TOXICOLOGY RESOURCES FOR
INDUSTRIAL HYGIENISTS IN
EMERGENCY RESPONSE

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Objectives of Talk

- Roles of the IH in chemical emergency response
- Resource identification and selection - hazard and toxicity information
- Resource identification and selection - exposure limits alternatives
Role of the Industrial Hygienist

- **Common Role:**
  - Advisor to Onsite Incident Commander
    - Health effects of Concern and Relevant Exposure Limits
      - Exposure assessment strategy
      - Entry and control procedures
  - Toxicology information supports decision making!
  - Needs and resources differ based on response phase:
    - Planning
    - Initial Incident Response
    - Ongoing Response
    - Recovery and Clean-up
This process incorporates the fundamental concepts of toxicology – that for non-cancer effects, there is an exposure threshold below which exposure is safe and the onset of toxicity is a function of the exposure concentration.
Hazard and Toxicity Information

- Hazard and Toxicology Information Sources
  - Rapid response phase:
    - CHEMTREC®; MSDS; etc.
  - Planning or ongoing management phase:
    - TOXNET; Agency Toxicity reviews; EPA and EU chemical registration databases; etc.
  - Other integrated resources
    - CHEMM; HSDB, etc.
Using Toxicology Information

- Things to know:
  - Rapid sources of key target organs and effects
  - The difference between potential hazard and degree of potency; and the indicators of potency embedded in current information resources
  - Current hazard and labeling classifications
    - DOT placards and NFPA codes
    - European Union Risk-phrases
    - Globally Harmonized Systems (GHS)
    - H-phrases and symbols
  - The many sources of detailed toxicology summaries and their relevance and reliability (peer reviewed?)
Types of Exposure Guidance

- There are many sources and types of exposure limit information that can apply at different phases of an emergency response scenario:
  - Exposure duration
    - Acute versus chronic?
  - Exposure population
    - Responders, workers, general population?
  - Exposure frequency
    - Routine or infrequent?

- How do you find these and select one for your scenario?
Types of Acute Limits

Occupational Exposures

- Routine operations
  - ACGIH Threshold Limit Value (TLV®)
    - TWA, STEL or Ceiling Limits
  - AIHA Workplace Environmental Exposure Level (WEEL™)
    - TWA, STEL or Ceiling Limits

- Special occupational populations or scenarios
  - NIOSH Immediately Dangerous to Life or Health Values (IDLH)
  - U.S. EPA – pesticide limits for agricultural workers and new chemical registration
  - U.S. DoD – war fighter limits; submarine air quality, etc.
Types of Acute Limits

- **General Population Exposures**
  - **Routine Conditions**
    - U.S. EPA Acute Reference Values (ARE)
    - U.S. state values (often for facility permitting) such as California acute reference exposure limits (REL); Texas environmental screening levels (ESL)
  - **Non-routine operations**
    - NAS/NRC Acute Emergency Guideline Levels (AEGL)
    - AIHA Emergency Response Planning Guidelines (ERPG™)
    - DOE Temporary Emergency Exposure Levels (TEEL)
Dose-Response: AEGLS

Threshold Levels

DEATH

AEGL-3

Increasing likelihood of death

DISABLING

Impairment of ability to escape

Increasing severity of irreversible or other serious long-lasting effects

AEGL-2

Increase in notable discomfort

DISCOMFORT

Increasing severity of reversible effects (with or without signs/symptoms)

AEGL-1

DETECTABILITY

Increasing complaints of objectionable odor, taste, sensory irritation or other mild, non-sensory or asymptomatic effects
Types of Chronic Limits

- US EPA: Reference Dose (RfD); Reference Concentration (RfC)
  - Concentration of a chemical thought to be safe with continuous lifetime of exposure
- WHO or US FDA: Acceptable Daily Intake (ADI)
- ATSDR: Minimal Risk Level (MRL)
- Health Canada: Tolerable Daily Intake (TDI)
- IPCS: Tolerable Intake (TI)
Why Do You Need to Know?

- Increased duties outside of routine operations
  - In well controlled operations – periodic or task operations often greatest exposure concern
  - Increased role in evaluating off-site community exposures or releases for emergency response
  - Greater roles in events that affect the general population
- Preferred value may not be available
- Understanding basis of other values – allows for better judgments in:
  - Interpreting results for an existing value
    - Current value seems reasonable compared to array of existing values?
  - Filling gaps when an existing value is not available or may be out-dated
Selecting Among Resources

- How to decide which value among many
  - Mandated regulatory hierarchy
  - Other considerations to weigh in decision
    - Relevance of the guide value to the scenario of interest
    - The degree to which the exposure guidance includes current literature and methods (development and full review date)
    - Confidence in the value
      - Screening vs. full assessment
      - Robustness of limit setting process (e.g., authoritative agency, peer review, etc.)
Approaches to Identify Guidance

- Emergency Response
  - Contact emergency response resource – e.g., CHEMTREC® or the manufacturer MSDS contact number

- Planning
  - Search databases or contact organizations for specific reference value of interest
  - Compile array of relevant limits as a surrogate for the desired scenario limit
  - Seek to develop limits for values of interest
    - Nomination through ERPG™ Committee, etc.
    - Develop value with internal or consulting resources using current risk assessment methods with peer review
Resource Links Not Exhaustive

- **Hazard and Toxicology Databases**
  - EPA IRIS [www.epa.gov/iris](http://www.epa.gov/iris)

- **Exposure Limit Resources**
  - ACGIH TLV®
  - AEGLs [http://www.epa.gov/opptintr/aegl/](http://www.epa.gov/opptintr/aegl/)
  - NIOSH IDLH [http://www.cdc.gov/niosh/idlh/idlh-1.html](http://www.cdc.gov/niosh/idlh/idlh-1.html)
  - NIOSH RELS [http://www.cdc.gov/niosh/npg/default.html](http://www.cdc.gov/niosh/npg/default.html)

- **Integrated Emergency Response Information**
  - Chemical Hazards Emergency Medical Management (CHEMM) [near completion]
Integrative Resources Are Needed

- Increased need for “tool boxes” and decision support systems, ideally:
  - One-stop shopping
    - Rich source of toxicology data, and
    - Rich source of methodology information, and
    - User algorithms (or at least exports to user tools)
  - Tools to identify the most relevant content
    - Need access to everything, but want most relevant first: relevance sorting, quality filters, value of information tools, decision logics
  - Compatibility with mobile technology
    - Do we have an App for that?
Take Home Points

- The number of resources available is vast!
- Part of effective planning process is knowing ahead of time where to get health hazard and exposure limit information
- A process is needed to prioritize and select among available resources
- The utility of the resources will vary by the
  - Phase of the response
  - The nature of the scenario
- New efforts to develop integrated data resources and decision tools to help — see next talk!