This file includes the quiz questions that are expressed mostly with text. Additional quiz questions involving figures are included in the PowerPoint files at: users.ntua.gr/mpanta/Teaching\_EN/EnvironmentalGeotechnics

**Unit: RISK ASSESSMENT**

• Do you agree with the statement “in general, we worry less about a substance existing in the subsurface as a result of natural processes”?

Yes 🞏 No 🞏

• In order to explain the difference in units between (a) the dose at which 50% of the organisms remain alive (LD50), mg/kg, and (b) the reference dose (RfD), mg/(kg⋅day), you would say that (check all you would like to say):

🞏 time is not a factor in the measurement of LD50

🞏 RfD accounts for health impacts resulting from long-term exposure

🞏 something else

• For the remediation of a contaminated site, we focus our priorities on the contaminants that (check all answers you consider to be correct):

🞏 contribute mostly to risk

🞏 are detected more frequently

🞏 have the higher reference dose (RfD)

When you are certain that you have checked all answers you consider to be correct, go to the next slide

*For the remediation of a contaminated site, we focus our priorities on the contaminants that contribute mostly to risk.*

🗹 Yes, this answer is correct.

*For the remediation of a contaminated site, we focus our priorities on the contaminants that are detected more frequently.*

🗷 Frequency of detection has already been taken into account during the first stage of risk assessment calculations.

*For the remediation of a contaminated site, we focus our priorities on the contaminants that have the higher reference dose (RfD).*

🗷 No, contaminants with high RfD’s are less toxic compared to contaminants with low RfD’s, as far as non-carcinogenic health impacts are concerned.

**Unit: MECHANISMS OF POLLUTION SPREADING (QUALITATIVE)**

• An underground storage tank of gasoline was removed when a leak was discovered. Which of the following two statements do you think is more probable?

🞏 After tank removal, gasoline ceases to spread (as LNAPL)

🞏 After tank removal, gasoline may or may not spread further (as LNAPL)

• STATEMENT Released NAPLs will reach a depth that depends on the quantity released.

COMMENT The sentence above is a correct statement provided that ... (complete the sentence).

• How can you explain that sorption (Kp) is not analogous to contaminant hydrophobicity (Kow, Koc)?

- The main sorption mechanism is not absorption to organic matter

- This is what happens at the Borden site: the organic carbon fraction is low, foc=0.02%, that’s why the relationship Kp = foc Koc cannot describe measured values

**Unit: SUBSURFACE FLOW**

• In general, ground water does not move between two points 1 and 2 when … (check all correct answers, one or more)

🞏 points 1 and 2 have the same pressure

🞏 points 1 and 2 are at the same elevation

🞏 points 1 and 2 have the same energy

🞏 points 1 and 2 are in a soil with very low permeability

• For water flow between points 1 and of 2 in the curved tube in the sketch below, when calculating hydraulic gradient i = Δh1,2/L, (a) L = L1, (b) L = L2 or (c) L = L3?



• The average linear velocity or seepage velocity ... (check all correct answers)

🞏 is the Darcy velocity divided by porosity

🞏 is discharge divided by the portion of the cross section that is available for flow

🞏 gives good estimates when used in calculations of travel time of contaminants in laboratory experiments

🞏 is a good approximation of the actual groundwater velocity within the soil pores

• The Laplace equation (∇2h=0) is valid when we have... (check all correct answers, one or more)

🞏 constant fluid density

🞏 homogeneous and isotropic soil

🞏 no pumping, no injection

🞏 something else

**Unit: SOIL-CONTAMINANT INTERACTION**

• The solubility of trichloroethene (TCE) is equal to 1100 mg/l. We take a groundwater sample from a well (from the saturated zone, it goes without saying), run an analysis for TCE, and find CTCEw=10mg/l. Can we draw some conclusion on whether the site has DNAPL (TCE in nonaqueous phase) or not?

Yes 🞏 No 🞏

• Do you agree with the statement “all contaminants sorb to soil”?

Yes 🞏 No 🞏

• The solubility of trichloroethene (TCE) is equal to 1100 mg/l. Chemical analysis of a groundwater sample from a well gives a concentration >1100 mg/l. What do you conclude from this result?

🞏 The analysis is wrong (it gave an impossible value)

🞏 TCE is present as a nonaqueous phase liquid at the well

🞏 Pumping caused sorbed contaminant to enter the well

• Check all the statements with which you agree and add any other correct statement you can think of

🞏 the relationship CAs = Kp CAw is empirical

🞏 the relationship CAs = Kp CAw is a model

🞏 the relationship CAs = Kp CAw is valid only for organic contaminants

🞏 the relationship CAs = Kp CAw is valid only for hydrophobic organic contaminants

🞏 the relationship CAs = Kp CAw is not valid for clays

🞏 the relationship CAs = Kp CAw is not valid for soils with low fraction of organic content

🞏 something else (about the validity of CAs = Kp CAw)

**Unit: TRANSPORT OF SOLUTES (DISSOLVED CONTAMINANTS) IN SATURATED SOIL: ΜATHEMATICAL DESCRIPTION**

• For the same boundary conditions, the solution of the equation for transport due to diffusion describes the spreading of the contaminant (in 1D): 

- in the air\* of the unsaturated zone (\*exact solution in dry unsaturated zone – what is different when Sw > 0?)

- in saturated soil

In which medium to you expect faster contaminant spreading? Why?

• An aqueous solution of two contaminants has been released in the subsurface and reached the water table. You use the same transport equation to study their spreading in groundwater. From the parameters listed below, mark which ones you expect to be the same and which different in the equation used to describe the spreading of each contaminant:

- Duration of contaminant release Same 🞏 Different 🞏

- Contaminant concentration at the source Same 🞏 Different 🞏

- Advection velocity Same 🞏 Different 🞏

- Retardation factor Same 🞏 Different 🞏

- Coefficient of diffusion Same 🞏 Different 🞏

- Coefficient of mechanical dispersion Same 🞏 Different 🞏

- Half life Same 🞏 Different 🞏

**Unit: REMEDIATION TECHNOLOGIES**

• Give examples of remediation technologies that reduce hazard and remediation technologies that reduce risk

• Give examples of remediation technologies that are suitable for sites where NAPL contaminants are present