

## National Exams December 2012

09-MMP-A6, Environmental Protection

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.

No calculator permitted.

3. FIVE (5) questions constitute a complete exam paper.

The candidate must answer question 1. The candidate may answer any four of the remaining five questions posed.

Only the first five questions as they appear in the answer book will be marked.

4. Each question is of equal value (20 marks). Marks are allocated as indicated.

5. Most questions require an answer in essay format. Clarity and organization of the answer are important.

### **1. Regulatory issues and management best practices**

Discuss the role of FIVE of the following acts, regulations, or industry associations in the regulation or management of mine waste and mine closure.

Your discussion should include the activities governed by the legislation or addressed by the industry guidelines, the responsibilities assigned to the mine operator (including engineering staff), and the consequences of failing to meet any requirements, where applicable.

Discussion of each item should take five to eight sentences.

Select FIVE of:

#### **Federal Legislation and Regulations**

- Canadian Environmental Assessment Act (CEAA)
- Metal Mining Effluent Regulations (MMER)

#### **Provincial Legislation, Regulations and Referenced Codes**

/4 each  
20  
marks  
total

- Mining Act Part VII / Mine Development and Closure Ontario Regulation 240/00 **OR**  
Mines Act [RSBC 1996] Chapter 293, Part 10: Reclamation and Closure **OR**  
Environmental Protection and Enhancement Act [Alberta 2010] Chapter E12 Part 6:  
Conservation and Reclamation
- Lakes and Rivers Improvement Act (LRIA) Ontario

#### **Industry Associations and Voluntary Guidelines**

- Canadian Dam Association – Dam Safety Guidelines
- Mining Association of Canada – Towards Sustainable Mining Tailings Working Group
- International Cyanide Management Code for the Gold Mining Industry
- International Network for Acid Prevention: GARD (Global Acid Rock Drainage Guide)

## 2. Basic terms and knowledge

True/False. Answer each of the five questions below with a “true” or “false” in your answer booklet. Provide a one to two sentence explanation of your answer.

- /2 each  
10 marks  
total
- Subaqueous tailings disposal (to fresh water lakes) is legal in Canada.
  - Fisheries are regulated by the provinces in Canada.
  - Mineral and mining rights fall under federal jurisdiction.
  - Federal environmental approval is required for most mining projects in Canada.
  - Mine sites in Canada are not allowed to discharge effluent to the environment.

Define ANY FIVE of the following terms. One to two sentences should be sufficient for each term. Only the first five definitions provided in the answer booklet will be marked.

Define FIVE of:

- /2 each  
10 marks  
total
- Tailings
  - Valley-fill construction
  - Raised embankment
  - Phreatic surface
  - Plasticity index
  - Atterberg limits
  - Creep
  - Subsidence

## 3. Acid rock drainage

- 5 marks
- Briefly describe how the acid generating potential of an ore body is assessed.  
Your description should take approximately five sentences.
  - Provide a detailed description of conventional active treatment of acid rock drainage (ARD) impacted mine water with lime.  
Your description should include an overview of the steps involved in the method, including relevant chemical reactions involved, a discussion of the benefits and disadvantages of the method, and an indication of the relative cost and effectiveness of the method.  
10 marks  
Discussion in part (b) should take approximately ten sentences.
  - List five active or passive methods used in the prevention or mitigation of ARD.  
5 marks

**4. Reclamation and mine closure**

- 5 marks a) Reclamation of tailings dams may present special challenges due to difficulties in establishing suitable ground conditions for earth moving equipment. Identify three methods of limiting the amount of pond water and/or reducing pore water pressures in tailings impoundments.
- 15 marks b) Mine closure planning is a requirement of the mine permitting process in all Canadian provinces and territories. Identify what engineering investigations need to be considered in the closure plan for an underground mine in order to deal with hazards associated with the mine complex. Include mine entry points, roadways and mine areas, underground infrastructure, mine gas, and groundwater.

Point form or a table may be used for this question.

**5. Tailings disposal options**

- 15 marks a) The upstream method of raised embankment construction is the most commonly used embankment type in Canada. Provide a detailed description of the upstream method, including the benefits and limitations of the method and an indication of the relative costs and material demands when compared to centerline and downstream designs. Your answer should indicate the situations where this construction approach is not appropriate. A table and/or diagrams may be used to simplify the discussion.

Discussion should take 10-15 sentences.

- 5 marks b) Briefly discuss the benefits and issues associated with subaqueous tailings disposal in natural water bodies (lakes). Your discussion should include both technical and social issues and/or benefits.

Discussion should take five to ten sentences.

**6. Effluents and emissions**

12 marks a) What are the primary environmental health concerns associated with the following substances:

- Arsenic
- Mercury
- Lead
- Silica

Discussion should take three to six sentences each and include typical airborne and waterborne transmission mechanisms, human health effects, and identification of the minerals or ore deposit type(s) most commonly associated with the substance.

8 marks b) Discuss one method of dust control used for open pit haul roads and one method used for waste dumps or tailings impoundments. For each method discuss the advantages or benefits of the method as well as any drawbacks. Four to six sentences should be sufficient for each method.

## Marking Scheme

All questions carry equal marks of 20 points. Five answers constitute a complete exam paper.

1. 20 marks total (5 items times 4 marks each)
2. 20 marks total (10 items times 2 marks each)
3. (a) 5 marks  
(b) 10 marks (4 marks for steps; 2 marks for chemistry and 4 marks for discussion)  
(c) 5 marks
4. (a) 5 marks  
(b) 15 marks (5 marks for hazard identification and 10 marks for study identification)
5. (a) 15 marks  
(b) 5 marks
6. (a) 12 marks (3 per substance)  
(b) 8 marks (4 per method)