Reclaiming the Sierra
Gold Country Community Summit on Mining Impacts

Presented by The Sierra Fund
November 8-9, 2010
Miners Foundry, Nevada City, California

WORKSHOP NOTES

Best Management Practices and Stimulating New Technologies
Stone Hall, Tuesday November 9, 11:30am

Notes taken reflect the best effort to capture what was said in presentations and in the discussion time following. They are presented here in order to encourage further discussion about these matters. These notes do not necessarily reflect the views of The Sierra Fund staff, board or funders.

Alice Rich of A.A. Rich and Associates facilitated this panel discussion and Victor Izzo of the Central Valley Regional Water Quality Control Board, Charles Alpers of the United States Geological Survey and Tom Parilo representing the Nevada Irrigation District presented.

Alice Rich outlined the goal of this panel discussion as identifying best management practices associated with abandoned mine remediation, identifying the obstacles to remediation actions, and providing information for the Mining Toxins Working Group.

Victor Izzo, Central Valley Regional Water Quality Control Board

The Regional Water Quality Control Board is concerned with the quality of water before it goes into water systems. The Regional Board's responsibility is to protect the resource. Mining waste (from waste rock or tailing) can cause water quality issues.

Mr. Izzo deals with mercury mines, copper mines, and gold mines. A main question is how to prioritize the mine sites. In general, they try to do the worst sites first.

It is hard to encourage cleanups because there are Good Samaritan statutes in state law but not in federal law. The Regional Board's Abandoned Mine Lands Unit is made up of only two people and they see new mines reported daily. Trying to identify the responsible party is the first step, and a major issue. In general, the present owners have responsibility for contaminated discharges.

Responsible Party searches have succeeded in finding resources but it is especially hard for small mines. A small cleanup is considered to be in the range of $100K-$1M , medium ~$10M and huge ~$100M+.

Mr. Izzo gave a number of examples of successful mine cleanups that used best management practices:

- Spenceville: Fish and Game field pit, treated water, very successful
- Abbot Turkey Mercury Mine
- Carson Hill Gold Mine: treated with reverse osmoses
- Empire Mine Arsenic: worked with Parks and Mining company, caped and re-vegetated
- Sliger Mine: small flow, used a bio cell
- Walker Copper Mine: plug in and decrease copper, now downstream there are fish

In general during mining there are lots of resources but after there are none.

Charlie Alpers, United States Geological Survey

Fate and Transport

Heavy metals in fish tissue increase in concentration around mined areas. And even if arsenic and lead are naturally high, they become even higher in mined areas.

Acid mine drainage (AMD) and elevated metals are all potentially toxic to aquatic life. There is also AMD in hydraulic pits, for example pit lakes, such as You Bet Mine. Often even when the water is neutralized, zinc and nickel stay in solution, so even neutral drainage can have water quality issues.

Grain size fraction is key for sampling, and also for understanding transport issues associated with heavy metals and erosion. In general with increased surface area, smaller grain size particles, there is an increase in the conversion from elemental to reactive mercury, a precursor to methylation.

Speciation is also very important to understanding fate and transport issues associated with abandoned mines. Mercury is an example: if we could disrupt the methylation process we could have an effect in cleanup, and decrease mercury concentration in fish. Speciation is also important for chromium, because chrom 6 and chrom 3 have very different toxicities.

The impact of mercury on human health is primarily a fish consumption issue. Impacts of arsenic, chromium, or lead are primarily the result of exposure from ingestion or inhalation of contaminated dust. The form of arsenic, chromium or lead that one is exposed to directly impacts the potential toxicity.

As far as animals go, birds that eat fish show an impact from mercury contamination. Foster terns show effects of mercury poisoning, and reduced reproductive success. In general, if there is AMD then there

is less aquatic life. Methylmercury in fish may also affect fish reproduction. There still needs to be research on some species because it has not been done on the fish local to the Sierra.

What we need to know:

- Quantify the benefits of remediation
- Learn if hydro turbines increase methyation
- Magnitude of atmospheric mercury contribution
- How to develop TMDLs for mecury
- How can science support BMPs?

Tom Parilo, consultant representing the Nevada Irrigation District presented a case study of a work in progress, the Combie Reservoir Sediment and Mercury Removal Project. The intent of this project is to remediate mercury from legacy mining.

NID owns and operates two reservoirs on the Bear River, both of which are 303(d) listed as impaired for mercury: Rollins and Combie.

Combie has 200,000 tons of sediment accumulated in it. Combie is a source of water for Lake of the Pines. Combie has been dredged since the 1960's but that was halted in 2003.

This project utilizes a patented technology, the Pegasus Mercury Extraction Equipment to remove mercury from the dredged sediment.

The 26 million pounds of mercury that was brought to the Sierra during the Gold Rush was estimated to be lost to the environment at a 10-30% loss rate. One result of this today is that bass have lots of methylmercury in them.

This project would restore the storage capacity of Combie reservoir, improve recreational activities, support local industry, and study the effects of project activities.

Combie provides 5,550 AF of water storage, and is two miles long. A picture taken during low water shows the accumulated sediment.

Project components include: an electric dredge, and slurry piped along the levee road to a mobile de-watering system and mercury removal equipment. There are also turbidity curtains, and the existing aggregate operation nearby that has agreed to take the material.

The major challenge of this project was to use technology to meet water quality standards. NID had to find portable equipment to avoid any long term site impacts. The mercury extraction equipment is a 12 inch concentrator and can only process 250 gallons of material a minute, which made this a three to five year project and significantly more expensive.

The primary obstacle to developing this project is that NID needed in-house expertise. The perception that this is NID's problem continues to be a problem because this is a watershed-wide problem. Consequently the process to educate the regulators and landowners was very important to project development. Funding continues to be the major issue for this project, estimated to cost $9 million.

This success of this project requires an agency willing to lead, and supportive partners, landowners, and tribes.

Current status: NID has submitted a $1 million proposal to the Sierra Nevada Conservancy for site setup costs, a $3 million budget item through Senator Feinstein for operational costs, and plans to submit a Cleanup and Abatement Funds request.

NID has submitted their application for permits including the 401, 404, and 1600. They expect to start the project in 2011.

Discussion and Questions

- Gold dredging may redistribute methylmercury into the environment. Can there be a new gold dredge that could be designed to capture mercury?
  - Tom: The Pegasus mercury concentrator was developed by two guys from Canada, and adapted from gold mining equipment.
  - Charlie: In suction dredging, the speed of the material needs to match the through put—so it would have to be small batches, but even that doesn't get fine grain material—silt and clay still gets through. Our experience at Humbug Creek was that it takes a long time for fine particles to settle out, especially the reactive part.
- Can you calculate mercury loads for TMDL development using the load estimate for fine particles? It seems particularly easy to overestimate. In short, are the fines still eroding or have they already eroded?
  - Charlie: This is still a research question. Mineral speciation is needed to determine the source of fines as either hard rock or hydraulic. Some of this has been done by James Allen. But in general when the creeks run muddy the material is still coming down, still eroding.
- Is mercury the only contaminant of concern at Combie?
  - No, we have done an antideg study to address the others.
- How to deal with sludge in dam removals?
  - Charlie: The Upper Yuba River Studies program needs to be considered. On the Klamath, where there is active dam removal, mercury behind the dams is a problem, even though preliminary tests didn't show it was a problem.