

Black Butte Mine Tailings Identification

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Introduction

Recent community outreach efforts in the London Road and Cottage Grove area has suggested that tailings from the former Black Butte Mine (BBM) in southern Lane County may have historically been removed from the site and used for various construction projects (e.g. roads, landscaping, foundations) in the area. However, tailings have not been found in any off-site location in the London and Cottage Grove area, to date. BBM tailings are contaminated with mercury and arsenic. Arsenic is generally of more concern due to its higher toxicity than mercury. Mercury in spent tailings is less bioavailable than elemental mercury (found in industrial equipment) or methyl mercury which (found in fish).

South of BBM in the Sutherlin area, a 17-mile long railroad bed was constructed of tailings from the former Bonanza mercury mine, referred to as the Red Rock Road (RRR). Bonanza Mine and BBM are similar both in geology, chemical concentrations, and historical operations. There has been anecdotal evidence suggesting that tailings were used in other construction or landscaping projects in the area around Bonanza mine (i.e Plat I Reservoir dam, Nonpareil school playground, landscaping in residential yards). To date, there has been no solid evidence supporting the anecdotal references of off-site uses of tailings. This could simply be because the tailings are vegetated or covered with newer gravel from a different source.

The purpose of this document is to provide information that will help identification of potential tailings. Photographs of tailings from BBM, Bonanza Mine, and RRR are provided below.

Ore Processing

Freshly mined mercury ore, cinnabar, is generally much redder in color than the roasted ore. Unprocessed cinnabar is presented in Figure 1. Cinnabar is first crushed and roasted at 700 to 1000 ° F in order to pull off mercury vapor, which is later condensed into liquid mercury. The roasted ore (tailings) is then dumped on site near the milling area. Generally ore is crushed to about 1" minus, although depending on the age of the milling operation and the type of furnace, there could be a variety of crushing sizes. Roasted ore is lighter in color than the uncooked ore, yet it still retains some of the color banding that is common with these types of mercury ore deposits in the Western US.

Tailings Identification

As mentioned above, the grain size can vary. At BBM, the large end of the grain size spectrum is about 1.5", but generally the grain size range is about 1" minus. The material tends to be very angular due to crushing during the milling process and tends to have a larger fines fraction than the original ore, due to weathering. Figure 2 presents BBM tailings from a sample collected from the bottom of one of the tailings pile. Figure 3 presents a fresh surface of the BBM main tailings pile during the EPA Removal in 2007.

According to the Unified Soil Classification System (USCS), which is predominantly used for identification of soils/gravels for construction purposes, BBM tailings would be classified as a Well Graded Gravel (GW) or a Well Graded Gravel with Silt (GM). Well graded means that there is a variety of grain sizes ranging from greater than ¾" down to silt size particles. An individual silt particle is almost not visible to the human eye. There may be more fines (silts and clays) depending on the amount of weathering, but generally the fines tend not to exceed 10%. The surface of RRR is a good example of how the material will weather if it's used for road construction and exposed to the weather and traffic. Roasted ore is not a very strong rock and thus it breaks down with both continued mechanical and chemical weathering (e.g. vehicular traffic, freezing temperatures, rain). Figures 4 and 5 present photo's of RRR. Notice that the banding is much less apparent in weathered tailings.

According to the Munsell color chart, a system used to identify various types of soil by color, BBM tailings fall between 10R and 2.5YR, generally in the 5/3 to 7/6 value/chroma ranges. This range of colors is generally referred to as light reddish brown.

In summary, BBM tailings should be fairly readily distinguishable from other native soils in the area by the red/pink color. Native soils in the Mid Coast Willamette River valley are generally brown to dark brown. Native soils in the hills around Cottage Grove are also generally brown to dark brown. Vegetation may have a more difficult time growing in BBM tailings, not due to the toxicity, but due to the limited amount of fines or organic material. However, once established, like the scotch broom at BBM, vegetation will easily cover the tailings.

Figures



Figure 1 – Fresh cinnabar (mercury ore), from a Nevada mine. This is very similar to the type of ore once present at the Black Butte Mine. Notice the deep red color of the mineral cinnabar near the top. The lower portion of the grain has a lighter, more pink color, which is similar to the color found in Black Butte Mine tailings.



Figure 2 – BBM tailings vs. native soil. The picture represents about 5 inches of a core sample that was collected at depth in a tailings pile at BBM. On the right side of the core section are BBM tailings which are red and slightly banded. The left side of the color change in the core sample is native soil (silt with organics) which is brown and much less red.



Figure 3 – Tailings from the main tailings pile at BBM – At closer inspection, the material is pinkish with light color banding, friable/crumbly, and more weathered-looking than fresh ore. This photo was taken during the EPA Removal Action in 2007.



Figure 4 – Surface of RRR during sample collection in 2009. Notice the more homogenous appearance in color, less banding, and also the fine-grained nature of the material.



Figure 5 – Surface of RRR during sample collection in 2009. Again, notice the more homogenous appearance in color, less banding, and also the fine-grained nature of the material.