

Part III – 60% of total score

You will use the information provided in the scenario from Part II along with additional information below to answer the following questions.

Situation: Wells C and D are currently being pumped for agricultural irrigation purposes. Well E is a private domestic well that is also being pumped. A traffic incident resulted in a tank truck filled with the non halogenated Volatile Organic Compound (VOC) Methanol to be spilled near the site of Well B. Although measures to clean up the spill at the surface were conducted the pollutant was recently found during the sampling of Well E.

- 1) If the assumptions of the Hydrogeology Challenge scenario are correct what wells are at risk with the conditions stated above? [1]
D, E
- 2) Using the horizontal velocity calculated in Part II, approximately how long will it take for the contaminant to travel to the nearest at risk well? Show work for partial credit. [2]
 - a. There are no at risk wells
 - b. 75-150 days
 - c. 150-300 days
 - d. More than 1 year
- 3) Using the horizontal velocity calculated in Part II, approximately how long will it take for the contaminant to travel to the farthest at risk well? Show work for partial credit. [2]
 - a. There are no at risk wells
 - b. 75-150 days
 - c. 150-300 days
 - d. More than 1 year
- 4) Assuming the assumptions of the Hydrogeology Challenge are correct, if the irrigation wells to the north of well E were to stop pumping would this eliminate all risk of contamination to other wells? Why or why not? [2]

The contaminant is not cleaned up so the wells are still at risk. Groundwater continues moving regardless of the pumping conditions.

- 5) Which well is least likely to be affected by the contamination? [1] Well A
- 6) Of the four techniques in the remediation table which two are the least appropriate and why? [4]

Phytoremediation of groundwater is not applicable to VOCs

Air sparging is applicable but the clay layer is the area would prevent the effective movement of the contaminant to the surface where it would evaporate.

Remediation Technique [2]	Definition [2]	In-Situ or Ex-Situ [1]	Type [1]	Applicable to VOCs [1]
Air Sparging	7) Injects air underground to help remove vapors from groundwater. It helps contaminants evaporate faster.	8) In-Situ	9) Physical	10) Yes
Air Stripping	11) The process of moving air through contaminated groundwater in an aboveground treatment system. Often used with pump and treat method	Ex-Situ	12) Physical	13) Yes
Thermal Treatment	14) Moves or 'mobilizes' harmful chemicals using heat. Chemicals move towards wells where they are collected and piped to the ground surface to be treated using other methods	15) In-Situ	16) Thermal	17) Yes

18) Phytoremediation	Uses plants to clean up contaminated environments	In-Situ	19) Biological	20) No
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