

**Final Examination Topics for  
Environmental Engineer Master Students**  
*Contaminated Site Remediation and Environmental Geotechnics spec*

**Waste Management; Waste Disposal, Waste Incineration**

1. The consequences of waste generation. Definitions: 1) Waste management, 2) Waste preparation, 3) Sustainable development. Difference between open- and closed-cycle production-consumption processes.
2. Please describe the generation, main characteristics and utilization possibilities of red mud.
3. The prevention of the waste formation. The tasks in the production and in the consumption process as well as from governmental side. Meaning of reuse, recycling and waste utilization. The general objectives of environmental protection and economical advantages of waste utilization.
4. The main material properties, process engineering characteristics of municipal solid waste (MSW) and their determination. The process engineering aim of waste preparation (residual MSW) and sorting (selective collected MSW). A schematic configuration of a sorting plant with main machines. The products and fractions of the sorting procedure.
5. Aspects of site selection of landfills
6. Landfill types
7. Base lining system and leachate water collection system
8. Facilities of landfills, landfill monitoring
9. Remediation of landfills (layers, timing etc.)
10. Aftercare of landfills
11. Properties and classification (PM) of solid air pollutants
12. Effect of solid air pollutants on flora, fauna and environment
13. Classification of mechanical solid separators
14. Classification, advantages and disadvantages of wet separators

## **Water Chemistry, Soil Chemistry, Site Remediation and Risk Assessment**

1. Introduce the main inorganic components of water, their origin, main characteristics, how they influence the type of waters.
2. What kind of general environmental condition indicators do You know? Interpret the main features/characteristics of them.
3. Characterize the chemical bounds exist in water molecule and exist between water molecules and give what kind of consequences comes from these bounds in the feature of water.
4. Characterize water as a solvent and a chemical reaction partner. Give the main feature of dissolution of gases, liquids and solids. Give an example of redox reaction and acid-base reactions in which the water is a reaction partner.
5. Introduce the carbonate system of natural waters. Dissolution of carbon dioxide, dissociation and its pH dependency.
6. The term/definition or risk. Risk assessment and risk management (in general). Conservative assumptions and its role in risk assessment. Iterative approach and its role in risk assessment. Explain the Monte Carlo method, and its use in risk assessment.
7. Introduction to the health risk assessment methodology. The SPR concept and its consequences. How the risk-based approach did reshaped the practice of contaminated site remediation. Remediation target value (concentration) setting – concept and method.
8. Human health risk assessment methodology 1. Introduce the methodology framework, and the purpose of the particular steps of the method. Detailed introduction to Problem formulation and Exposure assessment. How does contaminant transport modeling serve the purpose of exposure assessment?
9. Human health risk assessment methodology 2. Introduce the methodology framework, and the purpose of the particular steps of the method. Detailed introduction to Toxicity Assessment and Risk identification.

10. Geosynthetic materials (type, functions and applications of geosynthetic materials, application in landfilling, testing methods and qualification of geosynthetics)
11. Contaminant transport processes through barriers (dominant transport phenomenon through clay liners, mass transport through vertical slurry walls, diffusion-back diffusion, adsorption properties of clay minerals, mathematical formulations of mass transport)
12. Geotechnical site investigation (methodology of investigation, drilling, penetration tests, and other shallow subsurface investigation tools, sampling tools, special sampling methods in contaminated site investigation)
13. Guideline value-based vs. risk-based site, specific remediation, explain the change in concept and its consequences. Method and significance of remediation target value (concentration) setting. Factors that must have influence on the target value.
14. The framework of contaminated site remediation: detection – site characterization – remedial action – monitoring. Draw and explain each step (goal, tools, purpose, consequences). Conventional methods and recent trends/tools in site investigation.
15. What are the LNAPL and DNAPL type of contaminants? Explain why DNAPL-s get special attention in the remediation business, what are the special demands of DNAPL site characterization. Introduce the reductive dehalogenation of chlorinated ethanes (in situ chemical reduction).
16. Remedial actions and methods 1. Introduce some of the classification aspects of remedial actions. Introduce (draw and explain) the Pump and treat, air sparging and soil vapor extraction technologies (mechanism, applicability, benefits, limitations)
17. Remedial actions and methods 2. Introduce some of the classification aspects of remedial actions. Introduce the monitored natural attenuation (MNA) and permeable reactive barrier (PRB) technologies (mechanisms, applicability, benefits, and limitations).
18. Remedial actions and methods 3. Introduce some of the classification aspects of remedial actions. Introduce (draw and explain) the In situ chemical oxidation and in situ chemical reduction methods (mechanisms, applicability, benefits, limitations).