

Pro-Mack Mining

Underwater Mining Specialists

Mark Stopher
Acting Regional Manager
California Department of Fish and Game
601 Locust Street
Redding, CA 96001

6 March 2010

Dear Mr. Stopher:

I understand that a presentation was made at the most recent suction dredge PAC meeting concerning a mercury clean-up pilot project that I personally was involved with on the South Fork of the Yuba River, Malakoff Diggins, Humbug during 2007 and the fall of 2008. As I am at somewhat of a disadvantage of not being able to study any final findings concerning that project, and it sounds to me like some of the results are being taken out of the proper context, please allow me to go on record in the ongoing suction dredge CEQA process with a factual basis concerning the project:

I was first contacted about the project on 23 August 2008 by Matthew Wetter of Tetra Tech EM Inc., which is an environmental services engineering company based at 10860 Gold Center Drive, Suite 200 | Rancho Cordova, CA 95670 | www.tetratech.com. Mr. Wetter e-mailed me that Tetra Tech was "*working with Dave Lawler at the BLM on a mercury removal treatability study,*" and was interested in contracting the services of my company, Pro-Mack Mining, to provide underwater excavation (dredging work) for the project. Mr. Wetter asked me to provide a bid for our services. Tetra Tech also provided the following information:

"Contract Officer Representative (COR): David Lawler is the designated Contracting Officer Representative (COR) for the project. Mr. Lawler is located in the California State Office. Mr. Lawler can be contacted at Bureau of Land Management, CASO, Attn: Dave Lawler (CA-920), 2800 Cottage Way Ste. W-1834, And Sacramento, CA 95825-1886, Cell phone: (916) 425-3740"

In order to gain a better understanding of the project and make a proper bid, I followed up in a telephone conversation with Mr. David Lawler. In turn, Mr. Lawler sent me the following explanation:

BPS Project Title: HUMBUG CK-SOUTH YUBA PILOT MERCURY CLEANUP PROJECT

BPS Project Number : (#36234)

Description: The Humbug Creek Project site is located at the confluence of the South Yuba River and Humbug Creek on unpatented BLM administered land within the North Bloomfield Mining District. Project proposes to remove a mercury "hot spot" consisting of several hundred pounds of elemental mercury contained within the Humbug Creek Delta, located at the confluence of Humbug Creek and South Fork Yuba River. Thousands of pounds of elemental mercury were lost from historic placer gold sluice box systems at the North Bloomfield Hydraulic gold mining operations during the 1850's-1880's period. Significant amounts of elemental and amalgamated mercury were then deposited within a hydraulic tailings dam at the confluence of Humbug Creek and South Fork Yuba River. The tailings dam has subsequently been destroyed during a series of 100+ year flood events on the South Yuba, allowing mercury contaminated sediment to discharge seasonally downstream. BLM manages 7 miles of contiguous watershed on the South Yuba from 1/2 mile upstream from Humbug Creek to Purdon Crossing. This site represents an excellent pilot - mercury "hot spot" removal project, since significant watershed impacts have occurred to the BLM-managed portion immediately downstream from the hydraulic mine. Project proposes to use modified suction dredge equipment - combined with conventional placer gold recovery equipment/technology to recover large quantities of elemental mercury without undue degradation or impacts to the watershed.

Geographic Description: T.17N, R.9E., S.14, MDBM, NEVADA CO., CALIFORNIA (SOUTH YUBA RIVER WATERSHED)

Benefits: The Humbug Creek Delta site is one of the known elemental mercury "hot spots" known in the Sierra Nevada region with elevated mercury levels in water and sediment. Removal of high concentrations of elemental mercury contained in mercury-contaminated stream and river sediments at this site will eliminate a pollution "point source of discharge" of hazardous materials under the Clean Water Act and reduce downstream discharge within the South Yuba River watershed. The California State Water Control Board and other regulatory agencies require that BLM mandate significant reductions in mercury loads from its managed lands within the Sacramento River watershed - Bay Delta region, under its existing basin plan.

Feasibility: This site is one of BLM's emerging priority AML 1010 sites for pilot cleanup. Project implementation will include use of modified suction dredge equipment - combined with a conventional placer gold recovery equipment and technology to recover large quantities of elemental mercury without undue significant degradation or impact to the watershed. During FY99-03, USGS technical specialists have previously collected water, sediment, and biota samples from selected sites within this watershed. During FY06, USGS technical specialists and watershed stakeholders (e.g. Trout Unlimited, SYRCL) will coordinate on pre-remediation sampling of water, sediment, and biota at this specific site. BLM coordinators and contractor(s) will also compile all required CERCLA and NEPA-related environmental documents. Testing of pilot mercury removal methods will also occur. During FY07, BLM coordinators and contractor(s) will undertake pilot cleanup of fluvial bedload areas containing elemental mercury concentrations. During FY08-09, post-remediation monitoring will be undertaken to assess the watershed benefits of mercury "hot spot" removal.

Support: *There is widespread support from interagency Federal partners (USFS,ACE,EPA), State Partners (DOC AMLU,CWQCB,RWQCB, CA Fish&Game, Public Health), County Partners (Dept. Env'tl Health) and various watershed stakeholders (Trout Unlimited, NCRCD,SYRCL, Yuba Watershed Institute). Trout Unlimited has been working on AML partnerships efforts in Utah (American Fork) - subsequent remediation actions have effectively reduced toxic metal source loading to downstream watershed environments. Trout Unlimited volunteers can potentially assist with collecting additional macroinvertebrates and fish from the project site for bioassessment purposes. The California State Water Resources Control Board (CA-SWRB) is highly interested in removal of elemental mercury "hot spots" in priority watersheds. The South Yuba is a 303(d) listed impaired water body for mercury. The SWRCB will to match funds with BLM on this cleanup project.*

Project Objectives: *To develop portable suction dredging equipment that will effectively recover elemental mercury from submerged sediments.*

Subsequently, Pro-Mack's involvement in the project (hereafter referred to as "BLM project") was contracted by Tetra Tech. This evolved into several site visits and a trial run during the fall of 2007, using a standard 3-inch Keene dredge. The trial run was mainly to work out how we would do the project during 2008 using an 8-inch dredge.

During one of the site visits, I had a personal opportunity to engage in a substantial discussion with Mr. Charlie Alpers, USGS Research Chemist, who I understand is a leading authority on the subject of mercury. Mr. Alpers was directly involved with this BLM project. As I am an expert in heavy metals recovery, I found Mr. Alpers very interesting. During our conversation, Mr. Alpers instructed me on several points which he believed were important in context to the BLM project objective to determine if normal suction dredges can properly be used to recover mercury from established mercury waste sites. Here are a few of the points Mr. Alpers made (according to my understanding, in my own words):

- 1) The nature of mercury as an element allows it to break down into such small particles (perhaps smaller than particles), that they can become permanently suspended in water. Mr. Alpers described this as "colloidal." This, similar to the salt in sea water.
- 2) Through different kinds of physical and biological activity, elemental mercury can be transformed into different forms and migrate away from the original location (point source).
- 3) Mr. Alpers and the other USGS scientists involved in the BLM project made it abundantly clear that science has shown that very small particles of mercury have a strong attraction to very, very small particles of light sediment.
- 4) Mr. Alpers told me that modern science now has the equipment to measure the presence of mercury in nearly every substance known to man. He told me mercury is present nearly everywhere. He said the instruments at his disposal would detect mercury in any of the soils or riverbeds in California.

In view of these revelations from Mr. Alpers, it seemed clear to me without going any further that standard suction dredges could not be used to remove 100% of the mercury from established mercury waste sites. Standard suction dredges (use of gravity separation recovery systems) will be effective at removing all or most of the elemental mercury down to a certain size fraction. Pro-Mack (and Keene Engineering) has developed advanced gravity recovery systems on suction dredges that will recover elemental mercury effectively down to any size fraction within the visible range.

But when you start getting down to capturing colloidal (mercury which has become part of the water), or capturing extremely fine sediments with mercury attached to them, it is clear that gravity separation alone (such as the Nelson Concentrator) is not the answer for 100% results.

Please keep in mind that this explanation is in context to the BLM Project Objective, which was to determine whether or not standard suction dredges can be used to effectively recover the mercury from an established mercury waste site located at the bottom of a flowing waterway.

Sometime during the summer of 2008, the California Water Quality Control Board made a formal objection to BLM and USGS. In view of the 98% recovery results (of mercury from an established mercury waste site in another location) by Mr. Humphreys using a 4-inch dredge, the Water Board did not want us to use an 8-inch dredge at the confluence of the South Yuba River and Humbug Creek. While I was not privy to all the communications involved, I was informed by Mr. Wetter that the potential of a 2% loss of mercury into the water column might be considered a water quality violation by the State of California.

Consequently, BLM formally revised the purpose of the project to the following (please see attached *Revised Scope of Work for agreement between the USGS and the BLM* which is dated June 27, 2008):

Purpose:

Because dredge operators have collected and recovered large amounts of Hg from the South Yuba River near Humbug Creek, the BLM wishes to remove and recover these Hg-contaminated sediments, thus removing a potential environmental hazard from the ecosystem. However, it is unknown what impact the removal process will have in the immediate vicinity of the dredge operation or downstream. The BLM initially proposed to remove the Hg from the confluence using a suction dredge. Although suction dredging has been shown to recover as much as 98% of the mercury from contaminated river sediments, qualitative evidence suggests that the dredging may, through "flouring" of the Hg during the suction dredging, actually enhance Hg transport and reactivity and ultimately increase Hg uptake in downstream biota (Humphreys, 2005). Before suction dredging or any other removal technique can be used, the hotspot will need to be characterized to determine the potential impact of the removal on downstream environments.

Since dredging within the active waterway was no longer going to be part of the project, another site visit was scheduled so that we could locate a place(es) to take samples outside of the active waterway. Matt Wetter may have a record of who participated in that visit to the site. I was there, along with several participants from the USGS. We found a gravel bar out in the S. Yuba River that was located near the confluence of Humbug Creek. We also found some dry riverbed just downstream from Humbug Creek. As dredging was not going to be allowed, these were pretty-much the only two remaining options to obtain samples. We decided to sample the gravel bar (located out in the river) first, and then follow with the riverbed gravels alongside the river.

As I had originally bid the project to provide an 8-inch dredge, and we were not going to be able to use that, Matt Wetter asked me if there was some other type of gear that Pro-Mack could provide to assist with the project. So my Pro-Mack team went to work in our shop to create a suction excavation system that would contain all of the material, using recirculated water, so that there would be zero discharge back into the active waterway. This system used the same principle as a normal dredge to create suction at the nozzle. But this was different because water and excavated material were pumped into a holding tank, and the water was then pumped out of the holding tank to provide suction to the nozzle. We were using the same water over and over again within a closed system to create our suction-power at the nozzle (please see attached images).

Because Mr. Alpers voiced concern about colloidal mercury, and very small particles of mercury that attach themselves to sediment, Pro-Mack devised a suction recovery system that would capture 100% of the sediment, along with 100% of the water used in the excavation process. I ran this idea by the BLM project team in a phone conference, and the participants (USGS, BLM, Tetra Tech) expressed interest and encouragement. My understanding is that BLM (Dave Lawler) ran the idea by the Water Board and they decided to send Rick Humphreys out to observe our project. He was present when we operated Pro-Mack's self-contained suction system, and Mr. Humphreys, along with everyone else present, agreed that we made no discharge into the river using our self contained suction system.

To my knowledge, this is the only system -concept in existence that will provide 100% recovery of hazardous materials in all forms from waste sites (mercury or otherwise), either above or below the water.

Here follow some very important observations which should not be ignored:

- 1) The gravel we were excavating from the bar out in the South Yuba River was above the river during late fall flows. They will be underwater during winter flows, or at least during storm events. This was mostly loose gravel. It was not a hard-packed streambed; it was not compacted or armored. This means that those gravels likely get swept downstream during storm events; especially large storm events. Therefore, any mercury recovery we obtained within our closed system is the same mercury that will be washed down the river system during storm events. Since our excavation was small in comparison to the whole area of the South Yuba that is identified as a waste site, it is reasonable to assume that huge volumes of mercury are moving downstream during storm events.

2) This was just a trial run of a closed circuit suction excavation system to determine if it would work. It was only the first phase on a small scale. Tetra Tech, BLM and USGS agreed to analyze samples of the collected water to see if our closed system will recover and concentrate mercury; specifically the very fine mercury that they are so concerned about. Since it was just a beginning-test, I don't believe that anyone kept close track of the volume of gravel that we excavated. More importantly, we did not measure how many times the same water was recirculated to excavate the waste materials.

While I have not seen the test results on our recirculated water, I understand that Mr. Alpers stated in the recent PAC meeting that the mercury levels were very high. This is good. It means our system worked very well to recover and concentrate the small particles of mercury from the waste site which Mr. Alpers and other scientists are concerned about; particles so fine in size that no gravity system alone can be expected to provide adequate recovery if 100% results are desired.

Note: Before using our closed suction system, after carefully sanitizing the tank (with a solution which USGS brought along specifically for that purpose), we carefully filled it with water from the South Yuba River. I am certain that the USGS team captured and analyzed water samples from the South Yuba to create a baseline. Therefore, any increase in mercury in the water from our closed system will be mercury that we recovered and concentrated from the waste material at the site. The higher the concentration of mercury within our closed system, the more mercury we removed from the environment!

3) In a closed system such as this, the longer we operate it in the waste site, the more times the very same water is exposed to the waste, and the more concentrated the mercury will become in the water. We ran the system for perhaps two hours or longer. The pump we used produces 350 gallons per minute. This means the water was recirculated through the waste material more than 100 times. I understand that during the PAC meeting, Mr. Alpers reported that suspended sediment and mercury was present in the water from our closed test seven days afterwards. That is exactly what you would expect to see with recirculated water that was used 100+ times to excavate mercury-contaminated material!

4) Very important: While anti-mining activists are sure to try, the results of this test (concentration of mercury in the water used within our closed system) cannot be correlated or compared to normal suction dredging in California's waterways. Here is why:

A) First of all, we were doing the project in an established mercury hot spot. Please read David Lawler's BPS Project description above. This site is so contaminated, the California Water Board refused to allow BLM and USGS to operate suction dredge there for the BLM project. Even while we were conducting our tests, Rich Humphreys was swimming around the area with mask and snorkel and finding visible mercury on the bedrock. We were panning mercury from the bedrock just upstream from where we performed this testing. This place is loaded with mercury contamination!

It would be grossly unfair to compare the average stretch of California waterway to this established waste site where *"Thousands of pounds of elemental mercury were lost from historic placer gold sluice box systems"* (BPS Project description).

B) To my knowledge, California's average waterways have not been quantified as to the amount of mercury which exists in them. If present at all, the amount of mercury is sure to vary from one location to the next. According to Mr. Alpers, some level of mercury can be located anywhere (everywhere). **Therefore, for the purpose of dredge regulation, we should be concerned with hazardous levels of mercury.** We should not be comparing normal suction dredge activity to an isolated extreme condition! **For the purpose of dredge regulation, it would be highly indefensible to use the results of a toxic cleanup test as a baseline average for all waterways in California!**

C) The water from our closed system that was recirculated through mercury waste at least 100 times cannot be compared to the water discharge from a normal dredging system in an average waterway. Our closed system exposed the same water over and over to pre-established mercury waste (continuous exposure for hours). The water flowing through a normal dredge will have been exposed to gravel only once (for several seconds), likely in a location which does not contain hazardous levels of mercury in the first place. Any attempt to compare normal dredging conditions with a concentrated solution used to clean up a heavily contaminated site would be completely lacking in intellectual integrity.

D) Our closed system design appears to have confirmed Mr. Alper's (and the California Water Board's) concerns about potential losses of fine particles of mercury if standard suction dredges are used to clean up established mercury waste sites. That is, if California's policy is to proceed with mercury recovery only if 100% results can be obtained.

We could argue over whether or not the dredge system is causing flouing, or if the mercury is already present there in a form that is too small to recover using gravity methods. But it doesn't really matter. If our closed system concentrated suspended mercury in the water, it seems reasonable that recovery systems (used in established waste sites) must be developed that contain all of the water which is used during the excavation and gravity separation process. Then the water will need to be treated.

E) Because the mercury that is not removed from active river systems is sure to migrate downstream, and we have already developed the prototype of a closed excavation system, I would encourage the various State and federal agencies to continue the important work which BLM and USGS has been doing in this area. I would be pleased to participate, as long as the process is intended to clean up California's waterways, rather than put suction dredgers out of business.

F) Anyone who would attempt to use the important results we have obtained in a very serious waste site to reflect upon conditions in a normal dredging setting is probably more motivated by political gain, than in cleaning up California's waterways.

The truth is that suction dredging is the only workable way of discovering where the mercury hot spots are located in California's waterways. According to the BLM BPS Project description above, it was suction dredgers who discovered the waste site at the South Yuba River and Humbug Creek. And it will require suction dredges (modified into closed systems) to remove the contamination. Mercury that is not removed will haunt California for the foreseeable future.

This very same scenario could be playing out in other locations. Suction dredgers are the solution to this problem. Shutting them down because mercury is proven to exist within isolated locations would be counterproductive. This is because Mother Nature will just keep pounding that mercury down into more-broadly distributed, smaller and smaller particles while we do absolutely nothing about it.

5) Most important: Based upon all of the results we obtained in this BLM project, along with all of the concerns expressed by BLM, USGS, DFG, California tribes and environmental organizations, there may be some serious problems with the Nevada Irrigation District's (NID) plan to clear toxic Gold Rush mercury from Combie Reservoir (they also intend to use a suction dredge).

According to the press release at <http://www.theunion.com/article/20100227/NEWS/100229808/1066&ParentProfile=1053>:

*"NID had Canadian firm Pegasus Earth Sensing Corp. demonstrate the system last fall and managed to extract **six grams of mercury per ton** of sediment dredged from the bottom of the reservoir. NID routinely dredges the reservoir to extract silt and keep water capacity as high as possible for customers."*

*"Pegasus designed their **centrifuge** to extract gold from ancient river rock, but company officials found it did a better job of trapping mercury, according to Monohan."*

A centrifuge is a gravity separation device. And while very effective at concentrating heavy metal particles down to a certain size, it will not be effective at recovering the colloidal mercury which Mr. Alpers is concerned about. Even worse, a centrifuge is designed specifically to discharge (as tailings) the very fine particles of light sediment which USGS scientists are so concerned about (because micro-particles of mercury attach to them).

Perhaps the largest concern should be that all of the colloidal mercury and fine sediment which is stirred up in the water during the excavation process ("*NID routinely dredges the reservoir to extract silt and keep water capacity as high as possible for customers.*") will most certainly be creating a water quality violation of huge proportions -- for all the reasons which are being expressed by PAC participants in the suction dredge CEQA process. The NID Project description on line shows a diagram of the planned dredge system. More than just a suction dredge, **the NID dredge will employ a cutter head at the nozzle** (see <http://evereadymarineservices.com/downloads/Eveready%20Marine%20Services%204.pdf>). A cutter head is a powerful grinding machine that is designed to break up solids and force oversized material out of the way. A cutter head will create enormous disturbance down in the contaminated sediments. Consequently, some substantial portion of the disturbed water and light sediments within the contaminated material will be greatly disturbed, pushed out of the way and not be sucked up as dredged material.

Reading more about the NID project at http://www2.newsvirginian.com/wnv/news/local/article/old_technology_new_solution/42961/961/

*"Tim Crough, assistant general manager with the Nevada Irrigation District, who is overseeing the project, said the district wants to remove the mercury **in its elemental stage**, where it is less harmful." He said, "Knelson Concentrators' mercury-removal process combines traditional dredging technology with a "spin" process, using the company's Knelson Mercury Recovery Concentrator, to separate and remove the mercury from the sediment and out of the water. **"If we can remove 95 percent of it, which the Knelson Concentrator is expected to do, we can free up that much of the river system from having the contamination of methyl mercury,"** Crough said.*

<http://www.sacbee.com/2009/03/24/1723627/nevada-irrigation-district-plans.html>:

*"Tim Crough, the district's assistant general manager, said the Combie project would combine dredging with a centrifuge process to "spin" the mercury out of water extracted from the lake. **"It's a pretty novel approach," said Charles Alpers, a research chemist with the U.S. Geological Survey in Sacramento and a consultant for the project.**"*

*"The elemental mercury that would be removed, according to Ryan Jones, a Knelson Concentrators representative, is relatively simple to recover and inexpensive when using the company's device. **"The important thing is to get the elemental mercury out of the material so that it can't convert to methyl mercury,"** ' Jones said."*

The press release goes on to say: **"The consultant (Carrie Monohan) is also on the staff of the Sierra Fund in Nevada City, which has been educating Californians about the mountain range's toxic mining past in recent years."**

At <http://www.conawayranch.com/content/mercury-rising>

"Elizabeth "Izzy" Martin, CEO of the Sierra Fund, is quoted as saying *"The state's rules are forcing Sacramento into that mode. They're a hundred miles down from the problem and trying to filter it out. Sacramento would very much like to come up here and clean up the mercury because they think it will probably be cheaper to clean up four hundred pounds of mercury up here than it will be to filter out two pounds of mercury down there."*

While I personally would not disagree with these statements, there appears to be two different standards being applied here. The Water Board is objecting to normal suction dredges because Rick Humphries measured a 2% loss of mercury from a standard 4-inch dredge. Mr. Alpers and the Sierra Fund are objecting to normal suction dredges because of the potential of not recovering colloidal mercury and extremely fine particles of mercury that have evolved out of the elemental stage and attach themselves to fine sediments which can remain suspended in water for long periods of time.

Yet both Mr. Alpers and the Sierra Fund are directly involved as consultants in this NID project which is only targeting 95% of the elemental mercury.
How can this be?

DFG can do the math on six grams of mercury per ton of sediment. There is no doubt that this should be classed as a mercury hot spot, hazardous waste site. That amount of mercury will exceed the average amount of mercury in California's rivers by thousands or millions of times. Yet the Sierra Fund, who is working so hard to put suction dredgers out of business in sections of California waterways where hazardous levels of mercury are not even present, is completely ignoring the science which has been developed in the BLM project, the very science which they are now attempting to use against suction dredgers.

All you need to do is look at Charles Alper's data on the amount of mercury in the water that we concentrated in Pro-Mack's closed tank system, and you will know that the NID project and Sierra Fund are stirring up the very same kind of contaminated water and sediments at the bottom of the Combie Reservoir with the use of a cutter head devise (powerful grinding machine) -- **which is a source of drinking water for Californians.**

Mr. Alpers and the Sierra Fund cannot have it both ways. If it beneficial for NID (at a cost of \$8+ million) to recover 95% of the elemental mercury from an established waste site within a drinking water supply, while stirring up and spreading around particles of mercury which are too small to recover, then it is also beneficial to have suction dredgers recovering 98% of any mercury they happen to encounter while assisting the State to locate new hot spots (at no cost to the State or federal governments).

The CEQA process is designed to flush out real problems using the best available science. There is supposed to be integrity in the process. If you are allowing gravity separation equipment to process mercury from a mercury hot spot inside of a reservoir, then you certainly cannot object to gravity concentration technology being used by suction dredgers in areas which are not known to contain any hazardous levels of mercury.

I hope this helps place Mr. Alper's test results in a more balanced perspective, and would be pleased to provide more information upon request.

Sincerely,

Dave McCracken

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