CIVE 7332

Pollutants in the Environment

Pathogens

Bacteria, protozoa, virus, prions that can cause disease and death. Usually associated with waste from human activities.

Oxygen Demanding Materials

Usually organic chemicals associated with human activities. Often will degrade naturally of sufficient time and O2 are available.

Inorganic Materials

Cations and anions that pose a threat to health or economic use of air, soil, or water. Metals that are problematic, but not toxic (see hazardous chemicals).

Hazardous Chemicals

Ignitability-Materials that pose a fire hazard during routine handling

Corrosivity-Materials that require special containers because they corrode standard containers.

Reactivity-Materials that react spontaneously with air or water, are unstable to shock or heat, generate toxic gases, or explode during routine handling.

Toxicity-Materials that release toxicants in quantities that pose a threat to human or environmental health when improperly handled.

Effects

Acute effects- immediate damage,Chronic effects-long term damage; many years until effect is noticed.

Transport Mechanism

Principal mechanism of transport through the environment is from the movement of fluids in which the materials are suspended. Water and air through atmospheric, surface and ground systems. Emphasis in the course is water quality, but air is equally and possibly more important. Live 3 days without water, but only 6 minutes without air.

Exposure Sources

Biological cycles-Uptake and decay of animal and plant life, excretion of materials, etc. Domestic waste-Discharges of raw and treated wastewater. Industrial waste-Discharges of raw and treated wastewater, discharges of raw and treated off-gases. Nonpoint source-Landfill leachate, stormwater runoff. As a rule of thumb, a nonpoint source is any source that you cannot "point" to. (Although humorous, this definition is quite practical)

Exposure and Risk

Fundamental question is what are the risks associated with assimilation of a certain compound at a certain concentration over short (acute) and long (chronic) term?

Risk Assessment

Toxic response analysis, ***Exposure Concentration*****,** Cost-benefit analysis, Revealed and expressed preference analysis

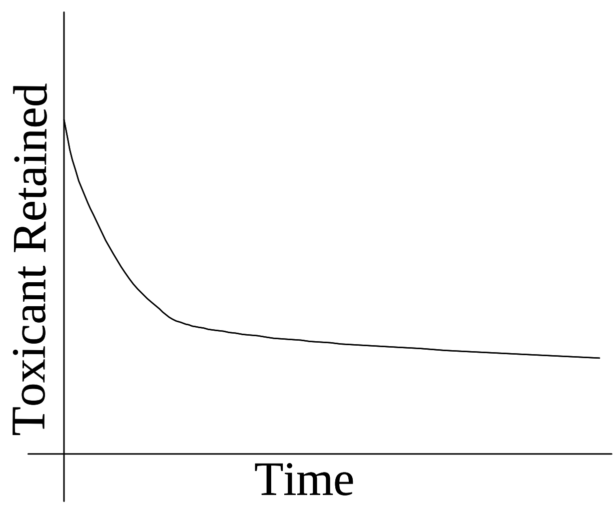
Exposure Concentration

Source of compound, production rates, and release rates to environment. Characteristics of compound relevant to its ability to travel and react in the natural environment**.** Data to estimate the population at risk. Occupation. Medical surveillance. Socioeconomic use habits. The source and compound characteristics can be incorporated into models. The risk analysis is a second step.

Dose Response

For response to a contaminant the material must be toxic and the receptor must be exposed.A highly toxic material with no exposure is not a hazard. A mildly toxic material with high exposure could be very hazardous. Environmental toxicology typically assumes: For dilute pollutants, toxicity is proportional to concentration. The longer the contact time, the greater the probability of toxic effects. Amount of toxicant initially absorbed is gradually decreased by metabolic activity and excretion with other bodily wastes.

Retention Dose



Time integral of the retention curve is called the *retention dose*.

The lifetime retention dose is called the *dose commitment*.

A typical formula for estimating retention dose is: R=C x U x D

Threshold

In drug therapy there exist threshold doses where response to the drug changes. Typically two thresholds in drugs exist, a lower bound where no therapeutic effect is observed, and an upper threshold where damage (usually death) occurs. Similarly toxicants are thought to also have thresholds. A practice used is that one-percent of the threshold dose for animals is acceptable for humans (normalized by body weight)

Latency

In support of the threshold hypothesis it has been observed that the period between exposure and response (tumors) for carcinogen increases as dose decreases. Generally it is accepted that the product of dose and latent time raised to a power is a constant.

Estimating Fate of Chemicals

The fundamental tool used to predict concentrations in the environment is the mathematical model, supported by data, laboratory experiments, and judgement. Models are used in many disciplines such as :Economics: predict market activity, occurrence or recessions or periods of productivity.Meteorology: short-term weather conditions, long-term climatological conditions. Engineering: predict performance of engineered structures. ***Predict transport and fate of pollutants*****.**