Risk Perception, Assessment and Management I

Risk perception, assessment & manag. I

- Hazard, exposure, and risk
- Thinking about risk
- Risk assessment processes
  - Overall procedure
  - Data collection and evaluation

Hazard, exposure and risk

- **Hazard**: the inherent properties of a substance, object, or activity with a potential for adverse or harmful effects to occur

- **Exposure**: a quantitative measurement to the extent to which a given hazard is present

- **Risk**: the probability that an adverse effect will occur to someone

Hazard, exposure, and risk - example

- Hazard: arsenic (As) is a human carcinogen
- Exposure: a 60-kg person in Bangladesh drinks 2 L water containing 90 µg/L As everyday
- Risk: using the carcinogenicity data for As and the given exposure, the person has 0.2% possibility of cancer development caused by As ingestion in his entire life

P&G, 2012

Thoughts about risk: public risk perception

Orders of perceived risk for 30 activities or technologies

Activity or technology	College students	Experts	Activity or technology	College students	Experts
Nuclear power	1	**20**	Contraceptives	9	**11**
Handguns	2	**4**	Fire fighting	10	**18**
Smoking	3	**2**	Surgery	11	**5**
Pesticides	4	**8**	Food preservatives	12	**14**
Motor vehicles	5	**1**	Spray cans	13	**26**
Motorcycles	6	**6**	Large construction	14	**13**
Alcoholic beverages	7	**3**	Private aviation	15	**12**
Police work	8	**17**	Commercial aviation	16	**16**

Slovic (1987), Science

Thoughts about risk: public risk perception

TABLE 4.5 Some characteristics that elevate the perception of risk.

Attributes that elevate the perception of risk	Attributes that lower perception
Involuntary	Voluntary
Exotic	Familiar
Uncontrollable	Controllable
Controlled by others	Controlled by self
Dread	Accept
Catastrophic	Chronic
Caused by humans	Natural
Inequitable	Equitable
Permanent effect	Temporary effect
No apparent benefits	Visible benefits
Unknown	Known
Uncertainty	Certainty
Untrusted source	Trusted source

Masters (1998) Introduction in Environmental Engineering and Science, 2nd ed.

Thoughts about risk: cost-effectiveness

Life-saving interventions and their cost-effectiveness

Interventions	**$/life-year saved***
Chlorination of drinking water	$3,100
Radon remediation in homes with levels ≥ 21.6 pCi/L	$6,100
Radon remediation in homes with levels ≥ 8.11 pCi/L	$35,000
Radon remediation in homes with levels ≥ 4 pCi/L	$140,000
Mandatory seat belt use law	$69
Improve educational curriculum for beginning drivers	$84,000

*in 1993 dollars

Tengs et al. (1995), Society for Risk Analysis

Thoughts about risk: “How clean is clean?”

You applied a soil remediation technology to reduce Cu concentration in a contaminated soil down to 200 mg/kg. This is still above the regulation level of 150 mg/kg. You searched nearby areas which are not contaminated and found that the background Cu concentration is 30-250 mg/kg.

Is the soil clean?

You tested with the soil to find that there’s no possibility for Cu to be released out from the soil.

Now, is the soil clean?

How clean is clean???

Thoughts about risk: implications

Environmental problems need to be managed based on ***risk*** that is properly estimated in order to protect the human health in an efficient and cost-effective manner, and to persuade the general public

- (Quantitative) risk assessment: quantification of a risk at a certain situation
- Risk management: the use of the results of a risk assessment to make policy decisions

US EPA's risk assessment process

For human risk assessment:

- Data collection and evaluation
- Toxicity assessment
- Exposure assessment
- Risk characterization

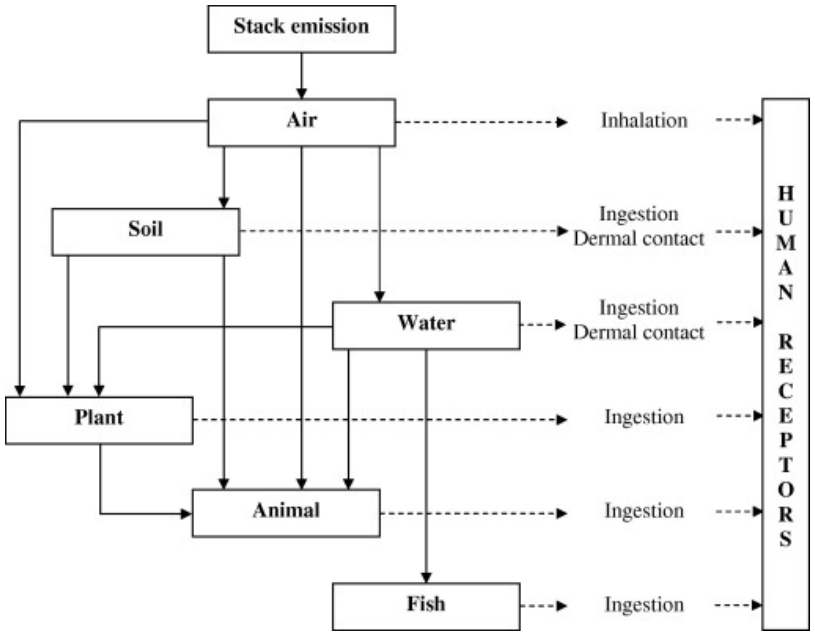
* Risk assessment is considered to be *site-specific*: the whole steps of a risk assessment is conducted for every contaminated site

Data collection and evaluation

- Collecting background information of a site
  - Possible contaminants
  - Concentrations of the contaminants in key sources and media (air, soil, water, …), characteristics of sources, and information related to the chemical's release potential
  - Characteristics of the environmental setting that could affect the fate, transport, and persistence of the contaminants

- Form a "conceptual site model":

  initially identify potential exposure pathways and exposure points important for assessing risk



Example conceptual site model

Reading assignment

- Textbook Ch6 p. 234-236