Name: _____

Student No.: _____

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

THE LASSONDE MINERAL ENGINEERING PROGRAM

FINAL EXAM
DECEMBER 21, 2001
9:00 a.m.

Mining Environmental Management
MIN 430F

Note: This is a closed book exam.

Parts A and B should be answered in the space provided in the exam. If insufficient space is available, write on the back of the preceding page and clearly indicate the question.

Part C should be answered in the booklet(s) provided.

Part A (30 marks)

Answer any 5 of the Part A questions in the space provided (not in the booklet). If you answer more than five questions, **only the first five answers will be marked**.

Each answer is worth six marks and generally requires at least six specific points. Sentence form is not required, but make sure your points are complete thoughts.

A1 Describe three symptoms you would expect to see off-site that would lead you as an investigator to suspect that a nearby mine is likely discharging AMD. Be sure to provide the rationale and evidence to support your statements. For example, *"the fish/plants are dying"*, does not provide sufficient rationale to conclude that AMD is the cause (6 marks).

A2 List and provide a brief description of the three types of cyanide (6 Marks).

A3 Wisconsin and Montana have banned the use of cyanide in ore processing. Other states are considering adopting a similar ban. Provide three reasons why the mining industry considers the ban of cyanide to be unnecessary and three mitigation methods you would employ to manage cyanide impacts (6 marks).

A4 Provide a clear definition of both an:
- Environmental Management System audit, and
- Compliance audit

Provide at least two elements that are unique to each particular type of audit (6 marks).

A5 Define the three basic types of cover used in a tailings management facility to control AMD discharge. Provide three reasons as to why you would select one type of tailings cover over the others in a temperate climate (6 marks).

A6 There are ten (10) basic steps in a Reclamation Plan. Name (or describe) 6 of the steps and describe why each step is important (6 marks).

A7 Describe the installation and operation of a Minewall station:

- Apparatus required
- Installation particulars
- Sampling particulars
- Four different parameters to be measured (6 marks)

A8 What are 3 of the acceptable forms of Financial Assurance in mine closure. Explain one positive and one negative aspect of each from the perspective of the government (6 marks).

A9 There are twelve (12) components of an EMS of which eight are listed below:

- Organizational commitment
- Corporate environmental policy
- Environmental impact assessment (EIA)
- Community consultation
- Environmental management plan
- Operational and emergency procedures
- Training awareness and competence
- Emission and performance monitoring and measurement

Choose any three and under the name of the item, explain the goal and application of each component (6 marks).

A10 The Ontario Government considers all closure plans to be "interim". Provide three conditions/instances under which a closure plan amendment would be required. Which agency of the Ontario Government administers mine rehabilitation/reclamation? What legislation (including section number) in Ontario regulates mine rehabilitation/reclamation? These answers must be very specific. General descriptions will not be accepted (6 marks).

Part B (20 marks)

Answer any 5 of the Part B questions in the space provided (not in the booklet). If you answer more than five questions, **only the first five answers will be marked**.

Each answer is worth four marks and generally requires at least four specific points. Sentence form is not required, but make sure your points are complete thoughts.

B1 Briefly describe the natural degradation process as it pertains to cyanide and list two factors that affect the rate of the reaction (4 marks).

B2 HDPE and other similar substances may be used as synthetic liners to prevent seepage or infiltration. List two advantages of using these materials to mitigate impacts (4 marks).

B3 Describe two methods of public consultation and provide the main advantage of each method (4 marks).

B4 A common measure in ARD water monitoring is known as "loading". What inputs do you need to calculate loading (i.e., A+B=C; Not the right equation!)? Define the variables (4 marks).

B5 There are three basic types of cover used in a tailings management facility to control AMD discharge – water cover, soil cover and complex cover. Provide four reasons as to why you would select one type of tailings cover over another in a temperate climate (4 marks).

B6 Define the Mine Closure terms:
- Temporary Suspension
- Progressive Rehabilitation

Describe a measure taken by a mine operator which is specific to each type of closure (4 marks).

B7 Define "cumulative impact" analysis and describe one example of a cumulative impact (4 marks).

B8 You have been hired to perform an environmental audit of a mill/concentrator and tailings pond facility. List four items (potential "findings") you would watch for during the site tour (4 marks).

B9 Over the duration of the course several guest lecturers gave presentations. Describe four key points you took from any guest lecture(s). (4 marks).

B10 For four main mine facility components, describe the key method you would prescribe during mine design to minimize/prevent off-site impacts from AMD (4 marks).

Part C: Long Answers (50 Marks)

You must answer all questions in Part C. Answers must be provided in the booklet provided. Sentence form is not required, but use complete thoughts. **Make sure you provide enough detail.**

C1 The main goal of a mine Owner, having completed mining is to close and reclaim the facility in a manner which meets three key objectives, namely "physical stability", "chemical stability" and "aesthetics and (end) land use", as quickly and effectively as possible. In most jurisdictions, the Owner will not be in a position to "walk away" from the site until these conditions are met. You are the Owner of a gold mine which has been closed for a period of time. The mine facility includes an open pit, a stream diversion (around the pit), a plant site (buildings have concrete foundations), waste rock dump, ore stockpile, tailings management facility and sediment pond, along with all other ancillary facilities such as access roads, tailings pipeline, water supply pipelines, power line, explosives storage building, fuel storage facility, etc. You have been working towards meeting all of the objectives set out in your approved closure plan . Provide (in bullet format) an outline of the main technical points to be contained in a letter which you are preparing to submit to the government agency responsible for mine closure, describing the conditions of six aspects of your site and your rationale for why the government should feel confident in assuming title to your property, relieving you of further responsibility (i.e., to "walk away"). Remember to address the following:

- Conditions which demonstrate you have attained "stability"
- The evidence you would expect to present in support of your arguments
- The major stakeholders in the closure of your mine (e.g., local community, First Nations, financial institutions).

(20 marks)

C2 Sketch a cross section of a typical complex tailings cover used to control AMD. Label each of the key elements of the liner system and provide a brief explanation as to the function of each element. To avoid clutter, it is suggested that you provide your explanation of function in bullet point format under your sketch (10 marks).

C3 To reclaim an area on a mine site you need four distinct elements: soil/till, soil amendments, seeds and shrubs/trees. Choose a final land use goal from those discussed in class. Describe how you would reclaim a 10 ha disturbance using each of the four elements. Provide enough detail in a logical sequence that would assist the operations and revegetation crews accomplish the reclamation/land use goal (10 marks).

C4 What was the focus of environmental concern at Island Copper Mine from conception through closure? Describe two specific monitoring programs conducted over the life of the mine to address this concern (e.g. biological, chemical or physical activities). What, were the long-term impacts of the environmental concern? (10 marks).