Abandoned Mine Lands Case Study

Elizabeth Mine

Protecting People, Ecosystems, and Heritage – A Shared Legacy

- **Elizabeth Mine covers approximately 850 acres.**
- **Elizabeth Mine is one of the oldest copperas and copper mines in the nation.**
- **Since 2003, EPA has provided $9 million for removal cleanup activities.**
- **In September 2006, EPA signed a Record of Decision (ROD) to determine the cleanup actions for the entire site. EPA will continue stabilization and cleanup activities.**

The Elizabeth Mine Superfund site is an abandoned copper and copperas (ferrous sulfate) mine located in the Vermont Copper Belt in the east-central part of the state. The ore body was first discovered in the late 1700s and copperas production began soon after in the early 1800s. Mining activities continued at Elizabeth Mine for nearly 150 years. Over the years, historic tailing piles and waste piles have become a substantial source of acid mine drainage (AMD). The historic significance of the site complicates planning, investigations, and cleanup activities. To provide the best opportunity to fully consider stakeholder concerns, EPA has implemented a phased cleanup. The initial phase is a non-time-critical removal action (NTCRA) to address three major sources of contamination. When funding was not available to initiate the NTCRA after the discovery that the tailing dam was at risk of failure, EPA began a time-critical removal action (TCRA) to stabilize the dam and re-route surface water. In 2006, EPA began work under the NTCRA to further stabilize the dam and address remaining contamination. This mine is one of the most significant remnants of the once thriving northeastern U.S. copper mining industry. The site's historic nature inspired a great deal of local and regional interest, as there are few such mine landscapes remaining in New England. EPA has strived to maintain a balance between historic resource preservation and environmental remediation; however, it is increasingly difficult when historic resources are often the primary source of contamination. EPA has developed a cleanup approach that will achieve the environmental cleanup objectives at Elizabeth Mine while minimizing the effect on the historic resources.

November 2006

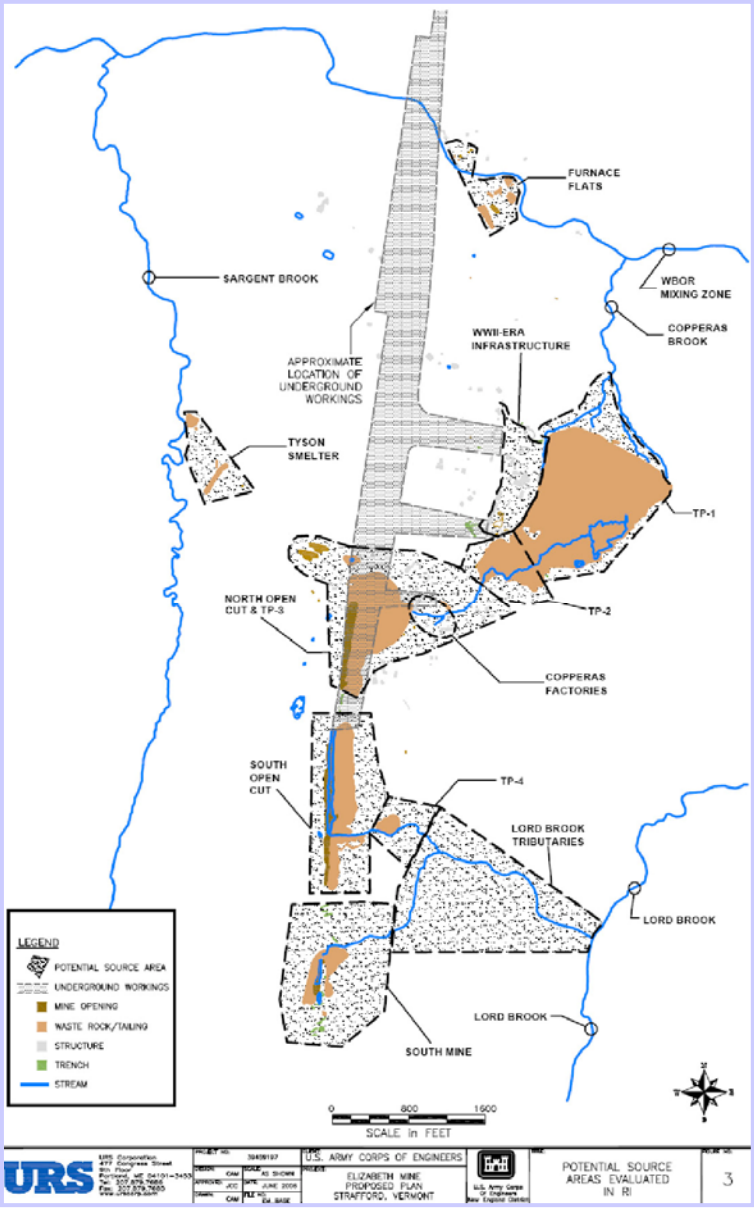

Figure 1: Elizabeth Mine site map.

GEOGRAPHY/GEOMORPHOLOGY

Elizabeth Mine is located in the heart of the Vermont Copper Belt, near the village of South Strafford in east-central Vermont. The Vermont Copper Belt is composed of massive, copper-rich sulfide deposits that trend north to south. The rock strata (predominantly metamorphosed sediments) containing these deposits extend from Massachusetts to the Gaspe Peninsula, Quebec. It is hypothesized that the deposits were formed on an ancient ocean floor near vents which released the sulfur deposited in the sediments. Several mines were constructed along this deposit in Vermont, including Ely Mine and Pike Hill Mine to the north.

Surrounded by hilly and steep terrain, the mine is located at elevations between 940 feet at the top of Copperas Hill and 1,600 feet at the West Branch of the Ompompanoosuc River. There are two small watersheds that have been impacted by the mining activities at Elizabeth Mine: Copperas Brook watershed and Lord Brook watershed. Copperas Brook drains an area of 266 acres, a valley containing the most significant contaminant sources at Elizabeth Mine. Flowing just over one mile from the upper most waste rock and heap leach tailing pile (known as Tailing Pile #3 [TP-3]), Copperas Brook is adjacent to the Upper and Lower Copperas Factories which are the oldest mining works. It then travels through Tailing Piles #1 and #2 (TP-1 and TP-2), to its confluence with the West Branch of the Ompompanoosuc River. The confluence is located approximately 5.7 miles (9 kilometers) upstream from the Union Village dam. The Ompompanoosuc River then empties into the Connecticut River, approximately 3 miles (5.5 kilometers) downstream from the Union Village Dam. Concurrently, Lord Brook drains an area of 2,270 acres, flowing for 4.5 miles before reaching the West Branch of the Ompompanoosuc River. Lord Brook receives mine drainage from an unnamed stream that drains a waste rock dump, the South Mine, and the South Open Cut. The unnamed stream enters Lord Brook about 3 miles above its confluence with the West Branch of the Ompompanoosuc River.

HISTORY OF THE ELIZABETH MINE

Elizabeth Mine produced both copperas (1809 - *ca*. 1882) and copper (1832 - 1958) throughout its operational life. Each product involved unique processing and refining technologies which had different impacts on the site. Copperas production ended prior to the most productive copper mining period, leaving waste rock and heap leach piles that released the majority of the AMD impacting the Copperas Brook. Over 80% of the aluminum, cadmium, cobalt, copper, and zinc loading results from runoff in this area. Remnants of early copperas and copper mining are still evident at TP-3. Copper production at the Elizabeth Mine reached its zenith during its latest period of operation (1942 - 1958), which included copper production to support World War II and the Korean War. The floatation mill discharged tailings that resulted in the creation of the two largest tailing piles at the site, TP-1 and TP-2. Although a less significant source of aluminum, cadmium, cobalt, copper, and zinc, the discharge from TP-1 contributes a substantial load of iron and manganese to the West Branch of the Ompompanoosuc River.

Ely Mine and Pike Hill Mine – two other historic Vermont Copper mines – are located nearby in Vershire and Corinth, Vermont, and are located along the same copper sulfide deposit that made the Elizabeth Mine so successful. Ely Mine was listed on the NPL in 2001 and Pike Hill Mine in 2004. The remedial investigation/ feasibility study of these sites is underway.

Figure 2: The ARD-laden Copperas Brook below the North Open Cut. Up the slope TP-3 can be seen. The stone foundation of one of the Copperas Factories is an example of the historic features of the Elizabeth Mine.

Approximately 1 ton of iron per week is discharging from the seeps at the toe of TP-1 into Copperas Brook. Prior to the installation of the soil buttress, TP-1 presented a threat of slope failure and mass movement of the highly saturated fines and tailings. If such a catastrophic failure had occurred, it would have resulted in downstream property damage and potentially 20 miles of stream and river contamination. In addition to the tailing piles at TP-1 and TP-2 and the waste rock/heap leach piles at TP-3, there are additional sources of AMD at the site. The South Mine, South Open Cut, and Tailing Pile #4 (TP-4) are source areas within the Lord Brook watershed, contributing AMD to Lord Brook and its tributaries. The air vent, which is a discharge point for the mine pool, discharges AMD directly to the West Branch of the Ompompanoosuc River. Other potential sources of AMD evaluated by EPA included the waste rock and slag adjacent to Sargent Brook (Tyson Smelter); the remnant waste rock, slag, and roast beds along Furnace Flats; and the soil within and adjacent to the former Copperas Factories.

COPPERAS

The copperas deposits of the Elizabeth Mine were first discovered in 1793 at an outcrop near the top of what would later become known as Copperas Hill. It was initially hoped that the deposit would prove to be a source of iron, but its high sulfur content made iron difficult to extract with the mining and processing technology of the time. All copperas in the U.S. was imported from Europe until 1807. The embargo against the U.S. during the Napoleonic Wars effectively stopped all copperas imports. A domestic copperas source was needed. Focus turned to Elizabeth Mine to meet the country's demand for copperas. Elizabeth Mine flourished in 1809 and continued production well into the mid-1880s, providing copperas for fabric dying, wood treatment, inks, and for disinfectants.

Typical of early mines in the eastern U.S., the Elizabeth Mine was initially a surficial or open cut mine, which consisted of deep excavation trenches along the ore body to allow mineral extraction. This method created the North Open Cut, adjacent to TP-3, and was possibly used to create an exploratory cut, South Mine, found south of the South Open Cut. Underground mining began in the 1830s when the Upper Adit was excavated to grant greater access to the ore. This first adit also gave better access to the existing copper ore and heralded the beginning of copper production at the mine.

The mining company, South Strafford Copperas Works, became one of the largest, most successful and longest-lived 19th century sulfide-ore copperas works in the U.S. Copperas production ended in the 1880s due to competition from other sources, primarily the rapidly growing steel industry. It was discovered that copperas was a by-product generated in steel production. TP-3 is a rare surviving feature showing the copperas extraction and processing methods of the 1880s; however, TP-3 is also the most significant source of copper contamination at Elizabeth Mine. Remnants of the wooden troughs for sluicing ore, pilings for those troughs, stone walls, foundations from early processing and production structures, and foundations of miners' residences are still present in the area of TP-3, which makes this area of historic interest. Preserving this landscape and the historic structures has been one of the major points of discussion with Elizabeth Mine Community Advisory Group (EMCAG), the Vermont State Historic Preservation Office (VTSHPO), the Vermont Department of Environmental Conservation, and other local stakeholders.

COPPER

Copper mining and smelting began around 1830 when the Upper Adit was excavated to allow better access to the ore body, and lasted until the final closure of the mine in 1958. Excavation of additional adits and vertical shafts continued throughout the remaining life of the mine. At closure, there were approximately 10 miles of underground works at Elizabeth Mine. Today, a vent shaft created about half a mile upstream of the confluence of Copperas Brook and the West Branch of the Ompompanoosuc River has become a source of AMD outflow, leading to the conclusion that much of the underground mine workings have gradually filled with groundwater.

Figure 3: AMD in the Copperas Brook flows across dead vegetation along lower TP-3. The bright violet color of the roasted waste rock reveals the significant iron content of the pyrrhotite.

In the 1880s, as copperas production was ending, the mine began to focus solely on copper production. As copper mining operations expanded, underground workings had to be extended by excavating additional shafts and access points to allow greater access to the ore body and mining works. Copper mining and smelting at Elizabeth Mine became sporadic in the early 20th century and mining operations all but ceased, due to both market fluctuations in the price of copper and the rise of larger, more productive copper mines in the western U.S. From approximately1830 to 1930, only 9 percent of the total copper ore the Elizabeth Mine would eventually produce had been extracted.

At the start of World War II, the demand for domestic copper production began to rise with the war effort, requiring the mine to be reopened and underground works expanded. Throughout World War II and the Korean War, Elizabeth Mine continued to produce copper. A new open cut to the south – South Open Cut – was also

excavated and mined during the 1950's. From 1942 until 1958, nearly 3 million tons of ore were extracted, yielding approximately 50,500 tons of copper. The extraction and processing of the copper ore during this time period produced the largest tailing pile on the site, TP-1, which covers approximately 32 acres. These tailings were a result of a floatation process by which copper was extracted from crushed and ground ore. This much more efficient processing method recovered over 91 percent of the copper in the ore. The remaining material was slurried down the valley into a tailing pond, which then eventually built up into TP-1 and TP-2. During this time, the Copperas Brook was diverted via a buried concrete pipe through TP-1 and TP-2 to help prevent erosion and further saturation of the tailing. After the mine closed in 1958, maintenance of the water control structures ceased, the tailing dam began to erode, and the diversion pipe began to decay and accrue iron precipitates. A portion of this diversion pipe above TP-2 (further up the valley from TP-1) has failed causing a breach in TP-2, and resulting in Copperas Brook flowing over and into TP-1. The flow then forms a pond on the surface of TP-1, allowing Copperas Brook to percolate through TP-1.

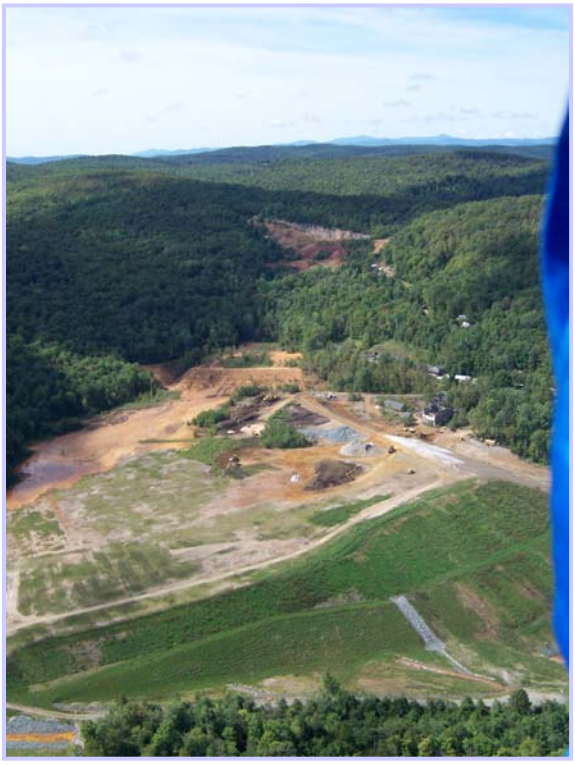

Figure 4: TP-1 and TP-2 are shown in the photo with TP-3 in the back part of the photo. The breach in the TP-2 tailing dam and the pond on TP-1 are shown along with the buttress to stabilize the TP-1 tailing dam.

HISTORIC RESOURCES

Apart from the historic value of the mine itself, the remains of many mining structures and production buildings can still be found at the Elizabeth Mine site. Mining and ore processing stopped when the mine closed in 1958, but many of the structures built during World War II and Korean War operation remain, though in poor condition. All of the processing equipment has been removed and some parts of the main processing buildings have collapsed. There are no remaining intact structures from the earlier copper and copperas operations, but stone foundations, early copperas production equipment, and pilings from ore sluices can still be found around the site, with most concentrated below TP-3.

EMCAG, VTSHPO, and EPA created a partnership to develop a cleanup approach that both address the environmental degradation caused by the source areas at the Elizabeth Mine and preserve the historical structures and character of the mine to the extent possible. While preservation of the three major source areas (TP-1, TP-2, and TP-3) is not fully compatible with the environmental restoration, EPA has been able to develop cleanup plans for the Copperas Factories, South Open Cut, South Mine, and the mine structures that will leave these historic resources substantially intact. In addition, the historic resources at Furnace Flats and the former Tyson Smelter will not be impacted by cleanup activities.

To document the historic resources at the site, EPA conducted a series of historic resource investigations and prepared several reports which address the historic nature of the Elizabeth Mine. EPA has prepared three historic reports for identification and evaluation of historic properties: *Statement of Limits, National Register Eligibility, and Potential Resources in the Proposed APE*; *Historical Context and Preliminary Resource Evaluation of the Elizabeth Mine, South Strafford, Orange County, Vermont and its Addendum*; and *Historic/Archaeological Mapping and Testing Elizabeth Mine Site*. EPA has also produced the Historic

American Engineering Record and Historic Industrial Landscape documentation which included: a historic narrative; 66 large format photographs of historic features; four standard HAER format drawings; 25 aerial photographs; 59 terrestrial photographs to document the historic resources at the site.

MINE IMPACTS

Figure 5: Copperas Brook can be seen flowing along the east side of TP-2, where concrete piping once redirected the stream away from the tailing piles. As can be seen here, that system long ago failed, resulting in this deep gully.

AMD has most likely been a part of the Elizabeth Mine since work first began at the site. The oldest tailing pile, TP-3, near the North Open Cut, produces the greatest amount of acidity since it contains the oldest and least-processed sulfide-bearing material. This is exacerbated by the topography of the mining site and the location of the TP-3 waste piles in the headwaters of the natural drainage of the Copperas Brook watershed. Air and water interact with the remaining sulfides in the piles to create AMD, which is then channeled through the waste rock while flowing downgrade and then across TP-2 and TP-1. Due to the high acidity of the runoff coming from TP-3, the leachate more readily dissolves and suspends toxic metals such as aluminum, copper, cadmium, iron, and zinc found in the waste rock and native soil. These dissolved metals remain in solution until pH increases at the confluence of the Copperas Brook and the West Branch of the Ompompanoosuc River, over a mile downstream from TP-1. This causes extensive iron staining downstream of the confluence of Copperas Brook and the West Branch of the Ompompanoosuc River.

Figure 6: TP-3 and the old roasting beds with the North Open Cut to the left and up the hill.

The most recently produced tailings and fines at TP-1 and TP-2 (World War II and Korean War era) are predominantly a source of iron contamination. Also, prior to the TCRA, they represented a physical hazard with potential for structural failure. The South Open Cut, South Mine, and TP-4 were also identified as significant sources of AMD. Adjacent and beneath TP-3, bedrock and overburden groundwater exceeds the groundwater standards for the State of Vermont as well as state and federal drinking water standards. Cadmium was detected at over 200 times the cleanup standard of 5 micrograms per liter (µg/l). Overburden groundwater contamination also exists beneath and adjacent to TP-1 and TP-2. The water within the underground workings of the Elizabeth Mine was contaminated above groundwater standards. This water is in contact with the sulfidic wall rock of the mine workings and residual waste material within the underground workings.

Lead has been found in the soil of the former Copperas Factories. The soil was contaminated with lead at concentrations as high as 680,000 milligrams per kilogram (mg/kg). These levels are unsafe for human contact with the soil and this area is targeted for a cleanup action.

Apart from the mine drainage, the abandoned exploratory cuts in the southern portion of the mine, the remaining adits, hidden shafts, and the mining cuts also present a physical hazard as the site has become overgrown. These areas are easily accessible, and no warning signs or fences are currently in place to prevent access. Waste materials from the mining and milling operations exist today as tailings, waste rock piles, heap-leach piles, and smelter slag at various locations around the mine site and present physical hazards to those who use the site for recreation.

AMD from Elizabeth Mine has resulted in extensive plant and organism die-off in the Copperas Brook and has rendered the stream a dead water body. For the first miles below the confluence of the Copperas and West Branch of the Ompompanoosuc River there is a decrease in both fish populations and benthic organism populations. The impacts to the benthic community extend for 4 miles below the confluence of Copperas Brook and the West Branch of the Ompompanoosuc River. The Air Vent across the West Branch of the Ompompanoosuc River from the old Furnace Flats roasting and smelting beds is also a source of AMD flowing into the West Branch of the Ompompanoosuc River. However, the water in the West Branch of the Ompompanoosuc River upstream from the mixing zone generally meets Vermont Class B Water Criteria, whereas the water in the mixing zone fails both Vermont Class B Water Criteria and EPA Ambient Water Quality Criteria.

The major source of loading to the West Branch of the Ompompanoosuc River is Copperas Brook. Copper concentrations in some of the sampling locations in the mixing zone are 700 times above the Vermont standard, while aluminum concentrations have been found to be 200 times the Vermont standard. All of the runoff from the source areas (TP-1, TP-2, TP-3, South Open Cut, South Mine, TP-4) also exceed Vermont Class B Water Criteria. Sediments below confluence contain elevated levels of copper, while sediments from Copperas Brook exceed Toxic Effects Range Medium values for copper. Sampling of local residential wells determined they were not impacted from the AMD from the mine, and local groundwater meets safe drinking water standards.

The Vermont Agency of Natural Resources (VT ANR) first conducted an environmental impact study in 1977 and again in 1990. These reports were bolstered by several other investigations over the years, including those done by the U.S. Army Corps of Engineers (USACE) in 1984, U.S. Geological Survey (USGS) in 1998, and the Elizabeth Mine Study Group (EMSG) in 1999. In the fall of 1999, VT ANR formally requested that EPA examine the site and seriously consider performing a cleanup action at the site.

POTENTIAL DAM FAILURE CHANGES CLEANUP PLANS

EPA determined that a phased approach for cleanup at Elizabeth Mine would be the best method for inclusion of stakeholder concerns. The initial phase, the NTCRA, addressed the three major sources of contamination at the site. These actions included addressing TP-1 and TP-2. In the past, Copperas Brook was diverted around TP-2 and TP-1 through an underground concrete pipe. This pipe carried Copperas Brook through TP-1 and discharged the Brook at the toe of the TP-1 tailing dam. In addition, the tailing pile contained dewatering towers during mine operation to prevent saturation. The outlets from these towers were buried by erosion from the face of the tailing dam and were identified as seepage areas along the toe of the tailing dam. This Copperas Brook diversion system began along the eastern side of TP-2. The upper portion of the diversion system failed some time after the mine closure. The evidence of the failure can be seen in the deep gully that formed after

system failure. This gully is now the current streambed of the Copperas Brook. This redirection of the Copperas Brook, and eventual re-channeling, also contributed to the formation of a small lake on the surface of TP-1 and the further saturation of that tailing pile. The tailing dam of TP-1 was quite steep as it had been left as-is when the mine closed in 1958 with no additional stabilization conducted prior to closure. Due to the high level of erosion on the face of this slope, the height of the dam, and the 32-acre tailing pile, there was a great deal of concern on the part of EPA that the tailing dam retaining the saturated TP-1 might fail. Such a failure would cause a mudslide downstream, burying the Copperas Brook, damaging homes, and causing severe damage to the West Branch of the Ompompanoosuc River.

ELIZABETH MINE COMMUNITY ACTION GROUP MEMBER ORGANIZATIONS:

- Town Strafford Selectboard
- Town of Thetford Selectboard
- Elizabeth Mine Study Group (EMSG)
- Citizens for a Sensible Solution (CASS)
- Elizabeth Mine Survivors
- Adjacent Landowners and Residents
- Non-residential Landowners
- Thetford Conservation Commission
- Strafford Planning Commission
- Strafford Historical Society

To address this concern, an analysis was conducted in 2002 to investigate the potential for tailing dam failure at TP-1 and TP-2. Based on this investigation, EPA determined that the tailing dam at TP-1 was unstable and threatened downstream residents and the West Branch of the Ompompanoosuc River. There was also concern that the high levels of rainfall in New England, the freeze-thaw that took place each spring, the fine grain size of the tailings, and the location of tailings over relatively impermeable glacial till would all increase the chance for catastrophic failure. In 2004, the concern for catastrophic failure in addition to the lack of funding to initiate the NTCRA spurred EPA and the State of Vermont to start a time-critical action – the TCRA – for slope stabilization. EPA began installation of a soil buttress and a new conveyance system for Copperas Brook. EPA repaired dam erosion, installed drainage pipes, constructed wetlands, and removed tailings material as part of the stabilization effort. Over 30,000 cubic yards of material were removed from TP-1 during stabilization, which should also reduce the amount of AMD generated by the site. Within a year, EPA completed the TCRA and began the design for the NTCRA.

By 2006, EPA began construction of several components of the NTCRA: the stabilization of the west side of the tailing dam; the diversion of surface water around portions of TP-1 to reduce ponding; and the removal of tailings from a section of Copperas Brook immediately below TP-1. From 2000 until 2006, EPA performed a remedial investigation and feasibility study (RI/FS) to define the cleanup actions needed in addition to the TCRA and NTCRA. In September 2006, a ROD for the remaining cleanup actions was signed. The outcome of the RI/FS as reflected in the ROD demonstrates EPA's effort to balance all of the critical issues at Elizabeth Mine.

PUBLIC INVOLVEMENT

Elizabeth Mine closed for the last time in 1958, after intermittently operating for over 150 years. The mining landscape left behind is considered by some local residents to be an important reminder of the area's mining legacy and an important historical resource. Local residents use the site for hiking, walking, and cross-country skiing.

The first meeting between EPA and a small group of local officials and residents was held during the fall of 1999. EPA held the first public information meeting in February 2000,

COMMUNITY CONCERNS:

- Environmental/Personal health
- Truck traffic/truck noise
- Property impacts of noise/dust/traffic safety
- Ecological impacts of delayed cleanup
- Personal liability
- Property values
- Cost of cleanup
- Proportional response to hazards
- Alternatives to proposed solutions
- Lack of community involvement in decision process
- Justification for federal involvement
- Historical preservation

outlining the intent to perform the remedial and removal actions to mitigate the source of the AMD from TP-3. This public information meeting was attended by over 200 individuals. During this meeting, the community asked EPA to better document the threat posed by the site. Community members stressed the importance of understanding and incorporating local interests during the cleanup process.

The community also expressed a number of concerns about having the federal government implement a project that could disrupt community life. Many people were concerned that community members would be held liable for the cleanup. In addition, many individuals did not feel that the mine was causing a sufficiently significant environmental impact beyond Copperas Brook to merit cleanup. There was also strong coalition of individuals interested in preserving the mine as a historic resource.

To address the community concerns, the diverse constituents within the community, and to serve as a focal point for discussion and coordination, EPA helped local stakeholders form their advisory group, EMCAG, in March 2000. EMCAG consists of ten member organizations representing a cross section of the community. Early meetings of EMCAG focused primarily on whether or not the mining site even needed to be cleaned up.

Further discussions with EMCAG resulted in the EPA developing a Community Involvement Plan that outlined the major concerns of the community, stressing the need for the community to remain involved throughout the cleanup process. After six months of discussion regarding EPA involvement, EMCAG unanimously agreed to support placing of Elizabeth Mine on the National Priorities List (NPL). The members of EMCAG felt that EPA had taken their concerns into account. The Elizabeth Mine site was proposed for the NPL in December 2000 and was listed in June 2001. The rapid listing could not have been possible without the efforts of the Vermont congressional delegation, the support of the Governor of Vermont, and the support and cooperation of the members of EMCAG.

Since the formation of the community group in March 2000, EPA has regularly met with EMCAG. Working with EMCAG, EPA developed a process for local input in shaping the cleanup at the site. This process included the development of a series of interim reports for review by EMCAG and public meetings to discuss the various technical approaches for addressing mine waste. EPA provided the community with expert technical support through the Technical Outreach Services to Communities (TOSC) Program and a Technical Assistance Grant (TAG) to retain experts. The TOSC program provided funding for a mining expert, a hydrogeology expert, and public health experts to assist EMCAG with its research, community outreach, and decision making. Comments from EMCAG, the Strafford Selectboard, VT ANR, TAG advisors and the TOSC experts were used to develop cleanup actions included in the NTCRA and the ROD.

EPA also promptly involved EMCAG and community members when the analysis of the TP-1 tailing dam raised concerns for failure. Once EPA determined that the tailing dam at TP-1 was unstable and threatened downstream residents and the West Branch of the Ompompanoosuc River, letters were sent to both EMCAG and local residents identified in the hazard zone. A public meeting was held to inform community members about what actions were to be taken to prevent dam failure and to listen to any community concerns about slope stabilization.

CURRENT SITE CONDITIONS

As of October 2006, EPA has completed the TCRA and has begun activities under the NTCRA. EPA constructed a soil buttress; stabilized the tailing dam; graded the slope above the buttress to reduce erosion; relocated 30,000 cubic yards of mine tailings; repaired the deteriorating drainage pipe that carries the flow

around the tailing dam; and constructed a surface water conveyance channel along the west side of the large tailing pile to carry storm water around the tailing pile. Over the next year, EPA expects to complete the design for the entire NTCRA and implement cleanup actions for several more components of the NTCRA.

Overall, EPA developed a cleanup approach to address lead contamination at the former Copperas Factories that will preserve the historic foundations while protecting human health. Two areas of historic significance – the Furnace Flats area and Tyson Smelter area – will be not be subject to any cleanup actions as they do not represent a significant threat to human health and the environment. Only two structures are being impacted by the cleanup actions, leaving the historic mine buildings largely intact.

In September 2006, EPA signed an ROD to identify the remaining cleanup actions at the Site. The design for these cleanup actions is expected to occur in 2007/2008.

LESSONS LEARNED/CONCLUSION

The historic significance of the site and local stakeholder interest required additional effort by EPA to ensure effective communication. Active involvement by the community through EMCAG allowed stakeholders a vehicle through which to make their ideas known and help allay community concerns while the TOSC program and TAG technical advisors also helped communications between local stakeholders and EPA. By working closely with local communities and quickly responding to evolving site conditions, the stakeholders and EPA created a process that will aid continued cleanup efforts at Elizabeth Mine.

Progress at the site has been facilitated by the following:

- Identification of emergency situations requiring time-critical actions and flexible site management to address evolving site conditions and new information;
- Assistance from recognized experts on mining issues, including EPA's National Mining Team, EPA Region 8, USGS, and the U.S. Department of Energy to aid the Region in site response;
- Use of the NPL as a funding source for cleanup where no potential responsible party has been identified; and
- Public participation in all steps of the site remediation process.

In a state and Region with few large abandoned mines, reaching out to national experts brought a full breadth of knowledge to the cleanup process. The possibility of the tailing dam failure significantly changed the engineering approach and reprioritized the cleanup actions at the site. Close work among parties ensured the time-critical and non-time-critical actions are appropriate to address the challenging changing conditions at Elizabeth Mine.

ACRONYMS

AMD	Acid mine drainage
CASS	Citizens for a Sensible Solution
EMCAG	Elizabeth Mine Community Advisory Group
EMSG	Elizabeth Mine Study Group
mg/kg	Milligrams per kilogram
µg/l	Micrograms per liter
NPL	National Priorities List
NTCRA	Non-time-critical removal action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TAG	Technical Assistance Grant
TCRA	Time-critical removal action
TOSC	Technical Outreach Services to Communities
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VT ANR	Vermont Agency of Natural Resources
VTSHPO	State Historic Preservation Office