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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN BERNARDINO

Coordination Proceeding Special Title (Rule 1550(b) **SUCTION DREDGE MINING CASES**	Judicial Council Proceeding No. JCPDS 4720 **REPLY DECLARATION OF THOM SEAL IN SUPPORT OF MINERS' JOINT MOTION FOR INJUNCTION AGAINST DEFENDANTS** Judge: Hon. Gilbert G. Ochoa Dept.: S36 Date: June 23, 2015 Time: 8:30 a.m.
Related Actions: *Karuk Tribe of California, et al. v. California Department of Fish and Game* *Hillman, et al. v. California Department of Fish and Game*	 RG 05211597 – Alameda County RG 09434444 – Alameda County

Karuk Tribe of California, et al. v. California Department of Fish and Game	RG 1263796 – Alameda County
Kimble, et al. v. Kamala Harris, Attorney General of California, et al.	CIVDS 1012922 – San Bernardino County
Public Lands for the People, et al. v. California Department of Fish & Game, et al.	CIVDS 1203849 – San Bernardino County
The New 49'ers, et al. v. State of California; California Department of Fish and Game, et al.	SCCVCV 120048 – Siskiyou County
Foley, et al. v. State of California; California Department of Fish and Wildlife, et al.	SCSCCV 13-00804 – Siskiyou County
Walker v. Harris, et al.	34-2013-80001439 – Sacramento County

I, Thom Seal, declare:

1. I am a professor in the Mining Engineering Department at the University of Nevada. I have a Ph.D in Mining and Metallurgical Engineering, and am a Registered Professional Engineer, NV.

2. I am familiar with the environmental issues opponents have raised with regard to suction dredge mining, and served as a member of a task force in Oregon appointed to advise the Governor concerning proposed legislation on the subject.

3. One of my research topics is mercury in mining. I was chair for the MS thesis this spring-15 titled: "Investigations of Mercury Reduction in Gold Stripping Processes at Elevated Temperatures." Also, I am a co-author of recent related publications on mercury: "Minimizing Mercury Pollution during Gold Ore Processing", SME 2011. There are several pending scientific articles on this mercury research here at UNR, in which I am the principal investigator.

4. I make this Declaration in support of the motion by suction dredge mining interests for an injunction to bar the California Department of Fish and Wildlife from prohibiting suction dredging on federal lands where operators comply with the California regulations prevailing in 2009 when the Department stopped issuing permits.

5. In my professional scientific opinion, such an injunction will have no appreciable adverse environmental effects.

6. Some facts on Mercury:

- Elemental Mercury is element 80 with symbol Hg^{o}.
- Elemental Mercury has a density of 13.534 so Hg is 13.5 times heavier than water.
- Mercury occurs in the average earth's crust at 80 ppb (parts per billion) = 80 ppm = 0.08 grams per metric ton = <u>160 pounds Hg per one million (US) tons of crust</u>.
- Mercury is slightly soluble in water at normal atmospheric temperatures (solubility of elemental Hg is 1.2×10^{-7} mol/kg at 273.15 K) so at 50°F = 53 pounds Hg dissolve per million (US) tons of water, 240 million gallons water.

H. Lawerence et al, "The solubility of mercury and some sparing soluble mercury salts in water and aqueous Electrolyte Solutions"

http://www.nist.gov/data/PDFfiles/jpcrd274.pdf.

7. With respect to the issue of mercury that may be released if suction dredge operators encounter mercury in California rivers and streams, suction dredges efficiently collect approximately 98% of the mercury they encounter. A California Water Boards study in May 2005 "presented an opportunity to test the notion that recreational gold miners effectively clean up mercury hotspots while suction dredging for gold." "Along with gold, recreational dredgers recover iron (nails bolts, etc.), lead (fishing weights, buckshot, and spent bullets) and mercury (elemental mercury, mercury/gold amalgam, and mercury stained gold)." "This report documents the results of a suction dredge test that was completed in September 2003 by State Water Board, USFS, and DFG staff." "When mercury droplets touch, they fuse into much large droplets (up to 25 millimeters)". "High runoff coincides with winter storms, and these flows have ranged to 80,000 cfs (ft^3/sec) as recently as 1997." And "post dredge test inspections also showed that mercury had re-deposited on bedrock that had been dredged clean. Higher controlled flows may be moving sediment and mercury". "Mercury may concentrate at the hotspot because after it is carried over the bedrock hump during high flows, it encounters a low flow velocity zone on the downstream side of the bedrock hump. The river current on the downstream side lacks the power to move mercury anymore (except during extreme high winter events) so it drops out on bedrock on the downstream side." In conclusion: "A suction dredge set up to recover gold recovered liquid mercury from the mercury hotspot. The dredge recovered about 98 percent of the mercury in a test sediment sample enriched in mercury." This mercury recovery from the dredge included minus 30 mesh passing size mercury droplets and the "sediment retained a substantial amount of liquid mercury as small (e.g., 1mm) and fine droplets of floured mercury".

Humphreys "Mercury Losses and Recovery During a Suction Dredge Test in the South Fork of the American River" California Water Boards, 2005:

http://westernminingalliance.org/wp-content/uploads/2014/01/Humphreys-2005-Water-Boards-Merc-Report-D-L-M.pdf

Observations from an EPA Alaska eight inch (8") dredge study found: "For the unfiltered samples, two metals, copper and zinc, showed distinct increases downstream of the dredge. Total copper increased approximately 5-fold and zinc approximately 9-fold at the transect immediately downstream of the dredge, relative to the concentrations measured upstream of the dredge. For both metals, the concentrations declined to near upstream values by 80 m downstream of the dredge. The pattern observed for total copper and zinc concentration is similar to that for turbidity, suggesting that the metals were in particulate form, or associated with other sediment particles." And "Values of dissolved mercury actually were greater upstream of the dredge".

Todd, et al, "Impact of suction dredging on water quality, benthic habitat, and biota in the Fortymile River and Resurrection Creek, Alaska", EPA, April, 1999: http://www.swrcb.ca.gov/water_issues/programs/peer_review/docs/dfg_suction_dredging/03_Ch4_2WQTOX_references_Feb2011/109_Royer_1999.pdf

Mercury has a density of 13.5 (g/ml) while copper has a density of 8.0 and zinc has a density of 7.1, so the settling velocity of mercury would be somewhat faster than copper and zinc with similar particles as found in the above Alaska 8" dredge study, "concentrations declined to near upstream values by 80 m downstream of the dredge". These physical facts clearly do not support claims that floured mercury travels downstream for great distances from the site where it was disturbed. Plus, "when mercury droplets touch, they fuse into much large droplets (up to 25 millimeters)". This is an obvious benefit to the environment notwithstanding the remaining 2% that may fall back into the water.

8. It is important to review the peer reviewed published science on the subject of mercury and have an understanding of the life cycle of mercury in streams. The following illustration (Figure 2 from Wood) is of a typical stream with bottom sediment, a column of water, and the air above. From the illustration, and the science, methylmercury, CH_3Hg^+ is only formed in the sediment. And according to J. M. Wood "the pH optimum for the synthesis of

methylmercury either under laboratory conditions or in natural sediments is 4.5", which is rather

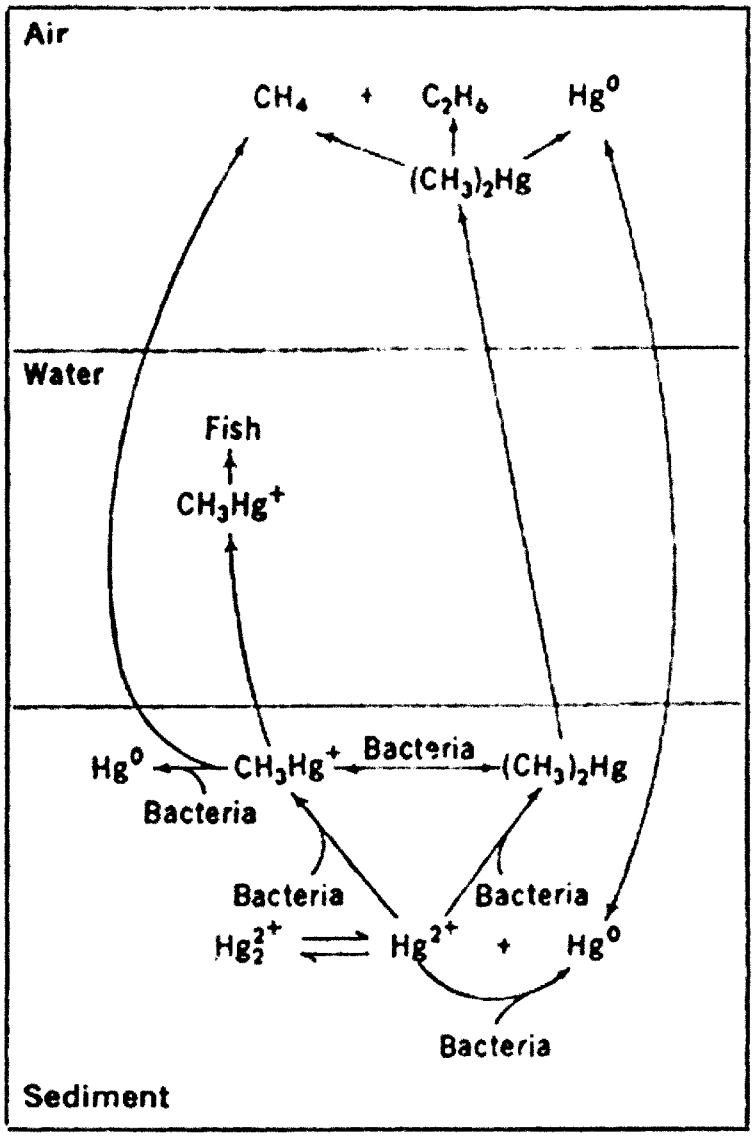

Fig. 2. The biological cycle for mercury.

low for most streams. In addition, "Other microorganisms can detoxify their environment of methylmercury by reducing it to Hg^0 (mercury metal) plus methane." Also, "the rate of synthesis of methylmercury depends on the concentration of available Hg^{2+}, the composition of the microbial population, the pH, the temperature, the redox potential, and the synergistic or antagonistic effects of other metabolic or chemical processes."

Science. J. M. Wood, "Biological Cycles for Toxic Elements in the Environment",1974 Mar 15;183(4129):1049-52

In a later article by M. J. Colombo, et al, "Anaerobic bacteria play a central role in the Hg biogeochemical cycle through their catalysis of Hg methylation."

Science Direct, M.J. Colombo, J. Ha, J. R. Reinfelder, T. Barkay and N. Yee, . J. M. Wood, "Anaerobic oxidation of Hg(0) and methylmercury formation by Desulfovibrio desulfuricans ND13", Geochimica et Cosmochimica Acta, Volume 112, 1 July 2013, Pages 166–17;

http://www.sciencedirect.com/science/article/pii/S0016703713001439

Thus, methylmercury only forms in sediments where there is a low pH (US-EPA drinking water standards are: 6.5 to 8.5) at pH of 4.5, which has 100 times the concentration of acid (H^+) ions than in safe drinking water and only in the presence of specific anaerobic bacteria (lack of oxygen, anoxic).

http://safewater.supportportal.com/link/portal/23002/23015/Article/22806/What-is-the-federal-standard-for-pH-in-drinking-water?_ga=1.52858920.1016067586.1429311656

In addition, in a January 2010, EPA reported that "since suction dredge mining creates turbidity in the stream it is likely this action increases oxygenation of the waters and therefore, methylation of inorganic mercury would be less likely to occur in these habitats."

"Biological Evaluation for Small Placer Miners in Idaho National Pollutant Discharge Elimination System (NPDES) General Permit";

http://www.epa.gov/region10/pdf/permits/npdes/id/idg370000_be_01_2010.pdf

9. I was able to obtain some measurements from the input waters for the Nimbus Fish Hatchery on the American River near Folsom, California. The highest mercury reading was less than 1/100th of the mercury levels required under drinking water standards (US-EPA), and the very limited data available did not demonstrate any relationship between mercury levels and the general cessation of suction dredge mining activity.

10. It is possible to engineer and modify the dredge design to improve Hg capture above the 98% recovery reported. I understand this activity is underway, but not completed with quantified measurable mercury recovery efficiencies reported at this time.

11. Upon reviewing the references provided by representatives of the Karuk Tribe and the Opposition, I do professionally question the references as actually being independent peer reviewed scientific literature and the use of extrapolated spiked mercury chemistry room temperature experiments to conclusions that the same chemistry occurs in mountain streams.

12. In conclusion, by removing the mercury from the streams by dredging, the amount of available mercury available to be methylated sometime in the future is reduced by 98%, benefiting the environment and mankind.

Executed on June 14, 2015.

Thom Seal, Ph.D., P.E., Q.P.

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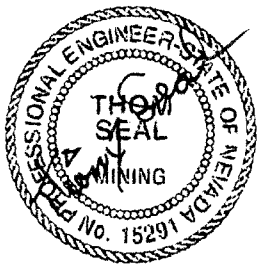

PROOF OF SERVICE

I, Carole Caldwell, hereby declare under penalty of perjury under the laws of the State of California that the following facts are true and correct:

I am a citizen of the United States, over the age of 18 years, and not a party to or interested in the within entitled cause. I am an employee of Murphy & Buchal, LLP and my business address is 3425 SE Yamhill Street, Suite 100, Portland, Oregon 97214.

On June 17, 2015, I caused the following document to be served:

REPLY DECLARATION OF THOM SEAL IN SUPPORT OF MINERS' JOINT MOTION FOR INJUNCTION AGAINST DEFENDANTS

by transmitting a true copy in the following manner on the parties listed below:

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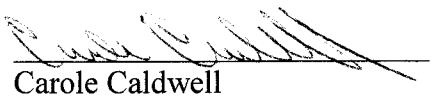

Carole Caldwell
Declarant