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Contaminants Hydrogeology (3GH2213)

Filières concernées	Nombre d'heures	Validation	Crédits ECTS
Master en hydrogéologie et géothermie	Cours: 28 pg	Voir ci-dessous	3

ph=période hebdomadaire, pg=période globale, j=jour, dj=demi-jour, h=heure, min=minute

Période d'enseignement:

- Semestre Printemps

Equipe enseignante

Daniel Hunkeler

Contenu

This course begins by discussing the fundamental processes controlling substance migration from the land surface through the soil and vadose zone into groundwater flow systems. We will address organic and inorganic substances separately, as their governing processes differ. Organic contaminants will be covered in greater depth, as they are the primary concern at point-source sites in Switzerland and more frequently trigger the need for remediation.

We will develop conceptual models and perform calculations to determine how chemical properties influence migration. Using simplified mathematical models, we will explore contaminant dynamics and input into groundwater. The course then shifts to point-source management, a core activity for geological and hydrogeological consultancies. Because site management is governed by both science and policy, we will also review the Swiss legal framework and common field investigation techniques.

Finally, we will integrate these concepts through comprehensive case studies. Students will navigate the entire site management process: developing conceptual site models, planning investigation strategies, conducting risk assessments, and evaluating remediation options within the context of Swiss law.

Forme de l'évaluation

CA graded

Written exam (1.5h) on a date to be defined at the beginning of the course. The exam includes several questions on fundamental processes that control the fate of organic and inorganic contaminants. Some questions include some calculations. In addition, the students have to outline a conceptual scheme of a contaminated site.

Modalités de rattrapage

Repeat : Written test (1.5h) during exam session following the course, coordinated with professor. The repeat exam includes the same elements as original exam.

Documentation

Power Point presentation.

Script explaining major processes that control the behavior of organic contaminants.

Documentation of case study.

Pré-requis

Groundwater chemistry

Forme de l'enseignement

Lectures and exercises

Computer lab: Models to simulate contaminant behavior

Group projects: Case studies linking the different parts of the course:

- Proposal of site investigation strategy
- Risk assessment for a polluted site to evaluate need for monitoring/remediation
- Proposal of remediation method

Objectifs d'apprentissage

Au terme de la formation l'étudiant-e doit être capable de :

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- Develop conceptual site models (CSMs) that characterize the migration of various contaminants through soil and the subsurface.
- Design site-specific investigation strategies that integrate contaminant properties, legal requirements, and economic feasibility.
- Select appropriate remediation strategies based on specific contaminant characteristics and hydrogeological conditions.
- Carry out risk assessments according to legal framework to identify whether a site requires intervention, monitoring, or no further action.

Compétences transférables

- Communicate complex scientific concepts to non-academic stakeholders
- Integrate scientific, legal and economical considerations