

Module 10
Written exam
Future research needs
Course evaluation
Course closure

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Risk Assessment of Contaminated Sites: From Source Zones to Water Resources

Module 10: Plan

13.00-13.30

- **Exam**
 - *Multiple choice*

13.30-14.00

- **Future Research needs: Brainstorm**
 - *Intro*
 - *Group work*
 - *Prepare 1 powerpoint slide*

14.10-14.45

- **Risk assessment in a fracture system (CAC, JCC)**
 - *Geological characterization (CAC)*
 - *Modeling of fracture systems (JCC)*

15.00-15.30

- **Future research needs: Presentations**

15.30-16.00

- **Evaluation and course closure**

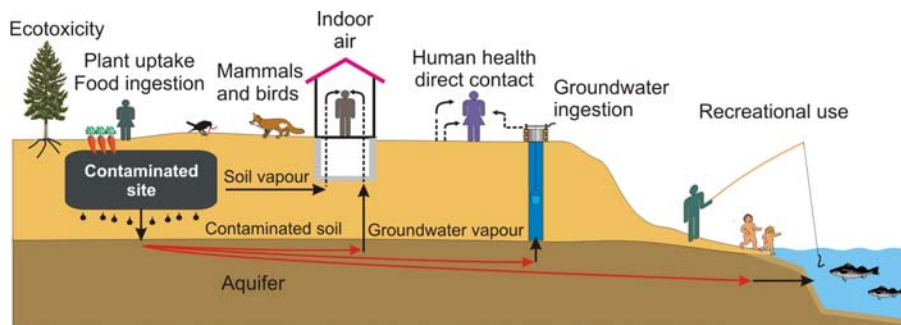
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Risk Assessment of Contaminated Sites: From Source Zones to Water Resources

Future research needs

- 6 groups to be formed
- Research in risk assessment related to:
 - Concepts of risk assessment and management of contaminated sites
 - Volatile organic compounds and gaseous transport
 - Soil contamination: Sorption and bioavailability
 - Soil contamination: Plant and dietary uptake
 - Groundwater – risk models and advanced risk assessment
 - Water resources and surface water at catchment scale
- Brain storm
 - Select a chairperson
 - Make one powerpoint slide
 - Identify a speaker
- Presentation
 - 3 minutes presentation
 - Motivate ideas

Framework



Future Research needs

- **Ideas suggested by the PhD students**

- *3 minutes presentations*
- *Motivation for ideas*

- **Research in risk assessment related to:**

- *Concepts of risk assessment and management of contaminated sites*
- *Volatile organic compounds and gaseous transport*
- *Soil contamination: Sorption and bioavailability*
- *Soil contamination: Plant and dietary uptake*
- *Groundwater – risk models and advanced risk assessment*
- *Water resources and surface water at catchment scale*

- **Ideas suggested by the teachers**

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Risk Assessment of Contaminated Sites: From Source Zones to Water Resources

Concepts of Risk Assessment and management of Contaminated sites



- Prioritisation of suspected Contaminated sites
 - Handling of uncertainties
 - Cheap screening tools (e.d. tree core sampling)
- After-use of contaminated sites
 - Criteria for successful remediation
 - Reliable estimates: remediation time
- Remediation technologies
 - Innovative methods: data base with field results → statistical evaluation
- Toxicity assessments
 - Characterisation of new (more) chemicals
 - Vulnerable groups
 - Rat – human (transferability?)
 - Accumulated effect of several chemicals?
- Ethical considerations?
 - Notion of „acceptable risk“?
- Groundwater – surface water interaction

Volatile organic compounds and gaseous transport

- Sampling of soil air
 - Passive sampling in soil and indoor environments
- Influence zone / advective transport
 - Effects / modelling of pressure fluctuations
- Transport in fractured unsaturated soil
- Biodegradation
 - Effects of physical/chemical factors
 - Methods for rate estimation (in situ / lab)
- Optimization of in situ remediation techniques
 - Influence zone during ventilation/SVE
 - Passive ventilation

Sorption & bioavailability

- Clear definition of bioavailability
- Apply the concept of ecotoxicology to bioavailability
- Is K_d sufficient to represent real life
- In situ method to measure sorption/bioavailability of chemical and bacteria

Soil contamination – Plant and dietary uptake

- Remediation:

GMO plants, Plants just not found yet, increased growth, enhanced uptake, are the most mobile parts of the compounds removed

- Dietary Uptake:

Are the metals just passing through the organism or absorbed

World wide limits for diet/quality control

Soil concentration vs plant concentration – models

Biomagnification

Groundwater – risk models and advanced risk assessments

- More realistic
 - Decrease uncertainties, more sensitivs
- Bench marking – transparency
 - Fullfill certain criteria
- User friendly
 - Eg. Interface
- Complex input
 - Surface water interaction
 - RA in fractured systems
- WFD – Good Ecological Status

Water resources and surface water at catchment scale

- Mass flux studies between ground and surface water
- Integration studies from various fields
 - aerosols - water – soil
- Investigation of surface runoff
- Optimization of sampling and measuring techniques

Volatile organic compounds and gaseous transport

- VOC transfer over capillary zone
- Importance of degradation for VOC intrusion into buildings and risk to groundwater
- Gas transport of VOCs in fractures

Soil contamination

- Physical entrapment versus strong surface adsorption - which process dominates the binding of non-accessible soil contaminants.
- Risk evaluation of new types of pollutants, prediction of pollutant reactions and spread in the soil horizon.
- Development of new methods for the analysis and speciation (incl. biosensors) of solutes in aqueous solution as well as characterization of solids and particle surfaces.

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Risk Assessment of Contaminated Sites: From Source Zones to Water Resources

Plant uptake, risk assessment and phytoremediation

- Toxicology: Acceptable daily dietary intake of environmental contaminants
- Exposure: Uptake of organic compounds into food crops (models & experiments)
- Phytoremediation: Efficiency (success and costs, time required)

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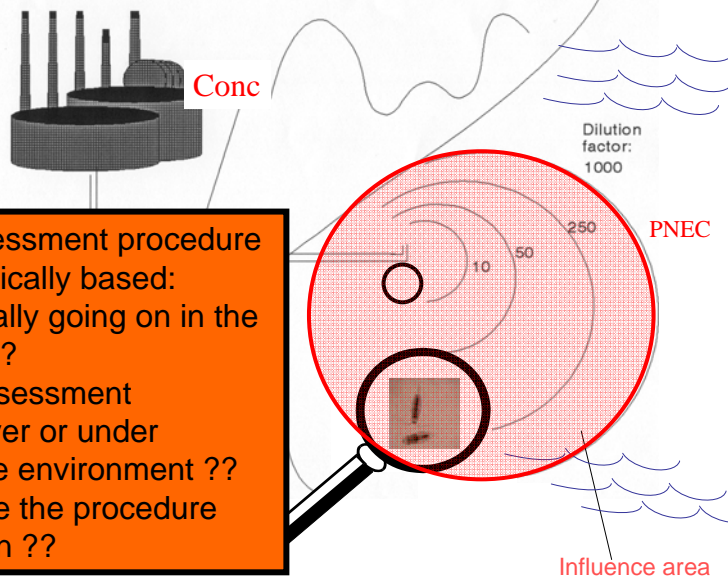
Advanced risk assessment in groundwater: local scale

- **Fate of "novel" compounds in groundwater**
 - Pharmaceuticals and modern pesticides
 - Nanoparticles
- **Degradation of chlorinated solvents**
 - Ethanes, abiotic/biotic
 - Oxidation of chlorinated ethenes
- **Robust microbial molecular methods to deduce degradation**
- **Risk assessment of fractured media (Ida, Camilla and Julie)**
- **Reactive solute transport models**
 - Sequential degradation of chlorinated ethenes
 - Fermentation and redox processes

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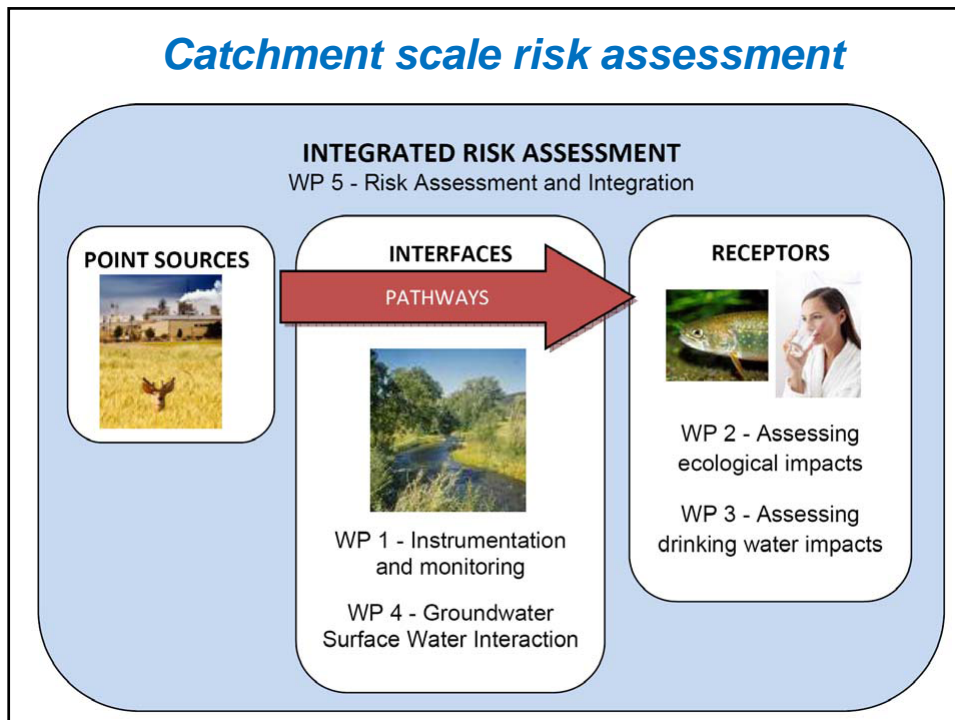
Risk Assessment of Contaminated Sites: From Source Zones to Water Resources

Assessment of chemicals in the environment



The risk assessment procedure is not scientifically based:
What is actually going on in the environment ?
Is the risk assessment procedure over or under protecting the environment ??
Can we make the procedure less uncertain ??

Catchment scale risk assessment



Management and legislation

- **Robust risk assessment tools**
 - Flux approaches versus quality criteria
 - Screening models
 - Unsaturated zone
- **Decision support systems coupling site characterization, risk assessment and management (Ursula)**
- **Use of environmental economics and LCA in risk assessment and remediation**
- **Risk assessment: Harmonized European methods (today, each country has different methods and different legal standards)**