Evaluation of Capping Methods at Homestake Open Cut Mine

David Robbins, LBNF/DUNE FSCF Intern

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Introduction

To facilitate the construction of DUNE, ~800,000 tons of rock will be blasted, skipped, conveyed, and discharged into the open cut in Lead, SD. When the excavation phase of construction is completed in May 2024, evaluation of potential environmental impacts caused by the deposited rock must be done. The main concern is the potential for dust to become airborne if there is the presence of high wind and lack of precipitation.

Figure 1– Image of the Open Cut and discharged rock on July 3rd, 2023.

Methods considered for fugitive dust containment were:

- No Action
- NALCO DUSTBIND Plus Capping Agent
- Shotcrete
- Concrete Impregnated Blankets
- Hydroseeding
- MacMat (3D Synthetic Mesh)

Considerations for the best method include contractual agreements, safety concerns, water runoff, feasibility, time to installation, public perception, and possibility for rock discharge to restart in 5-10 years by South Dakota Science and Technology Authority (SDSTA).

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Data and Analysis

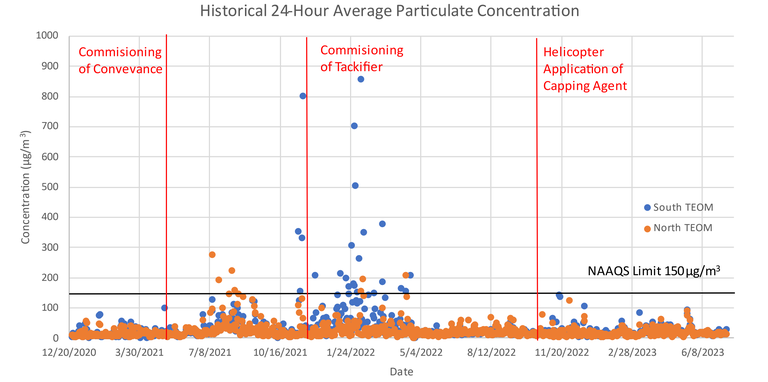

Figure 2 – Graph Depicting the 24-Hour Average Concentrations of Particulate Matter Since December 20th, 2020.

Figure 2 shows the historical data collected by two tapered element oscillating microbalance (TEOM) stations. The large spike from December 2021 to February 2022 reflects the increased winds and low precipitation and corresponding low humidity.

A noticeable trend is the reduction of events exceeding the (National Ambient Air Quality Standards) NAAQS limit over time. This reflects weather trends and improved operating practices.

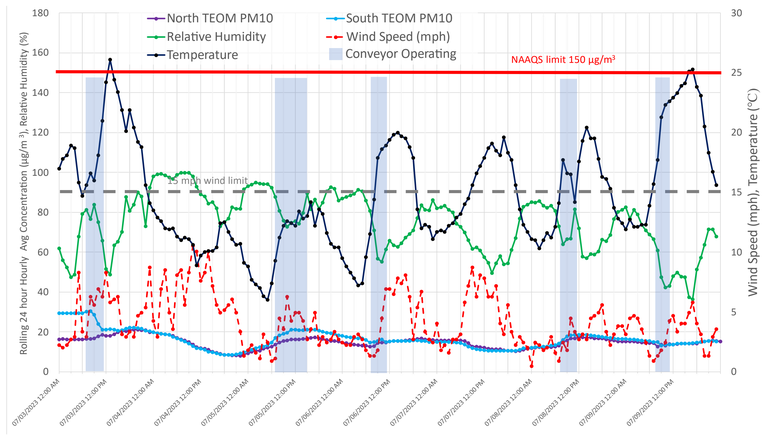

Figure 3 – Graph Depicting the Hourly Particulate Concentration, Wind Speed, Relative Humidity, Operating Times, and Temperature for the Week of 7/10/23 to 7/17/2023.

Figure 3 depicts hourly data with temperature, wind speed, conveyor operation, and PM10 concentration. It should be noted that PM10 levels stay relatively consistent even with increased wind speeds and temperature with current dust mitigation techniques such as tackifier and water sprayers.

Long-term static conditions of the rock without current active dust mitigation techniques are unknown due to a lack of available data. Solutions that balance resilience to dryness and wind while minimizing installation time, cost, and personnel exposure to health and safety risks are preferred.

Figure 4 – Blackhawk helicopter applying NALCO DUSTBIND PLUS on the discharged rock using a modified Bambi bucket on October 19th, 2022.

Conclusions

The research performed evaluating the various solutions supports the application of NALCO DUSTBIND PLUS. The application method is well understood, repeatable, and could even be improved upon due to previous experience. This method mitigates safety concerns of other methods that require rappelers to work in the open cut. The cost of this method is ~$165,000 per application, which is much less than the estimated $1.5+ million dollars for other methods. Application time is one day compared to 60+ days.

The no action option was not recommended due to the NALCO method being applied as needed while having a positive public perception.