Haz-Map

A Project to Map Occupational Toxicology Information into a Relational Database

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Outline of Talk

- Haz-Map Basics
- Precursor of Haz-Map
- Information Sources
- Updating the Database
- Peer Review of Methods and Content
- Conclusions

Chemicals Added to Database

- First content added: 700+ chemicals from the NIOSH Pocket Guide.
- Each chemical flagged for adverse effects.

Controlled Vocabulary of Adverse Effects

Category	Adverse Effects
Lung Toxin	Asthma, Pneumonitis, Chronic Bronchitis, and Fibrosis
Neurotoxin	Neuropathy, Parkinson's Syndrome, and CNS Solvent Syndrome
Hematotoxin	Methemoglobinemia, Aplastic Anemia, and Hemolytic Anemia
Dermatotoxin	Contact Dermatitis, Chloracne, and Skin Burns
Carcinogen	Known, Probable, or Possible
Other Tissue Toxin	Hepatotoxin, Nephrotoxin, and Reproductive Toxin
Other Poison	Organophosphate, Carbamate, Organochlorine, Uncoupler, Chemical Asphyxiant, and Simple Asphyxiant

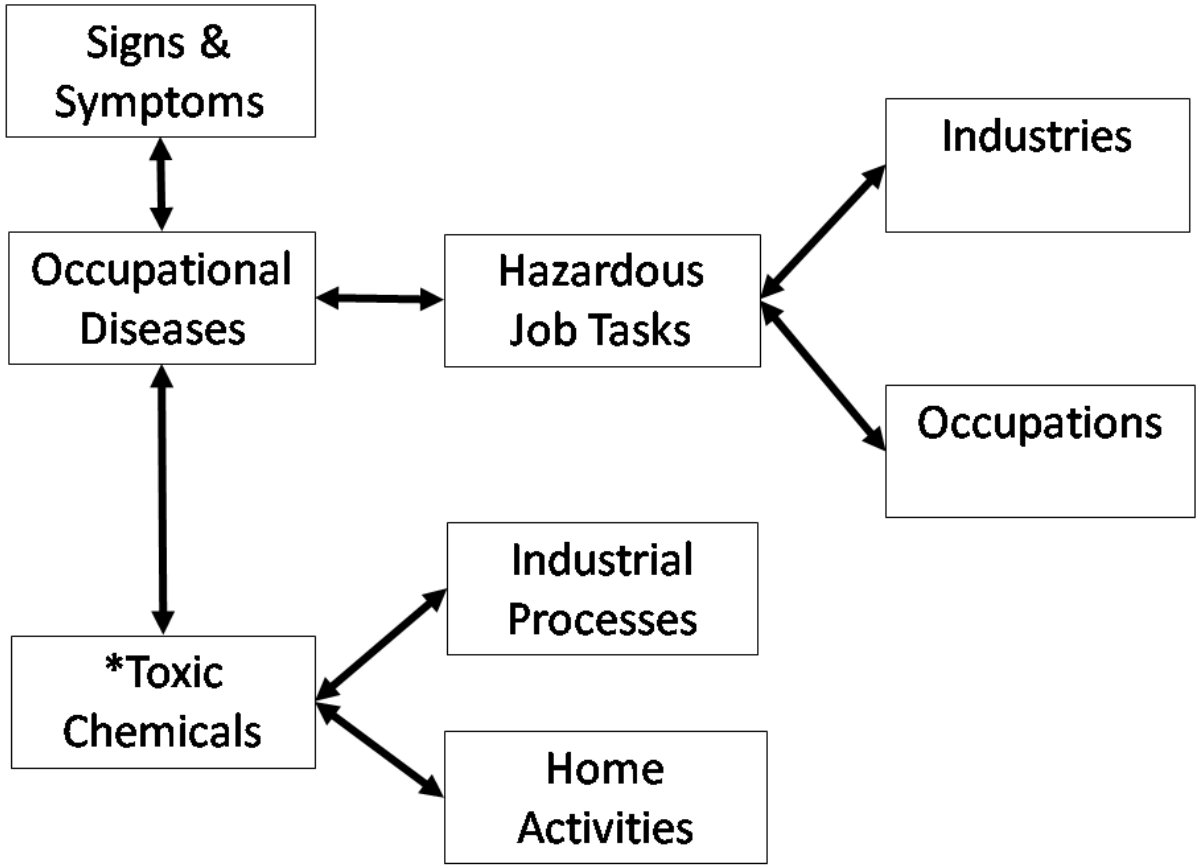
Distilling and Indexing Scientific Information

- Distilling refers to the process of sifting through the information for inclusion or exclusion.
- Only the most useful information is included.
- The information should help the user to distinguish between significant and harmful exposures.
- Given the user received a specific dose, what is the probability of harm?

Occupational Diseases Are Preventable If the Causes Are Correctly Identified

- By removing the worker from exposure;
- By removing the exposure from the workplace;
  - Ban chemical;
  - Enclose process;
  - Establish exposure limit;

Eight Major Tables in Haz-Map

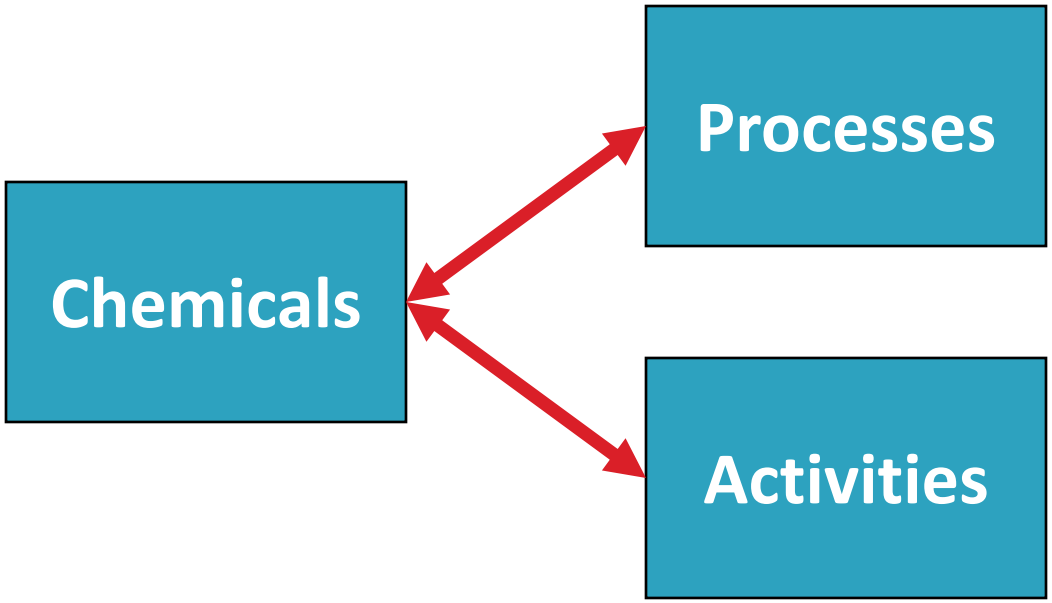


**Toxic chemicals include biological agents, e.g., latex rubber and grain dust.*

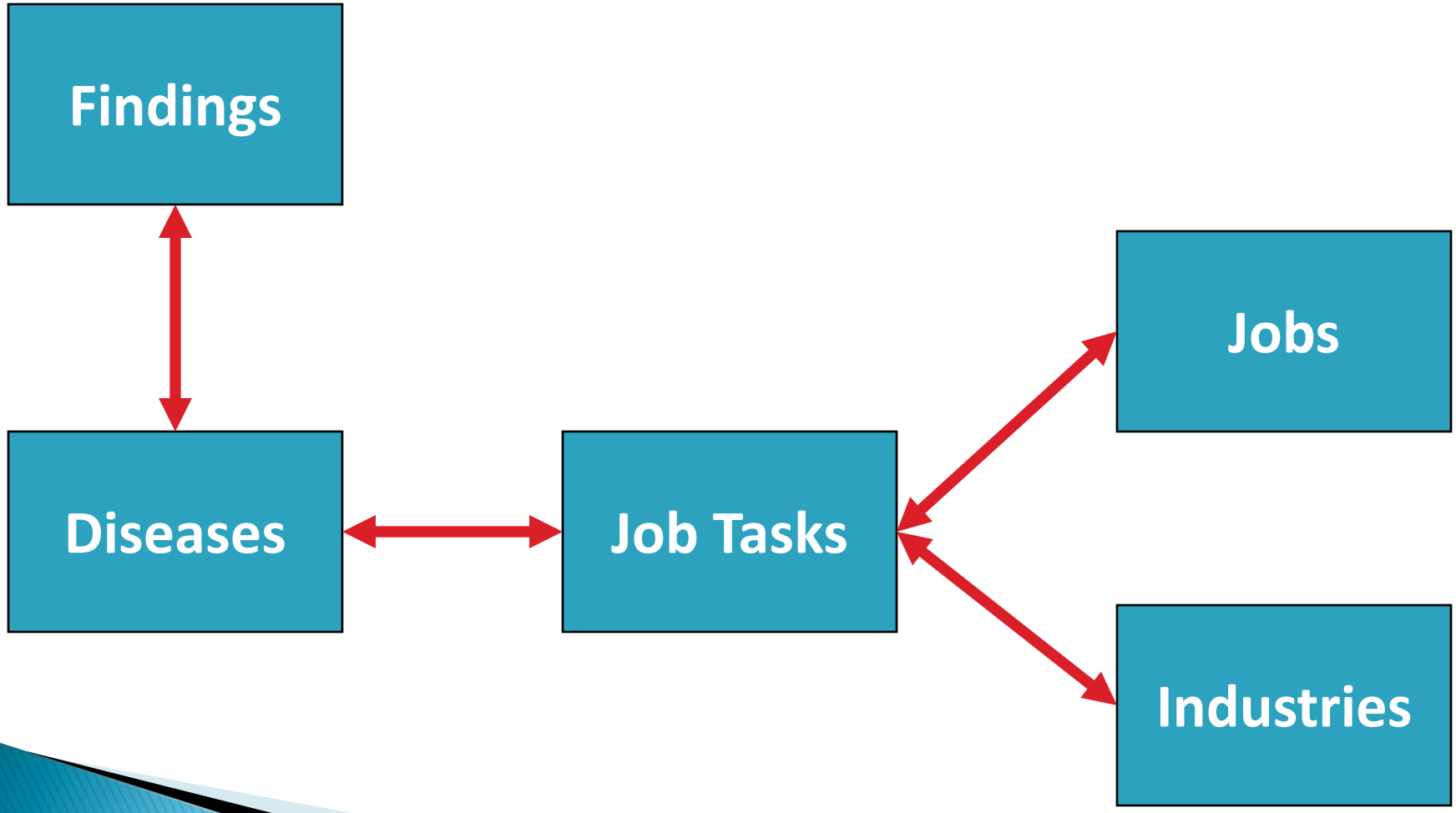
Each Table Contains Records

235 Diseases	5998 Agents (Chemicals)
227 Job Tasks	54 Processes
277 Jobs	27 Activities
624 Industries	122 Findings

The Chemicals Level



The Diseases Level



Hazardous Job Tasks

- A total of 227 job tasks and 277 jobs in Haz-Map.
- Jobs in Haz-Map are defined by the SOC (Standard Occupational Classification) system.
- A total of 2178 links between job tasks and jobs.
- A few examples of hazardous job tasks are shown in the next two slides.

Examples of 227 Hazardous Job Tasks

- Manufacture polyurethane products;
- Remove insulation installed before 1975;
- Extract coal;
- Inhale dust of moldy hay, silage, straw or grain;

Examples of 227 Hazardous Job Tasks

- Handle medical needles or surgical instruments;
- Operate internal combustion engine with inadequate ventilation;
- Repair or maintain gasoline or jet fuel tanks;
- Remove lead coatings;

Precursor of Haz-Map

- Sentinel Health Events

NIOSH Sentinel Health Events (Occupational)

- SHE(O)s first published by Rutstein et al. in 1983 and updated by Mullan and Murthy in 1991.
- 64 occupational diseases linked to causal agents and associated industries.
- “This list may serve as a framework for occupational health surveillance at the state and local level. It may also be used as a guide for practicing physicians caring for patients when there is a question of occupational illness.”

SHE(O)s Compared to Haz-Map

Occupational Diseases	SHE(O)	Haz-Map
Occupational Infections	20	105
Occupational Cancer*	13	19 (7 with no linked agents)
HP	4	30
Other	27	81 (7 SHE(O) diseases not added)
Total	64	235

**In Haz-Map, all leukemias are combined and scrotal cancer is not listed separately from skin cancer.*

SHE(O)s Compared to Haz-Map

- SHE(O)s not in Haz-Map: silotuberculosis, tetanus, talcosis, agranulocytopenia, cerebellar ataxia, carpal tunnel syndrome, and mononeuritis.
- In Haz-Map, but not in SHE(O) list: COPD, RADS, IVCD, oil acne, chloracne, contact urticaria, pneumoconiosis (benign & other), asphyxiation (simple & chemical), inhalation fever, metal poisoning (Mn, Cd, Cr, Hg, Pb, As) and other poisoning (fumigants, PCP, HF, DDT, and carbamates/organophosphates).

Information Sources

- Scientific textbooks and Internet resources.

Haz-Map Sources of Information

- Best and most up-to-date journals, monographs, textbooks, online databases, and websites;
- Sources of information in Haz-Map are referenced. For example, the reference tag [Sullivan, p. 79] refers to the Sullivan & Krieger textbook.
- See http://www.haz-map.com/refernc.htm for a complete bibliography and a list of all reference tags.

Internet Resources

- ChemIDplus
- ExPub
- Use these two portals to enter the name or CAS number of a chemical and to find information from many different websites.

Occupational Diseases

- In which links between diseases and occupational exposures are established.

Metals and Occupational Diseases

Disease Name	Caused by Compounds Containing
Toxic Neuropathy	As (inorganic); Tl; Pb; Hg
Pneumoconiosis, Other	Sb; Rare Earth Metals
Pneumoconiosis, Benign	Fe; Ba; Sn; Sb; Rare Earth Metals
Parkinsonism	Mn
Bone Cancer	Pu; Ra
Nasal Sinus Cancer	Ni; Ra
Skin Cancer	As (inorganic)
Occupational Asthma	Cr(VI); Ni
Contact Dermatitis, Allergic	Ni; Cr(VI)
Acute Tubular Necrosis	Cr(VI); U; Pb
Chronic Renal Failure	Cd; Pb

Health Effects of Ionizing Radiation

- See the chapter on "Ionizing Radiation" by John D. Boice, Jr. in *Cancer Epidemiology and Prevention*, edited by Schottenfeld & Fraumeni.
- "Fourteen epidemiologic studies have been conducted of more than 120,000 workers at uranium processing, enriching, metal fabrication, and milling facilities. These studies overall found no cancer to be significantly increased." [Boice, p. 274]

Chemicals Linked to Occupational Cancer

- See the chapter on “Occupation” by Siemiatycki, Richardson, and Boffetta in *Cancer Epidemiology and Prevention*, edited by Schottenfeld & Fraumeni.
- “Over the past 50 years, it is likely that the number of occupationally induced cancers has decreased in western countries.” [Siemiatycki, p. 344]

Updating the Database

- Continually reviewing and redrawing the map.

Adding and Updating Chemical and Disease Profiles

- All textbook references are reviewed when new textbook editions are published.
- A review of 663 chemicals added to Haz-Map in the 1990s was completed 3/8/2008.
- Another review of 156 chemicals added in the 1990s was completed 10/14/2011.
- 2400 chemicals from the HSDB database were added to Haz-Map in 2010.
- Ten diseases and approximately 600 chemicals were added in 2011.

2002 Review of Journals

- A review of selected epidemiology and occupational medicine journals for the period of 1998–2002 yielded 696 abstracts and 216 full-text articles.
- As a result of the review, some content was changed and hyperlinks to PubMed abstracts were added.

2008 Review of Journals

- Reviewed were all articles from Jan. 2005 through May 2008 in: Am J Ind Med, Chest, Int Arch Occup Environ Health, J Occup Environ Hyg, J Occup Environ Med, Occup Environ Med, and Scand J Work Environ Health.
- 284 papers selected to read and add to Haz-Map in the categories: Beryllium (12), Respiratory Diseases, (24), Solvents (16), Neurodegenerative Diseases, (4), Pesticides (4), Benzene (2), Welding (7), Toxicology (3), Cancer (49), Metals (28), OA (30), PFTs (7), Jobs (15), Farming (13), Silica (21), HP (9), CWP (4), and Other (36).

2011 Review of Journals

- The same journals as in 2008 from 6/08 through 1/11 were reviewed.
- Of the 256 articles selected to read, 13 were added as Haz-Map hyperlinks, 17 to a PubMed list on my website, and 56 as PMID references in Haz-Map text.

More Research Needed

- I looked for diseases and agents not in Haz-Map—checked 7 occupational medicine textbooks plus Schottenfeld and read about 200 papers retrieved from PubMed.
- These are diseases with no established chemical causes in the occupational setting: atherosclerosis, hypertension, solvent-induced hearing loss, porphyria cutanea tarda, rheumatoid arthritis, and scleroderma.
- None of these diseases were listed as a SHE(O)s in the 1991 paper by Mullan and Murthy.

Peer Review of Haz-Map Methods and Content

- Digital and Analog Textbooks

Not Like Editing a Textbook

- Create the index (controlled vocabulary) first, instead of making the index at the end.
- Publish the next edition in a few months rather than in a few years.
- Update information using the software (Microsoft Access) to sort or find by any field, e.g., CAS #, formula, synonym, or category.
- Use hyperlinks to connect to PubMed abstracts or to other web pages, e.g., EPA, OSHA, NIOSH, or IARC.

Like Editing a Textbook

- The editor chooses which information to include or exclude.
- The editor requires that all references are up to date and from the peer-reviewed literature.
- The editor ensures that all chapters are written clearly, topics are covered in a consistent manner, and indexing is accurate.
- After completion, the editor submits the new edition to a publisher for final layout design and copy editing.

Haz-Map Review Environment Since 2000 (NLM) and 2006 (DOL)

- Reviewed monthly in teleconferences with DOL and Paragon professional staff.
- New chemical profiles reviewed by Ann Gravatt, who has worked for many years on NLM's HSDB, and Paragon's Bernie Kokenge, PhD (chemistry).
- Mike Hazard, PhD (chemistry) and author of ChemIDplus, reviewed information in Haz-Map when it was first published in 2002.
- Bert Hakkinen, PhD (toxicology) has reviewed Haz-Map topics in his work at NLM since 2008.

Conclusions

- Haz-Map is a peer-reviewed and scientifically rigorous database of toxic chemicals and preventable occupational diseases.
- Diseases are included only if there is sufficiently robust evidence that occupational exposure can cause the diseases, and therefore, that the diseases can be prevented by good occupational hygiene practices.
- It is up to future mapmakers to build a better map and to fill in the details as more complete knowledge is discovered.