Pogo RTP Operating and Maintenance Manual

Pogo RTP Dam
NID ID#AK00304

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Pogo RTP O&M Manual Revisions			
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Table of Contents

1.0 INTRODUCTION 1
2.0 OPERATIONS 2
2.1 Facility Descriptions 2
2.1.1 Reservoir and Dam 2
2.1.2 Spillway 2
2.1.3 Diversion Ditch 3
2.1.4 RTP Head Tank and Plumbing System 3
2.1.5 Seepage Collection Wells 4
2.2 Storage Objective and Control of RTP 4
2.3 Monitoring 6
2.3.1 Reservoir Water Elevation and Volume 6
2.3.2 Seepage Collection Wells Pump-up Rate 6
2.3.3 Flow Rate of Run-off Water from Drystack Tailings Facility 9
2.3.4 Flow Rate of Seepage into Liese Creek 9
2.3.5 Dam Crest Elevation 9
3.0 MAINTENANCE 10
3.1 Dam and Abutments 10
3.2 Spillway 10
3.3 Diversion Ditch 10
3.4 Seepage Collection Wells 10
3.5 RTP Pumps, Head Tank and Affiliated Facilities 11
4.0 INSPECTION 11
4.1 Visual Inspection 11
4.2 Monthly Inspection 11
4.3 Periodic Safety Inspection 11
5.0 UNUSUAL OCCURENCES 12
5.1 Earthquake 12
5.2 Extreme precipitation 12
5.3 High water level 12
6.0 REFERENCES 13

List of Tables

Table 1 Information on seepage collection wells 4
Table 2 Pogo RTP Dam monitoring items 7
Table 3 Requirements of visual inspection 11

List of Figures

Figure 1: RTP volume-elevation curve 5
Figure 2: Drawdown curve for 300 gpm discharge from RTP 5
Figure 3: Pogo RTP Dam monitoring locations 7
Figure 4: Histrical pump up rate from SCW#5-#8 and reservoir elevation (2009 - 2010) 8
Figure 5: Histrical pump up rate from SCW#9 and reservoir elevation (2009 - 2010) 8

Lists of Drawings

Drawing A0172-VII-042: RTP Spillway Discharge Capacity

Drawing D-141198-51-N-0101: RTP Piping and Instrumentation Diagram

Appendices

APPENDIX A: PROJECT DATA SHEET
APPENDIX B: ROUTINE VISUAL INSPECTION FORM
APPENDIX C: DRAWINGS

1.0 INTRODUCTION

Sumitomo Metal Mining Pogo LLC (Pogo) is the operator of the Pogo gold mine, located 38 miles northeast of Delta Junction, Alaska.

The Pogo Recycle Tailings Pond (RTP) Dam (NID ID#AK00304) was constructed in 2004/2005. The Pogo RTP Dam is a lined rockfill structure constructed to provide storage of seepage and runoff waters from Drystack Tailings Facility (DSTF), treated mine drainage, and surface runoff from other facilities. Water from the reservoir is used in the mining and milling process or treated and discharged.

The Pogo RTP Dam was approved to operate as a Class II (significant) hazard potential dam as defined in 11 AAC 93.157 on May 25, 2006. The first Periodic Safety Inspection (PSI) was conducted in 2007 and the certificate of approval to operate a dam was renewed on December 31, 2007. During the second PSI in 2010, Alaska Department Natural Resources (ADNR) pointed out defects in the dam break analysis carried out in 2001/2002. It failed to evaluate the risk of inundation into the underground working area at the 1875 Portal and 1690 Portal and the influences to the Goodpaster River recreational cabins. Subsequently, ADNR decided to change the hazard potential class of Pogo RTP Dam from Class II to Class I (high). Pogo's certificate of approval to operate a dam was renewed on March 8, 2011.

Pogo conducted a new dam break analysis in April 2011 and it concluded that a hypothetical breach of the dam would lead to significant flooding in underground at the 1875 Portal and 1690 Portal. However, there is no expectation for inundation at the cabins along the Goodpaster River. This analysis endorsed the hazard potential class I for the Pogo RTP Dam.

The purpose of this Operation and Maintenance (O&M) Manual is to describe operating and monitoring procedures for the dam and reservoir under normal and unusual conditions, and to provide guidance and procedures for monitoring, maintenance, and routine inspection for the Pogo RTP Dam.

2.0 OPERATIONS

2.1 Facility Descriptions

2.1.1 Reservoir and Dam

The Pogo RTP Dam has a storage capacity of approximately 43.6 million gallons (Mgal). The Pogo RTP Dam is permitted for a crest elevation of 2,092 feet above mean sea level (amsl) which, as designed, results in a 40 Mgal capacity. The as-built configuration offers about 9% more storage capacity than the design configuration.

The Pogo RTP Dam serves as the impoundment where water can be stored prior to recycling or subsequent treatment and discharge to the environment. The Pogo RTP Dam impounds run off from the Drystack Tailings Facility (DSTF), captures natural flows from the catchment area below the limits of diversion ditch and the DSTF, and collects various plant site contact runoff water. Treated mine water may also be stored in cases when it cannot be discharged into the Goodpaster River as allowed by APDES Permit #AK-005334-1.

The dam is a membrane lined rockfill embankment with a hydraulic height of 67 feet. The dam crest is 35 feet wide and extends over a distance of 550 feet. The lined crest elevation is designed to be nominally 2,090 feet amsl, however, it was confirmed that the actual lined crest elevation ranged from 2,088.6 feet amsl to 2,089.4 feet amsl during the second PSI in 2010, by digging five holes at the crest of embankment.

2.1.2 Spillway

Located on the left abutment, the spillway intake structure is 8 feet wide rectangular reinforced concrete structure and discharges into a 6 feet diameter half corrugated steel pipe. The discharge from the south diversion ditch enters the channel on the downstream slope of the dam. The half culvert then transitions to 8 feet in diameter. The channel is approximately 600 feet long and subsequently discharges into a rip rap outfall located in a channel that would return flows to Liese Creek in the event of spillway operation.

The elevation of the sharp crested weir located in the spillway inlet is at elevation 2,084 feet amsl. The spillway discharge curve is shown on Drawing A0172-VII-042. The spillway has a maximum discharge capacity of 440 cubic feet per second (cfs), which is capable of meeting the combination of peak outflow from the reservoir (176 cfs) and the

south portion of the diversion ditch (310 cfs) in case of the Probable Maximum Precipitation (PMP) event (11 inches within 24 hours). The required capacity for the spillway chute based on combining the outflow from the RTP reservoir with the outflow from the south diversion ditch (436 cfs). This value is slightly lower than the addition of the flood peaks resulting from the reservoir and the diversion ditch individually due to the difference in timing between the two peaks.

2.1.3 Diversion Ditch

The 11,100 feet-long diversion ditch (6,800 ft for north side, 4,300 feet for south side) surrounding the DSTF aims to intercept the “non-contact” water from areas unaffected by mine development. The water from north side diversion ditch is discharged into the Liese Creek at the downstream of RTP via Flume #1, and the water from south side diversion ditch is discharged into the spillway chute via Flume #2.

The diversion ditch is designed to intercept a one in 200-year, 24-hour precipitation event (4.6 inches within 24 hours). One foot of freeboard and a 3 to 5 foot allowance for aufeis accumulation was also incorporated into the design. The estimated design flow is 163 cfs at the Flume #1 and 41 cfs at the Flume #2, respectively.

2.1.4 RTP Head Tank and Plumbing System

During normal operation of the Pogo RTP dam, the pond water is withdrawn by the RTP reclaim pumps located near the upstream toe of the RTP. Two 20 HP 6 inch submergible pumps (one for operation and the other for back up), each having a pumping capacity of 600 gpm, are set at 2,020 feet amsl. The reclaim pumps are:

- Manufactured by National Pump Company
- Model Number M14HC
- Motor type HITACHI 20 HP MOTOR (460 V, 3 Phase)

The pond water is sent to the 55,000 gallon RTP Head Tank located on the right abutment via a 6 inch diameter HDPE pipeline, then sent to the No. 2 Water Treatment Plant (WTP#2), Mill Plant, or underground working area by gravity flow. The discharge rate is between 100 gpm and 300 gpm under normal operations. In case the treated mine water cannot be discharged into the Off-River Treatment Works (ORTW), the treated mine water is sent from WTP#2 to the RTP Head Tank (up to 300 gpm). The

schematic plumbing system around the RTP Head Tank is shown on **Drawing D-141198-51-N-0101**.

2.1.5 Seepage Collection Wells

The seepage collection wells (SCWs) exist about 400 ft downstream of the RTP. There are four deep wells (SCW#5 - 8) and one shallow well (SCW#9) in operation. The SCWs collect the seepage from the RTP and return it to the RTP Head Tank. **Table 1** summarizes the information on SCWs. The collected seepage is sent to the RTP via 4 inch HDPE pipeline (see **Drawing D-141198-51-N-0101**).

Table 1 Information on seepage collection wells

SCW ID	Manf.	Model	HP	Voltage	Phase	Discharge in.	GPM	Casing in.	Pump Inlet ft
Well #5	Grundfos	40S50-15	5	460	3	2	25	5	67.50
Well #6	Grundfos	40S50-15	5	460	3	2	25	5	66.75
Well #7	Grundfos	40S50-15	5	460	3	2	25	5	71.00
Well #8	Grundfos	40S50-15	5	460	3	2	25	5	62.75
Well #9	Flygt	BS-2670.180	27	460	3	4	100	20	13

2.2 Storage Objective and Control of RTP

The RTP was originally designed as a water source for process makeup water at the Mill and drilling water at the underground mine. However, the source of the process makeup water has been changed to the treated mine water and the gravel pit pond water. The drilling water in underground is now supplied by the underground water recycling system. The storage objective of RTP has been changed to keep the minimum volume of water in case enough water cannot be supplied from the treated mine water and gravel pit pond. The water storage goal at the RTP is set at 5 Mgal. This is enough to supply makeup water to the mill for about 20 days, assuming a water consumption rate of 100 gpm at the Mill. **Figure 1** shows the RTP reservoir volume-elevation curve.

If the RTP water volume exceeds 5 Mgal (RTP reservoir elevation: 2,042 feet amsl), the RTP water is discharged into WTP#2, treated and then discharged into ORTW. The discharge rate from RTP is limited to 300 gpm due to the treatment capacity of WTP#2. **Figure 2** shows the drawdown curve for 300 gpm discharge from the RTP.

Figure 1: RTP volume-elevation curve

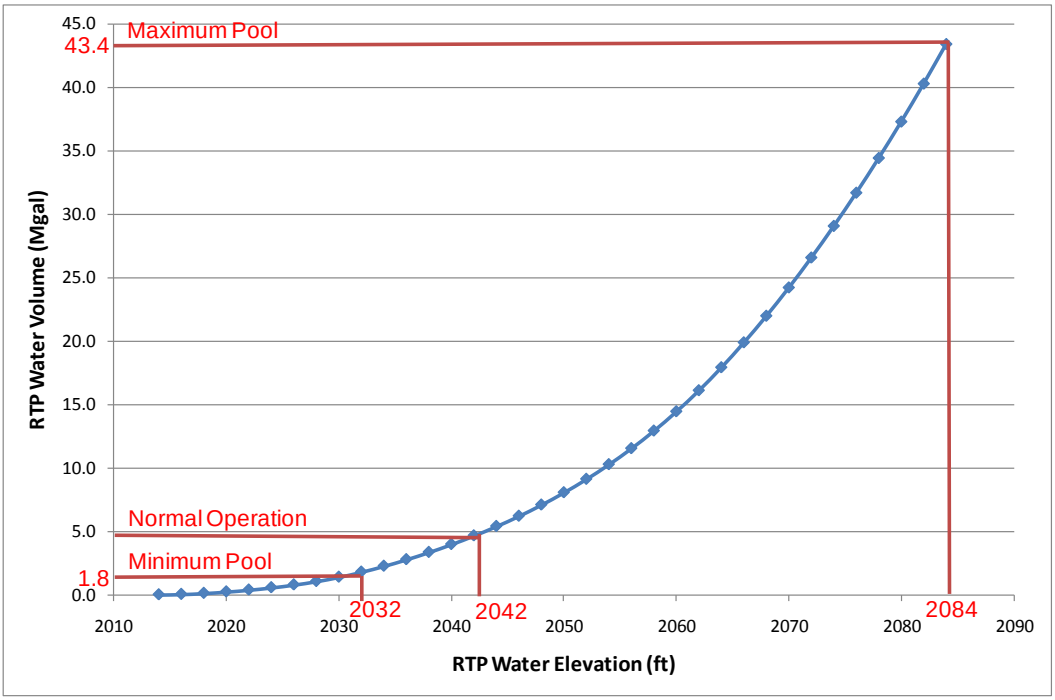
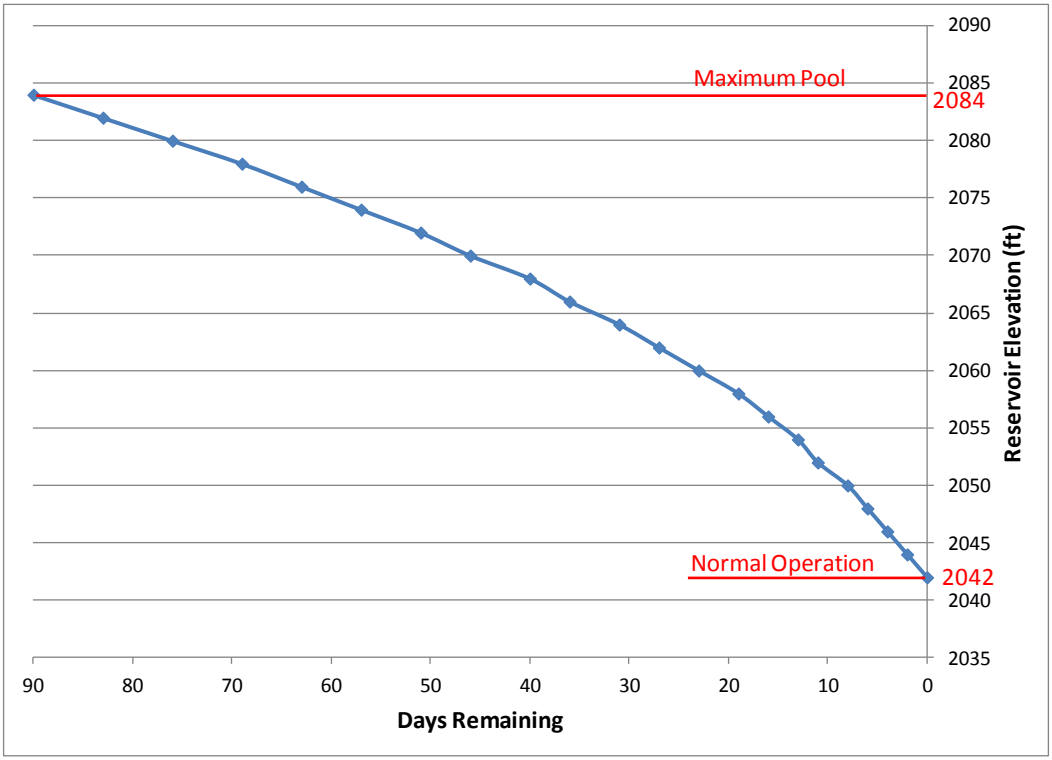


Figure 2: Drawdown curve for 300 gpm discharge from RTP



2.3 Monitoring

The monitoring and frequencies are summarized in **Table 2**. **Figure 3** shows the location of monitoring points.

2.3.1 Reservoir Water Elevation and Volume

The reservoir elevation is measured by the pressure transducer installed at the RTP reclaim pump station at the bottom of the reservoir. The pressure transducer is connected to the Data Communication System (DCS) and the data are recorded automatically and reported in the "Quick Morning Report from DCS" issued by the Mill Department on a daily basis.

2.3.2 Seepage Collection Wells Pump-up Rate

The pump-up rates of the SCWs are monitored by two flow meters which are connected to the DCS. One flow meter is for SCW#5 - 8, and the other is for SCW#9. The daily average flow rates are reported in the "Quick Morning Report from DCS" issued by the Mill Department.

The pump-up rates of the SCWs are dependent on the reservoir elevation. Historically, the pump up rate from SCW#5 - 8 increases from 70 gpm up to 170 gpm in proportion to the reservoir elevation (see **Figure 4**). The SCW#9 dries up when the reservoir elevation is 2,060 feet amsl (RTP volume: 14.4 Mgal) or lower. Once the reservoir level exceeds 2,060 feet amsl, the pump up rate from SCW#9 increases up to 170 gpm in proportion to the reservoir elevation (see **Figure 5**). The combined pump up rate from SCW#5 - 8 and SCW#9 is between 70 gpm and 340 gpm under normal operating conditions.

Table 2 Pogo RTP Dam monitoring items

Items	Location	Frequency	Monitoring
Reservoir water level and volume	RTP pump station	Daily	Pressure Transducer connected to DCS
Seepage collection wells pump-up rate	Seepage collection wells	Daily	Flow meters connected to DCS
Flow rate of run-off water from Drystack Tailings Facility	V-notch weir at the upstream of RTP	Weekly (Summer period)	Environmental staff
Flow rate of seepage into Liese Creek downstream of SCWs	V-notch weir at the downstream of SCW (to be installed)	Weekly when seepage appears	Environmental staff
Dam Crest Elevation	Dam crest survey monuments	Annually (September)	Mine surveyor

Figure 3: Pogo RTP Dam monitoring locations

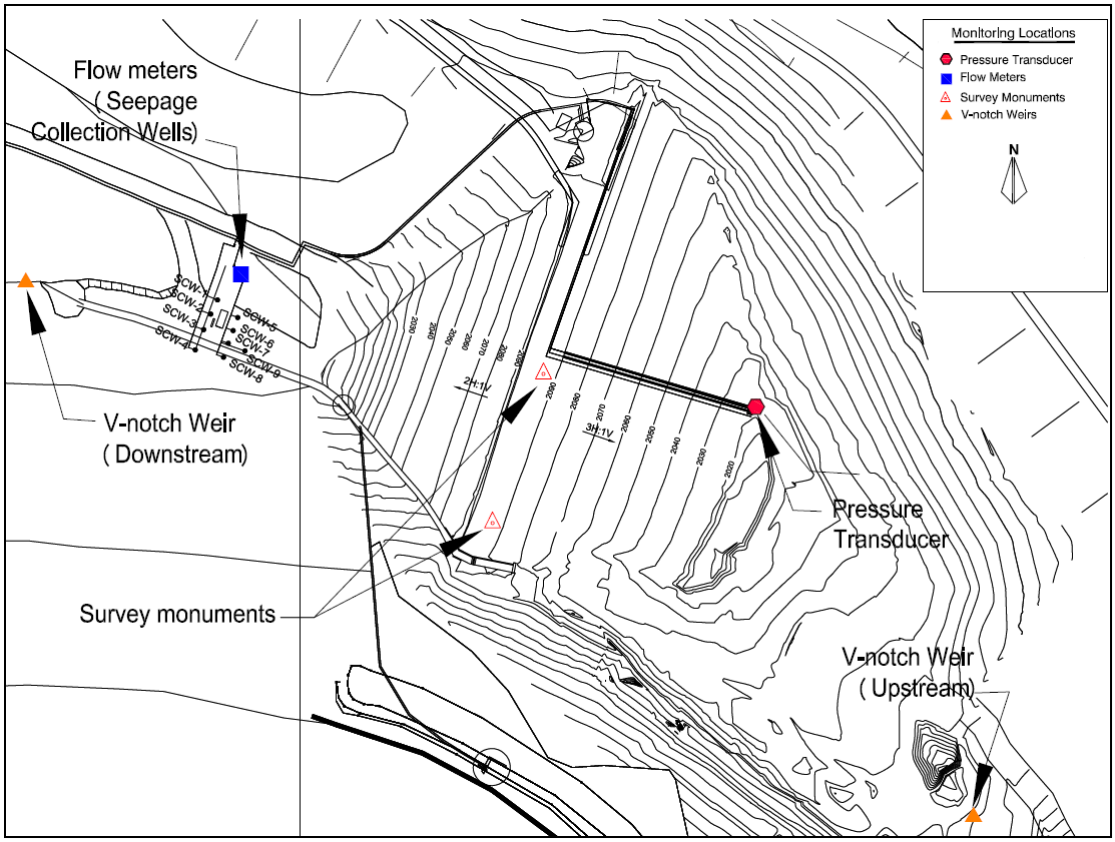


Figure 4: Histrical pump up rate from SCW#5-#8 and reservoir elevation (2009 - 2010)

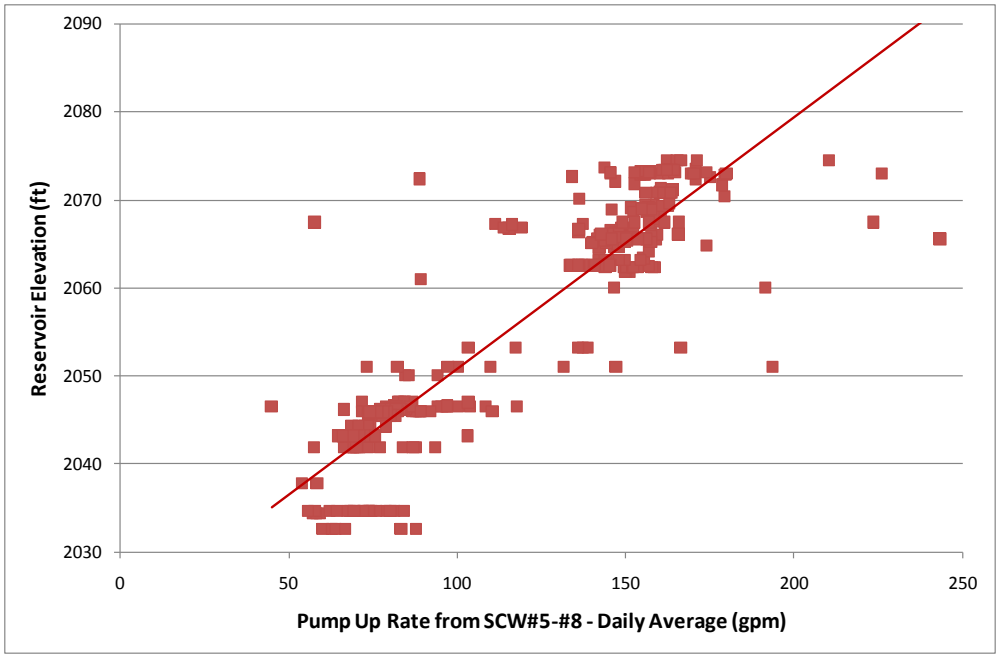
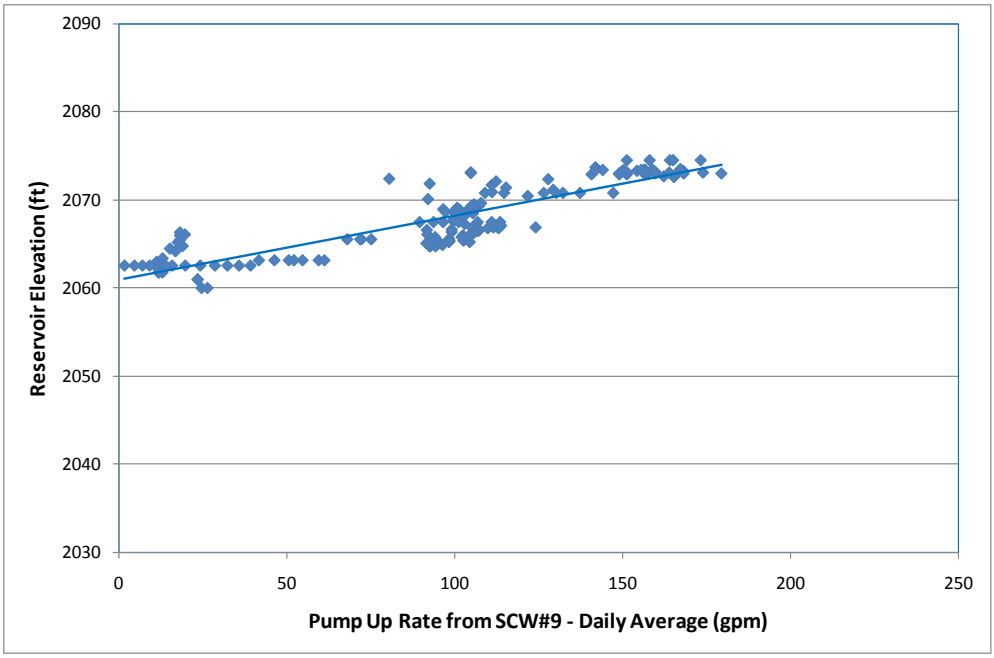


Figure 5: Histrical pump up rate from SCW#9 and reservoir elevation (2009 - 2010)



2.3.3 Flow Rate of Run-off Water from Drystack Tailings Facility

The flow rate of run-off water from DSTF is monitored at the V-notch weir upstream of the RTP during summer period when water flow appears. This information is used to evaluate the water balance of the RTP along with the flows recorded by meters at various points of the site wide plumbing system.

The environmental staff measures the height of water flowing over the weir using a tape measure once a week. The flow rate is estimated using Cone equation (Equation 1) in accordance with the Water Measurement Manual issued by U.S. Bureau of Reclamation. The data is recorded in the designated MS Excel file.

$$Q = 2.49 \times H^{2.48} \qquad \text{(Equation 1)}$$

Where,

Q: Flow rate (cfs)
H: Height of water flowing over the weir (ft)

2.3.4 Flow Rate of Seepage into Liese Creek

The flow rate of seepage into Liese Creek at the downstream of SCWs will be monitored at a V-notch weir that will be constructed in 2011. The environmental staff will measure the height of water flowing over the weir using a tape measure once a week, then estimate the flow rate using the Equation 1. The data will be recorded in the designated MS Excel file.

2.3.5 Dam Crest Elevation

Two survey monuments were established on the dam crest in 2010. The elevation of these monuments will be surveyed in September by the mine surveyors and the results will recorded in the monthly visual inspection form. The initial survey was conducted in September 2010, results are as follows:

- Center monument: 2,089.920 ft
- Spillway side monument: 2,091.682 ft

3.0 MAINTENANCE

This section summarizes the routine and preventative maintenance activities for the RTP site.

3.1 Dam and Abutments

The dam and abutments are inspected monthly. Any vegetation on dam and abutments is cleared, and the obstacles such as wood debris in the pond removed if possible.

3.2 Spillway

The spillway will be inspected monthly, and after any spill event. The inspection includes checks for signs of corrosion, irregularities in the spillway profile, damage from ice or rocks, and signs of piping along the flume outfall. Any damage to the structure will be repaired.

Debris or rocks that fall into the spillway conduit will be removed. Prior to the spring freshet, major ice accumulation within the spillway will be mechanically or steam cleared if needed.

3.3 Diversion Ditch

Major aufeis accumulations will be removed from the diversion ditches each spring prior to the freshet. The objective is to provide the proper flow path for the freshet, so that the ice will naturally thaw in the proper locations. It is imperative to keep the water flow within the ditches and off the adjacent access road.

Environmental staff is responsible for weekly visual inspection of the diversion ditch when the diversion ditch is accessible in accordance with Section 1.5.1.1 of Waste Disposal Permit 0131-BA002.

3.4 Seepage Collection Wells

Environmental staff is responsible for daily visual inspection of the seepage well pump controllers and flow meters. Any deviation from normal operations will be brought to the attention of the Maintenance Department.

There is no requirement for routine maintenance for the seepage collection pumps by the manufactures. The pumps are exchanged when any malfunction is occurs.

3.5 RTP Pumps, Head Tank and Affiliated Facilities

Mill Department is responsible for daily inspection of the RTP pumps, Head Tank, and affiliated facilities. Any deviation from normal operations will be brought to the attention of the Maintenance Department.

There is no requirement for routine maintenance for the RTP reclaim pumps by the manufacture. The pumps are exchanged when any malfunction occurs.

4.0 INSPECTION

4.1 Visual Inspection

Table 3 summarizes the requirements of visual inspection.

Table 3 Requirements of visual inspection

Facility	Frequency	Responsible	Remarks
Diversion Ditch	Weekly (when accessible)	Environmental Department	Check erosion or rock fall, aufeis accumulations, etc.
Seepage Collection Wells	Daily	Environmental Department	Check controller and flow meters
RTP Head Tank	Daily	Mill Department	Check controller and flow meters

4.2 Monthly Inspection

The RTP Dam is inspected visually by the environmental staff on a monthly basis. The inspection form is attached in **Appendix B**.

The inspection form should be reviewed to the Environmental Superintendent, and the electronic file saved in the designated folder until next scheduled PSI.

4.3 Periodic Safety Inspection

Periodic Safety Inspections (PSI) should be performed every three years as required by 11 AAC 93.159. The PSI must be performed by a qualified engineer. Prior approval of the engineer and the scope of the inspection must be agreed upon in advance with the Alaska Department of Natural Resources (ADNR). The draft PSI report shall be submitted to ADNR within 30 days after the visual inspection of the dam.

5.0 UNUSUAL OCCURENCES

The unusual occurrences identified in this section include:

- Earthquake
- Extreme precipitation
- High water level

5.1 Earthquake

If an appreciable earthquake event occurs (strong enough to be felt by site personnel), site personnel will inspect the Pogo RTP Dam site, including the dam, spillway, diversion ditch, and SCWs, and Mill Department will inspect the RTP reclaim pumps and Head Tank. Any deviation from normal operations will be reported to the Safety, Health and Environmental Manager.

5.2 Extreme precipitation

Extreme rainfall is defined as rainfall exceeding two inches in 24 hours. Rainfall information for Pogo Mine site can be obtained at the USGS home page called "Real-Time Water Data for Alaska." The address of relevant home page is:

http://waterdata.usgs.gov/ak/nwis/uv?cb_00065=on&cb_00060=on&cb_00045=on&format=gif_default&period=7&site_no=15477740

During these types of rainfall events, the pond condition will be observed and the spillway inspected to make sure it is clear of debris.

5.3 High water level

If the reservoir elevation exceeds the elevation of spillway floor (2,080.5 feet amsl), Tier 1 response actions will be activated in accordance with approved **Emergency Action Plan for the Pogo RTP Dam (NID ID#AK00304)**.

6.0 REFERENCES

- U.S. Department of the Interior Bureau of Reclamation, 2001, Water Management Manual.
- Teck-Pogo, 2002, Pogo Project Water Management Plan
- ADEC, 2003, Waste Disposal Permit 0131-BA002.
- ADNR, 2005, Guidelines for Cooperation with the Alaska Dam Safety Program.
- AMEC, 2004, RTP Dam Design Report.
- AMEC, 2006, RTP Dam 2004-2005 As-built Report.
- AMEC, 2011, Pogo RTP Dam Second Periodic Safety Inspection Report.
- Pogo, 2011, Interim Emergency Action Plan for the Pogo RTP dam.
- SRK, 2011, Pogo Mine RTP Dam Break Analysis.

Appendix A

Pogo RTP Dam Project Data Sheet

ALASKA DAM SAFETY PROGRAM
PROJECT DATA SHEET

A. GENERAL

Dam Name	Recycle Tailings Pond (RTP) Dam	
NID Number	AK00304	
Hazard Potential Class	Class I (High)	
Purpose	Water Management	
Year Built	2005	
Year Modified	N/A	
Location	64°26' N, 114°56' W	(Lat. & Long.)
Reservoir Name	Recycle Tailings Pond	
River or Creek Name	Liese Creek	
Owner	Sumitomo Metal Mining Pogo LLC	
Owner Contact	Sally McLeod, Environmental Superintendent	

B. DAM

Type	Membrane Lined Rockfill	
Core Type	Rock fill dam with composite membrane liner on upstream face	
Crest Length	550	feet
Crest Width	35	feet
Lined Crest Elevation	2090	feet
Crest Height (from d/s toe)	90	feet
Hydraulic Height	67	feet

C. PRIMARY SPILLWAY

Type	Open Channel with weir	
Location	South Abutment	
Spillway Crest Elevation	2084	feet
Top Width	8	feet
Bottom Width	8	feet
Length	100	feet
Discharge Capacity at Dam Crest	440	cfs

D. EMERGENCY SPILLWAY None

Type		
Location		
Spillway Crest Elevation		
Top Width		
Bottom Width		
Length		
Discharge Capacity at Dam Crest		

E. OUTLET WORKS

Type	Pumped withdrawals via 2 steel pipes	
Location	Inside HDPE piping along upstream slope and crest of dam	
Inlet Invert Elevation	2021	feet
Outlet Invert Elevation	2107	feet
Diameter	2 x 8 "	inches
Length	N/A	feet
Outlet Type	Head Tank	
Discharge Capacity into Head Tank	1.3	cfs

F. RESERVOIR

Normal Water Surface	2055	feet
Normal Storage Capacity	40	acre-feet
Maximum Water Surface Elevation	2087.3	feet
Maximum Storage Capacity	148.5	acre-feet
Maximum Surface Area at Dam Crest	7	acres
Surface Area at Spillway Crest	6	acres

G. HYDROLOGY

Drainage Basin Area	1.4	sq. miles
Average Annual Rainfall	19	inches
100 Year/24 Hour Rainfall	4.3	inches
100 Year Flood	112	cfs
Probable Maximum Precipitation	11	inches
Probable Maximum Flood	440	cfs
Flood of Record	1.88 inches in 21 hrs on 22 June 2006	
Inflow Design Flood	440	cfs

Appendix B

Routine Visual Inspection Form

Pogo Mine RTP Dam Monthly Inspection Report

Date		Inspector	

Record Readings		
RTP Water Level		ft E.L.
Seepage Collection Rate	#5-#8: gpm	#9: gpm
V-notch Weir Reading – Upstream of RTP		inch
V-notch Weir Reading – Downstream of SCW[1]		inch
Elevation of Survey Monument (Center)[2]		ft E.L.
Elevation of Survey Monument (Spillway Side)[2]		ft E.L.

1) V-notch weir at downstream of SCW will be installed in 2011.
2) Survey is conducted in March and September.

Visual Inspection		
Location	Check Point	Results/Action Items
Upstream Dam Face	• Any sign of erosion, collapse, subsidence? • Vegetation cleared?	
Dam Crest	• Any sign of subsidence? • Any damage on facilities?	
Downstream Dam Face	• Any sign of erosion, collapse, subsidence? • Any seepage? • Vegetation cleared?	
Reservoir Walls	• Any sign of erosion, collapse?	
Spillway Inlet (Concrete)	• Check concrete for cracks • Check connection with flume	
Spillway Outfall (Flume)	• Any obstacles in flume? • Any damage? • Any erosion on the ground?	

Comments:

Reviewed by:	Date:

Appendix C

Drawings