

CHAPTER 3: ENVIRONMENTAL ISSUES

BACKGROUND

Mining related operations in the area of Rico began with the staking of the first mining claim in 1869. The ores mined in the area were primarily silver and lead, and some form of mining has occurred in the area up until the 1980's. Two smelters were constructed during the 1880's: the Grandview (this smelter included milling) at the north end of town and the Pasadena on the south end. The Pro Patria mill (central) was built during 1902 and a new smelting process using magnetic separation technology was developed and used at this location.

Due to the mining and smelting history in and around the town of Rico there are environmental concerns related to heavy metals in soils, sediment, and water, as well as acid mine discharge from the former adits. There have been several Environmental Protection Agency (EPA) investigations, State (Brownfields) and private party Phase I and Phase II site assessments, voluntary clean-up plans (VCUPs), a water quality assessment, and a soils study all performed during the last twenty years. The following is a summary of the findings of each of those investigations.

SUMMARY OF ENVIRONMENTAL INVESTIGATIONS

Numerous environmental investigations have been performed in and around the town of Rico. They can be broken down primarily into three categories of investigation media: soil, sediment, and water. The soils issues and the sediment issues are related to investigating and characterizing the lead in soils and sediments from the former mining operations. The water issues are also related to the mining operations, the designed acid mine drainage neutralization settling ponds (also known as the "St. Louis Settling Ponds") and the water quality issues related to the capped tailings along the Dolores River and Silver Creek. The following summaries are generally organized from earliest to latest, to illustrate the evolution of the environmental issues related to the historical mining operations in the Town of Rico.

Environmental Protection Agency Investigations

EPA has performed several investigations, the first of which occurred in 1984, the second in 1986, and the last occurred in fall of 2003. The first EPA investigation focused on collecting surface water and sediment samples associated with the Argentine Mine, located on and adjacent to Silver Creek. The results of the investigation indicated sediment contamination downstream of the tailings and settling ponds for the acid mine drainage; however, only manganese was elevated in surface water downstream of the tailings and settling ponds.

The second EPA investigation appears to have focused on soil and sediment sample locations throughout the Town of Rico. The only available information for this investigation is a map showing locations of the samples and the reported lead concentrations at those locations; results indicated elevated lead levels throughout the area. No other information regarding concentrations of other metals was indicated on the map.

The most recent EPA investigation was performed in the Fall of 2003. The EPA focused on determining if waste material associated with the site has impacted the Dolores River, Silver Creek, groundwater that supplies drinking water, or if it poses health risks to the residents. The findings of this investigation indicated elevated lead levels in the Dolores River corridor and in certain neighborhoods, near the former smelters. As a result of this investigation ARCO has submitted a VCUP for soils investigation, remediation and restoration throughout the town of Rico. This work is ongoing as of the date of this analysis.

Walsh Environmental Phase I and Phase II

In 1995 Walsh Environmental performed a Phase I and Phase II site assessment for Rico Renaissance on approximately 3,000 acres of land in and around Rico. The findings of the limited soils and groundwater sampling indicated that there are elevated lead levels primarily related to former mining operations in the area. The report attempted to categorize the different types of areas where waste rock and tailings were evident; the following categories were given a high ranking (indicative of visible mine waste and elevated metals in the reported analytical data) and include: alluvium mixed with mine waste material, alluvium mixed with mill tailings, acid mine drainage, clinker/fill/ alluvium/contaminated mine drainage, clinker mine waste/fill material mixed with mine waste, fill material mixed with mill tailings, mine waste spoils, slag mixed with mine waste, tailings impoundments, wetlands mixed with tailings, and wastewater ponds. Again, the findings indicated that in those areas where mine tailings, slag, or spoils were evident in the surface and subsurface soils, elevated concentrations of metals were detected in the analytical samples for those areas.

ARCO VCUP/NAD Program

From approximately 1995 through 2004, ARCO has submitted approximately thirteen VCUP or No Action Determination (NAD) applications to manage tailings piles and slag piles in around the town of Rico; Table 3-1 indicates the site name, location relative to the Town of Rico, whether it was a VCUP or NAD application and the status of the request. ARCO has been the responsible party for the investigation/restoration of the former tailings piles in and around Rico due to the purchase of Anaconda Minerals during the 1980's. Under the VCUP program, administered by CDPHE, ARCO has removed and/or consolidated, stabilized, and capped mine tailings that had previously been located in or adjacent to Silver Creek and the Dolores River. The former tailing piles, identified in the table below, were re-contoured and capped to attempt to limit the amount of surface water infiltration, thereby limiting or eliminating the amount of leachate coming from these locations.

**TABLE 3-1
ARCO prepared VCUPs/NADs and Status**

Site Name	Location	VCUP or NAD	Approval or Withdrawn	Date of VCUP Completion Report
ARCO; Argentine Tails III	Northeast of Rico	NAD	Approval (no date available)	
ARCO; Columbia Tails II	West of Rico	VCUP	Approval	September 17, 1999
ARCO; Columbia Tails I	West of Rico	NAD	Approval (no date available)	
ARCO; Grandview Smelter I	North of Rico	VCUP	Approval	January 1997
ARCO; Grandview Smelter II	North of Rico	NAD	NAD Approval December 10, 1999	September 17, 1999
ARCO; Santa Cruz I	West of Rico	VCUP	Approval	January 1997
ARCO; Santa Cruz II	West of Rico	NAD	NAD Approval December 10, 1999	September 17, 1999
ARCO; Silver Swan I	Southwest of Rico	VCUP	Withdrawn	
ARCO; Silver Swan II	Southwest of Rico	VCUP	Approval	January 1997
ARCO; Silver Swan III	Southwest of Rico	NAD	NAD Approval December 10, 1999	September 17, 1999
ARCO; Argentine Tails I	Northeast of Rico	VCUP	Withdrawn	
ARCO; Argentine Tails II	Northeast of Rico	VCUP	Approval	January 1997

The thirteenth VCUP application is for the Rico Residential soils investigation, removal, and restoration. This VCUP is still pending approval with CDPHE as of January 2005 according to the CDPHE VCUP program website.

Titan Geologic and Geochemical Investigation

In 1996 Titan conducted a geological and geochemical mapping of the soils of Rico to characterize metals concentrations in relation to the mineralogy of the source material and historic mining and processing operations. Twenty-four rock outcrops and twenty-two surficial deposits were sampled as part of this study. The study concluded that concentrations of selected metals (including lead) in surficial deposits are derived predominantly from geologic processes acting on natural sources.

CDPHE and ARCO Lead Characterization

Also in 1996 the CDPHE and ARCO conducted a soils study of Rico, Colorado to attempt to document the sources of elevated lead levels found in residential soils in and around the Town of Rico. The report reached several conclusions:

- Natural Sources of elevated lead levels are present in and around Rico. The exposure and weathering are the cause of naturally occurring lead in the soils near surface mineral bearing ore bodies
- Man-made sources with elevated lead contents are present in the area. These sources include mine waste rock, mill tailings, and smelter slag. These mining related wastes are physically and mineralogically different from the naturally occurring materials.
- Long term impacts on soil properties resulting from the operation of the acid plant appear to be minimal
- Efforts to identify smelter products were inconclusive and more investigation is required to assess the potential smelter impacts.

Treatment Alternative St. Louis Ponds, Masters Thesis

The St. Louis Ponds were the site of lime neutralization and gravity sedimentation during mining operations. These were the preferred techniques for the treatment of the acid mine drainage; however, the neutralization process was discontinued and the plant dismantled after the sale of the property to Rico Renaissance during the 1990s. Kathleen S. Paser performed an analysis of treatment alternatives in 1996 as part of her Master Thesis for the Colorado School of Mines, Chemical Engineering and Petroleum Refining program. Ms. Paser evaluated the (then) current treatment method for the St. Louis acid mine discharge and reviewed alternate treatment technologies. Her findings indicated the following:

- There is approximately 40% loss of water throughout the pond system due to loss through recharge to the subsurface
- There is only marginal success using this treatment technology for the removal of CDPHE permitted metals (cadmium, copper, lead, silver, and zinc)
- 98% of the suspended solids in the treated drainage settle in the upper ponds closest to the mine and the solids primarily settled are iron and calcium
- The upper ponds are at 75% of their designed capacity due to the buildup of sediment resulting in channelized flow. This has caused a 74% reduction in the residence time in the upper ponds needed to facilitate sedimentation and a spillover of solids into the lower ponds.

Ms. Paser recommends dredging of the upper ponds as a short-term extension of the existing treatment system while other alternatives are evaluated. Her alternative treatment technologies include:

- Lime neutralization with sludge recycling
- Biogenic H₂S sulfide precipitation using municipal sewage as an electron donor, and
- Constructed wetlands

As of the date of this report, the water discharge from the St. Louis Adit is untreated.

CDPHE Water Quality Assessment

During the fall of 2001, CDPHE, Water Quality Control Division performed a water quality assessment at the request of ARCO, to assess potential permit limits for the Rico-Argentine Mine discharge. The assessment collected new data and assessed previously collected surface water data from the streams in and around the town of Rico. The assessment included seven point-source discharges, identified in the following Table 3-2, that are located within a three-mile radius of the town of Rico. The findings of the assessment indicate that during times of low flow there is a zinc water quality problem that results in the point source discharge contributions exceeding the stream's assimilative capacity by 31.6 lbs/day.

Table 3-2
Available Zinc Assimilative Capacities and Zinc Contributions

Maximum Assimilative Loading, Background and facility contributions at the 85th percentile	Loading in pounds lbs/day
Acute Maximum assimilative loading	4.95
Background Allocation	-0.95
St. Louis Ponds Point Source Contribution	-17.81
Blaine Adit Point Source Contribution	-8.01
Argentine Seep Point Source Contribution	-3.75
Columbia Tailings Seep Point source Contribution	-4.81
Rico Boy Adit Point Source Contribution	-0.39
Santa Cruz Adit Point Source Contribution	-0.35
Silver Swan Adit Point Source Contribution	-0.48
Deficit	-31.60

The surface water sampling, performed during the low flow periods of the Silver Creek and Dolores River, indicated that the capping performed by ARCO on the various former tailings piles has not eliminated the leaching from these former tailings piles and is still contributing metals loading under low flow conditions. ARCO has disagreed with the CDPHE findings and no permit application has been submitted for the adit discharge to date.

U.S. Fish and Wildlife Service Memorandum

USFWS reviewed the CDPHE water quality assessment and prepared a memorandum to address their concerns regarding the metals concentrations in Silver Creek and the Dolores River in and near the town of Rico. The following is an excerpt of the December 16, 2003 memo from Dan Wall of USFWS to Dale Hoff, Carol Russell, Sheldon Muller of EPA:

“Water is only one media whereby organisms can be exposed to chemicals in the environment and additional data collection may be warranted to determine if contaminated sediments are present. Settling ponds, wetlands and depositional areas will become contaminated with mine related waste as it precipitates out of the water column. Depending on the location, configuration and habitat quality of water bodies receiving contamination, ecological receptors may be adversely affected by contamination in the sediments. Additional water samples from settling ponds and wetlands may also be warranted.”

To date no ecological assessment has been performed on either Silver Creek or the Dolores River.

CDPHE Brownfield's Assessment

In 2003 CDPHE conducted a Phase I Brownfield's Assessment of two potential redevelopment sites in Rico: the Street Maintenance Garage area located within the town of Rico and the St. Louis Tunnel Area, north of town. The Brownfield's program is a state and federal program that facilitates the redevelopment of former industrial areas that have limited or no redevelopment due to environmental concerns. The findings of the assessment did not indicate elevated levels on any specific constituent in either area; however, the maintenance garage site is also the location of the former power plant: a potential source of polychlorinated bi-phenyls (PCBs) and no assessment of the potential for PCB contamination was conducted as part of the assessment. The St. Louis ponds area, north of the actual ponds, was the other focus of the soils and groundwater investigation, and is the area that is proposed for potential redevelopment under the Brownfield's program. No constituents of concern were identified in the proposed St. Louis ponds redevelopment area.

ARCO Residential Soils VCUP program

Arco's VCUP program for the investigation, removal, and restoration of the lead contaminated soils in neighborhoods is currently in progress; the additional analytical information generated as part of this program may be helpful in delineating the extent of elevated lead levels in and around the stream corridors. However, this information is not yet available and no interpretation of the extent of elevated lead from this study has been performed to date.

RELEVANT FINDINGS

Of the three environmental issues (soil, sediment, and water) that are currently being investigated, the soils program is currently much further along in the remediation/restoration process. The one area that has not been addressed is metals concentrations in stream sediments and their potential impact to ecological receptors; the issue identified by USFWS.

With respect to the water quality program, much remains to be done to address water quality issues. The following are issues that need to be addressed and that should be considered for both soil and groundwater in the context of stream restoration:

- Perform a sediment analysis along the Dolores and Silver Creek stream corridors in and around Rico
- Perform an ecological risk assessment within the Dolores River and Silver Creek in and around Rico
- Propose additional engineering controls to address point source issues related to the engineered caps within the stream corridor
- Identify and remove residual tailings that remain within the stream bed or alluvial fan as part of the stream restoration
- Perform a new feasibility study to address technically effective technologies to treat the mine discharge from the St. Louis Ponds
- Perform long term monitoring throughout the area once engineering controls and other remedies are established to document water quality/effectiveness

Environmental Concerns by Reach

The relevant findings above are not applicable for every reach of the Dolores River in the Town of Rico identified for stream restoration. There are several areas that have no environmental impacts that have been identified to date: areas north of the St. Louis Ponds (reaches G and H) and those south of town (reaches A, B, and C). The areas with specific environmental concerns lie within the Rico Study Reaches of D (1-5), E, F, and I; the following is a breakdown of the identified reaches with specific environmental concerns and recommendations for each in addition to the above recommendations.

Town of Rico - Reach D.1

- According to the CDPHE water quality assessment, the Silver Swan Adit is considered a point source discharge to the Dolores River and is contributing to the zinc load in the stream.

Town of Rico – Reach D.3

- According to the CDPHE water quality assessment, the Santa Cruz and Rico Boy Adits, and the Columbia Tailings are considered a point source discharge to the Dolores River and are contributing to the zinc load in the stream.

St. Louis Ponds Area – Reach F

- According to the CDPHE water quality assessment, the St. Louis Ponds and Adit are considered a point source discharge to the Dolores River; that point source discharge is a major contributor to the zinc load in the stream.
- There is a need to perform a new feasibility study to address technically effective technologies to treat the mine discharge from the St. Louis Ponds.

Silver Creek – Reach I

According to the CDPHE water quality assessment, the Argentine Seep Discharge and the Blaine Adit discharge are considered a point source discharge to Silver Creek and downstream, the Dolores River and are both major contributors to the zinc load in the stream. However, Mark Walker of CDPHE has provided information that the Blaine adit does not discharge into Silver Creek (although it was included as part of the point source by the water quality division of CDPHE) and that a coffer dam has reportedly been installed that diverts this water to the St. Louis tunnel. Further, there is a least one other point source discharge in Silver Creek that has not yet been investigated. Recommendations for the reach are:

- Perform a sediment analysis along Silver Creek stream corridor in and around Rico
- Perform an ecological risk assessment within Silver Creek in and around Rico
- Identify and remove residual tailings that remain within the stream bed or alluvial fan as part of the stream restoration
- Propose additional engineering controls to address point source issues related to the engineered caps within the stream corridor.