Q1 Name 3 engineered components of the containment program at McCormik & Baxtor superfund site (write 3 types of structural elements that help keep pollutents out of ground water & Willamette River).

him → ① The installation of non aquias phase liquid (NAPL) extraction wells for pumping out NAPLS

see oresp case study slide 26 → ② on site soil treatment along with soil cap over the entire site + sediment cap (and disposed; impermeable)

③ placing and driving sheet pillings and walls almost down to bed rock for ground water remedy

him → ④ excavation and off site disposal of site structures

they also put in drains for the water to be able to escape

Q2 Which two (2) of the following are the most negative (problem) characteristics of zero valent iron (ZVI) permeable reactive barriers

(A.) Very high and continuing O&M (operation and maintenence) cost

(B.) The tendency of iron oxides to "rust" and clog the barrier and reduce flow

? C. No way to install them to depths more than about 5 ft

~~D.~~ Volume cost of the treatment medium

~~E.~~ Are not very effective for chlorinated VOCs

~~F.~~ Energy intensive technology

Q3 One of our readings notes that "Brown fields projects are not typical remedial actions" what is meant by this? explain this in your own words and give some examples of specific aspects of brownfields (schnitzer) projects that differ from a typical non-brownfield remediation (Marathon or Eagle Harbor)

They are not typical remedial action because they have to take into consideration the typical goals and points of interest of the remeadial action seen in non-Brownfields as well as take into consideration additional actions (~~as part of the phase II ESA action~~) so they need to reconsider future economical, social and demografic impact and changes to the sites and the area surrounding the site (to further better the site and areas structure and value and better the sites community as a whole

Brownfield also see slide 11 Goals

Brownfield (schnitzer)	vs.	non-brownfield (marathon or Eagle harbor)
• cleaned up, treated, capped and redeveloped for increased community population and use		• cleaned up and treated as well capped but left alone and undeveloped
• institutional controls: land use, deeds -- etc.		• long term monetoring of site
• take into consideration the company doing the development over stages as they are able and not in one go		• institutional control: stop people fishing eagle harbor
• one PRP		• multiple PRPs

Q4 Lead (Pb) strongly absorbs to most soils. why did this chemical property play a major role in determining the main clean up strategy for the Gould NPL site in Portland?

lead is a heavy metal which does not biodegrade or decay nor is it rapidly absorbed by plants it also has a long half life of residance (1000years) so it accumulates in soils and increases in consentrations. also lead is typically not very mobile as it is immobalized by absorbstion to soil and organic matter and as it is insoluable in water it typically stays in the soil and can form layers. (note lead because it is insoluable in water it typically does not enter aquifers but if the soil particles are very small and mobile in aquifers then any lead absorbed on them can move into drinking water supplies.)

Q5 match characteristics to subsurface treatment option that best applies

unsaturated zone vadose

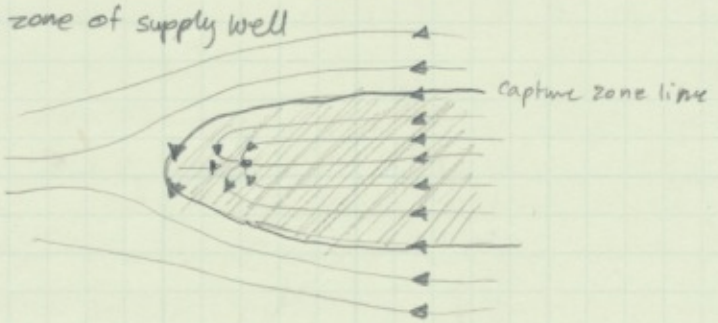
saturated zone

	Pump & treat	air sparging
• works for contamination > 200 ft deep		•
• Better option for a site with lots of chlorinated solvents in residual saturation in the vadose zone.	•	
• Better for a compact (small) plume of pesticides in the saturated zone.		•
• suitable for a site with a lot of dissolved hexavalent chromium Cr(VI)	•	
• can be used to stimulate biodegredation (bioremediation)		•
• Is still the most widely used technique	•	
• Will work ok in fractured rock		•
• could lead to uncontrolled contaminant movement		
• often requires soil vapor extraction		•
• often takes a really long time to get contaminants down to an acceptable level "tailing"	•	

Q6 A flow net depicted for aquifer with water supply well (a well that is pumping water out of the aquifer)

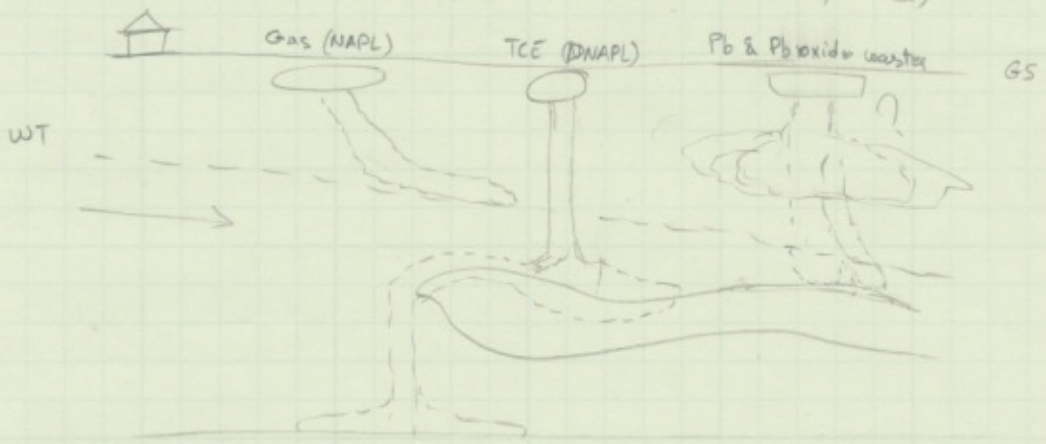
A) sketch in some arrow heads to indicat flow direction

B) shade in capture zone of supply well



Q7 Below a sketch side view of subsurface environment that has 3 known point sources of contamination in the overlaying soil. The aquifer is composed of two major types of porous material (shaded & unshaded) the hydrolic conductivity of each material is indicated. The bottom of the aquifer is impervious bed rock. The materials have just begun leaking into the soil.

Sketch a rough image of what the plume of each contaminent will look like in a few years after they have time to spread a seguificant distance (half way across)

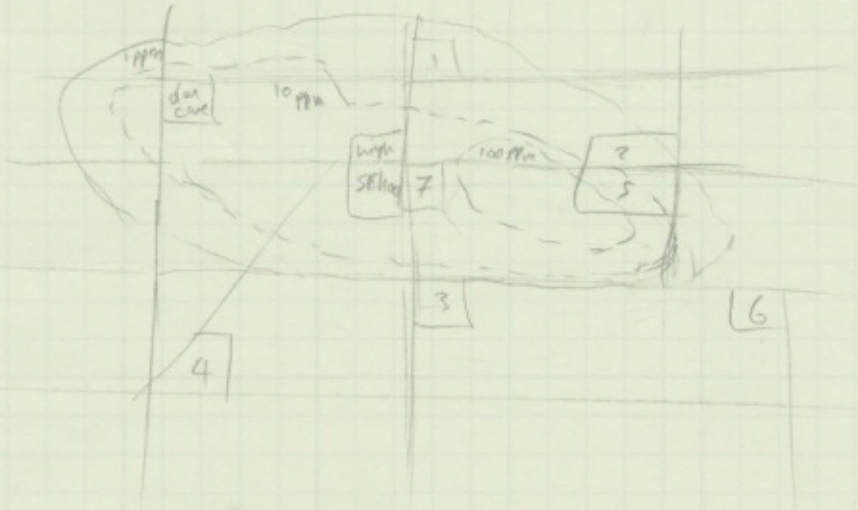


Q8 the city of chico Ca has discovered that some of the groundwater under this small city has a lot of PCE / solvent

A sketch of what the pollution problem looks like superimposed on a map of the area.

What are the likely sources of PCE contamination

Sources
Hobby shops
Paint &
machine &
dry cleaning



① metal plating plant
② Dry cleaners
③ Dry cleaners
④ Gas station
⑤ Gas station
⑥ machine shop
⑦ Garage & medicine

see slide 3 & 4 of NA

Q9 What would be some examples of good evidance that PCE is breaking down at a site like chico due to biological action?

good evidance of PCE degredation would be by looking for the reductive dechlorination steps and evidance of TCE (Trichloral ethylene) to 1,2 sis DEC (dichloroethylene) to VC (vinyl chloride) to Ethene ∴ it is showing degredation

PCE
↓
TCE
↓
1,2 sis DEC
↓
VC
↓
Ethene

good evidance would be if the site tests for TCE, DCE or VC since PCE breaks down into the mentiond chemicals. or if PCE shows signs of dilution in soil

Q10 Suppose the engineering firm in charge of the chico site wanted to assert that natural attenuation is an appropriate approach for the clean up.

Name 3 things that the state regulators would probably demand to be proven about the site in order to give permission for this approach.

① come up and Develop a conceptual model of site showing showing physical evidance of reduction conditions & or degredation and that this evidance is strong
(show evidance of chemical degredation happening and the the chemicals foot print is becoming smaller in other word show physical evidance of a retreating or static plume)

② show evidance by showing the analysis of site measurments throug sampling, looking at chemical signitures of degredation, by attempting a mass balance on the contaminant of concern to see if the total mass is declining and by demonstrating that all relevant physical factors were considered (flow, dispersion, dilution).

③ By monitoring of site and re evaluating conceptual model

✗ ① detailed study to fully characterize the site

✗ ② A study to show how the natural attenuation is helping in cleaning the contaminated site

~~✗~~ ③ The economical cost / money saving from using NA