

STATE OF ALASKA

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

*DIVISIONS OF WATER AND ENVIRONMENTAL
HEALTH*

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FIELD INSPECTION REPORT HECLA GREENS CREEK MINING COMPANY

Inspection Date: July 31, 2012, 8:00 AM – 3:45 PM

Report Date: August 28, 2012

Weather: Rain, 0.76-inches precip., 52°F, wind east southeast at 8.8 mph
measured at the Juneau airport

HGCMC Personnel: Jennifer Saran, Environmental Affairs Manager (EM), Pete Condon,
Chris Wallace

Agency Personnel: ADEC: Kenwyn George, Tim Pilon, Ed Emswiler
ADNR: Sharmon Stambaugh, Kyle Moselle, David Wilfong
USFS: Chad Van Ormer, Sarah Samuelson, Jeff Gabardi, John Kato,
Carol Seitz Warmouth, Joe Manning, Steve Paustian
NMFS: Chiska Derr
CBJ: Crystal Hitchins



Hecla Greens Creek Mining Company and Agency Staff at Site E

Purpose of visit: This was a routine annual site inspection for ADEC. The visit was useful for ADEC and agency staff as a follow-up to the meeting and presentation of the HGCMC 2011 Annual Reports the day before. It was a good opportunity to pay attention to issues that were brought out during the meeting. Various aspects related to compliance with the Waste Management Permit and the solid waste regulations were reviewed. This inspection focused to a large degree on bonding for closure of the mine in preparation for a two day work session that followed using the Standard Reclamation Cost Estimator (SRCE) model. We were able to observe all of the permitted waste disposal facilities and most of the unpermitted inactive waste rock sites and quarries. Transportation to and from Greens Creek was provided by the Hecla Greens Creek Mining Company (HGCMC) chartered boat.

920 Area and Reclamation of the Underground Mine: Plans for final reclamation and bonding for mine closure includes post-closure water treatment for the underground facility. HGCMC discussed recent developments related to the continuation of a report entitled "Greens Creek Mine Hydrology Investigation Interim Report 2010" produced by EDE Consultants in May of 2010. The overall objective of the investigation in the 2010 report was to characterize the hydrology and geochemistry in the underground mine area and to enable predictions of post-closure conditions. The report summarized previous investigations and detailed the results of work conducted to date.

The study indicates that large-scale dewatering has not occurred as a result of mine operations and drainage into the workings from seeps and boreholes has likely created a dewatered halo of limited extent around the underground workings. The water balance indicates, excluding inflow sources related to operations, the greatest source of water to the underground workings is inflow that accumulates in the 1350 level, at approximately 25 gpm. The water is fairly dilute and is chemically similar in composition to near-surface background water. Even at these relatively low concentrations, cadmium and potentially copper, iron, nickel, lead, manganese and zinc may exceed water quality standards. Concentrations of metal and sulfate are relatively low compared to underground waters. However, the estimated concentrations of constituents based on estimated mass loads represent the low end of the range of concentrations that might be expected in flooded workings that would flow at the rate of 5 gpm. Better characterization of secondary minerals in the underground environment, including identification of the types of salts, associated primary mineralogy, and the probable amount of this type of material is recommended.

A possible closure scenario includes submergence of mine workings to approximately the 900 level via natural flooding or controlled flooding with water from Greens Creek to minimize the oxidation of potentially acid-generating materials. Plugs will be installed in the two portals and in the vent raises. Flooding may take approximately 2-3 years to accomplish. The head gradients would favor leakage from the underground mine to the creek or to the land surface if the workings become flooded to an elevation above the Greens Creek base level. Alternatives to flooding the entire mine, such as flooding the lower workings below the Greens Creek valley base elevation or flooding only selected mine areas above that elevation that can be sealed via bulkheads, should be considered. Other methods of isolating water with high metals content should be investigated. This may include constructing bulkheads designed to prevent the easy transfer of water from deeper workings to the point of discharge at elevation 900.

An objective of continued underground hydrological study is to evaluate the potential of active and passive treatment options for mine water. This should take into consideration both the flows with low metals content collecting between the 1350 and 900 levels and those with high metals content from the lower workings (approximately 5 gpm). Continuous and batch discharge are being

considered. HGCMC believes a long-term plan would not have a road or electricity to maintain pumps. However, these would be needed for the short-term. This would include re-routing sections of the pipeline to allow gravity drainage from the portal (and Site 23) to the tailings area. Bridges are currently planned to be removed with the pipeline routed around the creek bed on-contour. The pipeline will need to be adequately protected against freezing since there will be a low flow of water passing through it in the winter.

Resurfacing the 920 Area and Mill Backslope

HGCMC pointed out the 920 area has been resurfaced with concrete in order to improve the management of storm water and other contact water in this heavily used part of the mine. Corrective actions have also been taken to deal with a slight movement of the mill backslope created when the bench for the mill site area infrastructure was established in 1987 and 1989. *This area contains acid producing and metals leaching waste rock.* Approximately 90 dewatering wells were installed to stabilize the slope. The waste rock will need removal and disposal at closure. This will most likely be accomplished by placing the rock underground.

Seep at Pond A and Pond B Area

A red/orange seep was discovered by ADF&G during a July 22, 2011 biomonitoring event near the old Pond B (removed) area. HGCMC reported on the unknown seepage and provided results of samples taken on October 4, 2011 in a letter dated July 27, 2012. The results show the conductivity (1,077 uS/cm) and iron (9,080 ug/l) were elevated. Sulfate was 504 mg/l (water quality standard is 250 mg/l) indicating pyrite may be present. pH results are circumneutral at 6.77 and thus the drainage is adequately buffered.

HGCMC mentions that iron rich seepage has occurred in this area since at least the mid-1990's. The staining could be the result of natural processes that have occurred in the drainage prior to development of the site. However, groundwater entering the pyritic fill used to construct the 920 site as mentioned in the section above could also produce the staining. The results indicate it is likely the facility is contributing to the flow.

Water drains through the fill used to construct the site and daylights at the toe where the seepage was observed. A collection and pumpback system installed in the vicinity of the old Pond B likely intercepts most of the water that flows into this area. However, the collection system may not capture the entire flow in the area. This could be a source of loading to Greens Creek. The resulting seepage may also be due to an ineffective pumpback system. Improvements are planned for this system in 2012. HGCMC should make and report on these improvements as soon as possible and continue to monitor the seepage. Results of this sampling were not reported for over a year from the time they were sampled. This is unacceptable. Samples should be taken of this site at least semi-annually and reported within a reasonable amount of time. This should be a point of future inspection by the Department.

Site 23/D: HGCMC gave the group a brief description of Site 23 design, construction and operation to achieve the performance goal of limiting infiltration of water and oxygen. This has been accomplished by constructing the fill in a bottom-up method and compacting the waste in 2-foot lifts. The more ARD producing waste is somewhat encapsulated within the pile with Class II/III being disposed at the back and core of the fill and Class I argillite being disposed more toward the bottom, front and sides, or nearer the surface. The pile is free draining with no phreatic head

built up within the facility. However, a free draining condition provides an opportunity for air to enter the pile via the toe drains. When the internal temperature of the pile is colder than the external air temperature, oxygen-deficient, carbon dioxide-rich air flows out of the toe drains at the base of the pile. When the pile temperature is warmer than external air temperature, oxygen rich air is drawn in. An engineering solution to this will be needed in the final closure design for the facility. This is mentioned below where the final cover design is mentioned. For now the pile is constructed as tightly as possible in order to eliminate a “chimney effect” caused by cracks, fissures and air spaces that allow for convection.

A working stockpile of argillite is staged at Site 23. This is used to armor and prevent erosion of the outside slopes at the waste disposal sites. Argillite, a Class I waste rock, possesses a high amount of carbonate. It is useful in buffering ARD producing tailings or waste rock. Argillite may contain high concentrations of various metals that requires it be used within containment only.

A pile of waste rock from the 1350 area is staged within lined containment at Site 23. This waste contains some Class IV acid producing and metals leaching rock. It has been mixed with lime prior to placement onto the lined pad at Site 23. The staging area is at full capacity. The current plan is to dispose this waste underground when space becomes available. Space at both tailings and underground sites is limited for the disposal of anything other than tailings. Work to extract waste rock from all of the inactive sites is curtailed because of this.



Site 23. Note contained stockpile of Site 1350 waste rock on left

Slope Monitoring

The annual report indicated some movement of the pile within the last year. Inclinometer IN-23-05-01 was installed at Site 23 at the end of 2005 to aid with stability monitoring at Site 23/D. The amount of movement has been approximately 12.2 mm (since 2006), with 2.0 mm movement from November 2010 to December 2011. Movement appears to be confined to a surface approximately 79.3 feet below ground level. This depth roughly corresponds to the base of the slide/colluvium unit and the top of the dense till in the foundation.

Three additional inclinometers were installed at Site 23 during the summer of 2010. One was installed in the lower portion of Site D and has shown no movement. Another inclinometer was installed west of the mid-slope of Site 23 and has shown approximately 1.6 mm of movement. A third inclinometer was installed at the top of Site 23. The movement in this zone has been about 1.2 mm from November 2010 to November 2011. The inclinometers at Site 23 and outside of Site 23 all show movement that corresponds to the base of the slide/colluvium unit at the top of the dense till, indicating the movement is related to a much larger feature (i.e., historical landslide) than Site 23.

This movement is consistent over time and HGCMC would like to reduce monitoring from quarterly to semi-annually because of this. According to a January 2012 "Action Items Checklist", Greens Creek must conduct further geotechnical analysis of the pile (factor of safety and magnitude of failure during earthquake events) given this new information. ADEC understands that a full report of the analysis will be submitted by the end of September 2012. ADEC believes this will be an on-going issue that will need to be studied and reported on in future annual reports. An unacceptable movement of the pile may be a reason to relocate it.

Reclamation

We stopped briefly at the Site 23 test plot at the lower end of Site 23 where the cover system was explained. The barrier layer continues to remain saturated at greater than 85% for the monitoring period. This implies the oxygen diffusion coefficient was minimized thus minimizing ingress of atmospheric oxygen through the barrier layer. However, water continues to flow through the barrier layer at a higher rate than modeled and would have the effect of producing an increased volume of leachate in the final closure configuration for both Site 23 and the Tailings Disposal Facility. The current design modified with a barrier layer with a lower hydraulic conductivity could result in a more effective design. Increasing the growth medium thickness from 2 feet to 1 meter may further protect the underlying capillary break and barrier layer from exposure by windthrow (blow down or uprooting of large, mature trees). This should be included.

The studies of the cover system conducted to date indicate the cover system will function to prevent the effects of freeze/thaw or windthrow. However, HGCMC has not provided details or considered the design of the cover system at the periphery of the landfill. Tree blow-down may be more of a concern at the leading edges of the fill where uprooting of trees may more likely occur and where the cover system is most sensitive to oxygen entry. The toe of the fill is where springs and run-off control devices will be located and where the cover system will also be required to limit the entry of air. Therefore special importance should be placed on how the cover system is designed, constructed and monitored at the toe of the fill. HGCMC is complimented in this inspection report with the work that has been accomplished to study cover system performance. Since there is a lack of experience with these cover systems there continues to be a lack of information with regard to conifer growth and blow-down. Unfortunately, the Oregon and O'Kane work did not bring attention to the lack of information having to do with how to construct the final configuration at the leading edges.

Several opportunities exist for imperfection of the cover system during installation (i.e. construction methods, variations in materials, etc) and afterwards (e.g. tree blow-down, erosion, freeze/thaw, etc) that could allow oxygen to enter. A cover system with an incomplete seal can allow airflow into the pile through convection or diffusion. The piles are also especially vulnerable to an incomplete seal at the toe of the fill because of tree blow down and erosion as mentioned above. Various other ways for air to enter or leave the pile exist by advection due to thermal gradient, wind pressure and barometric pumping. Temperature differences between the pile and outside air can also influence the direction of air flow as mentioned above. The installation of monitoring devices below the cover system that measure oxygen concentration profiles at selected locations within the tailings and waste rock landfills would be useful. The measurement of net neutralization potential (NNP) and pH would also be useful if an oxygen front was found to be moving through the pile (by way of regular analysis of oxygen as mentioned above). HGCMC is considering the development of a modified test plot on the tailings disposal facility that will likely include but not be limited to a

thicker growth layer and barrier layer with a lower hydraulic conductivity. Monitoring for oxygen, NNP and pH beneath the barrier layer would be useful and is recommended.



Test Cover System at Site 23. Note volunteer conifer growth and monitoring probes. Also note clover and grass growth on the cap. Deer and bear are excluded by an electric fence that surrounds this test plot

New Site 23 Surface Water Compliance Monitoring Station

HGCMC has requested, and ADEC would like to see a new compliance monitoring station downstream of Site 54 below the confluence of Gallagher Creek. This station is needed to identify the highest concentration of hazardous constituents migrating from the facility and whether or not contamination from Site 23/D has any effects on the down-gradient surface water environment. The station should be carefully selected and approved by ADEC in order to ensure that it is effective in catching seepage from both Sites 23 and D. The results of a 3-part survey started in the summer of 2011 to identify a new station have been completed and were presented at the annual meeting. ADEC, the USDA Forest Service and HGCMC will meet soon to discuss the new information and to identify the new monitoring station.



Site D. Note the area to the right near Greens Creek will be a potential location of a new surface water monitoring station

Pit 405

We stopped briefly at Pit 405 which is located at 7.6 mile on the B Road. The rock from this quarry was used for construction of the B Road and other mine infrastructure. Mine records indicate that approximately 13,000 cubic yards of production rock were backfilled into the quarry in 1988. The

quarry received reclamation materials (colluvium and glacial till) in 1994, 1995 and 1998 for use in future reclamation projects. The waste in Pit 405 is pyritic although monitoring of drainage downgradient of the quarry demonstrates that influences from the site are negligible. According to the annual report the production rock in the quarry is suggested to be either removed or covered in-situ. This is yet to be determined. Removal of the rock could be problematic as this would increase exposure of the now covered pyritic quarry wall. Reclamation costs should include the cost to remove waste from this site.



Pit 405

Site E: We stopped briefly at Site E. Approximately 365,000 cy of waste rock was disposed at this site of which about 200,000 cy was acid generating and metals leaching. This will eventually be moved to the tailings facility. Approximately 85,000 cy have been removed so far at around 40,000 cy a year. Until there is an approval for the tailings expansion the amount of material removed from the site will be minimal in order to give preference to tailings from mill operations. The contact water sump was approximately half full and appeared to be functional.



Site E: Approximately 85,000 cy removed



Contact water sump

Tailings Disposal Facility (TDF): The systems observed at the tailings disposal facility appeared to be in place and in good working order. The TDF has approximately 3 years of disposal capacity remaining. Before any future tailings are placed beyond the existing Phase II expansion area the following must happen:

1. an EIS process must determine how expansion is to proceed,
2. HGCMC must perform the engineering necessary to expand the facility, and
3. a permit renewal process must take place.

Currently tailings are being placed in the Northwest Pit 5 expansion area. HGCMC placed tailings using the specific criteria established by Klohn Crippen Engineering in 1999 using cellular configurations and compaction standards.

The East Ridge Expansion Area has not yet been used for tailings disposal. HGCMC is waiting for drier weather conditions (i.e., spring) for disposal. Since the shape of the East Ridge area is currently concave, HGCMC would like to place tailings during the driest time of year so that water does not pond. The goal would be to fill it as quickly as possible up to the point that it can more easily shed water, not to its full capacity. A drain in the east expansion area that conducts contact water to Pond 9 was not operational. This will need to be repaired prior to placing tailings in this area.

A fairly large area of the TDF is not accepting waste and remains uncovered. This provides an opportunity for the dispersion of fugitive dust. HGCMC should develop a way to cut down on fugitive dust by treating the upper surfaces of the landfill where waste disposal is not taking place.

According to the annual report:

1. the Northwest Tailings area received 359,374 tons (198,363 cubic yards) of tailings in 2011.
2. stability monitoring indicate the pile meets design specification.
3. target compaction densities (>90% Proctor) have been achieved in tailings placement.
4. construction activities included cleaning sediment from the lined degrit basins that were installed in 2009, completing construction of the East Ridge expansion, completing the extension of Wet Well A in the Pond 6 area, and electrical decommissioning of Wet Well

Please refer to the annual report and the ADEC assessment of it for more information regarding this site.



Tailings Disposal Facility: East Ridge Expansion Area



Tailings Disposal Facility: Northwest Expansion area- active placement taking place

Action items:

1. Provide better characterization of secondary minerals in the underground environment, including identification of the types of salts, associated primary mineralogy, and the probable amount of this type of material.
2. Consider isolation of mine lower-level, metals laden water barriers to prevent egress at the 900 level.
3. Alternatives to flooding the entire mine, such as flooding the lower workings below the Greens Creek valley base elevation or flooding only selected mine areas above that elevation that can be sealed via bulkheads, should be considered. Other methods of isolating water with high metals content should be investigated.
4. Improvements are planned for the area where observed seepage was found in the Pond B area. HGCMC should make and report on these improvements as soon as possible and continue to monitor the seepage at this location and all along the embankment adjacent to Greens Creek where there could be impacts from waters in contact with mine waste or other materials. Samples should be taken of this site and any other seeps semi-annually and reported within a reasonable amount of time. The report should include laboratory data sheets.
5. Provide a full report of the analysis of Site 23 movement by the end of September 2012.
6. Site 23 movement is consistent over time. Monitoring of inclinometers may be reduced from quarterly to semi-annually because of this.
7. Provide details of the cover system at the periphery of the landfill in the final cover design.
8. HGCMC is considering the development of a modified test plot on the tailings disposal facility that will likely include but not be limited to a thicker growth layer, and a barrier layer with a lower hydraulic conductivity. Monitoring for oxygen, NNP and pH beneath the barrier layer is needed in the design.
9. HGCMC should develop a way to cut down on fugitive dust at the tailings disposal facility by treating the upper surfaces of the landfill where waste disposal is not taking place.

Additional Comment:

The Alaska Department of Environmental Conservation appreciates the continuing cooperation of the Hecla Greens Creek Mining Company with the ADEC Solid Waste and Water Programs.

**** End of Report ****



THE STATE
of **ALASKA**
GOVERNOR SEAN PARNELL

Department of Environmental
Conservation

DIVISION OF ENVIRONMENTAL HEALTH
Solid Waste Program

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August 28, 2012

CERTIFIED MAIL # 7003 0500 0004 7871 1331
RETURN RECEIPT REQUESTED

Ms. Jennifer Saran
Hecla Greens Creek Mining Company
PO Box 32199
Juneau, Alaska 99803

Subject: Greens Creek Inspection dated July 31, 2012

Dear Jennifer Saran:

The Alaska Department of Environmental Conservation Solid Waste Program (ADEC) visited the Greens Creek waste disposal and other facilities on July 31, 2012. The visit was useful for ADEC and agency staff as a follow-up to the meeting and presentation of the HGCMC 2011 Annual Reports the day before. It was a good opportunity to pay attention to issues that were brought out during the meeting. This inspection focused to a large degree on bonding for closure of the mine in preparation for a two day work session that followed using the Standard Reclamation Cost Estimator (SRCE) model. Various items were observed and discussed at this inspection.

Please refer to the attached inspection report. At the end of the report is a list of Action Items that require your attention. Please provide the information requested from this list. If you have any questions, please feel free to contact me or Ed Emswiler at 907-465-5353.

Sincerely,

A handwritten signature in black ink, appearing to read "Ed Emswiler".

Ed Emswiler
Environmental Program Specialist
Solid Waste Program

cc: Sara Samuelson, USDA Forest Service, Juneau, Alaska
Joe Manning, USDA Forest Service, Juneau, Alaska
Allan Nakanishi, ADEC Wastewater Program, Anchorage, Alaska
Kenwyn George, ADEC Wastewater Program, Juneau, Alaska
Timothy Pilon, ADEC Wastewater Program, Fairbanks, Alaska
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