

# Bonita Peak Mining District BioCement – A Pilot Study

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## Background

Over one hundred years ago, during the mining days in the Upper Animas Valley, a railroad transported ore from the mines and mills of Middleton and Eureka down to Silverton. Numerous rail spurs extended this rail line to prominent locations in the valley, including the Kittimac Mill.

Though not entirely intact, this spur still has remnants that can be seen today. It's mostly old timbers and the old rail grade that extend from the former main rail line nearly to County Road 2 on the north side of EPA's Kittimac interim sludge management location.

During the recent remedial activities at Kittimac, this rail spur was protected and preserved. It is the long strip of sandy-colored tailings with temporary fence around it. Now, as activities at Kittimac are nearing completion, the question remains, how do we protect this historical resource?

EPA is considering the use of an innovative technology – BioCement.



*Historic rail spur at Kittimac.*

## BioCement technology

The theory behind BioCement is that the existing bacteria that reside in the tailings are used to turn the tailings into rock. The process is called “microbial induced calcite precipitation.”

The potential benefits of this process for the rail spur are two-fold. First, the tailings will be locked up in the new rock and will resist erosion and stabilize the tailings in place. The rock won't be the full thickness of the tailings, only five or six inches, but it will be enough to keep the tailings from moving around. Second, there is some evidence that the calcite rock will lock up metals, meaning that the treated tailings will no longer leach metals like lead, cadmium, arsenic, and others into the Upper Animas River.

This technology is new. In order to determine whether this is appropriate for use on the historic rail spur, EPA will be conducting a pilot study. The pilot study will use a small area of tailings near the rail spur to test the technology. If the pilot study is successful, BioCement may be used in other areas of the Bonita Peak Mining District Superfund site.

## Pilot study process

- **Choose a location.**

An area for the pilot test has been determined. It is in the remaining tailings that were left in place to preserve the rail spur, yet far enough away from the historical resource that any result of the pilot study will not impact it. It is also near County Road 2, so the access is easy.

The pilot study requires four 5' × 15' squares. The area where the tailings remain is large enough to accommodate this need without encroaching on the rail spur.

If the results of the pilot test are unsatisfactory, this area and the tailing affected by the pilot study could be removed with no signs of the test left in place.

If it is successful, then the tailings will be stabilized and the look of the tailings will be retained.

- **Apply urea and corn steep liquor to encourage the growth of the microbes.**

For the microbes to do the work in the BioCement process, they need to be fed. Their food is urea and corn steep liquor. Urea is the primary component in nitrogen fertilizer. When it is metabolized by the microbes, it produces a small amount of ammonia, but not enough to give off a significant odor. Corn steep liquor is a source of carbohydrates and allow the microbe to reproduce efficiently.

The effect of feeding the microbes is that they become more numerous. There will be more of them to turn the tailings into rock.

- **Add calcium.**

Once the population of microbes has been multiplied, calcium is fed to the microbes in the form of calcium chloride. After consuming the urea, the microbes become “ureolytic microorganisms.” What makes that special is that these microbes can take that calcium and turn it into calcite. Literally, if this process is successful, these microbes take the tailings and the calcium and turn it into rock.

## Expected results

The expected outcome is that the area of tailings EPA will treat with the BioCement process will be solid and durable and will retain most of its current appearance. The new rock should be resistant to erosion in the long-term.

Because this is new technology and needs to be proven before it is used on a large scale, a pilot study on a small area is the appropriate first step. If the pilot study is successful, there may be other, larger applications for this technology.

This pilot will begin in August of 2019 and should take around one to two months to complete.



*From tailings to rock, the BioCement process.*

## For more information, contact:

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