

POGO PROJECT FINANCIAL ASSURANCE REVIEW

**Sarah Zuzulock, MS
Center for Science in Public Participation**

May 2003

1.0 Introduction

The Pogo Project is a proposed mine located near the Goodpaster River in the Tanana Uplands in interior Alaska 38 miles northeast of Delta. This project is a joint venture between Teck-Pogo Incorporated (mine operator), Sumitomo Metal Mining Company Limited, and Sumitomo Corporation. This underground mine and milling operation will produce gold. Exploration of the Pogo Project claims was conducted from 1991 to 1998, with development beginning in 1999. Operations are anticipated to begin once the Pogo Project is permitted. The ore body is estimated to contain 9 million tons gold averaging 0.57 ounce per ton, and 5.6 million ounces at the 0.1 ounce per ton cutoff grade. The life of mine is estimated to be 11 years at the designed production rate of 2,500 tons per day initially with a maximum of 3,500 tons per day.

The gold ore is removed from underground workings using cut and fill techniques and transported via conveyor to the surface mill and concentrator facilities. Gold is proposed to be recovered in the mill by a combination of gravity concentration, flotation, and cyanide leaching. Tailings generated during metals recovery is prepped with cyanide destruction and filtration before being sent back underground (approximately 50%), or to a 36 acre dry stacked surface tails facility. The potential of acid rock drainage (ARD) in the tailings area and development rock sites was not discussed in the reclamation plan. It was mentioned, however, that the Liese Zone contains two tabular low-sulfide (3%) quartz zones (page 1-8). The mine site project facilities (underground mine, mill complex, miner camp, tailings, water treatment facilities) are proposed to impact approximately 417 acres, with an additional 1,398 acres disturbed for the powerline and the Shaw Creek all-season road.

Reclamation at the Pogo Project is planned to occur both concurrent with operations and after mining and milling have ceased. The two principle objectives for reclamation and closure of the Pogo Project are (1) to stabilize the land for post-mining use, and (2) to ensure water quality is not influenced after mining. The Pogo Project is located on approximately 41,880 acres of state mining claims. Post-mining land use is designated for wildlife habitat and recreation. To achieve post-mining land use, the Pogo Project reclamation plan includes enhancing wildlife habitat in 5 to 15 years by stimulating growth of early successional forests, blending topography, and establishing wetland areas.

Reclamation is described in five phases. Phase I involves reclamation of disturbance from exploration and construction areas not needed for reclamation. Phase II describes concurrent reclamation activities including reclamation of stockpiled mineralized development rock. Phase III includes final reclamation and closure of the mine site including removing facilities not needed for closure, stabilizing the site, and setting up a temporary closure camp. Phase IV, entitled post closure reclamation, begins once mine site closure is complete and includes operation of the water treatment plant for up to ten years and monitoring and maintenance. Phase V is post closure monitoring which will begin once water quality standards are met and all reclamation is complete. This includes a twenty year monitoring period for groundwater, stormwater, surface water, and vegetation.

The Pogo Project reclamation plan and closure cost estimates were prepared in accordance with standard engineering cost estimation procedures and are consistent with methods commonly used by industry as well as state and federal agencies. The proposed financial assurance falls under the regulation of the Alaska Department of Natural Resources Division of Mining, Land, and Water Management (ADNR-DOM), the Alaska Department of Environmental Conservation (ADEC), and the US Army Corps of Engineers (COE). The Pogo Project reclamation and closure costs are estimated at \$21,651,000 to cover the cost of mine site reclamation and closure, water treatment, and monitoring and maintenance of reclamation work, and surrounding water quality.

Current financial assurance amounts estimated for the Pogo Project guarantee reclamation takes place in the event of bankruptcy, or other circumstances where reclamation is not completed by Teck-Pogo Incorporated, and joint venture partners, are evaluated in this report. This technical review is based on analysis of the existing reclamation plan and financial assurance cost estimate listed below:

- *POGO Project Documentation Series for Permitting Approval Reclamation & Closure Plan, December 2002.*

This evaluation was developed to ensure that the financial assurance amount held for the Pogo Project by the state of Alaska are adequate to cover the costs of reclamation and closure as required by Alaska statutes and regulations. The state of Alaska is required to obtain financial assurances to ensure that the approved reclamation tasks are completed in the event Teck-Pogo Incorporated and joint venture partners fail to perform the necessary tasks as outlined in the reclamation plan.

2.0 Methods

If the state of Alaska becomes responsible for reclamation at the Pogo Project it is critical that adequate funding is available for completion of the required tasks. It is well documented at other mine sites (e.g. Summitville Mine in Colorado; Zortman Landusky, Beal, and Basin Creek mines in Montana; and Brohm Mine in South Dakota) that in the event the operating company files bankruptcy costs incurred by the State to perform reclamation are significantly higher than those originally estimated (Kuipers 2000). In some cases costs incurred by state and federal agencies can be 10 to 100 times higher than those estimated in reclamation plans and financial assurance calculations (Kuipers 2000). For these reasons this review of the Pogo Project reclamation plan and financial assurance takes a conservative approach to cost estimating.

Financial assurance estimates calculated in this review were performed in accordance with standard cost estimation procedures and are consistent with methods commonly used by state and federal regulatory agencies. Site-specific reclamation tasks and associated areas of disturbance were developed from the aforementioned financial assurance estimate. Assumptions, reclamation tasks and associated costs used in this estimate are the same as those used in the existing reclamation plan and financial assurance, except where noted in the explanations for each scenario.

First, the existing financial assurance estimate was replicated (as Scenario 0) in a format that allows for unit costs to be determined for specific reclamation tasks. Next, four scenarios were developed where unit costs, indirect costs, and project timelines were evaluated and varied as described in the following sections. Finally, cash flow worksheets were generated for each scenario.

Detailed estimate calculations and the resulting scenarios and assumptions are provided as Attachment 1 for the Pogo Project reclamation plan. Attachment 2 illustrates additional calculations made for the developed scenarios with extended water treatment and monitoring. Table 1 below summarizes the financial assurance amounts calculated for this review.

Table 1. Pogo Project Financial Assurance Costs Summary

Pogo Project Reclamation Plan	Pogo Project	CSP ² Scenarios			
	Scenario 0	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Based on 2002 reclamation plan.	Based on 2002 reclamation plan with increased indirect costs.	Based on Scenario 1 with changes to unit costs.	Based on Scenario 2 with 50 years water treatment.	Based on Scenario 2 with 100 years water treatment.
Capital Costs	\$13,474,394	\$17,292,139	\$19,396,987	\$20,628,987	\$22,168,987
Operating Costs	\$8,177,388	\$10,494,315	\$15,163,348	\$63,572,115	\$117,549,115
Total	\$21,651,782	\$27,786,454	\$34,560,335	\$84,201,102	\$139,718,102

3.0 Review of Pogo Project Reclamation Plan and Financial Assurance Calculations

3.1 Pogo Project Scenario 0

For Scenario 0 labor costs, equipment costs, material costs, and volumes estimated for specific reclamation tasks used duplicate those provided in the cost estimation worksheets in the Pogo Project reclamation plan. Subcontract costs estimated were added into the labor costs. Equipment costs and efficiencies are based on contractor quotes. These costs are typically estimated with the Caterpillar Performance Handbook, but the estimated equipment costs for the Pogo Project tend to coincide with other Alaska mine site estimates. Wage rates are not based on the Davis Bacon Wages for Alaska; however, the hourly wage rates used seem to coincide with labor costs estimated at other mines in Alaska. Material costs are based on contractor estimates.

Scenario 0 was generated to determine unit costs for specific reclamation tasks used in the Pogo Project cost estimate. Unit costs are evaluated and changed in subsequent scenarios. Although data inputs for Scenario 0 were derived from the Pogo Project reclamation plan slight differences in total amounts are observed. The Scenario 0 reclamation plan financial assurance amount differs by \$782 (\$21,651,000 - \$21,651,782). This results in less than a <1.0% difference when compared to the financial assurance generated for the Pogo Project.

Review of the Pogo Project reclamation plan and associated financial assurance calculation revealed the following observations:

- The reclamation plan needs more detail regarding closure tasks. For example, it is unclear in Appendix F of the reclamation plan which rock piles to be reclaimed contain mineralized rock versus non-mineralized rock. Periodic reevaluation of the reclamation plan will be necessary as more accurate volumes and project timelines are determined once operations begin.

- A detailed reclamation and closure schedule illustrating estimated timeframes for closure of major mine components (underground mine, impoundments, etc.) was not included in this reclamation plan. This is commonly used to generate a cash flow worksheet to determine the present dollar amount required to post financial assurance.
- Wetland habitat seems to comprise a significant (40%) portion of the land area proposed for disturbance under this proposal. Wetland reclamation and/or reconstruction for closure is often more costly than revegetation on 'dry land'. The cost estimate provided in Appendix F of the reclamation plan does not readily differentiate between wetlands and 'dry land' reclamation. Additional consideration should be given to the cost of contouring and revegetation planned on wetlands, and these areas should be distinguishable in the detailed cost estimation worksheets.
- The reclamation plan and cost estimate includes costs for salvage of mine site equipment and facilities. No salvage credit was applied to the cost estimate in either the company's reclamation plan or in any of the CSP2 scenarios.
- Water treatment after closure will utilize existing water treatment facilities until compliance standards are achieved. According to the reclamation plan water treatment facilities are planned for use up to 10 years after closure. The Pogo Project reclamation plan does not provide assurance that ARD problems from underground mine workings (a majority of sulfides and CN will be disposed of in paste) have been evaluated and will not occur; while the Liese Zone contains two tabular low-sulfide (3%) quartz zones. Additionally, the draft EIS discusses the potential for arsenic, iron, and nickel to exceed water quality standards at discharge (EPA et al. 2003). Based on experience at other mine sites with acid generating materials, ARD impacts can be expected to continue for a significant time period following reclamation. Although conditions will most likely improve following reclamation, water treatment facilities may be needed well into the future.

Due to the significant impacts on groundwater and surface water quality ARD and metal/metalloid loading has been demonstrated to cause, the potential for long-term water treatment should be examined more closely. Seepage from the dry stack and RTP facilities is expected to continue until closure, and most likely after closure, as these impoundments will be unlined facilities. The possible need for water treatment facilities into the future is addressed in Scenarios 3 and 4 of this review where water treatment is continued for periods of 50 and 100 years respectively.

- Maintenance and monitoring plans are not adequately described in the reclamation plan. Water quality assurance monitoring is presented as a single line item for Phases I through IV, and it is not clear if this is intended for site inspections, analysis costs, or both. For all 5 reclamation phases a detailed monitoring schedule including monitoring sites, parameters to be measured, frequency, duration, and cost should be determined.

In addition to monitoring, a detailed maintenance schedule should be developed. This should include regular inspections and maintenance as needed for the plugged portals, engineered soil covers, impoundment stability, and revegetation success to ensure closure goals are achieved.

3.2 **CSP** Scenario 1

Scenario 1 duplicates the Pogo Project reclamation plan (Scenario 0) financial assurance capital and operating costs with changes made to indirect costs as noted below. Scenario 0 indirect costs are calculated at 20% of the estimated contract costs, and Scenario 1 indirect costs are 54% of the estimated contract costs. The difference results from increases in Scenario 1 indirect costs to account for additional mobilization/demobilization, engineering redesign, procurement, construction management, contractor overhead, additional agency administration and inflation.

A financial assurance cost estimate should be performed under the assumption that reclamation is performed by a third-party under contract to the appropriate regulatory agency. Factors including contractor ownership, standby, overhead, engineering redesign, etcetera result in higher costs than those typical of reclamation costs when performed by mining companies. Indirect costs represent one of the most common areas in which financial assurance requirements are underestimated (Kuipers 2000). Indirect costs are added to this estimate to account for additional costs incurred in the event of agency management and oversight of reclamation and closure.

The Pogo Project cost estimate included indirect costs for contingency (5%), mobilization and demobilization (2%), contractor profit and overhead (10%), and agency administration (3%). In this estimate, indirect costs amount to 20% of the operating and capital contract costs.

The following indirect costs were applied to **CSP** Scenario 1:

- *Contingency.* Contingency costs reflect the level of detail and completeness of the cost estimate, as well as the degree of uncertainty of factors and assumptions used in the cost estimate. A contingency amount of 5% was applied to the estimated contract costs in the Scenario 1 cost estimate, which is the same percentage used in the Pogo Project cost estimate.
- *Mobilization / Demobilization.* Mobilization / demobilization costs account for the transport of equipment and materials to and from the mine site, as well as infrastructure needs. A mobilization/demobilization amount of 5% was applied to contract costs estimated in Scenario 1. The Pogo Project cost estimate uses 2% for mobilization / demobilization.
- *Engineering Redesign.* Engineering redesign costs stem from a lack of detailed information and plan development in a financial assurance estimate, as well as the need to account and design for actual conditions at the time of reclamation and closure. An engineering redesign cost of 3% was applied to the estimated contract costs used in Scenario 1. The Pogo Project cost estimate did not include any amount for engineering redesign.
- *Engineering, Procurement, Construction Management.* This indirect cost accounts for the requirement of construction engineering, procurement, and construction management on behalf of the agencies in the event they become responsible for reclamation. An indirect cost of 5% of the contract costs was used in Scenario 1, while the Pogo Project cost estimate does not account for the cost of this activity.
- *Contractor Overhead.* Contractor overhead accounts for administration, management, public relations, safety, environmental, legal, performance bonding and other costs associated with doing

business. A contractor overhead cost of 15% was applied to the estimated contract costs used in the Scenario 1 cost estimate. The Pogo Project cost estimate included 5% for contractor overhead.

- *Contractor Profit.* This indirect cost accounts for contractor profit. A contractor profit amount of 10% was applied to Scenario 1. The Pogo Project financial assurance estimate includes a contractor profit rate of 5%.
- *Agency Administration.* Agency administration includes costs incurred by state and federal agencies in situations where reclamation and closure are performed by regulatory agencies. Agency administration costs were accounted for as 8% of the contract costs in Scenario 1, but only 3% of the contract costs for the Scenario 0 cost estimate.
- *Inflation.* Inflation indirect costs account for the difference in the dollar value between the time the estimate was generated and reclamation and closure are performed. An inflation amount of 3% was applied to the contract costs estimated in Scenario 1. Inflation was not accounted for in the Pogo Project estimate.

Application of these indirect costs in Scenario 1 results in an overall increase of 28% over Scenario 0. The Pogo Project reclamation plan costs were estimated as \$27,786,454 under Scenario 1. Indirect costs for Scenario 1 amount to 54% of the estimated operating and capital contract costs, while indirect costs were 20% for Scenario 0.

3.3 CSIP² Scenario 2

Scenario 2 includes the addition of indirect costs as described for Scenario 1, as well as changes to unit costs and reclamation tasks as described below.

- *Growth Media Application.* The Pogo Project reclamation plan uses a 6 inch cover of growth media where required before revegetation. This cover depth may not be adequate to apply sufficient amount of growth media to all surfaces. For example, the most common surface receiving growth media in this estimate are gravel pads that will most likely require greater than 6 inches of cover for long-term revegetation success and stability.

Scenario 2 assumes application of a 12 inch cover of growth media to ensure that all surfaces are adequately covered with the growth media upon application. Unit costs and volumes of growth media required were both doubled for each specific reclamation task for this item to account for additional hauling and contouring costs. Contingent growth media stockpiles discussed in the reclamation plan should be evaluated for adequate growth media volume to provide 12 inch covers. These changes increased the cover application costs from \$353,358 in Scenario 1 to \$1,413,432 in Scenario 2.

- *Re-Seeding Costs.* The unit costs estimated in the Pogo Project reclamation plan for re-seeding seem low when compared to other operations. The revegetation procedures described in Appendix B of the reclamation plan describe different reclamation methods for minimally disturbed and highly disturbed areas. Minimally disturbed areas are to be scarified and fertilized to allow for natural recovery, while highly disturbed areas are prepared and reseeded.

Scenario 2 uses a revegetation unit cost of \$1,500/acre (\$0.31/sy) on flat surfaces, and all surfaces are assumed to be flat (detail not provided in cost estimate). These unit costs are based on Montana

Department of Environmental Quality (MDEQ) financial assurance recommendations. In addition, minimally disturbed areas not planned for reseeded in Scenario 0 were included in the revegetation costs of Scenario 2. This includes the drystack cover, solid waste facility cover, and airstrip. These changes increased the revegetation costs from \$110,779 in Scenario 1 to \$217,509 in Scenario 2.

- *Sludge Disposal.* Sludge from water treatment facilities will be backfilled underground while the mine is operating. After closure of the underground mine, sludge disposal will be required for the 10 year water treatment period. A sludge disposal unit cost of \$20,000/year to dispose of sludge generated from water treatment activities was added to Scenario 2.
- *Water Treatment Plant.* The Pogo Project reclamation plan assumes that existing water treatment facilities will be utilized after closure for up to 10 years, or until water quality standards are met. Two processes for water treatment are planned before discharge. The first is high-density sludge treatment to precipitate metals and arsenic, and the second is a lime-softening / recarbonation treatment to remove calcium and magnesium (EPA et al. 2003). The water treatment plant is anticipated to operate at 180 gpm for 8 months per year for 10 years. The estimated cost of \$3,500,000 for 10 years of water treatment at this flow rate results in a unit cost of \$6.00/ 1000 gallons treated water.

Scenario 2 assumes a water treatment cost of \$10.50/ 1000 gallons treated (see Attachment 2), based on the average unit cost of similar water treatment plants. At the same flow rate, this results in a 10 year water treatment cost of \$6,531,840. These changes increased the water treatment costs from \$3,500,000 in Scenario 1 to \$6,531,840 in Scenario 2.

Application of these additional costs in Scenario 2 results in an increase of the current financial assurance amount by approximately 60%. The Pogo Project reclamation plan costs were estimated as \$34,560,335 under Scenario 2.

Scenario 2 is the **CSIP** preferred alternative presented in this review. This scenario includes additional costs for indirect expenses, application of a 12 inch (vs. 6 inch) cover, revegetation, water treatment plant operation and maintenance, and sludge disposal. The 10 year duration of water treatment is accepted under Scenario 2, but it is strongly noted that the Pogo Project reclamation plan does not include technical justification regarding the estimated 10 year treatment period. For that reason, Scenarios 3 and 4 were developed to assess reclamation and closure costs in the event water treatment is required for longer than 10 years.

3.4 **CSIP** Scenario 3

Scenario 3 utilizes the same assumptions and changes made in Scenario 2, with the addition of 50 years of water treatment. As previously discussed, the Pogo Project reclamation plan does not include adequate detail regarding water quality, quantity, and acid rock drainage or metal loading impacts to assess the adequacy of the estimated maximum 10 years of water treatment and 20 years of monitoring and maintenance.

Therefore, Scenario 3 was developed to determine the cost differences should water treatment, monitoring, and maintenance need to be extended for 70 years (50 years water treatment plus 20 years monitoring and maintenance). In this case, water treatment plant operation and maintenance costs were increased to reflect an operational period of 50 years. This includes a sludge disposal cost of \$1,000,000 for 50 years of water treatment. Water treatment plant operating costs are estimated at \$32,550,000 for

this timeframe. Water treatment plant capital replacement costs totaling \$4,614,000 were also assumed. For capital replacement costs, a water treatment plant capital cost of \$2,614,000 was assumed based on the **CSIP**² water treatment plant capital unit cost of \$6,535/gpm and a water treatment plant capacity of 400 gpm. See Attachment 2 for additional details on **CSIP**² unit costs.

Monitoring and maintenance under this scenario is performed as described in the reclamation plan with the time period extended. Long-term operation and maintenance expenses increased to \$5,234,490. As mentioned previously, more detail is needed to determine the activities planned for post-closure monitoring to assess its adequacy for evaluating if closure goals are achieved. Under this scenario monitoring planned for Phases I to IV was extended for 50 years at an annual cost of \$50,000 per year, and Phase V monitoring was not changed. Monitoring and maintenance costs for plugs, drystack tails, and the RTP impoundment should be evaluated and included here to ensure that post-land uses and goals of reclamation (i.e. no influence on water quality) are achieved.

Application of these additional costs in Scenario 3 results in an increase of the current financial assurance amount by 289%. The Pogo Project reclamation costs were estimated as \$84,201,102 under this scenario.

3.5 **CSIP**² Scenario 4

Scenario 4 utilizes the same assumptions as Scenario 2, with the addition of 100 years of water treatment to mitigate acid generating drainage and/or metal and metalloid loading. This scenario was developed to determine the cost difference if water quality standards were not met for 100 years after closure. Monitoring and maintenance under this scenario continue for 120 years, or 20 years after water quality standards have been met.

In this case, water treatment plant operation and maintenance costs were increased to reflect an operational period of 100 years. Water treatment plant operating costs are estimated at \$65,100,000 for this timeframe. Water treatment plant capital replacement costs of \$4,614,000 were assumed. Sludge disposal costs for 100 years of treatment were estimated at \$2,000,000.

Monitoring and maintenance under this scenario is performed as described in the reclamation plan with the time period extended to 120 years. Long-term operation and maintenance expenses increased to \$7,734,490. As mentioned previously, more detail is needed to determine the activities planned for post-closure monitoring to assess its adequacy. Under this scenario monitoring planned for Phases I to IV was extended for 100 years at an annual cost of \$50,000 per year, and Phase V monitoring was not changed. Monitoring and maintenance costs for plugs, drystack tails, and the RTP impoundment should be evaluated and included here to ensure that post-land uses and goals of reclamation (i.e. no influence on water quality) are achieved.

Application of these additional costs in Scenario 4 results in an increase of the current financial assurance amount by 545%. The Pogo Project reclamation plan costs were estimated as \$139,718,102 under Scenario 4.

4.0 Conclusions

As illustrated by this review, the Pogo Project financial assurance of \$21,651,000 currently proposed may not be adequate to cover the costs of reclamation and closure incurred when these tasks are performed by a regulatory agency. In the event water quality standards are met within the assumed timeframe of 10 years, reclamation and closure costs could increase from between 28% and 60% as shown in Scenarios 1 and 2. If water treatment is required for 50 years the financial assurance amount could increase by 289%, and by 545% if water treatment is required for 100 years. This results in a potential increase of the overall financial assurance amount to between \$27,786,454 and \$139,718,102.

5.0 References

EPA, COE, ADNR. March 2003. *Draft Environmental Impact Statement Pogo Gold Mine Project Delta, Alaska National Pollutant Discharge Elimination System (NPDES) Permit Application No. AK-005334-1.*

Kuipers, JR. February 2000. *Hardrock Reclamation Bonding Practices in the Western United States.* Boulder: National Wildlife Federation.

Teck-Pogo Inc. December 2002. *POGO Project Documentation Series for Permitting Approval Reclamation & Closure Plan.*

Note: All attachments are Microsoft Excel spreadsheets, available to download at www.csp2.org/Reports