Summer Examinations 2015

ENV200115N

Module Title: Contaminated Land
Level: Five
Time Allowed: Two hours

Instructions to students:

• Enter your student number **not** your name on all answer books.
• Answer **all** questions from Section A and **two** questions from Section B.
• Section A carries 40% of the overall marks.
• Section B carries 60% of the overall marks.
• You do not need to use separate booklets for the questions in Section A, but use a separate booklet for each of the answers to questions from Section B. Label each booklet with the number/s of the question you are answering.
• Neither books nor notes may be taken into the examination.
• The use of electronic calculators is permitted.
• Students are permitted to remove this examination paper at the end of the examination.

No. of Pages 5
No. of Questions 12

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Section A

Answer all questions.

1. Define "Contaminated Land" in accordance with Part 2A of Environmental Protection Act 1990. (4 marks)

2. Identify and summarise the three ways in which a pollutant linkage can be broken. (6 marks)

3. When considering off site disposal of contaminated land the producer has a number of statutory requirements as well as practical issues to consider. Identify four of these potential issues. (4 marks)

4. Why is the herringbone pattern considered to be the most efficient sampling design? Use a diagram to illustrate your answer. (6 marks)

5. The bioremediation of contaminated land can be manipulated via biostimulation and one other method. Name this method and differentiate between these two techniques. (4 marks)

6. Chemical treatment technologies utilised a range of chemical reactions in the treatment of contaminated land. Define the following:
   a. Oxidation
   b. Reduction
   c. Hydrolysis (6 marks)

7. Cement and Lime are examples of two binders which are traditionally used in solidification and stabilisation techniques. Give two more examples. (2 marks)
8. Electrokinetics is a developing technology that is intended to separate and extract heavy metals, radionuclides, and organic contaminants from saturated or unsaturated soils, sludges and sediments, and groundwater.

a. Draw a diagram which depicts a simple electrokinetic remediation system in soil. 

(6 marks)

b. Annotate the diagram to demonstrate how contaminated are removed during in situ electrokinetic remediation.

(2 marks)

Total: 40 marks

End of Section A
Section B follows overleaf
Section B

Answer two out of four questions.

9. A potentially contaminated site of 50000m² has been identified for a new housing development. Each house plot will measure 15x30m. It is considered that there should be at least one sample per plot and there is no reason to suspect any elongation of hotspots.

Assuming that:

\[ k = 1.08 \] and
\[ N = kA/a \]

\( a \). Calculate the number of sampling points required within the site.  
(5 marks)

\( b \). Fully discuss soil sampling strategies which can be used within the determination and quantification of contaminated land with particular reference to sampling approaches and sampling depths.  
(25 marks)

**Total: 30 marks**

10. The use and acceptability of Monitored Natural Attenuation varies on a site-specific basis and in particular the combined impact of contaminant chemistry, hydrogeological and biogeochemical factors. Using a case study evaluate the use of Monitored Natural Attenuation, highlighting the assessment process that provides evidence of performance.  
(30 marks)

11. Phytotechnology is broadly defined as the use of vegetation to address contaminants in soil sediment surface water and groundwater. Briefly discuss the different mechanisms involved within phytoremediation and using a case study highlight the advantages and disadvantages for phytotechnologies.  
(30 marks)

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Section B continues overleaf
Section B continued.

12. In situ Thermal methods are advantageous in the remediation of contaminated land as they allow soil to be treated without excavation and transportations. Examples of such thermal methods include:

- Electrical resistance heating
- Injection of Hot air
- Injection of Hot water
- Injection of steam
- Radio frequency heating
- Vitrification

Choose two of the example above and for each example:

a. Describe the process (using diagrams where necessary).

b. Outline the highlights and limitations of the technique using examples.

(30 marks)

Total: 60 marks