THE STATE of ALASKA
GOVERNOR SEAN PARNELL

Department of Natural Resources

Division of Mining, Land & Water
Mining Resources Section
Southeastern Office

P. O. Box 111020
Juneau, Alaska 99811-1020
Main: 907.465.3400
TDD: 907.269.8411
Fax: 907.586.2954

August 8, 2013

June 25 and July 16, 2013 Inspectors: David Schmerge – USFS
David Wilfong – ADNR

July 29, 2013 Inspectors: David Schmerge – USFS
Jill Weitz – ADEC
David Wilfong – ADNR

Inspections of the Kensington Gold Mine

This Inspection report will cover three separate inspection events at the Kensington Gold Mine. The first visit was a general inspection that occurred on June 25, 2013, and was guided by Pete Strow of Coeur Alaska. The second visit was on July 16th, and consisted of a general inspection, but focused on the ARD remediation at the TTF, and the Revegetation Test Plots. The third visit on July 29th was a combination of a general inspection of the entire mine site By David Schmerge and Jill Weitz, and the documentation of the construction of the graphitic phyllite barrel tests by David Wilfong. During the third visit, the inspection by the USFS and ADEC was guided by Kevin Eppers of Coeur Alaska, and the barrel test construction was hosted by Pete Strow of Coeur Alaska. Round trip travel for all of the inspections was graciously provided by a USFS chartered Ward Air Cessna 206 or DeHavilland Beaver floatplane.

The two main points of interest during the July 16 inspection were the proposed Revegetation Test Plots at Snowslide Gulch, and the Acid Rock Drainage (ARD) remediation efforts at the Tailings Treatment Facility (TTF). The history and progression of each topic will be covered separately. However, the ARD remediation effort has affected the Revegetation Test Plots and vice versa. As such, one item may be referenced in the other's report section.


Figure 1 Staining due to metals leaching from low pH water.

Lower Slate Lake ARD

The ARD was noticed by Coeur staff when the snow cover melted from the TTF in late spring 2013. Acid generating graphitic phyllite (GP) had been accidentally placed as fill at the north end of the TTF after being excavated from near the dam while preparing the foundation for the Stage II lift. Much effort has been put into geochemically classifying the graphitic phyllite after staining was found forming in the emergency spillway after the first stage of the dam was built during the mine's construction. Shotcrete was sprayed on the exposed graphitic phyllite bedrock in an attempt to limit the infiltration of water and oxygen in hopes that it would limit the production of acid from the formation. It is unclear how successful the shotcrete has been with respect to infiltration/exfiltration as water continues to seep through areas of thin coverage. However, the shotcrete has been successful in neutralizing the low pH water seeping through it, as orange staining was found shortly after the shotcrete was placed, indicating that metals leaching was occurring from the water seeping through it. Attempts to seal the seeping water from cracks and holes in the shotcrete were ineffective. A small water treatment plant was built to treat the water being collected from the seeps.

Some of the acid generating graphitic phyllite material was mixed with other fill for unknown reasons during last summer's construction of the second stage of the downstream dam raise, and placed into a non-lined area of the TTF. Water quality tests showed that the resulting drainage from the area contained high levels of metals and a low pH as seen in Figure 1.

Coeur submitted a proposed remediation plan to remove the acid generating material and the plan was approved by the agencies near the middle of June. While the material is clearly observable by its black color (Figure 2), it was found to be too homogeneously mixed with the other fill material in the area, and the entire volume of fill had to be excavated and placed in containment to avoid any future releases of water with poor quality.

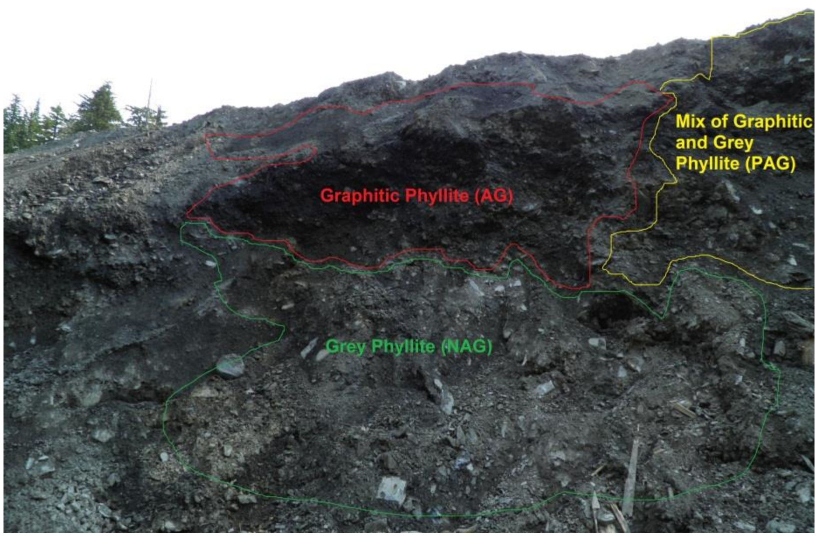

Figure 2 Outlines are for reference only and are not an accurate representation of the location or dissemination of the graphitic phyllite.

According to Coeur, as of August 5, 3800 tons of the material had been disposed of underground, and about 16,000 tons remained in containment in Pit 7 and the TTF waiting to be hauled. There are several lined and covered containment cells scattered throughout the Jualin side of the mine that are used to store the graphitic phyllite material that has been excavated from near the dam. All of the material is destined to be disposed of underground when space becomes available. Disposal of the material is completed by encapsulating it in secondary stopes with an semi-elastic paste consisting of tailings and cement. This minimizes the chance that blasting in adjacent stopes will fracture the encapsulating paste, and allow the infiltration of water and oxygen. It is planned to permanently submerge the disposal areas with water at the end of mine life.

Figure 3 Equipment used to load and haul the graphitic phyllite.

During the June 25th inspection, a Volvo EC480DL Excavator was actively digging material from the embankment and placing it into a lined load out area. From there, it was loaded into one of two Volvo A30F 30 ton articulating underground haul trucks.

The approved Remediation Plan called for the use of high carbonate content diorite to neutralize the effluent from the area of fill. The rock had already been placed at the time of the June 25 inspection, and the removal procedure had begun (Figure 3). Water management is a key component of mitigating the effects of the ARD. While the effects of the drainage are limited to the containment of the TTF, the Lower Slate Lake Water Treatment Plant (WTP) is not designed to treat ARD. A small ARD treatment plant that manages the effluent from the graphitic phyllite deposit is located at the south end of the TTF. Water is collected in ponds, sumps and caissons at the north end of the TTF, collected and pumped into an HDPE lined storage pond in a central location. When the storage pond is full, it is pumped into a tanker truck, and hauled to the ARD treatment plant. On July 16, an electric sump-pump was transferring water from a small natural drainage up to the ARD collection pond, but the hose was damaged and leaking as can be seen in figure 4.

Figure 4 The hose had been mended, but the repair was insufficient.

The substantial head pressure in the hose caused the leak to diminish the flow to the top of the hill, and the flow into the ARD pond had slowed to a trickle. The low pH water flowing from the damaged hose returned to the pond in which it came from where it was collected and pumped back into the leaking hose. Kevin was alerted to the problem. During the July 29 visit, it was noted that that the hose had been properly repaired, and the pond had been pumped nearly dry. It was apparent that the re-repaired hose had been effective in moving the poor quality water up the hill where it could be properly managed. Also noted during the July 29 inspection was the construction of a third HDPE lined containment cell in Pit 7 (Figure 5). Two smaller containment cells at the same location were filled to capacity. Substantial progress had been made on the construction of the third cell. The subgrade had been prepared, the HDPE liner welded, and a sandy gravel layer had been placed on top of the liner to reduce the risk of the 30 ton haul trucks causing damage to it.


Figure 5 Containment cell near completion.

On July 29, both David Schmerge and I expressed our concern to Kevin about the fact that no excavating or hauling was actively taking place during our visit, as had been the case during the earlier July 16 visit. When asked why, Kevin stated that labor and equipment assets were allocated elsewhere. The approved remediation plan called for all of the graphitic phyllite to be contained on the surface by July 16, 2013 and for the disposal of it underground by the end of the 3rd quarter (September 30, 2013). The containment date had passed 2 weeks prior, and it was becoming apparent that the disposal date would not be met either.

<u>Graphitic Phyllite Geochemical Testing</u>

The graphitic phyllite has undergone extensive testing to determine its ability to generate and neutralize acid. The rock containing pyrite was discovered during the excavation of the foundation for the initial construction of the Tailings Treatment Facility Dam. The pyrite is largely fine grained and disseminated throughout the graphitic phyllite with local pockets and veins.

Acid-base accounting (ABA) tests done during the initial construction of the dam showed the rock to be potentially acid generating (PAG). In the spring of 2012, the GP formation was diamond drilled, and samples from several of the drill holes underwent further ABA testing. While the ABA test results from several of the drill holes show the rock to be PAG, Subsequent humidity cell tests (HCT) have produced perplexing results. Although the HCTs are ongoing, they have not shown an expected drop in pH. One of the cell tests was discontinued, and three are ongoing. Golder Associates has been contracted by Coeur Alaska to consult them on the issue, and Rens Verberg with Golder believes that the small grain size used in the HCT gives additional buffering capacity due to the increase in surface area.

Golder believes that additional testing is needed, and kinetic barrel tests have been initiated. Some of the equipment needed for the barrel tests was on site during the July 16 inspection, and several small piles of graphitic phyllite had been segregated from the pile according to its sulfur content. The sulfur content was estimated in the field by Coeur Geologists, and was then confirmed in the lab using LECO analysis equipment. As can be seen in in Figure 6, the Piles were well graded, with particle sizes including riprap size chunks and smaller. I expressed my concern that since the humidity cell tests were not producing the expected results due to the small particle size, it was possible that the small particles in the piles may have skewed the results of the barrel tests. After consulting with Golder, the large chunks were separated out and the fines were washed from them, and only the large pieces would be used in the long term barrel tests.

Figure 6 Segregated pile of graphitic phyllite. The large pieces are to be used for testing.

The barrel tests were constructed during the July 29 inspection under the supervision from Rens Verburg and Albert Stoffers with Golder Associates. The ADNR witnessed the construction of the barrel tests, while inspectors from the USFS and ADEC toured the rest of the site. The barrels used in the test were not exactly identical, but they all had the same basic dimensions, and most importantly, the openings were all the same size. The size of the opening at the top of the barrel regulates the amount of rain that enters, and effectively controls the rate at which acid is produced. The new plastic barrels were washed before being transported to the site. A hole was drilled in the side of the barrel near the bottom, and a PVC fitting was installed then sealed with silicone sealant. A piece of geotextile was placed over the fitting on the inside of the barrel, so that no solids could escape.

Figure 7 Outlet covered with geotextile at the bottom of the barrel. About 2 more inches of sand was added.

Silica sand was then poured into the barrel until it covered the outlet (about 8 inches deep), then a layer of geotextile was cut to fit and set over the sand the discourage intermingling of GP and sand. Each of the four barrels was then filled with 440 pounds (200 kg) of graphitic phyllite, each with a different sulfur content. Each piece was individually loaded by hand until about 6 inches of depth was attained so no damage occurred to the geotextile separating the sand and GP. The rest of the pieces were

Figure 8 Filled barrel.

hand loaded into 5 gallon buckets and dumped into the barrels. The original plan called for <0.5, 1, 2, and 4 percent by weight (wt%) of sulfur content. Coeur geologists determined that 4% was not feasible, so <0.5, 1, 2, and 3 wt% was used for the long term tests.

Each barrel was labeled with its respective sulfur content. After all of the barrels had been filled, hoses were attached so that water that had infiltrated through the rock would drain into collection containers placed below the barrels. A rain gauge was installed near the barrels to collect and record the amount of rain that falls in the area. The gauge can be seen to the right of the barrels in Figure 9. A rope fence was erected around the area to ensure that the test area is not disturbed.

Figure 9 Completed barrel test area.

The barrel tests are designed to be a real time estimation of how the potentially acid generating graphitic phyllite will react when it has been disturbed and exposed to the elements, as it has been near the TTF dam. The leachate collection containers will be emptied once per month at regular intervals (unless frozen). The volume of liquid will be recorded, and if the volume of leachate is sufficient, a full suite chemical analysis will be performed. If the volume of liquid is not sufficient at a minimum, a measurement of pH and conductivity will be performed. The gathered data will be used to estimate the time needed for newly exposed GP to naturally attenuate to neutral conditions. The information will be used to help design a final closure configuration for the facility. The post-mining land use of the area is to consist of a remote hunting and fishing lodge. The overall post-mining TTF surface area will be approximately triple the pre-mining surface area.

Tailings Treatment Facility Dam

Stage II of the TTF dam was finished in the fall of 2012, and new graphitic phyllite was exposed during the excavation of the dam's foundation. The dam's emergency spillway is located at the west end of the dam. The concrete flume is dug into the GP with shotcrete covering the exposed outcrop of bedrock as seen in Figure 10.

Figure 10 Spillway and shotcrete covering the GP. Low pH water seeping through the shotcrete is eroding it.

In areas of thin or no cover, contact water is exfiltrating through the shotcrete, and draining into the spillway. It flows down the spillway and collects in the plunge pool where it is pumped to a batch ARD water treatment plant. The low pH water reacts with the carbonate in the shotcrete and is actively deteriorating the areas around the seeps. The eroding shotcrete allows the seeps to widen allowing more water to exfiltrate. It is unclear how or if the higher flow rates affect the quality of contact water.

The shotcrete was intended to limit infiltration and exfiltration of oxygen and water into the GP formation, consequently minimizing the production of ARD. It is difficult to gauge how effective the application of shotcrete has been in this role. A dialogue between the agencies and Coeur Alaska has been opened in the past to discuss whether or not the application of shotcrete would be the best alternative at closure. The discussion should be taken up again before the third (final) stage of the dam is built.

Figure 11 Staining beginning to show near the east end of the dam.

Light staining is beginning to appear on the east side of the dam (Figure 11). The same graphitic phyllite that was uncovered on the west side was excavated on the east side during the initial construction of the dam. Diorite wasterock was placed in the area to neutralize any acid that may be produced by the disturbed GP, because diorite can have a carbonate content of up to 40 kg $CaCO_3$/ton[1]. The staining has not been noted on the east side of the dam on previous inspections. It may be possible that the buffering capacity of the diorite is nearing its end, and low pH effluent with high metals concentration is surfacing. This is a concern as the only systems in the area to prevent the water from entering Slate Creek are pump-back wells. This area needs to be closely monitored.

It should be noted that a Grey Wolf had been seen in the vicinity of the TTF on several trips to the Kensington Gold Mine. This particular wolf was showing some abnormal behavior, as it did not show a fear of humans. This was a concern to the mine staff as human-wolf encounters could result in injury or death to either species. A wolf matching the description of the TTF wolf had been seen at the upper camp several times. The wolf was finally hazed out of camp using less-than-lethal rubber buckshot. The wolf was not seen around the mine for two days, and a wolf matching the description was killed by a vehicle about forty miles away. It is plausible that a wolf could travel that distance in two days, and a hair sample was taken from the "mine wolf" to compare to the "road kill wolf". The results are unknown.

Revegetation Test Plots

The approved Reclamation Plan requires the construction of revegetation test plots (plots) to evaluate three different methods of revegetating disturbed areas of the mine. The resulting data from the plots will be used to choose a method of revegetating the mine at closure. Vegetation is an important aspect in preventing soil erosion, particularly on slopes. The plan approval required the three test plots to be built and planted by July 15. During the July 16 inspection, it was noted that the plots had not been built. When asked why, Kevin stated that the equipment needed to build the plots was busy at the ARD remediation site. But later, while at the TTF, it was noted that the equipment was present, but was not being used. Kevin stated that the equipment operators were allocated elsewhere. Some of the operators were busy building the final GP containment cell, while others were busy crushing rock to be used as bedding material in the cell.

Figure 12 Completed Revegetation Test Plots

Although the construction deadline was surpassed, corrective action was not needed, and while on site on July 29, the plots were visited, and the soil had been spread and seeded according to the approved plan. As stated in the approved Revegetation Test Plot Plan, the same seed mix was used to plant each plot, but different additives were used. One plot used soil with no additive. One plot used a biopolymer designed to deter soil erosion and promote growth. The third plot used fertilizer and mulch spread on the soil with the seed. On July 29, none of the plots showed any growth, so it was too early to make any comparison. Each week, data from each plot is recorded. The results will be used to choose a method for revegetating the site.

Surface Exploration Sites

Several surface exploration sites had been chosen by Coeur for the 2013 season. The sites were located both on USFS managed land, and private property. During the June 25 inspection, a core drill rig was positioned directly over a runoff ditch that flowed directly into Johnson Creek. The surface drilling plan of operations (POO) states that no drilling will occur within 200 feet of flowing water, and a pre-shift checklist states that drill water is not to be within 200 feet of flowing water. With the positioning of the drill rig, it was impossible to keep sediment out of the ditch, and hence straight into Johnson Creek. Coeur was alerted to the problem during the inspection, and again during a regular meeting several days later.

During the next visit, the drill rig was still positioned above the ditch, but a culvert had been installed under the drill so any drill cuttings that escaped containment did not travel downstream. It was not a perfect solution, but it seemed to markedly cut down the turbidity in the ditch. Before and after photos can be seen in Figure 13 and 14.

Figure 13 Before the culvert was installed.

Figure 14 After the culvert was installed.

Figure 15 The thin layer of plastic separated the drill water and the ditch directly below.

The Alaska Department of Natural Resources would like to thank the United States Forest Service for providing transportation, and Coeur Alaska for providing safe and informative visits to the Kensington Gold Mine

End of Report