National Exams December 2017

04-Env-B4: Site Assessment and Remediation
3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is an OPEN BOOK EXAM.
   One of two calculators is permitted; any Casio or Sharp approved model.

3. Answer:

   a) FOUR (4) of the FIVE (5) questions in Section A

   b) ONE (1) of the TWO (2) questions in Section B.

   Only the first <u>four</u> questions and the <u>first</u> question in each section will be marked as they appear in the answer booklet.

4. Each question is of equal value at 20 marks.

5. Questions require calculation and/or answer in essay format. Clarity and organization of the answer are important.

6. Justify assumptions made.

Marking Scheme:

1. 20 marks
2. 20 marks
3. 20 marks
4. 20 marks
5. 20 marks
6. a) 17 marks; b) 3 marks
7. a) 17 marks; b) 3 marks

Section A: Four out of the Five Questions

A-1)   An incident occurred at an airport, where the main tank on the jet refueling truck was punctured, releasing kerosene onto the taxiway, which drained toward the grass infield. Approximately 20,000 L of fuel was released. No fire or explosion occurred due to the quick response of the first responders. However, some water and fire retarding foam were used along with chemical sorbent. The soil type for the entire property is loamy sand. There is a drainage ditch in the infield approximately 10 m from the taxiway. Describe the potential migration pathways that exist for the spilled fuel and the fire suppression materials. How would you rate the risk of the spill reaching the drainage ditch? What type of sampling is needed to determine the extent of the spill?

A-2)   A Phase I assessment has been completed of a closed down chromium plating facility. The plating was done inside, with the liquid wastes stored outside in open pits consisting of concrete block wall and poured concreted floor. Tanks still contain plating wastes, with tests revealing leakage from the tanks but no leakages from the building. The facility is adjacent to a creek on the south, housing to the north and west, with the east being agricultural lands. Describe further sampling you might undertake in the Phase II and what type of remediate technology or technologies would be appropriate to remediate the site. Which site clean-up standards would you use?

A-3)   Describe a Record of Site Condition, including when it is required, the contents and who completes it.

A-4)   Communities in Southern Ontario are trying to remediate and reuse industrial properties and railway lines. Many of the sites have contaminated soil, with a variety of contaminants including hydrocarbons, PAHs and heavy metals. The question always asked is whether the soil can be treated onsite in-situ or ex-situ and reused, or taken off-site for disposal or treatment. Discuss the merits and challenges of both options? Which option would you recommend? Why?

A-5)   You work for Transport Canada in the Transportation of Dangerous Goods section and are on weekend duty for Emergency Assistance. A train derailment happened where four tanker cars tipped over and started leaking their contents onto the soil. The first responders call in for assistance. In order to select the appropriate model to calculate the time for infiltration into the soil, describe the parameters you need from the first responder. Initial reports suggest that the tankers contain a common DNAPL. Comment on the mathematical relationships needed to model the infiltration and the challenges in obtaining some of these parameters.

Section B: **One** out of the **Two** Questions

B-1)   A subsurface investigation was completed at an abandon industrial property and the presence of trichloroethylene (TCE) was detected in the ground water. Further investigation and analysis showed that pump & treat would be the way to remediate the site as the submerged contaminated zone was 3 m thick.

   a) How long would it theoretically take to remediate the site (per well)?
   b) Does the remediation time make sense?

   Given:

   i)   average concentration of TCE stayed at equilibrium at 150 mg/L the entire time during pumping stage
   ii) k_d (TCE) = 0.00016 L/mg
   iii)   radius of one well 0.05 m, with radius of influence at 25 m, with ideal drawdown at 0.3 m
   iv)   porosity of soil = 0.4, soil bulk density = 1700 kg/m³
   v)   hydraulic conductivity = 2 x 10⁻³ m/s

B-2)   A gasoline tanker was involved in an accident, spilling the contents onto the soil. Approximately 5,000 L of gasoline were spilled. The gasoline spread and infiltrated into the median soil to a depth of 2.0 m. The average concentration of the contaminated soil was 3200 mg/kg dry wt. basis.

   a) If no other remediation efforts were taken, estimate how many days it would take for the gasoline to evaporate from the site if flux (J) = 3 x 10⁻⁶ g/cm²·s.
   b) What could be done to speed up the evaporation process?

   Given:

   i)   Soil conditions are sandy loam (sand @ 62%; clay @ 14%; OM @ 2.1 %, CEC @ 5.5 cmol/kg) with a density of 1400 kg/m³, porosity of 0.35.
   ii)   Water content of 25% (wt)
   iii)   Temperature 20°C
   iv)   Density of gasoline = 726 kg/m³