APPENDIX F, Dust Impact Monitoring and Implementation Plans

Dust Impact Monitoring and Implementation Plans

2010 Waste Management and Reclamation Plan Annual Report

Red Dog Mine
Teck Alaska Incorporated
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Introduction

The Red Dog Mine is located approximately 50 miles east of the Chukchi Sea, in the western end of the Brooks Range of Northern Alaska. Ore containing lead sulfide and zinc sulfide is mined and milled to produce concentrate. These concentrates are hauled year-round from the mine to concentrate storage buildings (CSBs) at the port, where they are stored for loading onto ships during the summer months. The storage capacity allows mine operations to proceed year-round. During the shipping season, the concentrates from the storage buildings are loaded into an enclosed conveyor system and transferred to the shiploader, and then into barges. The barges have built-in and enclosed conveyors and on-board loaders that are used to transfer the concentrates to the holds of deepwater ships.

Throughout the operating history of the mine, fugitive dust has been one of the main environmental issues. Process improvements from 1990 through the present have been aimed at reducing or eliminating fugitive dust from both mine and mill operations as well as transport of concentrates over the port road.

Environmental Impact Study and Risk Management Plans

In order to further the efforts toward reducing fugitive dusting from the mine, Teck has developed a Risk Management Plan (RMP) for effective management of fugitive dust concerns as identified in the 2008 Risk Assessment. The RMP required that six implementation plans be developed: Communication Plan; Dust Emissions Reduction Plan; Remediation Plan; Monitoring Plan; Uncertainty Plan; and Worker Dust Protection Plan.

The risk assessment report, RMP and the Monitoring and Remediation Plans are available on ADEC's webpage at: http://www.dec.state.ak.us/spar/csp/sites/reddog.htm. The Monitoring Plan encompasses the monitoring methods proposed for use at the Mine to ensure that the dust control protocols and monitoring methods outlined below are effective at reducing fugitive dust emissions. Readers are encouraged to review the RMP as well as the available plans on the DEC website in order to gain a more complete understanding of the programs in place at Red Dog.

The Communication, Monitoring and Remediation Plans have been submitted to DEC. DEC requested public comment on both the Monitoring Plan and the Remediation Plan. The public comment period ended August 2, 2010 and the plans are currently undergoing final revision prior to publication on DEC's website. The Worker Dust Protection Plan is currently undergoing review by the Ikayuqtit Technical Review Committee. Comments are due March 31, 2011. The Dust Emissions Reduction and Uncertainty Plans are in development.

Dust Control Measures

Equipment modifications and operational improvements have significantly reduced the level of fugitive dust generated by the operation. Major equipment modifications include enclosing all conveyor galleries, transfer points and stockpiles, and the application of negative pressure bag house and filter exhaust systems at transfer points and at loading/unloading facilities in the CSBs. Operational improvements include procedures to control road, tailings beach and mine activity dust as well as operational system checks. More detail can be found both on the DEC website and in the 2008 Risk Assessment Report.

Current air quality monitoring at both the mine and port verify full compliance within the respective ambient air boundaries with Federal standards and no impacts to air quality have been measured in Noatak or Kivalina, the two closest Native villages. Regular employee lead blood testing confirms that

health and safety of workers has been protected. Details on employee protection protocols will be available in mid 2011 in the Worker Dust Protection Plan, currently in final review.

The Dust Reduction Plan, currently in development, will include a discussion of the operational and equipment upgrades to be put in place to continue the focus on reducing the emissions of fugitive dust from the mine, port and DMTS. Red Dog evaluates new procedures, process controls and technologies on an ongoing basis to ensure the most effective dust controls are in place at all times.

Quarries, stockpiles, exposed areas, roads

Fugitive dust control for mine facility roads, quarry operations, stockpiles, and exposed areas is accomplished through the application of water and calcium chloride, and/or other dust control agents. In addition, testing of new dust control products is performed on an ongoing basis.

Tailings beaches

To prevent particulate matter from becoming airborne at the tailings beach a floating discharge line accomplishes sub-aqueous tailings deposition into the deeper parts of the tailings impoundment thereby preventing beach formation. Cold weather dust control solutions are always being researched, including new palliative formulae and flooding of the tailings beaches prior to the first snowfall.

Drilling

To prevent particulate matter from becoming airborne during drilling activities, Teck requires the use of water when drilling in the pit. Approximately 300 gallons of water (mixed with methanol to prevent freezing in the winter) are used each day the drills are operating.

Dust Impact Monitoring Activities

Historic and ongoing ambient air monitoring programs were conducted to measure fugitive dust emissions and to assess operational improvements. The program currently includes dustfall collection jars and ambient air monitoring using high-volume (hi-vol) air samplers or tapered-element oscillating microbalance (TEOM) samplers. Dustfall results indicate the primary sources of historic fugitive dust deposition within the port are the concentrate storage buildings (CSBs), associated ship-loading conveyors, and the re-entrainment of tracked contaminates from road surfaces. The TEOM samplers measure total suspended particulates (TSP) and particulate matter with an aerodynamic diameter of less than ten microns (PM_{10}) respectively. The monitoring has been conducted at various times and at multiple sites. The two monitoring techniques cannot be directly compared due to changes in monitoring location and particulate measurement parameters. However, a qualitative comparison of the monitoring data indicates a significant reduction in fugitive dust emissions since 1992.

Visible Emissions Evaluation

Visible emissions evaluation (VEE), as outlined under U.S. Environmental Protection Agency (EPA) Method 22, are one of the monitoring techniques required for the Title V air permit at Red Dog Mine, and are used to maintain compliance.

In addition to the Method 22 observations, EPA Method 9 Visible Emissions Evaluations are also required for some sources. Information on Method 9 and Method 22 VEEs is available in the Annual and Semi-Annual Reports submitted to the Alaska DEC as required by the Title V Operating Permit.

TEOM Air Monitoring

The tapered element oscillating microbalance (TEOM) air monitoring device is used for air quality monitoring at locations within the mine and port. The TEOMs produce real-time total dust measurements and collect discrete samples to be analyzed for metals concentrations. TEOMs are present at the Port at the CSBs and the Lagoon, and at the Mine at the PAC and the Tailings Dam.

Currently, TEOMs run continuously to measure real time TSP. The filters collect TSP-Pb and TSP-Zn concentrations over 24-hour periods every third day at the mine and every sixth day at the port. TSP, TSP-Pb and TSP-Zn concentrations are compiled into monthly averages for use in dust control and tracking activities.

Dustfall Jar Monitoring

Dustfall jars are passive accumulators of windblown dust. Dustfall jars provide a means to monitor large areas for long periods of time and can be used to supplement information collected via other monitoring techniques. Laboratory testing and analysis is performed for physical parameters (e.g., particle size) and inorganic chemical parameters (e.g., metals such as lead and zinc). Dustfall monitoring is based on an American Society for Testing and Materials (ASTM) standard test method D1739.

Dustfall jar arrays have been established within the mine, port, and road areas. The road stations were monitored for approximately 1 year, and the port and mine stations have been monitored since they were installed. Dustfall jars are collected for analysis approximately every 60 days. Dustfall jar data were used initially to help characterize the deposition patterns around mine, road, and port sources. The data continue to be evaluated to look for any temporal trends.

Marine Sediment Monitoring

Baseline samples were obtained from near shore marine sediments in 1990 to more accurately assess the levels of naturally occurring metals in the area immediately adjacent to the Port and to assist in detecting effects on marine sediments from dust associated with ship loading and port operations. Sampling was performed again in 1991 at the end of the shipping season. Results showed elevated levels of lead and zinc as compared to the baseline samples, suggesting the need for improved fugitive dust management during concentrate handling.

Monitoring has continued through the present on a regular basis in an attempt to gauge the effectiveness of improvements made at the Port by monitoring levels of lead and zinc in offshore sediments over time. Improvements to the Port equipment and operational protocols are detailed in the 2008 Risk Assessment Report.

Average sediment zinc concentrations have begun to show a decreasing trend between 1990 and 2010 based on a comparison of average relative percent differences (Table 2) with the results of the

regression analyses discussed above and provided in Appendix B. Average lead concentrations have increased overall since 1990; however the improvements to the port site and shiploader have resulted in a decrease in levels (although not yet to the original lows) since 2003.

Meteorological Monitoring

Meteorological monitoring has been conducted near the airport at the mine site, and near the PAC at the port site since 1996. An additional wind monitoring tower was constructed in 2002 at the mine near the mill facilities, and a National Weather Service weather station was installed near the airport in 2010.

Vegetation community monitoring

Monitoring of the vegetation communities surrounding Red Dog Mine and the DMTS is conducted every 3 years, with the most recent survey completed in 2010. Results will be made available to DEC when they are finalized. Monitoring of the vegetation surrounding the Mine is conducted in order to ascertain whether there are effects to the health of the vegetation as a result of exposure to dust associated with mine operations.

Moss tissue monitoring

Moss studies have been conducted since 1999 by the National Park Service (NPS) and TCAK. In 1999, the NPS conducted spot moss sampling in Cape Krusenstern National Monument adjacent to the road. Elevated lead values prompted the collection of moss and soil samples along six transects perpendicular to the road in the summer of 2000, which was published in a 2001 report. In 2001, the NPS returned to conduct a regional study that included sampling as much as 45 miles north and south of the road and the information was published in 2004. Moss was chosen as an appropriate medium for monitoring dust because it retains heavy metals absorbed through its leaves, and annual growth can be easily identified and sampled.

In 2001, TCAK conducted a program along seven transects perpendicular to the road and outside the Monument boundary. Additional, spot sampling was conducted at historic concentrate truck spill sites and around the port facility. In 2002 and 2008, additional sampling was performed around the mine site. Results of the 2008 moss study are in technical review prior to publication.

Caribou tissue monitoring

Fugitive dust from the DMTS road that has been transported onto plants or tundra soils could be consumed by animals that are in turn consumed by people. Caribou are a source of food for many regional subsistence communities; therefore subsistence use of caribou is considered a primary pathway of exposure. Caribou are therefore regularly monitored for lead levels to ensure that they remain safe for consumption.

A Caribou Health Assessment was most recently conducted in March of 2009. Local subsistence hunters assisted in taking 10 caribou which had overwintered in the Red Dog Mine Valley. Necropsies were performed by an Alaska Department of Fish and Game pathologist. Liver, kidney, muscle and hair tissue were sent to Wyoming State Veterinary Lab for metals analysis. Results were consistent with 1996 and 2002 results, showing no statistically significant increases in metals levels, and that caribou were safe for

consumption by local subsistence communities. Resampling is planned to occur every 6 years, with the next sample occurring in 2015.