DUST CONTROL MEASURES AT ASARCO INCORPORATED'S TROY UNIT TAILING IMPOUNDMENT[1]

by
Lawrence A. Erickson[2]

Abstract. ASARCO Incorporated's Troy Unit in northwest Montana has developed and implemented a system of dust control measures at the tailing impoundment with success. The measures used are proven methods modified to meet the specific needs and conditions at this site. Continuous gentle winds dry the impoundment area enough to create a significant surface management problem despite the mild damp climate of the region. The steps taken to prevent blowing dust include soil salvage and placement on disturbed areas not used for tailing disposal; revegetation; dividing the impoundment into sections; a sprinkler irrigation system; seeding inactive sections with a cover crop; covering road surfaces with coarse gravel and sand; and use of a water truck. These measures have reduced or eliminated blowing dust from Asarco's Troy Unit tailing impoundment.

Additional Key Words: tailing dust suppression, Montana, copper/silver tailing

Introduction

Location

The Troy Unit is located in Lincoln County, northwest Montana. The tailing site (el. 2,350 ft) is ten miles by air, south of the town of Troy in the Lake Creek valley and the mine site (el. 3,510 ft) is an additional five miles south at the base of Mt Vernon (5,580 feet).

Description of Operation

The Troy ore body is a quartzite hosted low grade copper/silver deposit. The daily production rate of 8,500 tons produces an annual tailing disposal rate of approximately three million tons. Ore is crushed in two stages and fed into two ball mills. The final tailing is 70% -150 mesh (55% -200) and is composed of 90% SiO_2, <5% calcite and <0.1% sulphides. All of the tailing is deposited on the surface. The tailing impoundment is built by upstream construction and occupies 450 acres with 320 acres of that being exposed tailing. See Figure 1.

[1]Paper presented at the 10th National Meeting of the American Society for Surface Mining and Reclamation, Spokane, Washington, May 16-19,1993.

[2]Lawrence A. Erickson is the Chief Engineer at Asarco's Troy Unit, Troy, MT 59935

Proceedings America Society of Mining and Reclamation, 1993 pp 443-446
DOI: 10.21000/JASMR93010443

Climate

The mild damp climate of the region produces about forty (40) inches of precipitation annually at the tailing site and over one hundred (100) inches at the mine site. Temperatures range from -25° to 105° F with a yearly average of 43° F. The growing season is approximately 100 continuous days above 32° F. Most of the precipitation is in the form of snow. Surface winds are generally 0 - 10 mph out of the south but northerly winds are common in the winter months. Despite the mountainous terrain and wet climate, continuous gentle winds dry the impoundment area enough to create a need for surface dust management.

Dust Control Measures

Dust suppression measures at the facility have evolved over the life of the operation to the present system in order to continue to meet air quality standards. These measures include topsoil salvage and placement; revegetation; sectioning of the impoundment; sprinkler irrigation; cover crops; road surface management; and, wind breaks.

Soil Salvage and Application

The soils in the tailing area consist of lacustrine deposits of glacial silts, sandy silts and silty sands. Before construction of the first tailing dike, soil was stripped from the tailing area and stockpiled around the impoundment. Soil is applied to the down stream slope of the dike as soon as possible after construction of additional 10 ft dike lifts of tailing. It has been found to be very effective to spread and compact the soil with a small dozer to a depth of 6 - 12 inches. Approximately 800,000 cubic yards of soil have been salvaged and will be applied to the surface of the impoundment at a depth of one to two feet during reclamation.

Revegetation

As required by the Troy Unit Operating Permit, the tailing impoundment will be covered with soil, seeded with field mix and planted with trees and shrubs. The first step taken to prevent blowing dust after initial construction was to revegetate the soil stockpiles. This temporary reclamation effort prevents blowing dust on about 130 acres. The curent USFS recommended field seed mix is composed of Timothy (Phleum pratense) 12%, Hard fescue (Festuca ovina) 12%, Orchard grass (Dactylis glomerata) 25%, Brome (Bromus spp.) 25% and Clover (Melilotus spp.) 26%. This mixture is broadcast at a rate of 25 pounds per acre with fertilizer (21-0-0) at 100 lb/ac. The introduction of straight nitrogen has produced very good germination results. Seeding is generally done in the spring or fall when there is enough moisture for good germination. Soil preparation is done by a D-3 dozer when spreading soil. Depressions made by the tracks help protect the seed from wind and help to collect moisture. Final seeding of field mix over the impoundment surface during final reclamation will be done with a tractor and drill.

Sectioning of the Impoundment

Early in the operation of the impoundment, it was found to be difficult to keep the entire area of exposed tailing wet; therefore, the impoundment was divided into four nearly equal sections with dikes 15 ft wide by 10 ft high. As the impoundment expanded, it was deemed cost effective to eliminate one dike and operate three sections which are 85 to 130 acres in size. Tailing is deposited along the perimeter of the impoundment in one section at a time through 5 - 7 valved spigots. Discharge locations are rotated hourly to keep the entire surface of the active section wet. The inactive sections are kept wet with a sprinkler irrigation system. In addition, the nearly east-west dikes

dikes provide a slight wind break to redirect wind from the surface of the impoundment.

Sprinkler Irrigation System

In June 1983, a sprinkler irrigation system was installed to keep the inactive sections of the tailing surface wet. The system uses thin wall aluminium piping and rainbird type sprinkler heads. A 100-hp pump and gravity feed charges 8,000 ft of 10-inch trunk line and 64,000 ft of 4-inch distribution lines with 550 gpm of water. Sixteen (16) sprinkler heads distributing over a 50-ft radius are rotated hourly to get complete coverage over the two inactive sections. The heads are continuously disconnected and moved to the new location by an operater riding a "4-wheeler" to make his "rounds". Tailing decant water is used for irrigation with additional water supplied from the mill process circuit and mine discharge. The system is assembled by a two man crew in April before dry weather begins and operated 12 hours per day through September when it is disassembled before freezing weather arrives. A section may be inactive for 1 to 1.5 years and in dry weather will become dusty in a few days so the timing for switching sections can be critical.

Cover Crop

To further reduce blowing dust, the inactive sections are seeded with a cover crop. In early years wheat was broadcast at 100 lb/ac and provided good results; however, price considerations resulted in trying oats (100 lb/ac) in 1987. The oats worked well but attracted game animals. The large number of animals on the impoundment became a concern so starting in 1988 barley has been used. Barley was recommended because of being hearty and growing well in sandy soils. The seed is drilled at a rate of 100 lb/ac with fertilizer (21-0-0) at 100 lb/ac. In 1992, no fertilizer was used with equally good results. It is assumed that the fertilizer is quickly washed through the sandy tailing during irrigation. This temporary cover provides additional protection for stabilizing the surface of the impoundment.

Tree and Shrub Planting

Native vegetation is left in place as long as possible before stripping soil and covering the area with tailing. In some areas, the soil is too thin and rocky to salvage so the unmerchantable trees are left as windbreaks to be covered with tailing. The reclamation plan calls for planting the surface with native trees and shrubs including Ponderosa pine (Pinus ponderosa), Douglas fir (Pseudotsuga menziesii), Western larch (Larix occidentalis), Ceanothus (Ceanothus spp.), Serviceberry (Amelanchier alnifolia), Alder (Alnus spp.) and Willow (Salix spp.). The trees and shrubs are to be planted at a density of 680 trees per acre (8 ft x 8 ft). Natural revegetation of trees and shrubs has begun on the slopes of the impoundment. The Mine Safety and Health Administration has objected to planting trees on the slopes of the impoundment while in operation because of the possibility of tailing piping along root systems.

Construction and Road Surface Management

There are eight (8) miles of unpaved road surface at the impoundment. These surfaces, including tops of the dikes, are covered with one (1) foot of coarse sand and gravel. The road base is graded to the inside of the impoundment where the excess covers the inside slope. Construction of dike lifts are generally scheduled for spring and fall months to take advantage of precipitation for dust control. The dikes are made of the fine sandy portion of the tailing and are very susceptible to drying and wind erosion those months. During dry weather and heavy traffic periods, road surfaces periodically are wet with a 1,800-gallon water truck and the sprinkler system.

Conclusion

Asarco has developed and implemented a system of dust control measures at the Troy Unit tailing impoundment with good success. The measures used are proven methods modified to meet the specific needs and conditions at this site. These measures have reduced or eliminated blowing dust and tailing from Asarco's Troy Unit tailing impoundment. The 6-day particulate sampler at the weather station near the tailing impoundment shows the Troy Unit to be in compliance with Montana air quality standards. Dust control measures at the Troy Unit cost $175/ac in 1992.

References

Toland, George C., Dames and Moore, 1980, Report of Design Studies, Tailing Pond Starter Dike and Decant System, Troy Project near Troy, Montana for ASARCO Incorporated, p 5.0-2 - 5.0-7.

Environmental Impact Statement, Volume I, Troy Project ASARCO Incorporated, Lincoln County, Montana, United States Forest Service and Montana Department of State Lands.