The Use of Air Monitoring Data in Risk Assessment
An Overview

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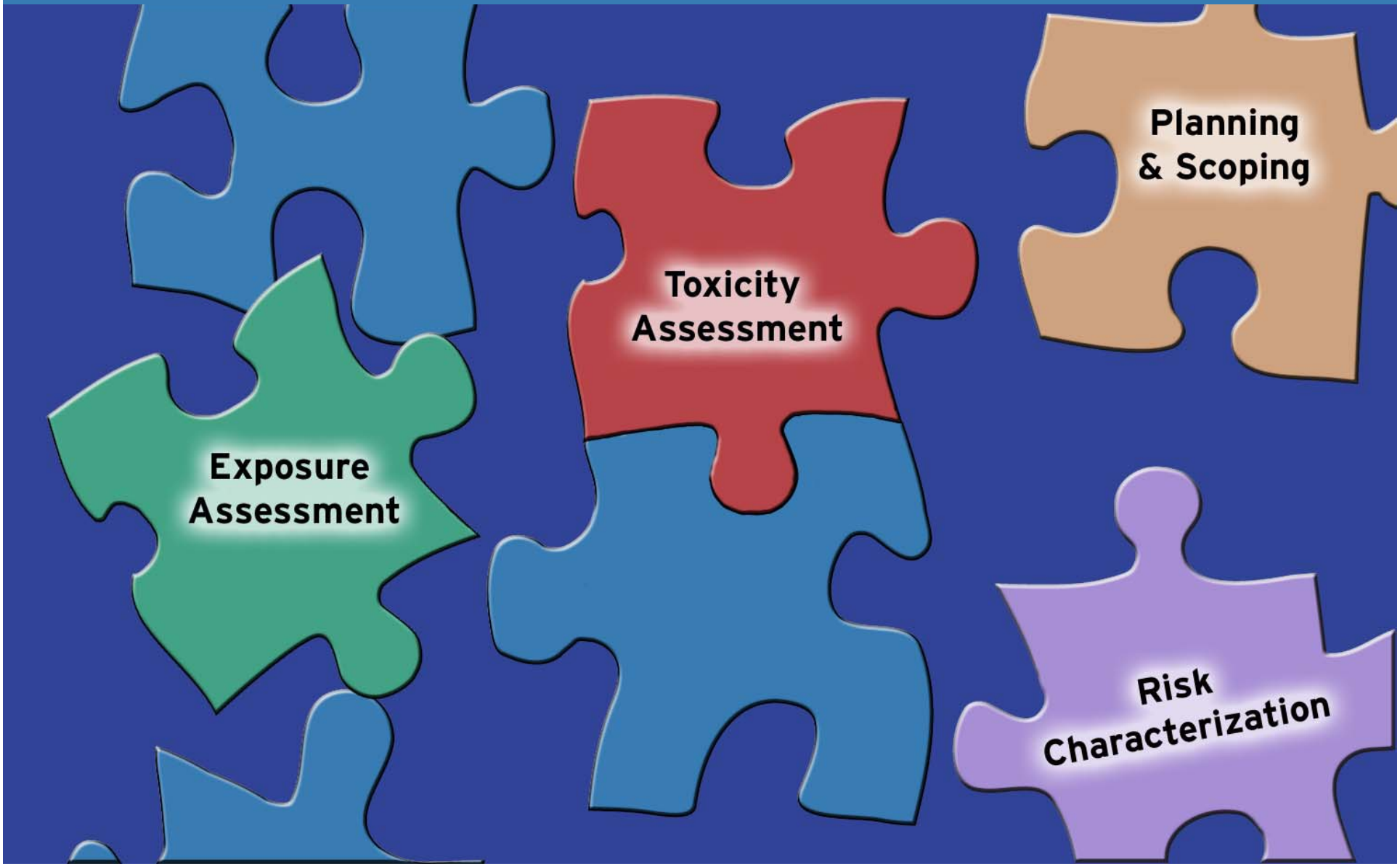
Good Afternoon!

1. What is air toxics risk assessment and how do we use it to make decisions?

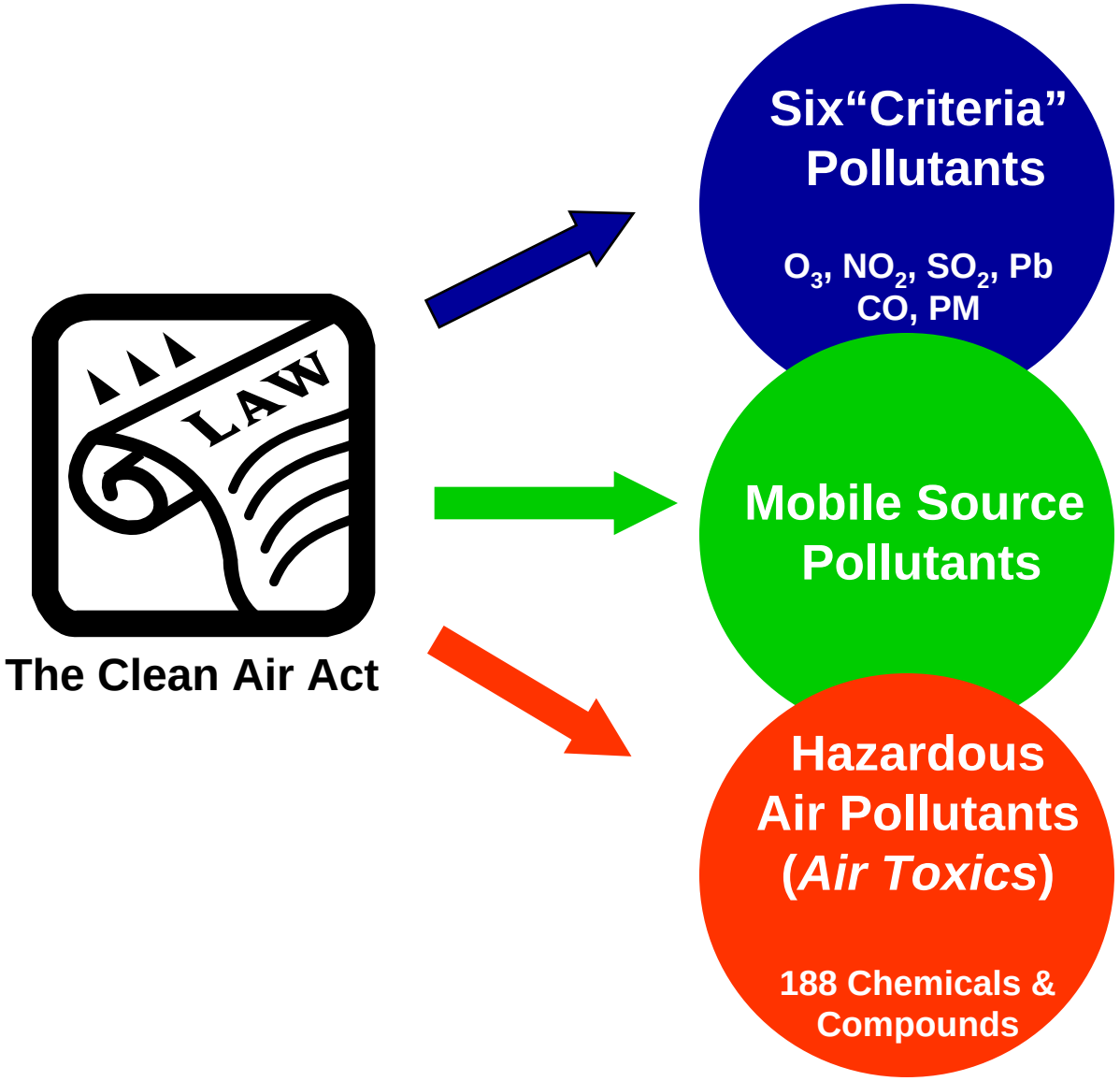
2. What is the role of monitoring data in evaluating risk?

3. What is the interplay of monitoring versus modeling for risk assessment?

Air Toxics Risk Assessment Overview

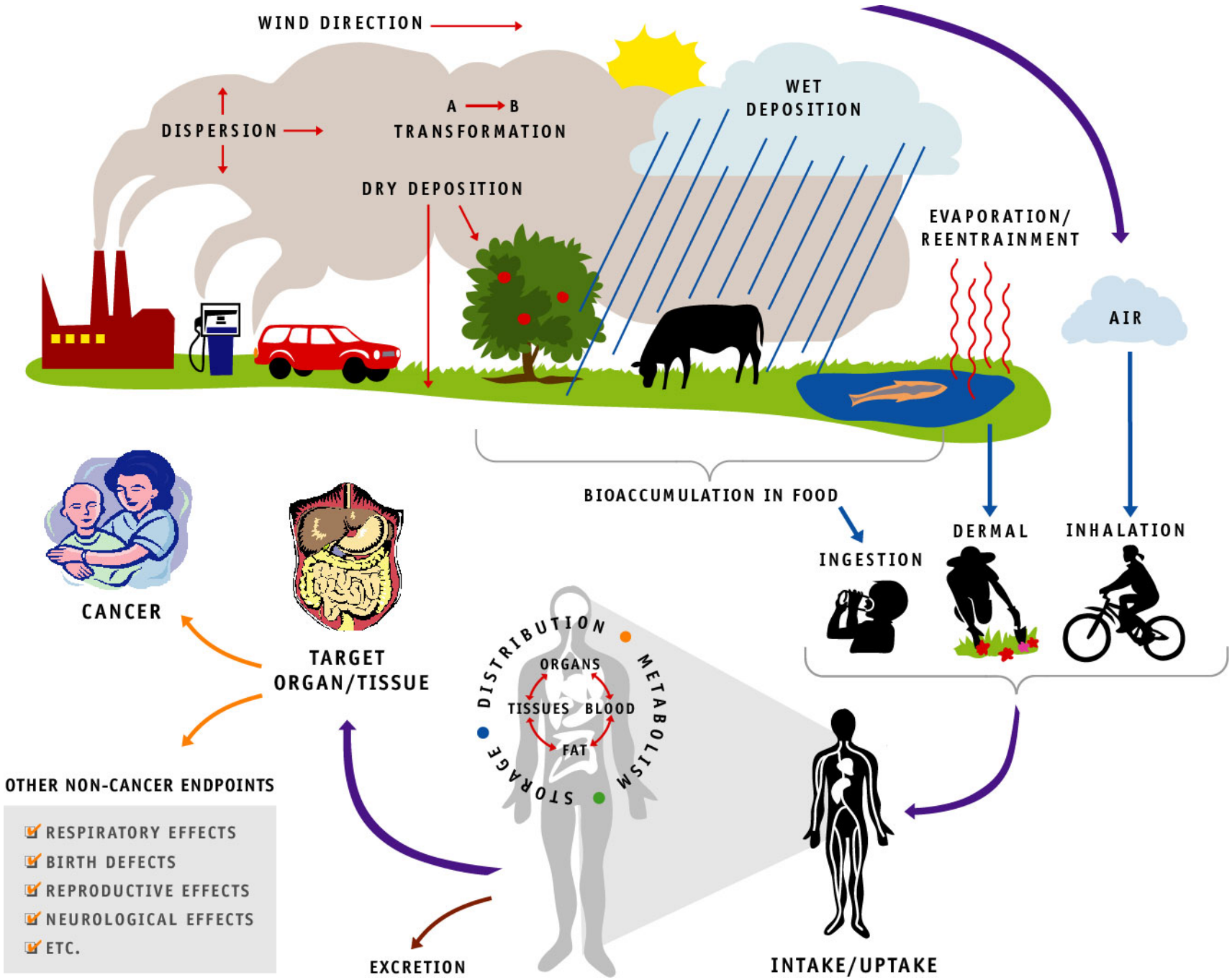


Our Main Air Pollutant Concerns

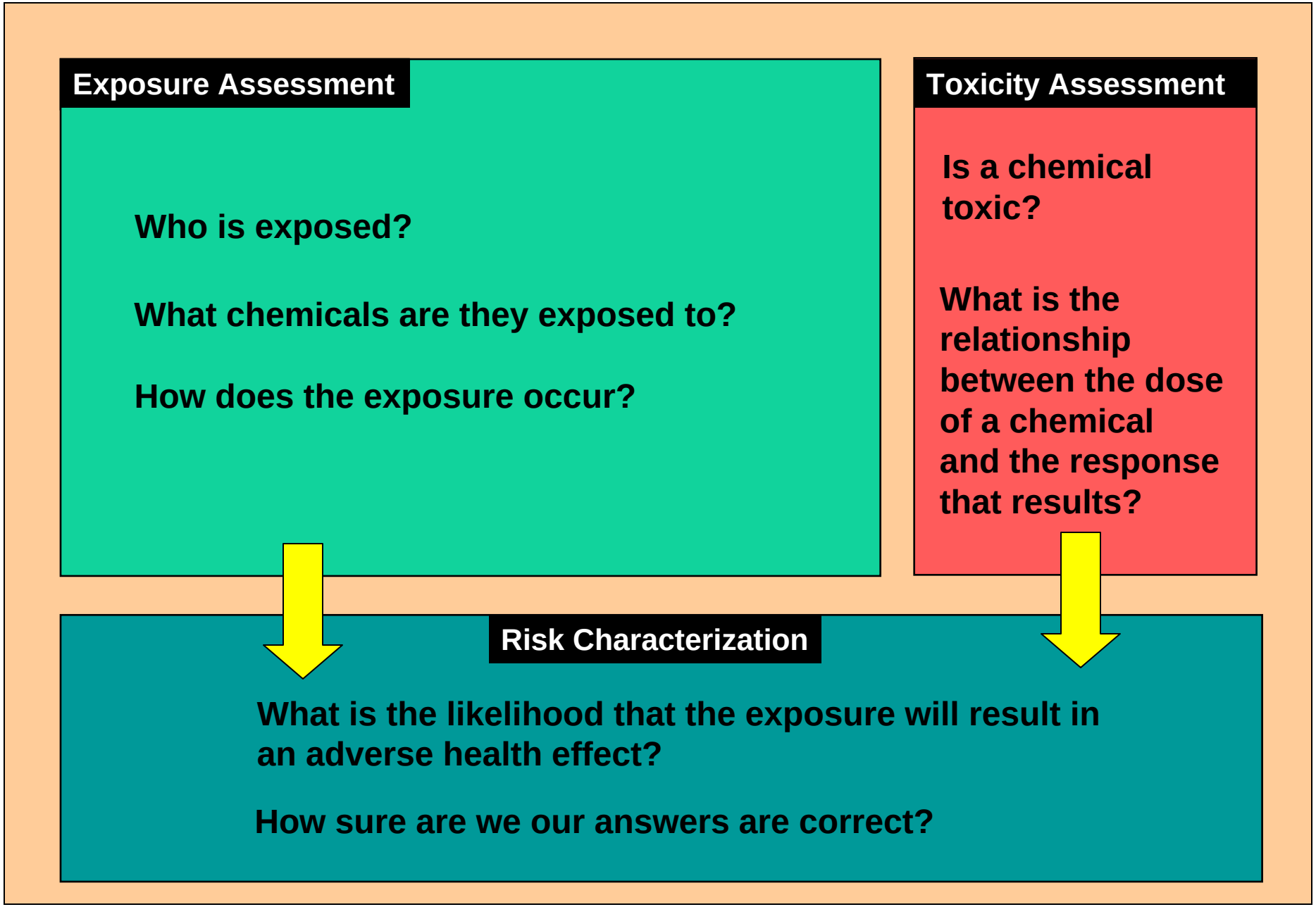


Air toxics pollution sources are everywhere!

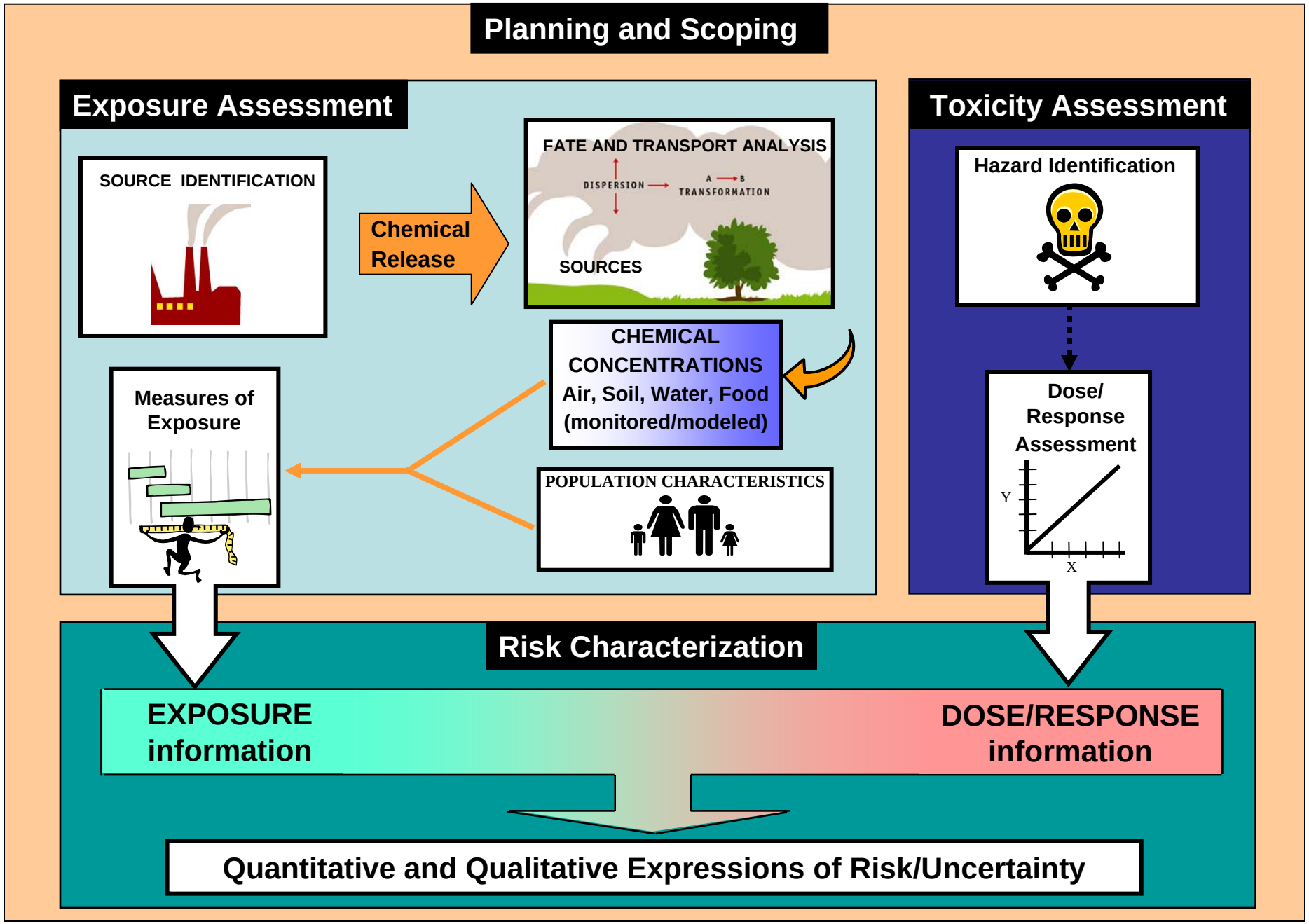
Courtesy of Sustaining the Environment and Resources for Canadians


WIND DIRECTION
DISPERSION
A → B
TRANSFORMATION
DRY DEPOSITION
WET
DEPOSITION
EVAPORATION/
REENTRAINMENT
AIR
BIOACCUMULATION IN FOOD
INGESTION
DERMAL
INHALATION
CANCER
TARGET
ORGAN/TISSUE
DISTRIBUTION
METABOLISM
STORAGE
ORGANS
TISSUES
BLOOD
FAT
OTHER NON-CANCER ENDPOINTS
RESPIRATORY EFFECTS
BIRTH DEFECTS
REPRODUCTIVE EFFECTS
NEUROLOGICAL EFFECTS
ETC.
EXCRETION
INTAKE/UPTAKE

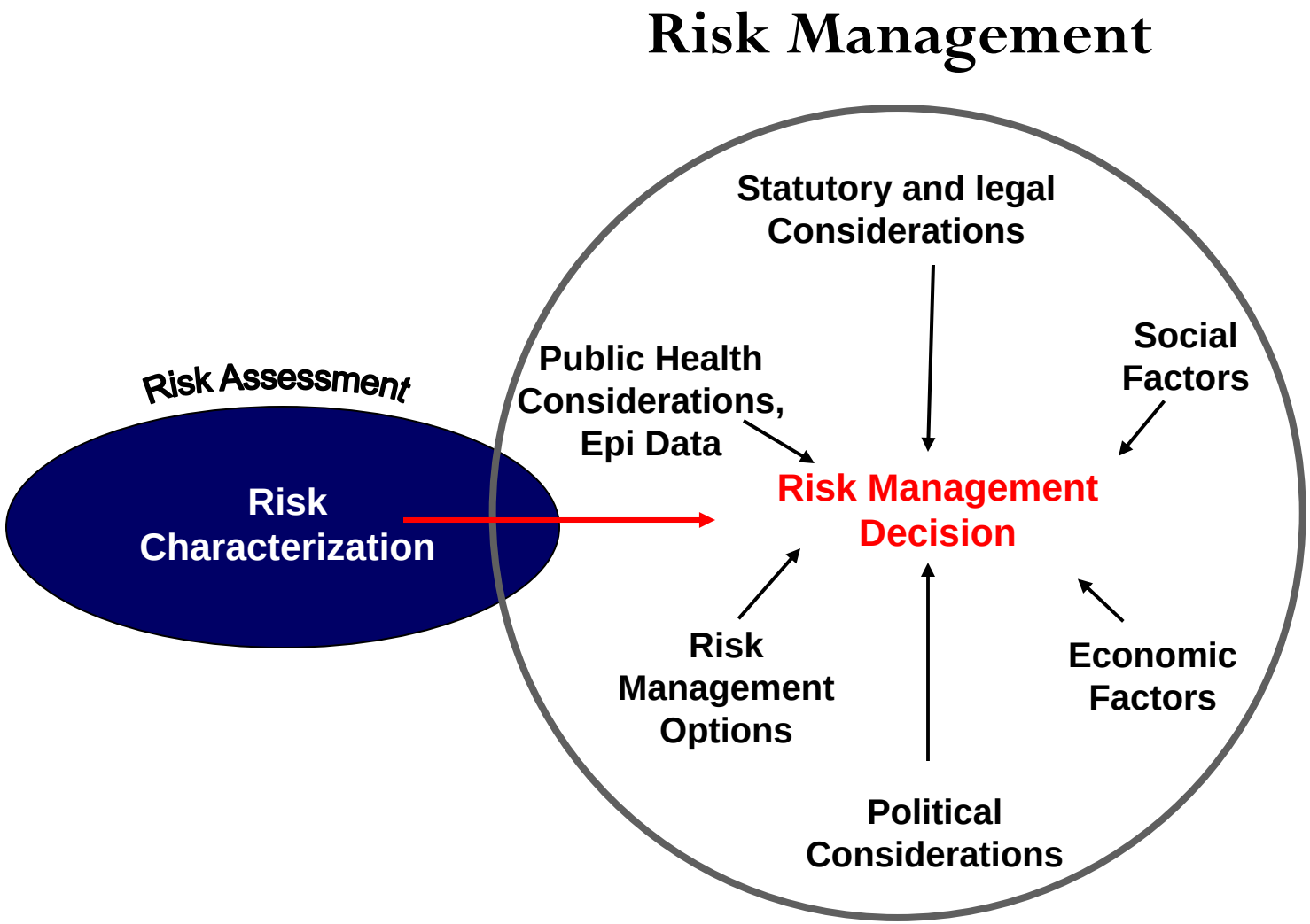
The General Risk Assessment Process



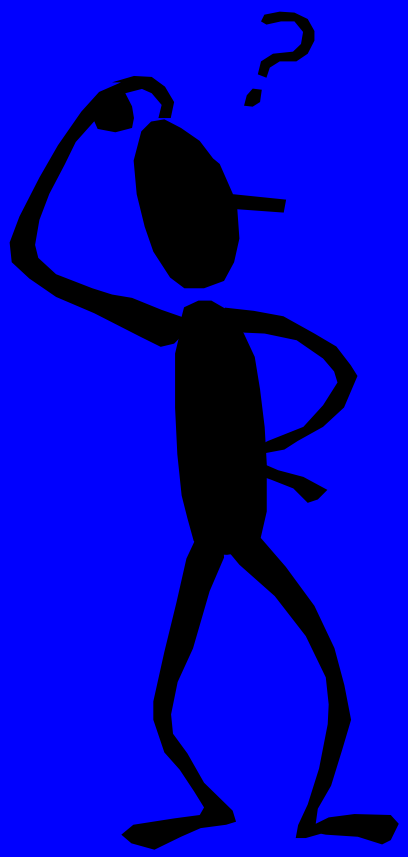
The Detailed Air Toxics Risk Assessment Process



Risk Assessment is only one element of decision making

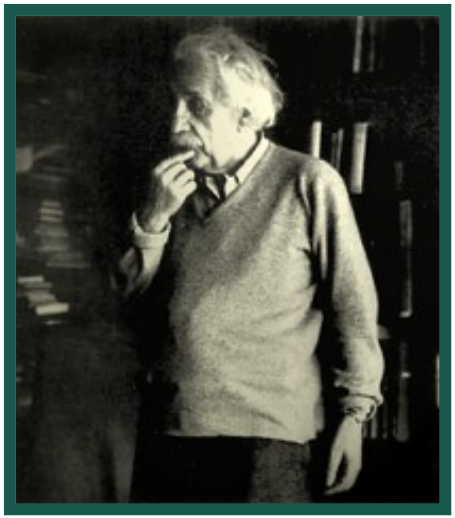


What is the role of monitoring data in evaluating exposure?



Monitoring for Risk Assessment Requires Good Upfront Planning and Scoping

- **Planning & Scoping is the first step of the air toxics risk assessment process. It is a deliberate and deliberative process that…**
  - Identifies the problems to be assessed
  - Identifies and engages, **at the outset**, all the necessary participants in the process
  - Sets the bounds of the analysis (i.e., elements to be included/excluded from the analysis)
  - Establishes a description of the interrelationship between stressors and receptors
  - Articulates the overall analysis plan for the assessment



"The formulation of a problem is often more essential than its solution."

Albert Einstein

Monitoring is most often used to evaluate exposure in a given place over (typically) two different timeframes…

Chronic Exposure

Long term (e.g., years to lifetime) exposure to (usually) relatively low levels of contaminant

Chronic exposures may result in *chronic effects* (cancer, chronic obstructive pulmonary disease, neurological problems, etc.)

Acute Exposure

Short term exposure (e.g., minutes, hours, days) to (usually) relatively high levels of contaminant

Acute exposures may result in *acute (and in some cases, chronic) effects* which can range from relatively mild (eye irritation), to extreme (an asthma attack), to fatal

Monitoring used to evaluate different exposure timeframes (cont.)…

Monitoring for Chronic Exposures

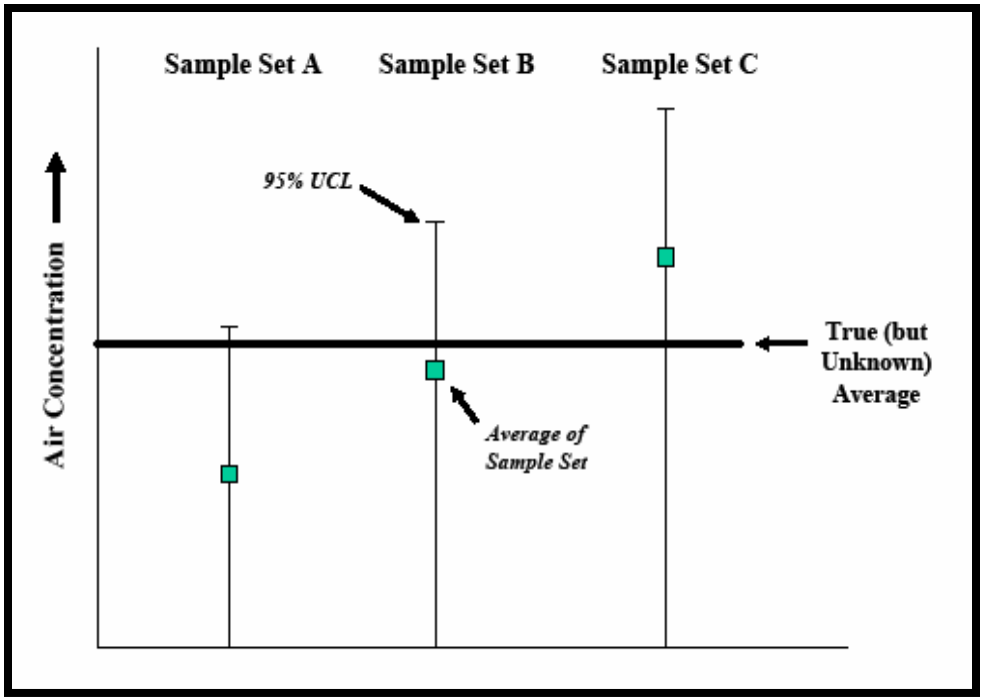
- **Typically, collect:**
  - Individual 24-h samples
  - Every 6 days
  - For a minimum of one full year
- **Combine full data set into an *annual average* that is used as a *surrogate* for long-term exposure**

Monitoring for Acute Exposures

- **Typically:**
  - ***Individual samples*** are used to evaluate the potential for acute exposures
  - ***No averaging*** is performed unless sample collection period is very short (e.g., “instantaneous monitors”)

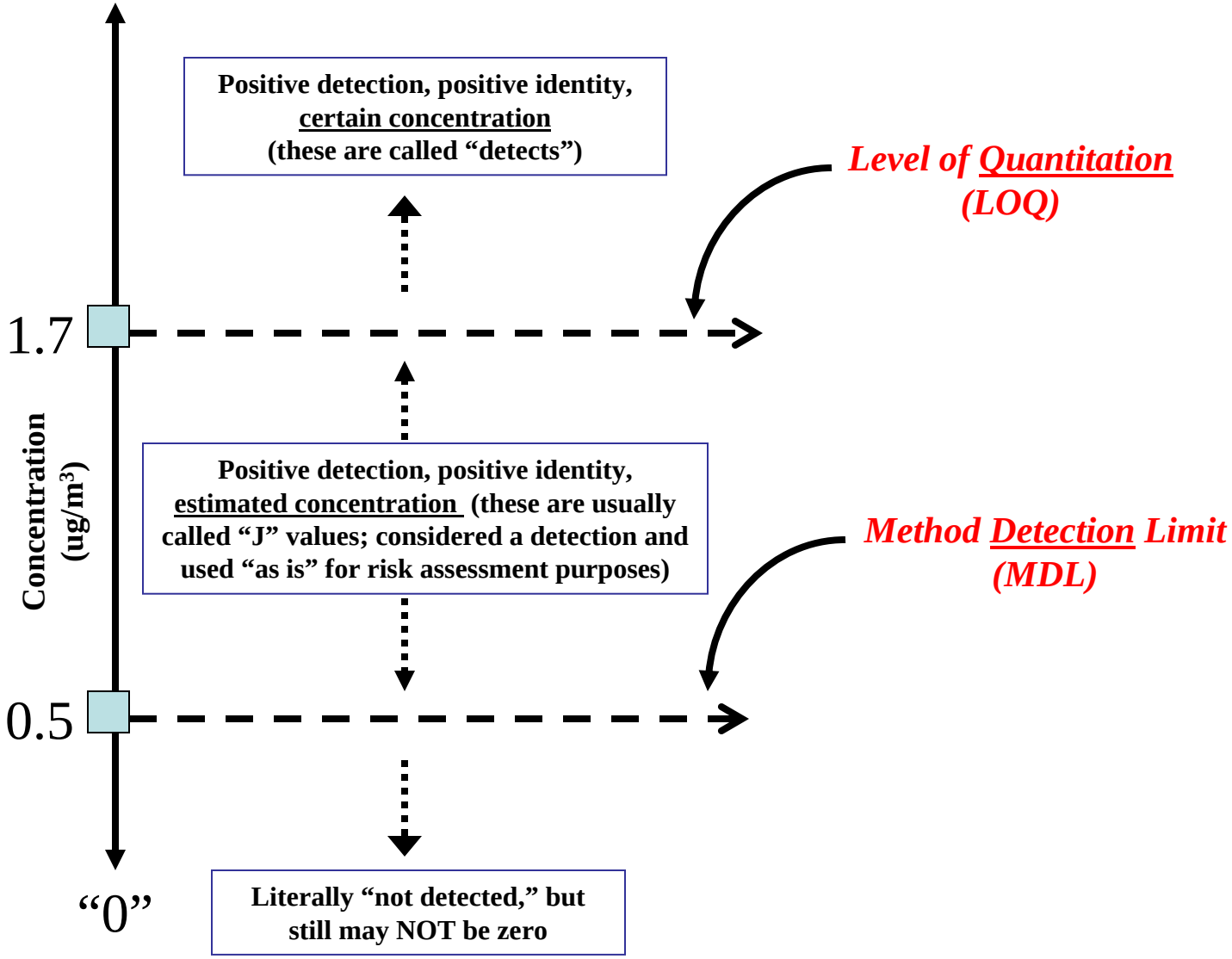
Monitoring for Chronic Exposure…. Nuance Number 1

- Calculating the annual average
  - The straight arithmetic average of the monitoring results is typically not considered sufficient to evaluate risk
  - The 95% Upper Confidence Limit (95% UCL) of the arithmetic average is commonly used instead*



*See: ATRA V1, Appendix I

Monitoring for Chronic Exposure….
Nuance Number 2 (Dealing with “Non-detects”)

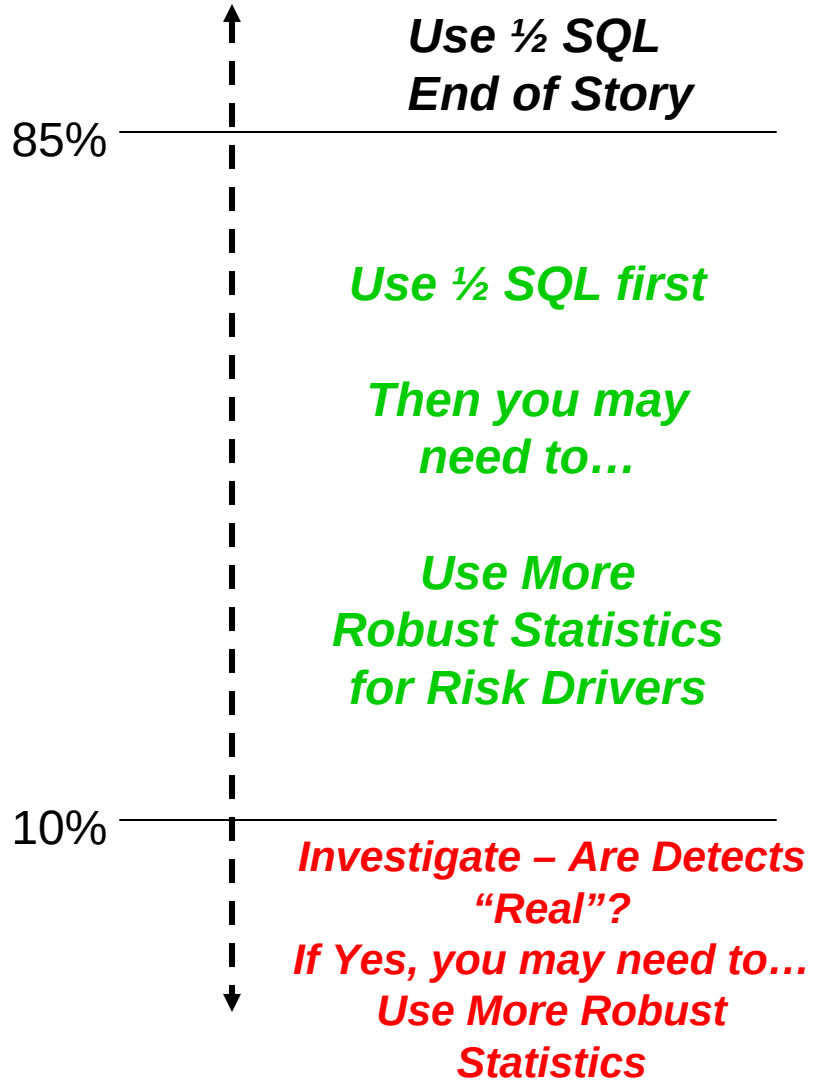


Monitoring for Chronic Exposure…. Nuance Number 2 (cont.)

- **Dealing with "non-detects" when calculating the 95% UCL**
  - How you incorporate non-detects in the averaging process can have a strong influence on the value of the 95%UCL
  - There are a variety of possibilities
    - MDL or ½ MDL as a surrogate concentration
    - SQL or ½ SQL as a surrogate concentration
    - Zero as a surrogate concentration
    - "More Robust" statistical methods
    - Etc.
  - Risk assessors typically use a **"<u>tiered approach</u>"** for dealing with non-detects

Monitoring for Chronic Exposure…. Nuance Number 2 (continued)

- **Non-detects - General Decision Rule**
  - If greater than 85% detects, use ½ SQL. Usually the end of the story.
  - If fewer than 10% detects, investigate whether they are "real" (i.e., is there a source? Were analytical limits low enough?). If yes, may need to use robust statistical methods to evaluate the non-detects
  - Between 85% and 10% detects
    - Use ½ SQL initially
    - May need to use more robust statistics for risk drivers



Monitoring for Acute Exposure….

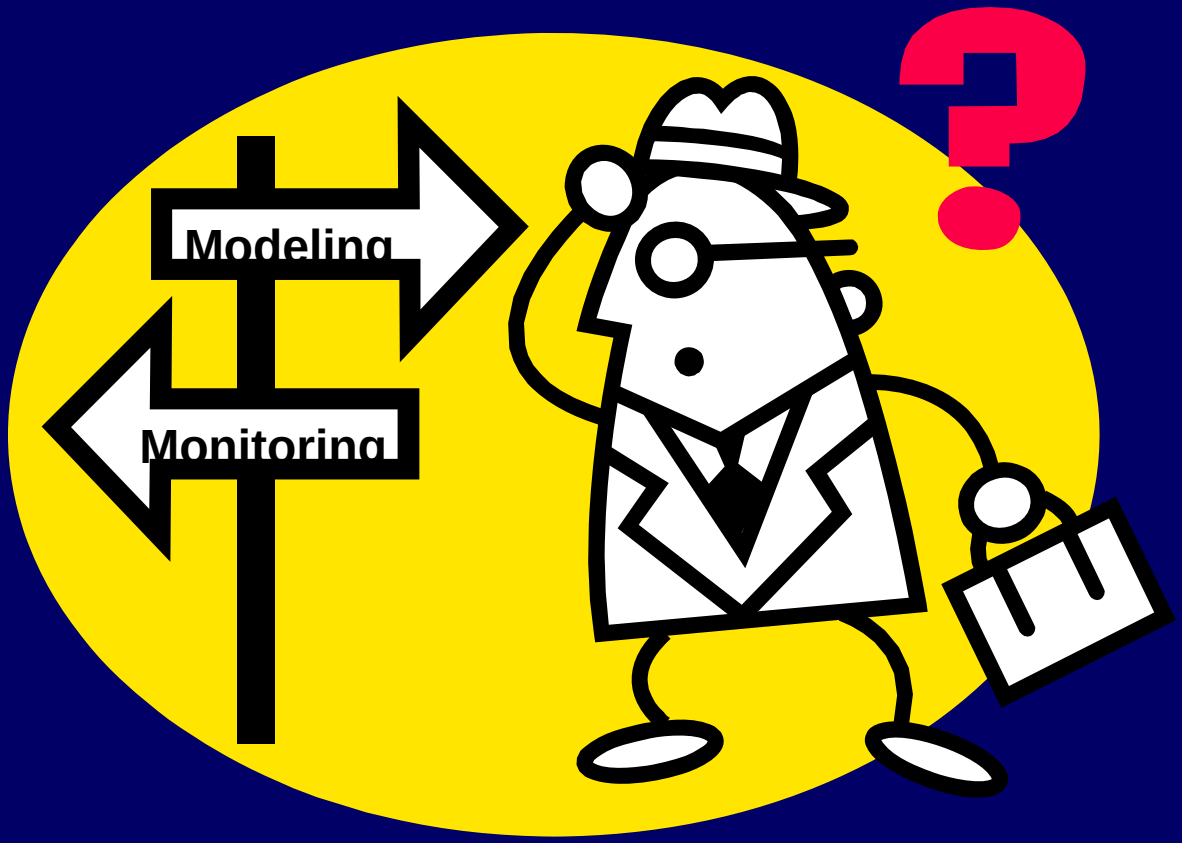
- **Not as straightforward as chronic exposure**
  - Acute toxicity values have been developed for purposes that vary more widely than chronic values
  - Some values are expressed as concentration-time matrices, while others are expressed as single concentrations for a set exposure duration
  - Some values may specifically consider multiple exposures, whereas others consider exposure as a one-time event
  - Some sources of acute values are intended to regulate workplace exposures, assuming a population of healthy workers exposed for a limited period of time each day and may also consider cost and feasibility

Monitoring for Acute Exposure….

- **OAQPS provides a list of available acute toxicity values***

Acute Dose-Response Values	AEGL-1 (1-h)	AEGL-1 (8-h)	AEGL-2 (1-h)	AEGL-2 (8-h)	ERPG-1	ERPG-2	MRL	REL	IDLH/10	TEEL-0	TEEL-1
CHEMICAL NAME	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3
Acetaldehyde					18	360			360		
Acetamide										25	75
Acetonitrile	22 [p]	22 [p]	390 [p]	170 [p]					84		
Acetophenone										10	30
2-Acetylaminofluorene										0.25	0.75
Acrolein	0.069 [i]	0.069 [i]	0.23 [i]	0.23 [i]	0.23	1.1	0.00011	0.00019	0.46		
Acrylamide									6		
Acrylic acid	4.4 [i]	4.4 [i]	140 [i]	41 [i]	5.9	150		6			
Acrylonitrile					22	77	0.22		19		
Allyl chloride					9.4	130			78		
4-Aminobiphenyl										0.5	1.5
Aniline	30 [f]	3.8 [f]	46 [f]	5.7 [f]					38		
Anisidine									5		
Antimony compounds									5		
Antimony pentafluoride										0.75	0.75

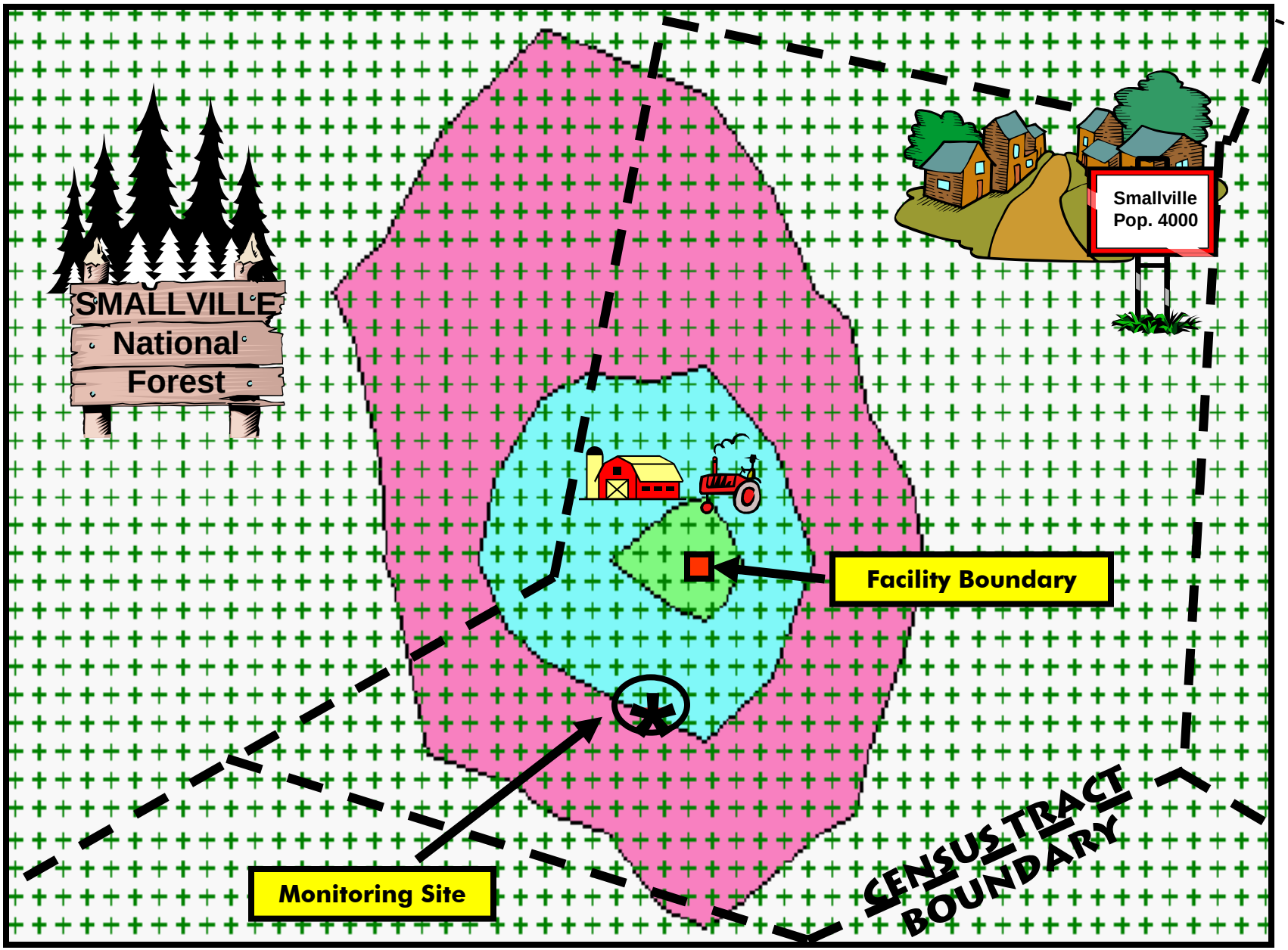
*(See: http://www.epa.gov/ttn/atw/toxsource/summary.html)



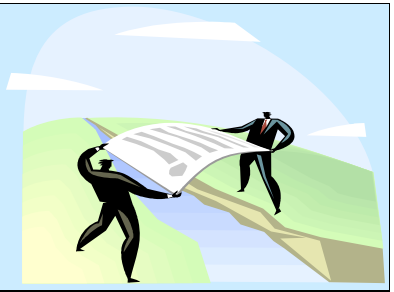
The interplay of monitoring and modeling for exposure assessment

To monitor or model….that is the question!

- Pick the correct tool (or combination of tools) for the questions you want to answer AND which will give you the quantity and quality of data needed to make decisions (e.g., is an exposure “safe”?)
- For exposure assessment, this typically means…
  - Use monitoring for “screening” level exposure assessments
  - Use modeling and a limited amount of monitoring for refined levels of exposure assessment (especially when there are multiple sources and chemicals and the exposure area is large)


SMALLVILLE
National
Forest
Smallville
Pop. 4000
Facility Boundary
Monitoring Site
CENSUS TRACT
BOUNDARY

For more information, see…



- **Air Pollution Risk Assessment (General)**
  - Air Toxics Risk Assessment (ATRA) Reference Library (Volumes 1-3)
    - Particularly, Volume 1, Chapter 10 and Appendices H & I
  - OAQPS Toxicity Values (Chronic & Acute)

    http://www.epa.gov/ttn/fera/

- **Region 4 Risk-based Screening Approach for Air Toxics Monitoring Data Sets**
  http://www.epa.gov/region4/air/airtoxic/athera1.htm

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