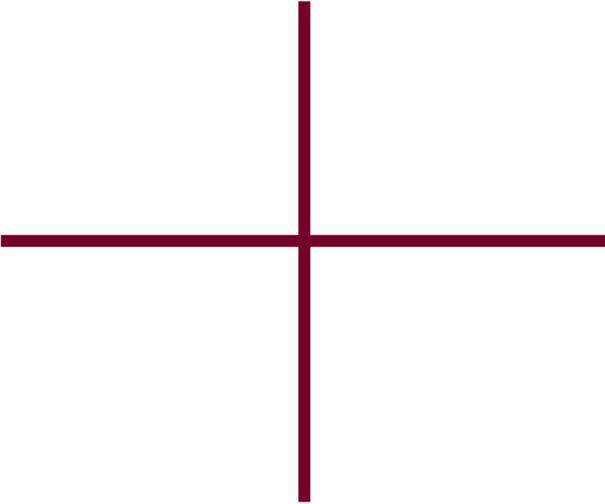




# Methodology for the Development of Health Hazard Ratings for Chemical Products



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# Background

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- Began creating SRS Hazard Ratings ~1993
- Developing ratings for pure substances and a few mixtures
- Based on available published data
- Created on an as-needed basis
  - Tanks
  - Secondary Containers
  - Damaged Labels

# Background Continued

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- Based on NFPA 704
- Major effort in 2004-5 driven by the revision of DOE O151.1

# Team Effort

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- Each member worked independently
- Entire team collectively reviewed the ratings
- Diverse backgrounds
  - PhD Chemical Engineering
  - MS Chemistry
  - MS Industrial Hygiene
  - BS Health & Safety

# Team Effort

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- Independent (2<sup>nd</sup>) team reviewed completed ratings
- Diverse backgrounds
  - BS Chemical Engineering
  - BS Chemistry
  - BS Industrial Management

# Considerations

- Health issues
  - acute toxicology
  - acute physical hazard
- Routes of entry
  - inhalation, dermal, and oral
- Biological model, NFPA 704 and other codes use
  - LC50-Albino Rat weighting 200 to 300 grams
  - LD50 oral-Albino Rat weighting 200 to 300 grams
  - LD50 dermal-Albino Rabbit weighting 2 to 3 kilograms
- The problem with this is that the available toxicological data frequently is not for one of the above combinations.

# Typical Data

- Routes of entry cited (not all inclusive)
  - Dermal
  - Inhalation
  - Intraperitoneal
  - Intravenous
  - Oral
  - Subcutaneous
- Biological Model cited (not all inclusive)
  - Cat
  - Dog
  - Fowl (Chicken, Duck, Wild Bird)
  - Guinea pig
  - Hamster
  - Human (Man, Woman, Child)
  - Mammal
  - Mouse
  - Raccoon
  - Rat
  - Rodent

# Possible Combinations

- Toxicological – LC Preferred Model
- Toxicological – LD dermal Preferred Model
- Toxicological – LD oral Preferred Model
- Physical
- Toxicological – LC Interpreted Model
- Toxicological – LD Dermal Interpreted Model
- Toxicological – LD Oral Interpreted Model
- Toxicological – LD Interpreted Model  
(both route and species)

# Methodology

- Start By Prioritizing routes of entry based on material state
  - Inhalation, Dermal, Oral
  - Material state {G, L, S (powder)}
- Review Mfr's MSDS for Ratings and/or data
  - NFPA and/or HMIS
  - Toxicological Data {LC50, LD50, etc.}
  - Inhalation rating Using DOT or UN Criteria
  - Dermal and Oral Hazard Considerations Using UN Criteria

# Methodology Continued

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- Compare against existing ratings
- Generate rating based on available data
- Mixtures
  - Synergistic and/or anti-synergistic behaviors

# Case 'A' – Verifiable MSDS data preferred model (Pure Chemicals)

- Review the MSDS for:
  - Toxicological data – confirm using RTECS and/or another source
  - Physical hazards such as corrosive
  - Health rating - (NFPA or HMIS)\*
  - Review other manufacturers' MSDS existing ratings
  - Other health info such as State/DOT/UN
- \* Note: Some manufacturers like J.T. Baker and Kodak have their own ratings system, which may not use the same criteria and therefore cannot be used

# Case 'B' – Verifiable MSDS data not preferred model (Pure Chemicals)

- Review the MSDS for:
  - Toxicological data – confirm using RTECS and/or other sources
  - Physical hazards such as corrosive
  - Search for additional data
  - Health rating - (NFPA or HMIS)
  - Review other manufacturers' MSDS existing ratings
  - Other health info such as State/DOT/UN
  - Capture the fact that the health rating is generated from data that did not use the preferred model

# Case 'C' – Inadequate or no verifiable data (Pure Chemicals)

- Manufacturer supplies an Estimated Value
  - Check Other Mfrs, Use Most Conservative
- Extrapolating Between Species
  - Risky, no real trends
- Extrapolating Between Similar Inorganic Chemicals
  - Risky but possible with a good knowledge of chemistry and toxicology
- Extrapolating Between Similar Organic Chemicals
  - Don't! Rare exception (some poly-alcohols, fats, waxes)

# Case 'C' Continued

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- TLVs, PELs, or TEELs
  - No, not necessarily based on toxicology
- Use of AEGLs and ERPGs
  - Yes, good but limited number of them
- Use of Similar Physical Characteristics
  - Limited, but possible {example – short chain amines}

# Case 'D' – Any/All of the above Cases for Mixtures

- Evaluate the individual components and assign each a rating
- Evaluate the potential interactions between the various components
  - Is there a synergistic effect:
    - The damage caused by the combined effect of n-hexane and methyl ethyl ketone on the nervous system is far greater than the sum of either of these substances acting alone
  - Is there a potentiation effect:
    - A dilute acid or base solution that would not be considered corrosive because of pH, but would become corrosive with the addition of a small amount of a 'harmless' (rating of 0) surfactant.

# Summary

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- MSDS is the first source of information
- Use preferred model if possible
- Verify data when possible (lit search)
- If extrapolating use extreme care
- Flag estimated values
- Independent review

# Info Sources (Some)

- *Registry of Toxic Effects of Chemical Substances (RTECS):*  
• <http://www.cdc.gov/niosh/rtecs/default.html>
- *The Agency for Toxic Substances and Disease Registry (ATSDR):*  
• <http://www.atsdr.cdc.gov/toxpro2.html>
- *The International Agency for Research on Cancer (IARC):*  
• <http://monographs.iarc.fr/>
- *National Toxicology Program (NTP):*  
• <http://ntp.niehs.nih.gov/>
- *National Institute of Occupational Safety and Health (NIOSH):*  
• <http://www.cdc.gov/niosh/homepage.html>
- *Toxicology Data Network (TOXNET):*  
• <http://toxnet.nlm.nih.gov/>
- *The Risk Assessment Information System (RAIS):*  
• <http://rais.ornl.gov/tox/metadata.shtml>
- *American Conference of Governmental Industrial Hygienists (ACGIH):*  
• <http://www.acgih.org/home.htm>
- *Comparative Toxicogenomics Database (CTD):*  
• <http://ctd.mdibl.org/>

# Requesting the *SRS*

## *Chemical Products Hazard Ratings*

- DOE personnel
  - Submit an email to the following requesting the document:
  - [jean.campbell@srnl.doe.gov](mailto:jean.campbell@srnl.doe.gov)
  - (803-725-3852)
- Other Federal Agency Personnel
- DOE Subcontractors
  - Submit an email to [jean.campbell@srnl.doe.gov](mailto:jean.campbell@srnl.doe.gov)
    - » (803-725-3852)
  - with the following information:
    - Name of the Company
    - Name of the Requestor (title, department, email address, phone)
    - Federal Contract Number
    - Mailing Address

# Requesting the *SRS*

## *Chemical Products Hazard Ratings*

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- Private Companies
- Other Agencies (City, County, State Governments)
  - These requestors will be required to work out licensing arrangements.
  - Please contact Licensing Specialist:
- Eric Frickey at 803-725-0406.
- [eric.frickey@srnl.doe.gov](mailto:eric.frickey@srnl.doe.gov)
- 803-725-0406