NJrisk PROJECT

Phase I Pilot Study
for Implementing an Integrated Computational Tool
to Support Prioritization of Chemicals of Emerging Concern

FINAL REPORT FOR THE PILOT PHASE
(July 2013 – March 2014)

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PART I – PROJECT IMPLEMENTATION

1 SUMMARY OVERVIEW

A nine-month Pilot Study was conducted from July 2013 to March 2014, in order to complete the necessary groundwork for the subsequent implementation of an integrated tiered system coupling computational platforms to support prioritization of Chemicals of Current and of Emerging Concern.

The Pilot Study built upon multiyear efforts that the Computational Chemodynamics Laboratory (of EOHSI) and Dupont have invested in the development of two existing software platforms that represent the state-of-the-art in exposure and hazard characterization, respectively, using extant data. Ultimately, the goal is to implement an integrated system (NJrisk) that allows many types of users to assess both hazard and exposure potentials of chemicals that are found (or could be introduced) in the New Jersey environment and/or biota, and to prioritize these chemicals for regulatory action based on tiered risk analysis.

1.1 Rationale

All regulatory agencies, nationally and internationally, face current challenges in their efforts to address concerns regarding the rapid introduction of many "new" chemicals or the use of "old" chemicals in new products, resulting to "new types of exposures" for human populations and ecosystems. A variety of approaches are being developed to support these efforts; our present effort directly addresses a critical State and National need.

A major attribute of the planned integrated NJrisk system is that, in addition to addressing chemicals of "current regulatory concern," it will also facilitate characterization of contaminants of "emerging concern." In general the term "emerging contaminants" refers to hazardous materials or mixtures that may have:

    a. a perceived or real threat to human health, public safety or the environment;
    b. no published or evolving health standards or guidelines;
    c. insufficient or limited available toxicological information that is evolving or being re-evaluated; or
    d. significant new sources, pathways, or detection limits.

Some major classes of Chemicals of Emerging Concern (CECs) include pharmaceutical and personal care products (PPCPs); engineered nanomaterials (ENMs) such as silver nanoparticles and carbon nanotubes; plasticizers, flame retardants, protective coatings; home cleaning products; and food additives.

1.2 Approach

The 9-month Phase I Pilot study used two operational computational platforms for hazard and for exposure ranking, respectively METIS (Metanomics Information System), developed by DuPont, and PRoTEGE (Prioritization and Ranking of Toxic Exposures with GIS Extension), developed by the Computational Chemodynamics Laboratory (CCL) of EOHSI. The specific aim of the Phase I study was to demonstrate and evaluate the feasibility of developing an integrative computational approach that "mines" extant databases in conjunction with exposure modeling to facilitate risk-based ranking of chemicals.

This aim was accomplished through the following tasks:

- **Task 0.** Installation and testing, on CCL servers, of a version of METIS that was provided by DuPont.
- **Task 1.** Definition and completion of representative exploratory case studies for a set of 15 chemicals of concern (emerging and current) selected for having a broad variety of

attributes with respect to chemical and toxicological properties; production, usage and disposal patterns; environmental distribution and accumulation patterns; and potential exposure routes and pathways.

- **Task 2.** Assessing the benefits and identification of the specific challenges of implementing a systematic and integrated approach for characterizing chemical exposures and hazards, through the analysis of exploratory case studies.
- **Task 3.** Initial definition and optimization of framework design, including software requirements and specifications for the subsequent development of the integrated tiered computational system (NJrisk).

Part I, Section 2 of this Pilot Phase Final Report summarizes the approach and methods used for implementing the above tasks. Part I, Section 3 provides a summary overview of the planned structure and components of NJrisk; this structure reflects the outcomes of the assessment performed during the Pilot Phase and defines a framework that will allow the incorporation of new sources of information as NJrisk evolves. Part II presents exploratory case studies for a set of fifteen (15) chemicals, showing the summary results from the combined PRoTEGE-METIS data retrieval and integration for these chemicals.

2   PILOT PHASE IMPLEMENTATION

METIS and PRoTEGE have been jointly employed to conduct Pilot Study involving hazard and exposure characterization applications for a broadly representative set of 15 chemicals of current and emerging concern, corresponding to various combinations of production volume, chemical properties, environmental distribution, usages, exposure pathways, etc. These case studies were analyzed and evaluated in order to identify optimal ways for future linking and merging appropriate METIS and PRoTEGE components and corresponding data retrieval and calculation procedures, and to establish initial software requirements and specifications for NJrisk that will be completed through the subsequent implementation and evaluation phases.

The following chemicals were selected for the Pilot Phase analysis:
1. 1,2,3–Trichlorobenzene (CASRN: 87-61-6)
2. Aldicarb (CASRN: 116-06-3)

3. Bisphenol-A (CASRN: 80-05-7)
4. Butylhydroxyanisole (CASRN: 8003-24-5)
5. Di-n-butylphtalate (CASRN: 84-74-2)
6. Hexabromocyclododecane (CASRN: 25637-99-4)
7. Methoxychlor (CASRN: 72-43-5)
8. n-Hexane (CASRN: 110-54-3)
9. Nonylphenol (CASRN: 25154-52-3)
10. octaBDE (CASRN: 32536-52-0)
11. Ammonium Perchlorate (CASRN: 7790-98-9)
12. Tetrabromobisphenol A (CASRN: 79-94-7)
13. Trifluralin (CASRN: 1582-09-8)
14. Tris (2-chloroethyl) phosphate (CASRN: 115-96-8)
15. Vinclozolin (CASRN: 50471-44-8)

2.1   Methods

The research and development effort undertaken through the Pilot Project addressed Tiers 1 and 2 of the Chemicals of Emerging Concern evaluation process depicted in Figure 1. These are the initial screening of substances of concern (Tier 1) and the preliminary hazard and exposure assessment (Tier 2). These two steps provide a sound specific basis for extending the analysis into a Risk Assessment (Tier 3).

As stated earlier, the above-mentioned effort utilized components from two operational state-of-the-art platforms for hazard and for exposure characterization and ranking:
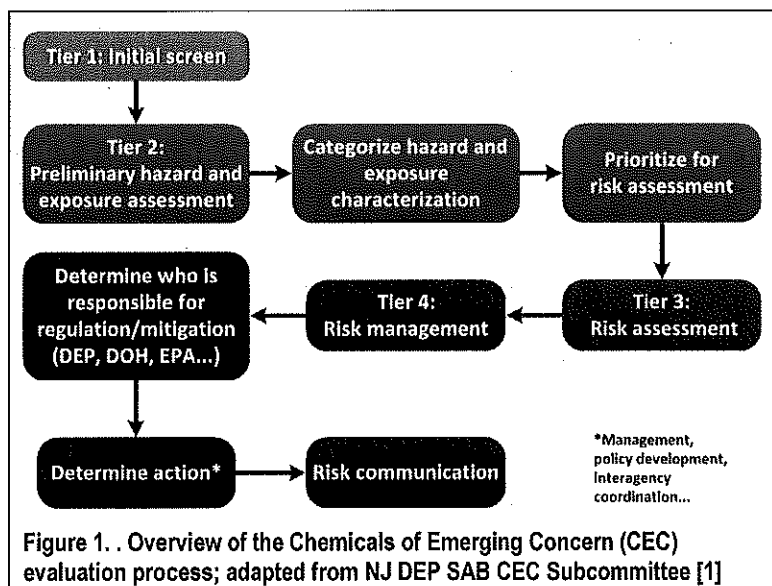
Figure 1. . Overview of the Chemicals of Emerging Concern (CEC) evaluation process; adapted from NJ DEP SAB CEC Subcommittee [1]

- METIS (Metanomics Information System), developed by DuPont, and
- PRoTEGE (Prioritization and Ranking of Toxic Exposures with GIS extension), developed by the Computational Chemodynamics Laboratory of EOHSI.

METIS [2] is a chemical informatics platform that provides a screening level view of potential environmental fate and effects, human health concerns, and societal perception issues associated with a chemical of concern. As an example, Figure 2 depicts "METIS attributes" that have been retrieved in a systematic manner from a variety of databases for a representative chemical. Typically these attributes are:

Figure 2.. Hazard-related attributes of chemicals retrieved and plotted by the Metanomics Information System (METIS)

- Environmental Persistence – indicates the predicted half-life in each environmental compartment,
- Soil Mobility – the potential for a chemical to migrate from soil into groundwater.
- Bioaccumulation – uses measured or estimated values to indicate the potential for a chemical to sorb to lipids,
- Aquatic Toxicity – the measured or estimated toxicity to aquatic organisms,
- CMR – indicates whether the compound is classified as known or suspected animal and/or human Carcinogen, Mutagen or Reproductive toxin,
- Public Perception – indicates that the chemical is present on a variety of regulatory, industrial and/or non-governmental lists that may influence how the public views a particular chemical,
- Environmental Impact – indicates the potential for the chemical to affect global warming and ozone depletion as compared to reference compounds,
- Long Range Transport (Air) – the potential for the chemical to travel long distances from its point of entry into the environment,
- Environmental Partitioning (Fugacity) – steady-state partitioning of a chemical in the environment (Air, Water, Soil, Sediment) based on different emission scenarios.
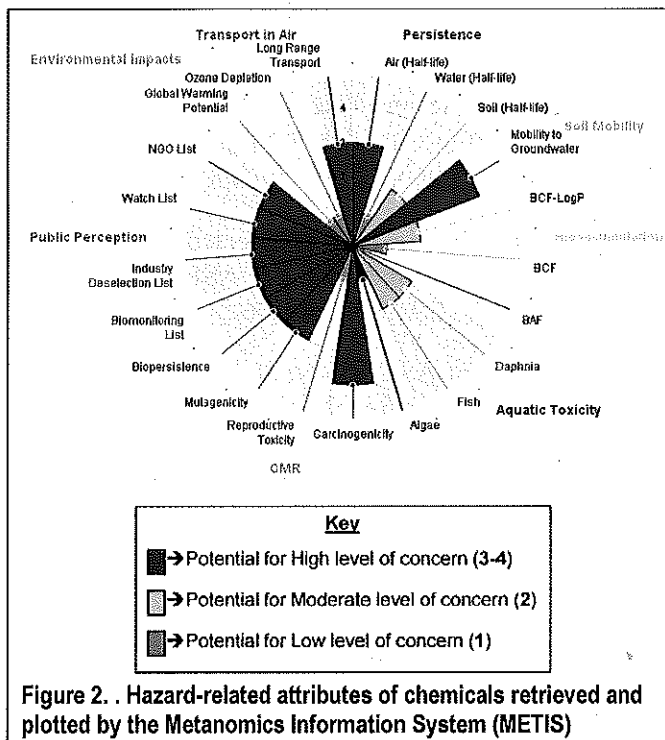
METIS has been built on open-source software that provides access to an aggregated database and estimation tool set. METIS retrieves and assembles information from over 1,400 publicly available databases (see Table 1 for a representative set of these databases). These data resources may contain, but are not limited to, physical and chemical properties, hazard, toxicological, environmental and regulatory information. The input for METIS is simply the chemical name, CAS #, or chemical structure. METIS retrieves information and assembles it together into a

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comprehensible view in seconds to minutes versus weeks to months that could be required, in some cases, by conventional searches.

Table 1. Selected databases accessed by METIS (hosted locally)

Database	Expanded Name
BCF	Bio-concentration Factors Gold standard database (Cefic LRI, EURAS)
CDAT – CDR	Chemical Data Access Tool -Chemical Data Reporting
CCRIS	Chemical Carcinogenesis Research Information System
DIPPR	Design Institute for Physical Properties
ECOTOX	ECOTOXicology database
HSDB	Hazardous Substances Data Bank
MITI	Ministry of International Trade and Industry (Existing and New Chemical Substances List)
PBDB	
PHYSPROP	Physical Properties Database
PubChem	--
SRC BCF	SRC Bioconcentration Factor
ToxMiner	--

PRoTEGE [3,4] is an analysis and modeling platform that facilitates exposure calculations at multiple tiers, utilizing available data on:

- chemical production volumes,
- intrinsic properties that affect the environmental dynamics of the chemical (e.g. volatility, solubility, etc.),
- intrinsic properties (such as lipophilicity) that affect the biological dynamics (absorption, distribution, metabolism, elimination) of the chemical, and subsequent uptake/bioaccumulation by humans and wildlife,
- chemical transportation modes and amounts,
- chemical usage in industrial, agricultural, etc. applications,
- environmental release/disposal amounts and spatiotemporal pattern,
- chemical uses in consumer products and in foodstuffs,
- environmental concentrations of chemicals in multiple media (including food and beverages),
- age- and gender-specific population distributions of physiological and behavioral attributes.

Figure 3. A schematic depiction of the conceptual framework of PRoTEGE (Prioritization and Ranking of Toxic Exposures with GIS Extension) [3,4]; this system uses a Life Cycle Assessment (LCA) approach to assess potential human exposures to chemicals that could take place during manufacturing, transportation, or using products containing these chemicals as well as following their environmental disposal.

PRoTEGE derives from and complements the Modeling ENvironment for TOtal Risk studies (MENTOR) [5-8], which supports detailed person-oriented ("bottom-up") source-to-dose exposure modeling for mixtures of multiple multimedia contaminants. MENTOR allows a study to focus on specific locations and subpopulations, but is both data and resource intensive. The simplified "top-down" population-oriented approach of PRoTEGE provides tiered estimates of exposures experienced by populations of concern, allowing calculations at the national, state or county level.
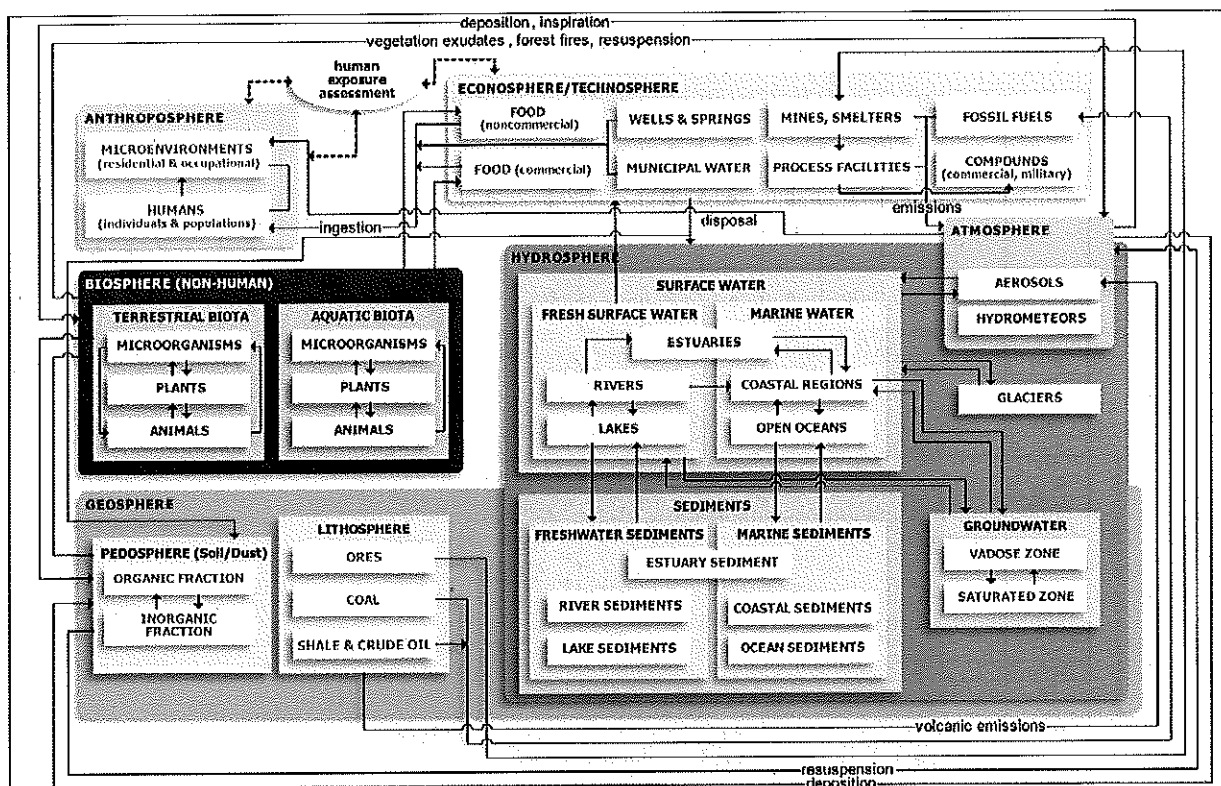
Figure 4. Multimedia/multipathway/multiroute exposure assessment in MENTOR (Modeling Environment for Total Risk studies) [5-7]; simplified modules of MENTOR focusing on human exposures have been developed for incorporation in PRoTEGE (Prioritization and Ranking of Toxic Exposures with GIS Extension) to support chemical ranking and screening when limited data are available. Additional PRoTEGE modules focusing on ecological exposures will be developed as part of the integrated NJrisk system.

The PRoTEGE approach takes advantage of, and integrates, both available measurements and model estimates to understand and quantify exposures of populations potentially at risk. Specifically, by utilizing over 50 available "information bases" (including various traditional databases and metadatabases, literature surveys, etc. as well as original studies reported in the literature – see Table 2a and 2b) of environmental releases, chemical production and usage, multimedia environmental concentrations, and age- and gender-specific population distributions of major physiological and behavioral patterns, the estimates of PRoTEGE provide a reasonably realistic assessment of exposures that could be experienced by the general population or by subpopulations of concern.

Table 2a. Representative databases and other information sources currently employed by PRoTEGE for developing exposure rankings of 15 chosen Chemicals of Emerging and Current Concern

CASRN				87-61-6	116-06-3	80-05-7	8003-24-5	84-74-2	25637-99-4	72-43-5	110-54-3	25154-52-3	32536-52-0	7790-98-9	79-94-7	1582-09-8	115-96-8	50471-44-8
Chemical Name				1,2,3-Trichlorobenzene	Aldicarb	Bisphenol-A	Butylhydroxanisole	Di-n-butylphthalate	Hexabromocyclododecane	Methoxychlor	n-Hexane	Nonylphenol	octaBDE	Ammonium Perchlorate	Tetrabromobisphenol A	Trifluralin	Tris (2-chloroethyl) phosphate	Vinclozolin
Chemical Class				VOC	CarP	Plz	EE	Plz	BFR	OCP	VOC	Alkylphenol/ NMJ	PBDEs	oxid	BFR	Herb	PEFR	Fung

Availability of Information for the Chemical in Databases and Reference Documents																			
	Physicochemical and/or Toxicological Properties	PAC																	
		NIOSH																	
		ICSC																	
		ToxProfs																	
		IRIS																	
		HSDB																	
		ITER																	
		McKay																	
		Howard																	
		RIVM rpts																	
		IARC																	
		PSAP																	
		NTP																	
		REACH																	
		PFD																	
		MSDS																	
		DSSTox																	
		TM																	
		SCP																	
		HPVIS																	
		ToxCast	Phase I																
			Phase II																
		ToxRefDB																	
		GESTIS																	
		CEBS																	
	Production and Use	SIDS																	
		EHPV																	
		HPD																	
		IUR																	
		ECD																	
		SRD																	
	Relea ses	TRI																	
		NEI																	
	Environmental Quality	NGA																	
		NAWQA																	
		AQS																	
		CERCLIS																	
		NATA																	
	Microenvironments and Biomarkers- Human and Ecological	TDS																	
		SDWIS																	
		NHANES	03-04																
			05-06																
			07-08																
			09-10																
		NHEXAS																	
	PK/PBPK Model (or Data)	SciLit																	
		BME																	
		ERDEM																	

Database does contains information on chemical of concern.

Database does not contain information on chemical of concern.

There are plans to include the chemical of concern but no data are yet available.

Table 2b. Databases and other information sources appearing in Table 2a

Data Source Abbreviation	Expanded Name
PAC	Protective Action Criteria
NIOSH	National Institute for Occupational Safety and Health
ICSC	International Chemical Safety Cards
ToxProfs	Toxicological Profiles
IRIS	Integrated Risk Information System
HSDB	Hazardous Substance Databank
ITER	International Toxicity Estimates for Risk
McKay	Mackay's "Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals"
Howard	Howard's "Handbook of Environmental Fate and Exposure Data for Organic Chemicals"
RIVM rprts	RIVM National Institute for Public Health and the Environment reports
IARC	International Agency for Research on Cancer
PSAP	Priority Substances Assessment Program
NTP	National Toxicology Program database search
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
PFD	Pesticide Fate Database
MSDS	Material Safety Data Sheets
DSSTox	Distributed Structure-Searchable Toxicity
TMI	The Merck Index
SCP	Scorecard Chemical Profiles
HPVIS	High Production Volume Information System
ToxCast	Toxicity Forecaster
ToxRefDB	Toxicity Reference Database
GESTIS	GESTIS - Information system on hazardous substances of the German Social Accident Insurance
CEBS	Chemical Effects in Biological Systems
SIDS	Screening Information Data Set
EHPV	Expended High Production Volume
HPD	Household Products Database
IUR	Inventory Update Reporting
ECD	Existing Chemicals Database
SRD	Source Ranking Database
TRI	Toxics Release Inventory Program
NEI	National Emission Inventory
NGA	National Geochemical Atlas
NAWQA	National Water-Quality Assessment Program
AQS	Air Quality System
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
NATA	National-Scale Air Toxics Assessments
TDS	Total Diet Study
SDWIS	Safe Drinking Water Information System
NHANES	National Health and Nutrition Examination Survey
NHEXAS	National Human Exposure Assessment Survey
ScLit	Scientific Literature
BME	Biomonitoring Equivalents
ERDEM	Exposure Related Dose Estimating Model

PRoTEGE incorporates various modeling methods that are available for developing screening estimates of exposure-relevant environmental concentrations of chemicals, including fugacity calculations [9,10], intake fractions [11,12], biomonitoring equivalents [13], etc.

When data are not available for a specific chemical, various assumptions need to be made; in these cases the estimates of PRoTEGE reflect plausible scenarios of chemical production, distribution, usage, disposal, etc.

Exposure metrics calculated by PRoTEGE provide semi-quantitative and quantitative (depending on the information that is available and the level/tier of analysis performed) measures of potential exposures to the chemical of concern. These metrics are based on a combination of available information on releases and concentrations, on types and degree of exposures reported in the literature, and expert judgment on various facets of the exposures. The four population-based metrics used for exposure ranking are: *pervasiveness, persistence, severity,* and *efficacy.*

- *Pervasiveness* reflects how widespread the exposures are (or could be) within the population of concern.
    - o Quantitative factors that are considered in ranking pervasiveness include: fraction of administrative unit (e.g. counties or municipalities) where emissions or usage of the chemical are reported; production amounts for the chemical; extent of usage of the chemical in consumer products; percentage of ambient concentrations above a threshold, etc.
    - o Semi-quantitative factors include information from the literature on whether exposures are wide-spread (e.g. based on the major release types), localized (e.g. based on transport scales), or limited to specific geographic areas (e.g. urban areas, farmland, coastal fishing regions, etc.).
- *Persistence* reflects the temporal frequency and/or duration of exposures experienced by the general population.
    - o Factors that are considered in ranking persistence include: temporal patterns of emissions and releases, pattern of potential contact with the chemical through food consumption or usage of consumer products, environmental half-lives, chemical reactivity, etc.
    - o Semi-quantitative factors include information on whether exposures are episodic, cyclical, or generally uniform over a long period of time.
- *Severity* reflects the potential for high levels of exposures.
    - o Quantitative factors that are considered in ranking severity include: peak release rates, levels of peak concentrations, acute effects occurring at or near reported ambient or microenvironmental levels of the chemicals, etc.
    - o Semi-quantitative factors include additional information on frequency of localized high releases, special behavior patterns that could lead to potentially high exposures, etc.
- *Efficacy* reflects the potential of the contact with the chemical to result in intake by humans (or other organisms of concern) and resulting in biologically relevant uptake.
    - o Quantitative factors include biological partition coefficients, while semi-quantitative factors include information on the form of the chemical exposures (e.g. food matrix).

The above four exposure metrics of PRoTEGE are assigned integer values on a scale of 1 to 5 for each chemical considered, corresponding to "very low," "low," "moderate," "high," and "very

high" exposure estimates, respectively. These rankings are calculated individually for the three major exposure routes: inhalation, ingestion, and dermal absorption; additionally, the rankings are averaged for the three routes to obtain an "aggregate ranking."

Table 3. PRoTEGE "Tier 1" exposure rankings for the 15 selected chemicals

Chemical		1,2,3–Trichlorobenzene	Aldicarb	Bisphenol-A	Butylhydroxyanisole	Di-n-butylphtalate	Hexabromocyclododecane	Methoxychlor	n-Hexane	Nonylphenol	octaBDE	Ammonium Perchlorate	Tetrabromobisphenol A	Trifluralin	Tris (2-chloroethyl) phosphate	Vinclozolin
Ranking Based on Inhalation Route	Pervasiveness	1	1	1	1	1	1	1	5	3	1	1	3	1	3	1
	Persistence	1	1	1	1	1	1	1	3	1	1	1	3	1	2	1
	Severity	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1
	Efficacy	2	1	1	2	1	1	1	3	1	1	2	1	1	1	1
Ranking Based on Ingestion Route	Pervasiveness	2	2	2	4	3	3	2	1	2	3	3	1	2	3	2
	Persistence	2	2	2	3	3	2	2	1	1	3	3	1	2	3	2
	Severity	1	2	2	2	1	1	2	1	1	1	2	1	2	2	2
	Efficacy	2	2	2	3	2	2	2	2	2	2	3	3	2	2	2
Ranking Based on Dermal Route	Pervasiveness	1	1	1	3	2	1	1	3	2	1	1	1	1	1	1
	Persistence	1	1	1	3	2	1	1	2	1	1	1	1	1	1	1
	Severity	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1
	Efficacy	2	1	1	3	1	2	1	4	2	1	1	1	2	2	2
Ranking Based on Aggregate Exposure	Pervasiveness	1.33	1.33	1.33	2.67	2	1.67	1.33	3	2.33	1.67	1.67	1.67	1.33	2.33	1.33
	Persistence	1.33	1.33	1.33	2.33	2	1.33	1.33	2	1	1.67	1.67	1.67	1.33	2	1.33
	Severity	1	1.33	1.33	1.67	1	1	1.33	1.67	1.33	1	1.33	1	1.33	1.33	1.33
	Efficacy	2	1.33	1.33	2.67	1.33	1.67	1.33	3	1.67	1.33	2	1.67	1.67	1.67	1.67
Ranking Based on Dominant Exposure Route for Each Metric	Pervasiveness	2	2	2	4	3	3	2	5	2	3	3	3	2	3	2
	Persistence	2	2	2	3	3	2	2	3	1	3	3	3	2	3	2
	Severity	1	2	2	2	1	1	2	2	1	1	2	1	2	2	2
	Efficacy	2	2	2	3	2	2	2	4	2	2	3	3	2	2	2

Table 4. PRoTEGE "Tier 2" raw data for the 15 selected chemicals

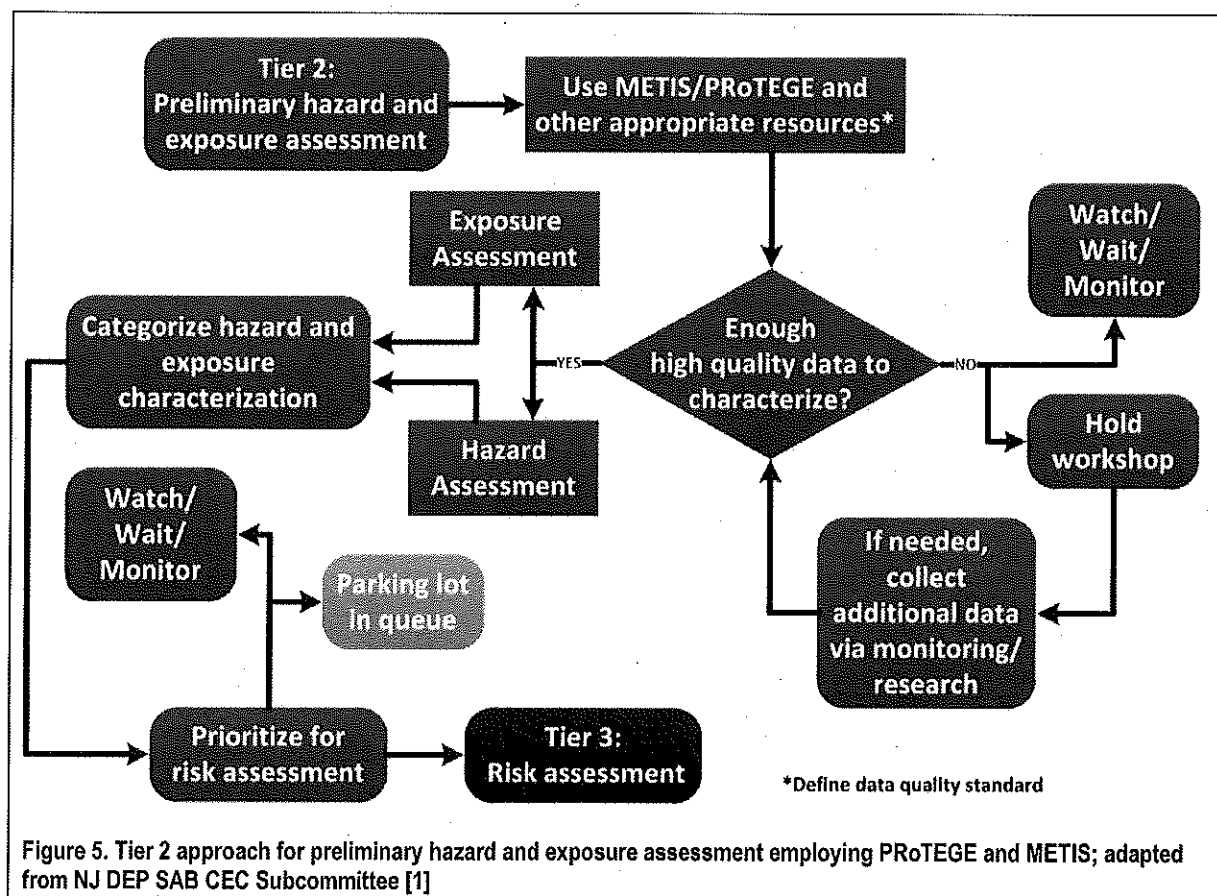| Chemical		1,2,3-Trichlorobenzene	Aldicarb	Bisphenol-A	Butylhydroxyanisole	Di-n-butylphthalate	Hexabromocyclododecane	Methoxychlor	n-Hexane	Nonylphenol	octaBDE	Ammonium Perchlorate	Tetrabromobisphenol A	Trifluralin	Tris (2-chloroethyl) phosphate	Vinclozolin
Estimated Intake through the Inhalation Route	10th %ile	0	0	1.19E-05	0	4.13E-03	0	7.10E-06	1.69E-01	2.62E-03	9.43E-10	0	1.92E-06	0	3.30E-02	0
	median	0	0	2.58E-05	0	8.50E-03	0	8.63E-06	3.67E-01	5.58E-03	6.29E-09	0	3.49E-06	0	2.85E-01	0
	90th %ile	0	0	5.54E-05	0	1.59E-02	0	1.06E-05	7.99E-01	1.08E-02	2.36E-08	0	5.65E-06	2.53E-05	1.01E+00	0
	95th %ile	0	0	6.88E-05	0	1.90E-02	0	1.07E-05	1.02E+00	1.29E-02	3.38E-08	0	6.42E-06	5.30E-05	1.85E+00	0
	% > 0.1 µmol/day	0	0	0	0	2.19E-01	0	0	9.80E+01	0	0	0	0	0	7.38E-01	0
Estimated Intake through the Ingestion Route	10th %ile	0	0	7.53E-07	0	7.65E-02	0	0	0	4.17E-06	0	6.43E-03	0	0	8.27E-05	0
	median	4.49E-06	0	2.36E-06	0	2.48E-01	1.56E-03	0	0	1.30E-05	0	2.27E-02	0	0	2.53E-04	0
	90th %ile	2.95E-05	0	7.88E-04	0	1.01E+00	1.86E-02	0	0	2.43E-05	1.88E-07	5.38E-02	0	0	3.36E-04	0
	95th %ile	4.21E-05	0	6.79E-03	0	1.63E+00	2.96E-02	1.11E-05	0	2.84E-05	3.64E-07	6.69E-02	0	0	3.67E-04	1.48E-04
	% > 0.1 µmol/day	0	0	0	0	8.44E+01	7.89E-01	0	0	0	0	9.99E-01	0	0	5.63E-01	9.11E-01
Estimated Total Intake	10th %ile	0	0	1.25E-05	0	7.86E-02	0	7.08E-06	1.67E-01	2.58E-03	8.52E-10	6.20E-03	1.89E-06	0	3.08E-02	0
	median	4.49E-06	0	2.81E-05	0	2.57E-01	1.56E-03	8.63E-06	3.67E-01	5.59E-03	6.29E-09	2.27E-02	3.49E-06	0	2.85E-01	0
	90th %ile	3.02E-05	0	1.11E-03	0	1.05E+00	1.92E-02	1.06E-05	8.12E-01	1.10E-02	2.22E-07	5.47E-02	5.70E-06	2.65E-05	1.07E+00	0
	95th %ile	4.43E-05	0	8.55E-03	0	1.77E+00	3.18E-02	2.36E-05	1.06E+00	1.33E-02	4.26E-07	6.88E-02	6.52E-06	6.10E-05	1.92E+00	2.16E-04
	% > 0.1 µmol/day	0	0	0	0	8.53E+01	1.51E+00	0	9.75E-01	0	0	1.98E+00	0	0	7.36E-01	1.82E+00

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Table 5. PRoTEGE "Tier 2" exposure rankings for the 15 selected chemicals

Chemical		1,2,3-Trichlorobenzene	Aldicarb	Bisphenol-A	Butylhydroxyanisole	Di-n-butylphthalate	Hexabromocyclododecane	Methoxychlor	n-Hexane	Nonylphenol	octaBDE	Ammonium Perchlorate	Tetrabromobisphenol A	Trifluralin	Tris (2-chloroethyl) phosphate	Vinclozolin
Ranking Based on Inhalation Route	10th %tile	0	0	2	0	4	0	2	5	4	1	0	2	0	5	0
	median	0	0	2	0	4	0	2	5	4	1	0	2	0	5	0
	90th %tile	0	0	2	0	4	0	2	5	4	1	0	2	2	5	0
	95th %tile	0	0	2	0	4	0	2	5	4	1	0	2	2	5	0
	% > 0.1 µmol/day	0	0	0	0	1	0	0	5	0	0	0	0	0	4	0
Ranking Based on Ingestion Route	10th %tile	0	0	1	0	5	0	0	0	1	0	4	0	0	2	0
	median	2	0	1	0	5	3	0	0	2	0	4	0	0	2	0
	90th %tile	1	0	3	0	5	4	0	0	1	1	4	0	0	2	0
	95th %tile	1	0	3	0	5	4	1	0	1	1	5	0	0	3	2
	% > 0.1 µmol/day	0	0	0	0	5	2	0	0	0	0	4	0	0	1	2
Ranking Based on Aggregate Exposure	10th %tile	0	0	2	0	5	0	2	5	3	1	4	1	0	4	0
	median	2	0	2	0	5	3	2	5	3	1	4	2	0	5	0
	90th %tile	2	0	3	0	5	3	1	5	3	1	4	1	1	5	0
	95th %tile	1	0	3	0	5	3	1	5	3	1	4	1	1	5	2
	% > 0.1 µmol/day	0	0	0	0	5	1	0	5	0	0	3	0	0	4	1
Ranking Based on Dominant Exposure Route for Each Metric	10th %tile	0	0	4	0	1	0	5	1	3	5	2	5	0	2	0
	median	4	0	4	0	1	3	4	1	3	5	2	4	0	1	0
	90th %tile	4	0	4	0	1	3	5	1	3	5	2	5	5	1	0
	95th %tile	5	0	3	0	1	3	5	1	3	5	2	5	5	1	4
	% > 0.1 µmol/day	0	0	0	0	1	5	0	1	0	0	3	0	0	1	5

2.1.1 Hazard, Exposure and Risk Characterization

The next paragraphs summarize the project implementation steps followed in the exploratory case studies; in subsequent project phases these steps will be optimized, coded, and incorporated in the integrated computational system.

The conceptual approach that was implemented "manually" through the Phase I study (to be "automated" in subsequent project phases via a user-friendly interface) is schematically presented in Figure 5.

Figure 5. Tier 2 approach for preliminary hazard and exposure assessment employing PRoTEGE and METIS; adapted from NJ DEP SAB CEC Subcommittee [1]

2.1.1.1 Hazard characterization and categorization

Hazard characterization and categorization employs information retrieved using METIS, following the criteria described in:

- EPA - TSCA Work Plan Chemicals: Methods Document [14],
- EPA - Design for the Environment Program Alternatives Assessment Criteria for Hazard Evaluation [15].

For hazards related to human health, evidence relevant to mammalian toxicity are considered, specifically:

- acute systemic toxicity,
- carcinogenicity, mutagenicity, reproductive/developmental toxicity (including endocrine disruption),

- neurobehavioral toxicity,
- repeated dose target organ toxicity,
- chemical respiratory sensitization.

These human health hazards are categorized as high, moderate and low, correspondingly, when there is:
- strong weight of evidence for mammalian toxicity (high hazard),
- uncertainty about or moderate weight of evidence or no data for mammalian toxicity (moderate hazard),
- weak weight of evidence for mammalian toxicity (low hazard).

Though the Pilot Phase focused primarily on human health hazards, exposures and risks, exploratory work also commenced for the consideration of ecological risks (that will be fully incorporated in the integrated NJrisk system in the subsequent project phases).

For hazards related to ecological impact, evidence related to acute and/or chronic aquatic toxicity is considered, specifically:
- fish toxicity,
- crustacean toxicity,
- algal toxicity.

Ecological hazards are categorized as high, moderate and low, correspondingly when there is:
- strong weight of evidence for environmental (aquatic) toxicity (high hazard),
- uncertainty about or moderate weight of evidence or no data for environmental (aquatic) toxicity (moderate hazard),
- weak weight of evidence for environmental (aquatic) toxicity (low hazard).

One special issue with respect to hazard characterization involves chemicals that impact the endocrine system. The integrated framework will evaluate endocrine activity rather than simply characterizing hazards in terms of "endocrine disruption." Endocrine activity can be defined as a change in endocrine homeostasis caused by a chemical or other stressor from human activities (e.g., application of pesticides, the discharge of industrial chemicals to air, land, or water, or the use of synthetic chemicals in consumer products.). Data considered include:
- *in vitro* data such as hormone receptor binding assays or ex vivo assays,
- *in vivo* data from studies of intact animals or wildlife (including aquatic organisms),
- ethically conducted human studies,
- *in vivo* short term exposures or altered (e.g., ovariectomized) animal models,
- structural similarity to known endocrine active substances using SAR tools such as AIM, QSAR, etc.

Each chemical of concern is evaluated for evidence of presence of endocrine activity:
- If data show evidence of endocrine activity then the chemical is designated as *potentially endocrine active*, while noting caveats and limitations.
- If there are no data available to evaluate this endpoint, endocrine activity is unknown and would be marked to indicate the *absence of information*.

- If data conclude no evidence of activity (no binding, perturbation, or evidence of endocrine-related adverse effects) then the chemical will be designated as having *no evidence of endocrine activity*, noting caveats and limitations.

2.1.1.2 Exposure characterization and categorization

Exposure characterization and categorization employs PRoTEGE to quantify and rank (potential) exposures as high, moderate, and low:

- **High Exposures** are associated with presence of the chemical of (current or emerging) concern in:
  - New Jersey environmental media and biota at significant concentration levels or as significant levels of biomarker measurements (where, in both cases, significance is determined for each chemical in relation to threshold levels associated with hazardous effects of the chemical),
  - food, children's toys, cosmetics/personal care products, consumer products, etc.
- Ranking of exposure is based upon distributional estimates for the three main routes of exposure (inhalation, dermal and ingestion) (μg/kg/day).
- **Moderate Exposures** are associated with presence of the chemical of concern in New Jersey environmental media and biota at concentrations less than the levels considered significant above but that may be steadily increasing due to continuing use of the chemical in products or due to ongoing activity of emission sources.
- **Low Exposures** are associated with presence of the chemical of concern in New Jersey environmental media and biota at low detectable concentrations or in new consumer products that have minor but potential increasing market penetration.

2.1.1.3 Risk characterization and categorization

Risk characterization and categorization ("tiered assessment") for each chemical of current or emerging concern employed the hazard and exposure rankings developed in the steps above. (These characterizations will ultimately include both human [mammalian] and ecological risk assessments and will determine whether or not a CEC candidate could be a significant risk that merits consideration on the New Jersey CEC prioritization list. The system will ultimately offer various options to the user, for both analysis and visualization.) One basic option for initial prioritization of chemicals for risk assessment is the calculation of a simple "prioritization score" that will be defined as:

prioritization score = hazard category x exposure category

In the initial prioritization process, a value of 1, 2, and 3, respectively, is assigned to the low, moderate and high categories of hazard and of exposure. In this process any value of the initial prioritization score higher than "3" results in a recommendation for further analysis. So a "high" designation (assigning a value of "3") in any hazard or any exposure category by itself assures that the chemical is ranked for further prioritization in the framework.

Values of the initial prioritization score in the range of 3-5 are considered as identifying a "medium priority" chemical. Values of this score that are "6" or higher identify "high priority" chemicals for further analysis. Figure 6 provides a visualization of this scoring via a "prioritization grid" for risk assessment. The simple initial prioritization scores, derived through the process described above, are depicted in the right hand side of the figure: the red cells

correspond to high priority chemicals and the orange cells correspond to moderate priority chemicals. The more detailed risk assessment grids in the left hand side of Figure 7 represent the potentially more detailed procedures analyzing and assessing relevant data and other information that will eventually be "condensed" into the simple scores used in the 3x3 grid of the right hand side of Figure 6.
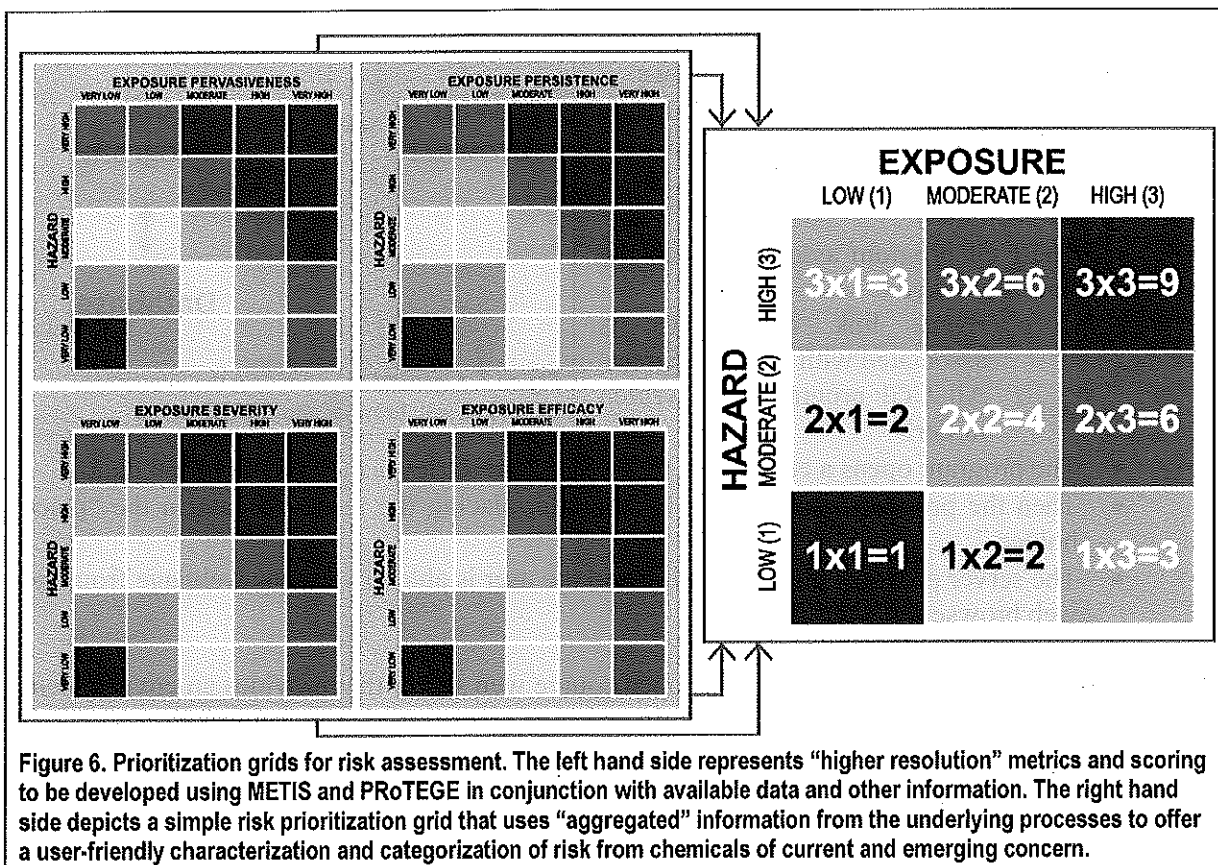

Figure 6. Prioritization grids for risk assessment. The left hand side represents "higher resolution" metrics and scoring to be developed using METIS and PRoTEGE in conjunction with available data and other information. The right hand side depicts a simple risk prioritization grid that uses "aggregated" information from the underlying processes to offer a user-friendly characterization and categorization of risk from chemicals of current and emerging concern.

2.2 Pilot Phase Installation of METIS

A "LAMP server" was set up at the Computational Chemodynamics Laboratory (CCL) for hosting METIS[*] and for the incorporation of PRoTEGE modules and expanded databases in the integrated NJrisk system. "LAMP" is an acronym for the following components of the server structure:

- **L**inux operating system
- **A**pache web server application, using Hypertext Transfer Protocol (HTTP)
- **M**ySQL (My Structural Query Language) relational data management system
- **P**HP, **P**erl, or **P**ython programming language for dynamic web pages

---

[*] The installation of METIS on CCL's server took place under the expert guidance of Mario Chen, of Du Pont de Nemours & Co.

The specific component versions of the present CCL LAMP server for METIS are:

- Linux Fedora v15 (Lovelock)
- Apache Tomcat v6.0.37
- MySQL v5.5.20
- Perl v5.12

The chain of events when accessing ("clicking on") a link in the METIS software is as follows:

- HTTP request is sent to the Apache Tomcat server with the user-specified data (e.g., chemical name, CAS number, etc.)
- The CGI program associated with the link is invoked
  - Every link in METIS is associated with a CGI program
  - All CGI programs are written in Perl

Figure 7. A general schematic for the interaction between a web browser and a LAMP server

- The program opens a connection to MySQL and retrieves the user-specified data
- Then the program generates an HTML file, placing the retrieved data in the "place holders"
- The server provides this HTML file and the user is able to view the webpage from the web browser.
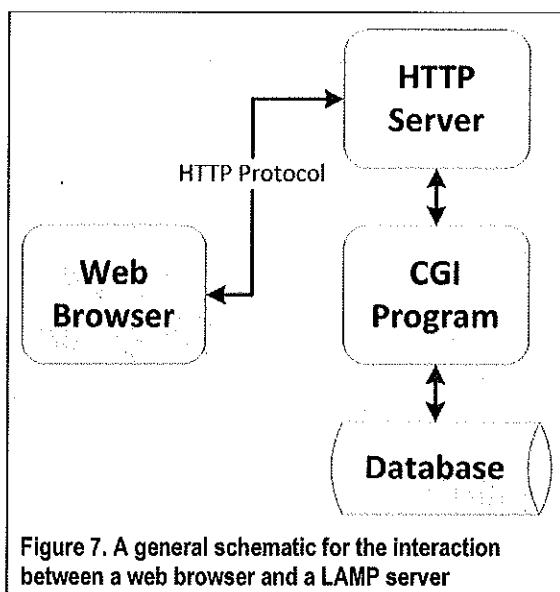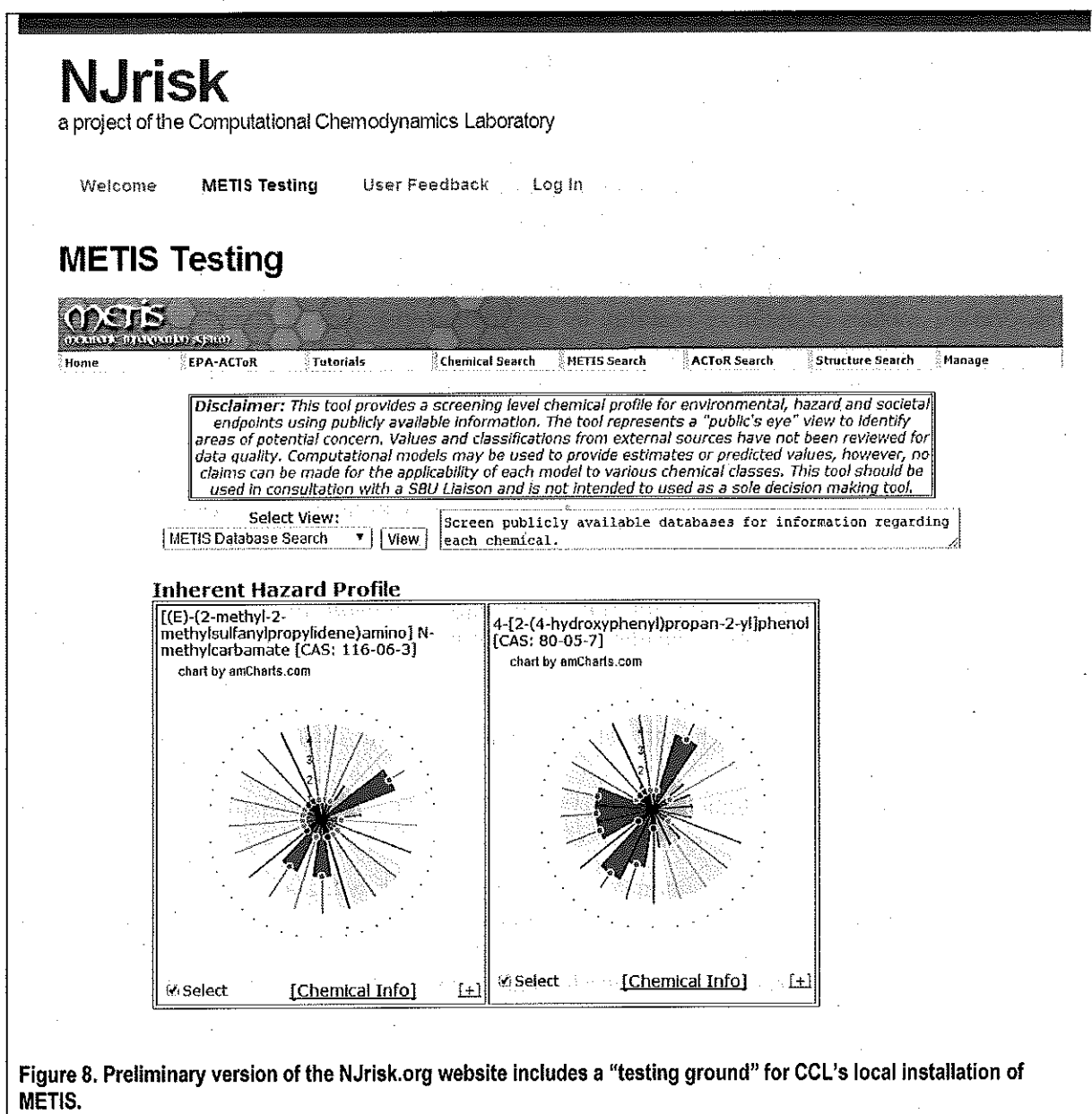
Apache Tomcat is being utilized as it is an open source web server that provides an environment for executing Java code. Common Gateway Interface (CGI) is enabled in Tomcat; it is required to produce dynamic web pages and it facilitates the exchange of information between the web server and a custom script (CGI script). The CGI scripts for METIS are written in Perl, although such scripts will also be written in Python, PHP, Java, C, etc. in the final implementation of NJrisk.

MySQL serves as the warehouse for the contents of METIS and will be utilized in the integrated NJrisk system. Currently, for METIS, the database contents are accessed through the Perl DBI (database-independent) interface.

NJrisk

a project of the Computational Chemodynamics Laboratory

Welcome   **METIS Testing**   User Feedback   Log In

METIS Testing

Home   EPA-ACToR   Tutorials   Chemical Search   METIS Search   ACToR Search   Structure Search   Manage

> *Disclaimer: This tool provides a screening level chemical profile for environmental, hazard and societal endpoints using publicly available information. The tool represents a "public's eye" view to identify areas of potential concern. Values and classifications from external sources have not been reviewed for data quality. Computational models may be used to provide estimates or predicted values, however, no claims can be made for the applicability of each model to various chemical classes. This tool should be used in consultation with a SBU Liaison and is not intended to used as a sole decision making tool.*

Select View:
[METIS Database Search ▾] [View]

Screen publicly available databases for information regarding each chemical.

Inherent Hazard Profile

[(E)-(2-methyl-2-methylsulfanylpropylidene)amino] N-methylcarbamate [CAS: 116-06-3]

chart by amCharts.com

4-[2-(4-hydroxyphenyl)propan-2-yl]phenol [CAS: 80-05-7]

chart by amCharts.com

☑ Select   [Chemical Info]   [+]   ☑ Select   [Chemical Info]   [+]

Figure 8. Preliminary version of the NJrisk.org website includes a "testing ground" for CCL's local installation of METIS.

2.3   Pilot Phase Outcomes

Deliverables of the Pilot Phase Study are:

- Outcomes of the exploratory case studies for the 15 chemicals that were selected to test the combined two-system approach of the Pilot Phase; these outcomes include summary numerical metrics as well as distributional estimates and graphical visualizations of hazards, exposures and risks.
- Software framework requirements for the subsequent integration of METIS and PRoTEGE in the upcoming implementation of NJrisk.

3   PLANNED STRUCTURE AND COMPONENTS OF NJrisk

The implementation and the completion of the Pilot case studies, employing both METIS and PRoTEGE, have been used to identify and assess potential issues of consistency, compatibility, etc. in data formats and core elements, and to develop plans for implementing the linking and integration of the two software tool sets in a manner that will best address analysis of the risk-relevant problems at hand while optimizing user accessibility of options and outcomes. Special effort will be put in designing a system, in the subsequent study Phases, that will be flexible and easy to use so as to substantially facilitate tasks involved in the risk analysis and management processes. The full implementation will utilize specific software requirements [16] and data/workflow models to optimize usability by employing principles of "user-centered design" [17]. Figure 9 illustrates the structure and components of the planned integrated NJrisk system, which will incorporate all the databases currently utilized in METIS and PRoTEGE *and will also include other publicly-available Federal databases*, as they become available.

When developed and completed the integrated NJrisk system:
- will facilitate characterizing and assessing separately both hazard and exposure potentials of chemicals found in the ambient environment and/or biota as well as in various residential, occupational, and public microenvironments;
- will specifically provide tools for *rapid screening of human and ecological health risk potential,* by using the above characterizations of hazard and exposure potentials;
- will support prioritization of chemicals for regulatory action based on potential and actual human health risks relevant to both the general population and to specific subpopulations of concern and ecological health risks relevant to wildlife in aquatic, terrestrial, and air environments; and
- will be expandable, allowing the users to incorporate information and address issues related not only to human but also to ecological health risks.

As mentioned above, development and application of NJrisk will also take advantage of and incorporate the outcomes of various ongoing initiatives by Federal (as well as international) agencies to assemble information on the physicochemical and toxicological profiles of chemicals. Such outcomes, resulting in integrated databases, are listed in Figure 9 under "Federal Database Network" (see, e.g. [18-20]). As an example, a database that has already been linked with METIS and PRoTEGE as part of the Pilot Phase of the project, and is expected to continue to be one of the data sources for NJrisk, is USEPA's ACToR (Aggregated Computational Toxicology Resource) [18] (see Table 6). This is an evolving database that allows access to various types of data on environmental chemicals, such as information on chemical structure, *in vitro* bioassays and *in vivo* toxicology assays. Chemicals in ACToR are compiled from sources that include the U.S. Environmental Protection Agency (USEPA), Centers for Disease Control (CDC), U.S. Food and Drug Administration (FDA), National Institutes of Health (NIH), state agencies, corresponding government agencies in Canada, Europe and Japan, universities, the World Health Organization (WHO) and non-governmental organizations (NGOs).

The integrated NJrisk system will be formulated and tested so as to ensure that it will be able to address a variety of specific issues, situations, and chemicals that would be of particular concern for the State of New Jersey. However, when completed it will be applicable at the national (US) scale and at any location (state/county/municipality) within the contiguous US. *Special attention will be given to the development of the user interface in order to optimize its*

functionality and simplicity, ensuring that users with a wide variety of backgrounds will be able to learn its usage quickly and access efficiently the integrated NJrisk system.

Table 6. Selected databases accessed by ACToR (a project currently in progress for the USEPA)

| Database	Expanded Name
ATSDR reports	Agency for Toxic Substances and Disease Registry Reports
ChEMBL	--
Danish EPA – Reports	
DSSTox	Distributed Structure-Searchable Toxicity
ECHA chemicals	--
Endocrine Disruptor Screening Program Database	--
Environment Canada Domestic Substances List	--
EPA SRS	EPA Substance Registry Services
EPISuite data	Experimental data used for EpiSuite modeling program
ExpoCastDB	--
IRIS	Integrated Risk Information System
IUCLID	International Uniform Chemical Information Database
NIOSH-IDLH	NIOSH - Immediately Dangerous To Life or Health Concentrations
NIOSH-NPG	NIOSH Pocket Guide to Chemical Hazards
OECD List of HPV Chemicals	--
ToxCastDB	Toxicity Forecaster database
TOXNET Toxicological data	--
ToxRefDB	Toxicity Reference Database
TSCA	Toxic Substances Control Act (TSCA) Chemical Substances Inventory
USDA PDP	USDA Pesticide Data Program
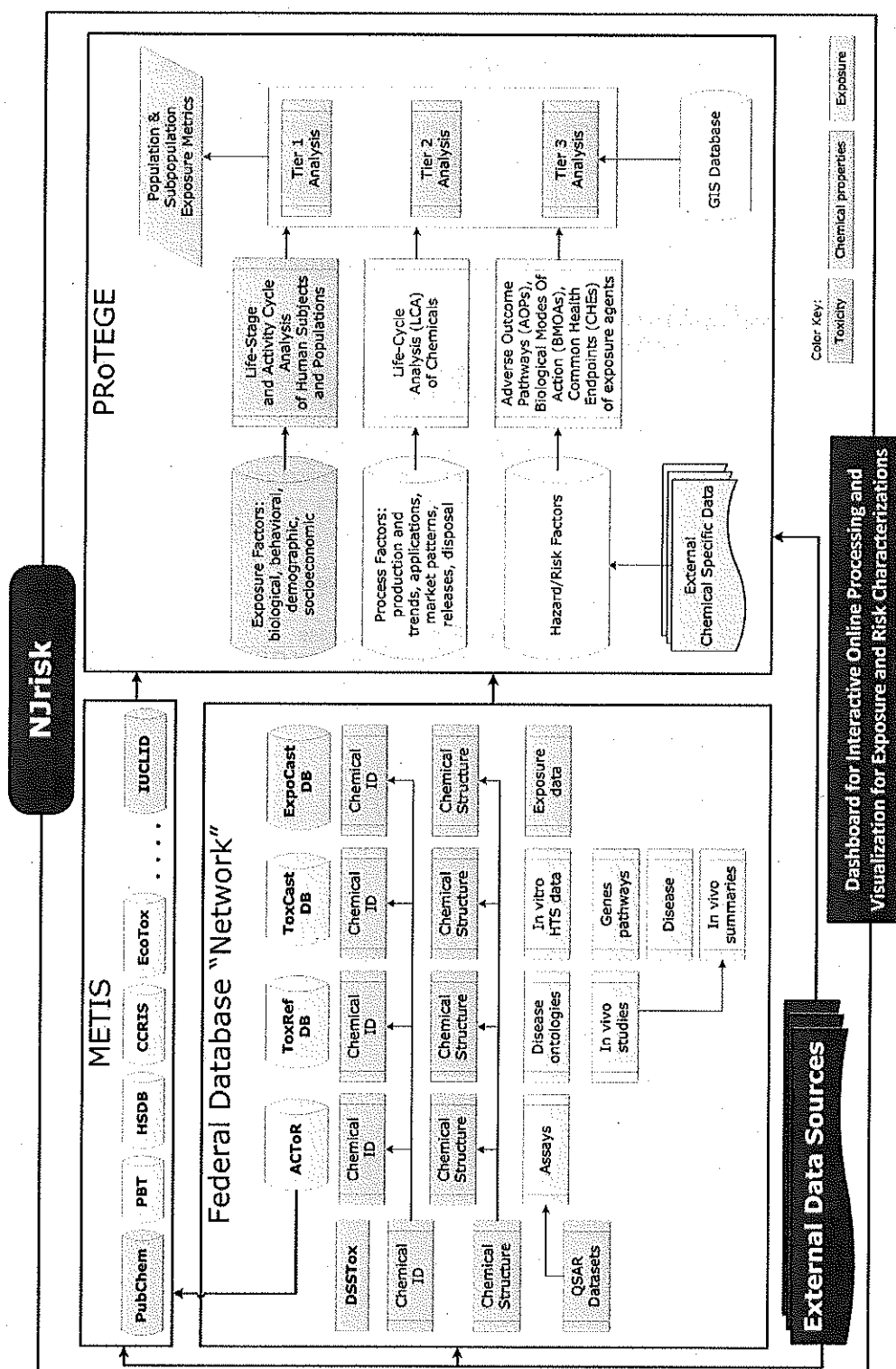
Figure 9. Structure and components of an integrated NJrisk system that will allow easy user access to outcomes from PRoTEGE and METIS in conjunction with various extant databases that are available or under development at USEPA and other Federal agencies

PART II – RESULTS OF EXPLORATORY CASE STUDIES FOR 15 CHEMICALS

1a. PRoTEGE Results for 1,2,3–Trichlorobenzene

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
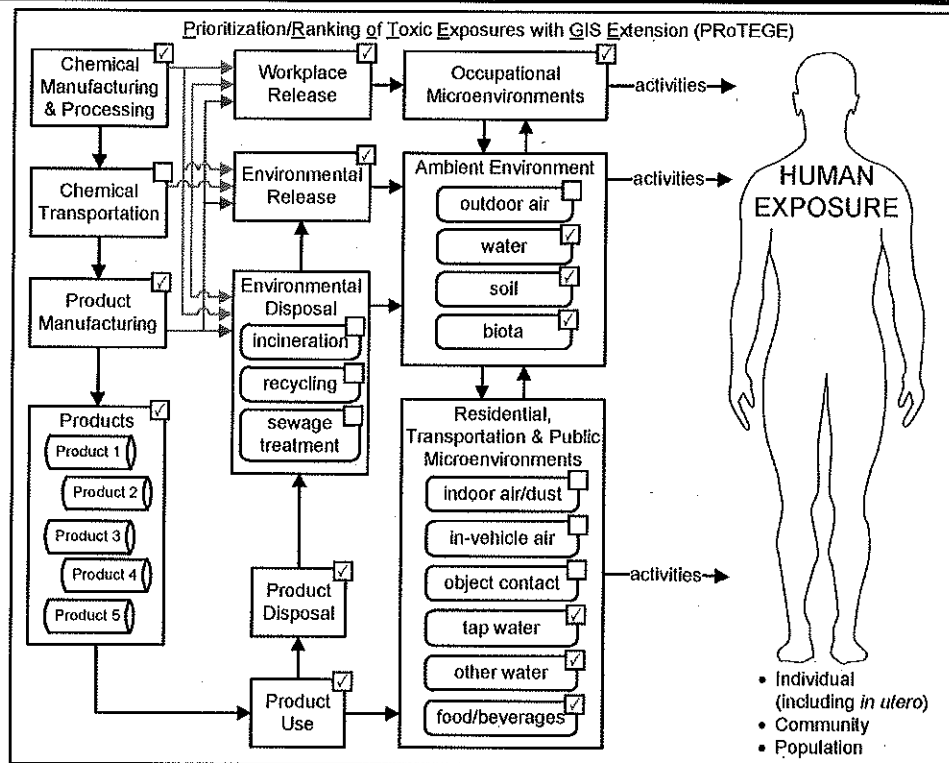
Summary Physico-Chemical Information	
Name	1,2,3–Trichlorobenzene
Other Names	
Chemical Formula	$C_6H_3Cl_3$
Chemical Class	VOC
Identifier	CAS: 87-61-6
Chemical Forms	
Physical Properties	

Molecular weight:181.45
Solubility: Slightly soluble in ethanol; very soluble in ether and benzene
Vapor pressure (25°C): 0.21 mm Hg

Additional Notes

| Exposure and Toxicity Information |
|---|
| **Toxicity Limits:** |
| **Toxicological Effects:** Skin, eye and respiratory irritations |
| **Exposure Limits:** TEEL:5 mg/m³ |
| **Chemical Use:** Transformer fluid, Chemical intermediate |
| **Exposure Routes:** Inhalation of ambient air, ingestion of food and drinking water, and dermal contact |
| **Target Organs:** |

		Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes			Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (µg/m³)	NA			Data Source: Ground Water – HSDB, concluded from 78 wells in NJ; Food – HSDB [21]; Surface water – HSDB, high conc. collected in the vicinity of an industrial outfall in the Calacasieu River estuary, LA; Tap water – NCOD, 131 detected out of 136,462 analyses; Soil – HSDB; Biota – HSDB, medium (42% of fish in the 400 sites sampled in the US)	Air			
Ground water (ppb)		< LOD						
Food (µg/kg)	0.0175	0.05	0.11		Surface Water			
Indoor Air (ng/m³)	NA				Ground Water			
Surface water (ng/L)	0.1	2.3	12		Soil			
Tap water (µg/L)	0.03	1.141	15.00					
Soil (pg/g)		190	540					
Dust (µg/cm²)	NA				Production	< 500,000 lbs/yr	Data Source: IUR	
Surfaces (µg/cm²)	NA							
Biota(ng/g)	0.1 -1	1.3	1.1-76					
Human Biomarkers				Data Source: All data from HSDB, and the studies are conducted in Canada; human milk study was done in 1992, in Canada, 54.1% of 497 samples > LOD				
Urine	NA							
Blood (ng/g)		1.17						
Adipose tissue (ng/g)		44						
Human milk (ng/g)		1.9	236					

Between Environmental Releases columns there is a row labeled "Chemical Production and Use" spanning the Emissions/% Counties columns above Production.

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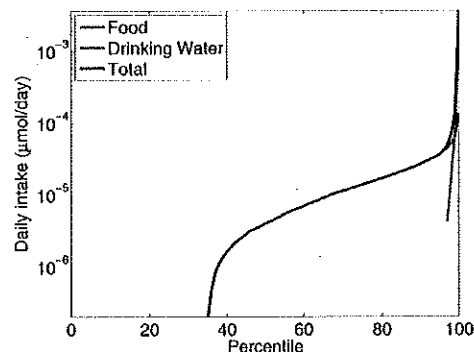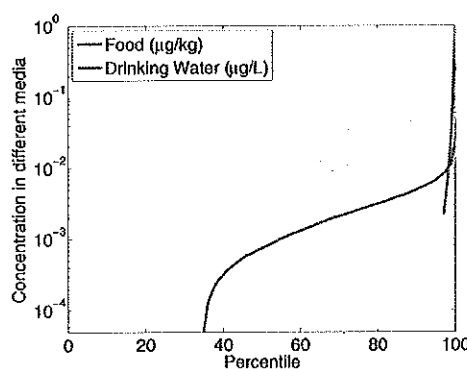| Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		●
	NIOSH		
	ICSC		●
	ToxProf		
	IRIS		
	HSDB		●
	ITER		●
	McKay		
	Howard		
	RIVM rprts		●
	IARC		
	P₄AP		●
	NTP		
	REACH		
	PFD		
	MSD		●
	DSSTox		●
	TMI		●
	SCP		●
	HPVIS		●
	ToxCast	Ph	
		Ph I	●
	ToxIfDB		
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		
	IUR		●
	ECD		
	IRD		
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		●
	AQS		
	CERCLIS		●
	NATA		
Micro-environments and Biomarkers-Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	IHEXAS		
PK/PBPK Model (or Data)	ScLit		PK m (R) [22]
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for 1,2,3–Trichlorobenzene

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	2
Ingestion	2	2	1	2
Dermal	1	1	1	2
Aggregate	1.33	1.31	1	2

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
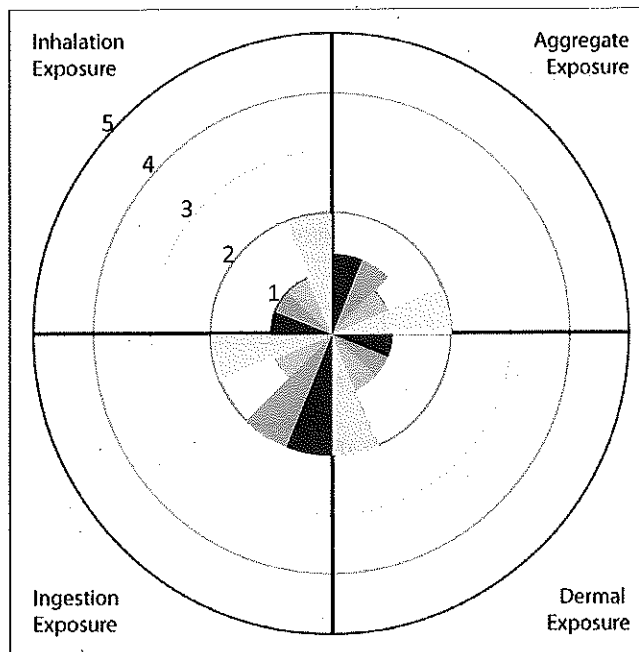
"Tier 2" Exposure Ranking for 1,2,3–Trichlorobenzene

	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0	4.5E-06	NA	4.5E-06
90 %tile	0	2.95E-05	NA	3.02E-05
% over 0.1 µmol/day	0	0	NA	0
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
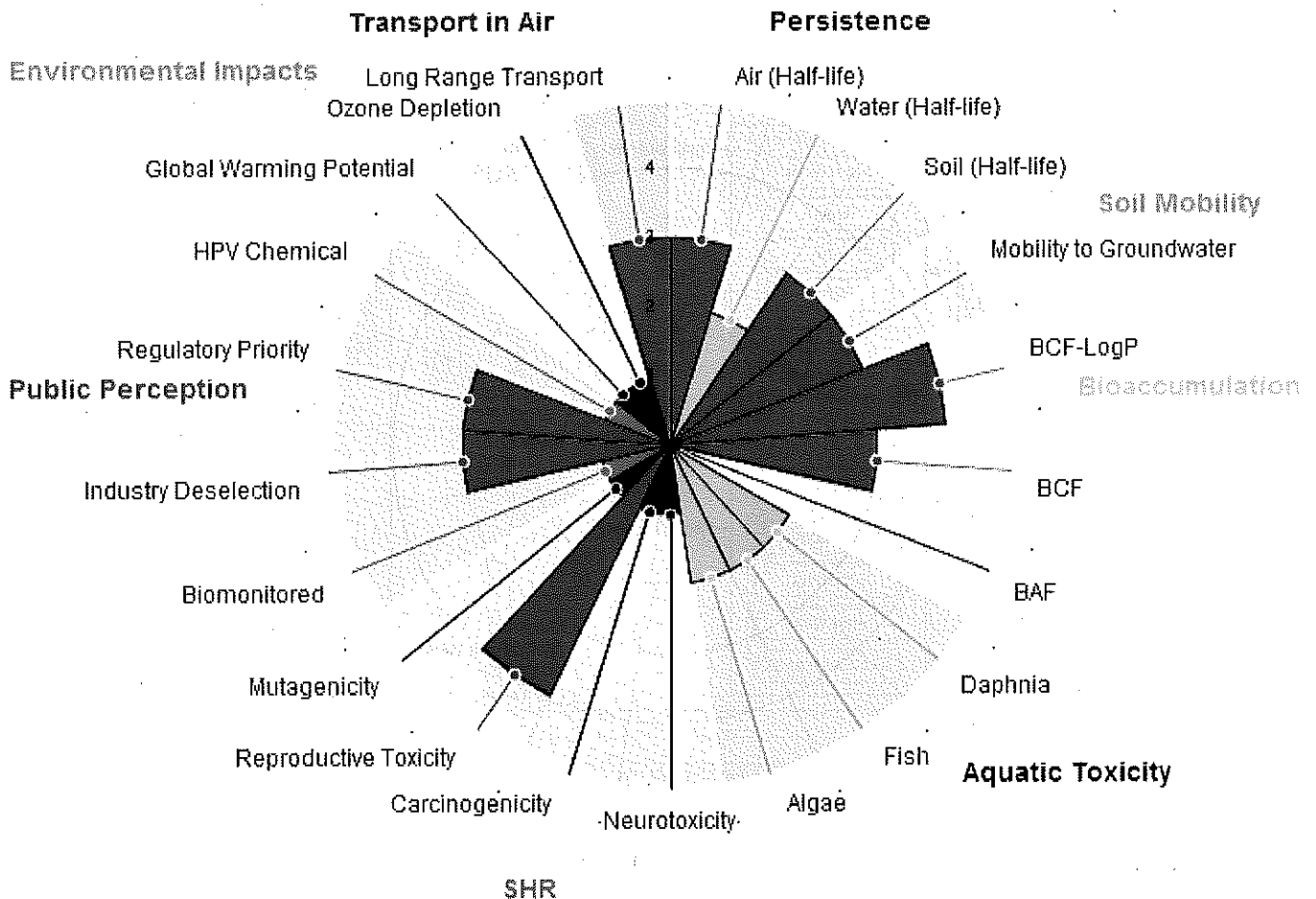
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

1b. METIS Results for 1,2,3–Trichlorobenzene

		CAS # 87-61-6
Persistence	Air (Half-life)	High persistence in Air (Estimated Half-life = 56.95 days)
	Water (Half-life)	Moderate persistence in Water (Estimated Half-life = 60 days)
	Soil (Half-life)	High persistence in Soil (Estimated Half-life = 120 days)
Soil Mobility	Mobility to Groundwater	High mobility to groundwater based on LogKoc = 3.141
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Experimental LogP=4.05
	BCF	High bioconcentration potential based on Experimental LogBCF = 3.11
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 0.46 mg/L indicates a Moderate toxicity to Daphnia.
	Fish	A measured LC50 (96-hr) = 3.2 mg/L indicates a Moderate toxicity to Fish.
	Algae	A measured EC50 (72-hr) = 1.6 mg/L indicates a Moderate toxicity to Algae.
SHR	Neurotoxicity	
	Carcinogenicity	
	Reproductive Toxicity	Evidence in living organisms for Humans; No or insufficient data gathered for Wildlife [as Trichlorobenzene] [EU_EDRP]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	1 out of 6 lists (SINLIST)
	Regulatory Priority	2 out of 10 lists (JDES_LST; JMON3)
	HPV Chemical	out of lists
	Global Warming Potential	No data on Global Warming potential
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion
	Long Range Transport	High potential for Long Range Transport in Air (CTD = 1382.05 km - A_TRNSPRT)

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## Graphical Summary of METIS Results for 1,2,3–Trichlorobenzene

Transport in Air   **Persistence**

Environmental Impacts   Long Range Transport   Air (Half-life)
                         Ozone Depletion   Water (Half-life)

Global Warming Potential   Soil (Half-life)

                                                      Soil Mobility

HPV Chemical   Mobility to Groundwater

Regulatory Priority   BCF-LogP
Public Perception   Bioaccumulation

Industry Deselection   BCF

Biomonitored   BAF

Mutagenicity   Daphnia

Reproductive Toxicity   Fish   **Aquatic Toxicity**

Carcinogenicity   Neurotoxicity   Algae

SHR

1c. NJrisk Preliminary Results for 1,2,3–Trichlorobenzene

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin.")

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HAZARD HIGH (3)			
MODERATE (2)	X		
LOW (1)			

2a. PRoTEGE Results for Aldicarb

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
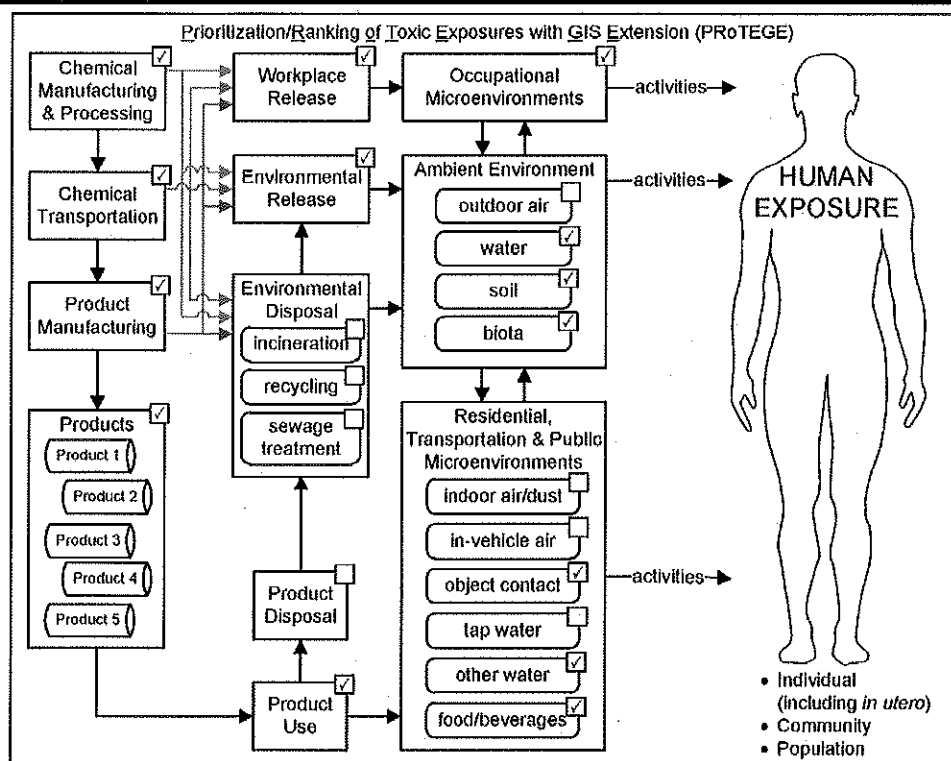
Summary Physico-Chemical Information	
Name	Aldicarb
Other Names	
Chemical Formula	$C_7H_{14}N_2O_2S$
Chemical Class	CarP
Identifier	CAS: 116-06-3
Chemical Forms	Crystals from isopropyl ether
Physical Properties	

Molecular weight: 190.27
Melting point: 99-100°C
Solubility (25 °C): in water 0.6%
Vapor pressure(20 °C): 9.75X10^{-5} mm Hg
Specific gravity (25 °C / 20 °C): 1.1950

Additional Notes

Decomposes above 100°C

Exposure and Toxicity Information
Toxicity Limits: RfD: 0.001 mg/kg/day (IRIS); Lowest Observed Effect Level (LOEL) for subclinical blood cholinesterase depression 0.025 mg/kg (HSDB)
Toxicological Effects: cholinergic symptoms, diarrhea, CNS depression and conduction abnormalities
Exposure Limits:
Chemical Use: Insecticide, acaricide, nematocide
Exposure Routes: ingestion of contaminated food, inhalation and skin contact
Target Organs:

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (µg/m³)	NA			Data Source: Ground water – HSDB, 0.04% of 2,306 groundwater samples (1992-1996) > LOD, max conc of 0.01 µg/L, high conc from aldicarb applied to farmland; Food – aldicarb was not measured in the TDS ('91 – '03); Surface water – HSDB, 14/92 > LOD; Tap water - NCOD, 24 detected out of 30,564 analyses*; Soil – HSDB, farmland; Biota - HSDB	Air	0.0575 (TRI 2008)	0.06% (TRI 2008)
Ground water (µg/L)	<LOD	<0.01	515				
Food (ppm)	<LOD				Surface Water		
Indoor Air (ng/m³)	NA				Ground Water		
Surface water (ppb)	1		4		Soil	0.0015 (TRI 2008)	0.03% (TRI 2008)
Tap water (µg/L)	<LOD						
Soil (ppm)	0.0048-0.0052	2	1330		Chemical Production and Use		
Dust (µg/cm²)	NA				Production		
Surfaces (µg/cm²)	NA						
Biota (ppm)	0.03-0.05	1.40	8.89				
Human Biomarkers							
Urine	NA						
Blood	NA						
Other	NA						

*Metabolites aldicarb sulfone and aldicarb sulfonide were detected in NCOD (detects/total; min; mean; max):
aldicarb sulfone (34/30,498; 0.10; 0.408; 1.14); aldicarb sulfoxide (35/30,467; 0.40; 3.592; 8.80)
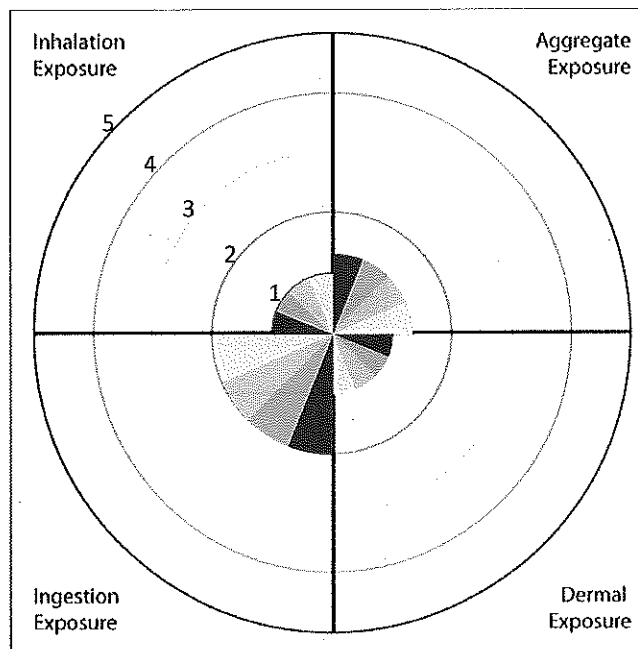
Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		●
	NIOSH		
	ICSC		●
	ToxProfs		
	IRIS		●
	HSDB		●
	ITER		●
	McKay		●
	Howard		●
	RIVM rprts		
	IARC		
	PSAP		
	NTP		●
	REACH		
	PFD		●
	MSDS		●
	DSSTox		●
	TMI		●
	SCP		●
	HPVIS		
	ToxCast	Ph I	●
		Ph II	
	ToxRefDB		●
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		
	IUR		
	ECD		
	SRD		
Releases	TRI		●
	NEI		
Environmental Quality	NGA		
	NAWQA		●
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		O
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PBPK m (H) [23]
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for Aldicarb

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	2	2	2	2
Dermal	1	1	1	1
Aggregate	1.33	1.33	1.33	1.33

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).

"Tier 2" Exposure Ranking for Aldicarb

insufficient data for analysis   insufficient data for analysis

	Inhalation	Ingestion	Dermal	Aggregate
Median (μmol/day)	0	0	NA	0
90 %tile	0	0	NA	0
% over 0.1 μmol/day	0	0	NA	0
% over 1 μmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
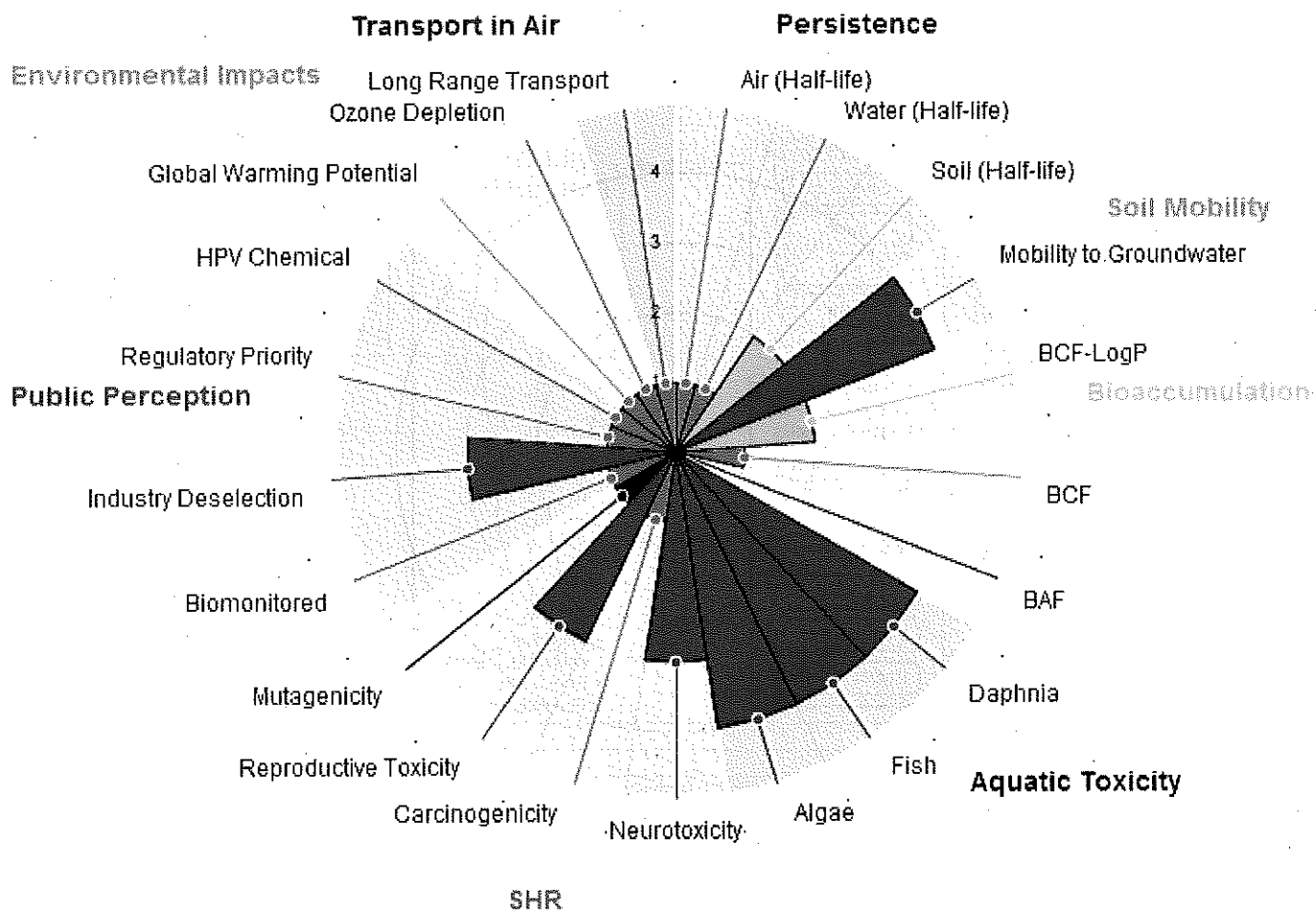
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

2b. METIS Results for Aldicarb

|		CAS # 116-06-3
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 1.162 days)
	Water (Half-life)	Low persistence in Water (Estimated Half-life = 37.5 days)
	Soil (Half-life)	Moderate persistence in Soil (Estimated Half-life = 75 days)
Soil Mobility	Mobility to Groundwater	Very High mobility to groundwater based on LogKoc = 1.512
Bioaccumulation	BCF-LogP	Moderate bioconcentration potential based on an Experimental LogP=1.13
	BCF	Low bioconcentration potential based on Estimated LogBCF = 0.17
	BAF	
Aquatic Toxicity	Daphnia	An estimated LC50(48-hr) = 577.766 mg/L indicates a Low toxicity to Daphnid. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Fish	An estimated LC50(96-hr) = 563.575 mg/L indicates a Low toxicity to Fish. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Algae	No toxicity estimate. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
SHR	Neurotoxicity	Known Neurotoxin [Grandjean et al]
	Carcinogenicity	Not classifiable [IARC_OE]; D (Not classifiable as to human carcinogenicity) [1986 Guidelines] [IRIS]
	Reproductive Toxicity	Suspected Endocrine Disruptor [JP_SED]; Evidence of potential for Humans; No or insufficient data gathered for Wildlife [EU_EDRP]; Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	1 out of 6 lists (RC_PIC)
	Regulatory Priority	0 out of 10 lists
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 8.30014 km - A_TRNSPRT)

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Graphical Summary of METIS Results for Aldicarb

Transport in Air

Persistence

Environmental Impacts
Long Range Transport
Ozone Depletion

Air (Half-life)
Water (Half-life)

Global Warming Potential

Soil (Half-life)

Soil Mobility

HPV Chemical

Mobility to Groundwater

Regulatory Priority

BCF-LogP

Public Perception

Bioaccumulation

Industry Deselection

BCF

Biomonitored

BAF

Mutagenicity

Daphnia

Reproductive Toxicity

Fish **Aquatic Toxicity**

Carcinogenicity

Neurotoxicity   Algae

SHR

2c. NJrisk Preliminary Results for Aldicarb

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "potential neurotoxin.")

EXPOSURE

LOW (1)   MODERATE (2)   HIGH (3)

HAZARD

HIGH (3)

MODERATE (2)   X

LOW (1)

3a. PRoTEGE Results for Bisphenol-A

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
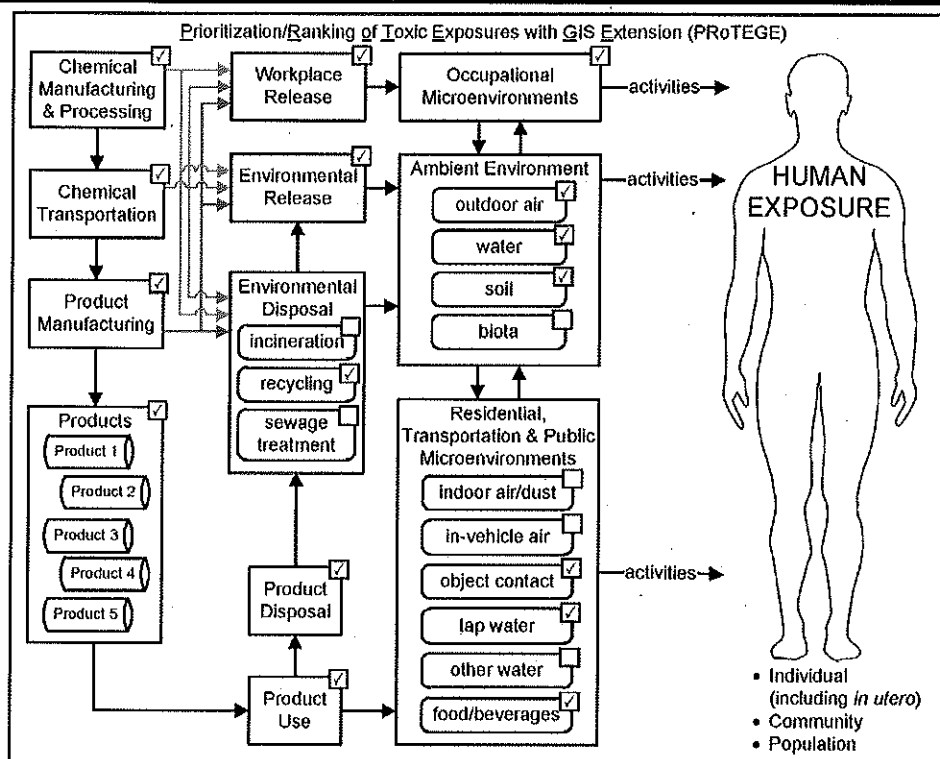
Summary Physico-Chemical Information	
Name	Bisphenol-A
Other Names	4,4'-dihydroxy-2,2-diphenylpropane
Chemical Formula	$C_{15}H_{16}O_2$
Chemical Class	Plzr
Identifier	CAS:80-05-7
Chemical Forms	
Physical Properties	
Molecular weight: 228.29 Melting point: 150-155 deg C (solidification range) (HSDB)	
Additional Notes	

- Individual (including *in utero*)
- Community
- Population

Exposure and Toxicity Information
Toxicity Limits: RfD (mg/kg/day): 0.05 (IRIS), NOAEL: 10 mg/m3 (repeated I); 50 mg/kg (repeated O) (REACH)
Toxicological Effects: Clear evidence of adverse development effects in rodents at high doses; Insufficient evidence for developmental and reproductive toxicity in humans [24]
Exposure Limits:
Chemical Use: plasticizer, fungicide, flame retardant, rubber chemicals
Exposure Routes: inhalation, ingestion, dermal contact
Target Organs:

	Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes			Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (ng/m³)	0.02	0.51	1.92	Data Source: Outdoor air – [25]; Ground water – HSDB, landfill or waste water treatment plant data; Food – [26] (5, 50, 95%tile), canned food; Surface water – HSDB, USGS 1999-2000, 41.2% of 139 streams >LOD; Tap water - [27]; Indoor Air - [28]; Surface water - [27]; Dust - [27]	Air	53.05 (TRI 2008)	1.98% (TRI 2008)
Ground water (µg/L)	0.003		1.41				
Food (mg/kg)	<LOD	<LOD	1.5		Surface Water	2.87 (TRI 2008)	0.28% (TRI 2008)
Indoor Air (ng/L)	<LOD		<LOD		Ground Water		
Surface water (µg/L)		0.14	12		Soil	95.74 (TRI 2008)	0.12% (TRI 2008)
Tap water (ng/L)	0.5	1.1	2				
Soil (ppm)	ND				Chemical Production and Use		
Dust (µg/g)	0.2	0.821	17.6		Production	1 billion lbs and greater	IUR
Surfaces (µg/cm²)	NA						
Biota	NA						
Human Biomarkers							
Urine							
Blood							
Other							

Availability of Information in Databases and Reference Documents			
	PAC		●
	NIOSH		
	ICSC		●
	ToxProfs		□
	IRIS		●
	HSDB		●
	ITER		●
	McKay		
	Howard		●
	RIVM rprts		
Physicochemical and/or Toxicological Properties	IARC		
	PSAP		
	NTP		●
	REACH		●
	PFD		
	MSDS		●
	DSSTox		●
	TMI		●
	SCP		●
	HPVIS		
	ToxCast	Ph I	●
		Ph II	●
	ToxRefDB		●
	CEBS		●
	SIDS		●
Production and Use	EHPV		
	HPD		●
	IUR		●
	ECD		●
	SRD		
Releases	TRI		●
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	u
		05-06	u
		07-08	u
		09-10	(u)
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PBPK m (R, H) [29]
	BME		● [30]
	ERDEM		

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	2	2	2	2
Dermal	1	1	1	1
Aggregate	1.33	1.33	1.33	1.33

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).

	Inhalation	Ingestion	Dermal	Aggregate
Median (μmol/day)	2.59E-05	2.35E-06	NA	2.82E-05
90 %tile	5.52E-05	0.000789	NA	0.00107
% over 0.1 μmol/day	0	0	NA	0
% over 1 μmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

3b. METIS Results for Bisphenol-A

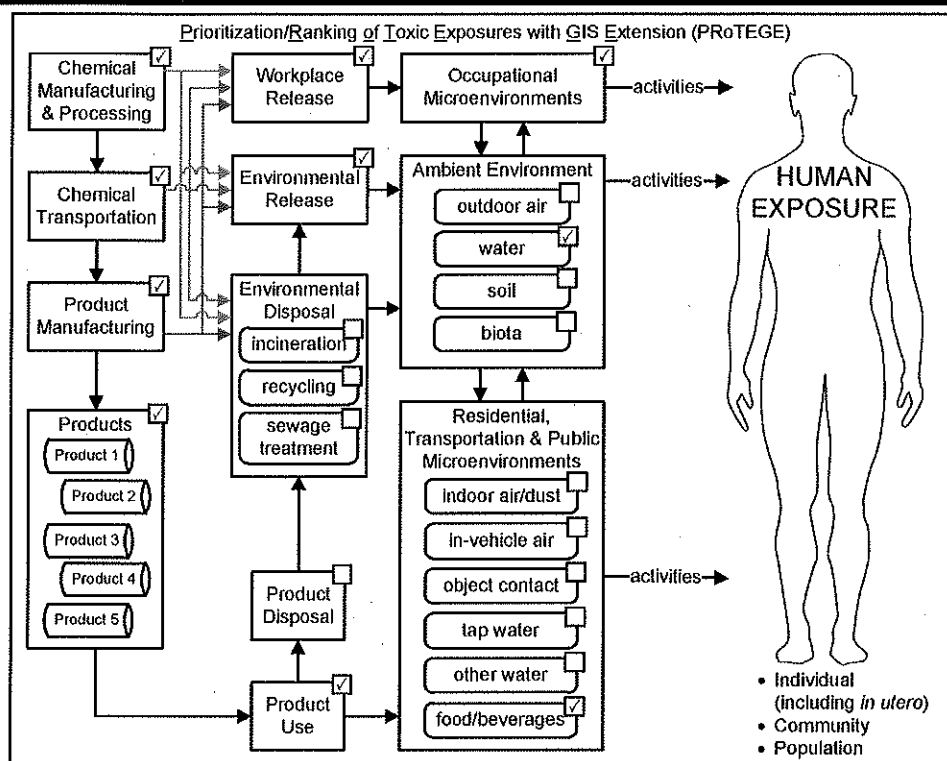|		CAS # 80-05-7
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.1327 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 0% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is very persistent in water (Min. BOD = 0%, Max. BOD = 0%).
	Soil (Half-life)	Moderate persistence in Soil (Estimated Half-life = 75 days)
Soil Mobility	Mobility to Groundwater	Low mobility to groundwater based on LogKoc = 4.876
Bioaccumulation	BCF-LogP	Moderate bioconcentration potential based on an Experimental LogP=3.32
	BCF	Moderate bioconcentration potential based on Experimental LogBCF = 1.57
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 13 mg/L indicates a Low toxicity to Daphnia.
	Fish	A measured LC50 (96-hr) = 8 mg/L indicates a Moderate toxicity to Fish.
	Algae	A measured EC50 (72-hr) = 4.8 mg/L indicates a Moderate toxicity to Algae.
SHR	Neurotoxicity	
	Carcinogenicity	
	Reproductive Toxicity	Evidence in living organisms for Humans; Evidence in living organisms for Wildlife [EU_EDRP]; Suspected Endocrine Disruptor [JP_SED]; Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	2 out of 2 lists (NHANES; NHANES IV)
	Industry Deselection	2 out of 6 lists (EUC2; SINLIST)
	Regulatory Priority	3 out of 10 lists (EU_RRAP; JDES_LST; JMON3)
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 0.0727834 km - A_TRNSPRT)

Graphical Summary of for Bisphenol-A
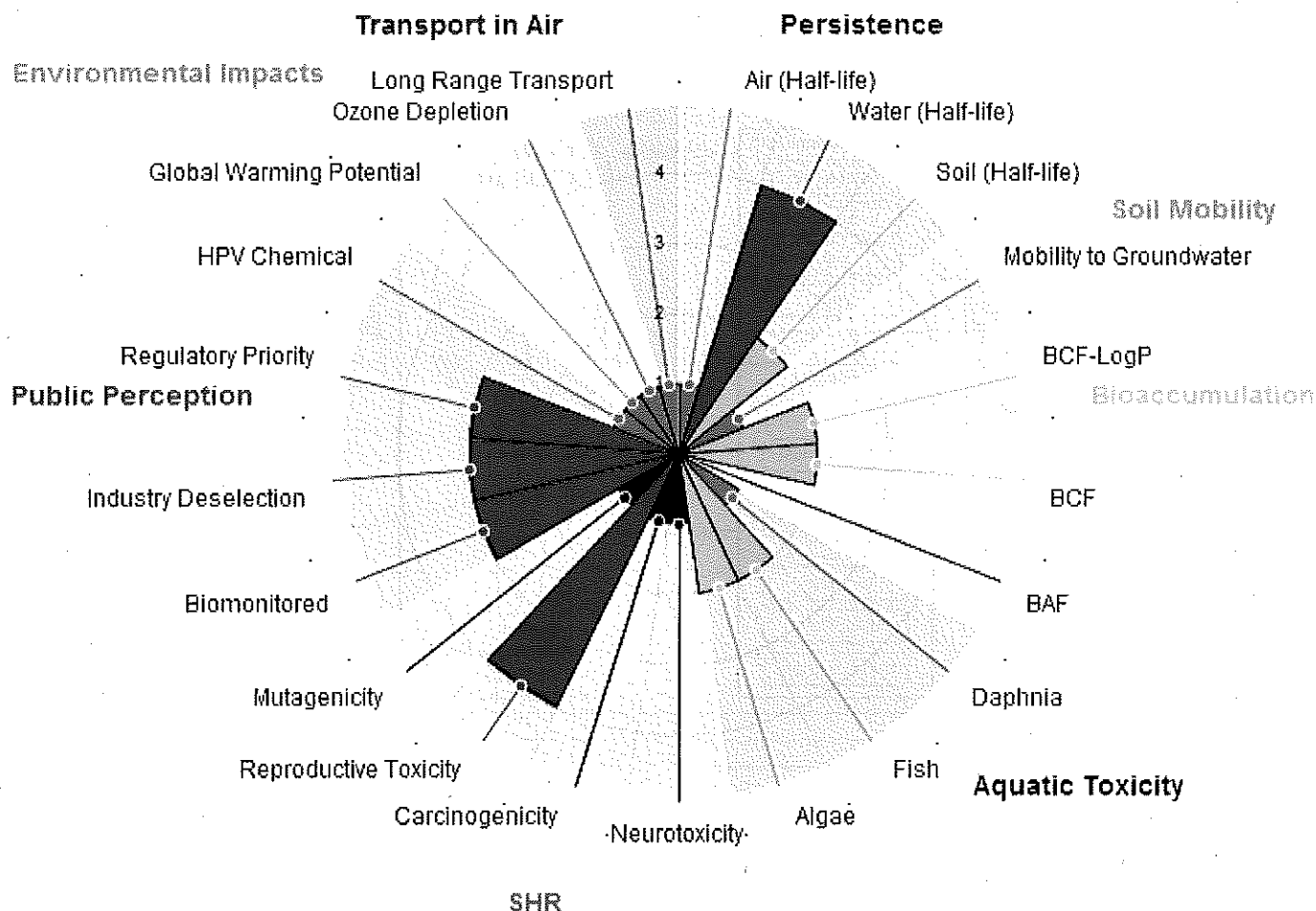
3c. NJrisk Preliminary Results for Bisphenol-A

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin.")

4a. PRoTEGE Results for Butylhydroxyanisole

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)

Summary Physico-Chemical Information	
Name	Butylhydroxyanisole
Other Names	Butylated Hydroxyanisole, BHA
Chemical Formula	$C_{11}H_{16}O_2$
Chemical Class	FP
Identifier	CAS: 8003-24-5
Chemical Forms	in a mixture with Phenol, (1,1-dimethylethyl)-4-methoxy- (CAS# 25013-16-5)
Physical Properties	
Molecular weight: 180.24	
Boiling point: 264-270 °C	
Melting point: 48-55 °C	
Solubility: Insoluble in water	
Additional Notes	

Exposure and Toxicity Information
Toxicity Limits:
Toxicological Effects: Reasonably anticipated to be a human carcinogen (NTP RoC 2005)
Exposure Limits: Generally recognized as safe for use in food when the total of antioxidants is not greater than 0.02% of fat or oil content (FDA)
Chemical Use: Antioxidant and preservative for fats and oils and in food packaging; used in cosmetics such as lipstick and eye shadow; antioxidant for some rubbers and petroleum products; stabilizer for vitamin A.
Exposure Routes: ingestion, dermal contact
Target Organs:

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air					Air		
Ground water							
Food					Surface Water		
Indoor Air					Ground Water		
Surface water					Soil		
Tap water							
Soil					Chemical Production and Use		
Dust					Production	660,000 lb/yr during 1970 to 1982	(IARC)
Surfaces							
Biota							
Human Biomarkers							
Urine							
Blood							
Other							

Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		
	NIOSH		
	ICSC		
	ToxProfs		
	IRIS		
	HSDB		
	ITER		
	McKay		
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		
	REACH		
	PFD		
	MSDS		•
	DSSTox		
	TMI		
	SCP		
	HPVIS		
	ToxCast	Ph I	
		Ph II	
	ToxRefDB		
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		
	IUR		
	ECD		
	SRD		
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers-Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for Butylhydroxyanisole

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	2
Ingestion	4	3	2	3
Dermal	3	3	2	3
Aggregate	2.66	2.33	1.66	2.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
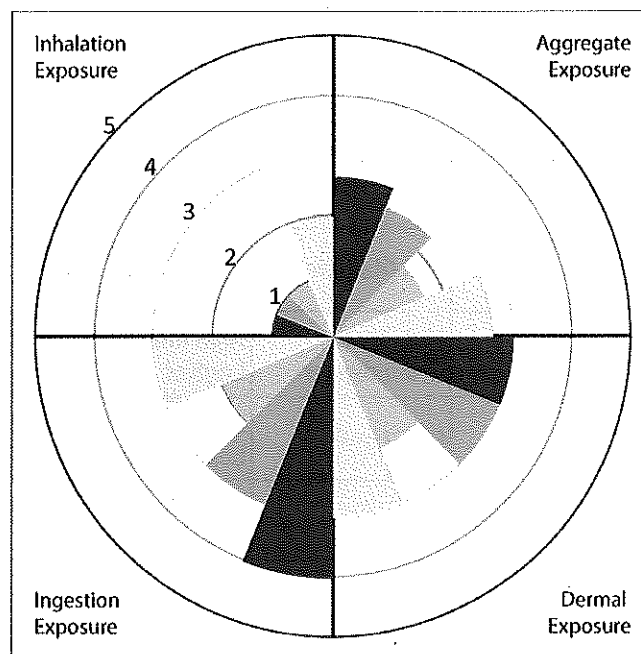
"Tier 2" Exposure Ranking for Butylhydroxyanisole

insufficient data for analysis   insufficient data for analysis

	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0	0	NA	0
90 %tile	0	0	NA	0
% over 0.1 µmol/day	0	0	NA	0
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)

## Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

4b. METIS Results for Butylhydroxyanisole

		CAS # 25013-16-5*	CAS # 8003-24-5*
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.2967 days)	Persistence in Air has not been calculated for this compound
	Water (Half-life)	Low persistence in Water (Estimated Half-life = 37.5 days)	Persistence in Water has not been calculated for this compound.
	Soil (Half-life)	Moderate persistence in Soil (Estimated Half-life = 75 days)	Persistence in Soil has not been calculated for this compound.
Soil Mobility	Mobility to Groundwater	High mobility to groundwater based on LogKoc = 2.925	Soil mobility has not been calculated for this compound
Bioaccumulation	BCF-LogP	Moderate bioconcentration potential based on an Estimated LogP=3.5	BCF value based on LogP has not been calculated for this compound
	BCF	Moderate bioconcentration potential based on Estimated LogBCF = 1.756	BCF value has not been calculated for this compound
	BAF		
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 2.3 mg/L indicates a Moderate toxicity to Daphnia.	No toxicity estimate.
	Fish	A measured LC50 (96-hr) = 5.8 mg/L indicates a Moderate toxicity to Fish.	No toxicity estimate.
	Algae	A measured EC50 (72-hr) = 5.2 mg/L indicates a Moderate toxicity to Algae.	No toxicity estimate.
SHR	Neurotoxicity		
	Carcinogenicity		
	Reproductive Toxicity	Evidence in living organisms for Humans; Evidence in living organisms for Wildlife [EU_EDRP]; Potential Endocrine Disruptor [TEDX_ED]	
	Mutagenicity		
Public Perception	Biomonitored	0 out of 2 lists	
	Industry Deselection	1 out of 6 lists (SINLIST)	0 out of 6 lists
	Regulatory Priority	1 out of 10 lists (JDES_LST)	0 out of 10 lists
	HPV Chemical	out of lists	
	Global Warming Potential	No data on Global Warming potential	
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion	
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 129.6 km - A_TRNSPRT)	Long Range Transport in Air has not been calculated for this compound

* Our current installation of METIS has more than one CAS number for this chemical and some of the data are not consistent.

## Graphical Summary of METIS Results for Butylhydroxyanisole
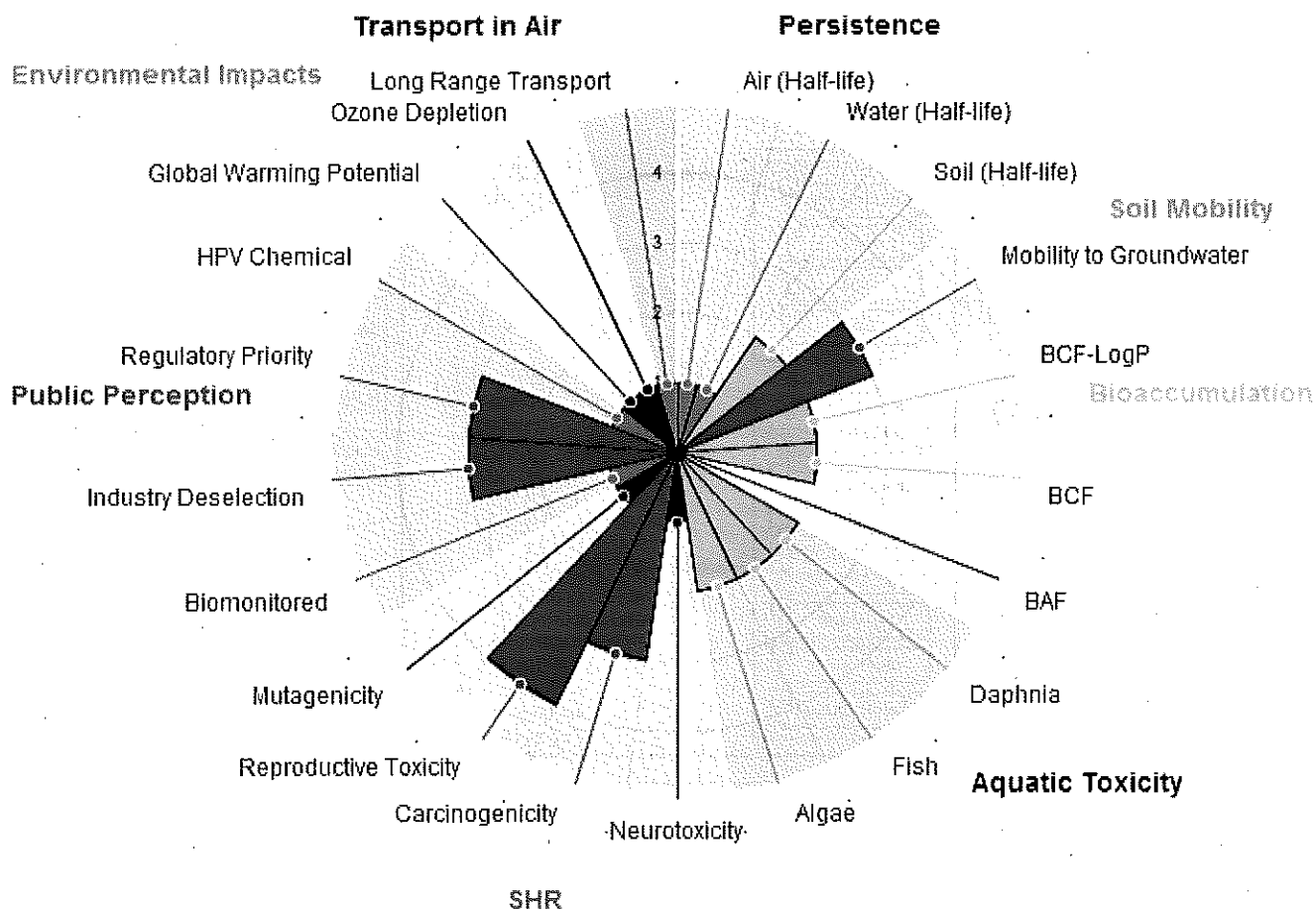
4c. NJrisk Preliminary Results for Butylhydroxyanisole

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin." Classified as "potential carcinogen" via PRoTEGE; the table of METIS results does not classify it as a carcinogen, but the graphical summary does.)

5a. PRoTEGE Results for Di-n-butylphthalate

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
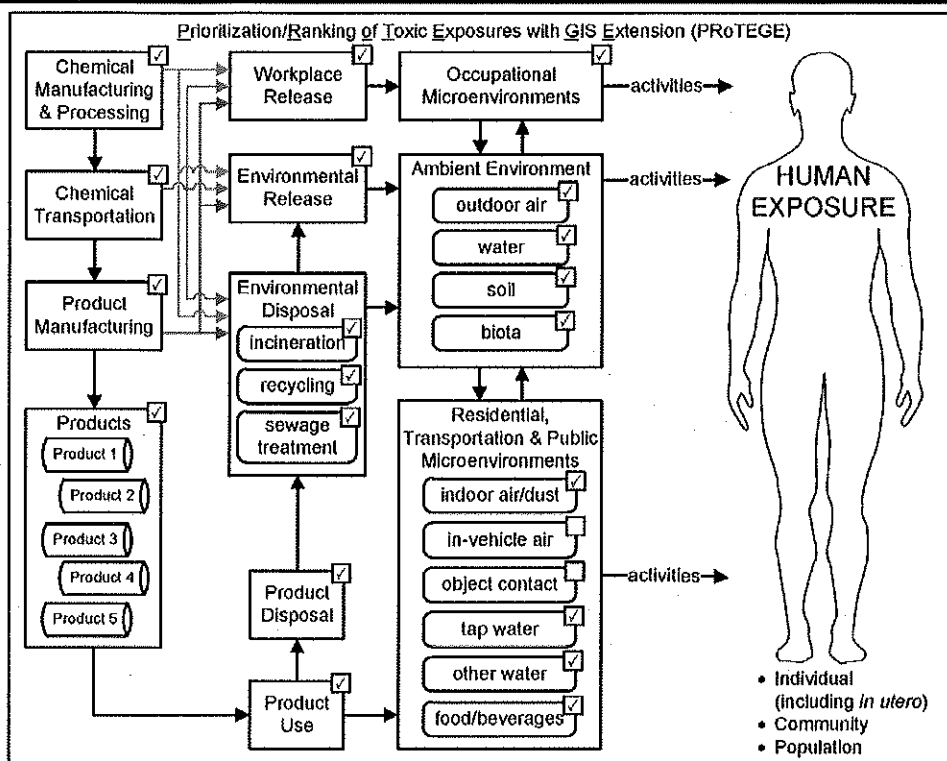
Summary Physico-Chemical Information	
Name	Di-n-butylphthalate
Other Names	DBP; Dibutyl-1,2-benzene-dicarboxylate
Chemical Formula	$C_6H_4(COOC_4H_9)_2$
Chemical Class	Plzr
Identifier	CAS: 84-74-2
Chemical Forms	
Physical Properties	
MW: 278.34 BP: 340°C FRZ: -35°C Sol: 0.001% VP: 0.00007 mmHg Sp.Gr: 1.05 Fl.P(oc): 159°C	
Additional Notes	
Colorless to faint-yellow, oily liquid with a slight, aromatic odor academic	

| Exposure and Toxicity Information |
|---|
| **Toxicity Limits:** RfD: 0.1 mg/kg/day; ; RfC: NA (IRIS) |
| **Toxicological Effects:** Group D not classifiable as to human carcinogenicity |
| **Exposure Limits:** NIOSH REL: TWA 5 mg/m³; OSHA PEL: TWA 5 mg/m³; TEEL-0: 5 mg/m³ |
| **Chemical Use:** Plasticizer |
| **Exposure Routes:** Inhalation, ingestion, skin and/or eye contact |
| **Target Organs:** Eyes, respiratory system, gastrointestinal tract |

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (µg/m³)	1.68*10⁻⁷	1.25*10⁻⁵	0.0052	Data source: Outdoor air (5ᵗʰ, 50ᵗʰ, 95ᵗʰ %ile) – NATA county-level annual average; Food – [31] (5, 50, 95%tiles); Indoor air - [28]; Tap water - [31]	Air	2453.93 (NEI 2005)	97.43% (NEI 2005)
Ground water						16.65 (TRI 2008)	1.36% (TRI 2008)
Food (µg/kg)	13.9	69	464		Surface Water	0.29 (TRI 2008)	0.09%
Indoor Air (µg/m³)	0.124	0.250	0.500		Ground Water	78.67 (TRI 2008)	0.03%
Surface water					Soil	7.89 (TRI 2008)	0.06%
Tap water (ng/L)	0.021	0.10	0.466				
Soil					Chemical Production and Use		
Dust					Production	26,000 tons/yr	Data Source: EU (1998)
Surfaces							
Biota							
Human Biomarkers							
Urine (µg/L)							
Blood							
Other							

| Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		•
	NIOSH		•
	ICSC		•
	ToxProfs		•
	IRIS		•
	HSDB		•
	ITER		•
	McKay		•
	Howard		•
	RIVM rprts		•
	IARC		
	PSAP		•
	NTP		
	REACH		
	PFD		
	MSDS		•
	DSSTox		•
	TMI		•
	SCP		•
	HPVIS		•
	ToxCast	Ph I	•
		Ph II	
	ToxRefDB		•
	CEBS		
Production and Use	SIDS		•
	EHPV		
	HPD		•
	IUR		
	ECD		•
	SRD		•
Releases	TRI		•
	NEI		•
Environmental Quality	NGA		
	NAWQA		
	AQS		O
	CERCLIS		•
	NATA		•
Micro-environments and Biomarkers-Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PK d (H) [32]
	BME		•[33]
	ERDEM		•

"Tier 1" Exposure Ranking for Di-n-butylphthalate

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	3	3	1	2
Dermal	2	2	1	1
Aggregate	2	2	1	1.33

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
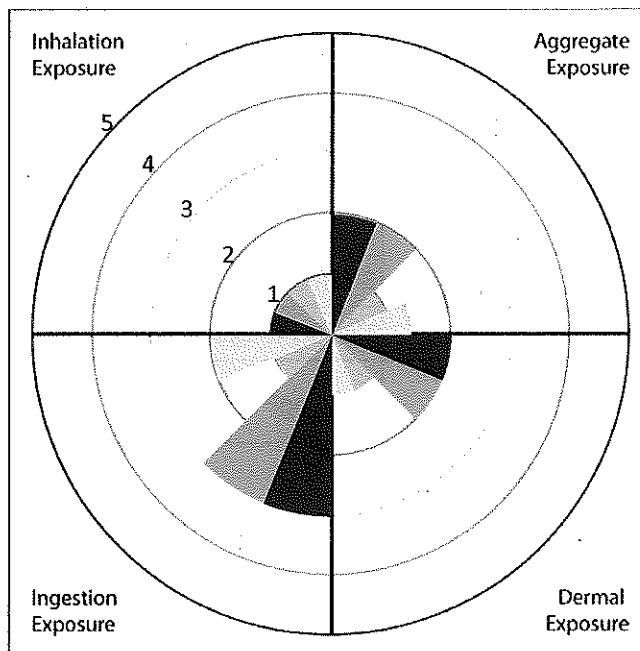
"Tier 2" Exposure Ranking for Di-n-butylphthalate
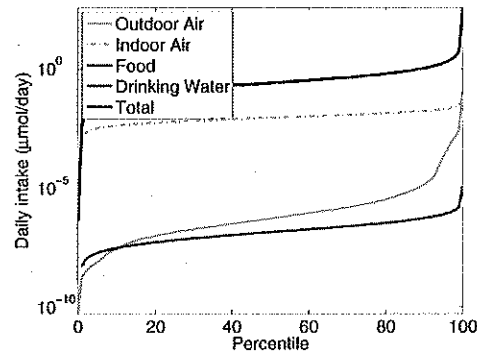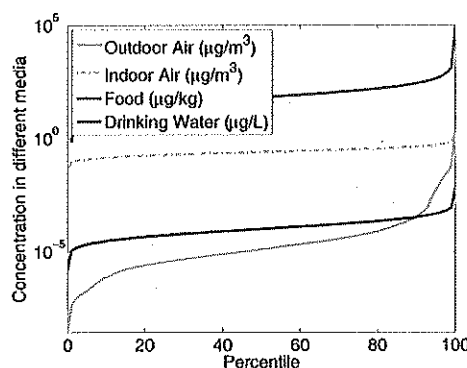
	Inhalation	Ingestion	Dermal	Aggregate
Median (μmol/day)	0.00849	0.248	NA	0.257
90 %tile	0.016	1.02	NA	1.07
% over 0.1 μmol/day	0.1	84.1	NA	85.1
% over 1 μmol/day	0	10.3	NA	11

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
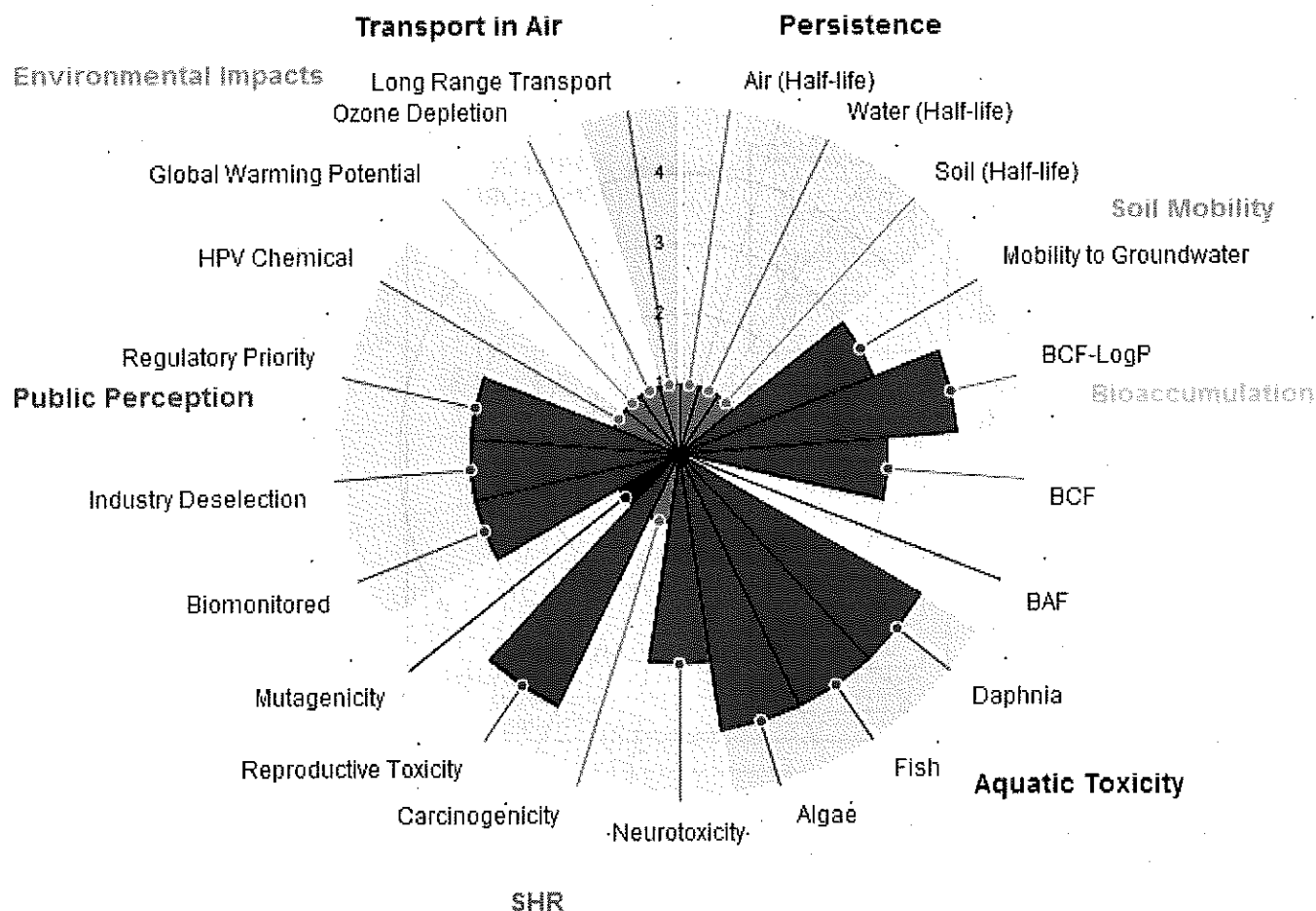
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

5b. METIS Results for Di-n-butylphthalate

		CAS # 84-74-2
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 1.153 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 69% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is not persistent in water (Min. BOD = 69%, Max. BOD = 69%).
	Soil (Half-life)	Low persistence in Soil (Estimated Half-life = 17.34 days)
Soil Mobility	Mobility to Groundwater	High mobility to groundwater based on LogKoc = 3.164
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Experimental LogP=4.5
	BCF	High bioconcentration potential based on Experimental LogBCF = 3.33
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 4.8 mg/L indicates a Moderate toxicity to Daphnia. However, this compound is classified as R50 (Very toxic to aquatic organisms.).
	Fish	A measured LC50 (96-hr) = 2.8 mg/L indicates a Moderate toxicity to Fish. However, this compound is classified as R50 (Very toxic to aquatic organisms.).
	Algae	A measured EC50 (72-hr) = 2.7 mg/L indicates a Moderate toxicity to Algae. However, this compound is classified as R50 (Very toxic to aquatic organisms.).
SHR	Neurotoxicity	Known Neurotoxin [Grandjean et al]
	Carcinogenicity	
	Reproductive Toxicity	Evidence in living organisms for Humans; No evident scientific basis for Wildlife [EU_EDRP]; Suspected Endocrine Disruptor [JP_SED]; Toxic to reproduction - Category 1B/2A [EU_RA17_5]; Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	1 out of 2 lists (NHANES)
	Industry Deselection	3 out of 6 lists (GADSL; EUC2; SINLIST)
	Regulatory Priority	3 out of 10 lists (EU_CAND; EU_RA14; JDES_LST)
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	

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## Graphical Summary of METIS Results for Di-n-butylphthalate

5c. NJrisk Preliminary Results for Di-n-butylphthalate

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin" and a "potential neurotoxin.")

6a. PRoTEGE Results for Hexabromocyclododecane

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
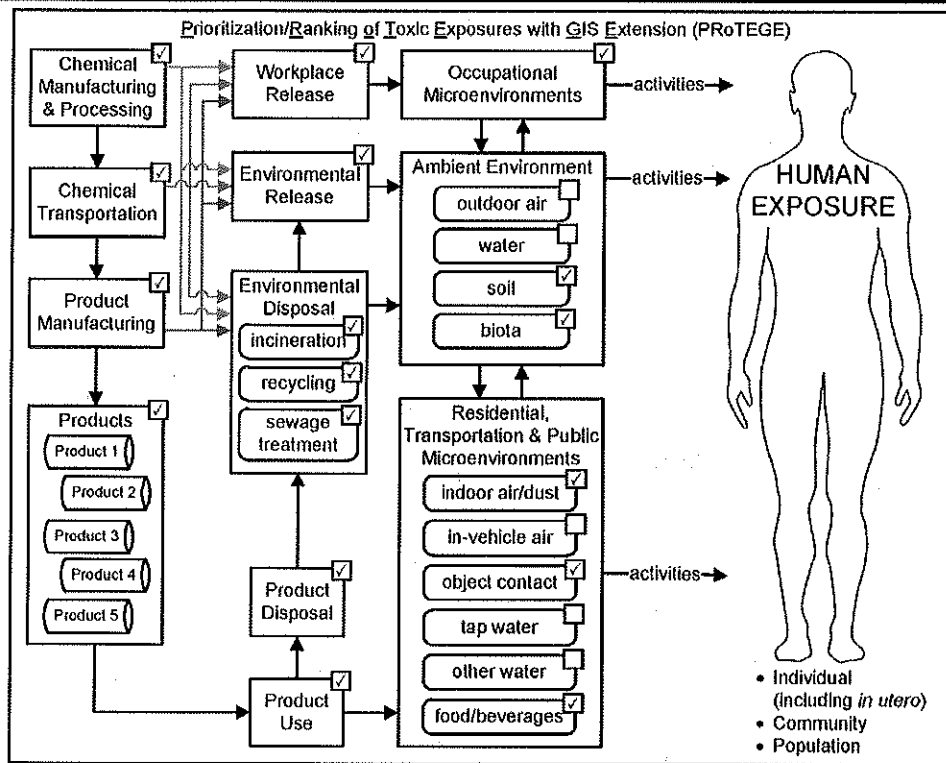
Summary Physico-Chemical Information	
Name	Hexabromocyclododecane
Other Names	
Chemical Formula	$C_{12}H_{18}Br_6$
Chemical Class	BFR
Identifier	CAS: 25637-99-4
Chemical Forms	
Physical Properties	
MW:641.7 Sol: In water, 6.56X10-3 mg/L VP: 4.72X10-6 mm Hg	
Additional Notes	

- Individual (including *in utero*)
- Community
- Population

Exposure and Toxicity Information
Toxicity Limits: NOAEL: 22.9 mg/kg/day
Toxicological Effects: light irritation
Exposure Limits: NOAEL 22.9 mg/kg/day
Chemical Use: flame retardant
Exposure Routes: ingestion of fish for general population, inhalation, and dermal contact for occupational population
Target Organs:

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air				Data source: Soil –HSDB; Food - [34] (5, 50, 95%tiles)	Air		
Ground water							
Food (µg/kg)	<LOD	1.02	19.0		Surface Water		
Indoor Air					Ground Water		
Surface water					Soil		
Tap water							
Soil (ppm)	0.000006		0.514		Chemical Production and Use		
Dust					Production		
Surfaces							
Biota							
Human Biomarkers							
Urine (µg/L)							
Blood							
Other							

Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		
	NIOSH		
	ICSC		●
	ToxProfs		
	IRIS		
	HSDB		●
	ITER		
	McKay		
	Howard		
	RIVM rprts		
	IARC		
	PSAP	.	
	NTP		
	REACH		●
	PFD		
	MSDS		●
	DSSTox		●
	TMI		
	SCP		●
	HPVIS		
	ToxCast	Ph I	
		Ph II	
	ToxRefDB		
	CEBS		
Production and Use	SIDS		●
	EHPV		
	HPD		
	IUR		
	ECD		●
	SRD		
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit	.	
	BME		
	ERDEM		

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	3	2	1	2
Dermal	1	1	1	2
Aggregate	1.66	1.33	1	1.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
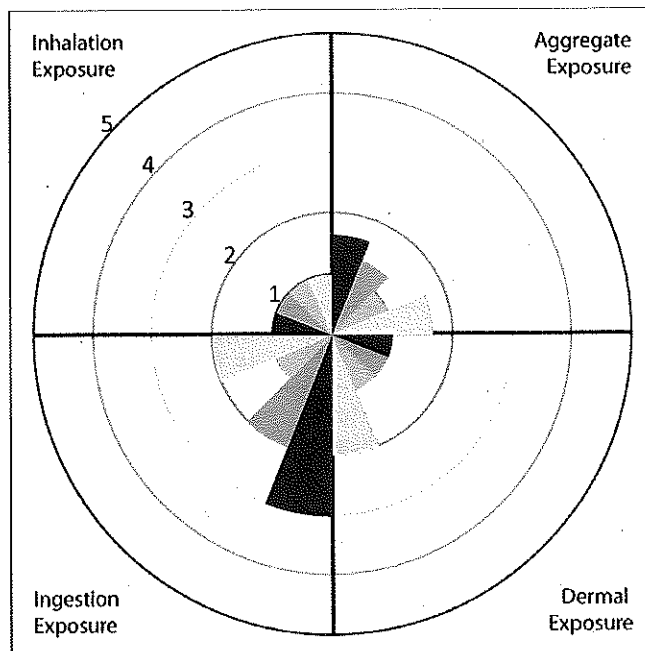
"Tier 2" Exposure Ranking for Hexabromocyclododecane
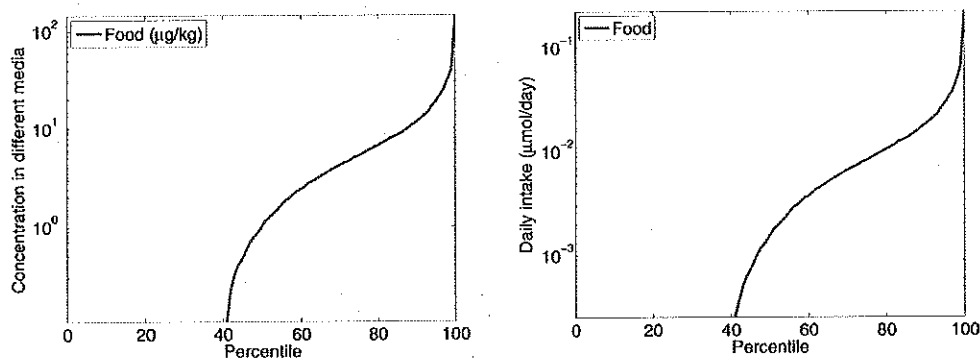
	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0	0.00156	NA	0.00156
90 %tile	0	0.0185	NA	0.0191
% over 0.1 µmol/day	0	0.766	NA	1.48
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)

## Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

6b. METIS Results for Hexabromocyclododecane

		CAS # 3194-55-6	CAS # 25637-99-4
Persistence	Air (Half-life)	High persistence in Air (Estimated Half-life = 2.133 days)	
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 1% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is very persistent in water (Min. BOD = 0%, Max. BOD = 4%).	Moderate persistence in Water (Estimated Half-life = 60 days)
	Soil (Half-life)	High persistence in Soil (Estimated Half-life = 120 days)	
Soil Mobility	Mobility to Groundwater	Low mobility to groundwater based on LogKoc = 5.097	Low mobility to groundwater based on LogKoc = 4.986
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Estimated LogP=7.74	
	BCF	Very High bioconcentration potential based on Experimental LogBCF = 4.26	
	BAF		
Aquatic Toxicity	Daphnia	An estimated LC50(48-hr) = 0.003 mg/L indicates a High toxicity to Daphnia.	
	Fish	An estimated LC50(96-hr) = 0.00191 mg/L indicates a High toxicity to Fish.	
	Algae	No toxicity estimate.	
SHR	Neurotoxicity		
	Carcinogenicity		
	Reproductive Toxicity	TOXIC TO REPRODUCTION - Hazard category 2 [EU_GHS]	
	Mutagenicity		
Public Perception	Biomonitored	0 out of 2 lists	
	Industry Deselection	1 out of 6 lists (SINLIST)	2 out of 6 lists (GADSL; SINLIST)
	Regulatory Priority	4 out of 10 lists (EU_CAND; EU_RA14; JMON1; JMON3)	3 out of 10 lists (EU_CAND; EU_RA14; JMON1)
	HPV Chemical	out of lists	
	Global Warming Potential	No data on Global Warming potential	
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion	
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 0.97013 km - A_TRNSPRT)	Low potential for Long Range Transport in Air (CTD = 343.267 km - A_TRNSPRT)

* Our current installation of METIS has more than one CAS number for this chemical and some of the data are not consistent.

## Graphical Summary of METIS Results for Hexabromocyclododecane
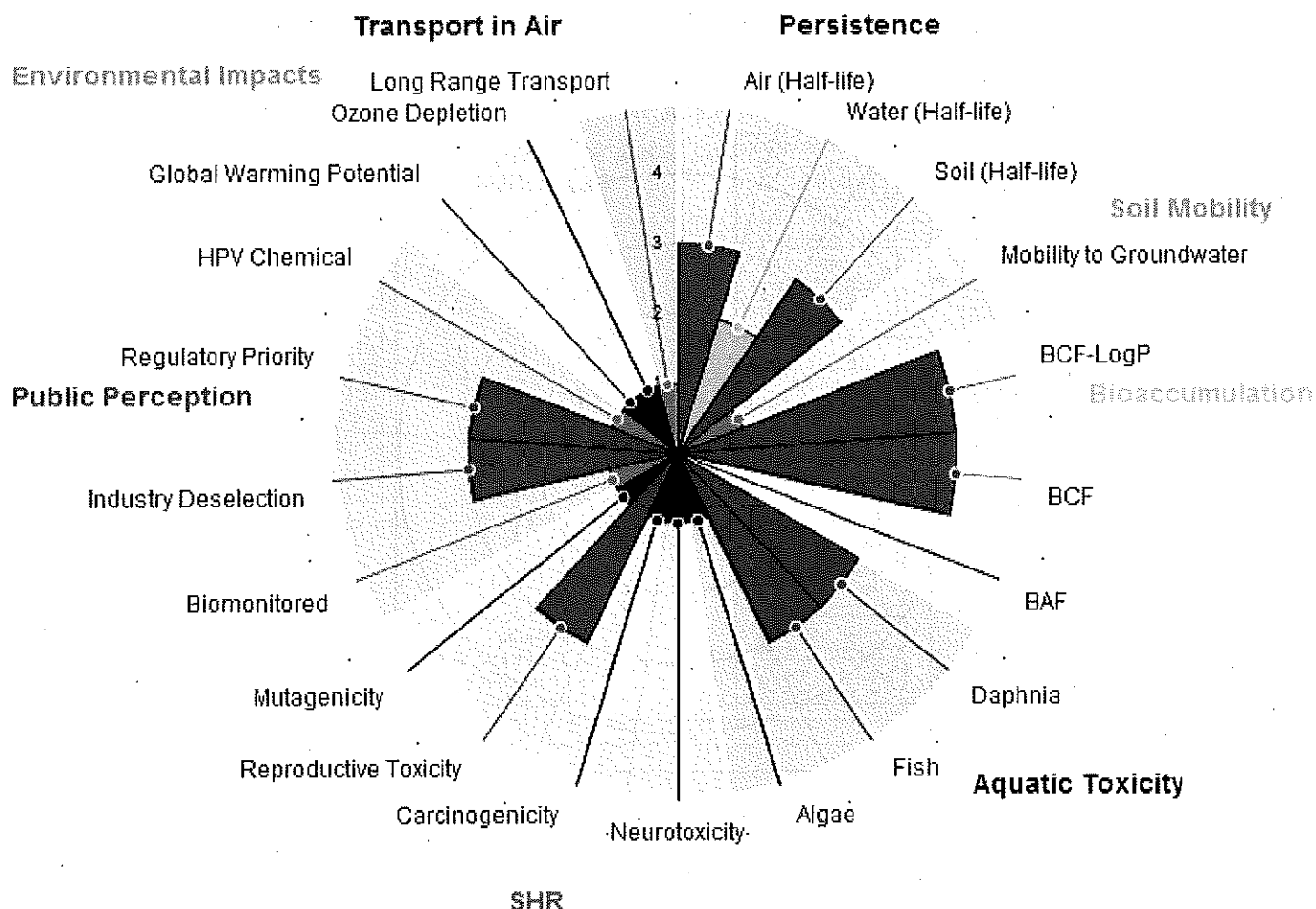
6c. NJrisk Preliminary Results for Hexabromocyclododecane

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

7a. PRoTEGE Results for Methoxychlor

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
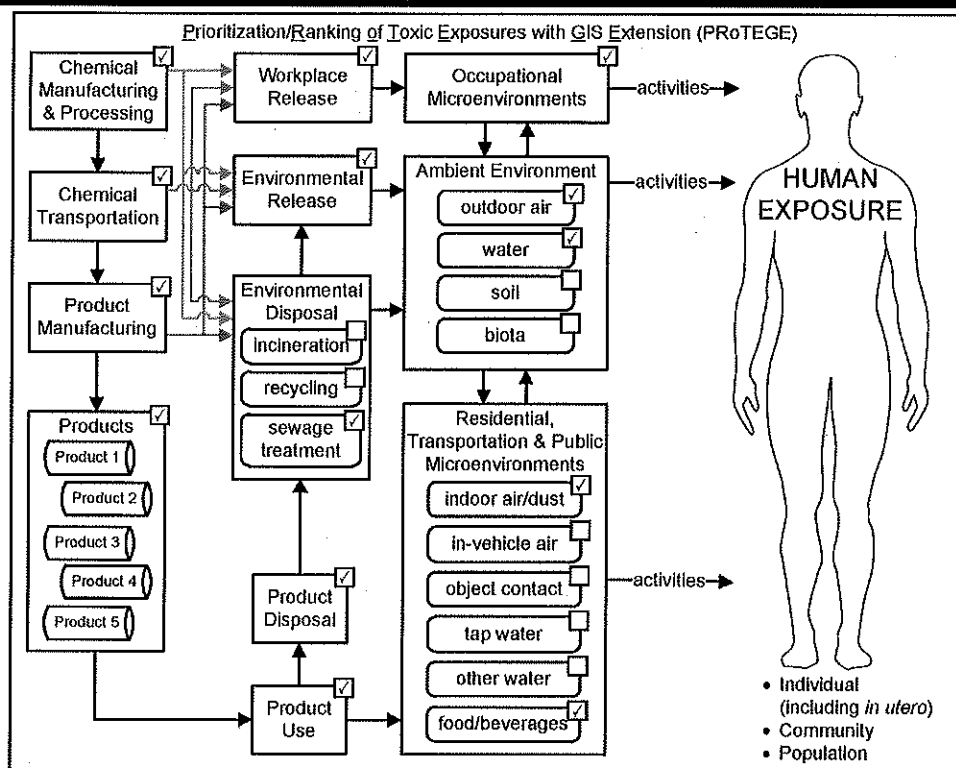
Summary Physico-Chemical Information	
Name	Methoxychlor
Other Names	p,p'-Dimethoxydiphenyltrichloroethane; DMDT; Methoxy-DDT; 2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane; 1,1,1-Trichloro-2,2-bis-(p-methoxyphenyl)ethane
Chemical Formula	$(C_6H_4OCH_3)_2CHCCl_3$
Chemical Class	OCP
Identifier	CAS 72-43-5
Chemical Forms	
Physical Properties	
MW: 345.7 BP: Decomposes MLT: 171°F Sol: 0.00001% VP: Very low	
Additional Notes	

Exposure and Toxicity Information
Toxicity Limits: RfD 0.005 mg/kg/day (IRIS)
Toxicological Effects: Not classifiable as to human carcinogenicity (IRIS)
Exposure Limits: OSHA PEL: TWA 15 mg/m³
Chemical Use: insecticide
Exposure Routes: inhalation, ingestion
Target Organs: central nervous system, liver, kidneys

Environmental Concentrations					
	Low	Medium	High	Notes	
Outdoor air (ng/m³)		0.25		Data sources: Outdoor air '08 annual mean @ one AQS monitor; Food (5th, 50th, and 95th %iles) - TDS 91-03; Tap water - [35] (>99% of measurements <RL)	
Ground water					
Food (ppb)	0.2	0.4	1.69		
Indoor Air					
Surface water					
Tap water (µg/L)	<RL	<RL	0.020 (99.9%tile)		
Soil					
Dust					
Surfaces					
Biota					
Human Biomarkers					
Urine					
Blood					
Other					

Environmental Releases		
	Emissions Tons/yr	% Counties Reporting Emissions
Air	0.0018	0.16
Surface Water	NA	NA
Ground Water	NA	NA
Soil	0.93	0.06
Chemical Production and Use		
Production		

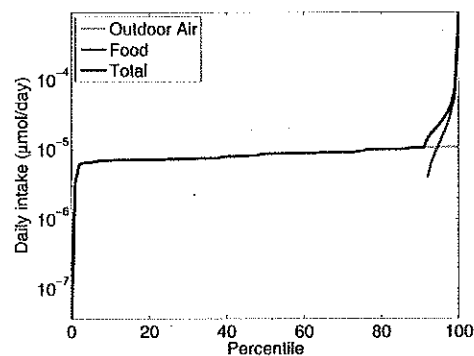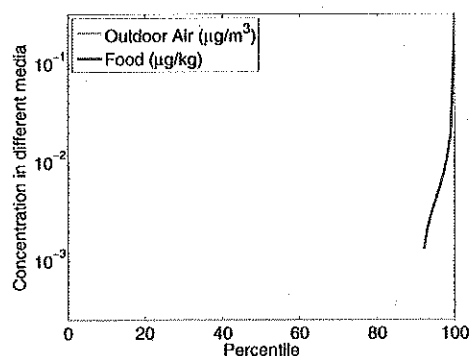| Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		●
	NIOSH		●
	ICSC		●
	ToxProfs		●
	IRIS		●
	HSDB		●
	ITER		●
	McKay		●
	Howard		●
	RIVM rprts		
	IARC		
	PSAP		
	NTP		●
	REACH		
	PFD		
	MSDS		●
	DSSTox		●
	TMI		●
	SCP		●
	HPVIS		
	ToxCast Ph I		●
	ToxCast Ph II		
	ToxRefDB		
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		●
	IUR		
	ECD		
	SRD		●
Releases	TRI		●
	NEI		●
Environmental Quality	NGA		
	NAWQA		
	AQS		●
	CERCLIS		●
	NATA		●
Micro-environments and Biomarkers- Human and Ecological	TDS		●
	SDWIS		●
	NHANES 03-04		
	NHANES 05-06		
	NHANES 07-08		
	NHANES 09-10		
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for Methoxychlor

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	2	2	2	2
Dermal	1	1	1	1
Aggregate	1.33	1.33	1.33	1.33

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).

"Tier 2" Exposure Ranking for Methoxychlor

	Inhalation	Ingestion	Dermal	Aggregate
Median (μmol/day)	8.63E-06	0	NA	8.63E-06
90 %tile	1.06E-05	0	NA	1.06E-05
% over 0.1 μmol/day	0	0	NA	0
% over 1 μmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)

Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

7b. METIS Results for Methoxychlor

		CAS # 72-43-5
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.1997 days)
	Water (Half-life)	Very High persistence in Water (Estimated Half-life = 180 days)
	Soil (Half-life)	Very High persistence in Soil (Estimated Half-life = 360 days)
Soil Mobility	Mobility to Groundwater	Low mobility to groundwater based on LogKoc = 4.629
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Experimental LogP=5.08
	BCF	Very High bioconcentration potential based on Experimental LogBCF = 3.91
	BAF	
Aquatic Toxicity	Daphnia	No toxicity estimate.
	Fish	An estimated LC50(96-hr) = 0.156 mg/L indicates a Moderate toxicity to Fish [CLOGP].
	Algae	No toxicity estimate.
SHR	Neurotoxicity	
	Carcinogenicity	Not classifiable [IARC_OE]; D (Not classifiable as to human carcinogenicity) [1986 Guidelines] [IRIS]
	Reproductive Toxicity	Evidence in living organisms for Humans; Evidence in living organisms for Wildlife [EU_EDRP]; Suspected Endocrine Disruptor [JP_SED]; Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	0 out of 6 lists
	Regulatory Priority	0 out of 10 lists
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 85.555 km - A_TRNSPRT)

## Graphical Summary of METIS Results for Methoxychlor

SHR
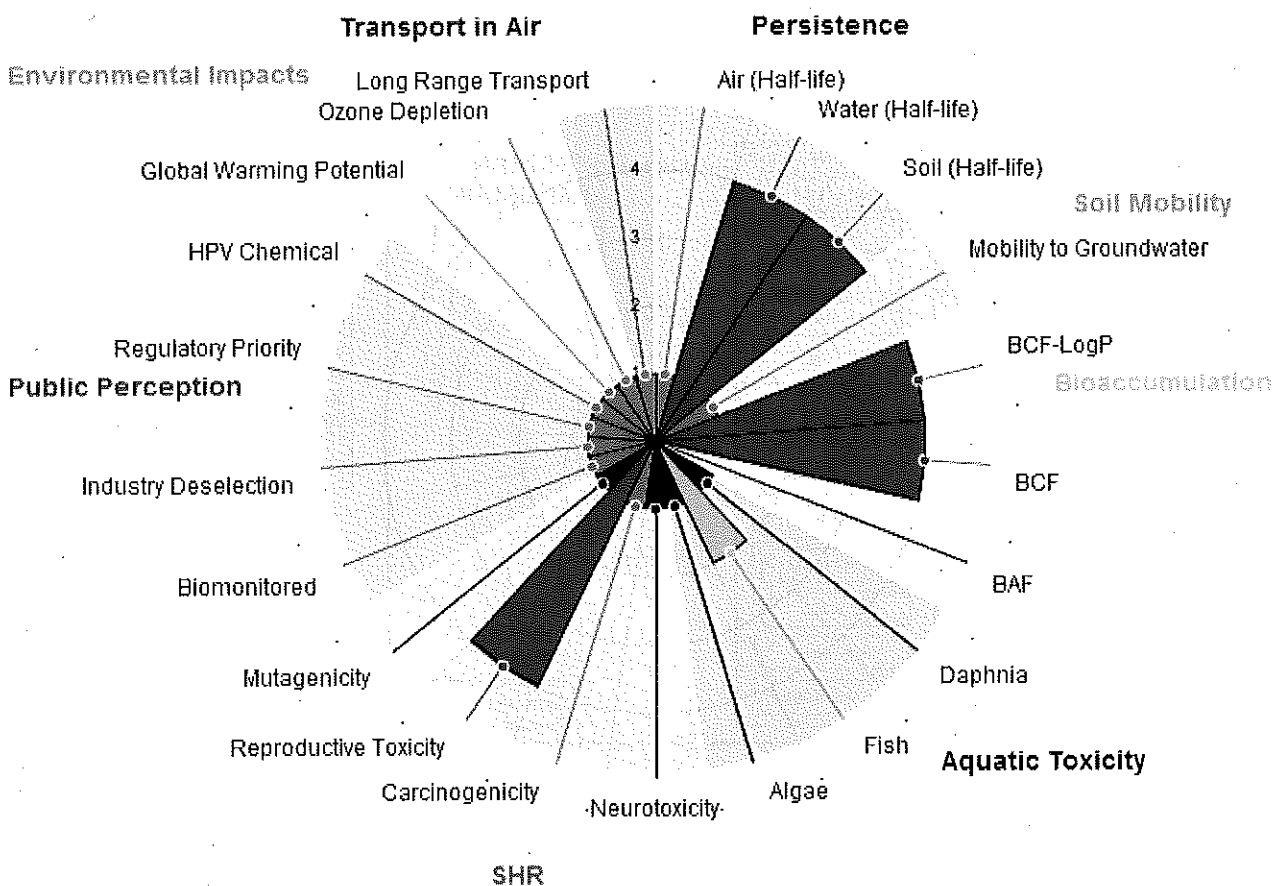
7c. NJrisk Preliminary Results for Methoxychlor

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin" and as having a "very high potential for persistence [water, soil] and a very high potential for bioaccumulation based on LogBCF = 3.91 [experimental] [vPvB]")

8a. PRoTEGE Results for n-Hexane

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
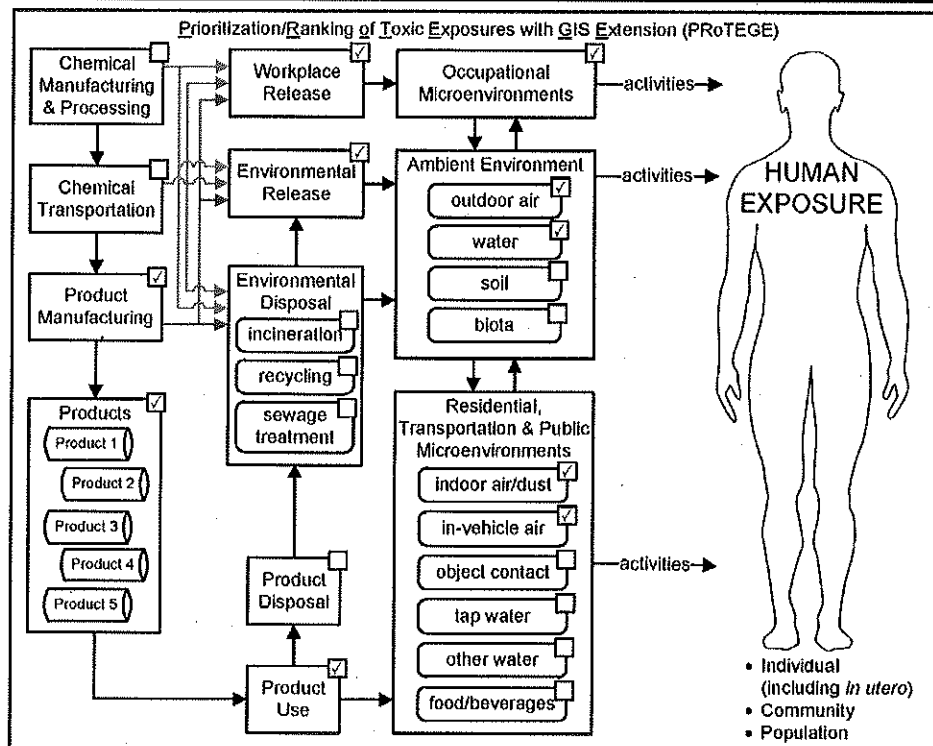
Summary Physico-Chemical Information	
Name	n-Hexane
Other Names	Hexane, Hexyl hydride, normal-Hexane
Chemical Formula	$CH_3[CH_2]_4CH_3$
Chemical Class	VOC
Identifier	CAS 110-54-3
Chemical Forms	
Physical Properties	
MW: 86.2	
BP: 156°F	
MLT: -219°F	
Sol: 0.002%	
VP: 124 mmHg	
Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.	
Colorless liquid with a gasoline-like odor.	
Additional Notes	

Exposure and Toxicity Information

Toxicity Limits: RfD: NA (IRIS); RfC: 0.7 mg/kg/day (IRIS)

Toxicological Effects: Neurotoxicity in humans (based on Sanagi et al., 1980 [36])

Exposure Limits: NIOSH REL: TWA 50 ppm (180 mg/m³); OSHA PEL: TWA 500 ppm (1800 mg/m³)

Chemical Use: Pure or commercial grade solvent; raw material in the synthesis of polyolefins, elastomers and pharmaceuticals; formulation of glues, stains, varnishes and other industrial chemicals

Exposure Routes: Inhalation, ingestion, skin and/or eye contact

Target Organs: Eyes, skin, respiratory system, central nervous system, peripheral nervous system

---

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (ppb)	0.040	0.185	0.901	Data sources: Outdoor air (5th, 50th, and 95th %iles) - '08 annual means @ AQS monitors; Surface water – HSDB; Indoor air - [37] (5, 50, 95%tiles)	Air		
Ground water						161376.58	99.94%
Food					Surface Water	4.12	2.64%
Indoor Air (µg/m³)	0.78	2.18	6.06		Ground Water	0.76	0.16%
Surface water (ng/L)	1.5		7.8		Soil	14.43	1.24%
Tap water							
Soil					Chemical Production and Use		
Dust					Production	500 million to < 1 billion Lbs/yr	Data Source: IUR 2006
Surfaces							
Biota							
Human Biomarkers							
Urine							
Blood							
Other							

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| Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		•
	NIOSH		•
	ICSC		•
	ToxProfs		•
	IRIS		•
	HSDB		•
	ITER		•
	McKay		•
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		
	REACH		
	PFD		
	MSDS		•
	DSSTox		•
	TMI		•
	SCP		•
	HPVIS		
	ToxCast	Ph I	
		Ph II	
	ToxRefDB		
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		•
	IUR		•
	ECD		☐
	SRD		•
Releases	TRI		•
	NEI		•
Environmental Quality	NGA		
	NAWQA		
	AQS		•
	CERCLIS		
	NATA		•
Micro-environments and Biomarkers- Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	(I)
		09-10	(b)
	NHEXAS		
PK/PBPK Model (or Data)	ScLit	PBPK m (H) [38]	
	BME		• [39]
	ERDEM		

"Tier 1" Exposure Ranking for n-Hexane

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	5	3	2	3
Ingestion	1	1	1	2
Dermal	3	2	2	4
Aggregate	3	2	1.66	3

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
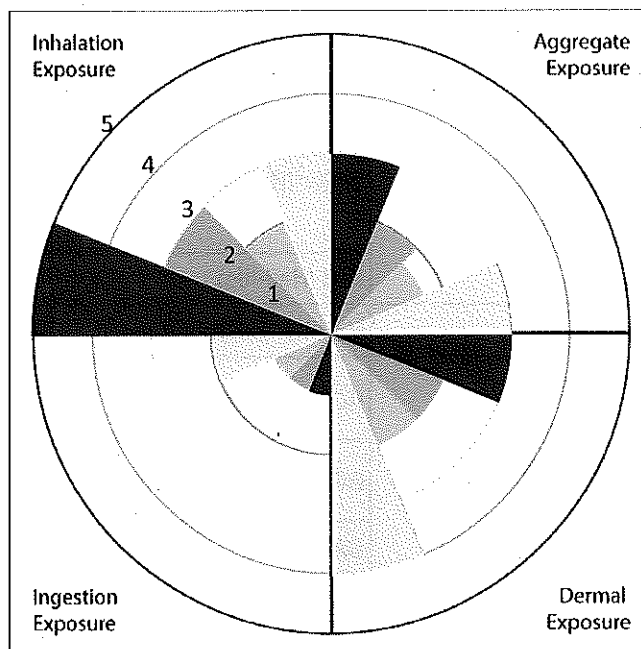
"Tier 2" Exposure Ranking for n-Hexane
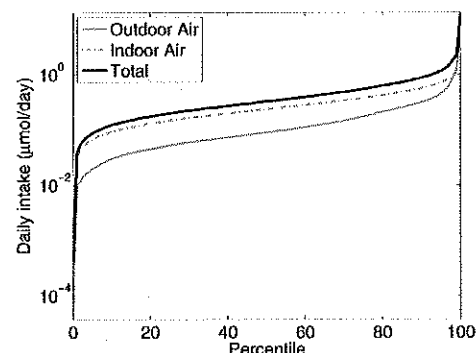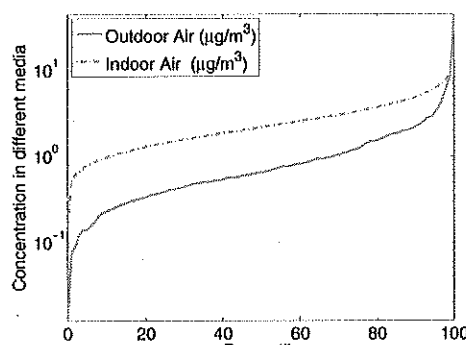
	Inhalation	Ingestion	Dermal	Aggregate
Median (μmol/day)	0.368	0	NA	0.368
90 %tile	0.799	0	NA	0.811
% over 0.1 μmol/day	98.1	0	NA	97.5
% over 1 μmol/day	5.34	0	NA	5.81

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
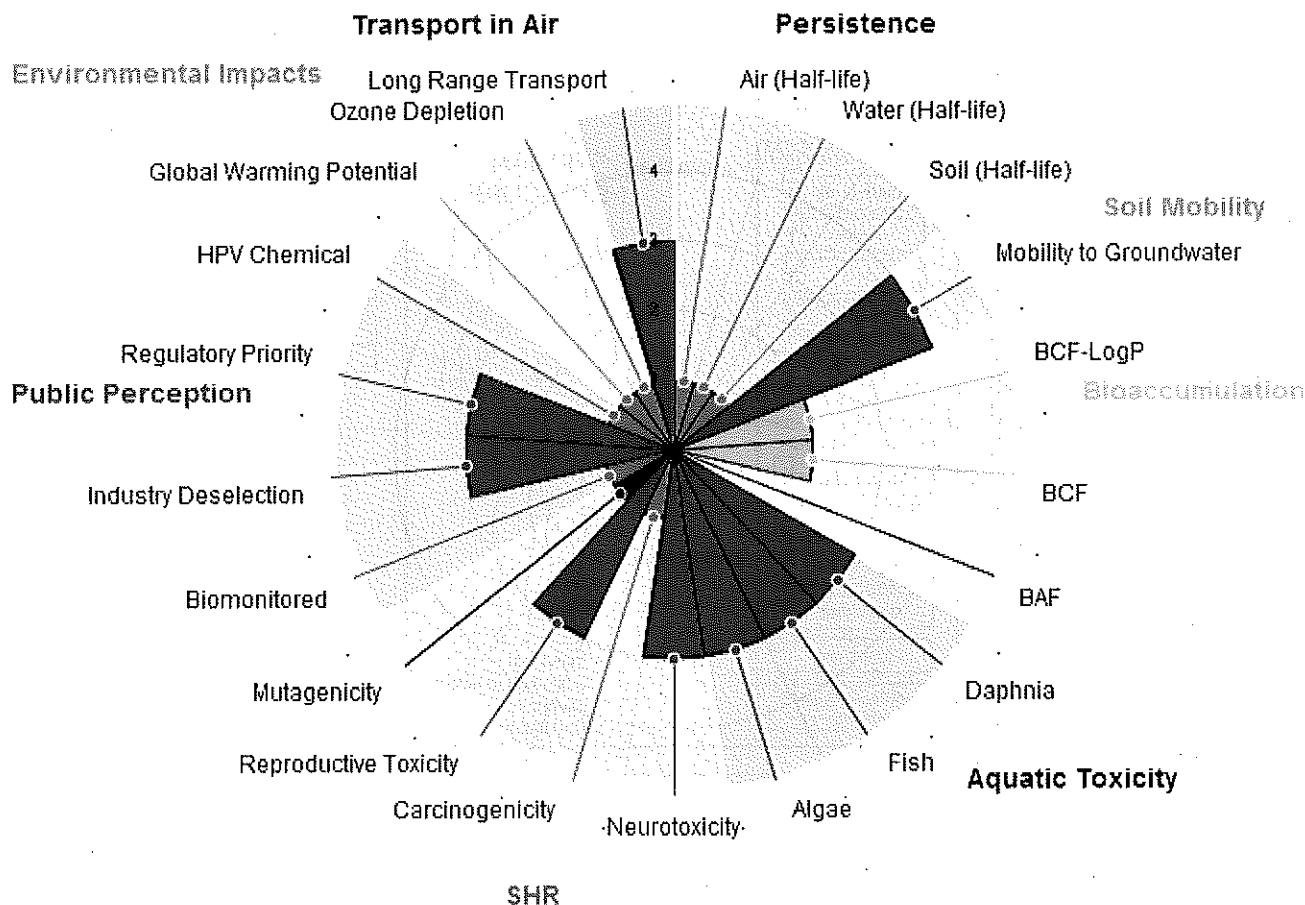
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

8b. METIS Results for n-Hexane

		CAS # 110-54-3
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 1.96 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 100% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is not persistent in water (Min. BOD = 99%, Max. BOD = 103%).
	Soil (Half-life)	Low persistence in Soil (Estimated Half-life = 17.34 days)
Soil Mobility	Mobility to Groundwater	Very High mobility to groundwater based on LogKoc = 2.173
Bioaccumulation	BCF-LogP	Moderate bioconcentration potential based on an Experimental LogP=3.9
	BCF	Moderate bioconcentration potential based on Estimated LogBCF = 2.303
	BAF	
Aquatic Toxicity	Daphnia	An estimated LC50(48-hr) = 4.587 mg/L indicates a Moderate toxicity to Daphnid. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Fish	An estimated LC50(96-hr) = 3.916 mg/L indicates a Moderate toxicity to Fish. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Algae	No toxicity estimate. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
SHR	Neurotoxicity	Known Neurotoxin [Grandjean et al]
	Carcinogenicity	
	Reproductive Toxicity	Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	2 out of 6 lists (EUC2; SINLIST)
	Regulatory Priority	2 out of 10 lists (EU_RRAP; JDES_LST)
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	High potential for Long Range Transport in Air (CTD = 587.52 km - A_TRNSPRT)

Graphical Summary of METIS Results for n-Hexane

Transport in Air   Persistence

Environmental Impacts   Long Range Transport   Air (Half-life)
Ozone Depletion   Water (Half-life)

Global Warming Potential   Soil (Half-life)

Soil Mobility

HPV Chemical   Mobility to Groundwater

Regulatory Priority   BCF-LogP

Public Perception   Bioaccumulation

Industry Deselection   BCF

Biomonitored   BAF

Mutagenicity   Daphnia

Reproductive Toxicity   Fish   Aquatic Toxicity

Carcinogenicity   Algae
Neurotoxicity

SHR

8c. NJrisk Preliminary Results for n-Hexane

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "potential neurotoxin.")

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HAZARD HIGH (3)			
MODERATE (2)			
LOW (1)			X

9a. PRoTEGE Results for Nonylphenol

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
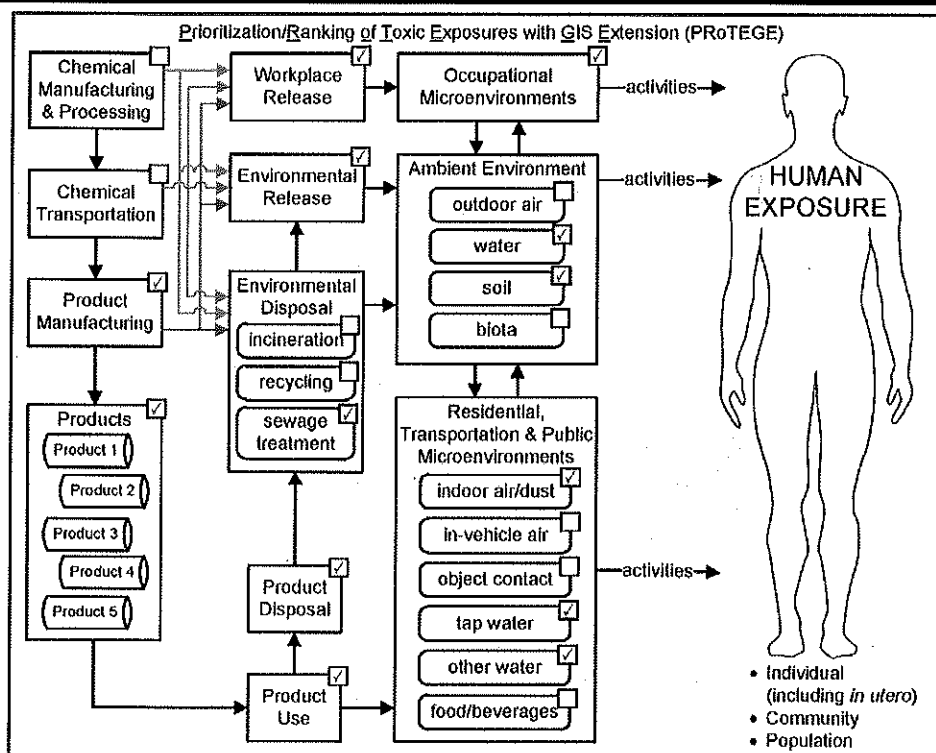
Summary Physico-Chemical Information	
Name	Nonylphenol
Other Names	
Chemical Formula	$C_{15}H_{24}O$
Chemical Class	alkylphenol/MU
Identifier	CAS 25154-52-3
Chemical Forms	
Physical Properties	
MW: 220.35	
Sol.: In water, 6.35 mg/L at 25°C, Sol in most organic solvents	
VP: 2.36X10⁻⁵ mm Hg at 25°C	
Additional Notes	

| Exposure and Toxicity Information |
|---|
| **Toxicity Limits:** LD50 Rat oral 1,600 mg/kg; LD50 Rabbit dermal 2140 mg/kg |
| **Toxicological Effects:** Moderately toxic if swallowed. Severely irritating to skin and eyes. |
| **Exposure Limits:** 2.5 mg/m³ (TEEL) |
| **Chemical Use:** Shale and clay stabilizer in drilling muds; nonionic surfactant; bactericides; dyes; drugs; adhesives |
| **Exposure Routes:** Occupational exposure to nonylphenol may occur through inhalation and dermal contact with this compound at workplaces during its production and formulation into commercial products |
| **Target Organs:** skin and eye |

Environmental Concentrations						Environmental Releases		
	Low	Medium	High	Notes			Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air				Data sources: Indoor air - [28]; Tap water - [40]; Surface water, Soil - HSDB.	Air		
Ground water							
Food (µg/g)					Surface Water		
Indoor Air (ng/m³)	62	130	272		Ground Water		
Surface water (µg/L)		0.8	40		Soil		
Tap water (ng/L)	3.5	6.6	12				
Soil (µg/kg)		162			Chemical Production and Use		
Dust					Production	< 500,000 lbs/yr	Data Source: IUR 2006
Surfaces							
Biota							
Human Biomarkers							
Urine							
Blood							
Other							

| Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		●
	NIOSH		
	ICSC		
	ToxProfs		
	IRIS		
	HSDB		●
	ITER		
	McKay		
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		
	REACH		●
	PFD		
	MSDS		●
	DSSTox		●
	TMI		●
	SCP		●
	HPVIS		
	ToxCast	Ph I	
		Ph II	
	ToxRefDB		
	CEBS		
Production and Use	SIDS		●
	EHPV		
	HPD		●
	IUR		●
	ECD		●
	SRD		●
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for Nonylphenol

Semi-Quantitative Exposure Ranking

	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	3	1	2	1
Ingestion	2	1	1	2
Dermal	2	1	1	2
Aggregate	2.33	1	1.33	1.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
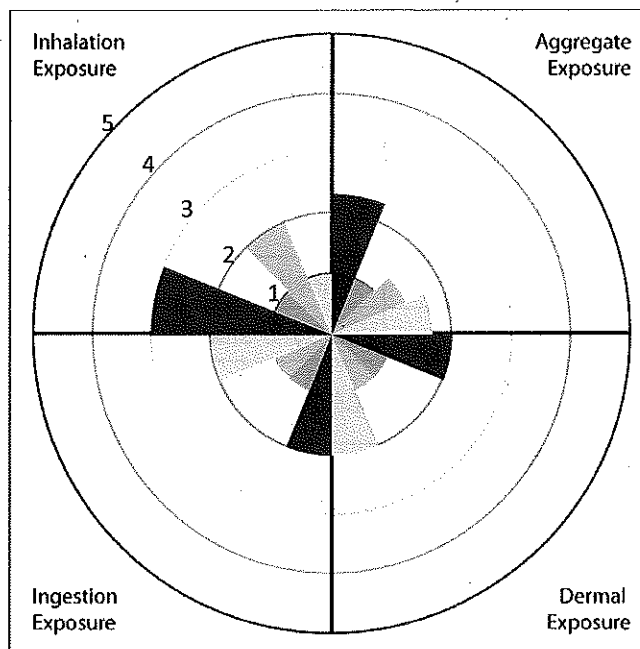
"Tier 2" Exposure Ranking for Nonylphenol
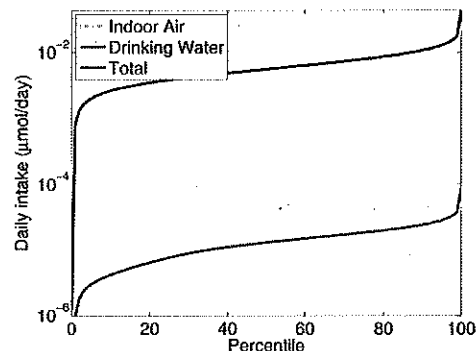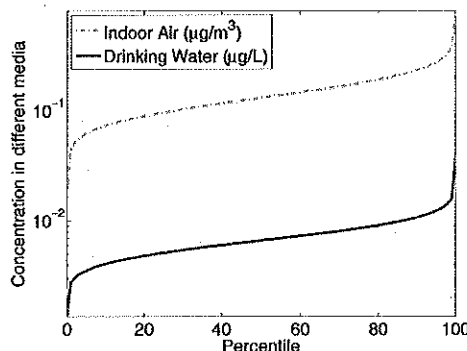
	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0.00557	0.000013	NA	0.00558
90 %tile	0.0107	2.42E-05	NA	0.0109
% over 0.1 µmol/day	0	0	NA	0
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
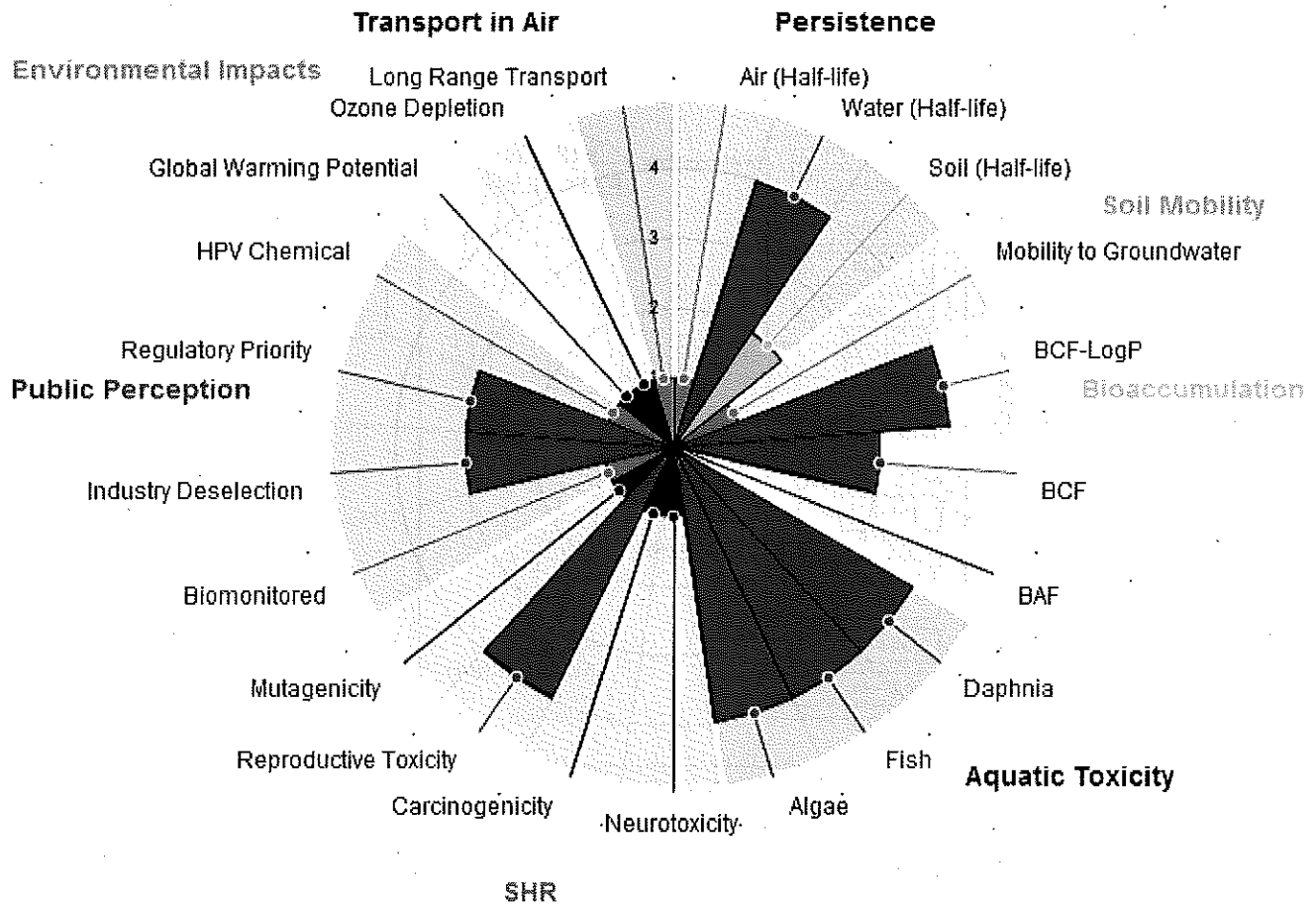
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

9b. METIS Results for Nonylphenol

		CAS # 25154-52-3
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.2059 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 0% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is very persistent in water (Min. BOD = 0%, Max. BOD = 0%).
	Soil (Half-life)	Moderate persistence in Soil (Estimated Half-life = 75 days)
Soil Mobility	Mobility to Groundwater	Low mobility to groundwater based on LogKoc = 4.452
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Estimated LogP=5.84
	BCF	High bioconcentration potential based on Estimated LogBCF = 3.522
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 0.059 mg/L indicates a High toxicity to Daphnia. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Fish	A measured LC50 (96-hr) = 0.24 mg/L indicates a Moderate toxicity to Fish. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Algae	A measured EC50 (72-hr) >9.2 mg/L indicates a Moderate toxicity to Algae. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
SHR	Neurotoxicity	
	Carcinogenicity	
	Reproductive Toxicity	Evidence in living organisms for Humans; Evidence in living organisms for Wildlife [EU_EDRP]; Suspected Endocrine Disruptor [as NONYL PHENOL] [JP_SED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	3 out of 6 lists (GADSL; EUC2; SINLIST)
	Regulatory Priority	2 out of 10 lists (JDES_LST; JMON3)
	HPV Chemical	out of lists
	Global Warming Potential	No data on Global Warming potential
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 96.8371 km - A_TRNSPRT)

Graphical Summary of METIS Results for Nonylphenol

Transport in Air

Persistence

Environmental Impacts — Long Range Transport — Air (Half-life)
Ozone Depletion — Water (Half-life)

Global Warming Potential — Soil (Half-life)

Soil Mobility

HPV Chemical — Mobility to Groundwater

Regulatory Priority — BCF-LogP

Public Perception — Bioaccumulation

Industry Deselection — BCF

Biomonitored — BAF

Mutagenicity — Daphnia

Reproductive Toxicity — Fish — **Aquatic Toxicity**

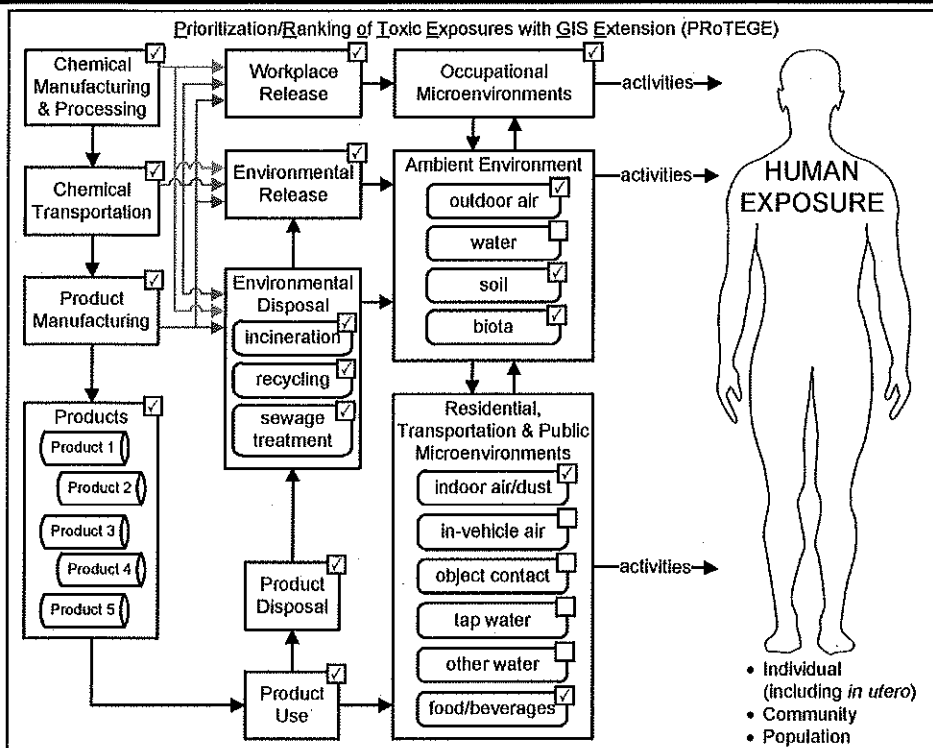Carcinogenicity — Neurotoxicity — Algae

SHR

9c. NJrisk Preliminary Results for Nonylphenol

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin" and as considered to be "persistent, bioaccumulative, and toxic.")

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HAZARD HIGH (3)			
HAZARD MODERATE (2)		X	
HAZARD LOW (1)			

10a. PRoTEGE Results for octaBDE

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)

Summary Physico-Chemical Information	
Name	octaBDE
Other Names	Octabromodiphenyl ether
Chemical Formula	$C_{12}H_2Br_8O$
Chemical Class	PBDEs
Identifier	CAS 32536-52-0
Chemical Forms	mixture of BDE 183, 197, and 207
Physical Properties	
MW: 801.31 SpGr: 2.76	
Additional Notes	

- Individual (including *in utero*)
- Community
- Population

Exposure and Toxicity Information
Toxicity Limits: RfD 0.003 mg/kg/day
Toxicological Effects: not classifiable as to its carcinogenicity to humans (IRIS)
Exposure Limits:
Chemical Use: flame retardant
Exposure Routes: ingestion (primarily seafood)
Target Organs:

	Environmental Concentrations					Environmental Releases	
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (pg/m³)	<LOD	0.438	2.28	Data source: Surface water and soil (sediment) – HSDB; Food - [34] (5, 50, 95%tiles); Outdoor air - [41] (5, 50, 95%tiles)	Air		
Ground water							
Food (ng/kg)	<LOD	<LOD	0.29		Surface Water		
Indoor Air					Ground Water		
Surface water (µg/L)			<LOD		Soil		
Tap water							
Soil (µg/kg)	8		21		Chemical Production and Use		
Dust					Production		
Surfaces							
Biota							
Human Biomarkers							
Urine							
Blood							
Other							

Availability of Information in Databases and Reference Documents			
	PAC		
	NIOSH		
	ICSC		
	ToxProfs		•
	IRIS		•
	HSDB		•
	ITER		•
	McKay		
	Howard		
	RIVM rprts		
Physicochemical and/or Toxicological Properties	IARC		
	PSAP		
	NTP		
	REACH		•
	PFD		
	MSDS		
	DSSTox		•
	TMI		
	SCP		•
	HPVIS		
	ToxCast	Ph I	
		Ph II	
	ToxRefDB		
	CEBS		
Production and Use	SIDS		•
	EHPV		
	HPD		
	IUR		
	ECD		•
	SRD		
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for octaBDE

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	3	3	1	2
Dermal	1	1	1	1
Aggregate	1.66	1.66	1	1.33

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).

"Tier 2" Exposure Ranking for octaBDE

	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	6.27E-09	0	NA	6.27E-09
90 %tile	2.36E-08	1.87E-07	NA	2.21E-07
% over 0.1 µmol/day	0	0	NA	0
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
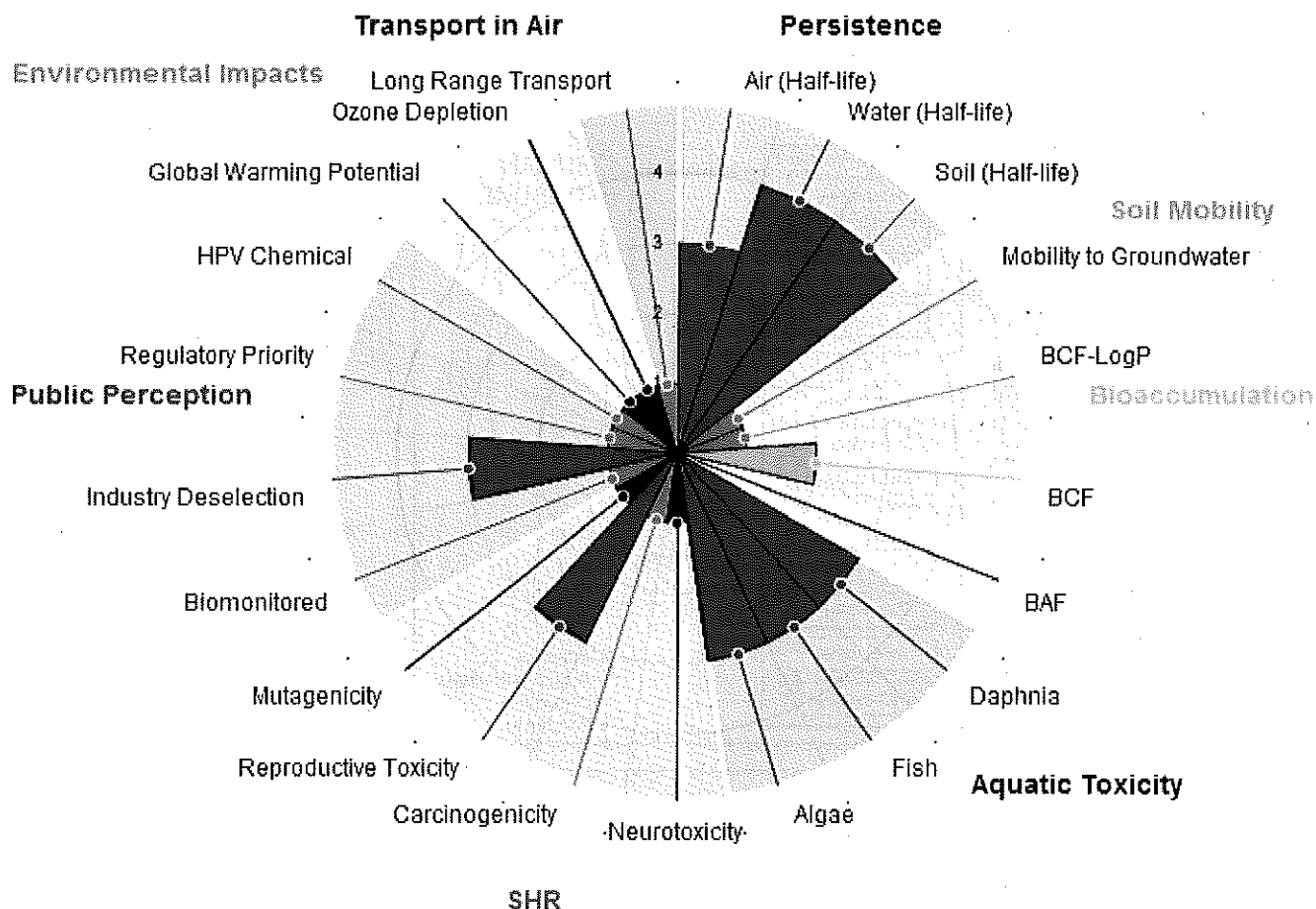
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

10b. METIS Results for octaBDE

		CAS # 32536-52-0
Persistence	Air (Half-life)	High persistence in Air (Estimated Half-life = 140.4 days)
	Water (Half-life)	Very High persistence in Water (Estimated Half-life = 180 days)
	Soil (Half-life)	Very High persistence in Soil (Estimated Half-life = 360 days)
Soil Mobility	Mobility to Groundwater	Low mobility to groundwater based on LogKoc = 4.996
Bioaccumulation	BCF-LogP	Low bioconcentration potential based on an Estimated LogP=10.33
	BCF	Moderate bioconcentration potential based on Estimated LogBCF = 2.492
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) >0.011 mg/L indicates a High toxicity to Daphnia.
	Fish	A measured LC50 (96-hr) >0.012 mg/L indicates a High toxicity to Fish.
	Algae	A measured EC50 (72-hr) >0.012 mg/L indicates a High toxicity to Algae.
SHR	Neurotoxicity	
	Carcinogenicity	
	Reproductive Toxicity	Toxic to reproduction - Category 1B/2A [EU_RA17_5]; Evidence of potential for Humans [EU_EDRP]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	2 out of 6 lists (EUC2; SINLIST)
	Regulatory Priority	0 out of 10 lists
	HPV Chemical	out of lists
	Global Warming Potential	No data on Global Warming potential
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 358.565 km - A_TRNSPRT)

Graphical Summary of METIS Results for octaBDE

Transport in Air   **Persistence**

Environmental Impacts   Long Range Transport   Air (Half-life)
                         Ozone Depletion   Water (Half-life)

Global Warming Potential   Soil (Half-life)

                                                  Soil Mobility
HPV Chemical   Mobility to Groundwater

Regulatory Priority   BCF-LogP
Public Perception   Bioaccumulation

Industry Deselection   BCF

Biomonitored   BAF

Mutagenicity   Daphnia

Reproductive Toxicity   Fish   **Aquatic Toxicity**

Carcinogenicity   ·Neurotoxicity·   Algae

SHR

10c. NJrisk Preliminary Results for octaBDE

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HAZARD HIGH (3)			
MODERATE (2)		X	
LOW (1)			

11a. PRoTEGE Results for Ammonium Perchlorate

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
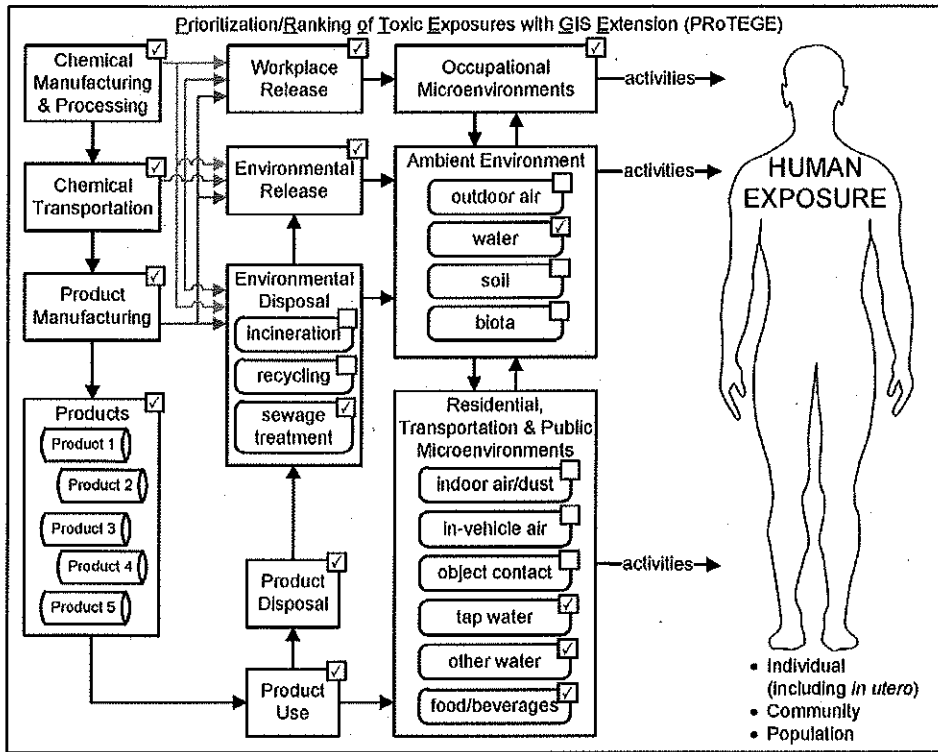
Summary Physico-Chemical Information	
Name	Ammonium Perchlorate
Other Names	
Chemical Formula	NH₄ClO₄
Chemical Class	oxdzr
Identifier	CAS: 7790-98-9
Chemical Forms	

Physical Properties

Physical Form: Dry Powder, Pellets or Large Crystals
Molecular weight: 117.49
Melting point: Exothermic decomposition before melting at >200°C
Solubility: Soluble in water (20.85 g/100 mL (20°C))
SpGr: 1.95

Additional Notes

Exposure and Toxicity Information

Toxicity Limits: RfD 0.7 µg/kg/day (IRIS)

Toxicological Effects: Not classified as carcinogenic by ATSDR and IARC; risk of thyroid cancer in rodents is not likely applicable to humans (NAS)

Exposure Limits: TEEL-0: 5 mg/m³

Chemical Use: oxidizer in rocket fuel

Exposure Routes: ingestion of food (0.08 to 0.39 µg/kg/day - TDS) and water, inhalation

**Target Organs:** Skin, eye, respiratory organs [42], thyroid gland [43]

	Environmental Concentrations					Environmental Releases	
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air				Data sources: Tap water (min, mean and max) - USEPA Unregulated Contaminant Monitoring (UCM) program (data for contiguous US) - Samples collected from 2000 May through 2005 Oct., 4% < LOD; Food (5th, 50th and 95th percentiles) - TDS 2005-2006, 16% not detected	Air		
Ground water							
Food (ppb)	0.4	3.2	24.16		Surface Water		
Indoor Air					Ground Water		
Surface water					Soil		
Tap water (µg/L)	4	9.3	200				
Soil					Chemical Production and Use		
Dust					Production	10 to < 50 million lbs	Data source: IUR 2006
Surfaces							
Biota							
Human Biomarkers				Urine: geometric mean and 95th percentile values (1,618 US residents aged >=20 years), 96.6% > LOD (NHANES)			
Urine (µg/L)		3.35	12				
Blood							
Other							

65

Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		●
	NIOSH		
	ICSC		●
	ToxProfs		□
	IRIS		●
	HSDB		●
	ITER		●
	McKay		
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		●
	REACH		
	PFD		
	MSDS		●
	DSSTox		●
	TMI		●
	SCP		
	HPVIS		
	ToxCast	Ph I	
		Ph II	
	ToxRefDB		
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		
	IUR		●
	ECD		O
	SRD		
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		●
	NATA		
	TDS		●
Micro-environments and Biomarkers- Human and Ecological	SDWIS		
	NHANES	03-04	u
		05-06	(u)
		07-08	(u)
		09-10	(u)
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PBPK m (R) [44]
	BME		
	ERDEM		

## "Tier 1" Exposure Ranking for Ammonium Perchlorate

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	2
Ingestion	3	3	2	3
Dermal	1	1	1	1
Aggregate	1.66	1.66	1.33	2

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
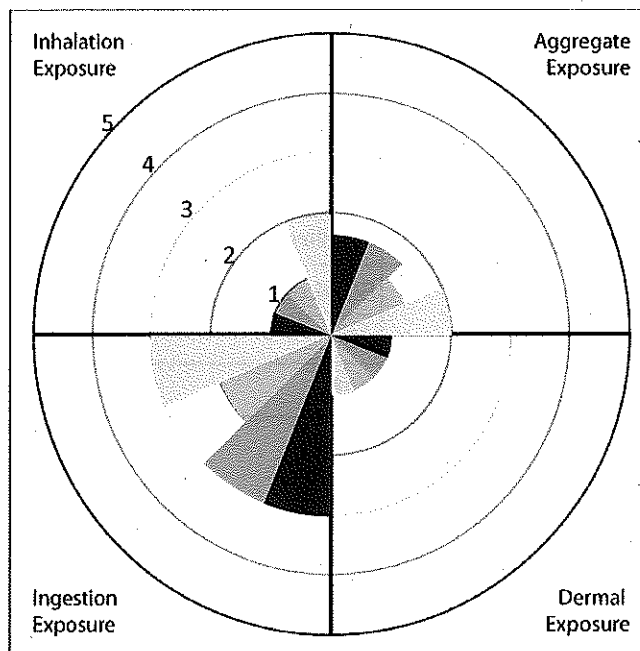
"Tier 2" Exposure Ranking for Ammonium Perchlorate
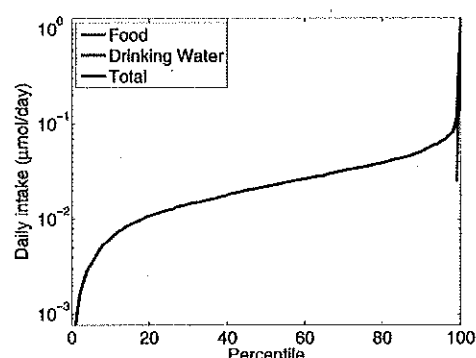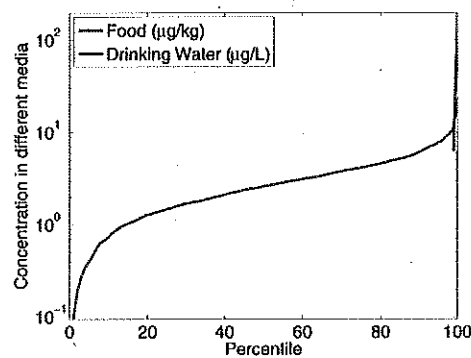
	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0	0.0227	NA	0.0227
90 %tile	0	0.0536	NA	0.0545
% over 0.1 µmol/day	0	0.996	NA	1.98
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)

Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

11b. METIS Results for Ammonium Perchlorate

		CAS # 7664-41-7
Persistence	Air (Half-life)	Persistence in Air has not been calculated for this compound
	Water (Half-life)	Persistence in Water has not been calculated for this compound.
	Soil (Half-life)	Persistence in Soil has not been calculated for this compound.
Soil Mobility	Mobility to Groundwater	Soil mobility has not been calculated for this compound
Bioaccumulation	BCF-LogP	BCF value based on LogP has not been calculated for this compound
	BCF	BCF value has not been calculated for this compound
	BAF	
Aquatic Toxicity	Daphnia	An estimated LC50(48-hr) = 551.992 mg/L indicates a Low toxicity to Daphnid. However, this compound is classified as R50 (Very toxic to aquatic organisms.).
	Fish	An estimated LC50(96-hr) = 582.147 mg/L indicates a Low toxicity to Fish. However, this compound is classified as R50 (Very toxic to aquatic organisms.).
	Algae	No toxicity estimate. However, this compound is classified as R50 (Very toxic to aquatic organisms.).
SHR	Neurotoxicity	
	Carcinogenicity	
	Reproductive Toxicity	Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	1 out of 6 lists (EUC3)
	Regulatory Priority	1 out of 10 lists (CAN_PSL)
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	Long Range Transport in Air has not been calculated for this compound

Graphical Summary of METIS Results for Ammonium Perchlorate
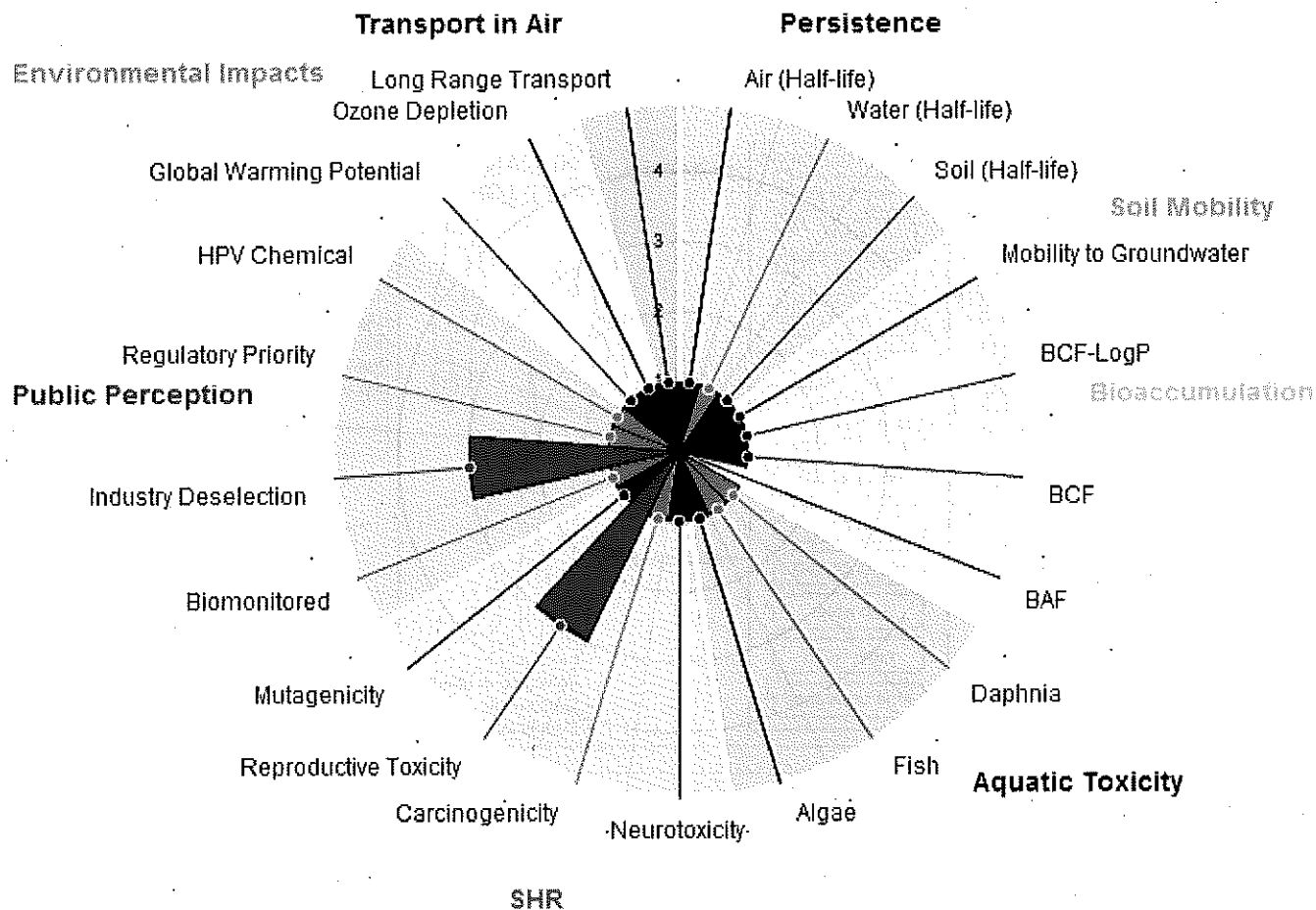

11c. NJrisk Preliminary Results for Ammonium Perchlorate

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

12a. PRoTEGE Results for Tetrabromobisphenol A

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
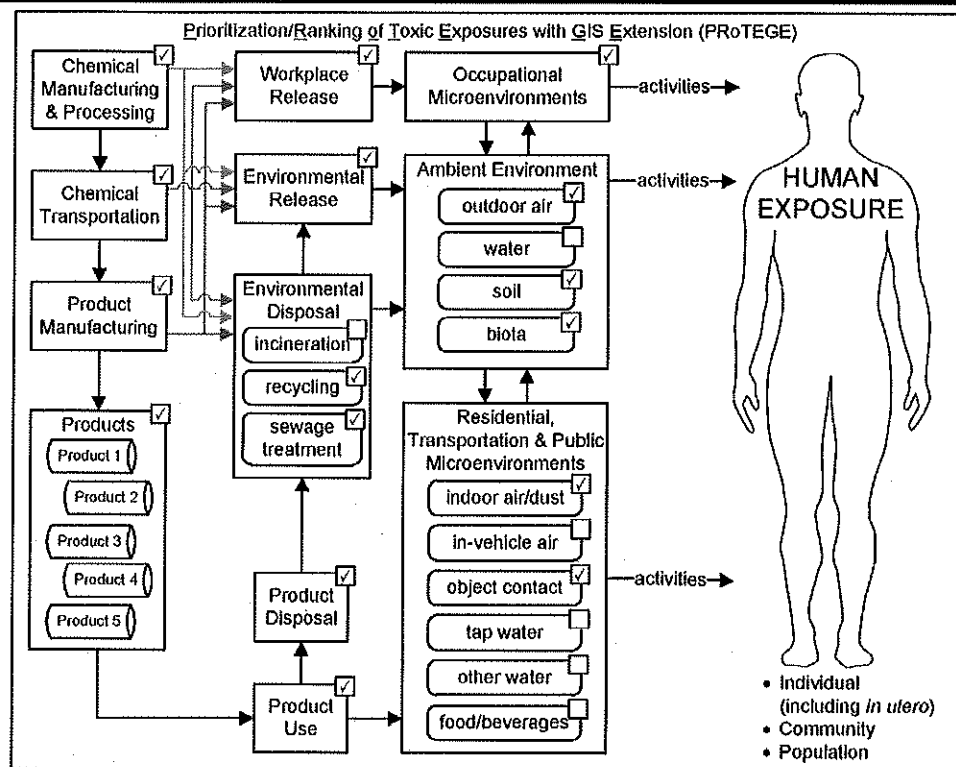
Summary Physico-Chemical Information	
Name	Tetrabromobisphenol A
Other Names	TBBPA, 2,2',6,6'-Tetrabromobisphenol A
Chemical Formula	$C_{15}H_{12}Br_4O_2$
Chemical Class	BFR
Identifier	CAS: 79-94-7
Chemical Forms	
Physical Properties	

Molecular Weight: 543.88
Melting Point: 179-181 deg C
Color/Form: Off-white powder
Density/Specific Gravity: 2.2 kg/L at 4 deg C
high lipophilicity (log Kow = 5.9)
low volatility ($7.0 \times 10-11$ atm m3/mol)
low water solubility (4.16 mg/L at 25 °C in H2O)

Additional Notes

Exposure and Toxicity Information
Toxicity Limits: LD50 Rat oral >5 g/kg; LD50 Rabbit dermal >2 g/kg
Toxicological Effects: Immunosuppressive effects on human natural killer cells [45]
Exposure Limits: NA
Chemical Use: Brominated flame retardant, plasticizer, circuit boards
Exposure Routes: Inhalation, dermal
Target Organs:

Environmental Concentrations						Environmental Releases		
	Low	Medium	High	Notes			Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air	<LOD			Data Sources: Indoor Air, Soil, Dust	Air			
Ground water	NA			[46]; Food - <LOD for common			20.55 (TRI 2008)	0.62% (TRI 2008)
Food	<LOD			foods [47]; Indoor air - [46]	Surface Water		0.01 (TRI 2008)	0.03% (TRI 2008)
Indoor Air (ng/m3)	0.123	0.2	32.6		Ground Water			
Surface water	NA				Soil		3.90 (TRI 2008)	0.06% (TRI 2008)
Tap water	NA							
Soil (ng/g)	0.12	25.2	100800			Chemical Production and Use		
Dust (ng/g)	0.4	47	520		Production		G (Current), 150,000 tons (ECD)	
Surfaces								
Biota	NA							
Human Biomarkers								
Urine (µg/L)								
Blood								
Other								

Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		
	NIOSH		
	ICSC		
	ToxProfs		
	IRIS		
	HSDB		●
	ITER		
	McKay		
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		
	REACH		
	PFD		
	MSDS		●
	DSSTox		
	TMI		●
	SCP		●
	HPVIS		●
	ToxCast	Ph I	
		Ph II	●
	ToxRefDB		
	CEBS		
Production and Use	SIDS		●
	EHPV		
	HPD		
	IUR		
	ECD		●
	SRD		
Releases	TRI		●
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PK d (R) [48]
	BME		
	ERDEM		

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	3	3	1	1
Ingestion	1	1	1	3
Dermal	1	1	1	1
Aggregate	1.66	1.66	1	1.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
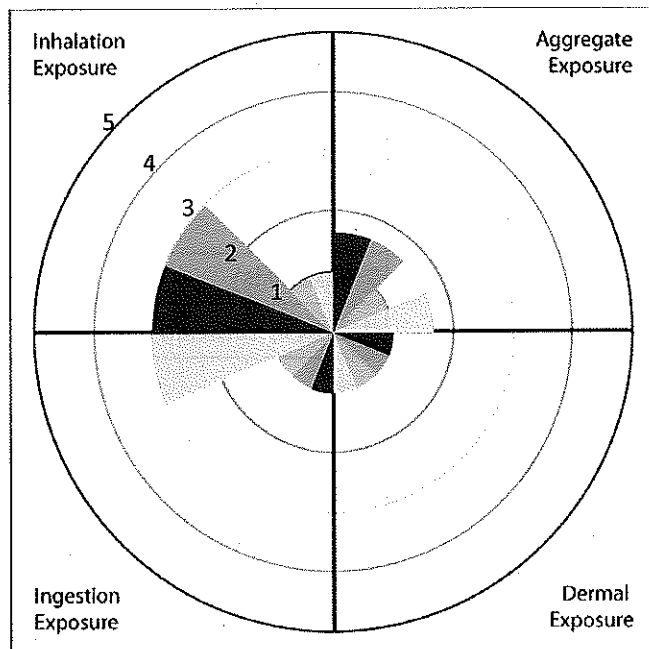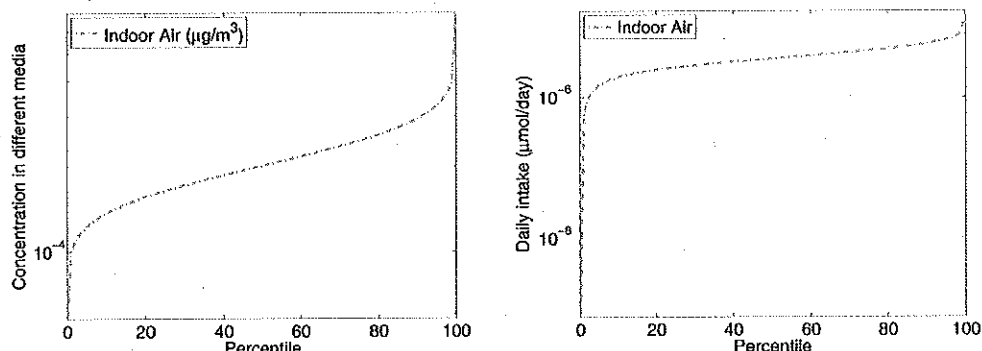
	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	3.49E-06	0	NA	3.49E-06
90 %tile	5.64E-06	0	NA	5.69E-06
% over 0.1 µmol/day	0	0	NA	0
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
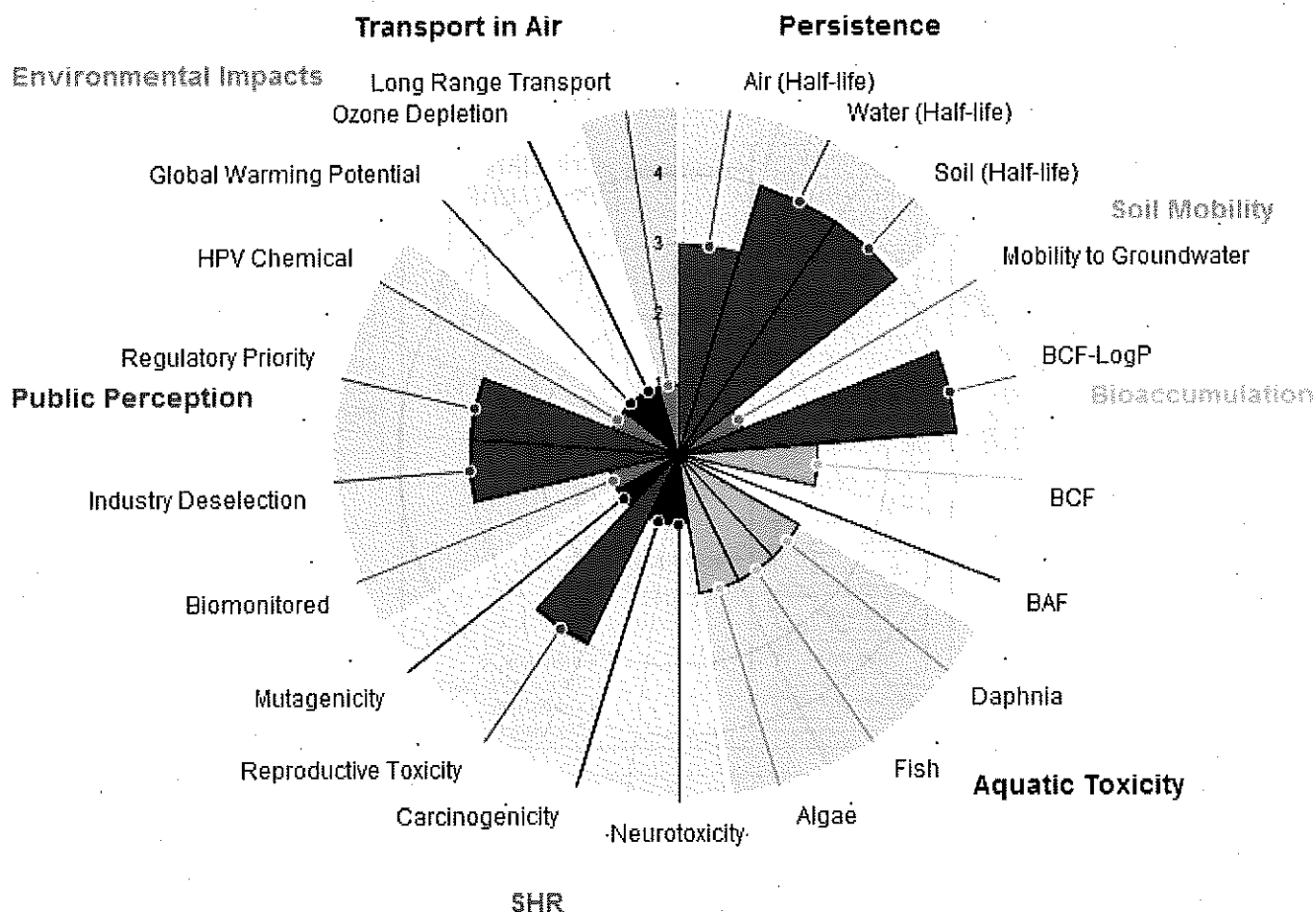
"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

12b. METIS Results for Tetrabromobisphenol A

		CAS # 79-94-7
Persistence	Air (Half-life)	High persistence in Air (Estimated Half-life = 3.615 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 0% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is very persistent in water (Min. BOD = 0%, Max. BOD = 0%).
	Soil (Half-life)	Very High persistence in Soil (Estimated Half-life = 360 days)
Soil Mobility	Mobility to Groundwater	Low mobility to groundwater based on LogKoc = 5.75
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Estimated LogP=7.2
	BCF	Moderate bioconcentration potential based on Experimental LogBCF = 2.21
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 7.9 mg/L indicates a Moderate toxicity to Daphnia.
	Fish	A measured LC50 (96-hr) = 9.2 mg/L indicates a Moderate toxicity to Fish.
	Algae	A measured EC50 (72-hr) = 9.5 mg/L indicates a Moderate toxicity to Algae.
SHR	Neurotoxicity	
	Carcinogenicity	
	Reproductive Toxicity	Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	2 out of 6 lists (GADSL; SINLIST)
	Regulatory Priority	1 out of 10 lists (JMON3)
	HPV Chemical	out of lists
	Global Warming Potential	No data on Global Warming potential
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 0.571544 km - A_TRNSPRT)

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Graphical Summary of METIS Results for Tetrabromobisphenol A

Transport in Air

Persistence

Environmental Impacts   Long Range Transport   Air (Half-life)

Ozone Depletion   Water (Half-life)

Global Warming Potential   Soil (Half-life)

Soil Mobility

HPV Chemical   Mobility to Groundwater

Regulatory Priority   BCF-LogP

Public Perception   Bioaccumulation

Industry Deselection   BCF

Biomonitored   BAF

Mutagenicity   Daphnia

Reproductive Toxicity   Fish   **Aquatic Toxicity**

Carcinogenicity   Neurotoxicity   Algae

SHR

12c. NJrisk Preliminary Results for Tetrabromobisphenol A

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

EXPOSURE

LOW (1)   MODERATE (2)   HIGH (3)

HAZARD

HIGH (3)

MODERATE (2)

LOW (1)

X

13a. PRoTEGE Results for Trifluralin

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
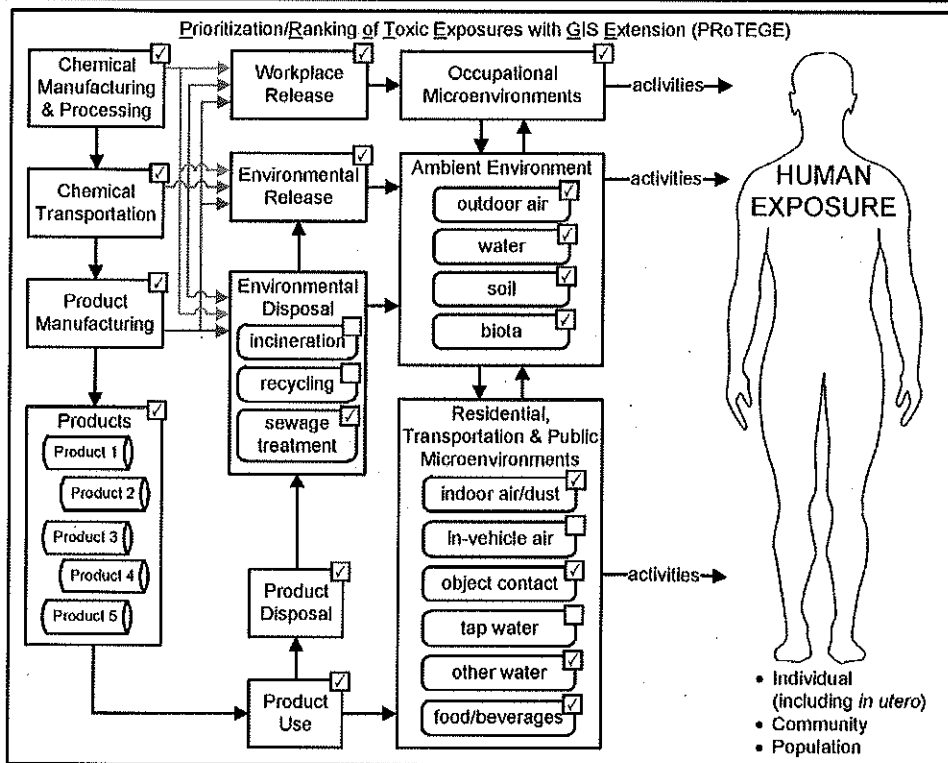
Summary Physico-Chemical Information	
Name	Trifluralin
Other Names	Agreflan, Elancolan, Treficon, Treflan, Crisalin, Trim
Chemical Formula	$C_{13}H_{16}F_3N_3O_4$
Chemical Class	Herb
Identifier	CAS: 1582-09-8; RTECS: XU9275000; EC: 609-046-00-1
Chemical Forms	
Physical Properties	

Yellow crystalline solid
Molecular weight: 335.28
Solubility in water: 18.4 mg/L at 25°C
Vapor pressure: negligible at 25°C
Density: 1.36 g/cm³ at 22°C
Melting point: 46 – 47 °C
Boiling point: 139 – 140 °C at 4.2 mmHg
Additional Notes

Exposure and Toxicity Information

Toxicity Limits: RfD: 7.5×10^{-3} mg/kg/day (IRIS); NOEL: 0.75 mg/kg/day (dog) , 10 mg/kg/day (rat) (IRIS)

Toxicological Effects: Carcinogenic classification – C (possible human carcinogen)

Exposure Limits:

Chemical Use: Herbicide

Exposure Routes: Dermal absorption, skin and/or eye contact, inhalation

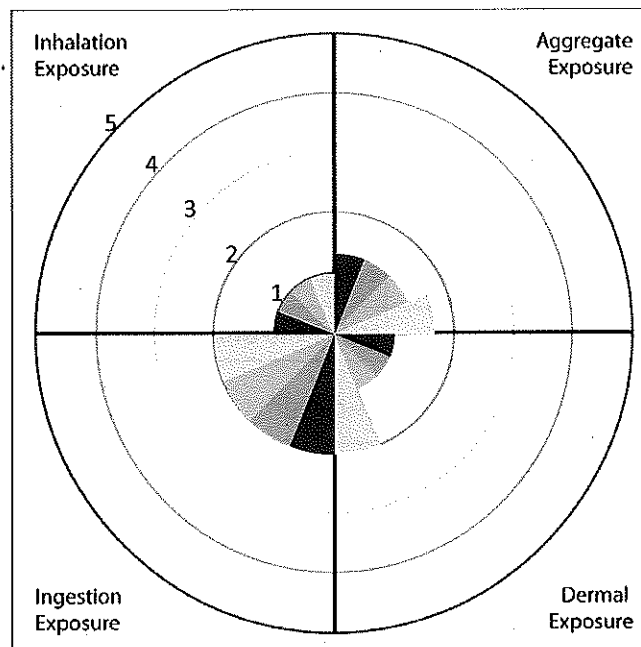**Target Organs:** Liver, skin, spleen

Environmental Concentrations						Environmental Releases		
	Low	Medium	High	Notes			Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (ng/m³)	0	0	1094.038	Data sources: Outdoor air (5%,50%,95%) – NATA county-level data; Ground water (mean, max, 1988 in 4 states in US) – HSDB; Food (detected only in animal feed) – FDA pesticide program; Soil (min, max, 1972 in 52 of 1533 soil samples from 37 states) - Natl. Soils Monitoring Program (HSDB); Indoor air - [28] (5, 50, 95%tiles)		Air	0.209 (TRI 2008)	0.47%
Ground water (ppb)		0.4	2.2					
Food	NA					Surface Water	-	
Indoor Air (ng/m³)	<LOD	<LOD	0.852			Ground Water	-	
Surface water						Soil	3.42 (TRI 2008)	0.06%
Tap water								
Soil (ppm)	0.01		1.29			Chemical Production and Use		
Dust						Production	9530 ton/year	
Surfaces								
Biota						Use	8.52 million lbs/year	Source: NAWQA
Human Biomarkers								
Urine								
Blood								
Other								

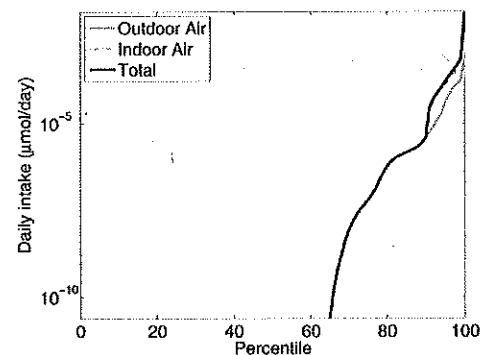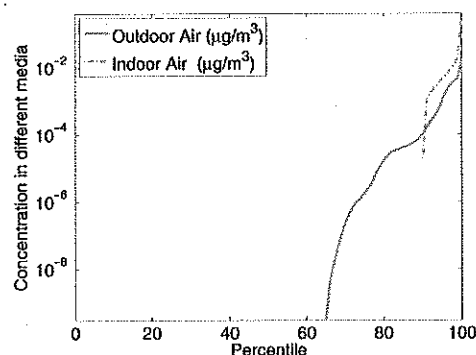| Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		•
	NIOSH		
	ICSC		•
	ToxProfs		
	IRIS		•
	HSDB		•
	ITER		•
	McKay		•
	Howard		
	RIVM rprts		
	IARC		•
	PSAP		
	NTP		•
	REACH		
	PFD		•
	MSDS		•
	DSSTox		•
	TMI		•
	SCP		•
	HPVIS		
	ToxCast	Ph I	•
		Ph II	
	ToxRefDB		•
	CEBS		
Production and Use	SIDS		
	EHPV		
	HPD		•
	IUR		
	ECD		
	SRD		•
Releases	TRI		•
	NEI		•
Environmental Quality	NGA		
	NAWQA		•
	AQS		☐
	CERCLIS		•
	NATA		•
Micro-environments and Biomarkers-Human and Ecological	TDS		
	SDWIS		
	NHANES	03-04	(s)
		05-06	(s)
		07-08	(s)
		09-10	(s)
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PK m (F) [49]
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for Trifluralin

Semi-Quantitative Exposure Ranking	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	2	2	2	2
Dermal	1	1	1	2
Aggregate	1.33	1.33	1.33	1.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).

"Tier 2" Exposure Ranking for Trifluralin

	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0	0	NA	0
90 %tile	0.000026	0	NA	2.73E-05
% over 0.1 µmol/day	0	0	NA	0
% over 1 µmol/day	0	0	NA	0

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
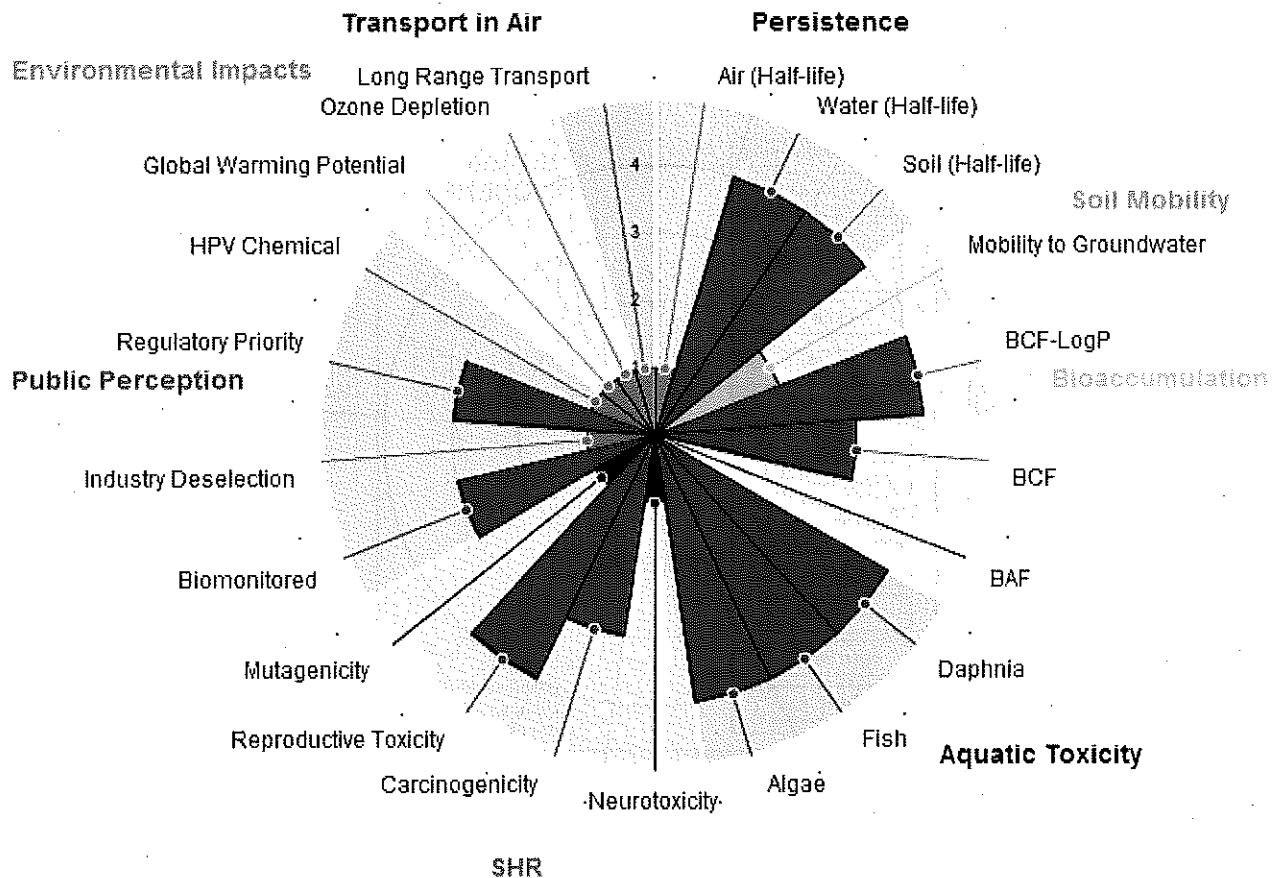
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

13b. METIS Results for Trifluralin

		CAS # 1582-09-8
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.4456 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 4% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is very persistent in water (Min. BOD = 2%, Max. BOD = 5%).
	Soil (Half-life)	Very High persistence in Soil (Estimated Half-life = 360 days)
Soil Mobility	Mobility to Groundwater	Moderate mobility to groundwater based on LogKoc = 3.986
Bioaccumulation	BCF-LogP	Very High bioconcentration potential based on an Experimental LogP=5.34
	BCF	High bioconcentration potential based on Experimental LogBCF = 3.62
	BAF	
Aquatic Toxicity	Daphnia	No toxicity estimate. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Fish	An estimated LC50(96-hr) = 1.475 mg/L indicates a Moderate toxicity to Fish [CLOGP]. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Algae	No toxicity estimate. However, this compound is classified as R50/53 (Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
SHR	Neurotoxicity	
	Carcinogenicity	CARCINOGENICITY - Hazard category 2 [EU_GHS]
	Reproductive Toxicity	Evidence in living organisms for Humans; Evidence of potential for Wildlife [EU_EDRP]; Suspected Endocrine Disruptor [JP_SED]; Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	1 out of 2 lists (NHANES)
	Industry Deselection	0 out of 6 lists
	Regulatory Priority	2 out of 10 lists (JDES_LST; JMON3)
	HPV Chemical	out of lists
	Global Warming Potential	A GWP= 0 indicates that this compound does not contribute to Global Warming
Environmental Impacts	Ozone Depletion	This compound does not contribute to Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 194.504 km - A_TRNSPRT)

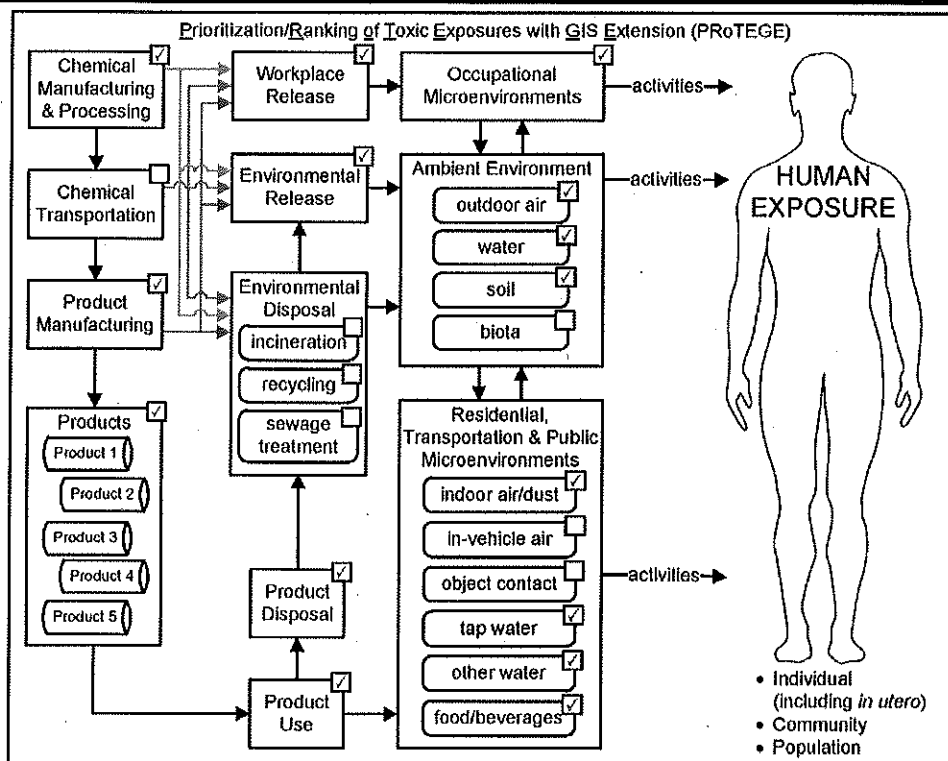## Graphical Summary of METIS Results for Trifluralin

Transport in Air   **Persistence**

Environmental Impacts   Long Range Transport   Air (Half-life)
                         Ozone Depletion   Water (Half-life)

Global Warming Potential   Soil (Half-life)
                                                                  Soil Mobility
HPV Chemical   Mobility to Groundwater

Regulatory Priority   BCF-LogP
Public Perception   Bioaccumulation

Industry Deselection   BCF

Biomonitored   BAF

Mutagenicity   Daphnia

Reproductive Toxicity   Fish   **Aquatic Toxicity**

Carcinogenicity   ·Neurotoxicity·   Algae

SHR

13c. NJrisk Preliminary Results for Trifluralin

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin.")

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HAZARD HIGH (3)			
HAZARD MODERATE (2)	**X**		
HAZARD LOW (1)			

14a. PRoTEGE Results for Tris (2-chloroethyl) phosphate

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)

Summary Physico-Chemical Information

Name	Tris (2-chlorethyl) phosphate
Other Names	Tolgard TCEP, Fyrol CEF
Chemical Formula	$C_6H_{12}Cl_3O_4P$
Chemical Class	PEFR
Identifier	CAS: 115-96-8; RTECS: KK2450000; EC: 015-102-00-0
Chemical Forms	

Physical Properties

Clear, transparent liquid
Molecular weight: 285.5
Soluble in water and most organic solvents
Solubility: 7000 mg/L
Vapor pressure: 6.125×10^{-2} mmHg at 25°C
Boiling point: 330°C
Melting point: -55°C
Density: 1.39 g/cm³ at 25°C

Additional Notes

Exposure and Toxicity Information

Toxicity Limits: LD50 rat oral – 1230 mg/kg (HSDB); LD50 rat inhalation > 5 mg/L for 4 hours (HSDB); LD50 rabbit dermal > 5000 mg/kg (HSDB);

Toxicological Effects: Carcinogenic in rats [50] and reproductive toxicant based on available animal data [51]

Exposure Limits: 7.5 mg/m³

Chemical Use: Plasticizer

Exposure Routes: Inhalation, ingestion, dermal contact

Target Organs: Skin, eyes

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air (µg/m³)	2		5	Data sources: Outdoor air (min, max)– samples from Kitakyusu, Japan (HSDB) [52]; Ground water – (min, mean, max) samples from Nieschen, Germany (HSDB) [53]; Food -TDS (5, 50, 95%tiles); Indoor air – [54,55] (5, 50, 95%tiles); Tap water - [56] (5, 50, 95%tiles); Soil (min, max) – samples from river and sea sediments near Kitakyushu City, Japan, 1980(HSDB) [57]; Dust (median) – Pilot study in Germany (HSDB) [58];	Air	NA	
Ground water (ppb)	0	71	96				
Food (ppb)	0.74	1	47.6		Surface Water	NA	
Indoor Air (µg/m³)	0.46	8.55	564		Ground Water	NA	
Surface water					Soil	NA	
Tap water (µg/L)	0.123	0.15	0.18				
Soil (ppm)	13		28		Chemical Production and Use		
Dust (µg/cm²)		0.1			Production	0.5 – 1 million lbs/year (2006)	Data source: US EPA
Surfaces							
Biota							
Human Biomarkers							
Urine	NA						
Blood	NA						
Other	NA						

Availability of Information in Databases and Reference Documents

|			
Physicochemical and/or Toxicological Properties	PAC		●
	NIOSH		
	ICSC		●
	ToxProfs		
	IRIS		
	HSDB		●
	ITER		●
	McKay		●
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		●
	REACH		●
	PFD		
	MSDS		●
	DSSTox		●
	TMI		
	SCP		●
	HPVIS		
	ToxCast	Ph I	
		Ph II	●
	ToxRefDB		
	CEBS		
Production and Use	SIDS		●
	EHPV		
	HPD		
	IUR		●
	ECD		●
	SRD		.
Releases	TRI		
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		
Micro-environments and Biomarkers- Human and Ecological	TDS		●
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit	PK m(R/r) [59]	
	BME		● [60]
	ERDEM		

"Tier 1" Exposure Ranking for Tris (2-chloroethyl) phosphate

Semi-Quantitative Exposure Ranking

	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	3	2	1	1
Ingestion	3	3	2	2
Dermal	1	1	1	2
Aggregate	2.33	2	1.33	1.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).
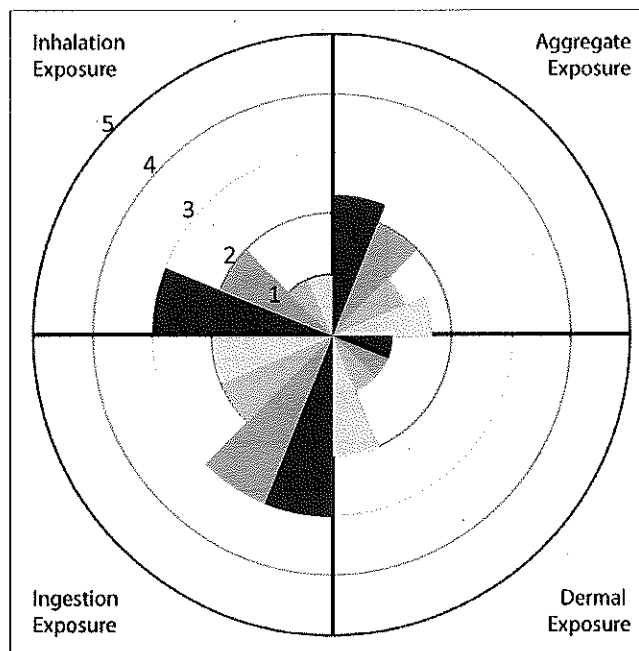
"Tier 2" Exposure Ranking for Tris (2-chloroethyl) phosphate
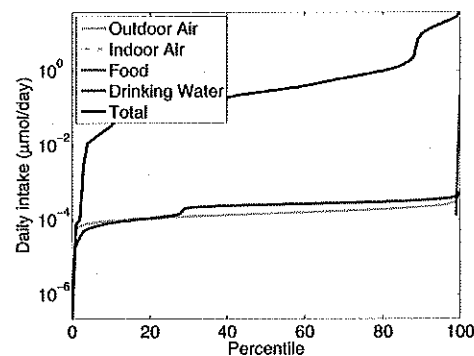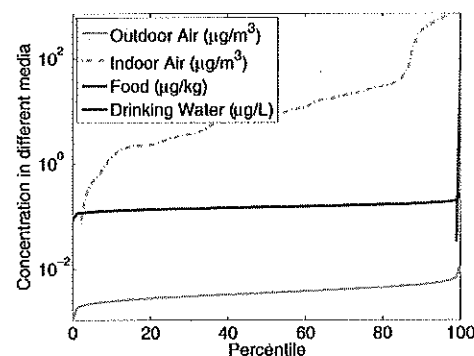
	Inhalation	Ingestion	Dermal	Aggregate
Median (μmol/day)	0.282	0.000253	NA	0.282
90 %tile	10.1	0.000336	NA	10.8
% over 0.1 μmol/day	73.5	0.563	NA	73.4
% over 1 μmol/day	20.3	0	NA	20.6

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
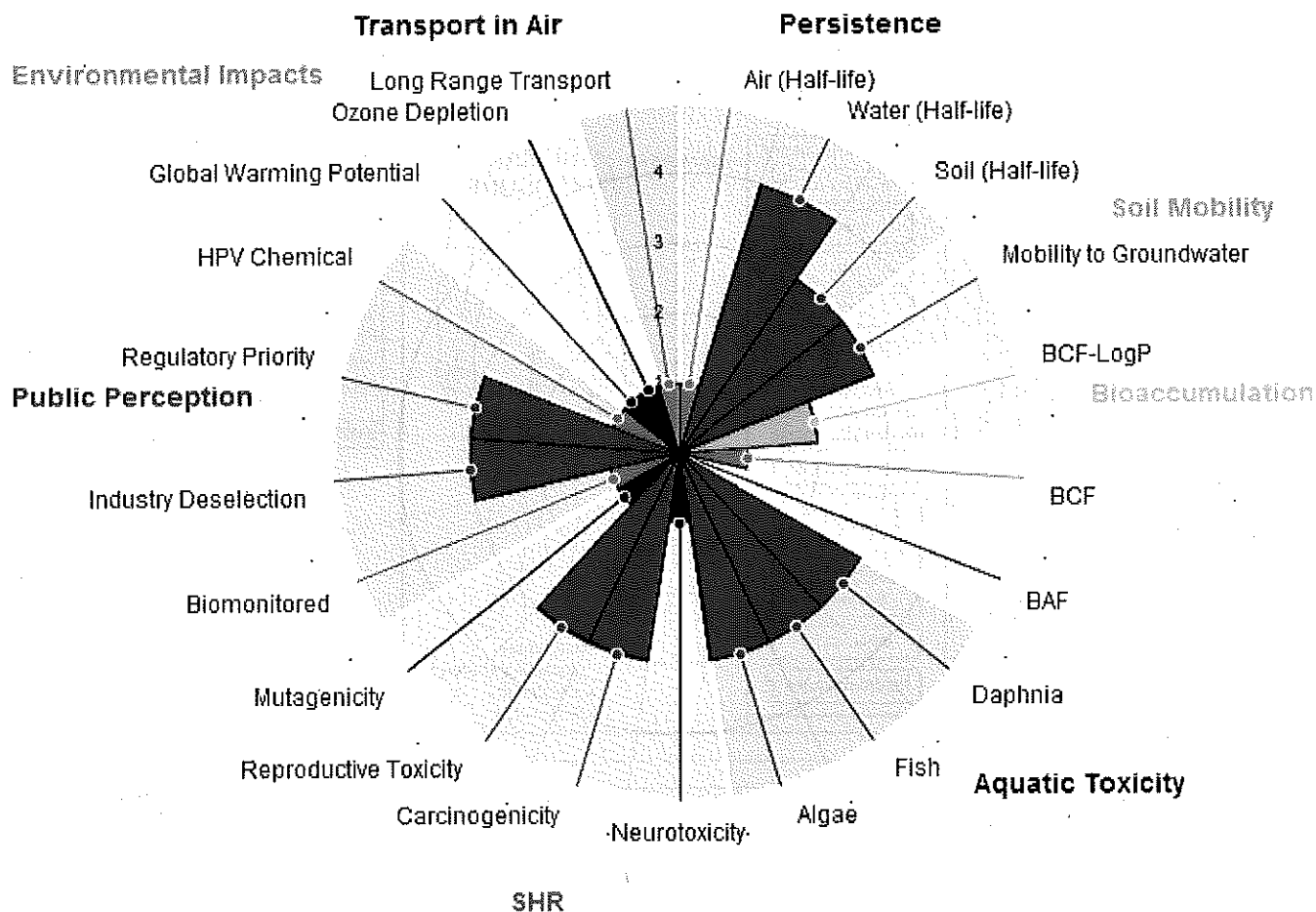
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

14b. METIS Results for Tris (2-chloroethyl) phosphate

		CAS # 115-96-8
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.4864 days)
	Water (Half-life)	A measured average Biochemical Oxygen Demand (BOD) = 4% using a Modified MITI Biodegradation Test (OECD 301C) would indicate that this chemical is very persistent in water (Min. BOD = 1%, Max. BOD = 5%).
	Soil (Half-life)	High persistence in Soil (Estimated Half-life = 120 days)
Soil Mobility	Mobility to Groundwater	High mobility to groundwater based on LogKoc = 2.478
Bioaccumulation	BCF-LogP	Moderate bioconcentration potential based on an Experimental LogP=1.44
	BCF	Low bioconcentration potential based on Experimental LogBCF = 0.4
	BAF	
Aquatic Toxicity	Daphnia	A measured EC50(48-hr) = 170 mg/L indicates a Low toxicity to Daphnia. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Fish	A measured LC50 (96-hr) >100 mg/L indicates a Low toxicity to Fish. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Algae	A measured EC50 (72-hr) = 450 mg/L indicates a Low toxicity to Algae. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
SHR	Neurotoxicity	
	Carcinogenicity	CARCINOGENICITY - Hazard category 2 [EU_GHS]
	Reproductive Toxicity	Toxic to reproduction - Category 1B/2A [EU_RA17_5]; TOXIC TO REPRODUCTION - Hazard category 1B [EU_GHS]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	3 out of 6 lists (GADSL; EUC2; SINLIST)
	Regulatory Priority	3 out of 10 lists (EU_CAND; EU_RA14; JDES_LST)
	HPV Chemical	out of lists
	Global Warming Potential	No data on Global Warming potential
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 87.5422 km - A_TRNSPRT)

## Graphical Summary of METIS Results for Tris (2-chloroethyl) phosphate

Transport in Air   Persistence

Environmental Impacts   Long Range Transport   Air (Half-life)
Ozone Depletion   Water (Half-life)

Global Warming Potential   Soil (Half-life)

Soil Mobility

HPV Chemical   Mobility to Groundwater

Regulatory Priority   BCF-LogP
Public Perception   Bioaccumulation

Industry Deselection   BCF

Biomonitored   BAF

Mutagenicity   Daphnia

Reproductive Toxicity   Fish   **Aquatic Toxicity**

Carcinogenicity   Neurotoxicity   Algae

SHR

14c. NJrisk Preliminary Results for Tris (2-chloroethyl) phosphate

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HAZARD HIGH (3)			
MODERATE (2)			
LOW (1)		X	

15a. PRoTEGE Results for Vinclozolin

Prioritization/Ranking of Toxic Exposures with GIS Extension (PRoTEGE)
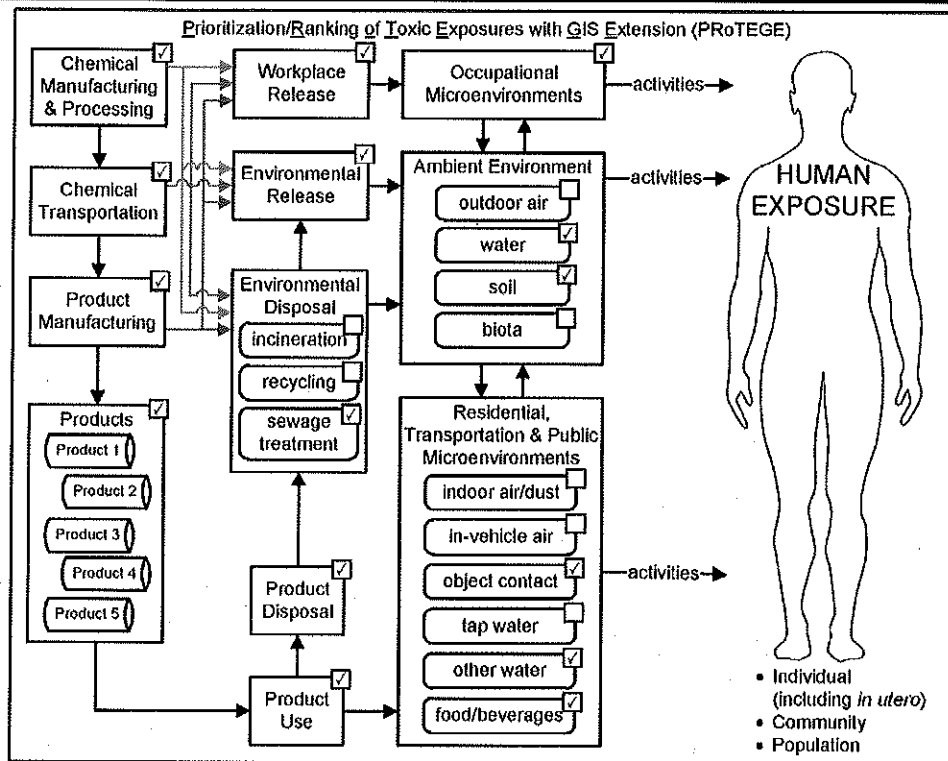
Summary Physico-Chemical Information	
Name	Vinclozolin
Other Names	Ronilan, Curalan, Vorlan, Touche
Chemical Formula	$C_{12}H_9Cl_2NO_3$
Chemical Class	Fung
Identifier	CAS: 50471-44-8
Chemical Forms	
Physical Properties	
Crystalline solid, with slight aromatic odor Molecular weight: 286.11 Melting point: 108°C Boiling point: 131°C at 0.05 mmHg Density: 1.51 g/cm³ Vapor pressure: 1.2e-7 mmHg at 20°C Solubility in water: 2.6 mg/L at 20°C	
Additional Notes	
Basic manufacturer: BASF Corporation	

Exposure and Toxicity Information

Toxicity Limits: LD50 dermal (rat) > 2.5 g/kg; LD50 oral (rat) 10 g/kg; LC50 inhalation (rat) > 29.1 g/m³ over 4 hr; NOEL: 100 ppm(2.5 mg/kg/day) (IRIS)

Toxicological Effects: Carcinogenic classification – C (Possible Human Carcinogen) (HSDB)

Exposure Limits:

Chemical Use: Fungicide

Exposure Routes: Inhalation of contaminated dust, dermal contact, ingestion of contaminated food

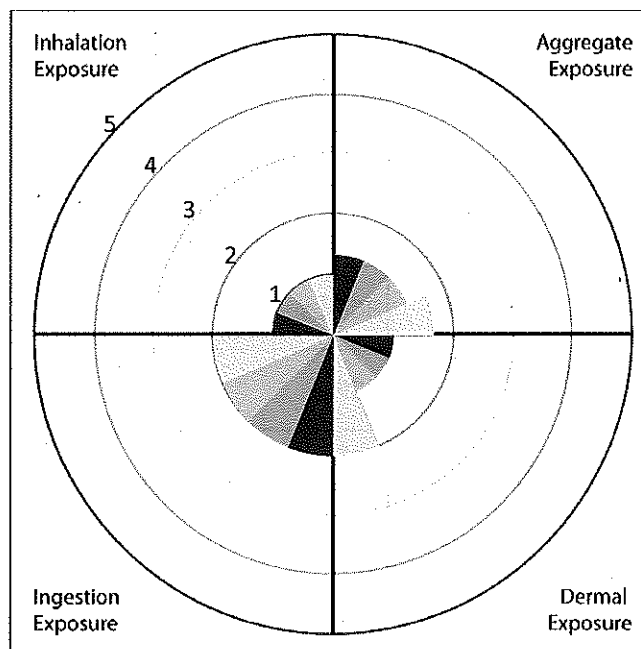**Target Organs:** Uterus, placenta

Environmental Concentrations					Environmental Releases		
	Low	Medium	High	Notes		Emissions Tons/yr	% Counties Reporting Emissions
Outdoor air				Data sources: Ground water (mean) - estimated environmental conc.(USEPA) [61]; Food (min, median, max) (TDS); Surface water (mean) - estimated environmental conc. (USEPA) [61]; Tap water - [56] (not detected in 15 samples)	Air		
Ground water (ppb)		0.57					
Food (μg/g)	0.6	2	204		Surface Water		
Indoor Air					Ground Water		
Surface water (μg/L)		9.4			Soil		
Tap water	<LOD		<LOD				
Soil					Chemical Production and Use		
Dust					Production		
Surfaces							
Biota					Use	51740 lbs/year	Source: NAWQA
Human Biomarkers							
Urine							
Blood							
Other							

Availability of Information in Databases and Reference Documents			
Physicochemical and/or Toxicological Properties	PAC		
	NIOSH		
	ICSC		
	ToxProfs		
	IRIS		•
	HSDB		•
	ITER		•
	McKay		•
	Howard		
	RIVM rprts		
	IARC		
	PSAP		
	NTP		
	REACH		
	PFD		•
	MSDS		•
	DSSTox		•
	TMI		•
	SCP		•
	HPVIS		
	ToxCast	Ph I	•
		Ph II	
	ToxRefDB		•
	CEBS		
	SIDS		
Production and Use	EHPV		
	HPD		•
	IUR		
	ECD		o
	SRD		
Releases	TRI		•
	NEI		
Environmental Quality	NGA		
	NAWQA		
	AQS		
	CERCLIS		
	NATA		•
Micro-environments and Biomarkers- Human and Ecological	TDS		•
	SDWIS		
	NHANES	03-04	
		05-06	
		07-08	
		09-10	
	NHEXAS		
PK/PBPK Model (or Data)	ScLit		PK d (R) [62]
	BME		
	ERDEM		

"Tier 1" Exposure Ranking for Vinclozolin

Semi-Quantitative Exposure Ranking

	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	1
Ingestion	2	2	2	2
Dermal	1	1	1	2
Aggregate	1.33	1.33	1.33	1.66

The semi-quantitative metrics of "Tier 1" reflect: (i) how widespread the exposures could be within the general US population (*pervasiveness*); (ii) the temporal frequency and/or duration of such exposures (*persistence*); (iii) the potential for high levels of such exposures (*severity*); (iv) the potential of the contact with the chemical to result in intake/uptake (*efficacy*).

"Tier 2" Exposure Ranking for Vinclozolin

	Inhalation	Ingestion	Dermal	Aggregate
Median (µmol/day)	0	0	NA	0
90 %tile	0	0	NA	0
% over 0.1 µmol/day	0	0.911	NA	1.82
% over 1 µmol/day	0	0.09	NA	0.176

"Tier 2" estimates are based on (a) different exposure factors sampled from national distributions for the general US population (inhalation rates, food intake rates, drinking water intake, time spent indoors, etc.); and (b) concentrations of the chemical in multiple media sampled from national measured distributions. (Contributions from Environmental Tobacco Smoke are not considered in "Tier 2" Exposure Characterization.)
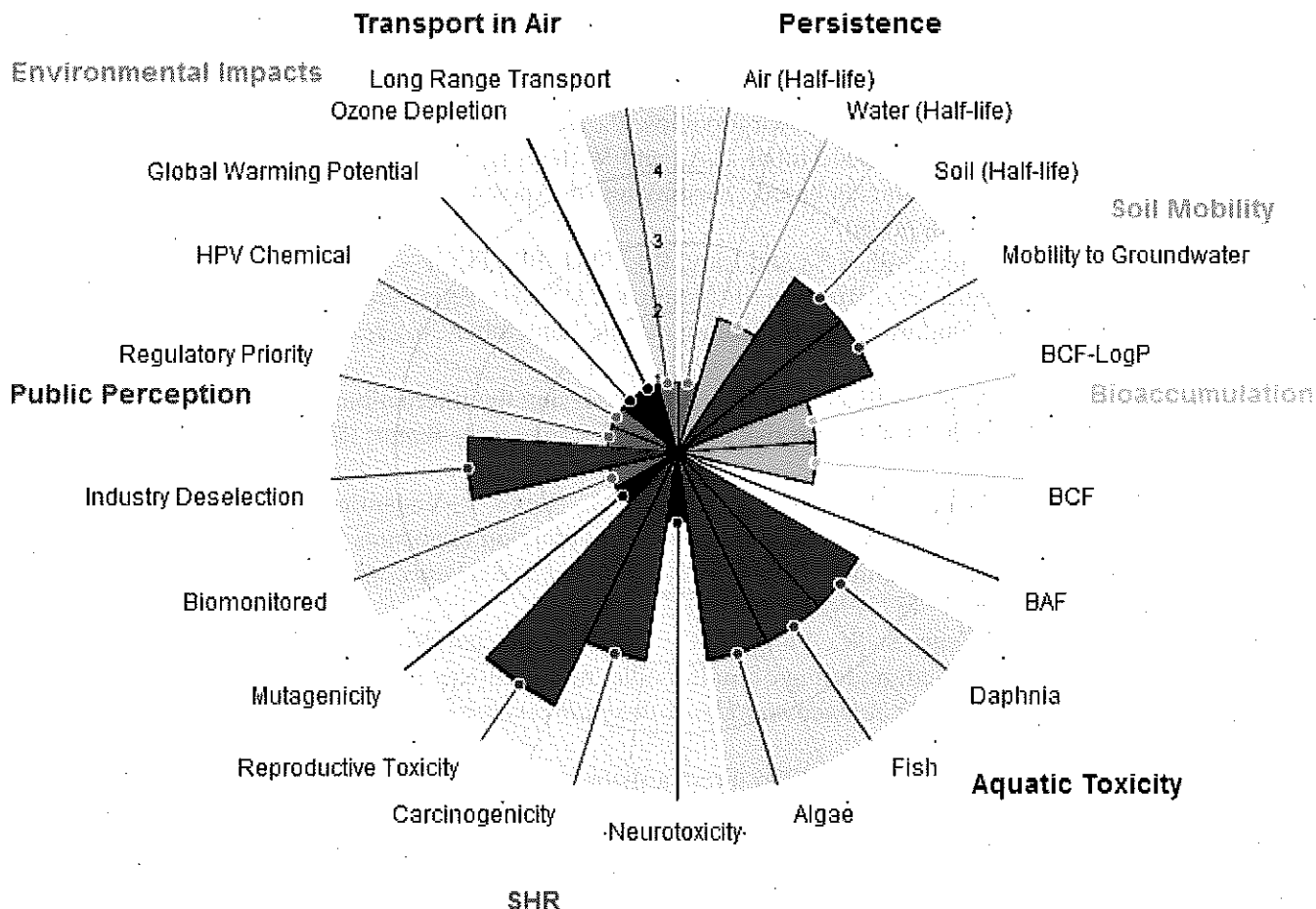
Resources for "Tier 3" Exposure Characterization

"Tier 3" exposure characterization should consider issues such as: exposures of susceptible subpopulations; occupational exposures; spatial and temporal heterogeneity of exposures, etc.

15b. METIS Results for Vinclozolin

		CAS # 50471-44-8
Persistence	Air (Half-life)	Low persistence in Air (Estimated Half-life = 0.3244 days)
	Water (Half-life)	Moderate persistence in Water (Estimated Half-life = 60 days)
	Soil (Half-life)	High persistence in Soil (Estimated Half-life = 120 days)
Soil Mobility	Mobility to Groundwater	High mobility to groundwater based on LogKoc = 2.453
Bioaccumulation	BCF-LogP	Moderate bioconcentration potential based on an Experimental LogP=3.1
	BCF	Moderate bioconcentration potential based on Estimated LogBCF = 1.712
	BAF	
Aquatic Toxicity	Daphnia	No toxicity estimate. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Fish	An estimated LC50(96-hr) = 25.689 mg/L indicates a Low toxicity to Fish. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
	Algae	No toxicity estimate. However, this compound is classified as R51/53 (Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.).
SHR	Neurotoxicity	
	Carcinogenicity	CARCINOGENICITY - Hazard category 2 [EU_GHS]
	Reproductive Toxicity	Evidence in living organisms for Humans; No evident scientific basis for Wildlife [EU_EDRP]; Suspected Endocrine Disruptor [JP_SED]; Toxic to reproduction - Category 1B/2A [EU_RA17_5]; Potential Endocrine Disruptor [TEDX_ED]
	Mutagenicity	
Public Perception	Biomonitored	0 out of 2 lists
	Industry Deselection	1 out of 6 lists (EUC2)
	Regulatory Priority	0 out of 10 lists
	HPV Chemical	out of lists
	Global Warming Potential	No data on Global Warming potential
Environmental Impacts	Ozone Depletion	No data on Ozone Depletion
	Long Range Transport	Low potential for Long Range Transport in Air (CTD = 64.1482 km - A_TRNSPRT)

Graphical Summary of METIS Results for Vinclozolin

Transport in Air — Persistence

Environmental Impacts — Long Range Transport — Air (Half-life)
Ozone Depletion — Water (Half-life)
Global Warming Potential — Soil (Half-life)
Soil Mobility
HPV Chemical — Mobility to Groundwater
Regulatory Priority — BCF-LogP
Public Perception — Bioaccumulation
Industry Deselection — BCF
Biomonitored — BAF
Mutagenicity — Daphnia
Reproductive Toxicity — Fish — **Aquatic Toxicity**
Carcinogenicity — Neurotoxicity — Algae
SHR

15c. NJrisk Preliminary Results for Vinclozolin

Disclaimer: These preliminary results are for software demonstration purposes only as they are using test versions of PRoTEGE and METIS. Actual rankings may differ when the final system has been implemented and tested.

(Currently METIS classifies and "flags" this compound as a "known human reproductive toxin.")

EXPOSURE

	LOW (1)	MODERATE (2)	HIGH (3)
HIGH (3)			
MODERATE (2)	X		
LOW (1)			

HAZARD

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