# 2011 ANNUAL ACTIVITY AND MONITORING REPORT

# SUMITOMO METAL MINING POGO LLC

Submitted To:

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# 1. Introduction

Sumitomo Metal Mining Pogo LLC (Pogo) prepared this report to fulfill the requirements of the *U.S. Environmental Protection Agency (EPA) NPDES Permit AK005334-1 (5/16/04)*, *Alaska Department of Environmental Conservation (ADEC) APDES Permit AK005334-1 (5/1/11), ADEC Waste Disposal Permit 0131-BA002 (12/18/03), Alaska Department of Natural Resources (ADNR) Pogo Mine Millsite Lease ADL416949 (3/9/04)*, *and ADNR Plan of Operations Approval F20039500 (12/18/03)*. This report covers the period from January 1, 2011 through December 31, 2011.

# 2. 2011 Monitoring

A prescriptive program of environmental monitoring is conducted as required by Pogo's permits and in accordance with Pogo's approved *Pogo Mine Monitoring Plan* and *Quality Assurance Plan (QAP)*.

The objectives of the monitoring programs are:

- To monitor the water quality of the effluent discharged from the facility,
- To monitor water quality changes in the Goodpaster River and in the groundwater below the facility that may occur as a result of mining activities or discharges from the facility,
- To monitor metal content in the fish tissue of juvenile Chinook salmon from the Goodpaster River upstream and downstream from the project facilities,
- To monitor the Carbon-in-Pulp (CIP) Tailings Processes associated with the underground paste backfill, and
- To monitor the Flotation Tailings and the materials placed in the Dry Stack Tailings Facility (DSTF).

Samples collected from the Water Treatment Plant #2 (WTP#2), groundwater stations, surface water stations, and the Off River Treatment Works (ORTW) effluent were

submitted to ACZ Laboratories, Analytica Environmental Laboratories, and Test America Inc. Environmental Laboratories. Samples collected for the Sewage Treatment Plant (STP), influent and effluent, were submitted to Analytica Laboratories. Annual WET Test samples were submitted to AECOM Environmental Laboratory and CH2MHill Laboratory. Flotation Tailings and Mineralized Developmental Rock samples were submitted to ALS Chemex.

## 2.1 SUMMARY

A summary of the 2011 monitoring results show:

- **Outfall 011:** Several pH exceedances were recorded on the continuous meters during February, March, August, and December. In March and April exceedances of the Monthly Average for Iron were reported. In April and June two exceedances for Iron Daily Maximum were reported. During July an exceedance of the Daily Maximum for Total Suspended Solids was reported. Refer to Section 2.2.1 for more detail.

- **Outfall 001:** During February and March four pH exceedances were recorded on the continuous meter. In March an exceedance of the Monthly Average for Manganese was reported. In April WAD cyanide exceedances of the Daily Maximum and the Monthly Average were reported. Refer to Section 2.2.2 for more detail.

- **Outfall 002:** During a six month period, beginning in March, fourteen exceedances of the Daily Maximum for Fecal Coliform were reported. During the month of June an exceedance of the Monthly Average for Fecal Coliform was reported. Refer to Section 2.2.3 for more detail.

- There are no adverse trends in Surface water samples collected during the year. Field readings from a malfunctioning probe on one of two YSI meters occurred in the second and third quarter. Refer to Section 2.3.1 for more detail.

- Three wells are located below the Recycled Tailings Pond (RTP) Dam, MW03-500, MW03-501, and MW03-502. They monitor groundwater downstream of the RTP seepage collection system. Samples were collected monthly during 2011. Refer to Section 2.4.1 for more detail.

- A round robin study was conducted on December 14, 2011. The study consisted of samples from the following locations: Outfall 011, Outfall 001, Water Treatment Plant #2, MW03-502, MW11-216, and SW01. Refer to Section 2.4.5 for more detail.

- A Hydro-Geophysical Study was conducted on the RTP Dam from August 16 - 23, by Willowstick Technologies, LLC. Refer to Section 2.4.6 for more detail.

- Interstitial Water monitoring for the DSTF indicates an increase in Hardness, Nickel, Selenium, and Sulfate levels. Pogo is investigating the use of a mill reagent (Copper Sulfate) that contains selenium**.** An unusually high sample for WAD Cyanide, collected on December 11$^{th}$, has been flagged as biased by our compliance laboratory. Refer to Section 2.5.5 for more detail.

- Primacy for Pogo's NPDES permit AK-005334-1 was transferred from the EPA to ADEC. Pogo was issued a new APDES permit AK0053341 on May 1, 2011. With the exception of the 2011 Annual Activity and Monitoring Report all DMR's and Quarterly Activity and Monitoring Reports were submitted to ADEC after the issuance.

- Pogo was issued a Notice of Violation (NOV) by ADEC on December 5, 2011 for reported exceedances of the permit effluent limitations in Pogo's NPDES permit AK-005334-1, reissued by ADEC, APDES permit AK0053341, on May 1, 2011. Refer to Section 2.2.5 for more detail.

A discussion of the results for each sampling program is provided below. Time series graphs are provided in **Appendix C**.

## 2.2 TREATED EFFLUENT MONITORING

*EPA NPDES AK-005334-1 (3/15/04), III.B; ADEC APDES AK-005334-1 (5/1/11), Appendix A 3.0*

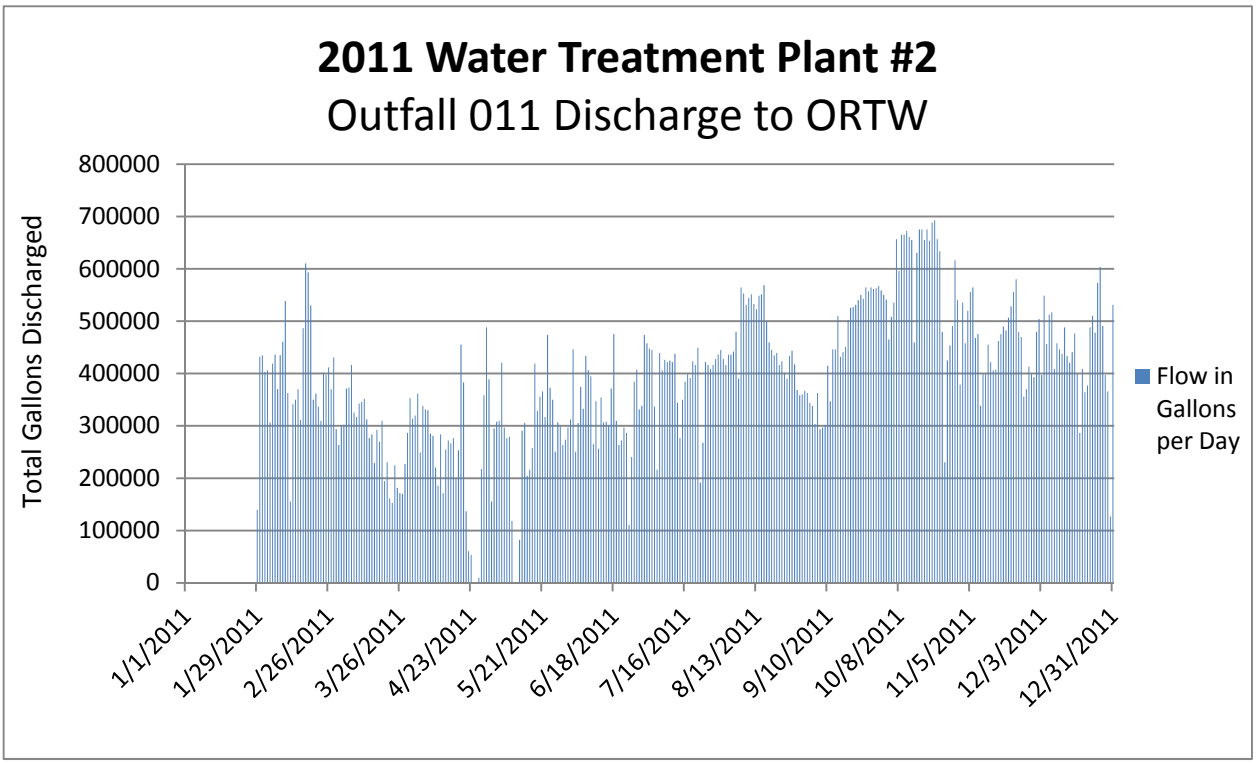
Detailed data of treated effluent were previously submitted to EPA and ADEC via copies of the Discharge Monitoring Reports (DMRs) under the NPDES Permit. Data was submitted just to ADEC via copies of the DMRs under the new APDES Permit. The monitoring locations for treated effluent are shown on **Figure 2 in Appendix A**.

### 2.2.1 Outfall 011- Treated Effluent from Mine Water Treatment Plant

*EPA NPDES Permit AK-005334-1 (3/15/04) I.B; ADEC APDES Permit AK-005334-1 (5/1/11), 1.2*

Groundwater and drill water collected from the underground workings are sent to Water Treatment Plant #1 (WTP#1), treated and returned for use underground, sent to the mill to be used as process water or discharged to the ORTW. Surface runoff and groundwater collected in the RTP is sent to WTP#2 (located near the 1525 portal), treated and then discharged to the ORTW or directed to the mill for use as process water. Discharge to the ORTW started on the 29$^{th}$ of January and continued through December 2011, with two short interruptions in April and May. The volume of water discharged from the WTP#2 is in **Chart 1**.

**Chart 1: 2011 Water Treatment Plant #2 Outfall 011 Discharge to ORTW**




Continuous pH data is collected at Outfall 011 along with weekly and quarterly laboratory samples for metals, Total Suspended Solids (TSS), Hardness, Weak-Acid Dissociable (WAD) Cyanide, Anions, Cations, and Total Dissolved Solids (TDS).

Suspect pH readings from the dual system of continuous meters at Outfall 011 were recorded in 2011. Readings taken during the same intervals at the other meter all show compliance with permit limits. Pogo replaced pH Meter A on March, 16 2011. The new meter was tested and calibrated before being put into service. Pogo does not believe there were any actual exceedances of pH effluent limits for Outfall 011.

In April and June, Pogo reported a potential exceedance of the daily maximum effluent limit for iron . Pogo also reported a potential exceedance of the monthly average effluent limit for iron in March, April and June. The calculated monthly average slightly exceeded the permit effluent limits. Pogo believes the source of the iron is the Gravel Pond water, approved by ADEC as supplemental make-up water in the mill.

In July, Pogo reported a potential exceedance of the daily maximum effluent limit for Total Suspended Solids (TSS). Pogo believes this sample was erroneous as no corroborating evidence was found to support the exceedance after a complete system check. Both prior and subsequent samples were reported as compliant.

Except as noted above, all results are within the limits and conditions set forth within the permit. 2011 Monitoring and historic data are provided in **Appendix G**. Time series graphs are provided in **Appendix C**.

### 2.2.2 Outfall 001 – Discharge from Off River Treatment Works

*EPA NPDES Permit AK-005334-1 (3/15/04), I.A; ADEC APDES Permit AK-005334-1 (5/1/11), 1.1*

Treated effluent from WTP#2 is sent to the Off River Treatment Works (ORTW). After mixing in the ORTW, water flows over the weir of Pond 2 (Outfall 001) at the ORTW and into the Goodpaster River. The sampling location is at the weir.

Continuous turbidity and daily pH data is collected along with weekly and monthly laboratory samples for metals and WAD Cyanide, TDS, Turbidity, Sulfate, and Hardness at Outfall 001. In addition, the same sets of laboratory samples were collected upstream from the discharge point (NPDES001B) to determine background water quality of the Goodpaster River.

The continuous pH meter for Outfall 001 recorded four suspect pH readings in February and March. Readings taken during the same intervals from the two pH meters at Outfall 011 and the pH meter at the Goodpaster River influent all showed compliance with the permit limits. Pogo's investigation determined the cause of the problem to be instrument malfunction due to low temperature. The continuous pH meter at Outfall 001 was taken out of service. Pogo is now measuring pH manually with the weekly sample. Pogo does not believe there were any actual exceedances of the pH effluent limits for Outfall 001.

In March, Pogo reported a potential exceedance of the monthly average effluent limit for Manganese. The monthly average slightly exceeded the permit effluent limit. An internal investigation determined the root cause of the problem to be naturally occurring Manganese introduced by the use of Gravel Pond water, approved by ADEC as

supplemental make-up water in the mill. Data collected following the issuance of the new APDES permit for river water at NPDES 001B indicated background concentrations as high as 40 ug/L for Manganese.

In April, Pogo reported five potential exceedances of the daily maximum and the monthly average effluent limit for WAD Cyanide as shown in **Table 1.**

**Table 1: WAD CN Exceedances**

| Date | WAD CN Level in ug/L |
|---|---|
| 4/10/11 | 12.00 |
| 4/13/11 | 11.00 |
| 4/20/11 | 9.40 |
| 4/24/11 | 16.0 |
| 4/27/11 | 23.0 |
| April Monthly Average | 11.2 |

Pogo believes that the WAD Cyanide results are not accurate due to the limitations inherent in the analytical method. This is the reason the facility-specific MDL and ML were requested, and approved, in the new APDES discharge permit that became effective May 1, 2011.

Except as noted above, all results are within the limits and conditions set forth within the permit. 2011 Monitoring and historic data are provided in **Appendix G**. Time series graphs are provided in **Appendix C**.

### 2.2.3 Outfall 002 – Treated Effluent from Sewage Treatment Plant

*EPA NPDES Permit AK-005334-1 (3/15/04), I.C; ADEC APDES Permit AK-005334-1 (5/1/11), 1.3*

The Sewage Treatment Plant (STP) operated throughout 2011 with discharge flows ranging between 8,652 and 29,416 gallons per day. Daily field parameters were collected to assess quality of treated effluent prior to discharge in the mixing zone in the Goodpaster

River. Weekly samples were also collected for Biological Oxygen Demand (BOD5), TSS, Fecal Coliform, Nitrates, and Chlorine. Influent data from STP002 were collected for BOD5 and TSS on a monthly basis to determine quarterly percent removal.

From March through September, Pogo reported several potential exceedances of the daily maximum as well as a potential exceedance of the monthly average (June) effluent limitations for Fecal Coliform. The results are summarized in the **Table 2.**

**Table 2: Fecal Coliform Exceedances**

| Date | Fecal Coliform Levels in CFU/100mL |
|---|---|
| 3/9/2011 | 34,000 |
| 3/11/2011 | 800 |
| 5/25/2011 | 1,727 |
| 5/31/2011 | 1,600 |
| 6/1/2011 | 4,700 (4,500 duplicate) |
| 6/8/2011 | 30,000 |
| 6/15/2011 | 3,700 (2,700 duplicate) |
| 6/22/2011 | 3,300 (4,700 duplicate) |
| June Monthly Average | 666 |
| 7/6/2011 | 570 |
| 8/10/2011 | 2,900 |
| 8/17/2011 | 5,200 |
| 8/31/2011 | 9,500 |
| 9/7/2011 | 200,000 |
| 9/12/2011 | 2,200 |

Pogo promptly investigated the potential exceedances and completed several corrective actions to address the elevated Fecal Coliform, including:

- Pogo regularly communicated with ADEC via phone and email. Pogo met with ADEC on June 13, June 27 and September 22 to apprise ADEC of its corrective action efforts.
- Increased effluent sampling frequency and sent split samples to a secondary laboratory.

- Completely inspected the system and replaced wear items, cleaned and disinfected system components, and replaced sand filters.
- Hauled decant water offsite to Delta Junction's wastewater treatment lagoon.
- Collected upstream and downstream samples from the Goodpaster River.
- Engaged Sanitherm to evaluation system.
- With ADEC's approval, purchased and installed a new UV system which was operational by December 3.
- Pogo has not reported an exceedance of the Fecal Coliform effluent limitations since September 12, 2011.

Except as noted above, all results were within the limits and conditions set forth within the permit. 2011 Monitoring and historic data are provided in **Appendix G**. Time series graphs are provided in **Appendix C**.

### 2.2.4 Whole Effluent Toxicity

*EPA NPDES Permit AK-005334-1 (3/15/04), I.D.7.a; ADEC APDES Permit AK-005334-1 (5/1/11), 1.4*

The annual WET test was conducted June 15 through June 21, 2011 by CH2M Hill's Aquatic Toxicology Laboratory in Corvallis, Oregon. A split of the same sample was also sent to AECOM Environmental Laboratory in Fort Collins, CO.

Results from both laboratories are presented in **Appendix B** and indicate that the toxicity for *Ceriodaphnia dubia* (water flea) was <1.0 $TU_c$. The results indicate that the toxicity for the more sensitive species - Pimephales promelas (fathead minnow), was reported as 1.0 $TU_c$ by one lab and <1.0 $TU_c$ by the other. Both species were well under the set toxicity trigger of 2.0 $TU_c$. Laboratory reports are provided in **Appendix G**.

All results are within the limits and conditions set forth within the permit.

## 2.2.5 Notice of Violation

*EPA NPDES Permit AK-005334-1 (3/15/04), I.D.7.a; ADEC APDES Permit AK-005334-1 (5/1/11), 1.1, 1.2, 1.3, Appendix A 1.6, 2.6*

On July 18, 2011, the ADEC and EPA inspected Pogo Mine to determine its compliance with the requirements of the Clean Water Act and NPDES/APDES permits that apply to the facility. The inspection and records review revealed violations noted in sections 2.2.1, 2.2.2, and 2.2.3 of this report. As mentioned above, and in the subsequent ADEC Notice of Violation (NOV) issued on 12/5/2011, the violations include:

- WAD Cyanide exceedances at Outfall 001
- Manganese exceedances at Outfall 001
- pH exceedances at Outfall 001
- pH exceedances at Outfall 011
- Iron exceedances at Outfall 011
- Total Suspended Solids exceedance at Outfall 011
- Fecal Coliform exceedances at Outfall 002

Other concerns listed by ADEC in the NOV include: the ongoing nature, number, and frequency of non-compliance events; the need to increase WTP #2 capacity from 400 to 600 gpm; and that any notice of any upset, anticipated by-pass, or exceedances must be reported to ADEC Compliance and Enforcement Program

In the NOV, ADEC acknowledges the substantial amount of time and effort that Pogo devoted to determining the cause of the potential exceedances and the transparency Pogo maintained by repeatedly meeting with ADEC representatives to discuss the ongoing issues. Pogo greatly appreciates ADEC's guidance and recommendations during Pogo's investigation and completion of the corrective actions.

Please refer to Pogo's January 12, 2012 response letter to ADEC**.** The letter addresses all of the alleged violations, describes the work completed to date, and outlines Pogo's plans to ensure that its future discharges are in compliance with the terms of the permit. It is Pogo's goal to comply with the APDES Permit and take appropriate measures to ensure compliance.

Pogo is also entering into a Compliance Order by Consent with ADEC to address

corrective actions planned to eliminate future violations. Pogo will submit a draft COBC to ADEC by March 16, 2012.

## 2.3 SURFACE WATER MONITORING

### 2.3.1 Goodpaster River

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), Section I.E.1.6; EPA NPDES Permit AK-005334-1 (3/15/04), I.E.6; ADEC APDES Permit AK-005334-1 (5/1/11), 1.5, Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.5*

Four surface water stations are monitored to evaluate water quality along the Goodpaster River. They are SW01 located upstream of the Pogo Mine, SW41 located downstream of Outfall 001, SW42 downstream of Outfall 002, and SW15 located downstream from all Pogo facilities.

Surface water station SW12 located on the Goodpaster River at the confluence of Central Creek was also sampled concurrently with the fish tissue monitoring program on September 27$^{th}$.

The locations of the surface water monitoring stations are shown in **Appendix A, Figure 2.**

Surface water samples are analyzed for WAD Cyanide, ion balance, major cations, anions, and total and dissolved metals. Physical and aggregate properties of ammonia, conductivity, hardness, nitrates, sulfates, pH, TDS, TSS, Turbidity, TKN, and Temperature were also measured.

Pogo had an issue with one of two YSI handheld field parameter meters during the second and third quarters. The Temperature/ Dissolved Oxygen (DO) sensor on meter # 2 intermittently reported negative temperature readings and near zero DO readings. This meter was inadvertently used before the sensor could be replaced. The meter was repaired once a replacement probe was secured and calibrated properly.

All other results are within the limits and conditions set forth within the permit.

2011 Monitoring and historic data are provided in **Appendix G**. Time series graphs are provided in **Appendix C**.

### 2.3.2 Fish Tissue

*EPA NPDES Permit AK-005334-1 (3/15/04), I.E.5, ADEC APDES Permit AK-005334-1 (5/1/11), 1.5.5*

In order to help assess long term trends in Goodpaster River quality, annual whole body analysis of juvenile Chinook Salmon are required at monitoring sites both upstream (SW01) and downstream (SW12) from the project facilities. Juvenile Chinook salmon were collected at these stations on September 27, 2011. Brandi Baker with the Alaska Department of Fish and Game assisted with the sampling effort. The cold weather and high water conditions during sampling suggest that Pogo should have collected earlier in the season this year. The required number of fish was not collected at either location; 14 fish were collected at SW12 while only 6 were collected at SW01. As required by **Fish Resource Permit SF2011-276** a report of collecting activities and data submission form was submitted to ADFG.

All results are consistent with historical data and no statistical differences are observed.

2011 Monitoring and historic data are provided in **Appendix G**. Time series graphs are provided in **Appendix C**.

## 2.4 GROUNDWATER QUALITY MONITORING

The locations of the groundwater monitoring stations are shown in **Appendix A, Figure 2**.

### 2.4.1 Downgradient of DSTF and RTP Dam

*Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.6.1.1; ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.1.4, 1.5.3, 1.5.7, 1.6*

Action limits for groundwater monitoring are set forth in the Pogo Mine Quality Assurance Project Plan as part of the requirements of the permit.

Three wells located below the RTP Dam, MW03-500, MW03-501, and MW03-502, monitor groundwater downstream of the RTP seepage collection system. Samples for these wells were collected monthly throughout 2011; however, the permit only requires a quarterly sample. Two samples at MW03-501 in December 2010 and February 2011 resulted in Iron

levels of 1,420 ug/L and 1,100 ug/L respectively. Pogo suspects these two samples were anomalous as prior, intermediate, and post sampling events indicate very little iron in the water. The results are also not supported by data in the surrounding wells.

Historic Nitrate levels show a seasonal increase toward the end of each year. In 2010 the analyte and method was changed from Nitrate as Nitrogen to Nitrate plus Nitrite as Nitrogen. This change was necessary to obtain a longer holding time on the sample because of Pogo's remote location and distance to the laboratory. This seasonal fluctuation jumped above action limits in 2010 after the method change was made because Nitrite is added to Nitrate levels amplifying the trend.

Two new monitoring wells were constructed downgradient of the DSTF and upgradient of the RTP as recommended by the Agencies. One bedrock monitoring well (MW11-001B) and one alluvial monitoring well (MW11-001A) were drilled, completed, and developed in September 2011. The purpose of the wells is to monitor the groundwater between the DSTF and the RTP.

There is no historic data for comparison. Initial results indicate measurable amounts of the majority of analytes. Some may be affected by the construction of the well and disturbance of localized substrate. The wells will be sampled monthly for the first year and then quarterly as specified in the Pogo Mine Monitoring Plan.

Seepage collection wells (SCW) 1 – 4 were abandoned and plugged during September 2011. These four wells were installed in 2005 after the completion of the RTP Dam. They have been offline since 2008 due to casing failure. Since they were not operational and were compromised beyond repair it was decided to abandon them.

Except as noted above, all results are within the limits and conditions set forth within the permit.

2011 Monitoring and historic data are provided in **Appendix H**. Time series graphs are provided in **Appendix C**. As-built reports for MW11-001A and MW11-001B are provided in **Appendix D**. The abandonment report for SCW 1 – 4 is also provided in **Appendix D.**

## 2.4.2 Downgradient of the Solid Waste Facility

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.5.3, 1.5.7, 1.6; Pogo Mine*

*Monitoring Plan, Revision 4.0 (12/18/03) 4.6.2.1.1*

Monitoring wells MW04-503 and MW04-504 were permitted to detect potential impacts to groundwater downgradient of a proposed solid waste facility. The solid waste disposal facility was not constructed. Solid waste is either incinerated onsite in accordance with Permit AQ0406MSS05, disposed in the DSTF in accordance with Permit 0131-BA002 or it is shipped offsite for disposal in an approved landfill.

### 2.4.3 Downgradient of Ore Zone

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.5.3, 1.5.7, 1.6; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03), 4.6*

Monitoring wells MW04-213 and MW99-216 provide information on water quality trends down-gradient from the ore zones.

Samples for MW04-213 were collected on May 17, and December 15, 2011. Manganese levels have been historically high at this well and continue to be so.

Samples were not collected at MW99-216 during 2011. A sudden rise in arsenic (As) and in selenium concentration (Se) beginning in 2008 prompted an investigation. Pogo believes that using the air-lift method of purging the well, which introduces compressed air causing the oxidation and release of metals.

It was determined that the exploration core hole being used as a monitoring well was drilled within a mineralized zone. The hole was completed without a surface seal, and was under-developed due to its very small diameter. During a meeting with the Agencies it was agreed that Pogo could replace MW99-216 with a real monitoring well and stop sampling it. Pogo is keeping MW99-216 as a piezometer well to monitor ground water levels; it will not be used to monitor ground water quality.

New monitoring well MW11-216 was constructed in September 2011 near the power line just above the lower camp facilities. This location was selected due to ease of access, lack of creating a new disturbance, and to ensure it is down gradient of any mineralized rock zones.

Results for MW11-216 are in the same time series graphs with MW99-216 for comparison. Initial results indicate levels consistent with historical data for the majority of analytes. Results for the analytes of concern (Arsenic & Selenium) indicate lower levels. Some analytes may be affected by construction of the well and disturbance of localized substrate. MW11-216 will be sampled monthly for the first year and then quarterly as specified in the Pogo Mine Monitoring Plan.

Except as noted above, all results are within the limits and conditions set forth within the permit.

2011 Monitoring and historic data are provided in **Appendix H**. Time series graphs are provided in **Appendix C**. As-built reports for MW99-216 and MW11-216 are provided in **Appendix D**.

### 2.4.4 Downgradient of ORTW

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), Sections 1.5.3, 1.5.7, 1.6*

Monitoring stations LL04-031 and LL04-032 provide information on ground water quality trends between the ORTW and the Goodpaster River. Samples were collected on February 9, and August 16, 2011.

All results are within the limits and conditions set forth within the permit.

2011 Monitoring and historic data are provided in **Appendix H**. Time series graphs are provided in **Appendix C**.

### 2.4.5 Round Robin Study

Pogo conducted a Round Robin Study on December 14, 2011 to evaluate intra lab bias between the three laboratories used by Pogo. Samples were collected from Outfall 011, Outfall 001, WTP #2 Influent, MW03-502, MW11-216, and SW01 and sent to ACZ, Analytica, and Test America for analysis. Labs were evaluated for quality of service, ability to meet hold times, logistics, results, ease of data transfer, and cost.

For the most part the analytical results are not statistically different; however there were a

few exceptions for each lab. Some of the samples shipped to ACZ could not meet hold times for the method due to shipping logistics and Pogo's remote location. Analytica had some sample preparation issues for the WAD CN sample at Outfall 011; the bottle was dropped and only 2 milliliters (mL) were available for analysis resulting in a 10x dilution and possible interferences. The metals bottle sent to Analytica for the sample at Outfall 001 was lost in shipment between Pogo and the laboratory; the sample aliquot was split from a preserved WAD CN sample (with approval from Pogo) with possible sodium interferences. Test America could not meet the Water Quality Standard (WQS) for Cadmium and four of six samples for WAD CN were statistically different than the other results.

Pogo has contracted Analytica for its analytical services from 2012 - 2014. The results are shown in **Tables 3 – 8**.

**Table 3: Outfall 011 Round Robin Results.**

| Outfall 011 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Laboratory | | | | | | Required MDL |
| | ACZ | | Analytica | | Test America | | |
| ***Parameter*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***(must be less than)*** |
| Cyanide, WAD | 12 | 3 | < 6* | 6** | 12.8 | 0.9 | 10 ug/L |
| Iron, Total Recoverable | 160 | 20 | 150 | 2.7 | 188 | 17 | 817 ug/L |
| Total Suspended Solids | < 5 | 5 | 4 | 0.5 | < 3.5 | 3.5 | 20 mg/L |
| Hardness, as CaCO3 | 296* | 1 | 89 | 0.013 | 91.7 | 0.033 | NA mg/L |
| **Comments:** *Greater than one Standard Deviation Difference. **The sample distillate container was dropped just prior to the coloring step and only 2.0 mL were left. Thus a 10X dilution was prepared for coloring (and the PQL increased). There is a possibility of interferences. | | | | | | | |

**Table 4: Outfall 001 Round Robin Results**

| Outfall 001 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Laboratory | | | | | | |
| | ACZ | | Analytica | | Test America | | Required MDL |
| ***Parameter*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***(must be less than)*** |
| Copper, Total Recoverable | 1.2 | 0.5 | 9.7 ** | 0.034 | 0.63 | 0.526 | 2.2 ug/L |
| Cyanide, WAD | < 3 | 3 | 2 | 1.2 | 8.4 * | 0.9 | 10 ug/L |
| Lead, Total Recoverable | < 0.1 | 0.1 | < 0.03 | 0.03 | < 0.111 | 0.111 | 0.5 ug/L |
| Manganese, Total Recoverable | 6.6 | 0.5 | 6.7 | 0.66 | 6.99 | 0.268 | NA ug/L |
| **Comments:** *Greater than one Standard Deviation Difference. **The metals sample for Outfall 001 was not received. 250 mL was split from a preserved one liter WAD CN sample. There is a possibility of sodium interferences. | | | | | | | |

**Table 5: WTP#2 Influent Round Robin Results**

| Water Treatment Plant #2 Influent | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Laboratory | | | | | | |
| | ACZ | | Analytica | | Test America | | Required MDL |
| ***Parameter*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***(must be less than)*** |
| Cyanide, WAD | 14 | 3 | 14 | 1.2 | 13.1 | 0.9 | 10 ug/L |
| Iron, Total Recoverable | 4,380 | 20 | 3,500 | 14 | 5,890 | 17 | 817 ug/L |
| Total Suspended Solids | 104 | 5 | 100 | 0.5 | 109 | 3.5 | 20 mg/L |
| Hardness, as CaCO3 | 219* | 1 | 56 | 0.013 | 59 | 0.033 | NA mg/L |
| **Comments:** * Greater than 1 Standard Deviation Difference. | | | | | | | |

## Table 6: MW03-502 Round Robin Results

| MW03-502 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Laboratory | | | | | | |
| | ACZ | | Analytica | | Test America | | Required MDL |
| ***Parameter*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***(must be less than)*** |
| Alkalinity, as CaCO3 | < 2 | 2 | < 1.2 | 1.2 | < 0.31 | 0.31 | NA mg/L |
| Alkalinity, Total | 95 | 2 | 94 | 1.2 | 95.9 | 0.31 | NA mg/L |
| Aluminum, Dissolved | 8 | 1 | NA | NA | 9.61 | 6.76 | 50 ug/L |
| Ammonia, as TKN | < 0.1 | 0.1 | 0.697 | 0.112 | < 0.0062 | 0.0062 | NA meq/L |
| Anion Sum | 3.7 | 0.1 | NA | NA | 4.99 | NA | NA meq/L |
| Antimony, Dissolved | 0.2 | 0.2 | 0.209 | 0.027 | 0.22 | 0.05 | 0.35 ug/L |
| Arsenic, Dissolved | 7.7 | 0.5 | 7.71 | 0.044 | 7.24 | 0.13 | 5 ug/L |
| Cadmium, Dissolved | < 0.05 | 0.05 | < 0.045 | 0.045 | < 0.189 | 0.189** | 0.1 ug/L |
| Calcium, Dissolved | 66.4 | 0.2 | 68 | 0.013 | 68 | 0.033 | NA mg/L |
| Cation Sum | 5 | 0.1 | NA | NA | 4.98 | NA | NA me/L |
| Chloride | 2.75 | 0.5 | 2.46 | 0.142 | 2.94 | 0.014 | 0.79 mg/L |
| Chromium, Total | < 0.5 | 0.5 | 0.518 | 0.049 | < 0.844 | 0.844 | 10 ug/L |
| Copper, Dissolved | 1.1 | 0.5 | 1.13 | | 1.51 | 0.526 | 2.2 ug/L |
| Cyanide, WAD | <3 | 3 | < 1.2 | 1.2 | 4.6* | 0.9 | 5.2 ug/L |
| Fluoride | < 0.1 | 0.1 | < 0.0044 | 0.0044 | | | NA mg/L |
| Hardness, as CaCO3 | 230 | 1 | 230 | 1 | 230 | 0.132 | NA mg/L |
| Iron, Dissolved | < 20 | 20 | < 2.7 | 2.7 | < 17 | 17 | 817 ug/L |
| Lead, Dissolved | < 0.1 | 0.1 | < 0.03 | 0.03 | < 0.111 | 0.111 | 0.5 ug/L |
| Magnesium, Dissolved | 15.6 | 0.2 | 16 | 0.012 | 14.6 | 0.012 | NA mg/L |
| Manganese, Dissolved | < 0.5 | 0.5 | 0.0542 | 0.017 | 0.71 | 0.268 | NA ug/L |
| Mercury, Total | | | 0.00122 | 0.00013 | < 0.000654 | 0.000654 | 0.01 ug/L |
| Nickel, Dissolved | < 0.6 | 0.6 | 2.66* | 0.05 | 0.4 | 0.232 | NA ug/L |
| Nitrate as Nitrogen, Total | 14 | 0.3 | | | 15.7 | 0.14 | 1.28 mg/L |
| Nitrite as Nitrogen, Total | < 0.01 | 0.01 | | | < 0.1 | 0.014 | NA mg/L |
| Nitrate plus Nitrite as Nitrogen, Total | 14 | 0.3 | 16.4 | 0.375 | 17.1 | 0.2 | 1.28 mg/L |
| Potassium, Dissolved | 2.5 | 0.3 | 2.9 | 0.31 | 2.36 | 0.079 | 3.18 mg/L |
| Selenium, Dissolved | 0.8 | 0.1 | 1.03 | 0.14 | 0.74 | 0.092 | 0.64 ug/L |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Silver, Dissolved | < 0.05 | 0.05 | 0.0856 | 0.028 | < 0.018 | 0.018 | 0.3 ug/L |
| Sodium, Dissolved | 8.1 | 0.3 | 8.3 | 0.028 | 7.39 | 0.099 | 3.9 mg/L |
| Sulfate | 83.36 | 0.5 | 83.8 | 0.0472 | 89.6 | 1.5 | NA mg/L |
| Total Dissolved Solids | 236 | 10 | 310 | 4.75 | 351 | 3.1 | NA mg/L |
| Zinc, Dissolved | 3 | 2 | 0.41 | 0.084 | < 3.08 | 3.08 | 16.8 ug/L |
| **Comments:** * Greater than 1 Standard Deviation Difference. ** Lab MDL higher than WQS. | | | | | | | |

## Table 7: MW11-216 Round Robin Results

| MW11-216 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Laboratory | | | | | | |
| | ACZ | | Analytica | | Test America | | Required MDL |
| ***Parameter*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***(must be less than)*** |
| Alkalinity, as CaCO3 | < 2 | 2 | < 1.2 | 1.2 | < 0.31 | 0.31 | NA mg/L |
| Alkalinity, Total | 319 | 2 | 330 | 1.2 | 332 | 0.31 | NA mg/L |
| Aluminum, Dissolved | 5 | 1 | NA | | < 6.76 | 6.76 | 50 ug/L |
| Ammonia, as TKN | < 0.1 | 0.1 | 0.141 | 0.112 | 0.123 | 0.075 | NA mg/L |
| Anion Sum | 9.7 | 0.1 | | | 10.4 | | NA mg/L |
| Antimony, Dissolved | < 0.2 | 0.2 | 0.0469 | 0.027 | 0.07 | 0.05 | 0.35 ug/L |
| Arsenic, Dissolved | < 0.5 | 0.5 | 0.119 | 0.044 | 0.34 | 0.13 | 5 ug/L |
| Cadmium, Dissolved | < 0.05 | 0.05 | < 0.045 | 0.045 | < 0.189 | 0.189** | 0.1 ug/L |
| Calcium, Dissolved | 81.4 | 0.2 | 80 | 0.013 | 85.4 | 0.033 | NA mg/L |
| Cation Sum | 10.4 | 0.1 | | | 10.5 | | NA mg/L |
| Chloride | < 0.5 | 0.5 | 0.416 | 0.142 | 1.2 | 0.014 | 0.79 mg/L |
| Chromium, Total | < 0.5 | 0.5 | 1.06 | 0.049 | < 0.844 | 0.844 | 10 ug/L |
| Copper, Dissolved | 0.6 | 0.5 | 0.294 | 0.034 | 0.85 | 0.526 | 2.2 ug/L |
| Cyanide, WAD | -3 | 3 | < 1.2 | 1.2 | 9.7* | 0.9 | 5.2 ug/L |
| Fluoride | 0.2 | 0.1 | 0.34 | 0.0044 | | | NA mg/L |
| Hardness, as CaCO3 | 488 | 1 | 480 | 1 | 490 | 0.132 | NA mg/L |
| Iron, Dissolved | < 20 | 20 | < 2.7 | 2.7 | 40.6 | 17 | 817 ug/L |
| Lead, Dissolved | < 0.1 | 0.1 | < 0.03 | 0.03 | < 0.111 | 0.111 | 0.5 ug/L |
| Magnesium, Dissolved | 69.1 | 0.2 | 68 | 0.012 | 67.1 | 0.012 | NA mg/L |
| Manganese, Dissolved | 2.1 | 0.5 | 1.95 | 0.017 | 2.71 | 0.268 | NA ug/L |
| Mercury, Total | | | 0.00035 | 0.00013 | < 0.000654 | 0.000654 | 0.01 ug/L |
| Nickel, Dissolved | < 0.6 | 0.6 | 3.34* | 0.05 | 0.24 | 0.232 | NA ug/L |
| Nitrate as Nitrogen, Total | 0.42 | 0.02 | | | 0.49 | 0.014 | 1.28 mg/L |
| Nitrite as Nitrogen, Total | < 0.01 | 0.01 | | | < 0.1 | 0.014 | NA mg/L |
| Nitrate plus Nitrite as Nitrogen, Total | 0.42 | 0.02 | 0.505 | 0.015 | 0.498 | 0.002 | 1.28 mg/L |
| Potassium, Dissolved | 3.9 | 0.3 | 4.5 | 0.31 | 3.89 | 0.079 | 3.18 mg/L |
| Selenium, Dissolved | 1.5 | 0.1 | 1.72 | 0.14 | 1.37 | 0.092 | 0.64 ug/L |
| Silver, Dissolved | < 0.05 | 0.05 | < 0.028 | 0.028 | < 0.018 | 0.018 | 0.3 ug/L |
| Sodium, Dissolved | 13.8 | 0.3 | 15 | 0.028 | | | 3.9 mg/L |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sulfate | 158.67 | 1 | 175 | 0.0472 | 179 | 1.5 | NA mg/L |
| Total Dissolved Solids | 518 | 10 | 540 | 4.75 | 606 | 3.1 | NA mg/L |
| Zinc, Dissolved | 3 | 2 | 1.06 | 0.084 | 3.15 | 3.08 | 16.8 ug/L |
| **Comments:** * Greater than 1 Standard Deviation Difference. ** Lab MDL higher than WQS. | | | | | | | |

## Table 8: SW01 Round Robin Results

| SW01 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Laboratory | | | | | | |
| | ACZ | | Analytica | | Test America | | Required MDL |
| ***Parameter*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***Result*** | ***MDL*** | ***(must be less than)*** |
| Total Dissolved Solids | 80 | 10 | 87.5 | 4.75 | 111 | 3.1 | NA mg/L |
| Sulfate | 21.02 | 0.5 | 19.2 | 0.0236 | 22.2 | 0.15 | NA mg/L |
| Chloride | < 0.5 | 0.5 | 0.194 | 0.071 | 0.4 | 0.014 | NA mg/L |
| Nitrate as Nitrogen, Total | 0.3 | 0.02 | | | 0.36 | 0.014 | NA mg/L |
| Nitrite as Nitrogen, Total | < 0.01 | 0.01 | | | < 0.1 | 0.014 | NA mg/L |
| Nitrate plus Nitrite as Nitrogen | 0.3 | 0.02 | 0.363 | 0.015 | 0.386 | 0.002 | NA mg/L |
| Cyanide, WAD | < 3 | 3 | < 1.2 | 1.2 | 4.6* | 0.9 | 20 ug/L |
| Aluminum, Total Recoverable | < 30 | 30 | < 14 | 14 | 13.2 | 6.76 | 50 ug/L |
| Antimony, Total | < 0.4 | 0.4 | 0.0867 | 0.027 | 0.12 | 0.05 | 3 ug/L |
| Arsenic, Dissolved | < 0.5 | 0.5 | 0.171 | 0.044 | 0.28 | 0.13 | 5 ug/L |
| Cadmium, Dissolved | 0.06 | 0.05 | < 0.045 | 0.045 | < 0.189 | 0.189** | 0.1 ug/L |
| Chromium, Dissolved | < 0.5 | 0.5 | 0.35 | 0.049 | < 0.844 | 0.844 | 10 ug/L |
| Copper, Dissolved | < 0.5 | 0.5 | 0.437 | 0.034 | 0.93 | 0.526 | 2.2 ug/L |
| Iron, Total Recoverable | < 20 | 20 | < 2.7 | 2.7 | 18.6 | 17 | 817 ug/L |
| Lead, Dissolved | < 0.1 | 0.1 | < 0.03 | 0.03 | < 0.111 | 0.111 | 0.5 ug/L |
| Manganese, Total Recoverable | 3 | 0.5 | 3.09 | 0.017 | 3.22 | 0.268 | NA ug/L |
| Nickel, Dissolved | < 0.6 | 0.6 | 0.755 | 0.05 | < 0.232 | 0.232 | NA ug/L |
| Silver, Dissolved | < 0.05 | 0.05 | < 0.028 | 0.028 | 0.02 | 0.018 | 0.3 ug/L |
| Zinc, Dissolved | | | 0.191 | 0.084 | < 3.08 | 3.08 | 16.8 ug/L |
| Selenium, Total Recoverable | < 0.1 | 0.1 | 0.205 | 0.14 | 0.13 | 0.092 | 1.9 ug/L |
| Mercury, Dissolved | | | 0.0004 | 0.00013 | < 0.000654 | 0.000654 | 0.01 ug/L |
| Hardness, as CaCO3 | 65 | 1 | 67 | 1 | 69.2 | 0.132 | NA mg/L |
| Alkalinity, as CaCO3 | < 2 | 2 | < 1.2 | 1.2 | < 0.31 | 0.31 | NA mg/L |
| Alkalinity, Total | 50 | 2 | 50 | 1.2 | 50 | 0.31 | NA mg/L |
| Turbidity | 0.5 | 0.1 | 0.22 | 0.03 | 0.159 | 0.0956 | NA NTU |
| Total Suspended Solids | < 5 | 5 | < 0.5 | 0.5 | < 3.5 | 3.5 | 20 mg/L |

**Comments:** * Greater than 1 Standard Deviation Difference. ** Lab MDL higher than WQS.

## 2.4.6 Hydrogeologic Study

ADNR's October 14, 2008 inspection report requests a hydrogeology study of the RTP Dam area and installation of a weir below the RTP.

The following activities were conducted in 2011: 1) Purchase of Flumes to measure flow and 2) Conducted a Hydro-geophysical Survey of the RTP area.

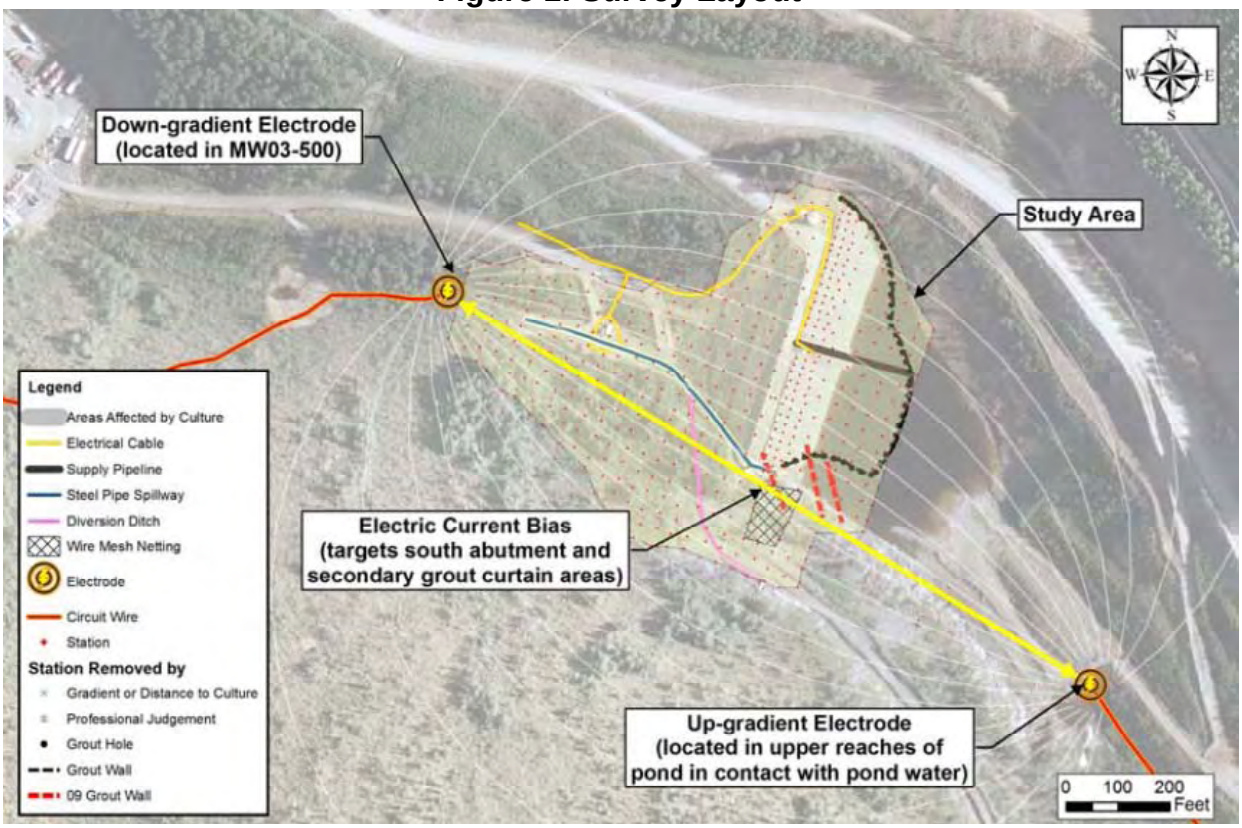
Flumes

Upon consultant with Pogo's consultant hydrologist, it was decided that a flume would be more accurate than a weir to measure flows. Four flumes were purchased for the following locations: 1) for placement along Liese Creek between the DSTF and RTP, 2) at the toe of the RTP Dam, 3) below the confluence of the North and South Diversion Ditches into Liese Creek, and 4) below Liese Creek Bridge. The flumes were custom manufactured in the lower 48 took and were not received until November 2, 2011. Installation is planned for May 2012. The proposed locations for flume installation are shown on **Figure 4** in **Appendix A**.

Hydro-geophysical Survey

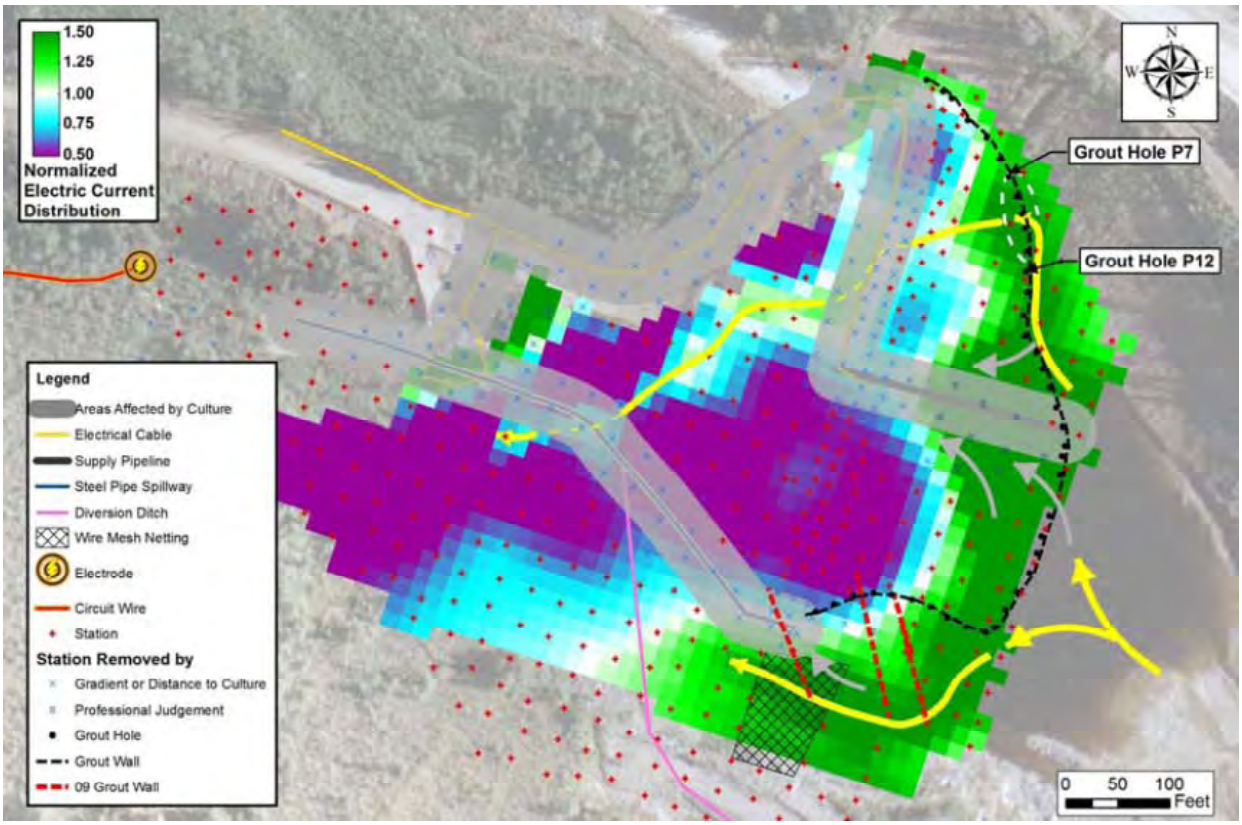
Aspen Hydrologic Services, LLC (AHS) with Willowstick Technology (Willowstick) completed a geophysical survey of the RTP area in order to determine the location of seepage(s) and develop a mitigation plan. The Willowstick method uses an application of magneto-metric resistivity or MMR for groundwater mapping and modeling. The method is high-speed, accurate, minimally invasive, and cost effective. The technology utilizes the principle that groundwater increases the electric conductivity of soil and rock through which it flows in order to map hydraulic flow paths. The survey covered the RTP dam, pond area, north and south abutments and below the dam to the monitoring wells (MW-500 thru 502) (**Figure 1**).

**Figure 1: Survey Layout**




The results of the survey show a potential flow pathway that flows from under the north abutment in the weathered diorite/paragneiss. When it contacts the gneiss bedrock, the seepage turns west and travels along the north-face of Pogo Ridge giving the appearance of continued seepage from the south abutment (Figure 2).

**Figure 2**. Preferential Seepage Flow beneath RTP Dam.




The survey also proved the success of the additional grouting of the south abutment (dashed red lines) in April 2009. AHS recommends dropping the water level of the RTP sufficiently for additional grouting of the north abutment of the dam from the 2075 ft elevation to the 2018 ft elevation to a depth of approximately 200 ft or several feet into competent bedrock. Pogo is currently working on a grouting plan. The complete ***Willowstick Geophysical Investigation*** report is attached as **Appendix E.**

## 2.5 PROCESS CONTROL MONITORING

Process facilities are monitored as follows.

### 2.5.1 Water Balance

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.5.1.4; Pogo Project Water Management Plan (2/2002), Sec. 4.0*

The beginning RTP reservoir volume was 9.2 million gallons and the ending RTP volume was 18.9 million gallons.

Added to RTP

- 53.2 million gallons of runoff and seepage water was collected in the RTP; and
- 3.7 million gallons of treated water were recycled to the RTP.

Removed from RTP

- 4.2 million gallons were pumped from the RTP for underground drill water;
- 21.8 million gallons were pumped from the RTP to the mill process; and
- 21.2 million gallons were pumped from the RTP to the water treatment plant.

Recycled at Mill

- 30.8 million gallons were recycled at the Mill from Water Treatment Plant; and
- 21.8 million gallons were recycled at the Mill from the RTP.

Discharge from ORTW

- 117.3 million gallons were treated and discharged via the ORTW.

### 2.5.2 CIP Tailings Cyanide Destruction

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.2.3, 1.5.1.3; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03), 4.4.3*

After cyanide destruction, the CIP tailings are stored in the CIP tank prior to being mixed

with cement and used as backfill in the mine. Pogo's QAP requires monthly grab samples at station PC001 (CIP Stock Tank), which is located directly after the cyanide destruction circuit. Pogo collects a daily sample during a paste pour. The QAP requires that at least 90% of the samples must contain less than 10 mg/kg of WAD Cyanide and none of the samples can contain more than 20 mg/kg of WAD cyanide.

During the second and fourth quarters of 2011, 100% of the CIP stock tank samples contained less than 10 mg/kg. During the first quarter 99% of the CIP stock tank samples contained less than 10 mg/kg and one sample contained more than 20 mg/kg (please refer to the Pogo 2011 First Quarter Activity and Monitoring Report for details). During the third quarter 99% of the CIP stock tank samples contained less than 10 mg/kg and 100% contained less than 20 mg/kg (please refer to the Pogo 2011 Third Quarter Activity and Monitoring Report for details). Results are reported in **Appendix C.**

### 2.5.3 Mineralized Development Rock Geochemistry

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.2.1, 1.5.1.6; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.4-4, 4.4.2.1, Appendix A*

Composite samples of development rock materials placed in the DSTF were collected on March 13, June 14, September 21, and December 13. These samples were analyzed for whole-rock chemistry and ABA and results are reported in **Appendix B** as PC002. No adverse trends are observed.

### 2.5.4 Flotation Tailings Geochemistry

*Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.4.1.1*

Flotation tailings geochemistry samples were collected on March 15, June 14, September 20 and December 11, at PC003, the underflow of the filter-feed tank at the end of the mill circuit, prior to disposal on the DSTF.

No adverse trends are observed. The results are presented in **Appendix B**.

### 2.5.5 Flotation Tailings Interstitial Water Chemistry

*Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.4-3*

The interstitial water from the tailings samples collected at PC003 on March 15, June 14, September 20, and December 11 were also analyzed. Results indicate an increase chromium levels during the year. The analysis of chromium was changed from dissolved to total; the difference in these two values may account for a portion of the increase. Pogo is investigating any other possible sources. Nickel levels are also showing an increase in concentration. Pogo suspects this is due to changes in ore chemistry.

A sample taken on December 11, 2011 at PC003 reported WAD CN at 65 ug/L. Pogo promptly began an investigation upon receiving the laboratory results. A subsequent sample was collected on February 5, 2012; the subsequent sample reported WAD CN at 15 ug/L. As such Pogo believes that this sample result is suspect and is not representative of PC003.

Selenium levels have continued to rise during the year. Pogo has identified a mill reagent (Copper Sulfate) that contains trace amounts of selenium**.** Alternative products are being evaluated for use in the mill however, the alternative products come in a different form and studies are being undertaken to see if anti-caking agents can be added so that the product can be used in Pogo's system. A truck load of new product has been ordered for evaluation and will arrive in the first quarter of 2012.

Except as noted above, no adverse trends are observed.

2011 Monitoring and historic data are provided in **Appendix H**. Time series graphs are provided in **Appendix C**.

## 2.6 VISUAL MONITORING

### 2.6.1 Facility Inspection

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.5.9.4, 1.6.1; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.1, 4.2, 4.2.1, 4.2.2, 4.2.3*

Weekly visual inspections of the RTP dam were completed throughout 2011. No

settlement or geotechnical concerns were observed.

### 2.6.2 Biological Survey

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.5.1.5; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03) 4.2.5;*

The objective of the visual biological survey program is to monitor wildlife interaction with the surface waste disposal facilities.

No wildlife issues with the RTP or DSTF occurred during the year.

## 2.7 DEVELOPMENT ROCK SEGREGATION AND STORAGE

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.2.7, 1.4.9, 1.5.1.6; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03), 4.3.1.2.3, 4.4.2.1, Appendix A*

During 2011, 1,210 rounds were blasted underground and sampled in accordance with the Rock Segregation Procedure. 363 rounds (30%) exceeded either the Arsenic threshold of 600 mg/l or the Sulfide threshold of 0.5% and these were encapsulated in the DSTF. One hundred and thirteen rounds were not sampled due to operational challenges and these rounds were also placed internally in the DSTF.

## 2.8 WASTE DISPOSAL

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.2.7, 1.5.5*

During 2011, 662,900 dry tons of flotation tailings and 149,600 tons of mineralized rock were placed in the DSTF. During the year, 128,049 dry tons of CIP Tailing and 257,415 tons of filtered flotation tailings were placed underground as paste backfill.

The quantities of miscellaneous waste materials placed either into the DSTF or underground during the year are shown in **Table 9**.

**Table 9: Miscellaneous Waste Disposal in DSTF and Underground**

| Material | Disposal Location | Quantity | unit |
|---|---|---|---|
| Grinding Media Flotation Debris Screen Residue | DSTF | 175 | tons |
| Water Treatment Plant Sludge | DSTF | 84.5 | yds |
| Water Treatment Plant Sludge | Underground | 0 | yds |

## 2.9 GEOTECHNICAL MONITORING

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.4.8; Pogo Mine Monitoring Plan, Revision 4.0 (12/18/03), 4.3*

A compaction test of DSTF tailings was carried out under the direction of SRK Consulting Inc (SRK) in March 2011, in order to evaluate the influence of cold weather on the compaction of DSTF tailings. Four windrows of DSTF tailings were prepared and left at the general placement area under freezing conditions for one day, two days, three days, and seven days. They were then compacted by roller compactor using three different rates (four, six eight passes). In-situ moisture content and dry density were measured at the site and laboratory tests such as Standard Proctor Tests, Flexible Wall Permeability Tests, and Direct Shear Tests were also performed. The positive results of these tests allow Pogo to place material on the Shell area of the DSTF year around. This concept was incorporated into Pogo's February 2012 approved **Pogo DSTF Construction and Maintenance Plan**.

The shells and the General Placement Area (GPA) of the DSTF were constructed between May 29 and December 31, 2011. Approximately 176,000 tons of tailings and non-mineralized rock were placed at the shells and approximately 207,575 tons of tailings, mineralized and non-mineralized rock were place in the GPA.

The geotechnical monitoring program for shell construction was carried out in accordance with the approved **Pogo QAP**. The geotechnical monitoring for shell construction consists of geotechnical tests that include grain size distribution, Atterberg limits, Standard Proctor Tests and field density measurements using the Troxler density gauge. A summary of 2011 geotechnical monitoring is as follows:

Five DSTF tailing samples were sent to Mappa Testlab in North Pole, Alaska, for geotechnical testing. The results are summarized in **Tables 10 and 11**. The optimum

water content ranged from 15.5% to 17.8%, and the average was 16.7%. The maximum dry density ranged from 108.1 pcf to 111.3 pcf, and the average was 109.7 pcf. These results are consistent with historical data.

The field moisture and density measurements were conducted five times in 2011. The results are summarized below in **Tables 12 and 13**. Four of the five measurements conducted during the year achieved the target of compaction (90% of maximum dry density). The measurement conducted on November 4 resulted in a lower dry density. This was due to testing in colder weather and the top layer having been compacted 12 hour prior to testing which compromised the testing method and equipment used for testing. The layer was ripped up and re-compacted on January 2, 2012. Shell construction ceased on November 7 due to mechanical failure of the compacting equipment and construction of the shells recommenced once the equipment was repaired and operational on January 2, 2012.

**Table 10: 2011 Geotechnical Monitoring for DSTF Shell Construction Results of Standard Proctor Tests for SHELL 2.**

| Date Sampled | Optimum Moisture Content (%) | Maximum Dry Density (pcf) |
|---|---|---|
| 6/18/11 | 16.8 | 108.2 |
| 8/19/11 | 16.1 | 110.0 |
| 9/10/11 | 15.5 | 110.5 |
| 10/6/11 | 15.7 | 111.3 |
| 11/4/11 | 16.4 | 108.1 |

**Table 11: 2011 Geotechnical Monitoring for DSTF Shell Construction Results of Standard** Proctor Tests for **SHELL 3.**

| Date Sampled | Optimum Moisture Content (%) | Maximum Dry Density (pcf) |
|---|---|---|
| 9/10/11 | 16.3 | 110.8 |
| 10/6/11 | 17.8 | 111.2 |

**Table 12: 2011 Results of Field Density Measurements at the DSTF Shell 2**

| Date Measured | Shell Elevation (ft AMSL) | Moisture Content (%) (Average) | Dry Density (pcf) (Average) | % of Maximum Dry Density (Average) |
|---|---|---|---|---|
| 6/18/11 | 2,290 | 21.9 | 101.2 | 93.5 |
| 8/19/11 | GPS Data Not Accurate | 26.2 | 98.6 | 90.0 |
| 9/10/11 | GPS Data Not Accurate | 20.8 | 102.8 | 93.5 |
| 10/6/11 | 2318 | 22.4 | 102.7 | 92.3 |
| 11/4/11 | GPS Data Not Accurate | 19.6 | 96.9 | 89.6 |

**Table 13: 2011 Results of Field Density Measurements at the DSTF Shell 3**

| Date Measured | Shell Elevation (ft AMSL) | Moisture Content (%) (Average) | Dry Density (pcf) (Average) | % of Maximum Dry Density (Average) |
|---|---|---|---|---|
| 9/10/11 | GPS Data Not Accurate | 22.2 | 102.7 | 93.3 |
| 10/6/11 | 2241 | 19.8 | 106.5 | 95.8 |

# 3. 2011 AS-BUILT REPORTS AND MAPS

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.4.13.1; ADNR Plan of Operations Approval F20039500 (12/18/03), pg. 4*

As reported in the 2011 Annual Activity and Monitoring Report, Pogo completed in 2010 construction of: 1) secondary containments for the Carbon-in-Pulp (CIP) Tailings Storage Tank and Backfill Dilution Water Tank; 2) secondary containment for the Paste Line between CV-02 splice shack and the 1690 Portal; and 3) secondary containment for the CIP Tailings Slurry and Backfill Dilution Water pipelines between Mill Plant and Paste

Plant. An As-built report for this project is provided in **Appendix F**.

Pogo Mine Site 2011 As-built maps are located in **Appendix A** of this report**.** **Figure 3** provides an overview of all facilities within the Pogo Millsite lease boundary at end of 2011. **Figures 3a** through **3d Appendix A** provide additional detail for the major areas of the mine.

# 4. RECLAMATION AND FINANCIAL RESPONSIBILITY

*ADEC Waste Disposal Permit 0131-BA002 (12/18/03), 1.4.1, 1.6.3, 1.10, 3; ADNR Plan of Operations Approval F20039500 (12/18/03), pg. 2 and 4; ADNR Pogo Mine Millsite Lease ADL416949 (3/9/04), Sec. 18*

An updated mine reclamation and closure cost estimate was agreed to by ADEC and ADNR March 9, 2011. The reclamation and closure bond is currently $44.43 million (refer to **Table 14**). The updated access road/transmission line reclamation and closure cost estimate was also agreed to by ADEC and ADNR on March 9, 2011 at $4.8 million (refer to **Table 15**). Pogo will be revising the reclamation and closure cost estimate in 2012 for an amendment to the Pogo Plan of Operations for the DSTF expansion.

## Table 14: Summary of Mine Reclamation and Closure Cost Estimates as of December 2011

| SUMMARY OF ESTIMATED RECLAMATION AND CLOSURE COSTS-POGO MINE SITE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 year holding cost | Phase I | Phase II | Phase III | Phase IV Water Treatment | Phase IV Reclamation | Phase V | Total |
| Direct Cost | | $ 1,952,300 | $ - | $ 770,900 | $ 7,953,500 | $ 5,205,600 | $ 2,990,200 | $ 104,800 | $ 18,977,300 |
| Site Management Cost | | | $ - | $ 26,500 | $ 2,668,800 | $ 5,433,728 | $ 1,902,100 | $ - | $ 10,031,128 |
| **Subtotal Direct Cost** | | **$ 1,952,300** | **$ -** | **$ 797,400** | **$ 10,622,300** | **$ 10,639,328** | **$ 4,892,300** | **$ 104,800** | **$ 29,008,428** |
| Indirect Costs | % of Subtotal | | | | | | | | |
| Mobilization/Demobilization | 5.0% | $ - | $ - | $ 39,870 | $ 531,115 | $ - | $ 244,615 | $ 5,240 | $ 820,840 |
| **Subtotal** | | $ 1,952,300 | $ - | $ 837,270 | $ 11,153,415 | $ 10,639,328 | $ 5,136,915 | $ 110,040 | $ 29,829,268 |
| Contractor Overhead and Profit | 15.0% | $ 292,845 | $ - | $ 125,591 | $ 1,673,012 | $ 1,595,899 | $ 770,537 | $ 16,506 | $ 4,474,390 |
| **Subtotal** | | $ 2,245,145 | $ - | $ 962,861 | $ 12,826,427 | $ 12,235,227 | $ 5,907,452 | $ 126,546 | $ 34,303,658 |
| Performance Bond | 3.0% | $ 67,354 | $ - | $ 28,886 | $ 384,793 | $ 367,057 | $ 177,224 | $ 3,796 | $ 1,029,110 |
| Insurance | 1.5% | $ 33,677 | $ - | $ 14,443 | $ 192,396 | $ 183,528 | $ 88,612 | $ 1,898 | $ 514,555 |
| **Subtotal** | | $ 2,346,177 | $ - | $ 1,006,189 | $ 13,403,616 | $ 12,785,812 | $ 6,173,288 | $ 132,241 | $ 35,847,322 |
| Contract Administration | 4.0% | $ 93,847 | $ - | $ 40,248 | $ 536,145 | $ 511,432 | $ 246,932 | $ 5,290 | $ 1,433,893 |
| Engineering Re-Design | 3.0% | $ - | $ - | $ 30,186 | $ 402,108 | $ - | $ 185,199 | $ 3,967 | $ 621,460 |
| Contingency | 15.0% | $ 351,926 | $ - | $ 150,928 | $ 2,010,542 | $ 1,917,872 | $ 925,993 | $ 19,836 | $ 5,377,098 |
| | | | | | | | | | |
| **Total Indirects** | | $ 839,650 | $ - | $ 430,151 | $ 5,730,112 | $ 4,575,789 | $ 2,639,111 | $ 56,533 | $ 14,271,346 |
| Total Direct + Indirect | | $ 2,791,950 | $ - | $ 1,227,551 | $ 16,352,412 | $ 15,215,116 | $ 7,531,411 | $ 161,333 | $ 43,279,773 |
| Infration Proofing | 2.66% | 74,192 | - | 32,620 | 434,542 | 404,320 | 200,137 | 4,287 | $ 1,150,099 |
| **Total Closure Cost** | | **$ 2,866,142** | **$ -** | **$ 1,260,171** | **$ 16,786,955** | **$ 15,619,437** | **$ 7,731,548** | **$ 165,621** | **$ 44,429,873** |
| | | | | | | | | Rounded | $ 44,430,000 |

## Table 15: Summary of Pogo Access Road/Transmission Line Reclamation and Closure Cost Estimates as of December 2011

| Pogo Access Road and Transmission Line - Estimated Closure Cost | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Phase I | Phase II | Phase III | Phase IV | Phase V | Total |
| Direct Cost | | $ - | $ 13,666 | $ - | $ 2,478,500 | $ - | $ 2,492,167 |
| Site Management Cost | | $ - | $ 128 | $ - | $ 582,645 | | $ 582,773 |
| **Subtotal Direct Cost** | | **$ -** | **$ 13,794** | **$ -** | **$ 3,061,145** | **$ -** | **$ 3,074,940** |
| Indirect Costs | % of Subtotal | | | | | | |
| Mobilization/Demobilization | 6.5% | $ - | $ 897 | $ - | $ 198,974 | $ - | $ 199,871 |
| **Subtotal** | | $ - | $ 14,691 | $ - | $ 3,260,119 | $ - | $ 3,274,811 |
| Contractor Overhead and Profit | 15.0% | $ - | $ 2,204 | $ - | $ 489,018 | $ - | $ 491,222 |
| **Subtotal** | | $ - | $ 16,895 | $ - | $ 3,749,137 | $ - | $ 3,766,032 |
| Performance Bond | 3.0% | $ - | $ 507 | $ - | $ 112,474 | $ - | $ 112,981 |
| Insurance | 1.5% | $ - | $ 253 | $ - | $ 56,237 | $ - | $ 56,490 |
| **Subtotal** | | $ - | $ 17,655 | $ - | $ 3,917,849 | $ - | $ 3,935,504 |
| Contract Administration | 4.0% | $ - | $ 706 | $ - | $ 156,714 | $ - | $ 157,420 |
| Engineering Re-Design | 4.0% | $ - | $ 706 | $ - | $ 156,714 | $ - | $ 157,420 |
| Contingency | 10.0% | $ - | $ 1,766 | $ - | $ 391,785 | $ - | $ 393,550 |
| 1 year holding cost | | | $ 41,000 | | | | $ 41,000 |
| **Total Indirects** | | **$ -** | **$ 48,038** | **$ -** | **$ 1,561,916** | **$ -** | **$ 1,609,955** |
| Total directs and indirects | | $ - | $ 61,833 | $ - | $ 4,623,061 | $ - | $ 4,684,894 |
| Inflation Proofing | 2.66% | $ - | $ 1,645 | $ - | $ 122,973 | $ - | $ 124,618 |
| **Total Closure Cost** | | **$ -** | **$ 63,478** | **$ -** | **$ 4,746,035** | **$ -** | **$ 4,809,513** |
| | | | | | | **Rounded** | **$ 4,810,000** |

## 4.1 ALL-SEASON ROAD AND TRANSMISSION LINE

*ADNR Right of Way Permit ADL416809, ADL417066, ADL416817 (12/18/03), Sec. 6*

No gravel was extracted from any Material Sites during 2011. No reclamation activity was conducted.

## 4.2 POGO MILLSITE LEASE

*ADNR Pogo Mine Millsite Lease ADL416949 (3/9/04), Sec. 8*

During 2011, Pogo demolished the old lower camp during 2010. A new core shack was built on the same site during the fall/winter/spring of 2010 into 2011. It is a 40' x 60' open floor, wood frame building on a poured concrete slab. Cost for demolition of this structure will be added to the cost model in 2012.

Pogo constructed a new Incinerator building east of the new lower camp during 2011. The Incinerator building is a 50' diameter thin shell concrete dome with a reinforced poured concrete footing. The cost for demolition of this structure will be added to the cost model in 2012.

Pogo installed two new Meteorological (MET) Stations during August 2011. One is located near the Pogo Airstrip and the other on top of Pogo Ridge above the 1690 portal. The MET Stations will be used to support air permitting and future expansion activities. The cost for removal of these structures will be added to the cost model in 2012.

# 5. PERMIT ACTIVITIES

## 5.1 CURRENT PERMIT ACTIVITIES

*ADNR Certificate of Approval to Operate A Dam for Pogo RTP Dam FY2011-14-AK00304 was issued on March 8, 2011.*

Pogo was issued ADEC APDES permit # AK0053341 on May 1, 2011.

For the renewal of Pogo's *ADNR Plan of Operations Approval F20039500 (12/18/03)* Pogo's *ADEC Waste Disposal Permit, 0131-BA002 (12/18/03)*, the following documents were submitted for agency's review:

- Pogo Plan of Operations
- Pogo Quality Assurance Plan
- Pogo Mine Monitoring Plan
- Pogo Reclamation and Closure Plan and associated cost models
- Pogo DSTF Construction and Maintenance Plan
- Pogo RTP Operating and Maintenance Manual

For the renewal of *Right-of-Way permits for Pogo Access Road ADL 417066 and ADL 416809 (12/18/03), Transmission Line ADL 416817 (12/18/03), and Communication Site Access Road ADL 417247 (10/1/04),* the following documents were submitted for agency's review:

- Access Road/Transmission Line Reclamation and Closure Cost Model
- As-built survey drawings were submitted to ADNR

## 5.2 FUTURE PERMIT ACTIVITIES

Future permitting activities planned for 2012 include:

- Renewal *ADEC Waste Disposal Permit, 0131-BA002 (**Waste Management Permit No. 2011DB0012 was issued on February 7, 2012**).*
- Renewal of *ADNR Plan of Operations Approval F20039500 (**Plan of Operation Approval F20129500 issued on February 7, 2012**).*
- Renewal of the *Right-of-Ways for the all-season road ADL416809 and 417066 (issue date 12/18/03), Transmission Line ADL 416817 (issue date 12/18/03), and Communication Site Access ADL 417247 (issue date 10/1/04).*
- Amendment of *US Army COE Section 404 Permit Q-1996-0211* to expand the DSTF Tailings Facility (DSTF) to 20 million tons (**issued on February 23, 2012**).
- Amendment of *Plan of Operation Approval F20129500 (February 2012)* for DSTF

Expansion and update of Cost Model.

- Amendment of *Plan of Operation Approval F20129500 (February 2012)* to change cost model to SRCE Model.
- Amendment of *Plan of Operation Approval F20129500 (February 2012)* for East Deep expansion.

**Sumitomo Metal Mining Pogo LLC**
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March 1, 2012

COR-12 -027
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Tim Pilon, Environmental Engineering Associate
Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, Alaska 99709-3643

Sharmon Stambaugh, Large Mine Coordinator
Alaska Department of Natural Resources
3700 Airport Way
Fairbanks, Alaska 99709-4699

Re: **Sumitomo Metal Mining Pogo LLC 2011 Annual Activity and Monitoring Report**

Dear Sir or Madam:

Enclosed is Sumitomo Metal Mining Pogo LLC (Pogo) 2011 Annual Activity and Monitoring Report for the for Pogo Mine Site, located 38 miles northeast of Delta Junction, Alaska. This report is prepared to fulfill the requirements of the *Alaska Department of Natural Resources (ADNR) Pogo Mine Millsite Lease ADL416949*, *U.S. Environmental Protection Agency (EPA) NPDES Permit AK005334-1*, *ADEC APDES Permit AK-005334-1,* and *Alaska Department of Environmental Conservation (ADEC) Waste Disposal Permit 0131-BA002*. This report covers the period from January 1, 2011 through December 31, 2011. The Annual Meeting is scheduled for Thursday April 12, at 3:30 pm at the West Mark Hotel in Fairbanks.

Please give me a call at 907-895-2897 or email me at sally.mcleod@smmpogo.com if you have any questions.

Sincerely,

Sally S. McLeod, CEM, REM
Environmental Superintendent

Enclosure: 2011 Annual Activity and Monitoring Report