



Case Study 11

Upper Arkansas River Tailings Restoration	
Name and Location	<p>Site Name: Upper Arkansas River</p> <p>Site Location: Leadville, CO</p>
Site Description	<p>Leadville Colorado has had a long history of precious and base metals mining. As a result of approximately 100 yrs. of mining at California Gulch, there were numerous uncontrolled releases of metals laden tailings. Tailings were deposited as discrete parcels along an eleven mile stretch of the Upper Arkansas. The 150, one to two acre deposits were characterized by lack of vegetation, low pH, high metals (Pb, Cd, Zn), pyritic soils and no soil structure. The tailings deposits had become a blight on the land use potential.</p> <p>The U. Ak. River portion of the site had largely been used as agricultural, pasturing cattle and recreational, fishing. The area is in a valley surrounded by the highest mountains of Colorado, subsequently because of the mining history and scenery, the location is a popular tourist haunt.</p>
Site Reuse Description	<p>The ecological enhancements involved incorporating locally available organic residuals into tailings deposits to create a fertile functioning soil. Biosolids from the Denver Metro Wastewater Treatment Authority were mixed with agricultural lime and tilled into the mine tailings. Approximately forty acres of the barren and toxic soils were converted to pasture and recreational lands. The toxic metals were immobilized and rendered significantly less bioavailable by this treatment.</p> <p>One landowner commented that it was the first time in eighty years he could pasture cattle on his land. Fly fishing enthusiasts now enjoy a scenic panorama of native grasslands in the floodplain rather than moonscape. The community and stakeholders were heavily involved in the end use decision making process! There were “core group” meetings on a monthly basis to address any concerns or issues.</p>
Stakeholder Involvement	<p>The stakeholders/partners in this site were landowners, Fish & Wildlife Service, mining companies, local government authorities, USDA, Bureau of Reclamation, and, EPA. Their roles/contributions were as follows; the landowners wanted the use of land returned by the mining companies, USDA developed the concept of biosolids & lime land application for metals immobilization and soils remediation, EPA implemented the large pilot project, local government authorities wanted control of the land use to ensure in met their master plan.</p> <p>The two main concerns of the stakeholders were establishing measures for success/failure and scientific assurance the project was technically sound.</p>



Upper Arkansas River Tailings Restoration

	<p>Both concerns were addressed through chemical extraction tests, ecological evaluation and modeling.</p> <p>US EPA was the only funding source.</p>
<p style="text-align: center;">Site Assessment Approach and Cleanup</p>	<p>The primary sources of contamination were fluvial deposits of tailings from the California Gulch Mining area. The contaminants of concern were high levels of lead, zinc and cadmium in low pH soils.</p> <p>The specific legal authority was CERCLA for the cleanup performed.</p> <p>In summary, Biosolids from the Denver Metro Wastewater Treatment Authority were mixed with agricultural lime and tilled into the mine tailings. USDA and University of Washington had shown that this mixture can immobilize metals and render them less bioavailable. The corrective action/remedy is still in place. This was in-situ remedy. The barren and denuded landscape from the tailings has been converted to fertile habitat for recreation and agriculture. The remedy was selected because of its cost-effective common sense approach. The remedy was attractive to site managers, stakeholders, and EPA management because it essentially recycles two waste materials to generate a revitalized landscape.</p> <p>Barriers encountered in employing remedy selected, there were quite a few. None were insurmountable. The first was mobilizing resources to such remote areas along the Upper Arkansas. The biosolids were free but the cost of transportation was not. Water for irrigation is a valuable commodity in the West. Given the low rainfall and high altitude, irrigation water was critical to the success of the project not just to get vegetation to grow but to retard the capillary rise of metal salts.</p> <p>There are no long term controls associated with the remedy, and, because the site is not complete, there is no closure letter.</p>
<p style="text-align: center;">Reuse</p>	<p>The land use had historically been agriculture, specifically pasturing horses and cattle. With changes in economic drivers for the community there was new demand for recreational outlets, mountain biking and fishing access to the Upper Arkansas River. With the collapse of the mining industry, the town of Leadville has evolved into a community relying on tourism. With tremendous mining history, the location offers miles of scenic bike trails, large areas of hiking and fishing access, and, resumed agriculture practices.</p> <p>The community and stakeholders have benefited from reclaimed mine lands. Largely for recreation and agriculture.</p>
<p style="text-align: center;">Obstacles</p>	<p>High altitude, Leadville is the highest elevation incorporated town in North America at 10,200 ft. The growing season is somewhere between 60-70 days, rainfall is approximately 17 in. Subsequently growing anything is difficult even under healthy environmental conditions, and, the</p>



Upper Arkansas River Tailings Restoration

	<p>site having acutely toxic soils made the effort that much more problematic.</p> <p>Another issue that drove the cost of remediation up significantly was the multiple layers of scientific evaluation of the remedy to placate natural resource trustees.</p>
Costs and Funding	<p>This project was funded through CERCLA. There was a redevelopment grant for the community.</p> <p>The total cost of the project was approximately two million dollars for forty plus acres.</p> <p>An in-situ ecological enhancement was used in the remediation. The cost savings associated with the selection of this remedy were tremendous. The only other option put forward for remediation at this site was “dig and haul”. A huge new repository for tailings would have had to be constructed, new roads constructed to access the 150 tailings deposits along the eleven miles of the Upper Arkansas R., fill material for backfill would be needed.</p>
Economic and Other Incentives	<p>There were economic incentives such as a conservation easements associated with this project but do not have the details.</p> <p>There were public relations incentives associated with this project. Early on, EPA did not recognize the importance of the community’s close historical relationship to mining. EPA overcame missteps to garner a more positive relationship with the town fathers by keeping the mining aesthetic in the remediation efforts.</p>
Time	<p>The project has not yet been completed because of funding shortfalls and “re-prioritization” to higher human health threat sites. Other non-trivial funding issues are related to the economy in general and mining companies inability to cost share.</p>
Other	
Contact Information	<p>Mike Zimmerman, OSC, EPA Region VIII, Denver, CO. Mike Holmes, RPM, , EPA Region VIII, Denver, CO.</p>