

November 16, 2009

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Mark Stopher
California Department of Fish and Game
Regional Headquarters
601 Locust Street
Redding CA 96001

Dear Mr. Stopher

Elemental mercury in our rivers and streams is a subject of concern to all of the population in California today. Although some amount of naturally occurring mercury is present in our waterways, especially in streams originating in the coastal range, mining during the 19th century is the main source of the mercury load contained in our California Rivers at present. Year after year, sediments, sand and gravels containing this mercury are being transported toward the delta. These are known facts. A lesser known but obviously apparent fact is that the same hydrological forces that transport these materials year after year constantly grind and re-suspend floured mercury, not on, but in the gravels above bedrock. Only in certain areas of our streams and rivers, where there is a concentrating hydrological effect, is the mercury re-concentrated into larger droplets. The remaining floured mercury, which is the majority fraction, remains suspended in the gravels as it has a lighter specific gravity than gold and is in a liquid state, which prevents it from being wedged into bedrock unless amalgamated with gold. This is an obvious fact, which has been apparent to the many suction dredge gold miners who have collectively accumulated millions of hours of dredging in our streams and rivers for the last 50 years. The modern suction gold dredge is the perfect concentrator for removing mercury from the gravels of our rivers. The California Water Resources Control Board did a study, finding that a suction dredge removed 98% of the mercury in the gravel it processed and this study did not even employ a modern design gold dredge operated by a professional operator. The CWRCB then concluded that the 2% mercury lost was worse than the 98% recovered. What kind of twisted logic is that? To be a successful gold miner requires a considerable amount of common sense. Apparently that is not a requirement to be a member of the CWRCB.

A more common sense approach would be to work with the mining community and possibly provide periodical collection points where mercury and lead could be disposed of in a proper manner. Suction dredge miners are obviously the best-equipped group to facilitate the removal of metallic mercury in our rivers as an incidental by-product of their economically beneficial activity. At relatively little expense to our California government, a large portion of the mercury in our rivers could be taken care of before it is allowed to migrate on down to the delta. We need to work together to protect our environment and encourage the wise use of our resources.

Enclosed is a three-page challenge by the AD-Hoc Anti-Mercury Committee dated June 2009. Included in their list of possible solutions is the use of suction dredges as a partial answer to the removal of mercury from our environment. In Washington State, a program has already been successful in the collection of over 150 lbs of mercury removed from the waterways of their state in a short amount of time. Let's get it done. Thanks for your consideration of the facts.

Sincerely,



Steve Tyler
5601 Bumper Road
El Dorado, Calif. 95623

Enclosures
Cc El Dorado County Board of Supervisors
Governor Arnold Schwarzenegger

A Challenge to Remove Mercury from the California Environment

June 2009

The undersigned ad-hoc committee has been following the many research projects about mercury and other toxins in the environment. The scope of the research results have been a source of astonishment at their depth and admiration for the results that have been published.

Summary: The goal of the ad-hoc committee was to learn about the presence and effects of mercury(Hg) in the environment and to identify methods of removing such a health hazard from the environment. After following the published research and learning of advances in Hg removal technology, we have concluded that the possibility for realization of the stated goals is now in sight. Furthermore, the recent economic downturn, rather than decreasing the realization of Hg removal, may actually increase the possibilities of removal. The recent passage of economic stimulus legislation by Congress to provide employment opportunities should allow funding of Hg removal for reasons of providing employment with the added benefit of removal of a health hazard.

Background: The dispersal of Hg in the environment in earlier geologic times occurred only with earth movements such as volcanic eruptions. More recent industrial activities such as burning fossil fuels and mining, especially for use in gold extraction, and the process of gold extraction, have resulted in increased concentrations of HG (Sacramento River Watershed Program: www.sacriver.org/issues/mercury), especially in California, to the extent that environmental Hg is a recognized health hazard. The recent report, presented as an executive summary at the December 2008 meeting of the Delta Tributary Mercury Council, "Mining's Toxic Legacy" (Carrie Monohan, PhD, Sierra Fund: www.sierrafund.org) traces the development of gold mining and its environmental consequences. The report states that 26 million pounds of mercury were brought to the California Gold Country of which about half were never recovered and escaped into the environment. This is the source of the estimated several hundred pounds of Hg that flow into San Francisco Bay annually. The report stated that the gold rush benefitted the entire United States and that the Federal and State governments should be involved in the mitigation of the problems.

The path of mercury into the food chain has been the subject of many studies. The results of these studies have led the Ad-Hoc Committee to conclude that removal of the metallic Hg, which is the source of Methyl-Hg, would result in the significant reduction (not easily quantifiable) of Hg from the food chain. The downstream progress of Hg-containing sediments has been severely reduced by the use of the natural outflow for agricultural, industrial, and urban activities, and, as a result, the flushing action of river transport to the ocean has been prolonged. For that reason, we believe that any removal of Hg from the sources will reduce the time for the concentrations to be lowered to where they are not dangerous to health.

Possible Solutions: The small-scale mining community using suction dredges and sluices in Washington State has provided a partial answer. In the May 2007 issue of the ICMJ Prospecting and Mining Journal, it was reported that the Washington Department of Ecology has received over 150 pounds of Hg from this source. The Hg was accumulated in the sluice boxes alongside the gold. Also, Carrie Monohan in the December 2008 presentation stated that metallic Hg was visible in a creek near her residence and that it was removed by simply using a common turkey baster. These reports have led the Ad-Hoc Committee to conclude that establishment of a state wide program of buying Hg that was removed from

the environment by miners or others, would result in a significant amount of Hg being intercepted before it causes any more damage. The USGS in publication "Fact Sheet 2005-3041 Version 1.1; C. N. Alpers, M. P. Hunerlach, J. T. May, R. L. Hothem (<http://pubs.usgs.gov/fs/2005/3014/>) states "Today, mercury is recovered as a by-product from small-scale gold dredging operations; also, mercury and gold are recovered as byproducts from some gravel mining operations, especially in areas affected by historical gold mining." These methods of Hg extraction from the environment if encouraged by financial incentives could, as stated previously, result in removal of significant amounts of Hg from the environment.

The Sierra watersheds are the sites of many reservoirs installed for irrigation and/or hydro power electric generation. Over the years, the silt that would otherwise be carried downstream has become trapped, and as a result, the holding capacity of the dams has diminished, thus necessitating removal of the silt. One such project at the Combie Reservoir on the Bear River has recognized this as an opportunity to also remove the Hg (private communication to I. Sturman). The project goals are listed as: renewed storage capacity, Hg removal from the sediment, commercial use of the dredged materials, improved recreation, and public education.

Other possibilities of interception could benefit from the model of the interception ponds installed on Cache Creek. Although not in the gold country, the Coast Range is the site of numerous Hg deposits that were mined for gold extraction use and thus Hg was introduced into the local mine environment.

The interception process in the Gold Country and the Coast Range could be the subject of many site specific research projects that would result in new methods of interception and Hg extraction.

The previously described procedures are specific for remediation of water-borne Hg. It is likely that there are many non-water related sites (Hg mines, industrial facilities, etc.). A 73 page summary of other methods of Hg removal was published by the U.S. Department of Energy in 2001 as "Mercury Contaminated Material Decontamination Methods: Investigation and Assessment" by M.A. Ebadian, PhD; Marshall Allen; Yong Cai, PhD; John F. McGahan (www.hcet.fiu.edu). An eight page article "Extractability and Bioavailability of Mercury from a Mercury Sulfide Contaminated Soil in Oak Ridge, Tennessee, USA" by F. X. Han, S. Shiyab, J. Chen, Y. Su, D. L. Monts, C. A. Waggoner, and F. B. Matta was published in Water Air Soil Pollution (2008) 194:67-75. Also, a detailed description (seven pages) of "...removing contaminants from contaminated soils...", "...using electrokinesis..." is available as a patent description "Process and Apparatus for recovering Heavy Metals from Contaminated Materials" (www.wipo.int).

The previously described methods for Hg removal will reduce the amount of Hg entering San Francisco Bay. However, the bay contains significant amounts of Hg owing to the water flow from both the Sierra Gold Country and the Coast Range deposits that have been mined. The Hg deposits from the Gold Country should be accompanied by deposits of gold (Au) as indicated in previous references (because of their similarity in density). This opens the possibility of locating higher concentrations (concentrated by natural forces, wind, wave, and tidal action), in bay sediments and selectively dredging them to remove the Hg (and Au) bearing layers using techniques such as air lift suction to minimally disturb the sediments. It may be that the concentration of Au in bay sediments is low, but recently developed technology (heap leaching) can extract Au from ores at less than one part per million by weight ("Gold from Panning to High-Tech Mining" Tom Farley, Invention and Technology, Summer 2008, Volume 23, Number 2). At this writing (June 2009) the price of Au is about \$900 per troy ounce. The price of Au has risen faster than the cost of extracting it. Any

recovery of Au would help mitigate the cost of Hg removal. The sediments from non-gold country sources, such as the Guadalupe River flowing into the south bay will require different methods for Hg extraction from the sediments, possibly centrifuge processing.

The previously mentioned economic stimulus plan was listed as a possible source of funds in "Cleanup of abandoned mines expected to continue", Joan Lowry (San Francisco Chronicle, February 16, 2009, page A11). "The final bill, approved by the House and Senate on Friday, contains more than \$1.5 billion for construction and maintenance projects in the Bureau of Land Management, the National Park Service and the Forest Service. This includes addressing pollution and safety hazards caused by abandoned mines on public lands." "... Senator Dianne Feinstein, D-Calif., (was) one of the lawmakers who sought the money." The article states that projects other than mine cleanups are also eligible for the funds. However, the economic stimulus bill is limited to Federal lands and thus cannot solve the entire problem of Hg contamination in California. But, there already are Superfund projects active in California, at Clear Lake, near Redding, and near Davis, Jane Kay (San Francisco Chronicle, April 16, 2009) so there are precedents.

The Challenge: The Federal, State, and Local Environmental and Water Quality Agencies, volunteer, non-profit environmental organizations local citizens organizations, mining companies, and small-scale miners are the vehicles by which the Hg contamination in California can finally be mitigated. These organizations are challenged to form an umbrella organization with the common goal of removing the Hg from the California environment. The task requires the application of a "Super Fund" clean up effort applied to the entire state, not just to a specific site. The results will not be instantaneous, but applying the methodology selectively to the most contaminated sites first, possibly one or a few at a time, will have the potential of reducing the San Francisco Bay and other California environment concentrations of Hg in tens of years rather than hundreds of years if nothing is done.

As quoted previously, the entire nation benefitted from the Gold Rush, thus it is appropriate that the cost for the clean up come from the federal government.

The Ad-Hoc Anti-Mercury Committee:

Benjamin E. Gordon: BS 1940, MS 1943 Magna Cum Laude, University of Illinois: Shell Oil Company and Shell Development Company, 31 years: Lawrence Berkeley Radiation Laboratory; Analytical Chemist; Supervisor, Analytical and Radio chemistry, 19 years: Netherlands Shell, Supervisor and Radiation Safety Officer, 4 years: 273 research papers.

John Rasmussen: Professor of Chemistry, Emeritus, University of California, Berkeley; Author of Encyclopedia Britannica Article "Radioactivity": Also, Biographical Entries in "Who's Who in America" and "American Men and Women of Science".

Ivan Sturman: BSEE, Carnegie Institute of Technology (now Carnegie-Mellon University) California Registered Professional Engineer: Field Engineer, Quality Control Manager, Earth Sciences Application Engineer, Civil Defense Research Engineer; Marine Mineral Exploration Engineer, Hydrographic Survey Engineer; Nuclear Radiation Instrument Systems Engineer for Nuclear Power Plants, 19 Research Papers: Volunteer Creek Restorer: Volunteer Restorer Historic Victory Ship.