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ENVIRONMENTAL AUDIT

YUKON PROPERTIES OF
CYPRUS ANVIL MINING CORPORATION

May, 1984

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1.0 SUMMARY AND RECOMMENDATIONS

In general, the Yukon Properties of Cyprus Anvil Mining Corporation (CAMC) are in good shape from the aspect of environmental protection and design. It must be stressed that continued management attention and support must be given to the environmental protection, design and operation of the properties to maintain this good rating and the resulting good relationship with government agencies that is so important for an operation of this size and importance to the Yukon economy. Problems that developed in the fall of 1982 clearly point out the need for management to keep abreast of monitoring and operating procedures.

The implementation of the proposed groundwater evaluation program in conjunction with waste rock disposal and pit planning will provide added confidence to identify situations that could affect planning and operations from an environmental viewpoint.

Prior to starting up the mill, effort must be made to minimize dust losses from hoppers, screens, conveyors. Some attention to dust prevention in control rooms and electrical switchgear may also be required.

Existing environmental monitoring is satisfactory for regulatory requirement and for company planning purposes.

Abandonment planning decisions will be required in the near future for Faro Creek diversion, Anvil property waste rock storage locations and long range planning for Grum, Vangorda and Dy property development. Economics may be made in maximum probable flood design based on recent Atmospheric Environment Service findings.

Development of procedures documents for waste rock disposal, tailings deposition, tailings impoundment management practices should be considered.

2.0 INTRODUCTION AND HISTORY

The Faro lead zinc deposit was discovered in about 1965 by Dynasty Exploration long after the Vangorda deposit was discovered in 1953. Financing was obtained and development commenced in the late 1960's. Development of the property occurred prior to the development of much of the land and water use legislation developed in the early 1970's by Indian and Northern Affairs Canada. Map 1 shows the location of the properties owned by Cyprus Anvil.

The various ore deposits occur at approximately the same stratigraphic level, Cambro-Hadrynian. All of the deposits are complexly folded. Polymetamorphosed strata form deposits with a variety of bedded ore types as follows: massive baritic sulphides, massive pyritic sulphides, massive pyrrhotitic sulphides and pyritic quartzites and ribbon banded graphitic quartzites.

When the mill and mine started up, as with most new ventures, cashflow was a problem. The first Faro Creek diversion was built in 1970, and washed out in 1971 resulting in sand, gravel and overburden from above Pit #2 into the north fork of Rose Creek. The diversion was rebuilt in 1972. In 1975 a minor washout of tailings occurred resulting in deposition of tails for some distance down Rose Creek and charges being laid against the Company. A discharge of cyanide reagent to the tailings pond as a result of plugged line resulted in charges and a stop order being issued by the Yukon Water Board. Recent biological sampling of Rose Creek shows that the creek has recovered to baseline quality found upstream of the facilities.

Considerable environmental monitoring occurs at the existing facilities and necessary environmental studies of the other potential sources of ore from Vangorda, Grum, Dy and Swim properties have been undertaken with only a few outstanding areas to be completed.

In the most recent history, detailed long term planning for tailings disposal and abandonment has been completed.

Pit water inflow control developed as a minor problem since the mill shut down in 1982. This resulted in temporary zinc levels that exceeded water licence levels. The problem was alleviated by neutralizing with lime, soda ash and mixing the supernatant water by pump circulation. During October, 1983 seepage from Pit #2 was flowing into the north fork of Rose Creek, but this flow is being rerouted to Pit #3 and is being handled with the pit inflow from Pits 1 and 3.

The following two pages show aerial photo overlays of the pits, faults and seepage locations.

3.0 REGULATORY REQUIREMENTS

Mining leases for the various lead zinc properties (Anvil, Vangorda, Grum, Dy, Swim) are obtained from the Yukon Territorial Government and Indian and Northern Affairs Canada. Leases for coal properties near Carmacks and Ross River have also been obtained.

Land Use Permits are obtained from Indian and Northern Affairs Canada for exploration and development of these leases.

The major environmental control concerning the properties is the Water Licence issued by the Yukon Water Board whose mandate is described in the Northern Inland Waters Act. This Licence authorizes the volume of water that can be used by the Corporation, the conditions of effluent treatment, handling and storage and the quality of any effluent from the tailings pond. Ground and surface water monitoring requirements (frequency, parameters, etc.) are spelled out, as are other geotechnical procedures for stability monitoring requirements and ultimate abandonment of the tailings impoundment.

In developing the Water Licence an intragovernmental committee representing Indian and Northern Affairs Canada (INAC), Department of Fisheries & Oceans (DFO), Health & Welfare Canada (HWC), Yukon Territorial Government (YTG) and other renewable and non-renewable resource agencies review the Company application and supporting information prior to holding public hearings to air relevant issues and concerns. The federal base metal mining liquid effluent guidelines and regulations promulgated under the Fisheries Act are considered as well as site specific resource concerns in establishing the conditions of the Licence.

Worker's Compensation rules primarily follow those established for the mining industry in British Columbia but are overseen by the Yukon Territorial Government. Mine safety is currently the responsibility of the Mine Inspection Branch of INAC, but is soon to be transferred to the territorial government. Enforcement of boiler, electrical and fire protection codes is the responsibility of the territorial government.

4.0 EXISTING STATUS

4.1 MINE

The Anvil deposit has been developed in three separate zones. Faro Creek bisected the deposit and two major faults and a number of minor faulting and fracturing are observed in the ore body area. Fine grained alluvial and colluvial deposits infill surface expressions of faults and generally overlay the valley.

4.1.1 Ground and Surface Water

Groundwater and some surface water that percolates through the fault systems is pumped from the bottom levels of the three pit zones to the tailings pond where neutralization with the alkaline tailings occurs. Groundwater quality from the pits generally show levels of zinc in the 3 to 50 mg/l (averaging 26.4 mg/l April-November, 1983) dissolved range (the low suspended solids observed in the water means little, if any, undissolved zinc present). Testing is to be undertaken to ascertain levels of zinc in groundwater above the pits to determine levels of zinc from natural leaching of zinc in the Anvil Range prior to reaching the Anvil Pit.

Large volumes of groundwater do not appear to enter or flow through waste rock benches, although occasional inflow (seepage) does appear on the pit walls. Surface runoff through the waste rock benches does not appear to result in increased levels of heavy metals.

In the late 1970's some ore was stockpiled in the vicinity of the waste rock benches. This ore has now oxidized without adversely affecting zinc levels in local surface runoff.

Aerial photo overlays at the end of Section 2.0 help to explain local ground and surface waters.

4.1.2 Fisheries

The activities of mining and waste rock disposal do not appear to be having any adverse affect on the fisheries resource of the north fork of Rose Creek or the main stem of Rose Creek. The stabilization of the Faro Creek diversion and the prevention of pit seepage from Zone 2 pit into the north fork of Rose Creek are being closely watched to assure no problems develop and are left unattended. Annual biological monitoring is conducted in Rose Creek to advise of any changes in the health of the biota what forecast any potential impact to the fisheries resource.

4.1.3 Stability of Pit and Waste Rock Slopes

The maintenance of safe pit slopes and proper waste rock slopes as recommended by consultants' studies and on-site engineering staff have have been and continue to be the basis of mine and waste rock planning. This will assure minimum costs for ultimate abandonment of waste rock. A long term abandonment plan has not been finalized for the pit which has at least two alternative abandonment options. The first question is whether to reroute Faro Creek through the pit thereby creating a permanent small but deep lake. Consideration is also being given to using the pit as an ultimate tailings abandonment plan. The aerial photo overlays outline present pit water sources and control systems. The importance of the Big Indian Fault to pit dewatering is to be evaluated over the next six to nine months.

4.2 MILL

The mill is a conventional lead zinc recovery facility comprising a cone crusher, rod and ball milling, zinc and lead flotation, coal fired concentrate driers and tailings flowing by gravity to a tailings pond.

The Water Licence allows for 7.2 million Imperial gallons per day (5000 Igpm) of water makeup. Poor market price and high operating costs resulted in mill shutdown in early 1982. Some mill modifications are being considered to make economies in the water balance. Although not significant in cost or magnitude, the success of these modifications will not be able to be assessed until the mill starts up again.

4.2.1 Air Emissions

Fired Concentrate Dryers

The mill contains one 7 million BTU per hour oil or coal fired concentrate dryer and four 6 million BTU per hour dryers designed for coal firing. One of the 6 million BTU/hour coal fired dryers has been modified to burn oil. Each dryer is equipped with a wet scrubber to assure good exhaust air quality. Scrubber effluent discharge goes to the concentrate thickeners. Dryer stacks extend about 4 metres above the building roof. No air quality problems appear to be associated with either the oil or coal fired dryers. Coal dusting has been associated with handling and storage of coal.

Hot Water Boilers

The mill contains three 8 million BTU/hr hot water boilers. Normal operation requires only two of the boilers to operate at any time. The boilers are oil fired with stacks extending about 4 metres above the building roof. No air quality problems appear to be associated with the hot water boilers.

Air Circulation and Dust Collection

Air circulation for worker health and safety is required in the crusher building, in the grinding area and in the flotation area. A detailed review of the dust collection and ventilation system should be done to evaluate if the existing ducting system is properly balanced with fan capacity. Prior to mill shutdown there were apparently Union-Management discrepancies on the dust levels in the crusher and screening areas. Most of these problems can be inexpensively resolved by building shrouds or covers over conveyors, screens, etc. Building a wall to separate the grinding section from the flotation area should be evaluated to ascertain if the grinding area causes dust problems in the flotation area. Dust collection practices will require continued attention prior to and after mill start-up.

Dust problems previously associated with lime handling were related to maintenance problems of baghouse filters on the lime silo. Subsequently, a wet scrubber was installed that is directed to the tailings launder. The installation of a pressure unloading system for the lime results in excessive dusting during truck to silo transfer when the mill isn't running.

Dust problems related to coal handling and storage appears to be a function of the moisture content of the coal. Problems were experienced when underground coal was being used, but recent open pit supply reportedly does not cause dusting problems when stockpiling or filling the coal hopper.

4.2.2 Industrial Effluent Control

The wet scrubber liquid discharges are added to the thickeners then sent to the tailings pond. A mill water balance is being developed to determine if the necessary volumes of water are available under the terms of the existing Water Licence to operate the mill at design or optimum tonnages. Some change in process piping and pump location should give better utilization of water and studies can be undertaken to evaluate the use of the 400 gpm (winter) to 700 gpm (summer) of pit seepage water as additional makeup water if necessary. Recycle of supernatant from behind the Cross Valley dam could also be considered without requiring modifications to the licenced water volumes. However, if groundwater wells are to be located west of the Cross Valley dam for recycle, this may require modifications to the Water Licence as this water may be defined as being water from the Rose Creek aquifer.

Flotation procedures have stressed reduction in the use of cyanide as a depressant. Cyanide control procedures may need to be evaluated and implemented. No other chemicals or reagents have been used that have the potential to cause health or environmental effects.

At present the mill is licenced to use up to 5007 Igpm over any one day, but based on an operating year the average approved water useage is only 3800 Igpm. While the existing storage volume in the raw water reservoir located on the main fork of Rose Creek is not large enough to allow continued removal of more than about 4500 Igpm over the winter, studies on use of pit water and recycling of tailings pond supernatant can provide additional water required with minimal effect on recovery efficiencies.

4.2.3 Sewage Disposal

Sewage from the mill and labs go to a septic tank that requires extensive maintenance. Sewage from the guardhouse goes to a septic tank system with a good tile field. The new office building septic tank and field have some minor problems. The lunch room sewage system is tied directly into the tailings line. A new health inspector has recently been appointed and he visited the property without making any requests for modifications.

4.2.4 Sanitary Landfill

Packing materials, waste paper and other organic wastes are disposed of at an internal face of a waste rock dump which is covered regularly. The earlier practice of dumping garbage on outside faces of a waste rock dump has been terminated due to adverse visual impact and material blowing around.

4.2.5 Salvage Yard

A salvage area exists for scrap steel, valves, piping, pumps, vehicles, shovels, drills and haul trucks, etc. in the vicinity of the mill. Much of this material has been cannibalized over time.

4.2.6 Contingency Plan for Fuel Spills or Other
Accidents That Could Affect the Environment

Major fuel storages are in the pit area and a permanent oil trap has been constructed below the toe of the waste dump in the original Faro Creek bed. Trapped fuel and oil is "burned off" from this trap.

All fuel storage facilities are provided with a containment dyke. All drainage from the plant site flows into the tailing pond where recovery or treatment can be performed.

Clean-up of chemical or concentrate spills from highway trucks are supervised by Cyprus Anvil personnel.

All significant spills which endanger the environment are reported to Yukon Emergency Measures Organization in Whitehorse. This organization has issued a contingency plan manual which is updated periodically.

4.3 TAILINGS IMPOUNDMENT

CAMC has developed its third tailings impoundment area. The first two are contiguous, have essentially been filled and will be ultimately located within the most recent structure built in 1981. The tailings pond is licenced in the Yukon Water Board licence issued effective March 24, 1982, expiring March 24, 1989. The tailings disposal area is adequate to mine the Anvil deposit, the Vangorda, Grum and Dy properties based on projected ore body reserves. A tailings placement plan is being developed as a Water Licence requirement and is expected to obtain ready approval of the Water Board staff.

The tailings pond is shown in Figure 4 with the Rose Creek diversion, the secondary containment pond between the Intermediate dam and the Cross Valley dam.

4.4 WORKER HEALTH AND SAFETY

CAMC installed a modern medical screening facility with audiometric, pulmonary lung function, sight screening, hematofluorometer (provides indication that further testing is required to assess levels of lead in the blood) testing capability. A full time nurse has been employed with responsibility to maintain employee health records. These records have been maintained since January, 1978 as required under the Yukon Territorial Regulations of the Mining Division of Indian & Northern Affairs Canada.

4.5 POLYCHLORINATED BIPHENOLS (PCB's) IN ELECTRICAL EQUIPMENT

There are 24 capacitors containing a total of 823.2 pounds of Polychlorinated Biphenol located at the Cyprus Anvil Mill Site. All capacitors have the required Environment Canada labels affixed.

4.6 OTHER OPERATIONS PROPERTIES

4.6.1 Carmacks Coal Properties

CAMC acquired two properties from Carmacks Coal Ltd. in the late 1960's, the Tantalus on the south side of the Yukon River and the Tantalus Butte property on the north side of the Yukon River. No development or mining has been conducted at the Tantalus property since acquisition. The mine had been operated as an underground mine and had caught fire prior to CAMC acquisition. The mine was sealed but occasionally snow melts to indicate the fire may still be smoldering. No action has been requested by INAC on this property for abandonment. There are no outstanding work requirements on the leases.

The Tantalus Butte operation was started as an underground operation and operated 1969-1977 as an underground mine by CAMC. After open pit mining was started on the property, an underground fire started in this property. As the property had surface raises, it was virtually impossible to seal the mine completely. The property is fenced by a single strand of wire and posted with signs warning not to trespass as minor cavings have occurred over the past years. The Mines Branch have not raised any further safety concerns.

A small stockpile of coal still exists on the Tantalus Butte lease. Considerable reclamation work has already been done on waste piles, tipple and above ground facilities. There needs to be some work done on one face of the open pit to reclaim it. The length of face is about 500 feet and some additional coal may be recovered in grading the slope to a stable angle. Consideration has been given to applying seed and fertilizer to the waste pile slopes, but has been held off pending resolution of source and type of fuel to be used for operating dryers and hot water boilers.

4.6.2 Ross River Properties

These leases were acquired in the late 1970's from a local equipment operator. Little development has been conducted beyond cutting trenches to ascertain quality of coal. A site visit next summer is warranted to develop a first hand evaluation.

Proximity to International Biological Program Site 61 as a Yukon Reserve and updated trapline surveys must be done.

5.0 ENVIRONMENTAL REQUIREMENTS TO BRING VANGORDA,
GRUM, DY AND SWIM PROSPECTS INTO PRODUCTION

During 1980 and 1981 considerable work was undertaken by CAMC staff to discuss the conceptual development of mining the Vangorda and Grum properties, transporting the ore from the deposits by conveyor belt to the existing mill for processing then disposal of tailings in the expanded Cross Valley Tailings Impoundment. Map 1 shows the general area of the prospects and existing facilities. Two areas were identified where further work should be undertaken. The first is the local Fannin Sheep population that utilize Mount Mye and migrate across the path of the conveyor belt. The Yukon Territorial wildlife biologist advised that an inexpensive program to alter the migratory route could be developed and implemented over two successive years under his guidance. The second area is the definition of local groundwater patterns in the ore body area and those areas projected for waste rock disposal. Care should be taken to obtain information during any future delineation drilling by measuring depth groundwater is determined at, conducting rising head permeability testing and analyzing groundwater quality. In the event no delineation drilling is to be undertaken, a groundwater evaluation program should be conducted prior to planning approval.

Surface water quality and hydrology, fisheries, vegetation, wildlife information has been acquired and appears adequate to prepare applications to obtain the necessary approvals for all properties except Swim. Ongoing meteorological monitoring of snow and rain precipitation at the Faro mill and townsite are adequate for planning purposes. Updating of trapline information should be done annually.

6.0 ABANDONMENT REQUIREMENTS

The main concern that needs to be answered in order to obtain approval of abandonment plans for the properties is the determination of the maximum probably flood (MPF) occurrence. The design and stability of stream beds, spillways and impoundments is related to the Maximum Probable Flood. Meteorological stations established at the mill and at the Faro air strip will be maintained to obtain site specific information to help project more accurately the precipitation event that would result in the MPF. Recent information from Atmospheric Environment Service concerning Probable Maximum Precipitation events were considerably higher than necessary in the original design. A review should reduce the estimated abandonment costs significantly.

The abandonment requirements that are presumed to be required in the future are:

6.1 FARO CREEK

Faro Creek will be rerouted through the Anvil Pit to the east of the tailings impoundment and the Faro Creek diversion reclaimed.

6.2 MINE PITS AND UNDERGROUND

Mine pits 1, 2 and 3 from the Anvil property will most likely be allowed to be flooded as small deep lakes. Backfill of any underground areas may utilize waste rock from overburden from Grum and Dy. No planning for abandonment of Grum, Dy, Vangorda or Swim has been given as delineation of ore bodies and waste volumes to be removed are not available. Abandonment is not considered to be a serious problem, but can be handled with existing reclamation techniques.

6.3 WASTE ROCK

Waste rock piles are constructed with suitable slopes to prevent erosion and maximize opportunity for natural regrowth.

6.4 MILL SITE

Mill buildings will have to be removed unless the site has historic value. Minor site grading and vegetation will be required.

6.5 TAILINGS

Tailings abandonment will continue to be the area that requires evaluation and study throughout the life of the mine to assure that the safest, most cost-effective remedy is employed. The additional meteorological data and monitoring information will help to define the abandonment program ultimately employed.

6.6 ROSE CREEK

Ongoing monitoring of slope stability and prediction of the Maximum Possible Flood will help confirm that the existing Rose Creek diversion is adequate for abandonment.

7.0 FUTURE ENVIRONMENTAL WORK REQUIRED

Very little environmental work of a mandatory nature is required. Much of the remaining work that is not mandatory can be done in conjunction with mill start-up. The work is listed in decreasing order of priority.

7.1 MANDATORY ENVIRONMENTAL WORK

- a. Problem of high zinc seepage from Zone 2 Pit through toe of waste into the north fork of Rose Creek appears to be rectified. Complete evaluation and long term solution of the problem may not be possible until after snow melt. A reoccurrence of the problem has the potential for high visibility (articles in paper, prosecution).
- b. Complete groundwater evaluation study. This must be done for proper planning of pit development, waste rock disposal and ultimate abandonment.
- c. Continue to operate meteorology station to allow better estimation of Maximum Probable Flood for abandonment purposes.
- d. Establish a water balance for the mill to evaluate potential water use practices that would allow saving water. While existing water licence does not appear to allow sufficient water to operate the mill at a 9500 tpd throughput day after day, an additional 400-700 gpm of pit water may be used to augment water volumes. Metallurgical studies show pit water doesn't adversely effect flotation. Tailings pond supernatant can also be instituted if additional water is required.

These should provide ample water, however, we should consider reopening the Water Licence to obtain the necessary water if required.

- d. Continue monitoring specified in the terms of the Yukon Water Board Water Licence.
- f. Implement dust collection improvements.

8.2 DISCRETIONARY ENVIRONMENTAL WORK

- a. Update contingency plans for mill and mine.
- b. Obtain groundwater information on the Grum, Vangorda and Dy properties.
- c. Develop the Fannin sheep migration route alteration program.
- d. Evaluate the riprap erosion problem at the bottom of the terracing in the Rose Creek diversion. This will help ultimate abandonment.