

Update on Selenium Projects at Tilden and Empire Mines

Volume 5

July 2016

Purpose Statement:

Cliffs Natural Resources' Michigan Operations Tilden and Empire Mines move over 60 million tons of rock annually in order to produce approximately 12 million tons of iron pellets. This large scale operation generates significant environmental interest. This newsletter will focus on selenium and the Empire Mine closure.

Inside This Issue

- 1 The Idling of Empire Mine
- 2 Storm Water Management at Cliffs Michigan Operations
- 3 Administrative Consent Order on Selenium Discharges
- 4 Tilden Mine Selenium Treatment Improvements

The Idling of Empire Mine

By: Cliffs Natural Resources' Michigan Operations

The Empire Mine began operations in 1963 and has undergone several expansions during its mine life. During peak production, Empire was able to produce 8 million tons of pellets per year and currently operates at a rated capacity of 5.5 million tons per year.

The Empire Iron Mining Partnership, which is owned by subsidiaries of Arcelor Mittal Steel USA and Cliffs Natural Resources Inc., will be idling the Empire Mine as a result of the expiration of the partnership and commercial agreements. Unfortunately, due to the expiration of the Empire Iron Mining Partnership and the limited availability of economic ore reserves, mining at the Empire is not currently economically viable. It is anticipated that the idling of operations at the Empire will be completed by the end of 2016 and will continue indefinitely into the foreseeable future.

Because the idle period will be indefinite, the Empire Mine has prepared a long-term care and maintenance plan to preserve the assets in an economically and environmentally

responsible manner. Empire intends to maintain the furnaces and associated ore processing facilities in a state of readiness to be available to resume production with minimal delay if economic conditions change making a return to production viable. During the idling period, the site will preserve all environmental permits and will comply with all monitoring, as well as other regulatory and permit requirements.

The idling of Empire will impact employees at both the Empire and Tilden Mines. Because the labor agreements at each facility recognize common seniority, employees at both operations are impacted by the reduction in workforce. Cliffs will continue to operate the Tilden Mine. The Tilden is a key operation for Cliffs with an annual rated capacity of 8 million tons.



Storm Water Management at Cliffs Michigan Operations

By: Jay Parent, MDEQ

The footprint of Cliffs Michigan Operations (Cliffs) iron mining and beneficiation operations covers approximately 24 square miles. Eight square miles is rock piles consisting of overburden and lean ore. These piles are hundreds of feet above the surrounding

landscape. Rain and melting snow traveling through these piles dissolve selenium from the rock. Cliffs' National Pollutant Discharge Elimination System (NPDES) permits required them to develop and implement a Selenium Storm Water Management Plan (SSWMP).

Development of this plan began in 2011. After extensive monitoring of water and biota, investigation of control strategies, and piloting of treatment technologies, a control system is being constructed.

The system will consist of 11 pump stations and 14 miles of pipe around the 21 mile perimeter of the mine site to direct the selenium impacted storm water to an unused mine pit. Another piping system is being installed to return water from the mine's freshwater storage basins to the adjacent watersheds so that they are not deprived of water. The current best estimate is that the pit will have capacity to store the water for 12 years before a treatment system will need to be operational.

The proposed treatment system consists of a series of tanks in which bacteria are used to eliminate oxygen. Under low oxygen (reducing) conditions, dissolved selenium oxides are converted to elemental selenium which will precipitate out of the water. This precipitate can then be removed and disposed of. Treatment technologies will continue to be evaluated and the final solution will be selected prior to the pit storage facility reaching design capacity.

The rock piles were constructed to minimize the filling of regulated wetlands. Since the piles are often built adjacent to these wetlands, some of the pumping stations will be located in wetlands and disturb the small streams flowing away from the mine site. The wetland/stream permit issued to Cliffs for construction of the storm water collection system requires mitigation for these unavoidable impacts to those wetlands and streams. The mitigation includes removing an undersized double culvert in Goose Lake inlet, funding a Marquette County Road Commission culvert replacement at Flopper Creek on CR 565, and use of wetland credits from the Republic Wetlands Preserve. The Flopper Creek culvert replacement has been identified as a high priority by the Michigan Department of Environmental Quality (MDEQ) for improving the quality of this brook trout stream.

This selenium storm water issue is unique in Michigan. Other closed iron mines have not shown the presence of elevated selenium. The MDEQ and Cliffs have been working cooperatively to identify and implement a solution for this complex and challenging issue. While some details need to be finalized, the overall framework for control has been set and construction has started. A significant commitment of staff and resources from both Cliffs and the MDEQ has made this accomplishment possible.



(Storm water leaving the Tilden North stock pile at Cliffs Natural Resources)



(Looking south at Empire stock piles from Negaunee)



Storm Water Management article in this newsletter.

Administrative Consent Order on Selenium Discharges

By: Steve Casey, MDEQ

The MDEQ and Empire Iron Mining Partnership (Empire) entered into an Administrative Consent Order to resolve ten months of selenium effluent violations between February 2014 and June 2015. The May 18, 2016, Consent Order acknowledges that Empire has already taken action to eliminate future violations (diverting selenium impacted storm water into an unused pit) and requires that Empire pay a \$95,000.00 fine and reimburse the MDEQ in the amount of \$1,350.00 for cost of the investigation/enforcement.

The MDEQ and Empire believe that the violations of selenium limits can largely be attributed to the diversion of selenium impacted storm water into the Empire Mine process water. This diversion was done with the encouragement of the MDEQ in order to reduce the selenium discharges to Warner Creek. Unfortunately, more selenium passed through the treatment system during late winter/spring than was allowed by the NPDES permit.

With Empire slated to be idled in late 2016, the process wastewater discharge will end. The selenium impacted storm water being stored in the Empire Pit will eventually be treated using the system described in the



Tilden Mine Selenium Treatment Improvements

By: Cliffs Natural Resources' Michigan Operations

Tilden Mine has been in operation since 1972 with the capacity to produce 8 million tons of iron ore annually. The Gribben Tailings Basin, a tailings management facility and wastewater treatment system, is an essential part of the process for beneficiation of low grade iron ore at Tilden and has a water clarification system where water is decanted from the tailings basin and chemically clarified prior to discharge via Tilden's NPDES Outfall 002.

Upon the 2012 reissuance of Tilden's NPDES Permit, the MDEQ implemented a compliance schedule to ensure selenium in Tilden's Outfall 002 would meet water quality standards. This required Cliffs to investigate and implement methodologies to reduce selenium concentrations to <5 micrograms per liter at Outfall 002.

A thorough evaluation of various technologies and management strategies was completed to determine the optimal mechanisms that could be employed to meet

the effluent limit for selenium at this outfall. The various technologies evaluated included reverse osmosis, multiple active biological treatment technologies, passive biological treatment, and chemical treatment. After the completion of these evaluations, it was determined that the treatment approach will include several actions, either individually or in aggregate, which will provide sufficient reductions in selenium concentrations to meet the final effluent limit for selenium at this outfall. These include:

1. The addition of a neutralizing agent to modify pH of the tailings slurry to create favorable conditions for the selenium to bind to remaining free iron;
2. Construction of (2) new 6,000 gallon per minute, high-rate unballasted clarifiers to improve the solids removal efficiencies during clarification;
3. Use of an iron based coagulant, as necessary, in the clarifiers to further sequester selenium prior to discharge; and
4. Improvements to water management infrastructure.

Tilden is on schedule to achieve completion of these projects to meet the 2017 date and will be working through the 2016 and 2017 construction seasons to finalize them. An overview of the construction can be seen in the photograph located on page 6.

This newsletter was developed and distributed by the Michigan Department of Environmental Quality with cooperation from Cliffs Natural Resources. It is intended to assist the public with information on the activities in and around the Empire and Tilden mines. If you have any questions, suggestions or would like to be added to the electronic mailing list, please contact Steve Casey by e-mail at caseys@michigan.gov.



(Existing clarifier is on the right and the new clarifier is under construction in the background)

