

Appendix A:

Final Workbook for Proposed CEC Framework

**NJ DEP SAB
CEC Workgroup
August 8, 2012**

CEC Sub-Committee

- John Dyksen - Chair
- Clinton Andrews
- John Gannon
- Jonathan Husch
- Robert Laumbach
- Peter Lederman
- Paul Lioy
- Mark Robson
- Nancy Rothman
- Judith Weis

NJ DEP Support to CEC Sub-Committee:

- Gary Buchanan
- Bob Mueller
- Gloria Post

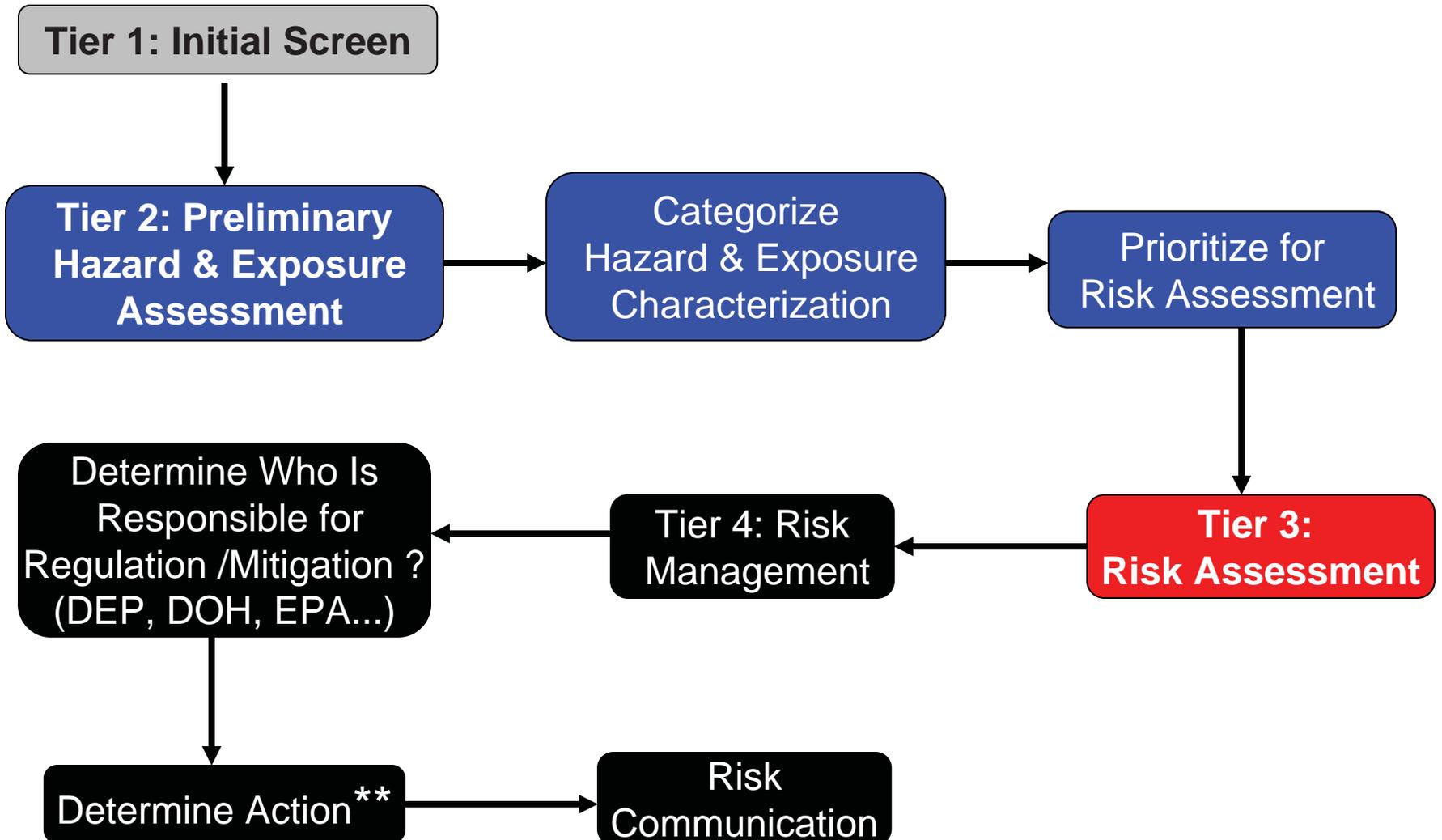
CEC Issue

- **What are the contaminants of emerging concern (surface water, ground water, air, biota, wastewater, & sediment) and what technical (e.g., monitoring, research) steps should DEP take to understand and manage them?**

Objective

- **Develop a NJ-specific CEC framework that assesses hazard and exposure potential of chemicals found in the NJ environment and/or biota and prioritizes chemicals for regulatory action based on risk assessment.**

CEC Evaluation Process Overview



** Management, policy development, interagency coordination....

Tier 1 - Initial Screen

Tier 1 - Initial Screen

Reason for Concern?

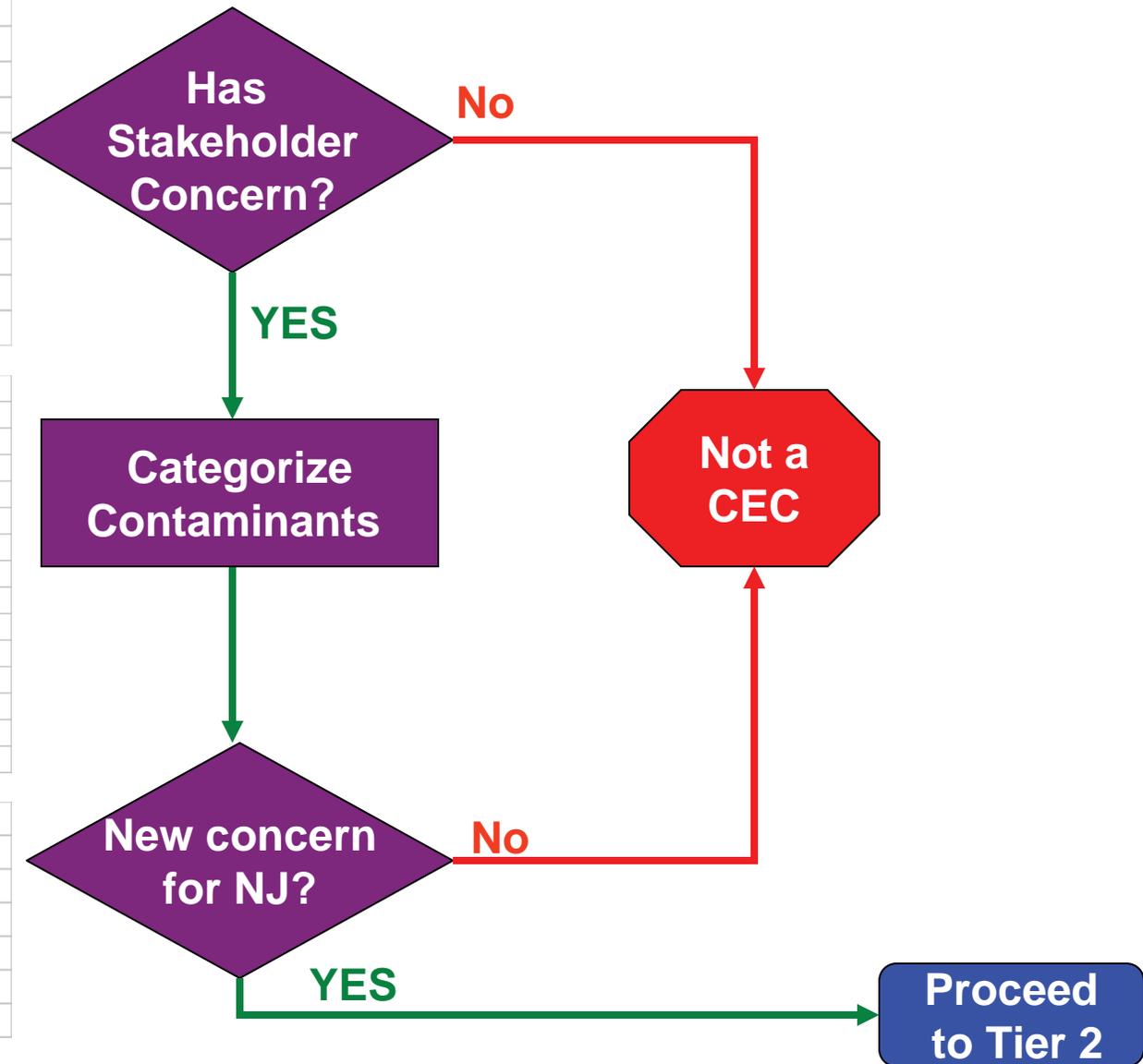
- a. Monitoring-Occurrence data from DEP or USGS
- b. Research – human/ecological impacts
- c. Federal regulators - EPA
- d. Media
- e. Citizens
- f. Legislature
- g. NGOs
- h. Growing usage of chemical
- i. Shrinkage of competing concerns
- j. Industry emerging in NJ
- k. New technology byproducts form CEC

Contaminant Category ?

- a. Pharmaceuticals
- b. Personal care products
- c. Nanoparticles
- d. Pesticides
- e. Steroids
- f. PAHs
- g. Radionuclides
- h. Synthetic organic compounds
- i. Inorganic compounds – metals
- j. Perfluorinated compounds
- k. Disinfection (oxidation) by-products
- l. Algal toxins
- m. Microbial contaminants
- o. Other - Define

New concern for NJ ?

- a. New chemical / ramped up production
- b. New type of use
- c. New effect identified
- d. New detection / increasing levels
- e. New source
- f. New exposure / exposure route



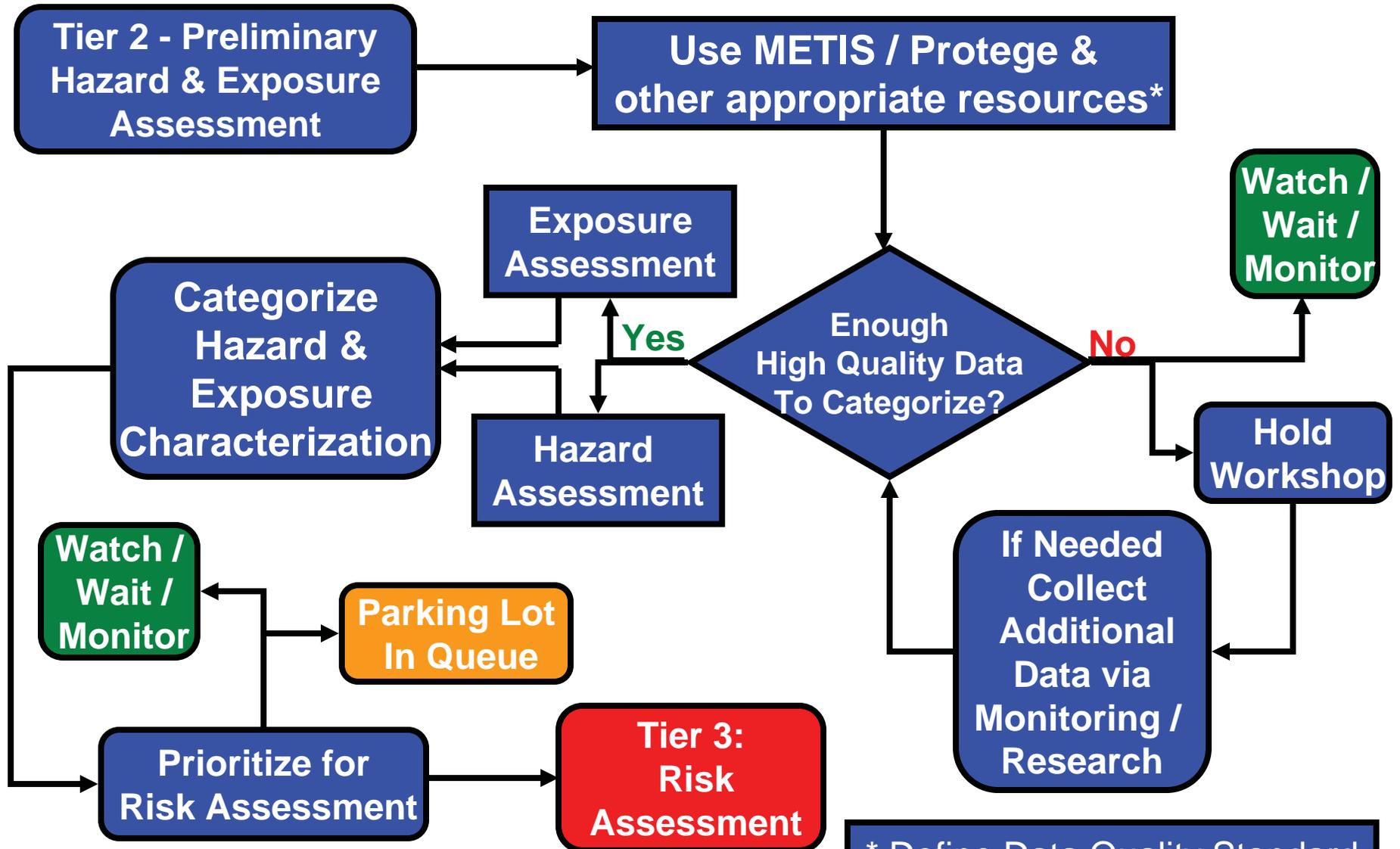
Tier 2 - Preliminary Hazard & Exposure Assessment

Key elements:

Hazard Assessment - METIS

Exposure Assessment - PRoTEGE

Tier 2 - Preliminary Hazard & Exposure Assessment



DuPont METIS: Chemical Screening Visualization Tool

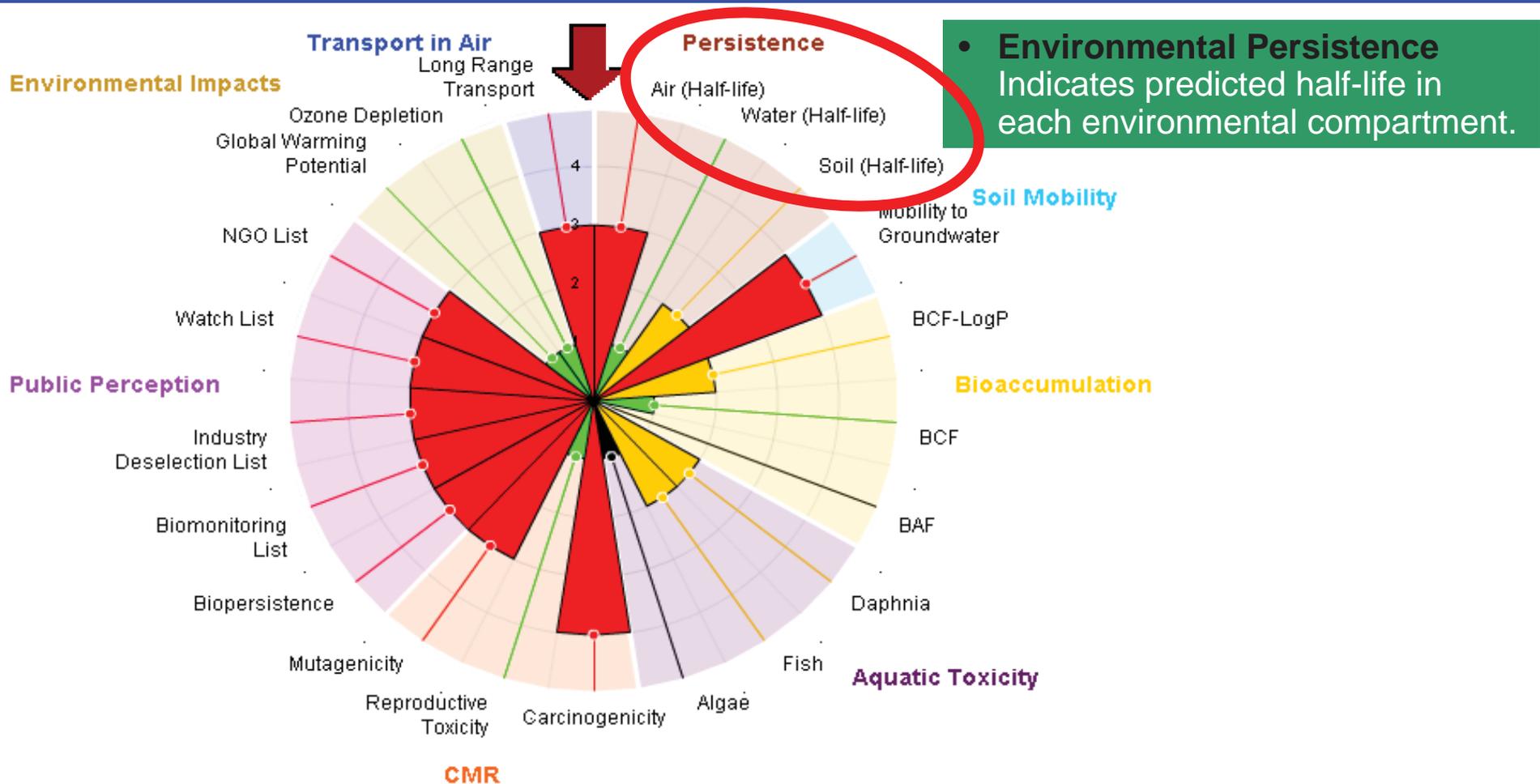
- **Metanomics Information System (METIS) is a chemical informatics platform that provides screening level view of potential**
 - Environmental fate & effects
 - Human health concerns
 - Societal perception issues
- **Built on open-source software that provides access to an aggregated database and estimation tool set**
 - 1400+ publicly available databases
 - Input: Chemical name, CAS #, or chemical structure.
- **Comprehensible view in seconds to minutes versus weeks to months by conventional searches.**

DuPont METIS

Potential for Concern

Indicated by Color: **Red: High / Very High; Orange: Moderate; Green: Low**
or

Indicated by Wedge Length: 1 = Low; 2 = Moderate; 3 = High; 4 = Very High

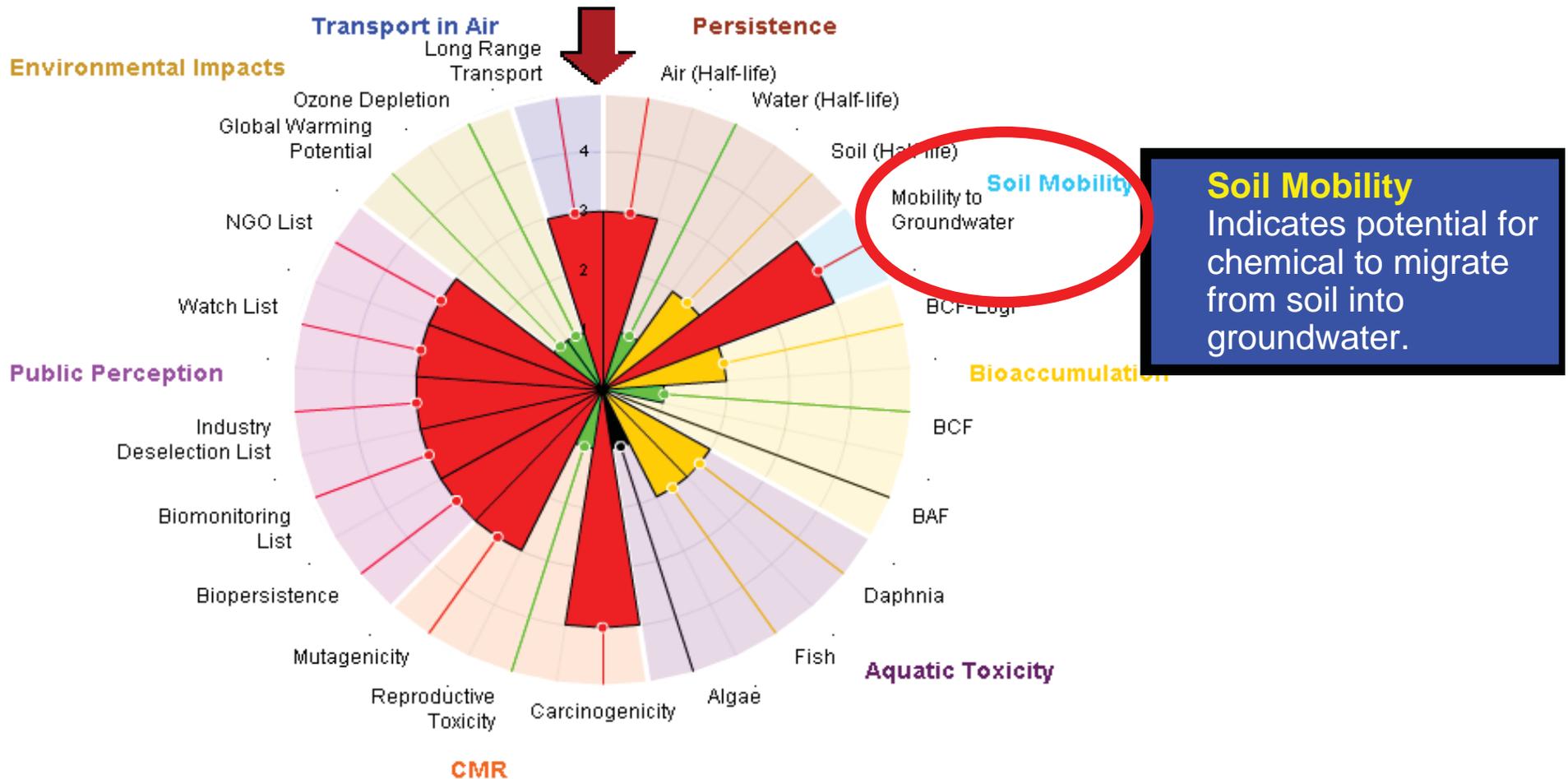


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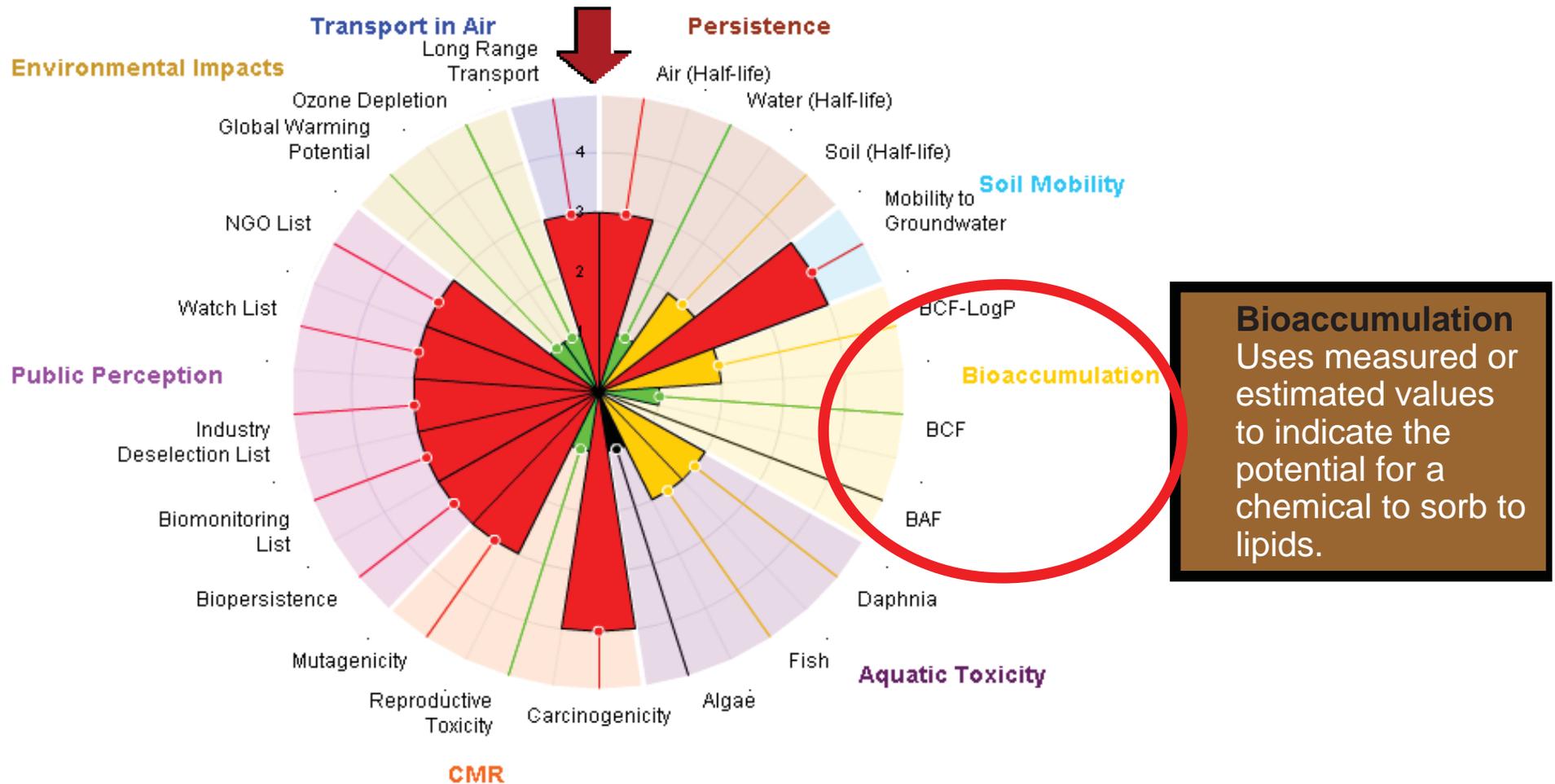


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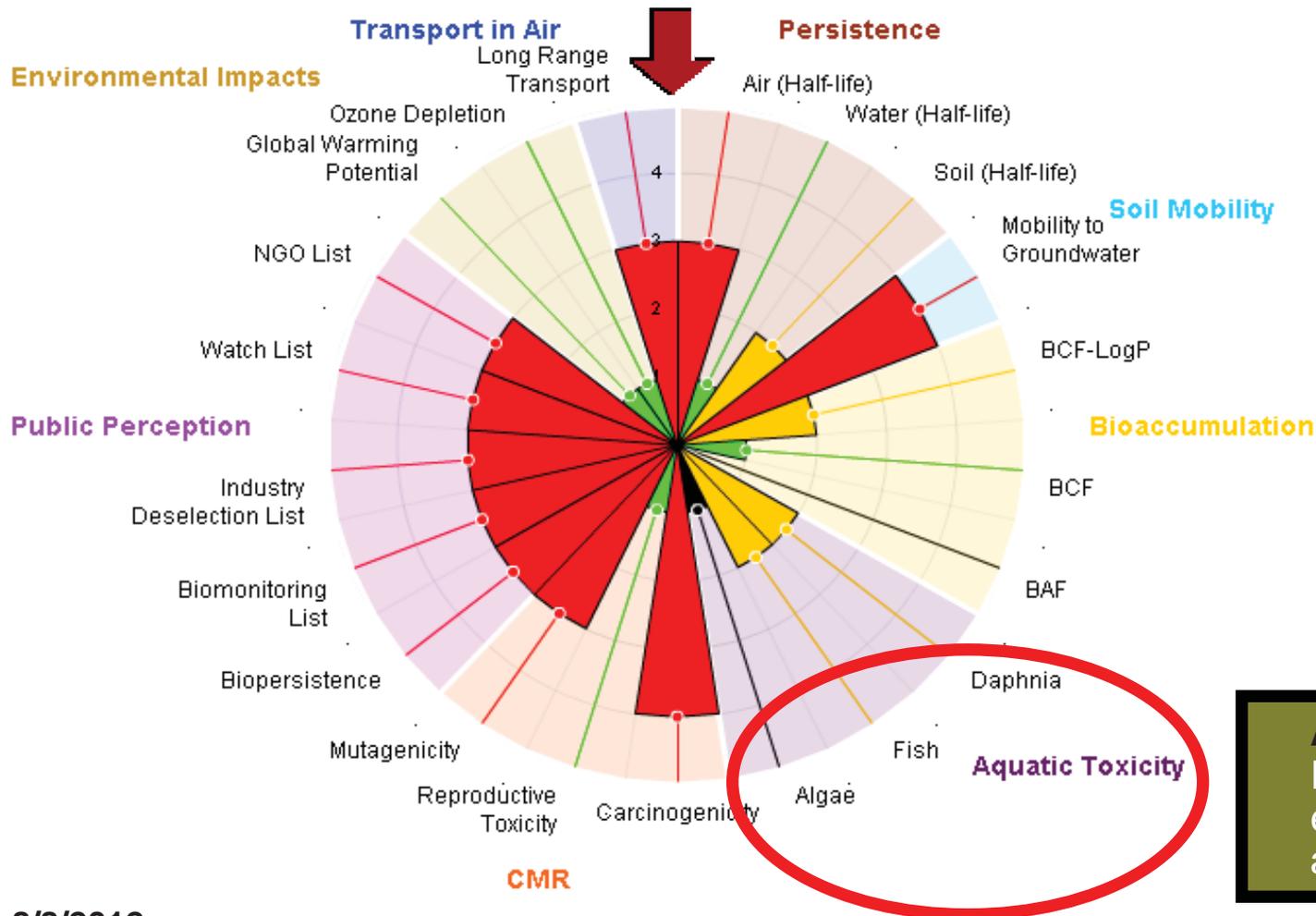
Bioaccumulation
Uses measured or estimated values to indicate the potential for a chemical to sorb to lipids.

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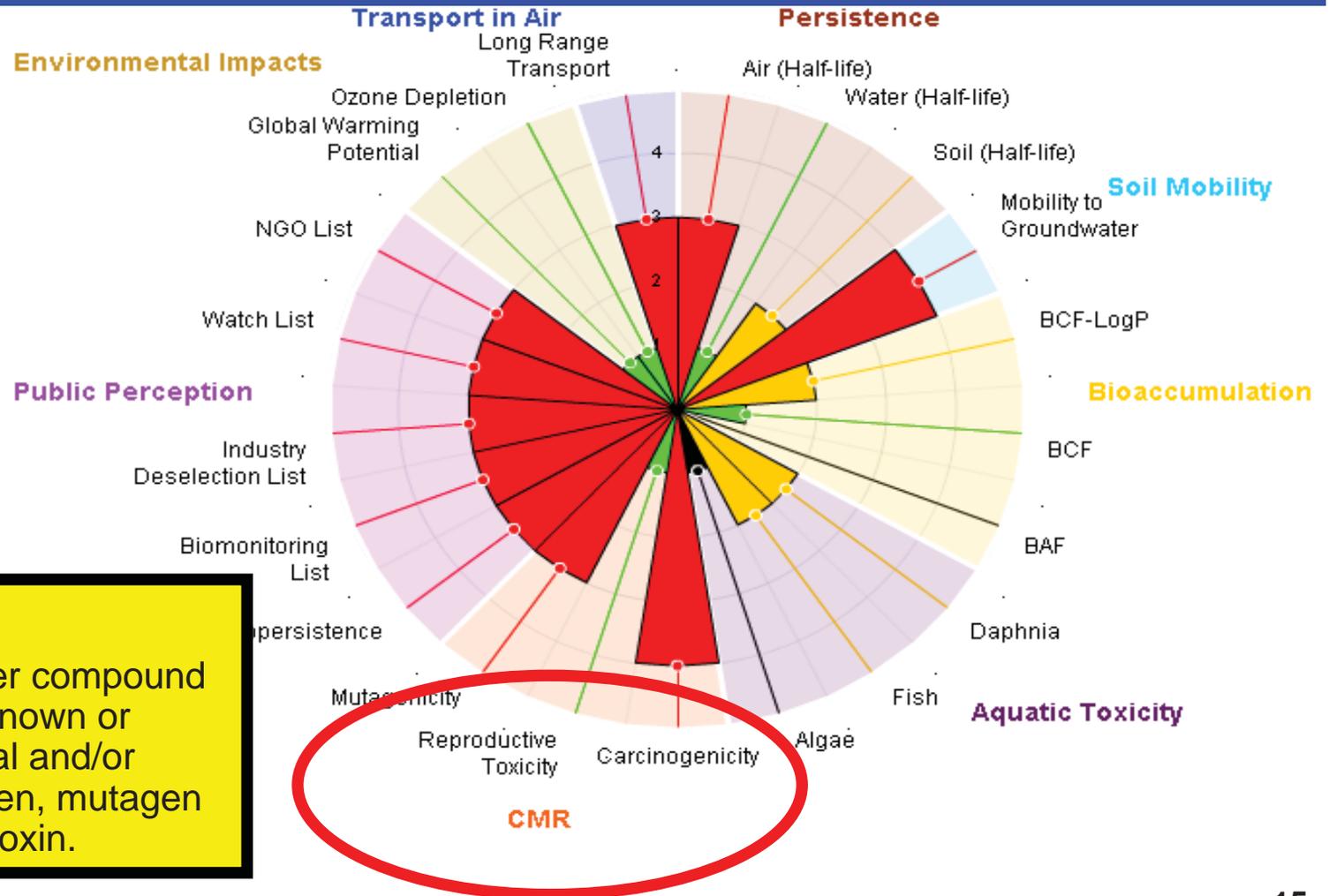
Aquatic Toxicity
Indicates measured or estimated toxicity to aquatic organisms.

DuPont METIS

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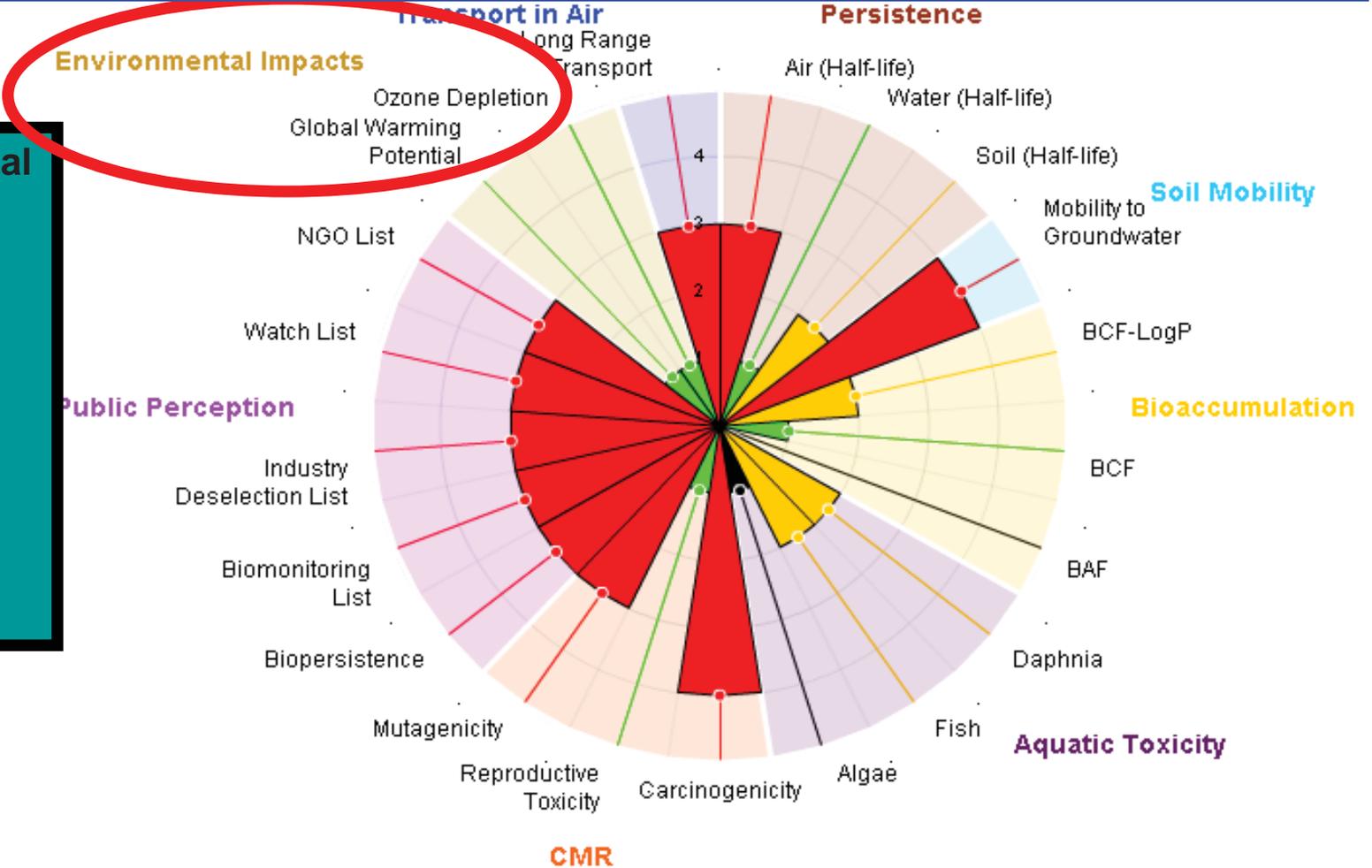


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Environmental Impact
Indicates potential for chemical to affect global warming and ozone depletion as compared to reference compounds.

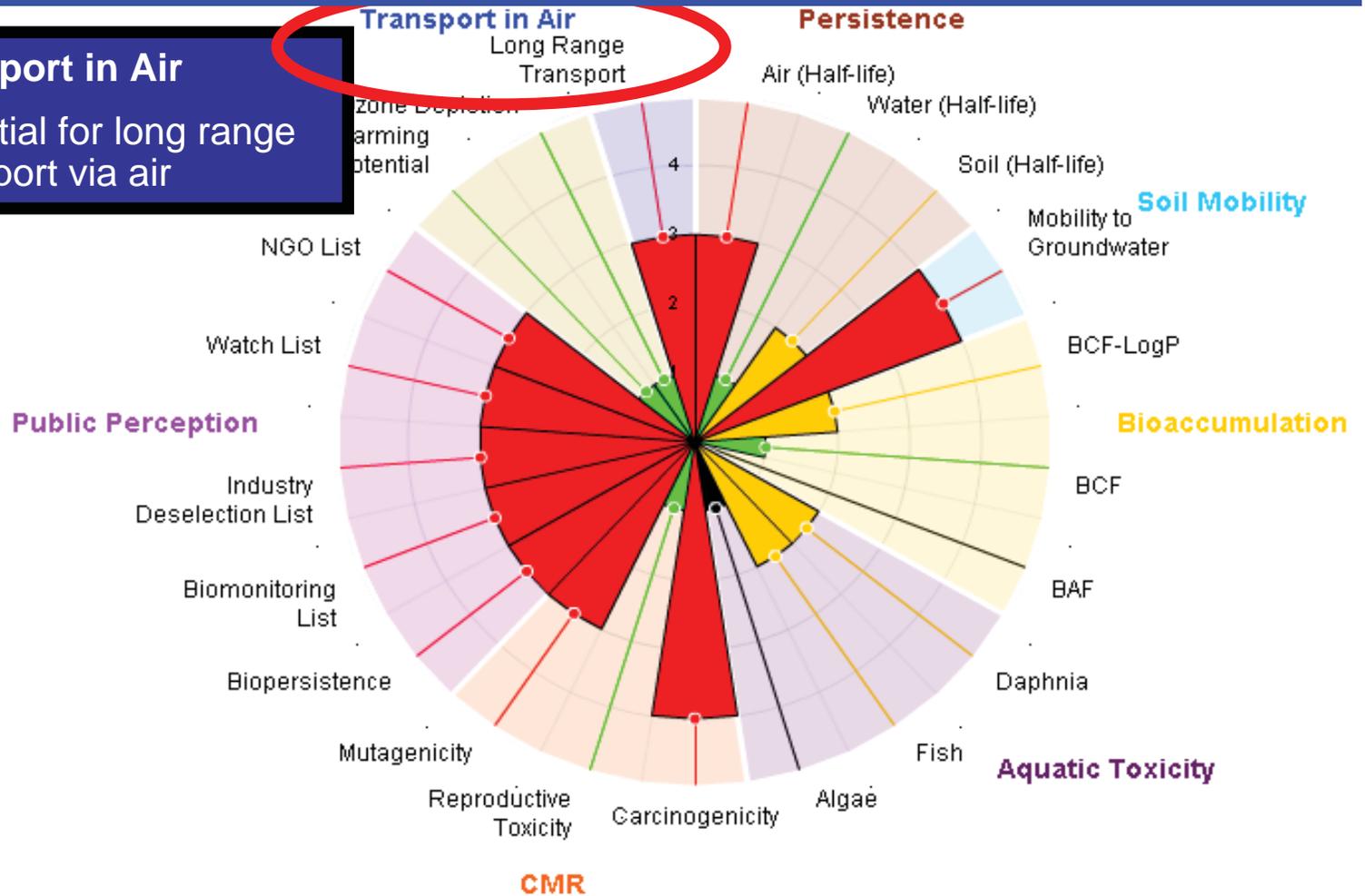
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Transport in Air
Indicates potential for long range transport via air



PRoTEGE

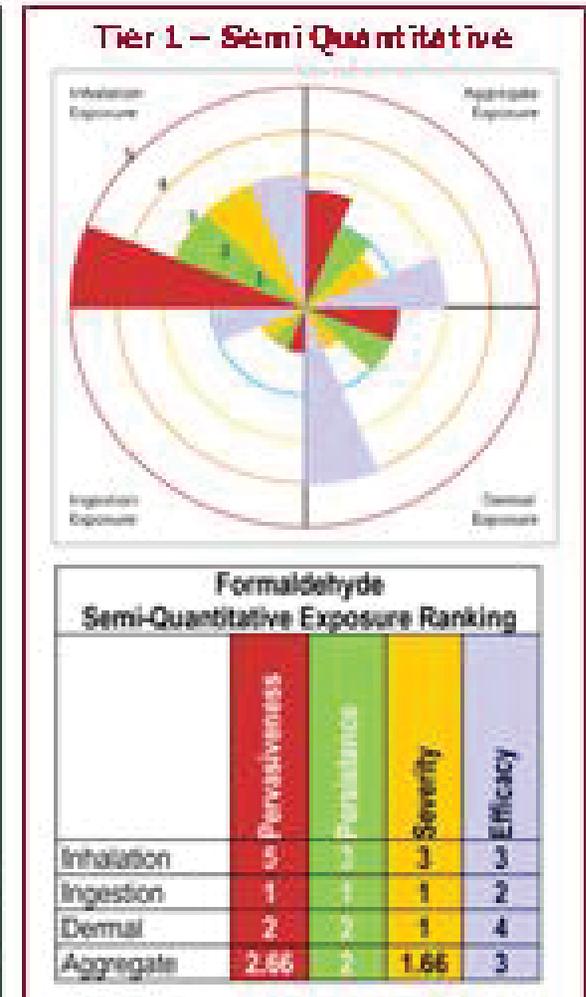
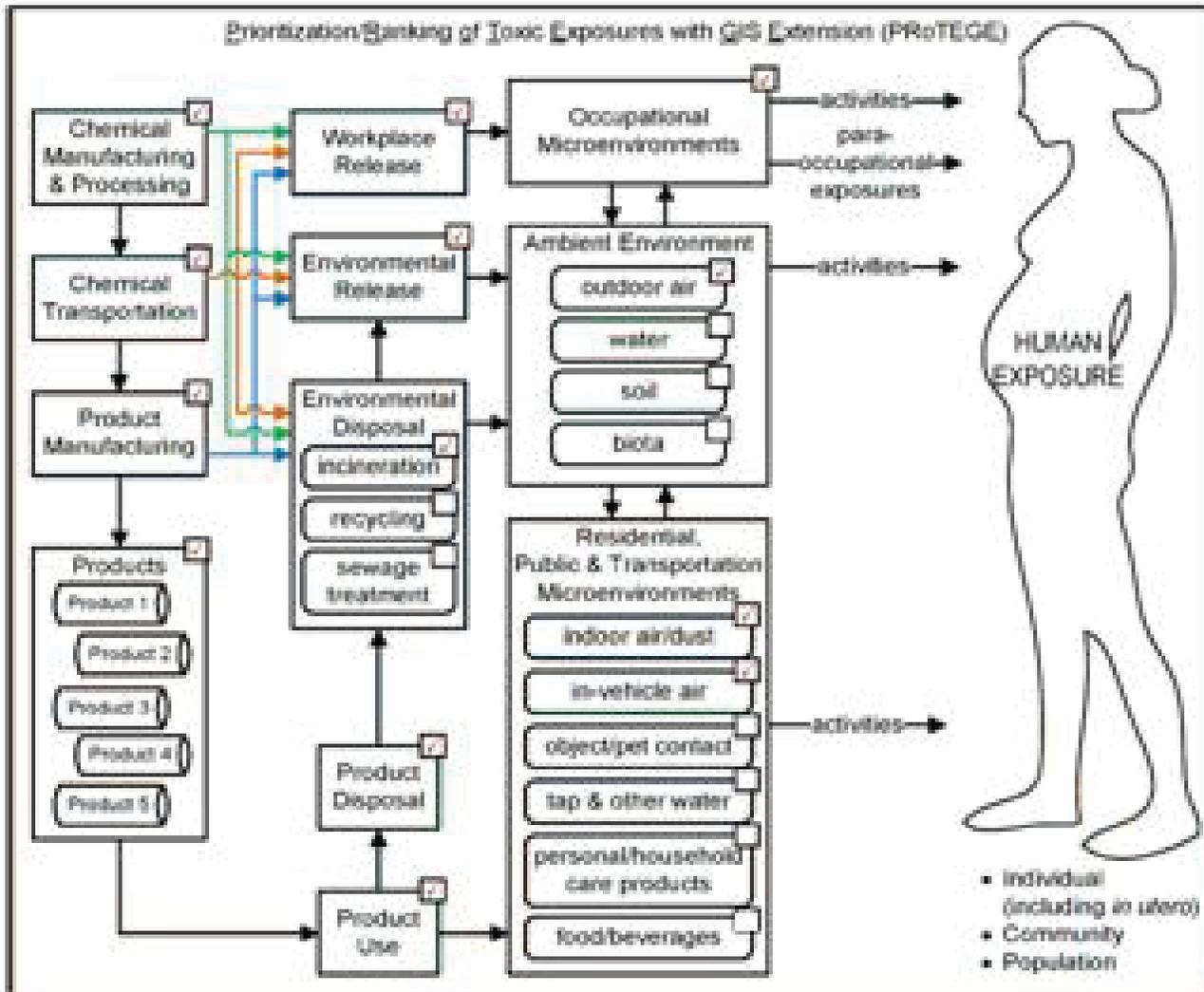
Exposure-Based

Prioritization of Chemicals

**Environmental and Occupational
Health Sciences Institute (EOHSI)**

PRoTEGE - a three-tier system that supports exposure-based prioritization of chemicals

PRoTEGE utilizes reduced components of the comprehensive HENRIK system to provide a simplified modeling platform employing extant data and modules for the "screening" assessment of human exposures associated with toxics in various (micro)environments and products

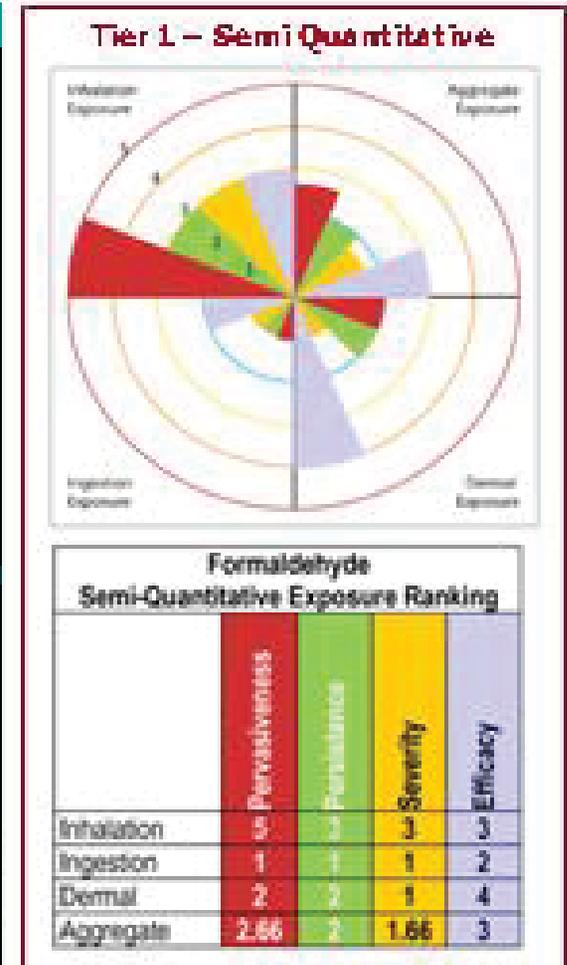


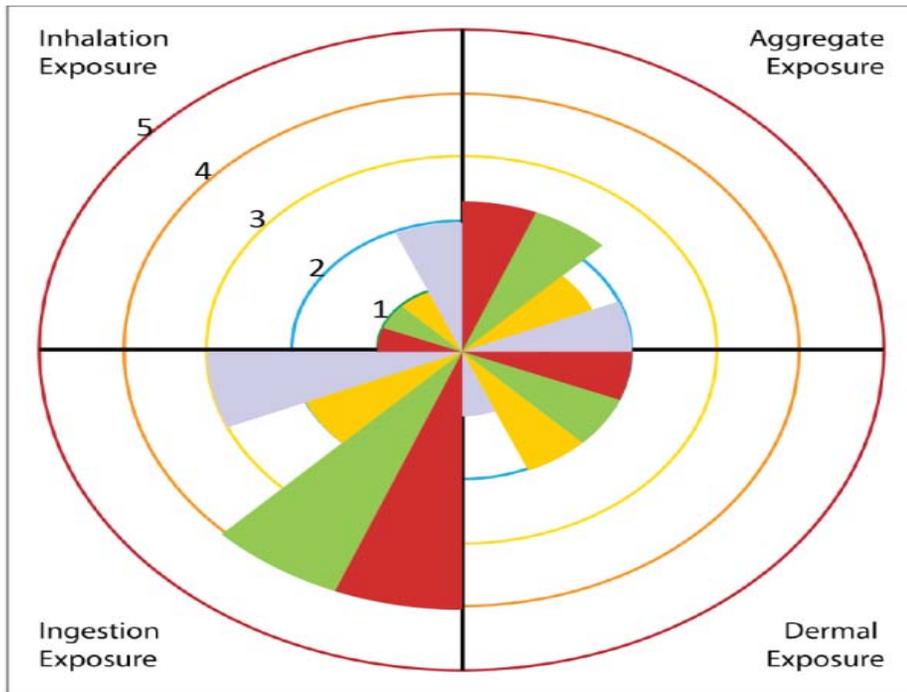
Tier 2 - Probabilistic distributions for the US population 5

Modeling Environment for Total Risk studies; development supported by USEPA, ATSDR, USDOE, NIDEP, ACC, and other government and private agencies.

PROTEGE - a three-tier system that supports exposure-based prioritization of chemicals

PROTEGE utilizes reduced components of the comprehensive HENRIK system to provide a simplified modeling platform employing extant data and modules for the "screening" assessment of human exposures associated with toxics in various (micro)environments and products





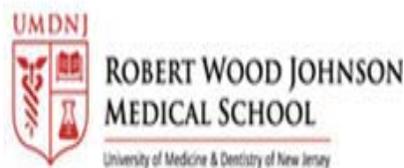
	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	2
Ingestion	4	4	2	3
Dermal	2	2	2	1
Aggregate	2.33	2.33	1.66	2

- “Tier 1” exposure metrics
 - Pervasiveness - how widespread the exposures are within the general US population
 - Persistence - the temporal frequency and/or duration of such exposures
 - Severity - the potential for high levels of such exposures
 - Efficacy - the potential of the contact with the chemical to result in intake/uptake

Tier 1 Exposure Levels:
 1 – Very Low; 2 - Low
 3 – Moderate; 4 – High;
 5 – Very High

Development of Exposure/Hazard Assessment Tool for NJ DEP: Proposal for Merger of METIS & Protege

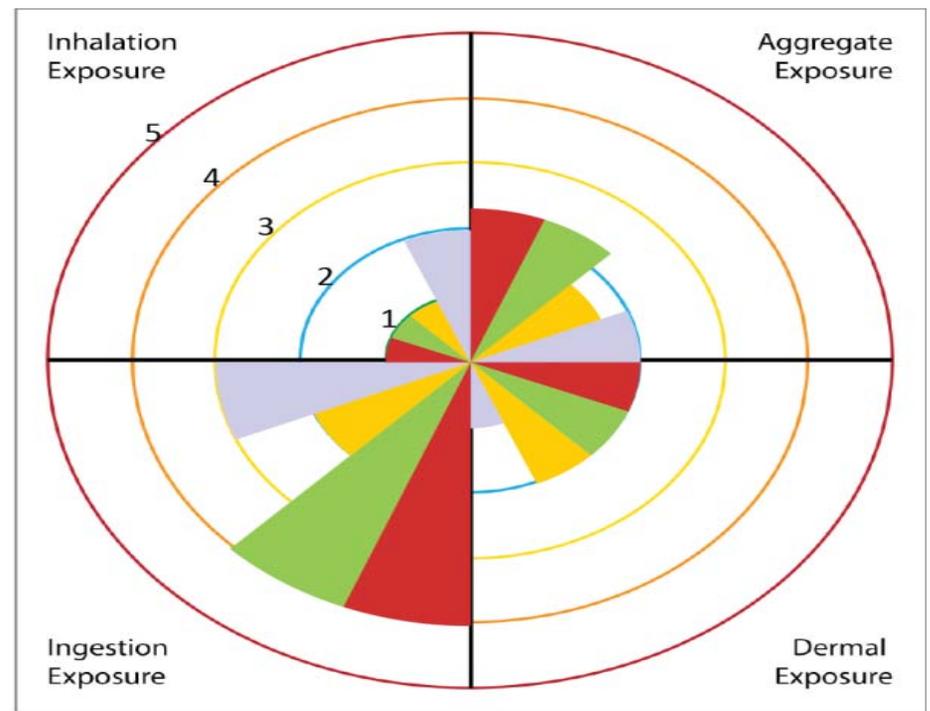
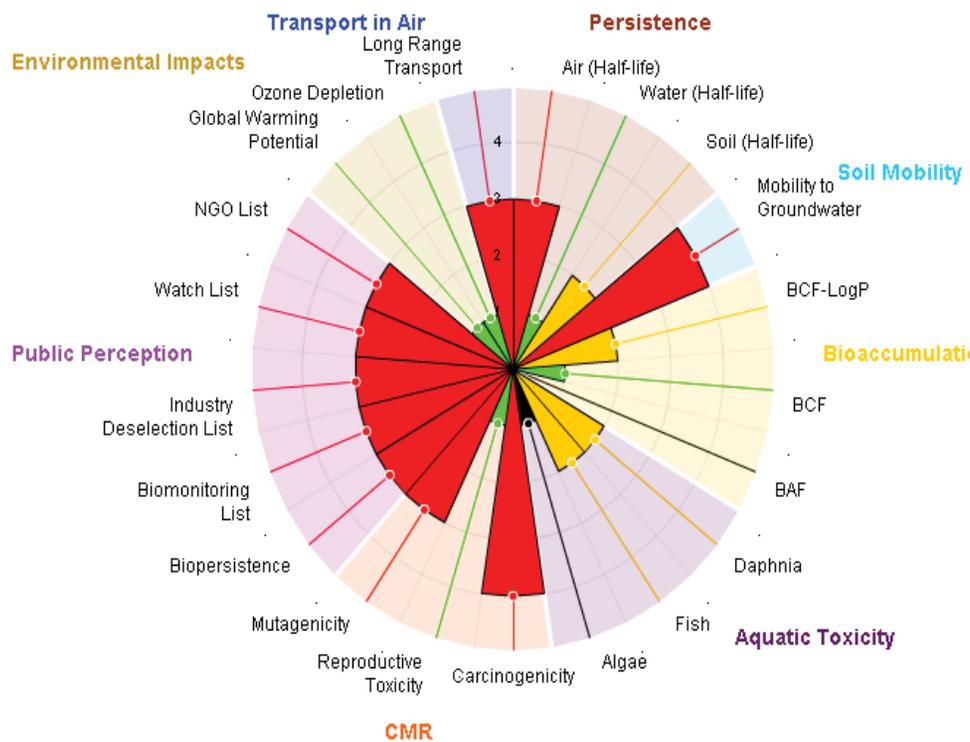
- The proposed system will be developed by systematically selecting, adapting, linking, testing, and eventually merging components from two available and currently evolving state-of-the-art platforms for hazard and for exposure characterization and ranking:
 - *METIS* (Metanomics Information System), developed by DuPont.
 - *PRoTEGE* (Prioritization and Ranking of Toxic Exposures with GIS extension), developed by the Computational Chemodynamics Laboratory of EOHSI.



Proposed METIS-Protege Tool

METIS

PRoTEGE



Tier 2 - Categorize Hazard & Exposure Characterization

Guidance for Initial Prioritization of Chemicals for Risk Assessment

Prioritization Score = Hazard category x Exposure category

Hazard or Exposure Categories:

3 - High

2 - Moderate

1 - Low

- **A "3" in any Hazard or Exposure Category defaults to a "3" value for the Initial Prioritization.**
 - Assures that any chemical with a high level endpoint of concern will be ranked for prioritization in the CEC framework.

Guidance for Hazard Characterization

- Evaluate evidence for mammalian or environmental toxicity:
 - Acute Systemic Toxicity
 - Carcinogen, Mutagen, Reproductive / Developmental Toxicity (including endocrine disruptors)
 - Neurobehavioral Toxicity
 - Repeated dose target organ toxicity
 - Chemical Respiratory Sensitizer
- Hazard criteria based on:
 1. EPA - TSCA Work Plan Chemicals: Methods Document (2/2012)
 2. EPA - Design for the Environment Program Alternatives Assessment Criteria for Hazard Evaluation (8/2011)

Categorization of Mammalian Hazard

3

- Strong weight of evidence for mammalian toxicity:
 - Acute Systemic Toxicity
 - Carcinogen, Mutagen, Reproductive / Developmental Toxicity (including endocrine disruptors)
 - Neurobehavioral Toxicity
 - Repeated dose target organ toxicity
 - Chemical Respiratory Sensitizer

2

-
- Uncertainty about or moderate weight of evidence or no data for mammalian toxicity:
 - Acute Systemic Toxicity
 - Carcinogen, Mutagen, Reproductive / Developmental Toxicity (including endocrine disruptors)
 - Neurobehavioral Toxicity
 - Repeated dose target organ toxicity
 - Chemical Respiratory Sensitizer

1

-
- Weak weight of evidence for mammalian toxicity

Table 1-A. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Acute Mammalian Toxicity				
Oral LD50 (mg/kg)	≤ 50 - 300	> 300 - 2,000	> 2,000	
Dermal LD50 (mg/kg)	≤ 200 - 1,000	> 1,000 - 2,000	> 2,000	
Inhalation LC50 (gas/vapor) (mg/L)	≤ 2 - 10	> 10 - 20	> 20	
Inhalation LC50 (mist/dust) (mg/L/day)	≤ 0.5 - 1.0	> 1.0 - 5	> 5	
Carcinogenicity	GHS 1A, 1B, GHS2	Limited Animal	Negative or SAR	
Mutagenicity/Genotoxicity	GHS 1A, 1B, GHS2	Positive <i>in vivo</i> or <i>in vitro</i>	Negative	
Reproductive Toxicity				
Oral (mg/kg/day)	< 50	50 - 250	> 250	
Dermal (mg/kg/day)	< 100	100 - 500	> 500	
Inhalation (gas/vapor) (mg/L/day)	< 1	1 - 2.5	> 2.5	
Inhalation (mist/dust) (mg/L/day)	< 0.1	0.1 - 0.5	> 0.5	

Table 1-B. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Developmental Toxicity				
Oral (mg/kg/day)	< 50	50 - 250	> 250	
Dermal (mg/kg/day)	< 100	100 - 500	> 500	
Inhalation (gas/vapor) (mg/L/day)	< 1	1 - 2.5	> 2.5	
Inhalation (mist/dust) (mg/L/day)	< 0.1	0.1 - 0.5	> 0.5	
Neurotoxicity				
Oral (mg/kg-bw/day)				
90-day (13 weeks)	< 10	10 - 100	> 100	
40-50 days	< 20	20 - 200	> 200	
28-days (4 weeks)	< 30	30 - 300	> 300	
Dermal (mg/kg-bw/day)				
90-day (13 weeks)	< 20	20 - 200	> 200	
40-50 days	< 40	40 - 400	> 400	
28-days (4 weeks)	< 60	60 - 600	> 600	

Table 1-C. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Repeated Dose (Chronic) Toxicity				
<i>Oral (mg/kg-bw/day)</i>				
90-day (13 weeks)	< 10	10 - 100	> 100	
40-50 days	< 20	20 - 200	> 200	
28-days (4 weeks)	< 30	30 - 300	> 300	
<i>Dermal (mg/kg-bw/day)</i>				
90-day (13 weeks)	< 20	20 - 200	> 200	
40-50 days	< 40	40 - 400	> 400	
28-days (4 weeks)	< 60	60 - 600	> 600	
<i>Inhalation (vapor/gas) (mg/L/6hrs/day)</i>				
90-day (13 weeks)	< 0.2	0.2 - 1.0	> 1.0	
40-50 days	< 0.4	0.4 - 2.0	> 2.0	
28-days (4 weeks)	< 0.6	0.6 - 3.0	> 3.0	
<i>Inhalation (dust/mist/fume) (mg/L/6hrs/day)</i>				
90-day (13 weeks)	<0.02	0.02 - 0.2	> 0.2	
40-50 days	< 0.04	0.04 - 0.4	> 0.4	
28-days (4 weeks)	< 0.06	0.06 - 0.6	> 0.6	

Table 1-D. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Respiratory Sensitization	GHS 1A and 1B Occurrence of respiratory sensitization; Evidence supporting potential for respiratory sensitization		No evidence supporting potential for respiratory sensitization	

Categorization of Environmental Hazard

- 3** • Strong weight of evidence for Environmental toxicity:
 - Acute or Chronic Aquatic Toxicity
 - » Fish toxicity
 - » Crustacea toxicity
 - » Algal toxicity

- 2** • Uncertainty about or moderate weight of evidence or no data for Environmental toxicity:
 - Acute or Chronic Aquatic Toxicity
 - » Fish toxicity
 - » Crustacea toxicity
 - » Algal toxicity

- 1** • Weak weight of evidence for Environmental toxicity

Table 2. Criteria for Determining Environmental Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Acute Aquatic Toxicity				
Fish 96 hr. LC ₅₀	< 1.0 - 10.0	> 10 - 100	> 100	
Crustacea sp. 48 hr. EC ₅₀	< 1.0 - 10.0	> 10 - 100	> 100	
Algal sp. 72 or 96 hr. EC ₅₀	< 1.0 - 10.0	> 10 - 100	> 100	
Chronic Aquatic Toxicity (NOEC or EC₅₀)				
Fish Early Life Stage	< 0.1 - 1	> 1 - 10	> 10	
Daphnia Reproduction	< 0.1 - 1	> 1 - 10	> 10	
Algal Growth Inhibition	< 0.1 - 1	> 1 - 10	> 10	

Supplemental Evaluation of Environmental Hazard

- Consider any available data for sublethal - growth, reproduction, development, etc. responses or "real" ecological responses at the population or community level.

Evaluation of Endocrine Activity

- Evaluate endocrine activity rather than characterize hazard 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 that will be 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.
 - Additional information gleaned from studies that are indicative of a chemical’s endocrine system interactions, such as changes in hormone profiles or reproductive organ weights.

Categorization of Endocrine Activity

- Available data for each chemical will be evaluated for evidence of the presence of endocrine activity.
-

3 – If data show evidence of endocrine activity then the chemical will be designated as potentially endocrine active, while noting caveats and limitations.

2 – If there are no data available to evaluate this endpoint, endocrine activity is unknown, untested and would be marked with a “ND” indicating the absence of information. (No Data)

1 – 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.

Input for Exposure Characterization

- **For Each Chemical**
 - **Emissions and products**
 - **Exposure pathways**
 - **Vulnerable populations**
 - **Exposure routes**
 - **Frequency of contact**
 - **Fate in the environment**
 - **Eco-exposures**

Categorization of Exposure Characterization

3

- Presence in NJ environmental media / biota at significant concentrations or as significant biomarker measurements, and relative ranking of exposure based upon distributional estimates for 3 the main routes of exposure (inhalation, dermal and ingestion) (ug/kg/day)
 - Presence in food, children's toys, cosmetics/ personal care products, consumer product and relative ranking of exposure based upon distributional estimates for 3 the main routes of exposure (inhalation, dermal and ingestion)
-

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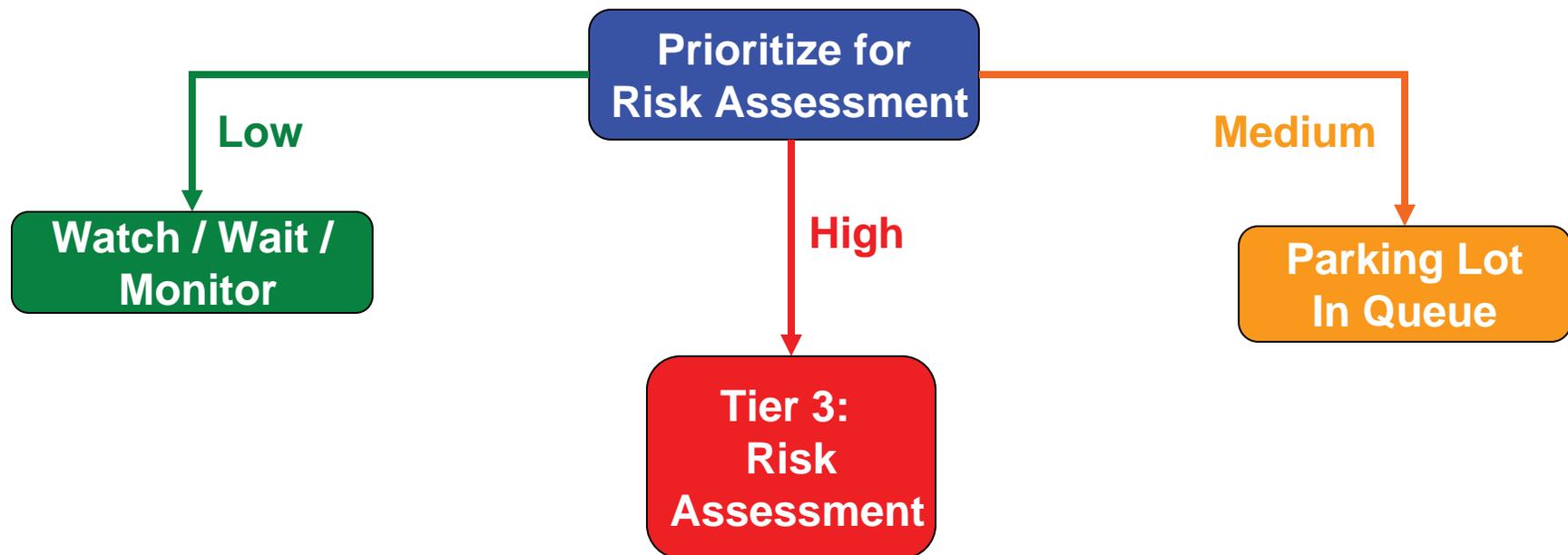
- Presence in NJ environmental media / biota at concentrations less than which may be steadily increasing due uses or emission sources
 - Uses/applications with estimated moderate exposure potential
-

1

- Detectable concentrations of new pollutants found in NJ environmental media / biota
- Manufacturing intermediate detected in NJ environmental media/ biota
- Uses/applications with estimated low exposure potential for NJ residents/biota

Tier 2 - Prioritize for Risk Assessment

Prioritizing for Risk Assessment



Initial Prioritization Grid for Risk Assessment

		Potential Exposure		
		Low 1	Moderate 2	High 3
Potential Hazard	High 3	3x1 = 3	3x2 = 6	3x3 = 9
	Moderate 2	2x1 = 2	2x2 = 4	2x3 = 6
	Low 1	1x1 = 1	1x2 = 2	1x3 = 3

* Red Boxes = Score of 9, then Score of 6 considered for Tier 3 Risk Assessment

Initial Prioritization Grid for Risk Assessment

"High Priority (red boxes)"

Potential Hazard

Potential Exposure

Low Moderate High

1 2 3

High 3

Moderate - 2

Low - 1

3x1 = 3	3x2 = 6	3x3 = 9
2x1 = 2	2x2 = 4	2x3 = 6
1x1 = 1	1x2 = 2	1x3 = 3

* RED - SEND TO TIER 3 RISK ASSESSMENT

Initial Prioritization Grid for Risk Assessment

"Medium Priority (orange boxes)"

Potential Hazard

Potential Exposure

Low Moderate High

1 2 3

High 3

Moderate - 2

Low - 1

High 3	3x1 = 3	3x2 = 6	3x3 = 9
Moderate - 2	2x1 = 2	2x2 = 4	2x3 = 6
Low - 1	1x1 = 1	1x2 = 2	1x3 = 3

* ORANGE - PARKING LOT, IN QUEUE

Initial Prioritization Grid for Risk Assessment

"Low Priority" (green boxes)

Potential Hazard

Potential Exposure

Low
1

Moderate
2

High
3

High 3

$3 \times 1 = 3$

$3 \times 2 = 6$

$3 \times 3 = 9$

Moderate - 2

$2 \times 1 = 2$

$2 \times 2 = 4$

$2 \times 3 = 6$

Low - 1

$1 \times 1 = 1$

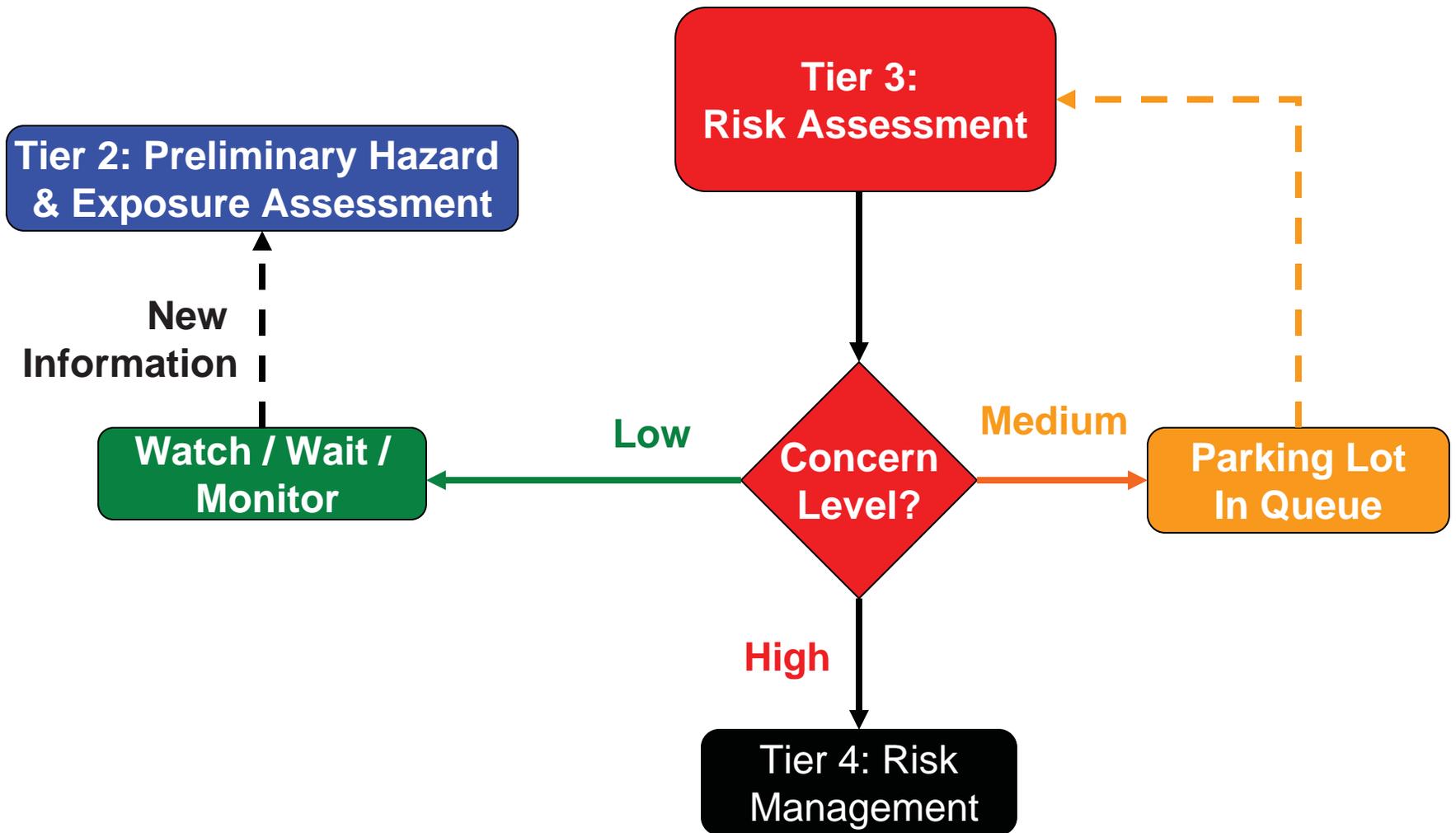
$1 \times 2 = 2$

$1 \times 3 = 3$

GREEN - WATCH, WAIT, MONITOR

Tier 3 - Risk Assessment

Tier 3 - Risk Assessment

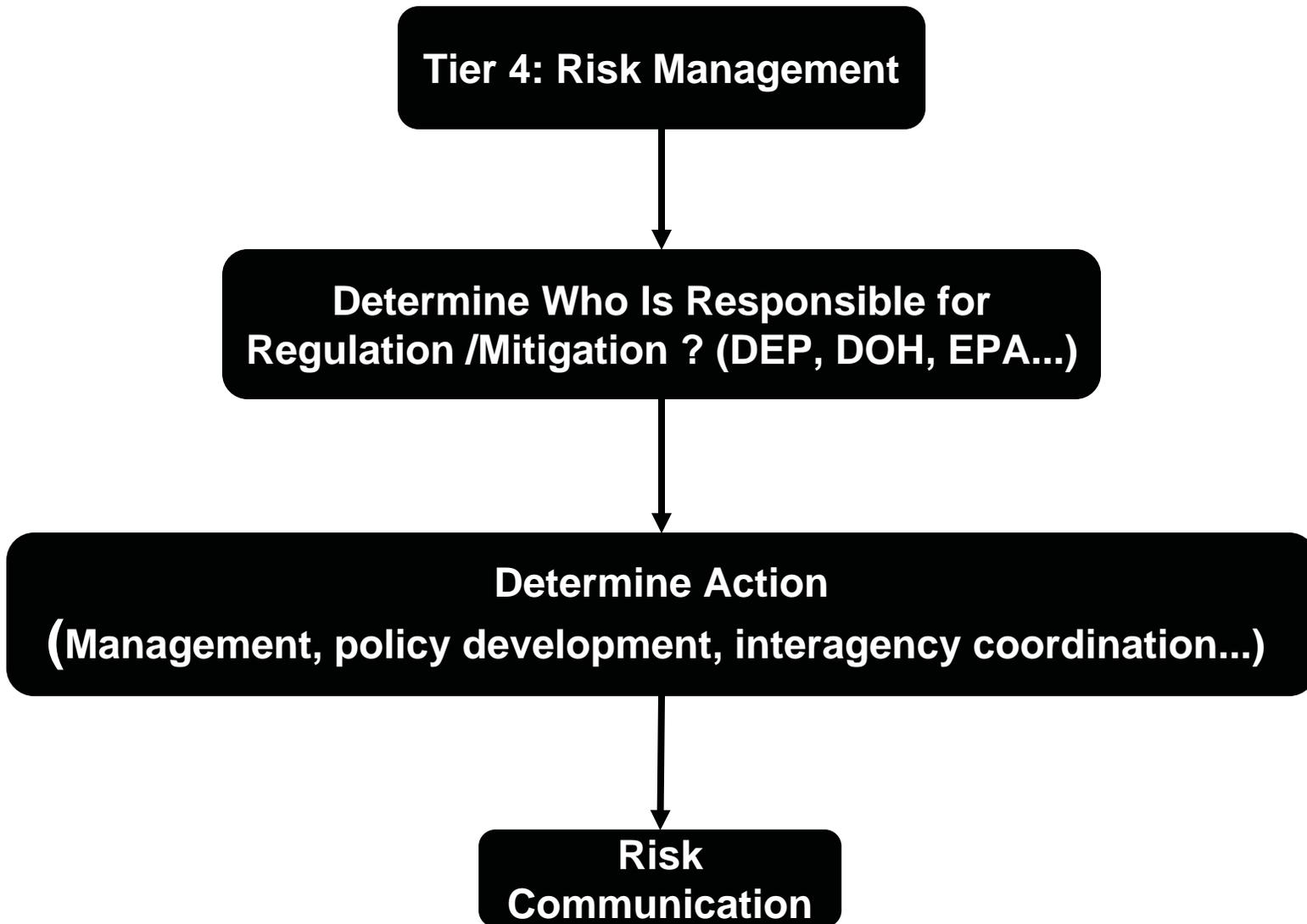


Tier 3: Risk Assessment

- Includes both Human (mammalian) & Ecological Risk Assessments.
- Risk assessment will determine whether or not CEC candidate is a significant risk that merits consideration on the NJ CEC prioritization list.

Tier 4 - Risk Management

Tier 4 - Risk Management



Tier 4: Risk Management

- Risk management of chemicals placed on the NJ CEC prioritization list will include recommended control or replacement options.
- Note: list needs to be manageable for NJ DEP with focus on mitigating risk of most critical CECs for NJ.

Deliverables

1. Determine who is responsible
2. Determine action
3. Risk Communication

Proposed CEC Framework Report to Executive Staff

Gary Buchanan and Bob Mueller, OS

CEC Workgroup

NJ DEP SAB

October 29, 2012

CEC Sub-Committee

SAB

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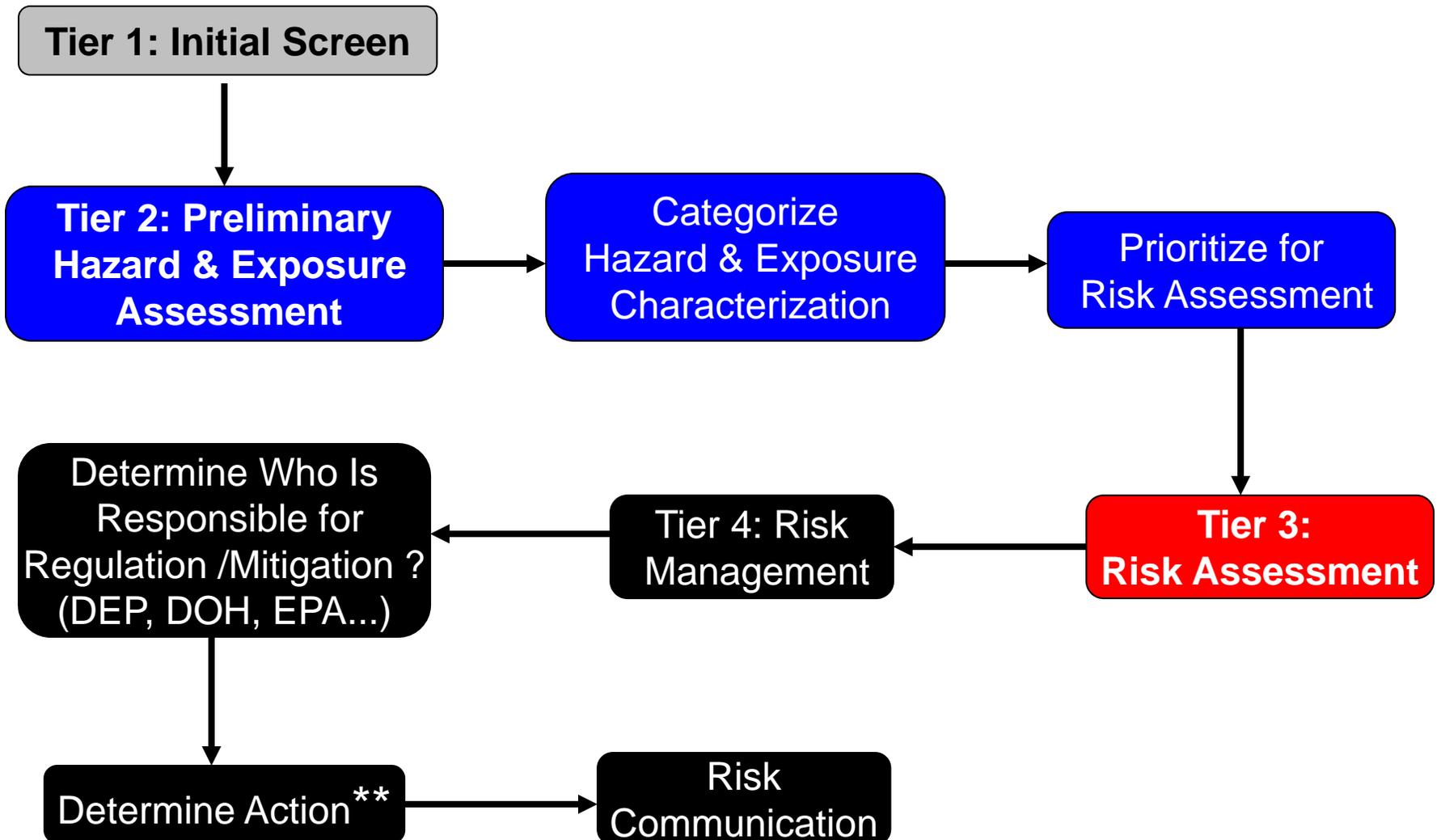
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**** Management, policy development, interagency coordination....**

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Stakeholder Concern?

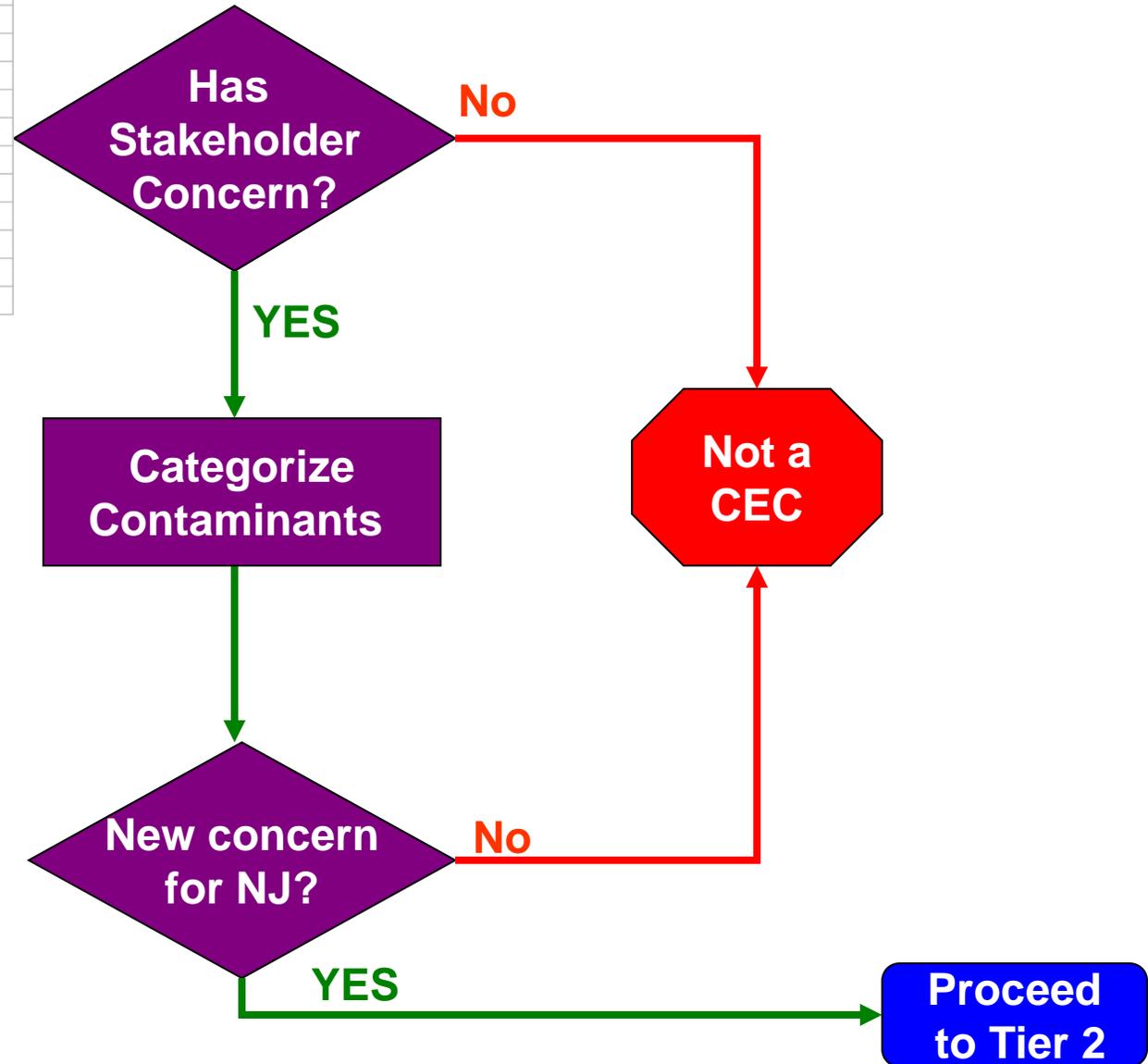
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- h. Growing usage of chemical
- i. Shrinkage of competing concerns
- j. Industry emerging in NJ
- k. New technology byproducts form CEC

Contaminant Category ?

- a. Pharmaceuticals
- b. Personal care products
- c. Nanoparticles
- d. Pesticides
- e. Steroids
- f. PAHs
- g. Radionuclides
- h. Synthetic organic compounds
- i. Inorganic compounds – metals
- j. Perfluorinated compounds
- k. Disinfection (oxidation) by-products
- l. Algal toxins
- m. Microbial contaminants
- o. Other - Define

New concern for NJ ?

- a. New chemical / ramped up production
- b. New type of use
- c. New effect identified
- d. New detection / increasing levels
- e. New source
- f. New exposure / exposure route



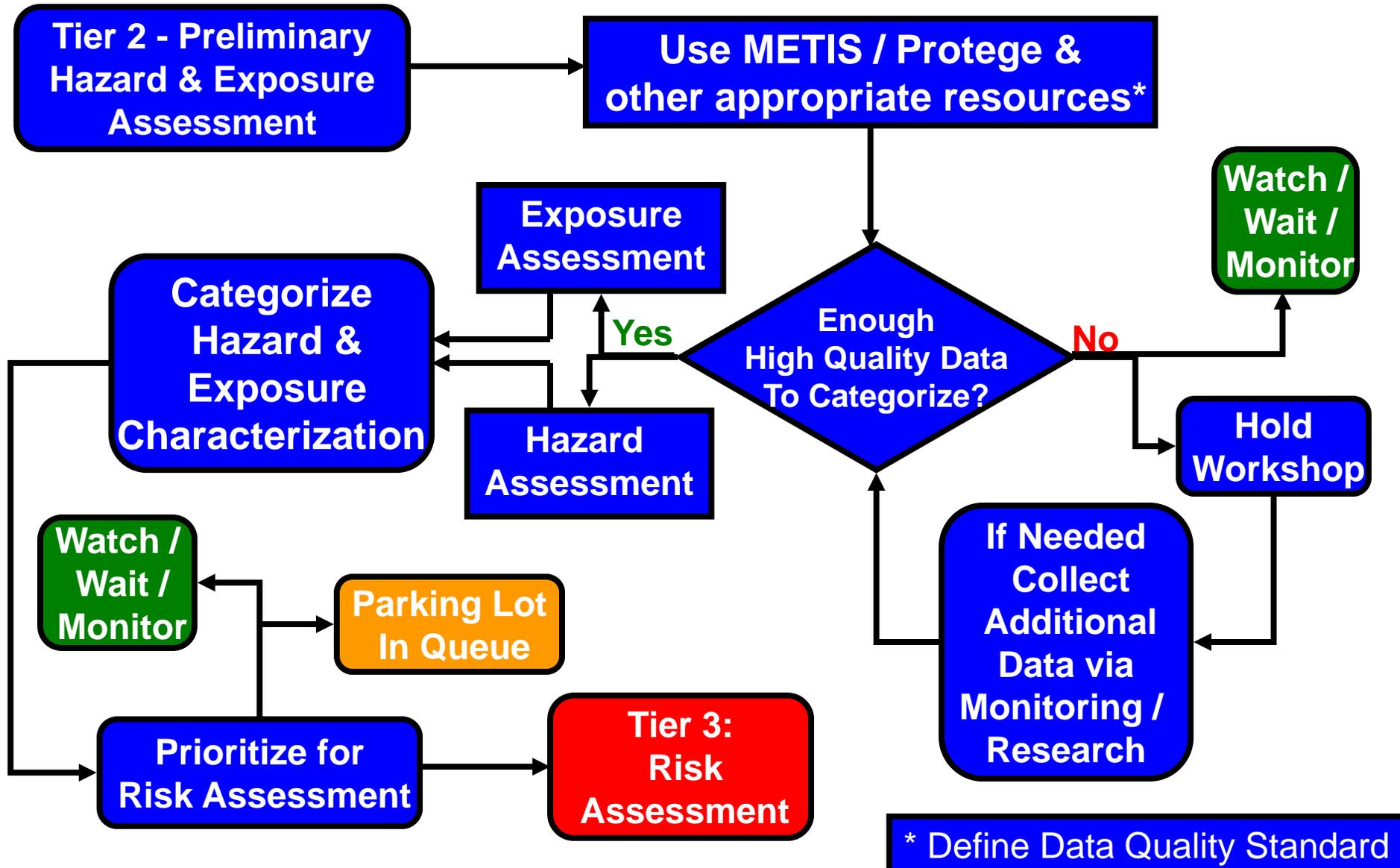
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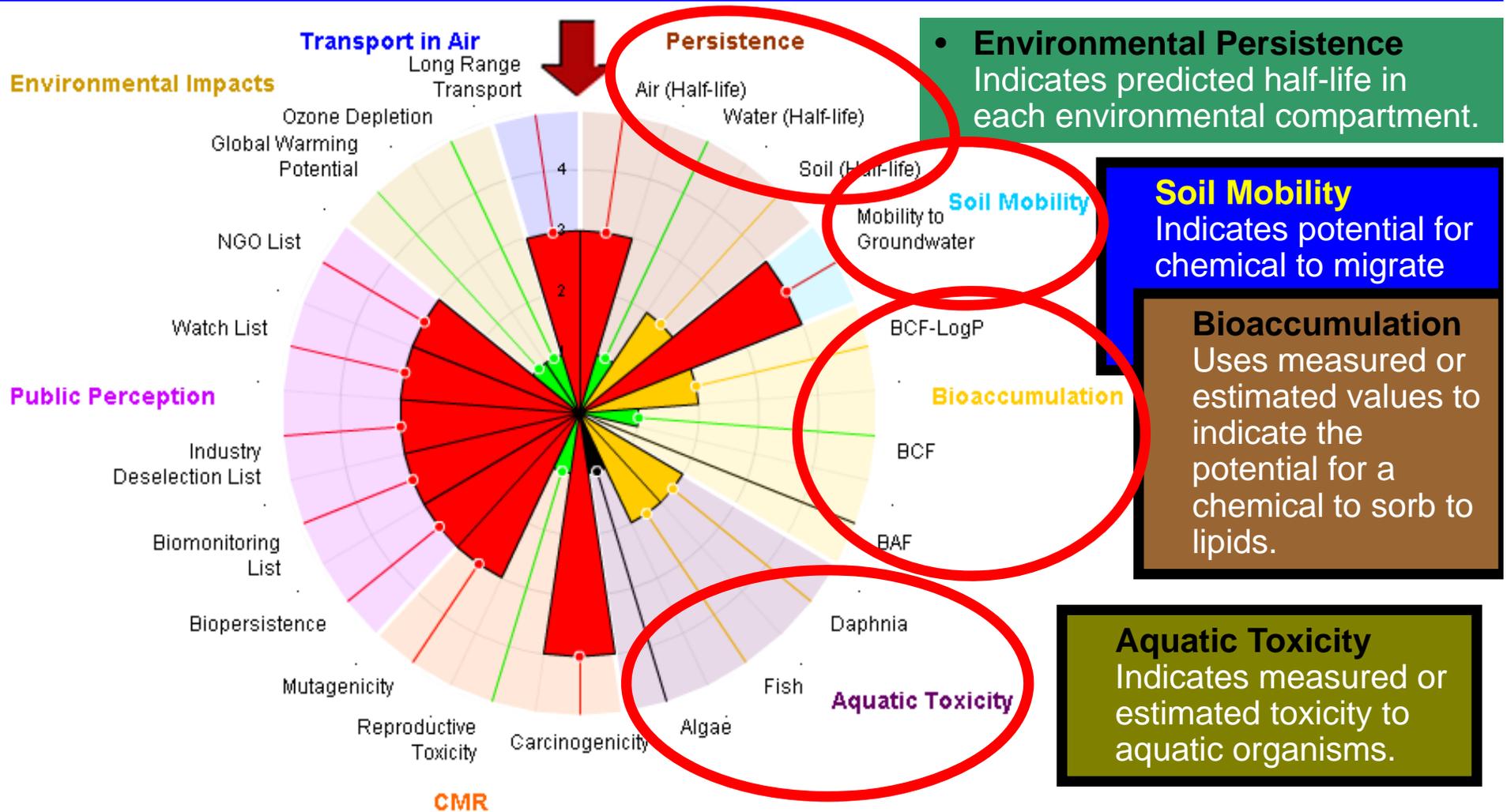
- **Metanomics Information System (METIS) is a chemical informatics platform that provides screening level view of potential**
 - Environmental fate & effects
 - Human health concerns
 - Societal perception issues
- **Built on open-source software that provides access to an aggregated database and estimation tool set**
 - 1400+ publicly available databases
 - Input: Chemical name, CAS #, or chemical structure.
- **Comprehensible view in seconds to minutes versus weeks to months by conventional searches.**
- **Ability to ‘mine’ down at any point to review data/research**

DuPont METIS

Potential for Concern

Indicated by Color: **Red: High / Very High; Orange: Moderate; Green: Low**
or

Indicated by Wedge Length: 1 = Low; 2 = Moderate; 3 = High; 4 = Very High



DuPont METIS

Potential for Concern

Indicated by Color: **Red: High / Very High; Orange: Moderate; Green: Low**
or

Indicated by Wedge Length: 1 = Low; 2 = Moderate; 3 = High; 4 = Very High

Transport in Air

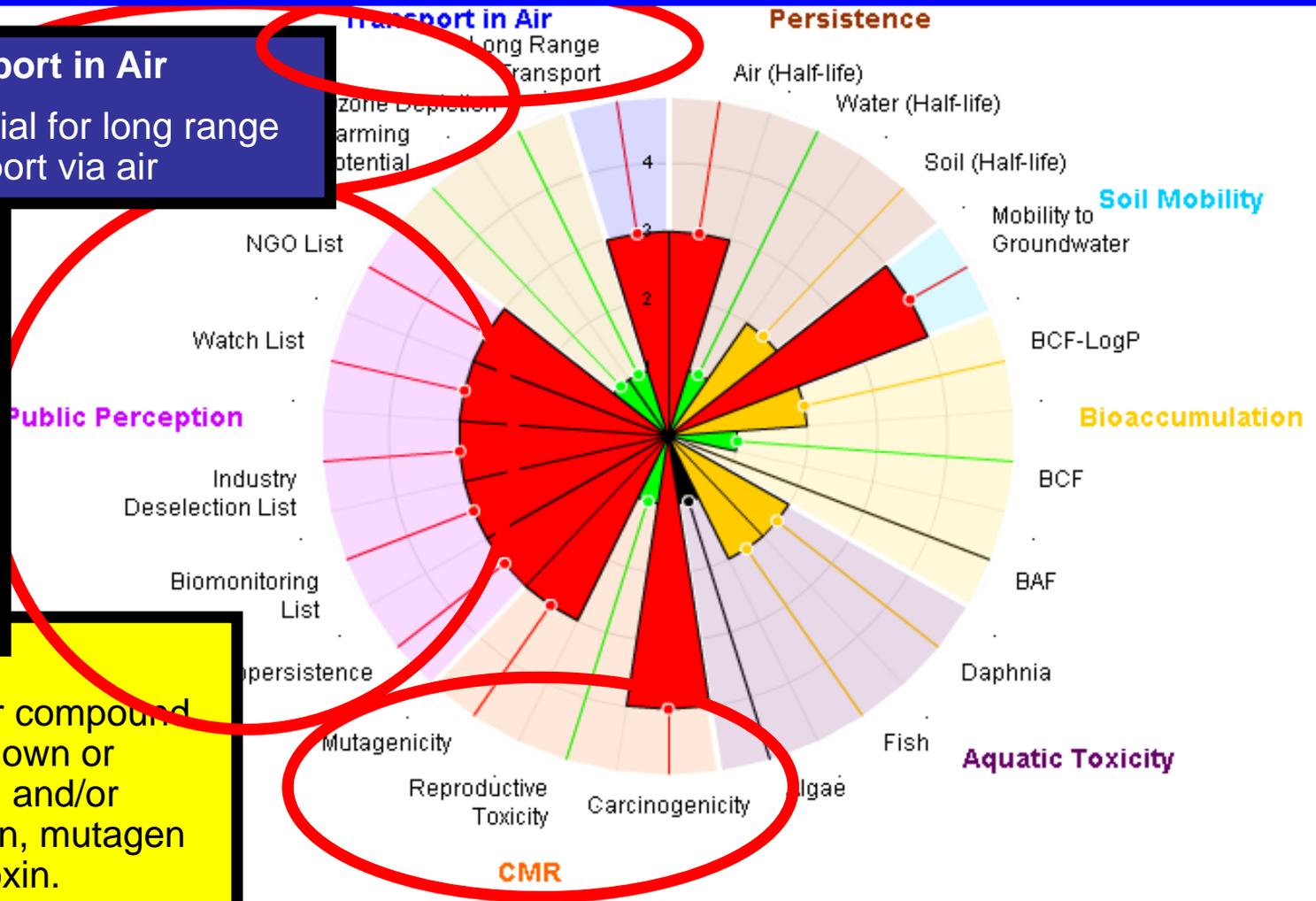
Indicates potential for long range transport via air

Impact

Indicates potential for chemical to affect global warming and ozone depletion as compared to reference compounds.

chemical.

is classified as known or suspected animal and/or human carcinogen, mutagen or reproductive toxin.



PRoTEGE

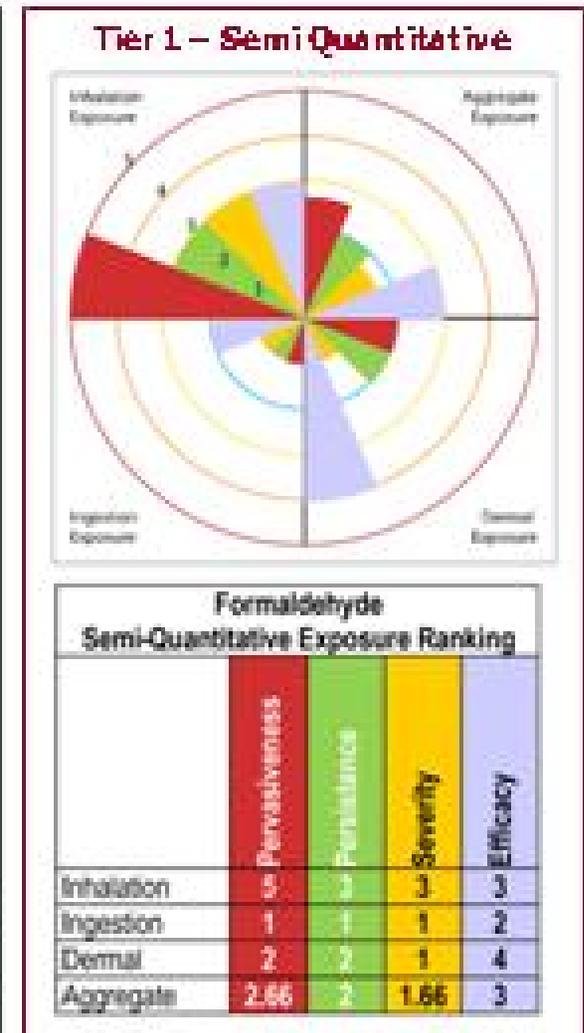
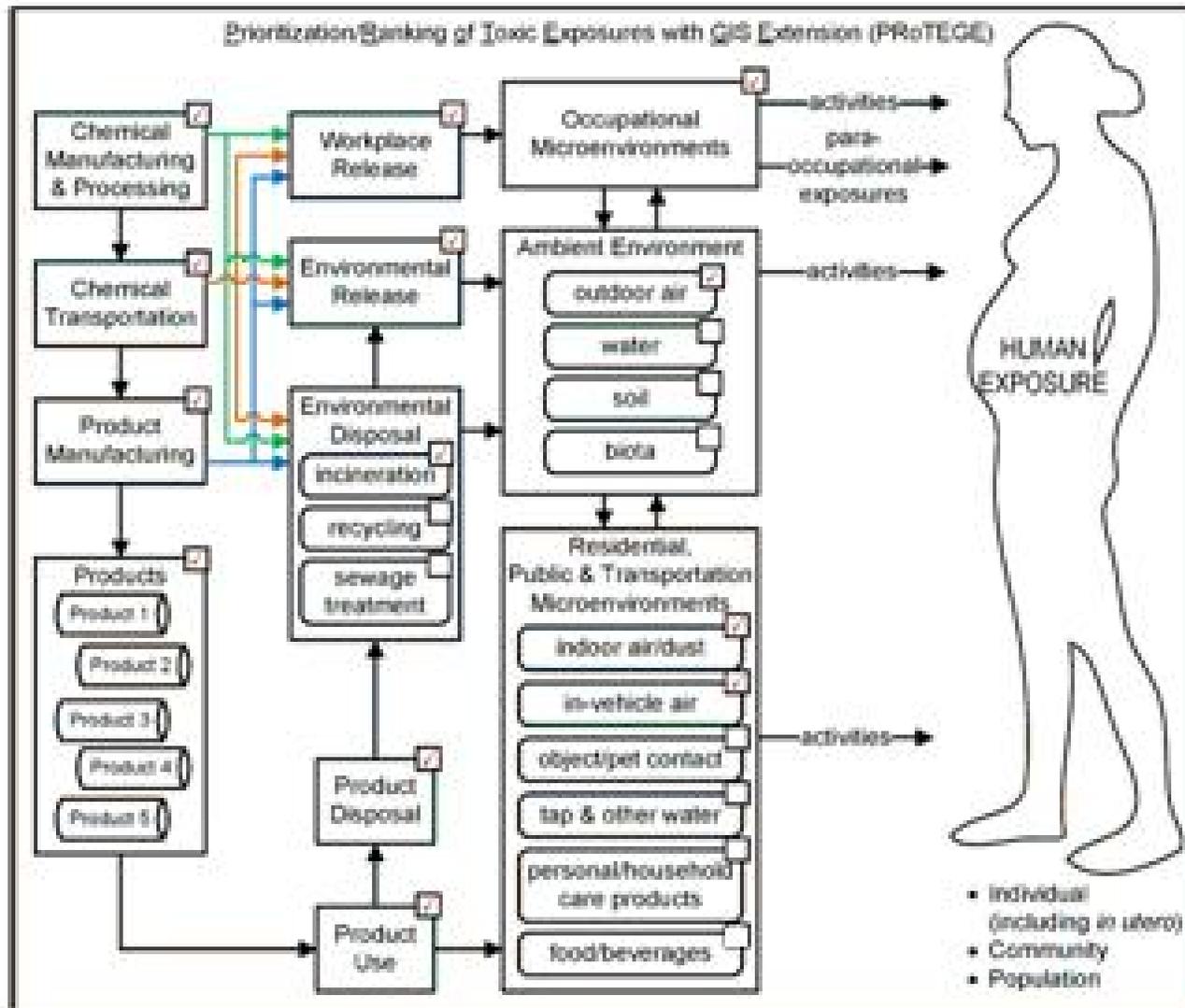
Exposure-Based

Prioritization of Chemicals

**Environmental and Occupational
Health Sciences Institute (EOHSI)**

PROTEGE - a three-tier system that supports exposure-based prioritization of chemicals

PROTEGE utilizes reduced components of the comprehensive HENTON system to provide a simplified modeling platform employing extant data and modules for the "screening" assessment of human exposures associated with toxics in various (micro)environments and products.

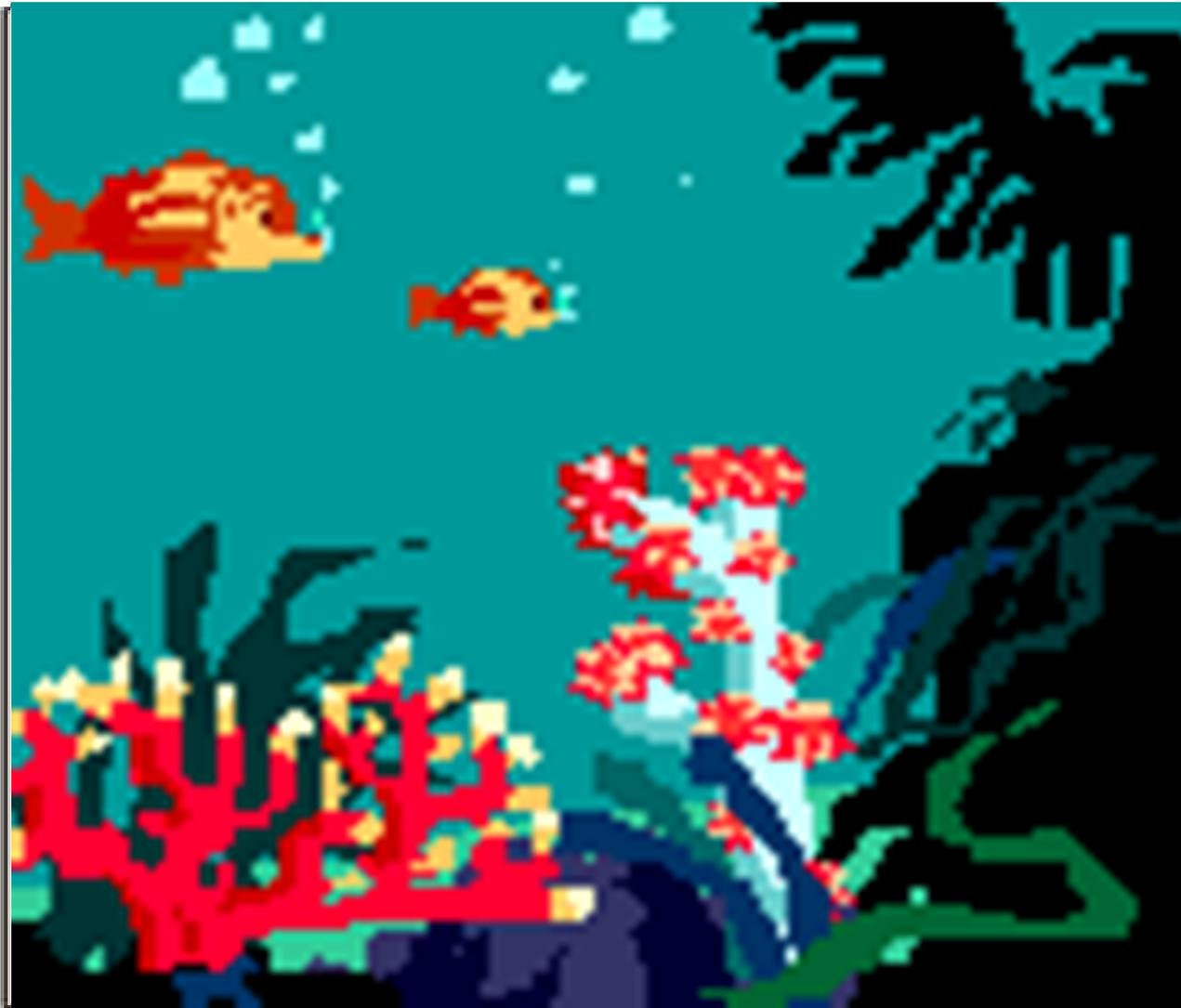


Tier 2 - Probabilistic distributions for the US population

Modeling Environment for Total Risk studies; development supported by USEPA, ATSDR, USDOE, NJDEP, ACC, and other government and private agencies.

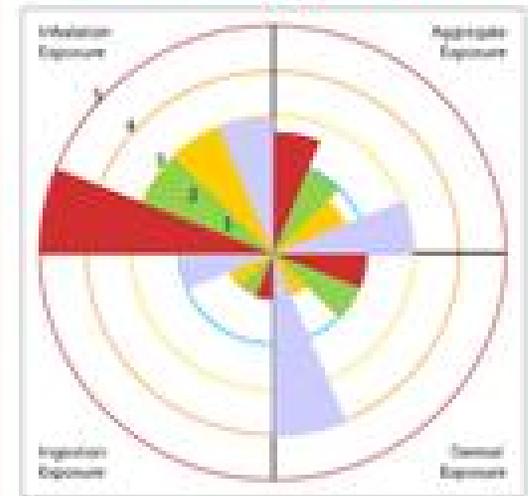
PRoTEGE - a three-tier system that supports exposure-based prioritization of chemicals

PRoTEGE utilizes reduced components of the comprehensive HEMTODR system to provide a simplified modeling platform employing extant data and modules for the "screening" assessment of human exposures associated with toxics in various (micro)environments and products



Modeling Environment for Total Risk studies; development supported by USEPA, ATSDR, USDOE, NJDEP, ACC, and other government and private agencies.

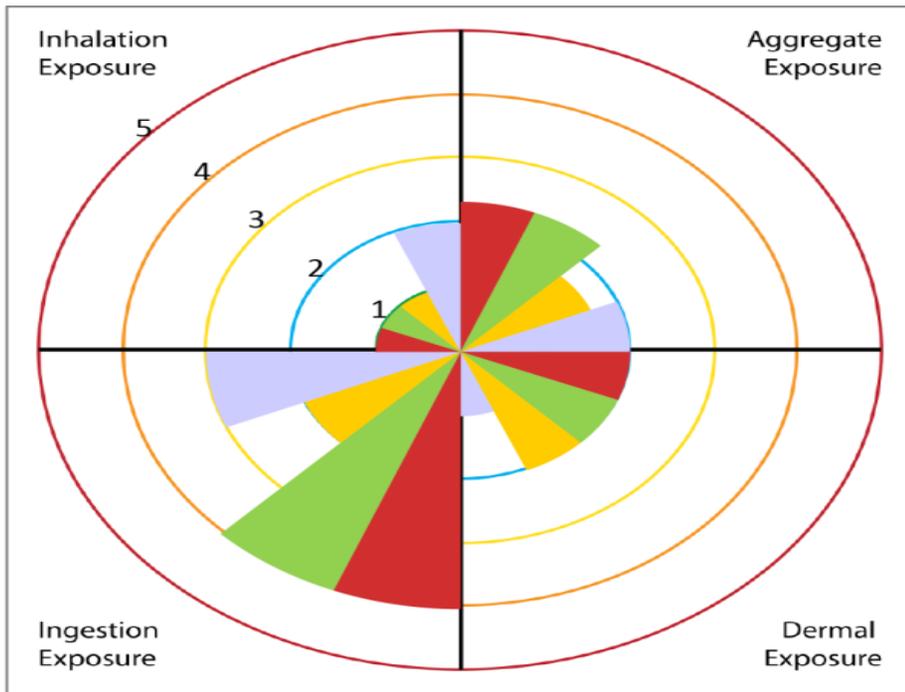
Tier 1 - Semi Quantitative



Formaldehyde Semi-Quantitative Exposure Ranking

	1 - Pervasiveness	2 - Persistence	3 - Severity	4 - Efficacy
Inhalation	3	3	3	3
Ingestion	1	1	1	2
Dermal	2	2	1	4
Aggregate	2.66	2	1.66	3

Tier 2 - Probabilistic distributions for the US population



	Pervasiveness	Persistence	Severity	Efficacy
Inhalation	1	1	1	2
Ingestion	4	4	2	3
Dermal	2	2	2	1
Aggregate	2.33	2.33	1.66	2

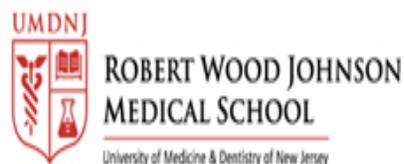
- “Tier 1” exposure metrics

- Pervasiveness - how widespread the exposures are within the general US population
- Persistence - the temporal frequency and/or duration of such exposures
- Severity - the potential for high levels of such exposures
- Efficacy - the potential of the contact with the chemical to result in intake/uptake

Tier 1 Exposure Levels:
 1 – Very Low; 2 - Low
 3 – Moderate; 4 – High;
 5 – Very High

Development of Exposure/Hazard Assessment Tool for NJ DEP: Proposal for Merger of METIS & Protege

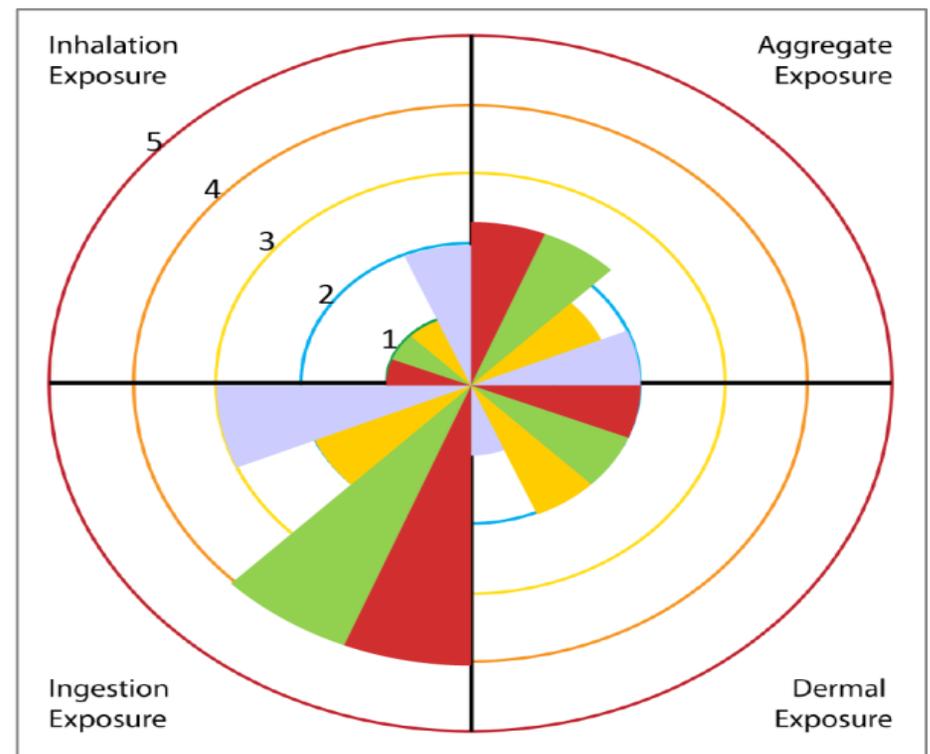
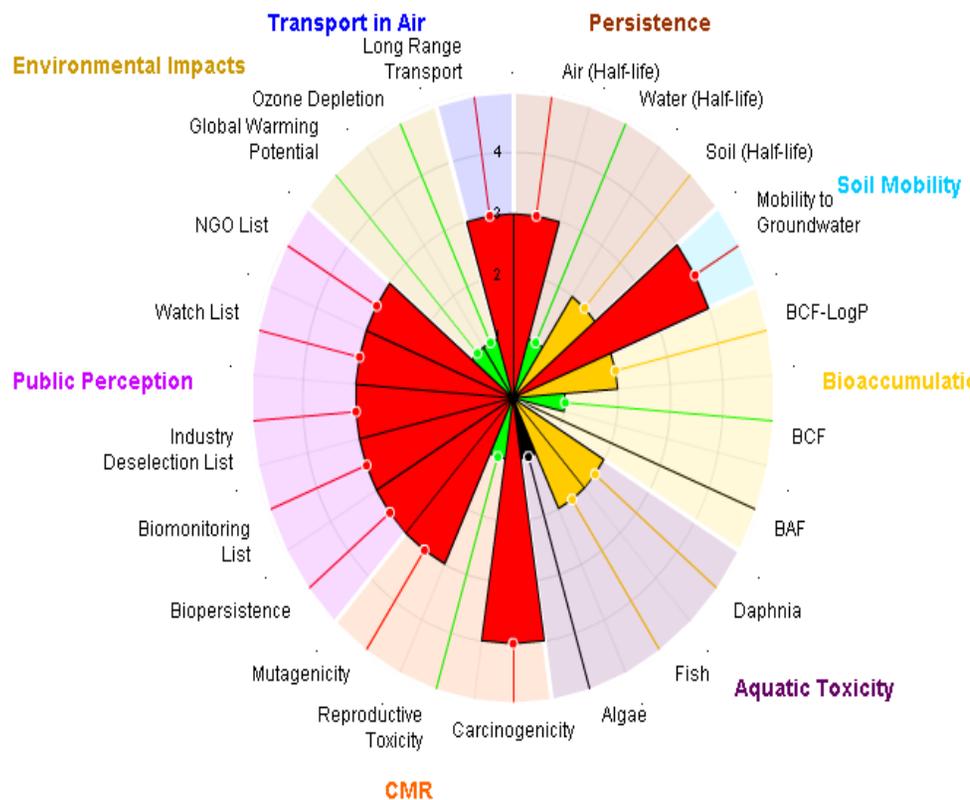
- The proposed system will be developed by systematically selecting, adapting, linking, testing, and eventually merging components from two available and currently evolving state-of-the-art platforms for hazard and for exposure characterization and ranking:
 - *METIS* (Metanomics Information System), developed by DuPont.
 - *PRoTEGE* (Prioritization and Ranking of Toxic Exposures with GIS extension), developed by the Computational Chemodynamics Laboratory of EOHSI.



Proposed METIS-Protege Tool

METIS

PRoTEGE



**Tier 2 -
Categorize
Hazard & Exposure
Characterization**

Guidance for Initial Prioritization of Chemicals for Risk Assessment

Prioritization Score = Hazard category x Exposure category

Hazard or Exposure Categories:

3 - High

2 - Moderate

1 - Low

- **A "3" in any Hazard or Exposure Category defaults to a "3" value for the Initial Prioritization.**
 - Assures that any chemical with a high level endpoint of concern will be ranked for prioritization in the CEC framework.

Guidance for Hazard Characterization

- Evaluate evidence for mammalian or environmental toxicity:
 - Acute Systemic Toxicity
 - Carcinogen, Mutagen, Reproductive / Developmental Toxicity (including endocrine disruptors)
 - Neurobehavioral Toxicity
 - Repeated dose target organ toxicity
 - Chemical Respiratory Sensitizer
- Hazard criteria based on:
 1. EPA - TSCA Work Plan Chemicals: Methods Document (2/2012)
 2. EPA - Design for the Environment Program Alternatives Assessment Criteria for Hazard Evaluation (8/2011)

Categorization of Mammalian Hazard

- 3 • Strong weight of evidence for mammalian toxicity:
 - Acute Systemic Toxicity
 - Carcinogen, Mutagen, Reproductive / Developmental Toxicity (including endocrine disruptors)
 - Neurobehavioral Toxicity
 - Repeated dose target organ toxicity
 - Chemical Respiratory Sensitizer

- 2 • Uncertainty about or moderate weight of evidence or no data for mammalian toxicity:
 - Acute Systemic Toxicity
 - Carcinogen, Mutagen, Reproductive / Developmental Toxicity (including endocrine disruptors)
 - Neurobehavioral Toxicity
 - Repeated dose target organ toxicity
 - Chemical Respiratory Sensitizer

- 1 • Weak weight of evidence for mammalian toxicity

Table 1-A. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Acute Mammalian Toxicity				
Oral LD50 (mg/kg)	≤ 50 - 300	> 300 - 2,000	> 2,000	
Dermal LD50 (mg/kg)	≤ 200 - 1,000	> 1,000 - 2,000	> 2,000	
Inhalation LC50 (gas/vapor) (mg/L)	≤ 2 - 10	> 10 - 20	> 20	
Inhalation LC50 (mist/dust) (mg/L/day)	≤ 0.5 - 1.0	> 1.0 - 5	> 5	
Carcinogenicity	GHS 1A, 1B, GHS2	Limited Animal	Negative or SAR	
Mutagenicity/Genotoxicity	GHS 1A, 1B, GHS2	Positive <i>in vivo</i> or <i>in vitro</i>	Negative	
Reproductive Toxicity				
Oral (mg/kg/day)	< 50	50 - 250	> 250	
Dermal (mg/kg/day)	< 100	100 - 500	> 500	
Inhalation (gas/vapor) (mg/L/day)	< 1	1 - 2.5	> 2.5	
Inhalation (mist/dust) (mg/L/day)	< 0.1	0.1 - 0.5	> 0.5	

Table 1-B. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Developmental Toxicity				
Oral (mg/kg/day)	< 50	50 - 250	> 250	
Dermal (mg/kg/day)	< 100	100 - 500	> 500	
Inhalation (gas/vapor) (mg/L/day)	< 1	1 - 2.5	> 2.5	
Inhalation (mist/dust) (mg/L/day)	< 0.1	0.1 - 0.5	> 0.5	
Neurotoxicity				
Oral (mg/kg-bw/day)				
90-day (13 weeks)	< 10	10 - 100	> 100	
40-50 days	< 20	20 - 200	> 200	
28-days (4 weeks)	< 30	30 - 300	> 300	
Dermal (mg/kg-bw/day)				
90-day (13 weeks)	< 20	20 - 200	> 200	
40-50 days	< 40	40 - 400	> 400	
28-days (4 weeks)	< 60	60 - 600	> 600	

Table 1-C. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Repeated Dose (Chronic) Toxicity				
<i>Oral (mg/kg-bw/day)</i>				
90-day (13 weeks)	< 10	10 - 100	> 100	
40-50 days	< 20	20 - 200	> 200	
28-days (4 weeks)	< 30	30 - 300	> 300	
<i>Dermal (mg/kg-bw/day)</i>				
90-day (13 weeks)	< 20	20 - 200	> 200	
40-50 days	< 40	40 - 400	> 400	
28-days (4 weeks)	< 60	60 - 600	> 600	
<i>Inhalation (vapor/gas) (mg/L/6hrs/day)</i>				
90-day (13 weeks)	< 0.2	0.2 - 1.0	> 1.0	
40-50 days	< 0.4	0.4 - 2.0	> 2.0	
28-days (4 weeks)	< 0.6	0.6 - 3.0	> 3.0	
<i>Inhalation (dust/mist/fume) (mg/L/6hrs/day)</i>				
90-day (13 weeks)	< 0.02	0.02 - 0.2	> 0.2	
40-50 days	< 0.04	0.04 - 0.4	> 0.4	
28-days (4 weeks)	< 0.06	0.06 - 0.6	> 0.6	

Table 1-D. Criteria for Determining Mammalian Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Respiratory Sensitization	GHS 1A and 1B Occurrence of respiratory sensitization; Evidence supporting potential for respiratory sensitization		No evidence supporting potential for respiratory sensitization	

Categorization of Environmental Hazard

- 3** • Strong weight of evidence for Environmental toxicity:
 - Acute or Chronic Aquatic Toxicity
 - » Fish toxicity
 - » Crustacea toxicity
 - » Algal toxicity

- 2** • Uncertainty about or moderate weight of evidence or no data for Environmental toxicity:
 - Acute or Chronic Aquatic Toxicity
 - » Fish toxicity
 - » Crustacea toxicity
 - » Algal toxicity

- 1** • Weak weight of evidence for Environmental toxicity

Table 2. Criteria for Determining Environmental Hazard Score

	High	Moderate	Low	Hazard Score
Ranking	3	2	1	
Chemical X				
Acute Aquatic Toxicity				
Fish 96 hr. LC ₅₀	< 1.0 - 10.0	> 10 - 100	> 100	
Crustacea sp. 48 hr. EC ₅₀	< 1.0 - 10.0	> 10 - 100	> 100	
Algal sp. 72 or 96 hr. EC ₅₀	< 1.0 - 10.0	> 10 - 100	> 100	
Chronic Aquatic Toxicity (NOEC or EC₅₀)				
Fish Early Life Stage	< 0.1 - 1	> 1 - 10	> 10	
Daphnia Reproduction	< 0.1 - 1	> 1 - 10	> 10	
Algal Growth Inhibition	< 0.1 - 1	> 1 - 10	> 10	

Supplemental Evaluation of Environmental Hazard

- Consider any available data for sublethal - growth, reproduction, development, etc. responses or "real" ecological responses at the population or community level.

Evaluation of Endocrine Activity

- Evaluate endocrine activity rather than characterize hazard 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 that will be 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.
 - Additional information gleaned from studies that are indicative of a chemical’s endocrine system interactions, such as changes in hormone profiles or reproductive organ weights.

Categorization of Endocrine Activity

- Available data for each chemical will be evaluated for evidence of the presence of endocrine activity.
-
- 3** – If data show evidence of endocrine activity then the chemical will be designated as potentially endocrine active, while noting caveats and limitations.
-
- 2** – If there are no data available to evaluate this endpoint, endocrine activity is unknown, untested and would be marked with a “ND” indicating the absence of information.
(No Data)
-
- 1** – 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.

Input for Exposure Characterization

- **For Each Chemical**
 - **Emissions and products**
 - **Exposure pathways**
 - **Vulnerable populations**
 - **Exposure routes**
 - **Frequency of contact**
 - **Fate in the environment**
 - **Eco-exposures**

Categorization of Exposure Characterization

3

- Presence in NJ environmental media / biota at significant concentrations or as significant biomarker measurements, and relative ranking of exposure based upon distributional estimates for 3 the main routes of exposure (inhalation, dermal and ingestion) (ug/kg/day)
 - Presence in food, children's toys, cosmetics/ personal care products, consumer product and relative ranking of exposure based upon distributional estimates for 3 the main routes of exposure (inhalation, dermal and ingestion)
-

2

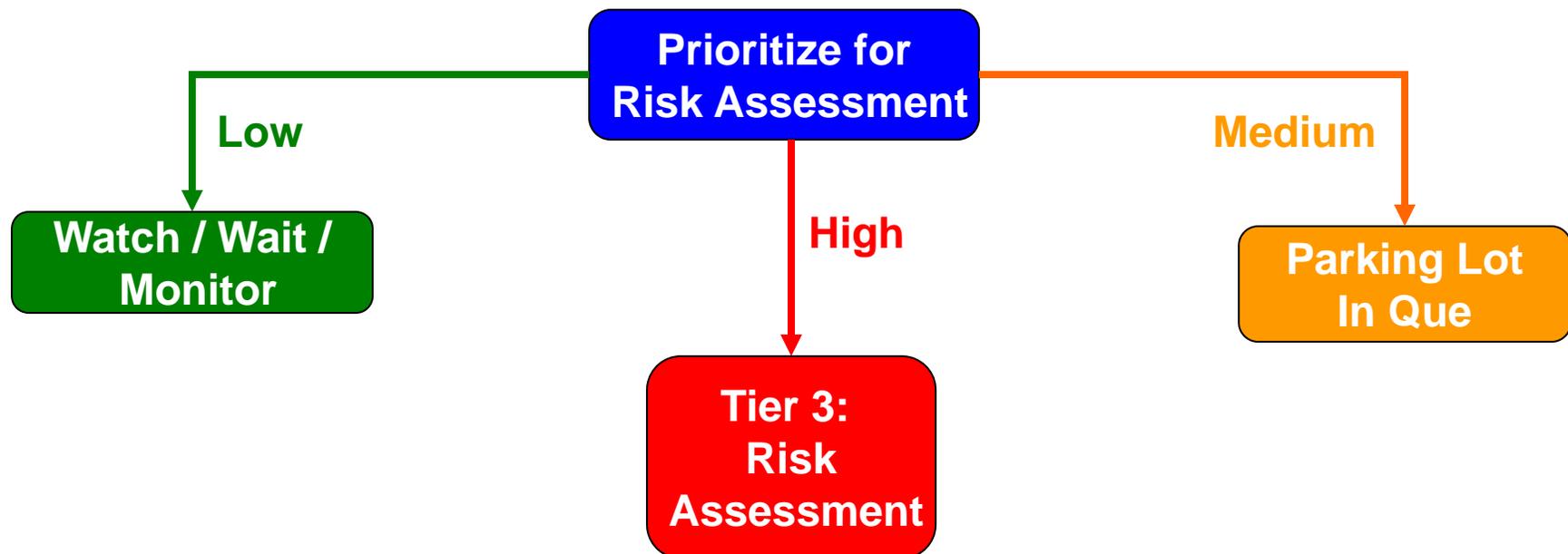
- Presence in NJ environmental media / biota at concentrations less than which may be steadily increasing due uses or emission sources
 - Uses/applications with estimated moderate exposure potential
-

1

- Detectable concentrations of new pollutants found in NJ environmental media / biota
- Manufacturing intermediate detected in NJ environmental media/ biota
- Uses/applications with estimated low exposure potential for NJ residents/biota

**Tier 2 -
Prioritize for
Risk Assessment**

Prioritizing for Risk Assessment



Initial Prioritization Grid for Risk Assessment

		Potential Exposure		
		Low 1	Moderate 2	High 3
Potential Hazard	High 3	3x1 = 3	3x2 = 6	3x3 = 9
	Moderate 2	2x1 = 2	2x2 = 4	2x3 = 6
	Low 1	1x1 = 1	1x2 = 2	1x3 = 3

* Red Boxes = Score of 9, then Score of 6 considered for Tier 3 Risk Assessment

Initial Prioritization Grid for Risk Assessment

"High Priority (red boxes)"

Potential Hazard

Potential Exposure
Low Moderate High
1 2 3

High 3
Moderate - 2
Low - 1

3x1 = 3	3x2 = 6	3x3 = 9
2x1 = 2	2x2 = 4	2x3 = 6
1x1 = 1	1x2 = 2	1x3 = 3

* RED - SEND TO TIER 3 RISK ASSESSMENT

Initial Prioritization Grid for Risk Assessment

"Medium Priority (orange boxes)"

Potential Hazard

Potential Exposure
Low Moderate High
1 2 3

High 3	3x1 = 3	3x2 = 6	3x3 = 9
Moderate - 2	2x1 = 2	2x2 = 4	2x3 = 6
Low - 1	1x1 = 1	1x2 = 2	1x3 = 3

* ORANGE - PARKING LOT, IN QUEUE

Initial Prioritization Grid for Risk Assessment

"Low Priority" (green boxes)

Potential Hazard

Potential Exposure

Low
1

Moderate
2

High
3

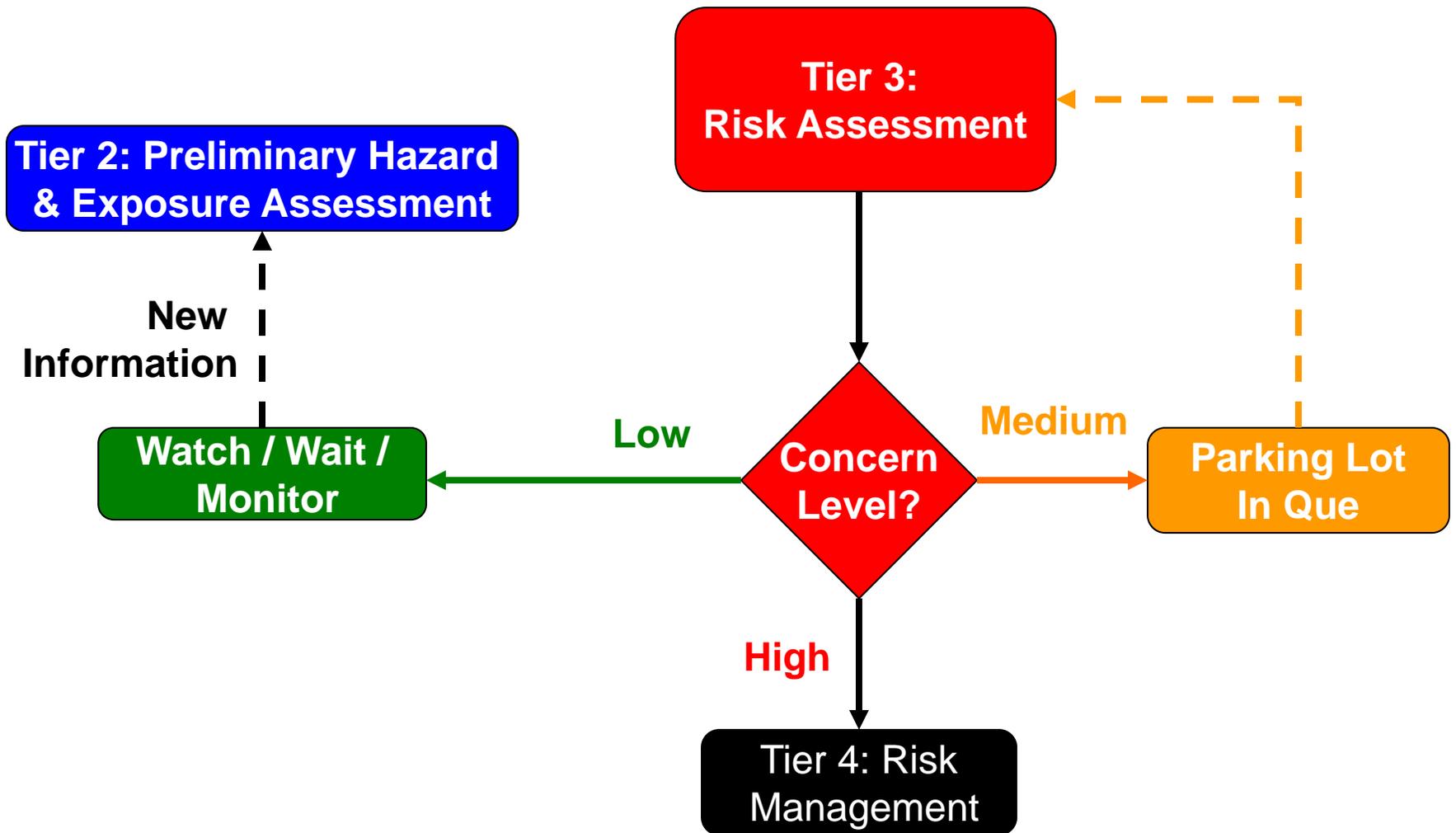
High 3
Moderate - 2
Low - 1

3x1 = 3	3x2 = 6	3x3 = 9
2x1 = 2	2x2 = 4	2x3 = 6
1x1 = 1	1x2 = 2	1x3 = 3

GREEN - WATCH, WAIT, MONITOR

Tier 3 - Risk Assessment

Tier 3 - Risk Assessment



Tier 3: Risk Assessment

- Includes both Human (mammalian) & Ecological Risk Assessments.
- Risk assessment will determine whether or not CEC candidate is a significant risk that merits consideration on the NJ CEC prioritization list.

Tier 4 - Risk Management

Tier 4 - Risk Management

Tier 4: Risk Management

**Determine Who Is Responsible for
Regulation /Mitigation ? (DEP, DOH, EPA...)**

**Determine Action
(Management, policy development, interagency coordination...)**

**Risk
Communication**

Tier 4: Risk Management

- Risk management of chemicals placed on the NJ CEC prioritization list will include recommended control or replacement options.
- Note: list needs to be manageable for NJ DEP with focus on mitigating risk of most critical CECs for NJ.

Deliverables

1. Determine who is responsible
2. Determine action
3. Risk Communication

Recommended Action Items

- Complete final editing of framework based on feedback from today's meeting
- Prepare report on framework
- Get agreement on proposal for scoping study on feasibility of merging Metis and Protege
- Finalize methodology for determining Hazard Score

Added After SAB Meeting

- **Chemistry Council of NJ**
- **NJ Business and Industry Assoc.**
- **AWWA**
- **Environmental Authorities of NJ**