How to Use Haz-Map

A Relational Database of Hazardous Chemicals and Occupational Diseases

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WHAT IS HAZ-MAP?

- A relational database of occupational toxicology accessible on the NLM website 2002-2019 and now at haz-map.com;
- Collects into one database the best information available regarding occupational exposures and diseases and supports the early recognition and prevention of work-related diseases;
- Links chemicals to occupational diseases, in which causality has been established by current scientific evidence;

HAZ-MAP BEGAN WITH A QUESTION.

- "Why can't we have a relational database of toxic chemicals and occupational diseases to store and query information similar to ones used by companies to manage data about employees, products, and customers?"

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

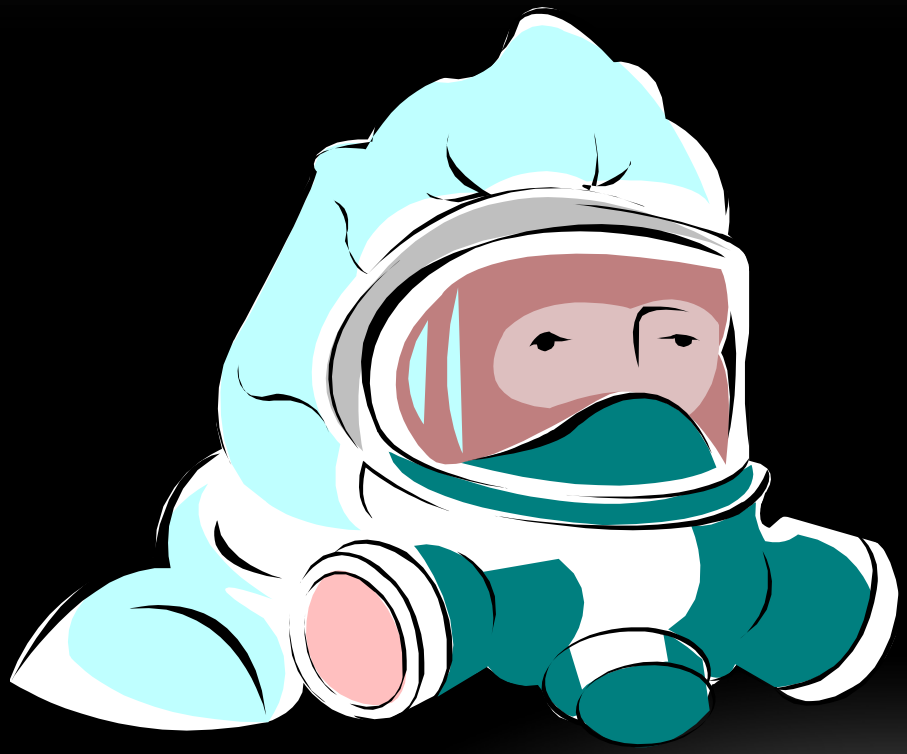
ADVERSE EFFECTS IN HAZ-MAP

- The most important adverse effects in occupational toxicology, based on my research;
- Each chemical is flagged with all adverse effects that apply;
- Adverse effects include those seen in high-dose animal experiments and in human cases of poisoning by ingestion;
- Not the same as occupational diseases;

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 harmless exposures.
- Given the worker 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;

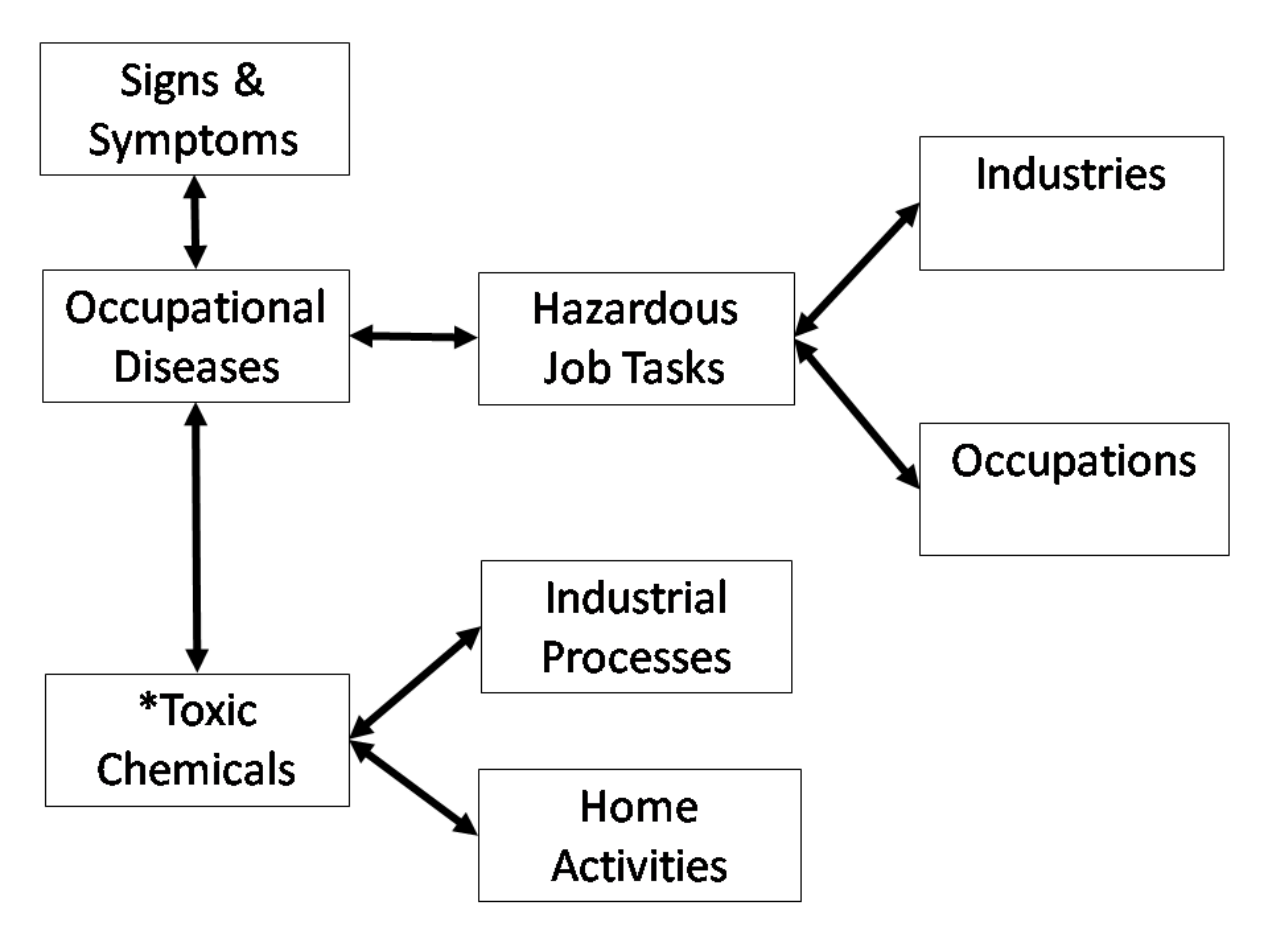
WHAT IS A TLV?

- "The concentration in air to which it is believed that most workers can be exposed daily without an adverse effect (i.e., effectively, the threshold between safe and dangerous concentrations). The values were established (and are revised annually) by the ACGIH and are time-weighted concentrations (TWA) for a 7- or 8-h workday and 40-h workweek, and thus are related to chronic effects. A short-term exposure limit (STEL) is defined as a 15-min TWA exposure, which should not be exceeded at any time during a workday even if the 8-h TWA is within the TLV-TWA." IUPAC Gold Book

DISEASES INCLUDED IN HAZ-MAP

- 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.

EIGHT MAJOR TABLES IN HAZ-MAP



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

EACH TABLE CONTAINS RECORDS

240 Diseases

242 Job Tasks

261 Jobs

624 Industries

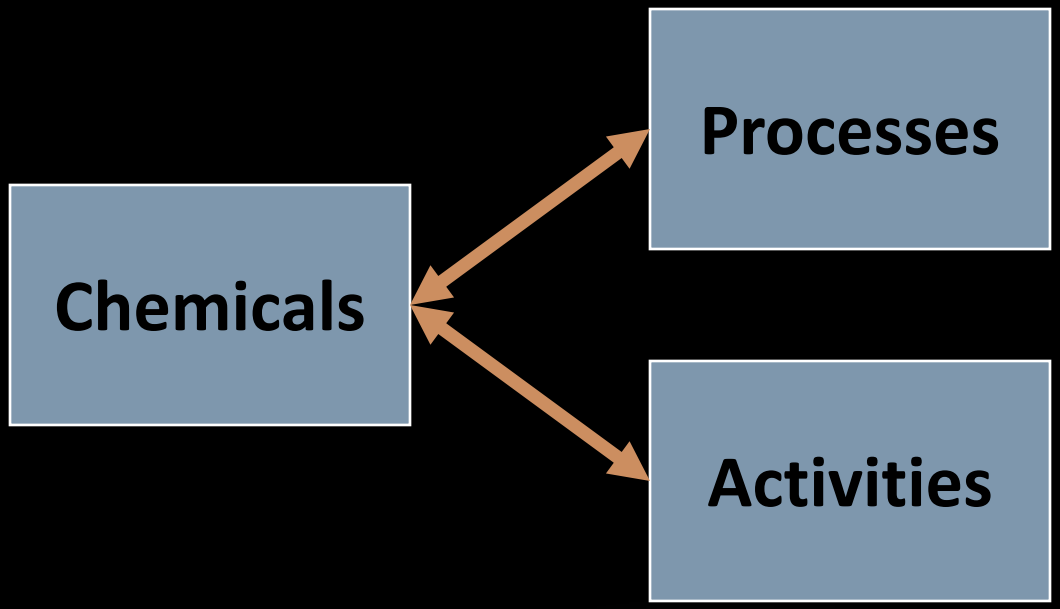
12,196 Agents (Chemicals)

54 Processes

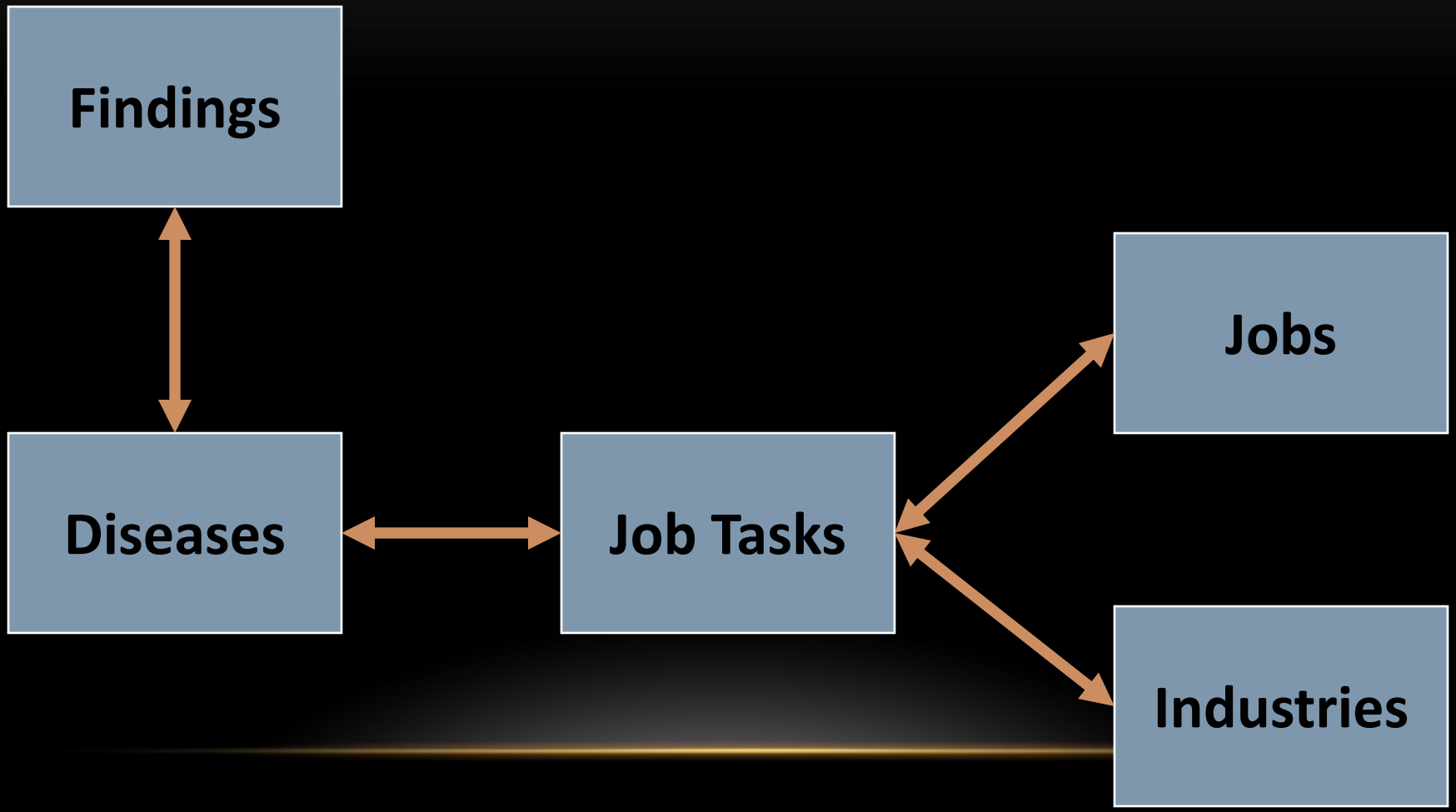
27 Activities

121 Findings

THE CHEMICALS LEVEL



THE DISEASES LEVEL



HAZARDOUS JOB TASKS

- A total of 243 job tasks and 261 jobs in Haz-Map.
- Jobs in Haz-Map are defined by the SOC (Standard Occupational Classification) system.
- A total of 2116 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;

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.”

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 “References” for a complete bibliography and a list of all reference tags.

WHAT IS EXPOSURE ASSESSMENT?

- “Exposure assessment is the quantification and evaluation of the dose of chemical incurred from the exposure situation under consideration.” [Sullivan, p. 79]
- “Exposure assessment is the step that quantifies the intake of an agent resulting from contact with various environmental media (e.g., air, water, soil, food). . . . It determines the degree of contact a person has with a chemical and estimates the magnitude of the absorbed dose.” [Hayes, p. 477]

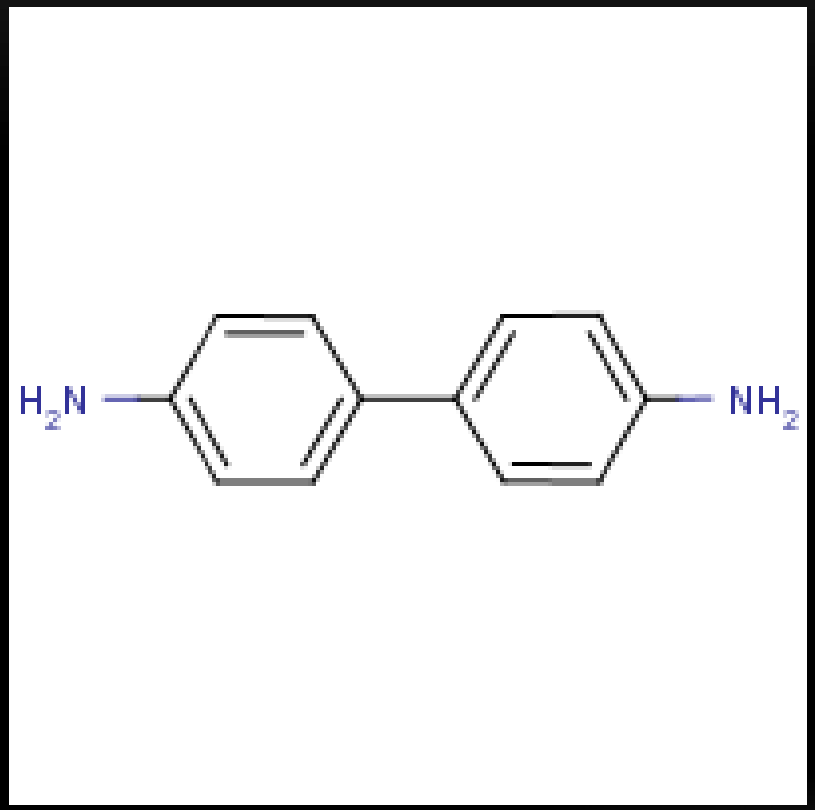
WHAT IS A TOXIC CHEMICAL?

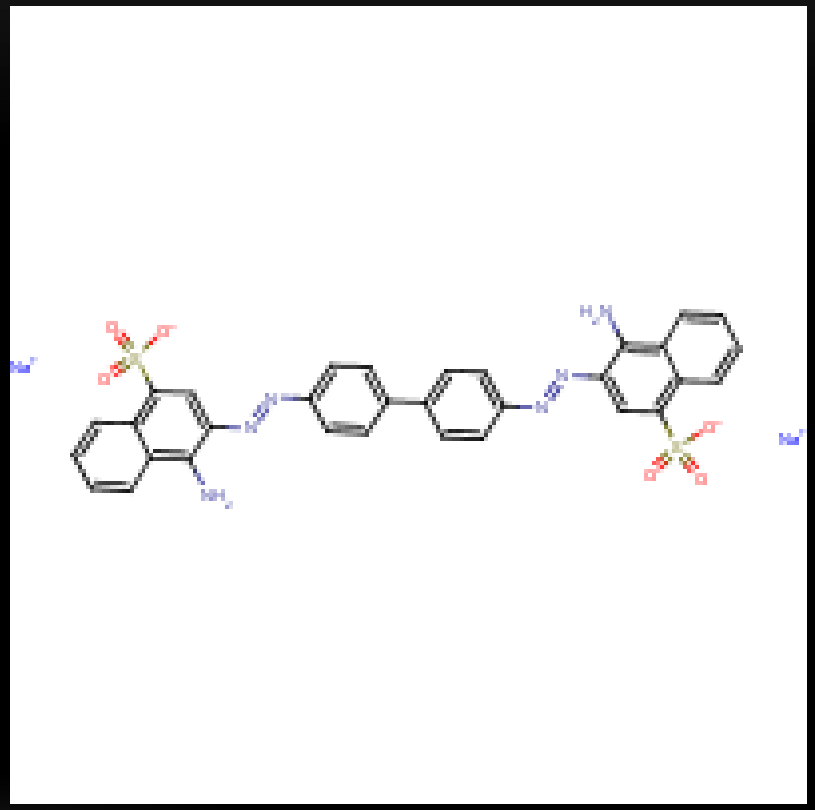
- “What is there that is not poison? All things are poison and nothing without poison. Solely, the dose determines that a thing is not a poison.” [Paracelsus, 1492-1541]
- “Hazard evaluation involves both the toxicity of the chemical or material and the opportunity for exposure to cause disease." [Sullivan, p. 32]

WHAT MAKES A CHEMICAL HAZARDOUS?

- "A distinction is made between toxicity and hazard. An extremely toxic chemical that is in a sealed container on a shelf has inherent toxicity but presents little or no hazard. When the chemical is removed from the shelf and used by a worker in a closed space and without appropriate protection, the hazard becomes great. Thus the manner of use affects how hazardous the substance will be in the workplace." [LaDou, p. 175]
- Hazard = Toxicity X Exposure

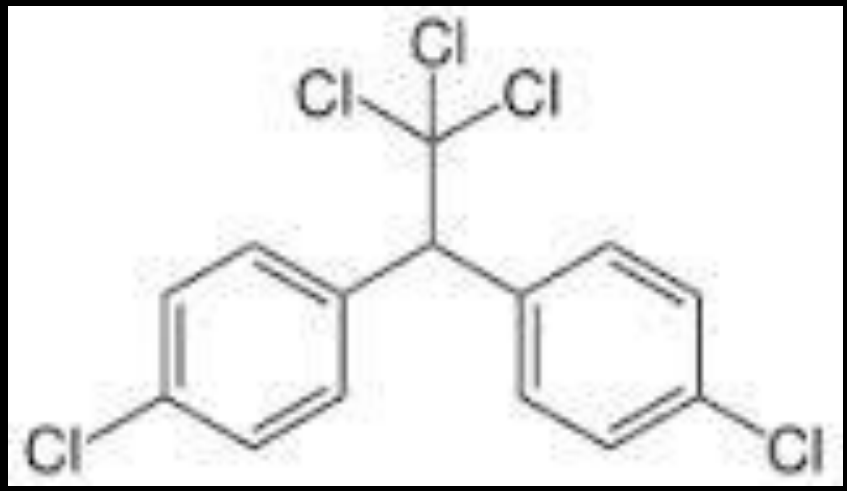
CHEMICAL TOXICITY IS RELATED TO CHEMICAL STRUCTURE





STRUCTURE-ACTIVITY RELATIONSHIPS

- For an unknown chemical, find a known chemical with a similar structure;
- Chemicals in the same class inherit the properties of that class;
- Many of the chemicals in “Other Classes” are categorized on the basis of chemical structure;
- Some examples of “Other Classes” are Acetals, Aldehydes, Benzaldehydes, Benzophenones, Chlorophenols, Ethylene Glycols, Halowaxes, Naphthalenes, Organic Acids, Phenols, Sulfites, and Thiols;



Structure of DDT

SATURATED VAPOR CONCENTRATION

- The vapor pressure (VP) is a measure of a chemical's volatility at room temperature (20-25° C or 68-77° F).
- Multiply VP times 1300 to estimate in ppm the saturated VP of the chemical after a spill in a confined space. [Sullivan & Krieger, p. 34]
- For example, if the VP is 76 mm Hg (1/10 of atmospheric pressure), then the saturated VP is 76 X 1300 = 98,800 ppm, i.e., about 1/10 of a million parts per million.

SATURATED VAPOR CONCENTRATION

- In updated chemical profiles, ACGIH now gives the "saturated vapor concentration." For example, the updated profile of cyanogen bromide in 2015 showed a vapor pressure of 122 torr (mm Hg) at 25 deg C and a saturated vapor concentration of about 16% (160,000 ppm). 122 X 1300 = 158,600.
- Also, see page 34 in Sullivan for the formula: saturated vapor concentration = vapor pressure X 1 million/760.

ODOR THRESHOLD, LC50, AND IDLH

- How does the saturated vapor concentration of the chemical compare to these values?
- If the victim smelled the chemical, then you know the concentration was higher than the odor threshold.
- The LC50 is the lethal concentration in 50% of the animals tested in an inhalation experiment.
- IDLH is an estimated concentration that is “Immediately Dangerous to Life or Health.”

DOSE-RESPONSE RELATIONSHIP

- Relationship between the dose of a toxic chemical and the incidence of an adverse effect;
- This is a fundamental law of toxicology expressed as, "The dose makes the poison.“
- For any poison, there exists a threshold dose below which adverse effects do not occur.

THE PLACEBO EFFECT DOES NOT DEPEND ON DOSE

- The placebo effect is real and measurable, but it is a subjective phenomenon.
- The placebo effect can occur below the threshold dose.
- In toxicology, the placebo effect is called the nocebo effect, i.e., an adverse effect rather than a pharmaceutical effect.
- The placebo effect may occur without detection in studies that are not double-blinded.

PUBLIC HEALTH IMPLICATIONS OF NOCEBO EFFECT

- Public announcements in news media that reinforce fear of chemicals or radiation can cause adverse health effects.
- There are no public health agencies that monitor the dissemination of chemical information.
- Results of isolated studies are often disseminated without providing any context of the current state of knowledge.