Fire / Smoke Emissions

Manitoba Clean Air Com

GUIDELINES FOR THE REHABILATATION OF MINING LANDS

Preamble

The disturbance to the environment upon the cessation of mining operations can be classified into two general forms, namely aesthetics and pollution of natural water flows. The former relates to the land mass and wastes thereon, including derelict structures, excavations, rock piles and tailings dumps. On the other hand, water pollution arises when the solid portion of the tailings contains metallic sulphide minerals, particularly iron, in excess of 1% by weight. Natural waters, which come in contact with the sulphides, are subject to chemical and bacteriological reactions which result in a low pH (acidic water) and liberation of heavy metals (Cu, Zn, Pb and Fe) both of which can be harmful to all forms of animals and aquatic life. Turbidity of water flows may also be of some concern.

The leaching process could continue for many years, depending upon conditions existing at the time of cessation of operations. Site of tailings deposit, percent sulphides therein, local water drainage patterns and vegetation cover are some of the factors which can adversely affect pH and heavy metals production for periods up to 50 years. This is the condition estimated for one tailings impoundment area in Ontario where the cost of collecting and treating the seepage water is $50,000 per year for a period of 55 years. Obviously this is an area worthy of great concern.

In order to restore the aesthetics of the mining lands and preclude the pollution of natural water flows after the termination of mining operations, it is essential that a program of preventative and remedial measures be formulated at an early stage in the life of the mining operation. Two equally important periods of the program are the pre-production era and the post-abondonment stage. Numerous objectives should be set including those listed below which might be applicable.

Development - Production Period

1. Preplanning in the form of a master plan is a prime pre-requisite if the total environment is to be preserved. Of critical importance is the restoration of the entire mining land with priority designated to the waste disposal area (rock and mill tailings). The disturbance to the environment should be planned in a manner which facilitates revegetation of waste rock and mill tailings sites.

2. Natural water flows should be diverted around waste disposal areas containing sulphide minerals in order to reduce the volume of water which would be subject to contamination.

3. Some of the desirable features relating to tailings dams are as follows:

(i) Ensure stability by good engineering design, construction and maintenance.

(ii) Where practicable, they should be impermeable to water flows in order to preclude seepage of acidic water. Impervious liners can be used to advantage for this purpose.

(iii) Promote progressive vegetation growth on the downstream sides. However, trees should not be planted due to the danger of extensive root growth ultimately creating channels for water flows and subsequently dam failure.

4. Implement a research project with the objective of investigating soil conditioning needs (fertilizer types and lime neutralization) and types of vegetation which will be amenable to permanent survival in the tailings material.

5. Establish vegetation growth progressively on those portions of the tailings impoundment areas which have reached their ultimate elevation.

Permanent Closure Period

6. Where permanent closure of the mining operation is not deferred in accordance with Section 3.04(5) of Regulations under The Mines Act:

(i) All buildings, equipment, processing facilities and accumulations of wastes should be removed and/or disposed of in a manner suitable to a pleasing environment.

(iv) The tops of shafts or raises openings to surface should be closed with a reinforced concrete plug at bedrock or on top of any existing concrete collar. If the concrete plug is below grade, the remaining hold should be filled to the surface contour.

(v) Surface pits and openings other than shafts and raises that are dangerous by virtue of their depth should be filled or sloped at an angle no greater than 1 vertical to 3 horizontal where practicable.

7. The problem of acid generation in sulphide bearing tailings can be alleviated in either of two ways; permanently inundating the entire tailings disposal area with water, or preventing penetration of water into the tailings mass.

8. Complete and permanent inundation of the tailings area with water would be subject to prior approval. The decision in this regard would be affected by local conditions relative to aesthetics, future land use, danger of dam failure, etc.

9. Prevention of water penetration into the tailings would in most instances be the most desirable approach. Means of accomplishing this objective through the use of present practicable technology include the following measures:

(i) Divert all natural water flows away from the tailings impoundment area.

(ii) Induce lateral flow of water rather than vertical flow into the tailings by grading the surface uniformily so as to facilitate rapid run-off.

(iii) Establish permanent vegetation growth over the entire area of the tailings site. This growth will consume approximately 50% of the normal precipitation, leaving the balance for rapid run-off.

10. The alternative to Items 8 and 9 is to collect all the contaminated drainage and seepage flows from the impoundment area for treatment in an acid neutralization plant. Unfortunately the sludge resulting from this treatment would be water soluble, thereby creating the additional problem of disposal of the sludge. As mentioned previously, the life of this treatment plant would be governed by the conditions existing at the time of closure so that the capital-operating costs could approach astronomical proportions.

11. There has been considerable research and development in the field of reclamation of tailings dumps, most of which has been documented. However, there still exists a large void in the area of practicable technology. Research projects such as the mine waste water pilot treatment plant sponsored by the Federal-New Brunswick governments and Brunswick Mining and Smelting may resolve some of the problems in the near future. It would be to the mine operator's advantage to keep abreast of developments in this field.