

National Examination, December 2017

04-Env-A6, Solid Waste Engineering and Management

3 hours duration

NOTES:

1. There are **18** questions for a total possible examination mark of 100.
2. Each question is of the value indicated.
3. This examination is a **CLOSED BOOK EXAM**.
4. Clarity and organization of the answer are important.
5. **One of two calculators is permitted; any Casio or Sharp approved model.**
6. 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.

- 10 marks 1. Outline a strategy that you would propose to your client municipality that will reduce Green House Gas (GHG) emissions due to solid waste generation.
- 5 marks 2. For a population of 50,000 estimate the annual area required (excluding buffer zone) for a normally compacted landfill having a refuse depth of 4 m excluding cover material. State any assumptions made.
- 3 marks 3. What are some of the significant hazards that the generation/emission of CH₄ in land fill gas (LFG) can pose?
- 5 marks 4. Estimate the required landfill area (not including a buffer zone) for a community of 31,000 persons. Assume a solid waste generation of 3 kg/capita.day, a compacted specific weight of solid waste in the landfill at 500 kg/m³ and an average landfill compacted depth of solid waste at 8 m.
- 4 marks 5. What factors do you have to consider in assessing under what circumstances and with what limitations you could discharge landfill leachate to a nearby wastewater treatment plant?
- 3 marks 6. What do you have to address in the development of a long-term landfill closure plan?
- 10 marks 7. Landfill mining is likely to play an important role in the future of waste management. Please provide concise answers to the following items:
- 7.1 List four (4) reasons why one would consider landfill mining.
 - 7.2 Provide a list of health and safety requirements.
 - 7.3 Briefly describe items to be considered in the work plan.
 - 7.4 Show a layout with labels of the equipment used in landfill mining.
- 6 marks 8. You have been commissioned to devise a strategy for extending the life of a community landfill. Outline what you would propose.
- 6 marks 9. Name 6 factors that affect landfill gas (LFG) production.
- 8 marks 10. Your town is considering establishing a new landfill to manage their solid waste. The citizens have become concerned. In order to address this concern and opposition by the citizens to a landfill in their community, the mayor has called a public meeting where you, as the town engineer has to address this opposition and attempt to soothe their concerns and fears. Identify the steps of your strategy in point form. Your objective is that at end of your talk the audience will have fewer concerns and the opposition has lessened.

- 3 marks 11. Name 3 variables that govern landfill gas production.
- 5 marks 12. List 5 general concerns with the landfilling of solid wastes.
- 8 marks 13. In your first position as junior city engineer you are assigned to report on the generation rates and composition of solid wastes from various sources of your community.
- 13.1 How would you go about it?
- 13.2 If these data were needed in 30 days and thus you had no time to assess the potential impact of any seasonal effects, how would you estimate this factor?
- 9 marks 14. To see whether or not a particular performance criterion is met, what are the typical engineering calculations that you need to make for the following:
- 14.1 Gas testing
- 14.2 Leachate control
- 14.3 Groundwater monitoring
- 6 marks 15. In waste separation:
- 15.1 When is waste separation at source warranted?
- 15.2 What items might be considered for separate collection?
- 3 marks 16. What does the moisture content of municipal solid waste depend on?
- 3 marks 17. What is the greatest deterrent to reclaim materials in the solid waste?
- 3 marks 18. List 3 factors you must consider in the post-closure care of a landfill.

100 marks