversible respiratory irritation effects; Low to moderate frequency of occurrence	Evidence in humans or animals shows reversible respiratory irritation effects; High frequency of occurrence; Sensitizing Substance	Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible damage to the respiratory system
Respiratory Irritation	GHS H Phrases		H335		H334	
Respiratory Irritation	GHS Category Level	Not classified by GHS and no structural alerts		1B	1A	1
Dermal Irritation	Key Phrases	Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified.	Evidence in humans and animals shows slight or minor reversible skin irritation effects	Evidence in humans or animals shows mild reversible skin irritation effects; Mild irritant	Evidence in humans or animals shows reversible skin irritation effects; Irritant	Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible skin burns; Corrosive
Dermal Irritation	GHS Category Level		3	1C, 2	1B	1A, 1
Dermal Irritation	GHS H Phrases			H316, H317	H315	H314
Eye Irritation	Key Phrases	Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified.	Evidence in humans and animals shows slight or minor reversible eye irritation effects	Evidence in humans or animals shows mild reversible eye irritation effects; Mildly irritating	Evidence in humans or animals show reversible irritation effects on the eyes from single or repeated exposure; Irritating	Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible eye damage; Irreversible
Eye Irritation	GHS H Phrases			H320	H319	H318, H314
Eye Irritation	GHS Category Level			2, 2B	2A	1
Exposure Limits	PEL/TLV ppm	200	100	25	5	<5
Exposure Limits	PEL/TLV (dusts/particles) mg/m3	10	5	1	0.1	<0.1
Exposure Limits	GHS Category Level		4	3	2	1
IDLH	ppm	1000	500	50	10	<10
Health	NFPA/HMIS 0,1,2,3,4	0	1	2	3	4

P2OASys in Practice

- Green Chemistry Labs
- Identify potential alternative chemistries for clients
- Initial insight of EHS for formulation mixtures
- Review chemistries for safer Hansen Solubility in Practice solvents







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