Public Comment
Statewide Mercury Policy-CEQA Scoping
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PLEASE ACCEPT THIS DOCUMENT AS MY FORMAL COMMENTS SUBMITTAL REGARDING THE ABOVE PROPOSED STATEWIDE MERCURY POLICY AND MERCURY CONTROL PROGRAM FOR RESERVOIRS. These comments are based in Fact and Scientific Studies and their documented results.

Please do not take these comments lightly as I am as concerned about reclamation of Mercury and other potentially toxic heavy metals that may be found in our State Waters.

COMMENTS TO THE STATE WATER RESOURCES CONTROL BOARD'S

Statewide Mercury Policy and Mercury Control Program for Reservoirs

Summary for CEQA Scoping Meetings
March 2012

MERCURY, SUCTION DREDGING, FACTS AND FICTION

MARCH 26, 2012

By Gary Goldberg

PUBLIC LANDS FOR THE PEOPLE, INC.

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First of all let me very up-front with all readers. I am NOT a Chemist, Geologist, or a Scientist of any sort. I am also not one of the "Extreme" Environmentalists that have espoused and propagated the false claims about Mercury. I am however, a normal American Patriot, a Miner, and a Suction Dredger (or was until California imposed the ILLEGAL BAN on Suction Dredging in all California waterways. I have obtained a Bachelor of Science Degree in Intermediate-Upper Education and a Master of Arts Degree in Management, so researching facts and teaching facts are within my expertise.

I am also, what most people consider a "GOOD Steward" of our lands, Flora and Fauna. In my over 60 years on this beautiful planet we call Earth, I have learned that it is important to respect all things, especially those limited resources we are bless with currently. I have spent many, many weeks in the wilderness of this Country from North to South and East to West. Always keeping to the tenant "Always pack out more than you pack in."

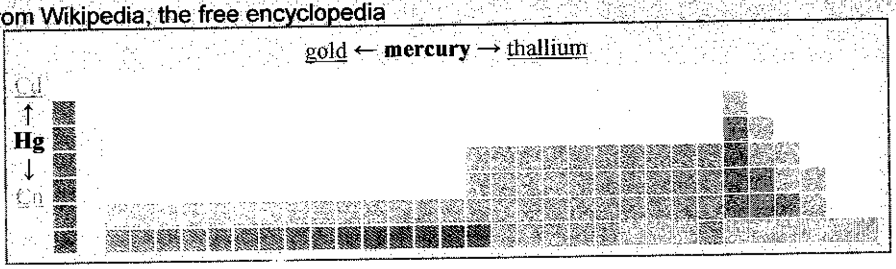
Do I consider myself an "Environmentalist?" You bet I do! Do I consider myself an "Extreme" Environmentalist?" Not on your life. The "Extremists" blindly follow some "self appointed" expert, regarding environmental issues and never question the "Facts" they present, which if they did, they would soon realize that they are being led "down the garden path" for some other nefarious reason.

That being enough of a small introduction, I would like to spend the rest of this treatise discussing the TRUTH about Mercury in our environment, how it gets there, what effects it has on everything on the planet, and the LIES being used against logical, rational people in our World. This is written with the hope that most people "conned" by the "extremists" will finally accept the scientific TRUTHS and stop believing the rhetoric.

First, let us start with a simple definition/explanation of "What is Mercury?" Wikipedia, today's most commonly used source for looking up "anything" is cited below:

Mercury (element)

From Wikipedia, the free encyclopedia

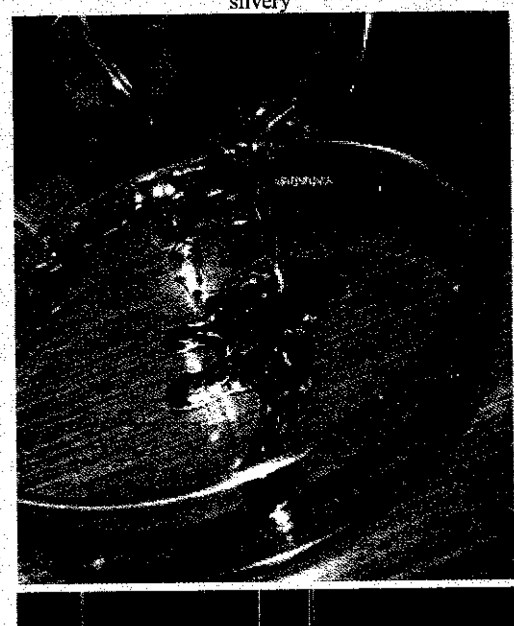


80Hg

Periodic table

Appearance

silvery



Spectral lines of mercury (UV not seen)

General properties

Name, symbol,number	mercury, Hg, 80
Pronunciation	/ˈmɜrkjəri/ or /ˈmɜrkəri/ *MER-k(y)ə-ree* alternatively /ˈkwɪksɪlvər/

	or /haɪˈdrɑrdʒɨrəm/ *hye-DRAR-ji-rəm*
Element category	transition metal
Group, period, block	12, 6, d
Standard atomic weight	200.59(2)
Electron configuration	[Xe] $4f^{14}$ $5d^{10}$ $6s^2$
Electrons per shell	2, 8, 18, 32, 18, 2 (Image)
Physical properties	
Phase	liquid
Density (near r.t.)	13.534 $g \cdot cm^{-3}$
Melting point	234.32 K, -38.83 °C, -37.89 °F
Boiling point	629.88 K, 356.73 °C, 674.11 °F
Critical point	1750 K, 172.00 MPa
Heat of fusion	2.29 $kJ \cdot mol^{-1}$
Heat of vaporization	59.11 $kJ \cdot mol^{-1}$
Molar heat capacity	27.983 $J \cdot mol^{-1} \cdot K^{-1}$

Vapor pressure

P (Pa)	1	10	100	1 k	10 k	100 k
at T (K)	315	350	393	449	523	629

Atomic properties	
Oxidation states	4, 2 (mercuric), 1 (mercurous) (mildly basic oxide)
Electronegativity	2.00 (Pauling scale)
Ionization energies	1st: 1007.1 $kJ \cdot mol^{-1}$
	2nd: 1810 $kJ \cdot mol^{-1}$
	3rd: 3300 $kJ \cdot mol^{-1}$
Atomic radius	151 pm
Covalent radius	132±5 pm
Van der Waals radius	155 pm
Miscellanea	
Crystal structure	rhombohedral

Magnetic ordering	diamagnetic[1]
Electrical resistivity	(25 °C) 961nΩ·m
Thermal conductivity	8.30 $W \cdot m^{-1} \cdot K^{-1}$
Thermal expansion	(25 °C) 60.4 $\mu m \cdot m^{-1} \cdot K^{-1}$
Speed of sound	(liquid, 20 °C) 1451.4 $m \cdot s^{-1}$
CAS registry number	7439-97-6

Most stable isotopes

Main article: Isotopes of mercury

iso	NA	half-life	DM	DE (MeV)	DP
^{194}Hg	syn	444 y	ε	0.040	^{194}Au
^{195}Hg	syn	9.9 h	ε	1.510	^{195}Au
^{196}Hg	0.15%	^{196}Hg is stable with 116 neutrons			
^{197}Hg	syn	64.14 h	ε	0.600	^{197}Au
^{198}Hg	9.97%	^{198}Hg is stable with 118 neutrons			

^{199}Hg	16.87%	^{199}Hg is stable with 119 neutrons			
^{200}Hg	23.1%	^{200}Hg is stable with 120 neutrons			
^{201}Hg	13.18%	^{201}Hg is stable with 121 neutrons			
^{202}Hg	29.86%	^{202}Hg is stable with 122 neutrons			
^{203}Hg	syn	46.612 d	β^-	0.492	^{203}Tl
^{204}Hg	6.87%	^{204}Hg is stable with 124 neutrons			

- v
- d
- e

Mercury is a chemical element with the symbol **Hg** and atomic number 80. It is also known as **quicksilver** or **hydrargyrum** (from "hydr-"*water* and "argyros" *silver*). A heavy, silvery d-block element, mercury is the only metal that is liquid at standard conditions for temperature and pressure; the only other element that is liquid under these conditions is bromine, and metals such as caesium, francium, gallium, and rubidium melt just above room temperature. With a freezing point of −38.83 °C and boiling point of 356.73 °C, mercury has one of the narrowest ranges of its liquid state of any metal.[2][3][4]

Mercury occurs in deposits throughout the world mostly as cinnabar (mercuric sulfide). The red pigment vermilion is mostly obtained by reduction from cinnabar. Cinnabar is highly toxic by ingestion or inhalation of the dust. Mercury poisoning can also result from exposure to water-soluble forms of mercury (such as mercuric chloride or methylmercury), inhalation of mercury vapor, or eating seafood contaminated with mercury.

Mercury is used in thermometers, barometers, manometers, sphygmomanometers, float valves, some electrical switches, and other scientific apparatus, though concerns about the element's toxicity have led to mercury thermometers and sphygmomanometers being largely phased out in clinical environments in favor of alcohol-filled, galinstan-filled, digital, or thermistor-based instruments. It remains in use in scientific research applications and in amalgam material for dental restoration. It is used in lighting: electricity passed through mercury vapor in a phosphor tube produces short-wave ultraviolet light which then causes the phosphor to fluoresce, making visible light.

Contents

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Properties

Physical properties

A pound coin (density ~7.6 g/cm^3) floats in mercury due to the combination of the buoyant and surface tension.

Mercury is a heavy, silvery-white metal. As compared to other metals, it is a poor conductor of heat, but a fair conductor of electricity.[5] Mercury has an exceptionally low melting temperature for a d-block metal. A complete explanation of this fact requires a deep excursion into quantum physics, but it can be summarized as follows: mercury has a unique electronic configuration where electrons fill up all the available 1s, 2s, 2p, 3s, 3p, 3d, 4s, 4p, 4d, 4f, 5s, 5p, 5d and 6s subshells. As such configuration strongly resists removal of an electron; mercury behaves similarly to noble gas elements, which form weak bonds and thus easily melting solids. The stability of the 6s shell is due to the presence of a filled 4f shell. An f shell poorly screens the nuclear charge that increases the attractive Coulomb interaction of the 6s shell and the nucleus (see lanthanide contraction). The absence of a filled inner *f* shell is the reason for the somewhat higher melting temperature of cadmium and zinc, although both these metals still melt easily and, in addition, have unusually low boiling points. Metals such as gold have atoms with one less 6s electron than mercury. Those electrons are more easily removed and are shared between the gold atoms forming relatively strong metallic bonds.[3][6]

Chemical properties

Mercury does not react with most acids, such as dilute sulfuric acid, although oxidizing acids such as concentrated sulfuric acid and nitric acid or aqua regia dissolve it to give sulfate, nitrate, and chloride salts. Like silver, mercury reacts with atmospheric hydrogen sulfide. Mercury even reacts with solid sulfur flakes, which are used in mercury spill kits to absorb mercury vapors (spill kits also use activated carbon and powdered zinc).[7]

Amalgams

Mercury-discharge spectral calibration lamp

Mercury dissolves to form amalgams with gold, zinc and many other metals. Because iron is an exception, iron flasks have been traditionally used to trade mercury. Other metals that do not form amalgams with mercury include tantalum, tungsten and platinum. Sodium amalgam is a common reducing agent in organic synthesis, and is also used in high-pressure sodium lamps.

Mercury readily combines with aluminium to form a mercury-aluminium amalgam when the two pure metals come into contact. Since the amalgam reacts with air to give aluminium oxide, small amounts of mercury corrode aluminium. For this reason, mercury is not allowed aboard an aircraft under most circumstances because of the risk of it forming an amalgam with exposed aluminium parts in the aircraft.[8]

Isotopes

Main article: Isotopes of mercury

There are seven stable isotopes of mercury with ^{202}Hg being the most abundant (29.86%). The longest-lived radioisotopes are ^{194}Hg with a half-life of 444 years, and ^{203}Hg with a half-life of 46.612 days. Most of the remaining radioisotopes have half-lives that are less than a day. ^{199}Hg and ^{201}Hg are the most often studied NMR-active nuclei, having spins of $\frac{1}{2}$ and $\frac{3}{2}$ respectively.[5]

History

The symbol for the planet Mercury (☿) has been used since ancient times to represent the element

Mercury was found in Egyptian tombs that date from 1500 BC.[9]

In China and Tibet, mercury use was thought to prolong life, heal fractures, and maintain generally good health, although it is now known that exposure to mercury leads to serious adverse health effects.[10] One of China's emperors, Qín Shǐ Huáng Dì — allegedly buried in a tomb that contained rivers of flowing mercury on a model of the land he ruled, representative of the rivers of China — was killed by drinking a mercury and powdered jade mixture formulated by Qin alchemists (causing liver failure, mercury poisoning, and brain death) who intended to give him eternal life.[11][12]

The ancient Greeks used mercury in ointments; the ancient Egyptians and the Romans used it in cosmetics which sometimes deformed the face. In Lamanai, once a major city of the Maya civilization, a pool of mercury was found under a marker in a Mesoamerican ballcourt.[13][14] By 500 BC mercury was used to make amalgams (Medieval Latin amalgama, "alloy of mercury") with other metals.[15]

Alchemists thought of mercury as the First Matter from which all metals were formed. They believed that different metals could be produced by varying the quality and quantity of sulfur contained within the mercury. The purest of these was gold, and mercury was called for in attempts at the transmutation of base (or impure) metals into gold, which was the goal of many alchemists.[16]

Hg is the modern chemical symbol for mercury. It comes from *hydrargyrum*, a Latinized form of the Greek word Ύδραργυρος (*hydrargyros*), which is a compound word meaning "water-silver" (hydr- = water, argyros = silver) — since it is liquid like water and shiny like silver. The element was named after the Roman god Mercury, known for speed and mobility. It is associated with the planet Mercury; the astrological symbol for the planet is also one of the alchemical symbols for the metal; the Indian word for alchemy is *Rasavātam* which means "the way of mercury".[17] Mercury is the only metal for which the alchemical planetary name became the common name.[16]

The mines in Almadén (Spain), Monte Amiata (Italy), and Idrija (now Slovenia) dominated the mercury production from the opening of the mine in Almadén 2500 years ago until new deposits were found at the end of the 19th century.[18]

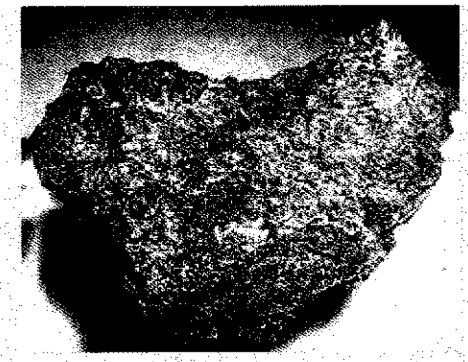
Occurrence

See also: Category:Mercury minerals and Category:Mercury mines

Mercury output in 2005

Mercury is an extremely rare element in the Earth's crust, having an average crustal abundance by mass of only 0.08 parts per million (ppm).[19] However, because it does not blend geochemically with those elements that constitute the majority of the crustal mass, mercury ores can be extraordinarily concentrated considering the element's abundance in ordinary rock. The richest mercury ores contain up to 2.5% mercury by mass, and even the leanest concentrated deposits are at least 0.1% mercury (12,000 times average crustal abundance). It is found either as a native metal (rare) or in cinnabar, corderoite,livingstonite and other minerals, with cinnabar (HgS) being the most common ore.[20] Mercury ores usually occur in very young orogenic belts where rock of high density are forced to the crust of the Earth, often in hot springs or other volcanic regions.[21]

Beginning in 1558, with the invention of the patio process to extract silver from ore using mercury, mercury became an essential resource in the economy of Spain and its American colonies. Mercury was used to extract silver from the lucrative mines in New Spain and Peru. Initially, the Spanish Crown's mines in Almaden in Southern Spain supplied all the mercury for the colonies.[22]Mercury deposits were discovered in the New World, and more than 100,000 tons of mercury were mined from the region of Huancavelica, Peru, over the course of three centuries following the discovery of deposits there in 1563. The patio process and later pan amalgamation process continued to create great demand for mercury to treat silver ores until the late 19th century.[23]



Native mercury with cinnabar, Socrates mine, Sonoma County, California. Cinnabar sometimes alters to native mercury in the oxidized zone of mercury deposits.

Former mines in Italy, the United States and Mexico which once produced a large proportion of the world supply have now been completely mined out or, in the case of Slovenia (Idrija) and Spain (Almadén), shut down due to the fall of the price of mercury. Nevada's McDermitt Mine, the last mercury mine in the United States, closed in 1992. The price of mercury has been highly volatile over the years and in 2006 was $650 per 76-pound (34.46 kg) flask.[24]

Mercury is extracted by heating cinnabar in a current of air and condensing the vapor. The equation for this extraction is

$$HgS + O_2 \rightarrow Hg + SO_2$$

In 2005, China was the top producer of mercury with almost two-thirds global share followed by Kyrgyzstan.[25] Several other countries are believed to have unrecorded production of mercury from copper electrowinning processes and by recovery from effluents.

Because of the high toxicity of mercury, both the mining of cinnabar and refining for mercury are hazardous and historic causes of mercury poisoning.[26] In China, prison labor was used by a private mining company as recently as the 1950s to create new cinnabar mercury mines. Thousands of prisoners were used by the Luo Xi mining company to establish new tunnels.[27] In addition, worker health in functioning mines is at high risk.

The European Union directive calling for compact fluorescent bulbs to be made mandatory by 2012 has encouraged China to re-open deadly cinnabar mines to obtain the mercury required for CFL bulb manufacture. As a result, environmental dangers have been a concern, particularly in the southern cities of Foshan and Guangzhou, and in the Guizhou province in the south west.[27]

Abandoned mercury mine processing sites often contain very hazardous waste piles of roasted cinnabar calcines. Water run-off from such sites is a recognized source of ecological damage. Former mercury mines may be suited for constructive re-use. For example, in 1976 Santa Clara County, California purchased the historic Almaden Quicksilver Mine and created a county park on the site, after conducting extensive safety and environmental analysis of the property.[28]

Chemistry

See also: Category:Mercury compounds

Mercury exists in two main oxidation states, I and II. Higher oxidation states are unimportant, but have been detected, e.g., mercury(IV) fluoride (HgF_4) but only under extraordinary conditions.[29]

Compounds of mercury(I)

Different from its lighter neighbors, cadmium and zinc, mercury forms simple stable compounds with metal-metal bonds. The mercury(I) compounds are diamagnetic and feature the dimeric cation, Hg2+
2. Stable derivatives include the chloride and nitrate. Treatment of Hg (I) compounds complexation with strong ligands such as sulfide, cyanide, etc. induces disproportionation to Hg^{2+} and elemental mercury.[30] Mercury (I) chloride, a colorless solid also known as calomel, is really the compound with the formula Hg_2Cl_2, with the connectivity Cl-Hg-Hg-Cl. It is a standard in electrochemistry. It reacts with chlorine to give mercuric chloride, which resists further oxidation.

Indicative of its tendency to bond to itself, mercury forms mercury polycations, which consist of linear chains of mercury centers, capped with a positive charge. One example is $Hg_3^{2+}(AsF_6^-)_2$.[31]

Compounds of mercury (II)

Mercury (II) is the most common oxidation state and is the main one in nature as well. All four mercuric halides are known. The form tetrahedral complexes with other ligands but the halides adopt linear coordination geometry, somewhat like Ag^+ does. Best known is mercury(II) chloride, an easily sublimating white solid. $HgCl_2$ forms coordination complexes that are typically tetrahedral, e.g. $HgCl_4^{2-}$.

Mercury(II) oxide, the main oxide of mercury, arises when the metal is exposed to air for long periods at elevated temperatures. It reverts to the elements upon heating near 400 °C, as was demonstrated by Priestly in an early synthesis of pure oxygen.[7] Hydroxides of mercury are poorly characterized, as they are for its neighbors gold and silver.

Being a soft metal, mercury forms very stable derivatives with the heavier chalcogens. Preeminent is mercury (II) sulfide, HgS, which occurs in nature as the ore cinnabar and is the brilliant pigment vermillion. Like ZnS, HgS crystallizes in two forms, the reddish cubic form and the black zinc blende form.[5] Mercury(II) selenide (HgSe) and mercury(II) telluride (HgTe) are also known, these as well as various derivatives, e.g. mercury cadmium telluride and mercury zinc telluride being semiconductors useful as infrared detector materials.[32]

Mercury (II) salts form a variety of complex derivatives with ammonia. These include Millon's base (Hg_2N^+), the one-dimensional polymer (salts of $HgNH_2^+)_n$), and "fusible white precipitate" or $[Hg(NH_3)_2]Cl_2$. Known as Nessler's reagent, potassium tetraiodomercurate(II) (HgI_4^{2-}) is still occasionally used to test for ammonia owing to its tendency to form the deeply colored iodide salt of Millon's base.

Mercury fulminate, (a detonator widely used in explosives);[5]

Compounds of mercury (IV)

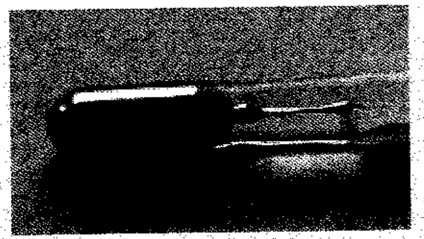
Mercury (IV) is the rarest oxidation state of mercury which is known to exist. The only known mercury (IV) compound is mercury(IV) fluoride.

Organomercury compounds

Main article: Organomercury compound

Organic mercury compounds are historically important but are of little industrial value in the western world. Mercury (II) salts are rare examples of simple metal complexes that react directly with aromatic rings. Organomercury compounds are always divalent and usually two-coordinate and linear geometry. Unlike organocadmium and organozinc compounds, organomercury compounds do not react with water. They usually have the formula HgR_2, which are often volatile, or HgRX, which are often solids, where R is aryl or alkyl and X is usually halide or acetate. Methylmercury, a generic term for compounds with the formula CH_3HgX is a dangerous family of compounds that is found in some a polluted water.[33] They arise by a process known as biomethylation.

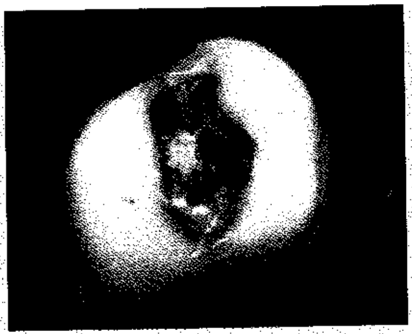
Applications



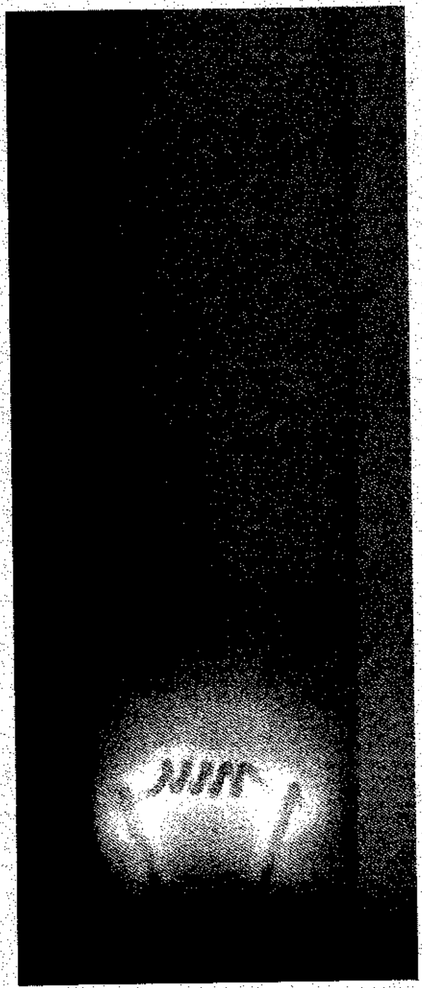
The bulb of a mercury-in-glass thermometer

Mercury is used primarily for the manufacture of industrial chemicals or for electrical and electronic applications. It is used in some thermometers, especially ones which are used to measure high temperatures. A still increasing amount is used as gaseous mercury in fluorescent lamps, while most of the other applications are slowly phased out due to health and safety regulations and is in some applications replaced with less toxic but considerably more expensive Galinstan alloy.

Medicine



Amalgam filling



The deep violet glow of a mercury vapor discharge in a germicidal lamp, whose spectrum is rich in invisible ultraviolet radiation.

See also: Amalgam (dentistry)

Mercury and its compounds have been used in medicine, although they are much less common today than they once were, now that the toxic effects of mercury and its compounds are more widely understood. The element mercury is an ingredient in dental amalgams. Thiomersal (called *Thimerosal* in the United States) is an organic compound used as a preservative in vaccines, though this use is in decline.[34] Another mercury compound Merbromin (Mercurochrome) is a topical antiseptic used for minor cuts and scrapes is still in use in some countries.

Since the 1930s some vaccines have contained the preservative thiomersal, which is metabolized or degraded to ethyl mercury. Although it was widely that this mercury-based preservative can cause or trigger autism in children, scientific studies showed no evidence supporting any such link.[35] Nevertheless thiomersal has been removed from or reduced to trace amounts in all U.S. vaccines recommended for children 6 years of age and under, with the exception of inactivated influenza vaccine.[36]

Mercury in the form of one of its common ores, cinnabar, is used in various traditional medicines, especially in traditional Chinese medicine. Review of its safety has found cinnabar can lead to significant mercury intoxication when heated, consumed in overdose or taken long term, and can have adverse effects at therapeutic doses, though this is typically reversible at therapeutic doses. Although this form of mercury appears less toxic than others, its use in traditional Chinese medicine has not yet been justified as the therapeutic basis for the use of cinnabar is not clear.[37]

Today, the use of mercury in medicine has greatly declined in all respects, especially in developed countries. Thermometers and sphygmomanometers containing mercury were invented in the early 18th and late 19th centuries, respectively. In the early 21st century, their use is declining and has been banned in some countries, states and medical institutions. In 2002, the U.S. Senate passed legislation to phase out the sale of non-prescription mercury thermometers. In 2003, Washington and Maine became the first states to ban mercury blood pressure devices.[38] Mercury compounds are found in some over-the-counter drugs, including topical antiseptics, stimulant laxatives, diaper-rash ointment, eye drops, and nasal sprays. The FDA has "inadequate data to establish general recognition of the safety and effectiveness", of the mercury ingredients in these products.[39] Mercury is still used in some diuretics, although substitutes now exist for most therapeutic uses.

Production of chlorine and caustic soda

Chlorine is produced from sodium chloride (common salt, NaCl) using electrolysis to separate the metallic sodium from the chlorine gas. Usually the salt is dissolved in water to produce a brine. By-products of any such chloralkali process are hydrogen (H_2) and sodium hydroxide (NaOH), which is commonly called caustic soda or lye. By far the largest use of mercury[40][41] in the late 20th century was in the mercury cell process (also called the Castner-Kellner process) where metallic sodium is formed as an amalgam at a cathode made from mercury; this sodium is then reacted with water to produce sodium hydroxide.[42] Many of the industrial mercury releases of the 20th century came from this process, although modern plants claimed to be safe in this regard.[41] After about 1985, all new chloralkali production facilities that were built in the United States used either membrane cell or diaphragm cell technologies to produce chlorine.

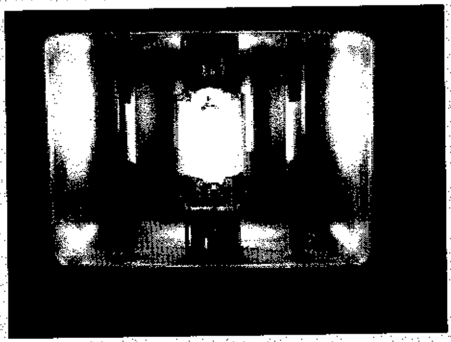
Laboratory uses

Some medical thermometers, especially those for high temperatures, are filled with mercury; however, they are gradually disappearing. In the United States, non-prescription sale of mercury fever thermometers has been banned since 2003.[43]

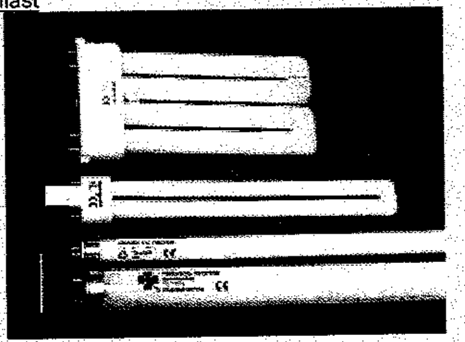
Mercury is also found in liquid mirror telescopes. The mirror is formed by rotating liquid mercury on a disk, the parabolic form of the liquid thus formed reflecting and focusing incident light. Such telescopes are cheaper than conventional large mirror telescopes by up to a factor of 100, but the mirror cannot be tilted and always points straight up.[44][45][46]

Liquid mercury is a part of popular secondary reference electrode (called the calomel electrode) in electrochemistry as an alternative to the standard hydrogen electrode. The calomel electrode is used to work out the electrode potential of half cells.[47] Last, but not least, the point of mercury, −38.8344 °C, is a fixed point used as a temperature standard for the International Temperature Scale (ITS-90).[5]

Niche uses



Skin tanner containing a low-pressure mercury vapor lamp and two infrared lamps, which act both as light source and electrical ballast



Assorted types of fluorescent lamps.

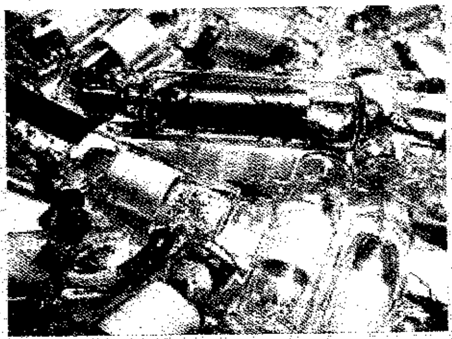
Gaseous mercury is used in mercury-vapor lamps and some "neon sign" type advertising signs and fluorescent lamps. Those low-pressure lamps emit very spectrally narrow lines, which are traditionally used in optical spectroscopy for calibration of spectral position. Commercial calibration lamps are sold for this purpose; however simply reflecting some of the fluorescent-lamp ceiling light into a spectrometer is a common calibration practice.[48] Gaseous mercury is also found in some electron tubes, including ignitrons, thyratrons, and mercury arc rectifiers.[49] It is also used in specialist medical care lamps for skin tanning and disinfection (see pictures).[50] Gaseous mercury is added to cold cathode argon-filled lamps to increase the ionization and electrical conductivity. An argon filled lamp without mercury will have dull spots and will fail to light correctly. Lighting containing mercury can be bombarded/oven pumped only once. When added to neon filled tubes the light produced will be inconsistent red/blue spots until the initial burning-in process is completed; eventually it will light a consistent dull off-blue color.[51]

Cosmetics

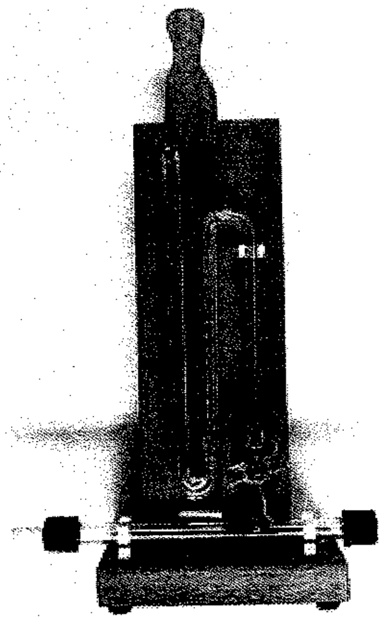
Mercury, as thiomersal, is widely used in the manufacture of mascara. In 2008, Minnesota became the first state in the US to ban intentionally added mercury in cosmetics, giving it a tougher standard than the federal government.[52]

A study in geometric mean urine mercury concentration identified a previously unrecognized source of exposure (skin care products) to inorganic mercury among New York City residents. Population-based biomonitoring also showed that mercury concentration levels are higher in consumers of seafood and fish meals.[53]

Historic uses



Old mercury switches



Mercury manometer to measure pressure

Many historic applications made use of the peculiar physical properties of mercury, especially as a dense liquid and a liquid metal:

- In Islamic Spain, it was used for filling decorative pools. Later, the American artist Alexander Calder built a mercury fountain for the Spanish Pavilion at the 1937 World Exhibition in Paris. The fountain is now on display at the Fundació Joan Miró in Barcelona.[54]
- Mercury was used inside wobbler lures. Its heavy, liquid form made it useful since the lures made an attractive irregular movement when the mercury moved inside the plug. Such use was stopped due to environmental concerns, but illegal preparation of modern fishing plugs has occurred.
- The Fresnel lenses of old lighthouses used to float and rotate in a bath of mercury which acted like a bearing.[55]

- Mercury sphygmomanometers (blood pressure meter), barometers, diffusion pumps, coulometers, and many other laboratory instruments. As an opaque liquid with a high density and a nearly linear thermal expansion, it is ideal for this role.[56]
- As an electrically conductive liquid, it was used in mercury switches (including home mercury light switches installed prior to 1970), tilt switches used in old fire detectors, and tilt switches in many modern home thermostats.[57]
- Owing to its acoustic properties, mercury was used as the propagation medium in delay line memory devices used in early digital computers of the mid-20th century.
- Experimental mercury vapor turbines were installed to increase the efficiency of fossil-fuel electrical power plants.[58] The South Meadow power plant in Hartford, CT employed mercury as its working fluid, in a binary configuration with a secondary water circuit, for a number of years starting in the late 1920s in a drive to improve plant efficiency. Several other plants were built, including the Schiller Station in Portsmouth, NH, which went online in 1950. The idea did not catch on industry-wide due to the weight and toxicity of mercury, as well as the advent of supercritical steam plants in later years.[59][60]
- Similarly, liquid mercury was used as a coolant for some nuclear reactors; however, sodium is proposed for reactors cooled with liquid metal, because the high density of mercury requires much more energy to circulate as coolant.[61]
- Mercury was a propellant for early ion engines in electric space propulsion systems. Advantages were mercury's high molecular weight, low ionization energy, low dual-ionization energy, high liquid density and liquid storability at room temperature. Disadvantages were concerns regarding environmental impact associated with ground testing and concerns about eventual cooling and condensation of some of the propellant on the spacecraft in long-duration operations. The first spaceflight to use electric propulsion was a mercury-fueled ion thruster developed by NASA Lewis and flown on the Space Electric Rocket Test "SERT-1" spacecraft launched by NASA at its Wallops Flight Facility in 1964. The SERT-1 flight was followed up by the SERT-2 flight in 1970. Mercury and caesium were preferred propellants for ion engines until Hughes Research Laboratory performed studies finding xenon gas to be a suitable replacement. Xenon is now the preferred propellant for ion engines as it has a high molecular weight, little or no

reactivity due to its noble gas nature, and has a high liquid density under mild cryogenic storage.[62][63]

Others applications made use of the chemical properties of mercury:

- The mercury battery is a non-rechargeable electrochemical battery, a primary cell, that was common throughout the middle of the 20th century. It was used in a wide variety of applications and was available in various sizes, particularly button sizes. Its constant voltage output and long shelf life gave it a niche use for camera light meters and hearing aids. The mercury cell was effectively banned in most countries in the 1990s due to concerns about the mercury contaminating landfills.
- Mercury was used for preserving wood, developing daguerreotypes, silvering mirrors, anti-fouling paints (discontinued in 1990), herbicides(discontinued in 1995), handheld maze games, cleaning, and road leveling devices in cars. Mercury compounds have been used in antiseptics, laxatives, antidepressants, and in antisyphilitics.
- It was allegedly used by allied spies to sabotage Luftwaffe planes: a mercury paste was applied to bare aluminium, causing the metal to rapidly corrode; this would cause structural failures.[64]
- Chloralkali process: The largest industrial use of mercury during the 20th century was in electrolysis for separating chlorine and sodium from brine; mercury being the anode of the Castner-Kellner process. The chlorine was used for bleaching paper (hence the location of many of these plants near paper mills) while the sodium was used to make sodium hydroxide for soaps and other cleaning products. This usage has largely been discontinued, replaced with other technologies that utilize membrane cells.[65]
- As electrodes in some types of electrolysis, batteries (mercury cells), sodium hydroxide and chlorine production, handheld games, catalysts, insecticides.
- Mercury was once used as a gun barrel bore cleaner.[66][67]
- From the mid-18th to the mid-19th centuries, a process called "carroting" was used in the making of felt hats. Animal skins were rinsed in an orange solution (the term "carroting" arose from this color) of the mercury compound mercuric nitrate, $Hg(NO_3)_2 \cdot 2H_2O$.[68] This

process separated the fur from the pelt and matted it together. This solution and the vapors it produced were highly toxic. The United States Public Health Service banned the use of mercury in the felt industry in December 1941. The psychological symptoms associated with mercury poisoning are said by some to have inspired the phrase "mad as a hatter". Lewis Carroll's "Mad Hatter" in his book *Alice's Adventures in Wonderland* was a play on words based on the older phrase, but the character himself does not exhibit symptoms of mercury poisoning.[69]

- Gold and silver mining. Historically, mercury was used extensively in hydraulic gold mining in order to help the gold to sink through the flowing water-gravel mixture. Thin mercury particles may form mercury-gold amalgam and therefore increase the gold recovery rates.[5] Large-scale use of mercury stopped in the 1960s. However, mercury is still used in small scale, often clandestine, gold prospecting. It is estimated that 45,000 metric tons of mercury used in California for placer mining have not been recovered.[70] Mercury was also used in silver mining.[71]

Historic medicinal uses

Mercury (I) chloride (also known as calomel or mercurous chloride) has been used in traditional medicine as a diuretic, topical disinfectant, and laxative. Mercury (II) chloride (also known as mercuric chloride or corrosive sublimate) was once used to treat syphilis (along with other mercury compounds), although it is so toxic that sometimes the symptoms of its toxicity were confused with those of the syphilis it was believed to treat.[72] It is also used as a disinfectant. Blue mass, a pill or syrup in which mercury is the main ingredient, was prescribed throughout the 19th century for numerous conditions including constipation, depression, child-bearing and toothaches.[73] In the early 20th century, mercury was administered to children yearly as a laxative and dewormer, and it was used in teething powders for infants. The mercury-containing organohalide merbromin (sometimes sold as Mercurochrome) is still widely used but has been banned in some countries such as the U.S.[74]

Toxicity and safety

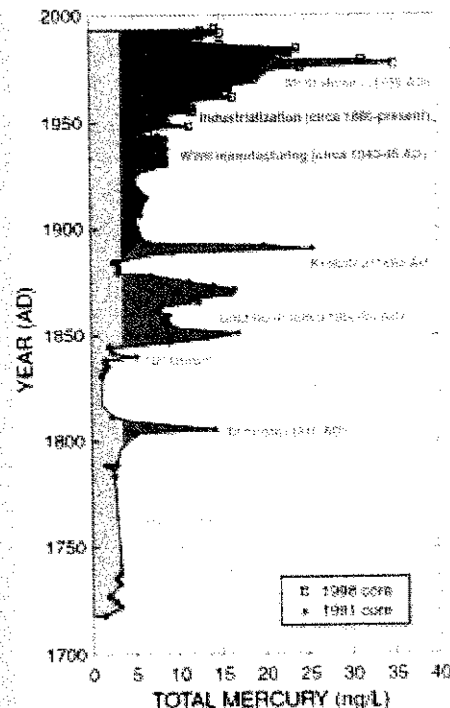
See also: Mercury poisoning

Mercury and most of its compounds are extremely toxic and must be handled with care; in cases of spills involving mercury (such as from certain thermometers or fluorescent), specific cleaning procedures are used to avoid exposure and contain the spill.[75] Protocols call for physically merging smaller droplets on hard surfaces, combining them into a single larger pool for easier removal with an eyedropper, or for gently pushing the spill into a disposable container. Vacuum cleaners and brooms cause greater dispersal of the mercury and should not be used. Afterwards, fine sulfur, zinc, or some other powder that readily forms an amalgam (alloy) with mercury at ordinary temperatures is sprinkled over the area before itself being collected and properly disposed of. Cleaning porous surfaces and clothing is not effective at removing all traces of mercury and it is therefore advised to discard these kinds of items should they be exposed to a mercury spill.

Mercury can be inhaled and absorbed through the skin and mucous membranes, so containers of mercury are securely sealed to avoid spills and evaporation. Heating of mercury, or of compounds of mercury that may decompose when heated, is always carried out with adequate ventilation in order to avoid exposure to mercury vapor. The most toxic forms of mercury are its organic compounds, such as dimethylmercury and methylmercury. However, inorganic compounds, such as cinnabar are also highly toxic by ingestion or inhalation.[76] Mercury can cause both chronic and acute poisoning.

Releases in the environment

The **neutrality of this section is disputed**. Please see the discussion on the talk page. Please do not remove this message until the dispute is resolved. *(September 2011)*



Amount of atmospheric mercury deposited at Wyoming's Upper Fremont Glacier over the last 270 years

Preindustrial deposition rates of mercury from the atmosphere may be about 4 ng / (1 L of ice deposit). Although that can be considered a natural level of exposure, regional or global sources have significant effects. Volcanic eruptions can increase the atmospheric source by 4–6 times.[77]

Natural sources, such as volcanoes, are responsible for approximately half of atmospheric mercury emissions. The human-generated half can be divided into the following estimated percentages:[78][79][80]

- 65% from stationary combustion, of which coal-fired power plants are the largest aggregate source (40% of U.S. mercury emissions in 1999). This includes power plants fueled with gas where the mercury has not been removed. Emissions from coal combustion are between one and two orders of magnitude higher than emissions from oil combustion, depending on the country.[78]

- 11% from gold production. The three largest point sources for mercury emissions in the U.S. are the three largest gold mines. Hydrogeochemical release of mercury from gold-mine tailings has been accounted as a significant source of atmospheric mercury in eastern Canada.[81]
- 6.8% from non-ferrous metal production, typically **smelters**.
- 6.4% from **cement** production.
- 3.0% from waste disposal, including municipal and hazardous waste, crematoria, and sewage sludge incineration. This is a significant underestimate due to limited information, and is likely to be off by a factor of two to five.
- 3.0% from caustic soda production.
- 1.4% from pig iron and steel production.
- 1.1% from mercury production, mainly for batteries.
- 2.0% from other sources.

The above percentages are estimates of the global human-caused mercury emissions in 2000, excluding biomass burning, an important source in some regions.[78]

Current atmospheric mercury contamination in outdoor urban air is (0.01–0.02 µg/m^3) indoor concentrations are significantly elevated over outdoor concentrations, in the range 0.0065–0.523 µg/m^3 (average 0.069 µg/m^3).[82]

Mercury also enters into the environment through the improper disposal (e.g., land filling, incineration) of certain products. Products containing mercury include: auto parts, batteries, fluorescent bulbs, medical products, thermometers, and thermostats.[83] Due to health concerns (see below), toxics use reduction efforts are cutting back or eliminating mercury in such products. For example, most thermometers now use pigmented alcohol instead of mercury, and galinstan alloy thermometers are also an option. Mercury thermometers are still occasionally used in the medical field because they are more accurate than alcohol thermometers, though both are commonly being replaced by electronic thermometers and less commonly by galinstan thermometers. Mercury thermometers are still widely used for certain scientific applications because of their greater accuracy and working range.

The United States Clean Air Act, passed in 1990, put mercury on a list of toxic pollutants that need to be controlled to the greatest possible extent. Thus, industries that release high concentrations of mercury into the environment agreed to install maximum achievable control technologies (MACT). In March 2005 EPA rule[84] added power plants to the list of sources that should be controlled and a national cap and trade rule was issued. States were given until November 2006 to impose stricter controls, and several States are doing so. The rule was being subjected to legal challenges from several States in 2005 and decision was made in 2008. The Clean Air Mercury Rule was struck down by a Federal Appeals Court on February 8, 2008. The rule was deemed not sufficient to protect the health of persons living near coal-fired power plants. The court opinion cited the negative impact on human health from coal-fired power plants' mercury emissions documented in the EPA Study Report to Congress of 1998.[85]

The EPA announced new rules for coal-fired power plants on December 22, 2011.[86] Cement kilns that burn hazardous waste are held to a looser standard than are standard hazardous waste incinerators in the United States, and as a result are a disproportionate source of mercury pollution.[87]

Historically, one of the largest releases was from the Colex plant, a lithium-isotope separation plant at Oak Ridge. The plant operated in the 1950s and 1960s. Records are incomplete and unclear, but government commissions have estimated that some two million pounds of mercury are unaccounted for.[88]

A serious industrial disaster was the dumping of mercury compounds into Minamata Bay, Japan. It is estimated that over 3,000 people suffered various deformities, severe mercury poisoning symptoms or death from what became known as Minamata disease.[89]

Occupational exposure

Due to the health effects of mercury exposure, industrial and commercial uses are regulated in many countries. The World Health Organization, OSHA, and NIOSH all treat mercury as an occupational hazard, and have established specific occupational exposure limits.

Environmental releases and disposal of mercury are regulated in the U.S. primarily by the United States Environmental Protection Agency.

Case control studies have shown effects such as tremors, impaired cognitive skills, and sleep disturbance in workers with chronic exposure to mercury vapor even at low concentrations in the range 0.7–42 μg/m^3.[90][91] A study has shown that acute exposure (4 – 8 hours) to calculated elemental mercury levels of 1.1 to 44 mg/m^3 resulted in chest pain, dyspnea, cough,hemoptysis, impairment of pulmonary function, and evidence of interstitial pneumonitis.[92] Acute exposure to mercury vapor has been shown to result in profound central nervous system effects, including psychotic reactions characterized by delirium, hallucinations, and suicidal tendency. Occupational exposure has resulted in broad-ranging functional disturbance, including erethism, irritability, excitability, excessive shyness, and insomnia. With continuing exposure, a fine tremor develops and may escalate to violent muscular spasms. Tremor initially involves the hands and later spreads to the eyelids, lips, and tongue. Long-term, low-level exposure has been associated with more subtle symptoms of erethism, including fatigue, irritability, loss of memory, vivid dreams and depression.[93][94]

Treatment

Research on the treatment of mercury poisoning is limited. Currently available drugs for acute mercurial poisoning include chelators N-acetyl-D, L-penicillamine (NAP), British Anti-Lewisite (BAL), 2,3-dimercapto-1-propanesulfonic acid (DMPS), and dimercaptosuccinic acid (DMSA). In one small study including 11 construction workers exposed to elemental mercury, patients were treated with DMSA and NAP.[95] Chelation therapy with both drugs resulted in the mobilization of a small fraction of the total estimated body mercury. DMSA was able to increase the excretion of mercury to a greater extent than NAP.[96]

Fish

Main article: Mercury in fish

Fish and shellfish have a natural tendency to concentrate mercury in their bodies, often in the form of methylmercury, a highly toxic organic compound of mercury. Species of fish that are high on the food chain, such as shark, swordfish, king mackerel, albacore tuna, and tilefish contain higher concentrations of mercury than others. As mercury and methylmercury are fat soluble, they primarily accumulate in the viscera, although they are also found throughout the muscle tissue.[97] When this fish is consumed by a predator, the mercury level is accumulated. Since fish are less efficient at depurating than accumulating methylmercury, fish-tissue concentrations increase over time. Thus species that are high on the chain amass body burdens of mercury that can be ten times higher than the species they consume. This process is called biomagnification. Mercury poisoning happened this way inMinamata, Japan, now called Minamata disease.

Regulations

In the United States, the Environmental Protection Agency is charged with regulating and managing mercury contamination. Several laws give the EPA this authority, including the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, and the Safe Drinking Water Act. Additionally, the Mercury-Containing and Rechargeable Battery Management Act, passed in 1996, phases out the use of mercury in batteries, and provides for the efficient and cost-effective disposal of many types of used batteries.[98] North America contributed approximately 11% of the total global anthropogenic mercury emissions in 1995.[99]

In the European Union, the directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (see RoHS) bans mercury from certain electrical and electronic products, and limits the amount of mercury in other products to less than 1000 ppm.[100] There are restrictions for mercury concentration in packaging (the limit is 100 ppm for sum of mercury, lead, hexavalent chromium and cadmium) and batteries (the limit is 5 ppm).[101] In July 2007, the European Union also banned mercury in non-electrical measuring devices, such as thermometers and barometers. The ban applies to new devices only, and contains exemptions for the health care sector and a two-year grace period for manufacturers of barometers.[102]

Norway enacted a total ban on the use of mercury in the manufacturing and import/export of mercury products, effective January 1, 2008.[103] In 2002, several lakes in Norway were found to have a poor state of mercury pollution, with an excess of 1 mg/g of mercury in their sediment.[104]

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91. ^ Liang, YX; Sun, RK; Sun, Y; Chen, ZQ; Li, LH (1993). "Psychological effects of low exposure to mercury vapor: Application of computer-administered neurobehavioral evaluation system". *Environmental Research* **60** (2): 320–7. Bibcode 1993ER.....60..320L. doi:10.1006/enrs.1993.1040. PMID 8472661.
92. ^ McFarland, RB and Reigel, H (1978). "Chronic Mercury Poisoning from a Single Brief Exposure". *J. Occup. Med.* **20** (8): 532. doi:10.1097/00043764-197808000-00003.
93. ^ *Environmental Health Criteria 1: Mercury*. Geneva: World Health Organization. 1976. ISBN 9241540613.
94. ^ published under the joint sponsorship of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization ; first draft prep. by L. Friberg (1991). *Inorganic mercury. Environmental Health Criteria 118*. Geneva: World Health Organization. ISBN 9241571187.
95. ^ Bluhm, RE et al (1992). "Elemental Mercury Vapour Toxicity, Treatment, and Prognosis After Acute, Intensive Exposure in Chloralkali Plant Workers. Part I: History, Neuropsychological Findings and Chelator effects". *Hum Exp Toxicol* **11** (3): 201–10. doi:10.1177/096032719201100308. PMID 1352115.
96. ^ Bluhm, Re; Bobbitt, Rg; Welch, Lw; Wood, Aj; Bonfiglio, Jf; Sarzen, C; Heath, Aj; Branch, Ra (1992). "Elemental mercury vapour toxicity, treatment, and prognosis after acute, intensive exposure in chloralkali plant workers. Part I: History, neuropsychological findings and chelator effects". *Human & experimental toxicology* **11** (3): 201–10. doi:10.1177/096032719201100308. PMID 1352115.

97. ^ Cocoros, G.; Cahn, P. H.; Siler, W. (1973). "Mercury concentrations in fish, plankton and water from three Western Atlantic estuaries". *Journal of Fish Biology* **5**(6): 641–647. doi:10.1111/j.1095-8649.1973.tb04500.x.edit

98. ^ "Mercury: Laws and regulations". United States Environmental Protection Agency. April 16, 2008. Retrieved 2008-05-30.

99. ^ "Reductions in Mercury Emissons". International Joint Commission on the Great Lakes.

100. ^ "Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment". 2002/95/EC. Article 4 Paragraph 1. e.g. "Member States shall ensure that, from July 1, 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)."

101. ^ "Mercury compounds in European Union:". EIA Track. 2007. Retrieved 2008-05-30.

102. ^ Jones H. (July 10, 2007). "EU bans mercury in barometers, thermometers". Reuters. Retrieved 2008-05-30.

103. ^ "Norway to ban mercury". EU Business. December 21, 2007. Archived from the original on 2008-01-21. Retrieved 2008-05-30.

104. ^ Berg, T; Fjeld, E; Steinnes, E (2006). "Atmospheric mercury in Norway: contributions from different sources". *The Science of the total environment* **368** (1): 3–9.doi:10.1016/j.scitotenv.2005.09.059.PMID 16310836.

Okay, Now that we have a clearer understanding of "What Mercury is", let us look at it in a little more depth. From the Wikipedia explanation above, we see that Mercury is a naturally occurring, rare element. We also see that Mercury has been used in the manufacturing process; it has been used in medicine for Dentistry Amalgams and as a stabilizer in some vaccines. (See Medicine above)

I would also like to emphasize the information contained in the paragraph **"Releases in the Environment"** in the above Wikipedia article. Clearly, Mercury is a naturally occurring phenomenon. Mercury, no matter what will always exist in our ecology.

It is important to get right to the heart of the matter that "Extreme" Environmentalists are so concerned with. Therefore, I would like to restate what Wikipedia said in the section "Other applications made use of the chemical properties of mercury."

Gold and silver mining. Historically, mercury was used extensively in hydraulic gold mining in order to help the gold to sink through the flowing water-gravel mixture. Thin mercury particles may form mercury-gold amalgam and therefore increase the gold recovery rates.[5] Large-scale use of mercury stopped in the 1960s. However, mercury is still used in small scale, often clandestine, gold prospecting. It is estimated that 45,000 metric tons of mercury used in California for placer mining have not been recovered.[70] Mercury was also used in silver mining.[71]

Recalling what Wikipedia stated above about the "Releases in the Environment", approximately 50% occur from natural sources. Of the other 50%, only 11% was/is caused by Gold production. Not to make light of this amount, while significant, there are many other more serious causes for the presence of mercury, but to date, the main focus of overzealous environmentalist has been small-scale gold mining.

I am not trying to defend those, past or present, who use(d) Mercury to gather fine particles of gold, but merely pointing out that the focus would be better aimed at the 65% from stationary combustion, of which coal-fired power plants are the largest aggregate source.

Modern, responsible small-scale miners do not pour Mercury into the rivers and streams in the United States. In fact, the small-scale miners actually remove the 98% of the Mercury encountered during their operations in the rivers and streams. [See ***BPS Project Title: HUMBUG CK-SOUTH YUBA PILOT MERCURY CLEANUP PROJECT, BPS Project Number : (#36234)]***

- In the mentioned report, Mr. Charlie Alpers, USGS Research Chemist and leading authority on the subject of mercury (circa Fall 2007) stated:

  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 stated [... that modern science now has the equipment to measure the presence of mercury in nearly every substance known to man. He said [... mercury is present nearly everywhere. He said the instruments at his disposal would detect mercury in any of the soils or riverbeds in California.

While this is most certainly true, these sophisticate instruments still cannot identify WHERE the mercury came from. It is not disputed that much of the mercury found in the soils and riverbeds in California came from antiquated methods of gold recovery. These methods, used in the late 1800's and early 1900's have been banned in more recent years It can therefore be surmised that little or no introduction of mercury into the streams and rivers in the United States currently comes from small-scale miners.

1. Having said that and remembering that small-scale miners have been proven to capture 98% [1] of the mercury encountered in their small dredging operations, it can safely be stated that small-scale dredgers are helping to "clean up" the waterways in California and many other states in the United States. This is a VERY GOOD thing! So, why are the small-scale miners constantly under attack by these extremist groups?

It has also been show that large-scale clean-up companies dredging to remove mercury from lakes and reservoirs can only capture 95% of the mercury encountered.[2] This has been confirmed by the Nevada Irrigation District's (NID):

*"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."*[3]

Claudia Wise, a retired Physical Scientist, U.S. Environmental Protection Agency has stated in numerous papers and presentations:

"Humphreys, Alpers and Marvin-DiPasquale have attempted to quantify effects of small-scale suction dredging on mercury. Although they have added bits of

[1] Pro-Mack Mining, Underwater Mining Specialists letter to Mark Stopher, CDF&G date 3/6/2010 from Dave McCracken, page 4.
[2] Pro-Mack Mining, Underwater Mining Specialists letter to Mark Stopher, CDF&G date 3/6/2010 from Dave McCracken, page 10.
3 Pro-Mack Mining, Underwater Mining Specialists letter to Mark Stopher, CDF&G date 3/6/2010 from Dave McCracken, page 10. The Union.com News "Gold Rush toxics in our water: What can be done?" by Dave Moller - Senior Staff Writer

information to the data base of known mercury hotspots, this information cannot be correlated to effects that suction dredges may have on Hg in the environment."

"Their conclusions were formed from observations made from enclosed containers under high surface tension. It is of concern that their observations were extrapolated from data gathered in a hotspot to represent a real stream environment where they say Hg would float indefinitely. Even while panning concentrates gold floats until the surface tension is reduced."

"Overburden and oxygenated water flowing off the end of a sluice box submerges and mixes below the water surface. This turbulent action breaks the surface tension and the dense materials settle out in a short distance."

"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."[4]

"Mercury (Hg) and methylmercury (CH3Hg+) concentrations in streambed sediment and water were determined by 27 locations throughout the Sacramento River Basin, CA.

"Although Hg concentrations in water downstream of the Hg mining operations were measured as high as 2248 ng/l during storm water runoff events, the transported Hg was found to have a low potential for geochemical transformations, as indicated by the low reactivity to the reducing agent (0.0001% of the total), probably because most of the Hg in the unfiltered water sample was in the mercury sulfide form."[5]

4 US EPA, 2010, Biological Evaluation f or Small Placer Miners in Idaho National Pollutant Discharge Elimination System (NPDES) General Permit, U.S. Environmental Protection Agency, Region 10, Seattle, Washington

5 Domagalski, J. 2001. Mercury and methylmercury in water and sediment of the Sacramento River Basin, California, Applied geochemistry, vol. 16, no15, pp.1677-1691

"In comparisons between mined and unmined basins, across all sites, fish Hg, as wet weight, was not significantly different between sites in unmined basins and mined basins."

"Concentrations of methylmercury in bed sediment and unfiltered stream water from sites in unmined basins were not significantly different from those in mined basins; however, total mercury concentrations were significantly higher in bed sediment and stream water from sites in mined basins." [6]

"Also noted was that percent of methylmercury (percentage MeHg/THg) in bed sediment and unfiltered water were significantly higher in unmined basins. Although THg concentrations in unfiltered water were higher as a group from streams in mined basins, MeHg concentrations were not as high relative to those unmined basins. Water from unmined basins low in THg was high in MeHg."[7]

Here now is a report regarding Methylmercury's effect on Fish and Human Health. This report was presented by two retired U.S. EPA Scientists, Claudia J. Wise and Joseph C. Greene:

Selenium Antagonism to Mercury

Claudia J. Wise, Physical Scientist
Joseph C. Greene, Research Biologist/Ecotoxicologist

Does Methylmercury Cause Significant Harm to Fish or Human Health?

Published peer reviewed articles leave no doubt that Hg contamination in historic mining basins is significant. However, little data is available regarding how small scale suction dredging effects Hg.

The fact remains that most suction dredgers throughout the state do not see hot spot's of Mercury. Most report seeing only occasional drops of mercury or amalgamated gold if, any.

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6 USGS. 2009. Mercury in Fish, Bed Sediment and Water from Streams Across The United States. 1995-2005

7 USGS. 2009. Mercury in Fish, Bed Sediment and Water from Streams Across The United States. 1995-2005

Humphreys (2005), Alpers (2007) and Marvin-DiPasquale (2009) have attempted to quantify effects of small scale suction dredging on mercury. Although they have added bits of information to the data base of known mercury hotspots, little is still known about effects suction dredges may have on Hg in the environment.

Rick Humphreys. 2005. Mercury Losses and Recovery, During a Suction Dredge Test in the South Fork of the American River. In House Report, California Water Board.
Charlie Alpers. 2007. CDFG PAC Meeting overview.

M. Marvin-DiPasquale, C.N. Alpers, J.A. Fleck, J.L. Agee, E. Kakouros, Le H. Kieu, E. Beaulieu, and D. Lawler. 2009. Presented at the 19th Annual Meeting of the Northern California Regional Chapter of the Society of Environmental Potential impact of disturbance events on mercury associated with hydraulic mining sediments. Toxicology and Chemistry.

Their conclusions were formed from observations made from enclosed containers under high surface tension. What is of concern is that their observations were extrapolated to represent a real stream environment where they say Hg would float indefinitely.

While panning gold concentrates even gold float until the surface tension is reduced.

Overburden and oxygenated water flowing off the end of a sluice box submerges and mixes below the water surface. This turbulent action breaks the surface tension and the dense materials settle out in a short distance.

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."

US EPA, 2010, Biological Evaluation for Small Placer Miners in Idaho National Pollutant Discharge Elimination System (NPDES) General Permit, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Tom Trexler shared with you, in his presentation on Hg speciation, some of the many factors that can mitigate Hg methylation. One factor is selenium's ability to moderate mercury toxicity.

There is no doubt that methylmercury can cause great harm. Examples of this occurred in Minimata, Japan where inhabitants were exposed to 27 tons of Hg waste dumped in the bay but with no corresponding shift in selenium levels.

SUSUMU NISHIGAKI* & MASAZUMI HARADA. 1975. Methylmercury and selenium in umbilical cords of inhabitants of the Minamata area. Nature 258, 324 - 325

"A large body of evidence has been published that indicates supplemental dietary selenium moderates or counteracts mercury toxicity," "Mercury exposures that might otherwise produce toxic effects are counteracted by selenium, particularly when the Se:Hg molar ratios approach or exceed 1."

Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, Environmental Science and Technology., 3919–3925

Selenium has a high affinity to bind with mercury, blocking mercury from binding to other substances, such as brain tissue. The bond formed is irreversible.

"All higher animal life forms require selenium-dependent enzymes to protect their brains against oxidative damage."

Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, Environmental Science and Technology., 3919–3925

At high exposures Se and Hg can each be individually toxic, but evidence supports the observations that co-occurring Se and Hg antagonistically reduce each other's toxic effects

Parizek et al. "The protective effect of small amounts of selenite in sublimate intoxication." Experientia. 1967 Feb 15;23(2):142-3.

Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, Environmental Science and Technology., 3919–3925

In 1978, scientists from Sweden were reporting that "mercury is accompanied by selenium in all investigated species of mammals, birds, and fish," adding that it "seems likely that selenium will exert its protective action against mercury toxicity in the marine environment"

Beijer, K., A. Jernelov (1978). "Ecological aspects of mercury–selenium interactions in the marine environment." Environ Health Perspect 25:43-5.

In 2000, a group of Greenland scientists published the results of mercury and selenium tests performed on the muscles and organs of healthy fish, shellfish, birds, seals, whales, and polar bears. They found that, "selenium was present in a substantial surplus compared to mercury in all animal groups and tissues"

R. Dietz, F. Riget and E. W. Born. An assessment of selenium to mercury in Greenland marine animals. The Science of The Total Environment. Volume 245, Issues 1-3, **17 January 2000, Pages 15-24**

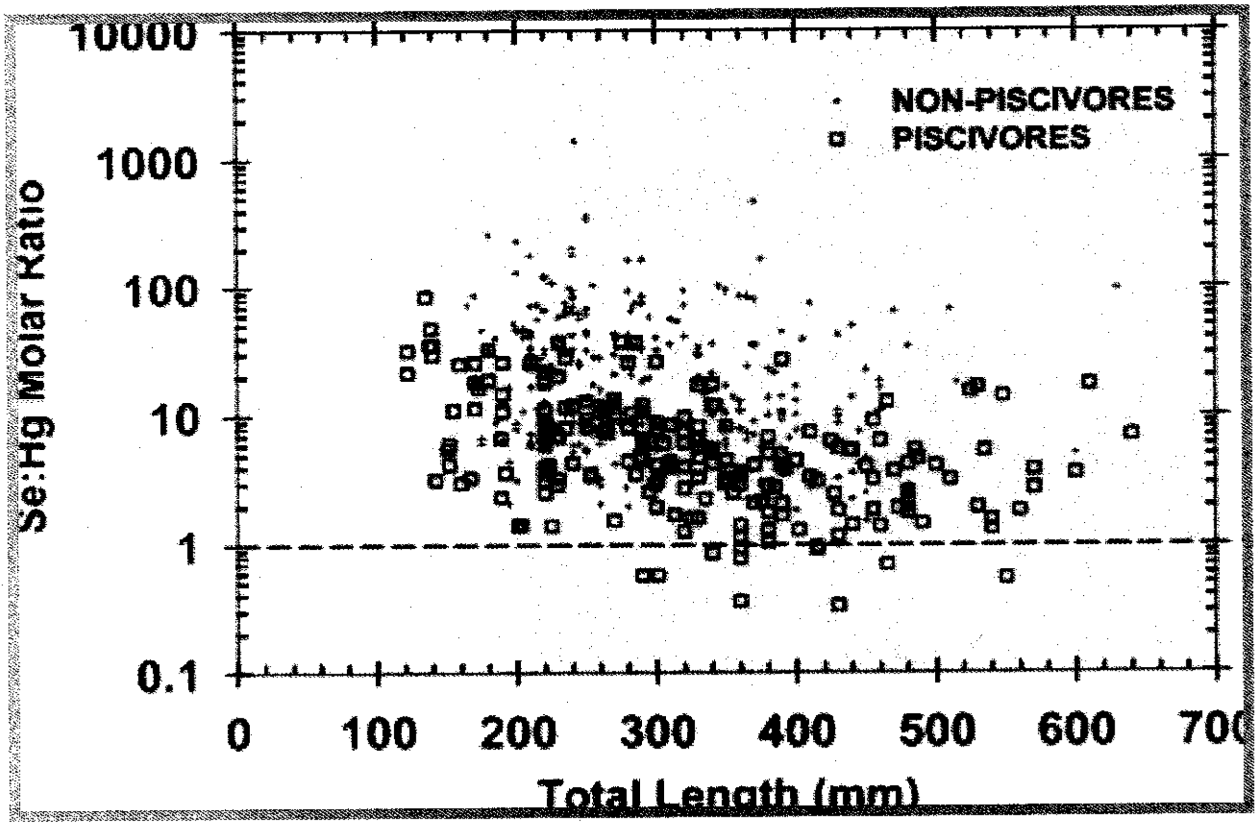
Researchers at Laurentian University in Ontario reported that selenium deposits, from metal smelters into lake water, greatly decreased the absorption of mercury by microorganisms, insects, and small fish. Suggesting a strong antagonistic effect of Se on Hg assimilation.

Yu-Wei Chen, N. Belzile and J. Gunn. Antagonistic effect of selenium on mercury assimilation by fish populations near Sudbury metal smelters? Limnology and Oceanography. 2001;46(7):1814-1818.

Peterson's group collected 468 fish representing 40 species from 130 sites across 12 western U.S. states. Samples were analyzed for whole body Se and Hg concentrations. The fish samples were evaluated relative to a wildlife protective Hg threshold of 0.1 ug Hg/g wet weight, and the current tissue based MeHg water quality criteria for the protection of humans 0.3 ug Hg/g wet weight and presumed protective against Hg toxicity where the Se:Hg molar ratios are greater than 1.

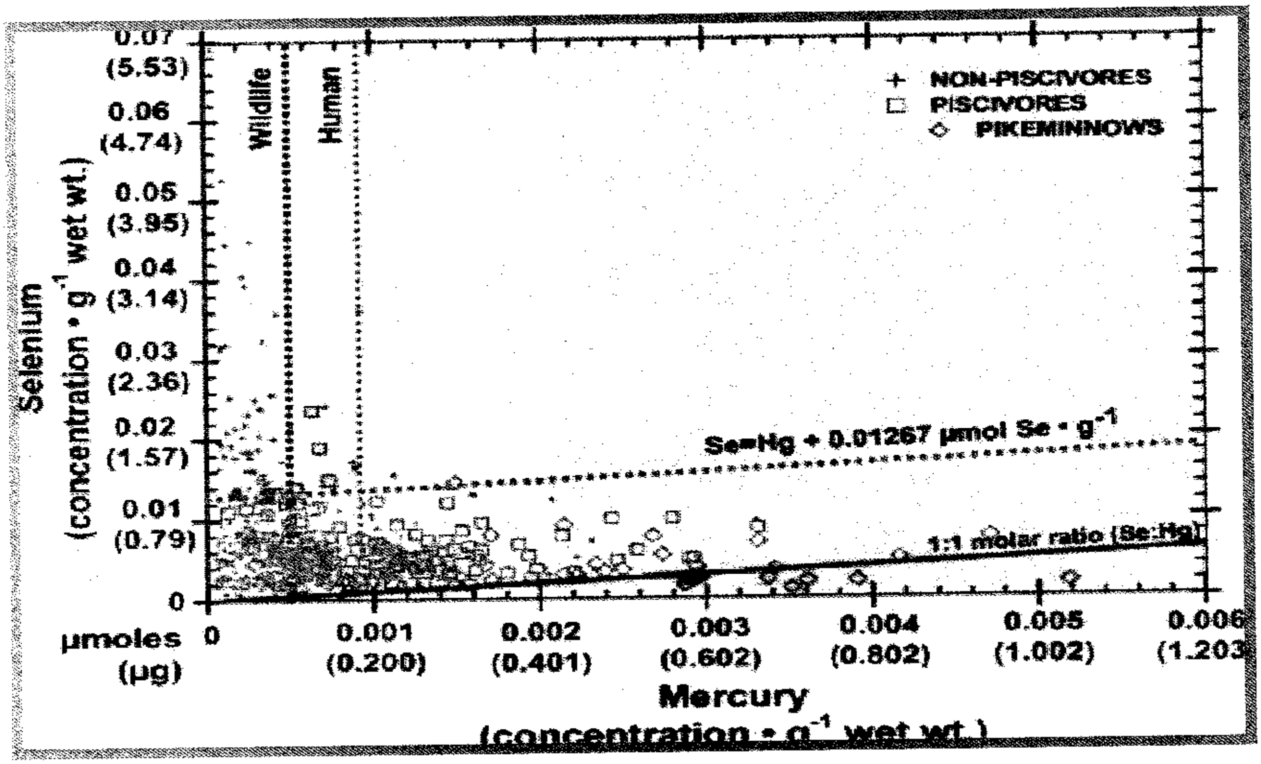
Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, Environmental Science and Technology., 3919–3925

Molar ratio of selenium to mercury relative to fish size. The horizontal dotted line is the Se:Hg, 1:1 line.



Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, *Environmental Science and Technology.*, *3919–3925*

Selenium and mercury concentrations in whole fish tissue.



Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, *Environmental Science and Technology.*, *3919–3925*

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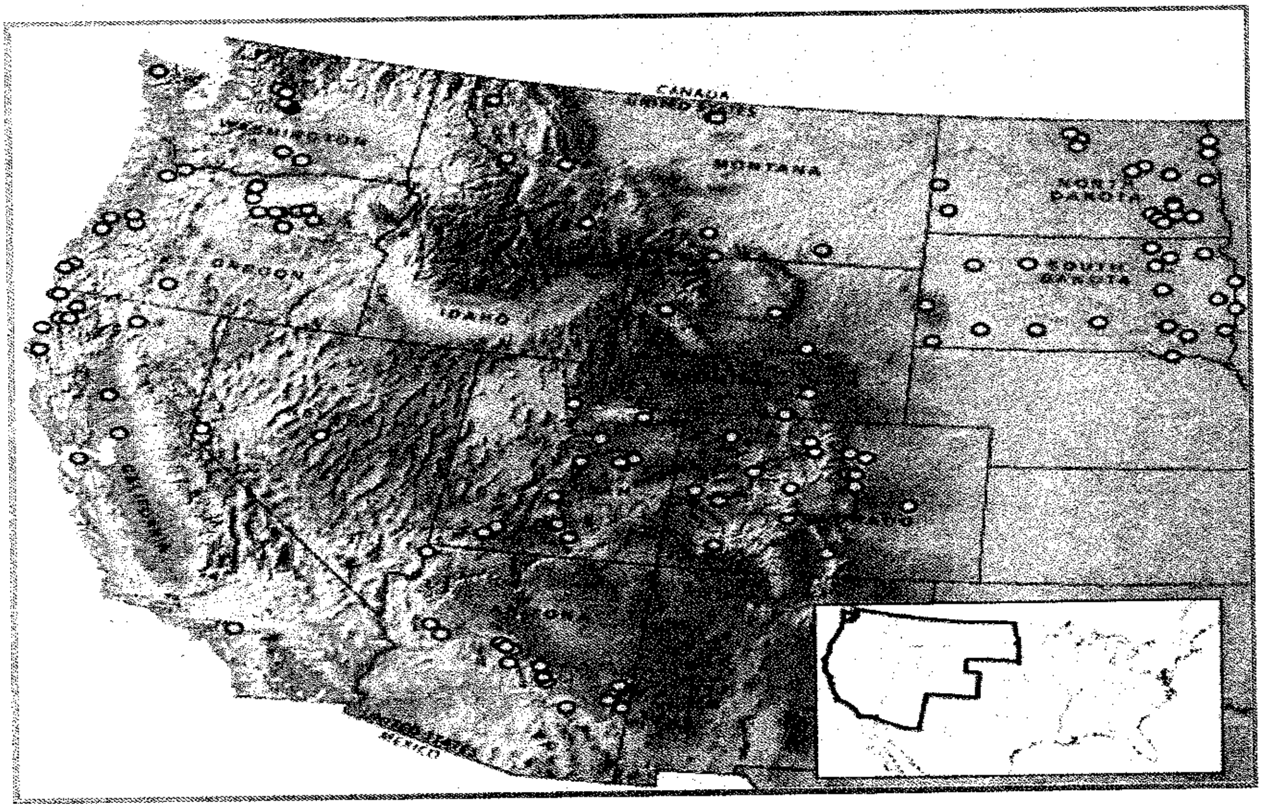
Location of probability based sites where fish tissue samples were collected for Hg and Se analysis.



Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, *Environmental Science and Technology., 3919–3925*

Results showed 97.5% of the freshwater fish in the survey had sufficient Selenium to potentially protect them and their consumers against mercury toxicity.

Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, Environmental Science and Technology., 3919–3925

Peterson's study included data for samples collected in California which, in all cases, contained proportions of mercury to selenium that were adequate to protect fish, wildlife and human health.

The California results were 100% protective.

"Mercury toxicity only occurs in populations exposed to foods containing disproportionate quantities of mercury relative to selenium."

Ralston, Nicholas. Physiological and Environmental Importance of Mercury-Selenium Interactions. United States Environmental Protection Agency National Forum on Contaminants in Fish. September 19, 2005.

According to OEHHA, no one in California has ever died of Mercury poisoning from eating sports fish.

"Methylmercury exposure to wildlife, and to humans through fish consumption, has driven the concern for aquatic mercury toxicity. However, the MeHg present in fish tissue might not be as toxic as has been suspected."

Harris HH, Pickering IJ, George GN. 2003. The chemical form of mercury in fish. Science 301:1203.

"Recent structural analysis determined that fish tissue MeHg most closely resembles MeHg cysteine (MeHg[Cys]) (*or chemically related species*) which contains linear two-coordinate Hg with methyl and cysteine sulfur donors.

MeHg[Cys] is far less toxic to organisms than the MeHgCl that is commonly used in Hg toxicity studies."

Harris HH, Pickering IJ, George GN. 2003. The chemical form of mercury in fish. Science 301:1203.

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40 years of research illuminates the conclusion of 100's of journal articles that indicate mercury is not a threat to the environment or human health if the molar ratio of Selenium:Mercury meets the defined criteria. The results from these studies also show that methylmercury is not deleterious to fish.

In conclusion, I am convinced that if the reader conducts their own investigation into the effects of Mercury on the habitat of streams and rivers in any of the Western States, they will conclude that the FACTS presented here are 100% accurate. They will likewise conclude that the FICTITIOUS statements proffered by the "Extremists" are fabrications and "Chicken Little" scare tactics being used to fulfill some other covert agenda!

I will now list some of the FACTS and Fallacies for the reader:

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FACTS vs. FICTION

FACT:

MERCURY IS A NATURALLY OCCURRING ELEMENT

FACT:

MERCURY HAS BEEN USED IN MANUFACTURING PROCESSES

FACT:

MERCURY HAS BEEN USED IN DENTISTRY AND MEDICINES

FACT:

MERCURY WAS USED IN GOLD MINING AS AN AMALGUM TO ATTRACT GOLD

FACT:

MERCURY HAS BEEN OUTLAWED FOR USE IN GOLD MINING

FICTION:

MERCURY POISONING OCCURS FROM EATING FISH FROM CALIFORNIA STREAMS AND RIVERS

FACT:

IN SPITE OF ALL THE MERCURY USED AND SPILLED IN CALIFORNIA RIVERS AND STREAMS FOR GOLD MINING PURPOSES IN THE PAST, ACCORDING TO OEHHA, NOT ONE REPORTED DEATH OF MERCURY POISONING FROM EATING FISH FROM CALIFORNIA RIVERS AND STREAMS HAS OCCURRED.

Here is a direct quote from http://www.oehha.ca.gov/fish/hg/index.html

Can mercury poisoning occur from eating fish in California?

No case of mercury poisoning has been reported from eating California sport fish. The levels of mercury in

California fish are much lower than those that occurred during the Japanese outbreak. Therefore, overt poisoning resulting from sport fish consumption in California would not be expected. At the levels of mercury found in California fish, symptoms associated with methyl mercury are unlikely unless someone eats much more than what is recommended or is particularly sensitive. The fish consumption guidelines are designed to protect against subtle effects that would be difficult to detect but could still occur following unrestricted consumption of California sport fish. This is especially true in the case of fetuses and children.

FACT:

SMALL- SCALE SUCTION DREDGERS HAVE BEEN PROVEN TO RECOVER AT LEAST 98% OF MERCURY FOUND IN RIVERS AND STREAMS IN AREAS OF HIGH MERCURY USE DURING "OLD" PROSPECTING/MINING DAYS.

FACT:

BEST COMMERCIAL RECOVERY EFFORTS OF MERCURY CONCENTRATIONS IN RIVERS AND STREAMS IS 95% OR LESS.

FACT:

SMALL- SCALE MINERS UTILIZING SUCTION DREDGES NOT ONLY CLEAN UP MERCURY FROM RIVERS AND STREAMS, BUT ALSO OTHER CONTAMINATES SUCH AS LEAD FROM FISHING WEIGHTS AS WELL AS RIFLE AND SHOTGUN AMMUNITION. ADDITIONAL DANGEROUS DEBRIS SUCH AS FISHING LURES, HOOKS, TANGLED FISHING LINE, AND EMPTY PLASTIC WATER BOTTLES ARE ALSO REMOVED.

FICTION:

SMALL-SCALE SUCTION DREDGING RELEASES MERCURY BURIED IN THE STREAMBED CAUSING HIGH DOWNSTREAM, TOXIC LEVELS OF MERCURY

FACT:

40 YEARS OF RESEARCH ILLUMINATES THE CONCLUSION OF 100'S OF JOURNAL ARTICLES THAT INDICATE MERCURY IS NOT A THREAT TO THE ENVIRONMENT OR HUMAN HEALTH IF THE MOLAR RATIO OF SELENIUM:MERCURY MEETS THE DEFINED CRITERIA. THE RESULTS FROM THESE STUDIES ALSO SHOW THAT METHYLMERCURY IS NOT DELETERIOUS TO FISH.

FACT:

FROM A CLAUDIA WISE POWERPOINT PRESENTATION: "THERE IS NO DOUBT THAT METHYLMERCURY CAN CAUSE GREAT HARM. EXAMPLES OF THIS OCCURRED IN MINIMATA, JAPAN WHERE INHABITANTS WERE EXPOSED TO 27 TONS OF HG WASTE DUMPED IN THE BAY BUT WITH NO CORRESPONDING SHIFT IN SELENIUM LEVELS."

HOWEVER, "A LARGE BODY OF EVIDENCE HAS BEEN PUBLISHED THAT INDICATES SUPPLEMENTAL DIETARY SELENIUM MODERATES OR COUNTERACTS MERCURY TOXICITY,"

"MERCURY EXPOSURES THAT MIGHT OTHERWISE PRODUCE TOXIC EFFECTS ARE COUNTERACTED BY SELENIUM, PARTICULARLY WHEN THE SE:HG MOLAR RATIOS APPROACH OR EXCEED 1."

"SELENIUM HAS A HIGH AFFINITY TO BIND WITH MERCURY, BLOCKING MERCURY FROM BINDING TO OTHER SUBSTANCES, SUCH AS BRAIN TISSUE. THE BOND FORMED IS IRREVERSIBLE."

"ALL HIGHER ANIMAL LIFE FORMS REQUIRE SELENIUM-DEPENDENT ENZYMES TO PROTECT THEIR BRAINS AGAINST OXIDATIVE DAMAGE."

FACT:

SMALL- SCALE SUCTION DREDGERS STIR UP THE NUTRIENTS BURIED IN THE SEDIMENT OF THE STREAM-BEDS PROVIDING ADDITIONAL FOOD FOR INDIGENOUS LIFE.

FACT:

SMALL- SCALE SUCTION DREDGERS PROVIDE SACTUARIES OF CALM WATERS FOR INDIGENOUS HABITAT IN NATURALLY FAST-MOVING WATERS, ALLOWING THEM PLACES TO REST/SLEEP.

FICTION:

IN A LAKE COUNTY NEWS ARTICLE WRITTEN NOVEMBER 17, 2009 BY ELIZABETH LARSON, DR. MOYLE WAS CITED AS FOLLOWS: "BUT GIVEN THE SEVERELY THREATENED NATURE OF SUMMER STEELHEAD, SPRING CHINOOK SALMON, AND COHO SALMON POPULATIONS IT IS BEST TO ASSUME THAT DREDGING (AND ASSOCIATED ACTIVITY) IS HAVING A NEGATIVE IMPACT UNLESS IT CAN BE PROVEN OTHERWISE. AS STUDIES SHOW, THERE ARE LOTS OF REASONS TO SUSPECT AN IMPACT IS THERE," MOYLE NOTED".

FACT:

AS STATED BY RETIRED U.S. EPA SCIENTIST, JOSEPH GREENE: "I FIND THIS *GUILTY UNTIL PROVEN INNOCENT* ATTITUDE DISTURBING COMING FROM A SCIENTIST. HOWEVER, DR. MOYLE HAS BEEN CONSISTENT IN HIS POSITION OF DENYING THE RIGHTS OF SUCTION DREDGERS TO PERFORM THEIR MINING OPERATIONS WHILE CLEARLY STATING THAT HE HAS NO SCIENTIFIC CAUSE EFFECT RELATIONSHIP THAT SUCTION DREDGING HAS EVER HARMED A SINGLE FISH".

FICTION:

DR. MOYLE GOES ON TO STATE, "IT SHOULD BE ASSUMED THERE IS HARM, UNLESS IT CAN BE PROVEN OTHERWISE. ONE REASON FOR TAKING THIS CONSERVATIVE POSITION IS THAT WE SIMPLY DO NOT KNOW THE EFFECT OF DREDGING ON MANY SPECIES."

FACT:

ONCE AGAIN, JOSEPH GREENE - RESEARCH BIOLOGIST, USEPA, RETIRED STATES: "THIS IS MERE OPINION WITHOUT SCIENTIFIC SUPPORTING DATA, FOR AS PREVIOUSLY DESCRIBED, DR. MOYLE HAS IN SUBSTANCE ACKNOWLEDGED THAT HE DOES NOT HAVE ANY DOCUMENTATION TO SUPPORT THESE ASSERTIONS."

FACT:

IN A LETTER DATED JANUARY 26, 2009 FROM DONALD KOCH, THEN DIRECTOR OF CALIFORNIA'S DEPARTMENT OF FISH AND GAME, ACKNOWLEDGED RECEIPT BY LETTER OF THE PETITION FOR EMERGENCY RULEMAKING AND STATED, "THE

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DEPARTMENT SHARES YOUR CONCERN ABOUT THE FISH SPECIES THAT ARE THE SUBJECT OF THE PETITION. HOWEVER, FOR THE REASONS EXPLAINED BELOW, THE DEPARTMENT MUST RESPECTFULLY DENY THE PETITION BECAUSE THERE IS NOT SUBSTANTIAL EVIDENCE TO SUPPORT A FINDING THAT AN EMERGENCY EXISTS AS A MATTER OF LAW."

FACT:

IN 1982, DR. MOYLE STATED, "FISH AND INVERTEBRATES DISPLAYED CONSIDERABLE ADAPTABILITY TO DREDGING, PROBABLY BECAUSE THE STREAMS NATURALLY HAVE SUBSTANTIAL SEASONAL AND ANNUAL FLUCTUATIONS".

FACT:

DISSOLVED OXYGEN (DO) IS PROBABLY THE SINGLE MOST IMPORTANT WATER QUALITY FACTOR. OUR ATMOSPHERE IS 20% OXYGEN OR 200,000 PPM (PARTS PER MILLION). RARELY WILL A POND HAVE MORE THAN 10 PPM OF DISSOLVED OXYGEN.

FACT:

CONCENTRATIONS OF LESS THAN 3 PPM DISSOLVED OXYGEN STRESS MOST WARM WATER SPECIES AND CONCENTRATIONS BELOW 2 PPM WILL KILL SOME SPECIES.

FACT:

OFTEN, FISH THAT HAVE BEEN STRESSED BY DISSOLVED OXYGEN OF 2 TO 3 PPM WILL BECOME SUSCEPTIBLE TO DISEASE.

FACT:

SUCTION DREDGING INCREASES THE AMOUNT OF DISSOLVED OXYGEN IN THE WATER. THIS IS CREATED BY THE MOVEMENT OF WATER UP THE HOSE, THROUGHT THE HEADERBOX, OVER THE DREDGE RIFFLES, AND THE CASCADING OF WATER FROM THE END OF THE SLUICE BACK INTO THE RIVER/STREAM/POND, ETC.

FACT:

THE IDEAL STREAM WILL HAVE HIGH LEVELS OF DISSOLVED OXYGEN, GOOD WATER CLARITY, SUFFICIENT SHADE, A RELIABLE WATER SOURCE, DIVERSE HABITAT, A SNAKE-LIKE DEEP CHANNEL, A GRADIENT BETWEEN 0.5% AND 2%, FERTILE WATER, A GRAVEL BOTTOM AND COOL TEMPERATURES. THESE FACTORS WORK IN HARMONY TO DETERMINE THE QUANTITY AND QUALITY OF FISH.

FICTION:

SUCTION DREDGING CREATES LARGE PLUMES OF TURBIDITY WHICH ARE HARMFUL TO DOWNSTREAM BIOTA.

FACT:

"EFFECTS FROM ELEVATED LEVELS OF TURBIDITY AND SUSPENDED SEDIMENT NORMALLY ASSOCIATED WITH SUCTION DREDGING AS REGULATED IN THE PAST IN CALIFORNIA, APPEAR TO BE LESS THAN SIGNIFICANT WITH REGARD TO IMPACTS TO FISH AND OTHER RIVER RESOURCES BECAUSE OF THE LEVEL OF TURBIDITY CREATED AND THE SHORT DISTANCE DOWNSTREAM OF A SUCTION DREDGE WHERE TURBIDITY LEVELS RETURN TO NORMAL." (CDFG, 1997)

FACT:

EXTENSIVE STUDIES HAVE DETERMINED THAT THE BEST METHOD OF REMOVING MERCURY OUT OF OUR WATERWAYS IS DREDGING, EITHER BUCKET LINE OR SUCTION DREDGING.

FACT:

THE GOVERNMENT HAS DETERMINED THAT COMMERCIAL DREDGING IS TOO COSTLY TO UNDERTAKE.

FACT:

SUCTION DREDGE MINERS PERFORM THIS PROCESS FREE OF CHARGE (NO COST TO THE GOVERNMENT OR TAX-PAYERS).

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FICTION:

THE SUCTION DREDGE PROCESS REINTRODUCES THE MERCURY BACK INTO THE RIVERS/STREAMS/PONDS, ETC.

FACT:

IT HAS BEEN PROVEN THAT SUCTION DREDGING CAPTURES 98% OF THE MERCURY FOUND IN THE SUCTION DREDGE PROCESS. THE FACT THAT A POTENTIAL OF 2% OF DREDGED UP MERCURY IS REINTRODUCED INTO THE WATER IS SIGNIFICANTLY LESS THAN WHAT WAS PRESENT BEFORE THE DREDGING PROCESS.

FACT:

DURING THE 1980'S MR. GERALD HOBBS COLLECTED MORE THAN 300 POUNDS OF MERCURY OVER A 7 YEAR PERIOD OF DREDGING ON THE YUBA RIVER IN CALIFORNIA. MOST DREDGERS REMOVE SIGNIFICANT AMOUNTS OF MERCURY EVERY YEAR THAT THEY ARE ALLOWED TO DREDGE.

FACT:

MOST SUCTION DREDGE MINING OCCURS IN AREAS WHERE HIGHER CONCENTRATIONS OF MERCURY ARE FOUND, SINCE THEY ARE THE GOLD RICH AREAS WHERE OLD-TIME MINERS UTILIZED MERCURY (BEFORE THE DANGERS OF MERCURY WERE KNOWN).

FACT:

SUCTION DREDGING PERFORMS THE SAME FUNCTION IN SUMMER AND FALL MONTHS AS "MOTHER NATURE" PERFORMS IN HER SPRING FLOODS, THUS EXTENDING THE POSITIVE EFFECTS ON THE WATERWAYS.

RECOMMENDATION:

CALIFORNIA AND OTHER STATES WHERE SUCTION DREDGING NORMALLY OCCUR SHOULD SET UP MERCURY COLLECTION STATIONS WHERE MINERS CAN DELIVER THE CAPTURED MERCURY. THIS WOULD ALLOW THE STATE(S) TO TRACK EXACT AMOUNTS OF MERCURY RECOVERED BY SUCTION DREDGE MINERS.

Think about it for a second. The State's argument is essentially that the mercury in the river bed is "locked" in the river. It's OK for the river to move it, but not OK for the dredge to move it. This argument requires that you buy into the following chain of logic:

1. A natural event that creates a bottom moving event is OK if it moves all the mercury, because according to CDFG it is occurring during a high water event, so the amount of Hg being flushed doesn't matter. This ignores that quantity of mercury released has nothing to do with amount of water flow. The reality is this mercury will move a long distance under high water flows, and there will be a lot of it.

2. Mercury, under their argument is essentially in a HAZMAT container at the bottom of the river and is therefore never moving during low flow except if a dredge disturbs it. This ignores the Humphries study that found mercury moving at extreme low flow due to gravity.

3. The amount of mercury, CDFG claims in the Final SEIR that dredgers remove is "insignificant." They then say suction dredgers, on average recover about 50kg a year. OK, take that times the 50 years we've been recovering is 2.5 metric tons of mercury or 10% of the total mercury released during the gold rush. Likely, the amount of mercury recovered in the 1960's and 1970's was far higher, but we have no records. The recovery and removal of 2.5 tons of mercury is not insignificant.

On Thu, Mar 8, 2012 at 9:20 PM, Mr. Rick Eddy wrote:

Mr. Mike Phelps reminds us that mercury is not a discharge. See Case below:

Reintroduction of Mercury

In United States v. Lambert, 18 Env't Rep.Cas. (BNA) 1294, 1981 WL 14886 (M.D.Fla.1981), aff'd, 695 F.2d 536 (11th Cir.1983), the court stated that back-spill from excavation "does not ... constitute the discharge of a pollutant [under the Act], when the dredged spoil simply falls back into the area from which it has just been taken. Such an event cannot reasonably be considered to be the addition of a pollutant." [FN16]

<u>OTHER MAJOR AREAS OF CONCERN</u>

1. I am concerned that the SWRCB Project personnel seem to working in a vacuum and I question what attempts, if any, have been made to coordinated with other responsible agencies to establish a Mercury Policy and Statewide Plan.

- Since it has been established that the majority of mercury contamination is cause by airborne means (i.e. coal-fired power plants), I fail to see that any attempt has been made to coordinate with California Environmental Protection Agency's Air Resources Board.

2. While the SWRCB is only studying the issue of mercury in reservoirs, it seems to be missing the root cause of the problem. That is, the agency has failed to take a requisite "Hard Look" at the elimination of the source of the contamination. As stated above, the largest contributor is industrial air pollution. This program seems to be a "band-aid" when major surgery is needed.

3. As stated in item 2 above, I am more concerned with mitigation of the problem, or at least some program to minimize the current existing mercury contamination issue. I have stated in the treatise above, that RECLAMATION is the way to mitigate existing mercury, as well as other "heavy metals" such as lead and other potentially toxic metals in the California waters.

    - Reservoirs are filled by the rivers and streams that feed them. This is where some of the mercury found in reservoirs comes from. This is the 11% described above that was caused by "uninformed" miners back in the late 1800 and early 1900's. The toxic nature of mercury was not even known back then.

    - The State of California has seen fit to pass legislation to halt ALL suction dredging operations in California waters. This action is completely contrary to the goals of the intended project's purpose. California miners, utilizing suction dredges have been removing Elemental Mercury from the streams and rivers, even before it has a chance to enter the reservoirs, or has a chance to become MethylMercury, which everyone seems to be most concerned about.

    - Small-scale suction dredge miners have been removing this Elemental Mercury for years without ANY cost to the State. In point of fact, these small-scale miners have been required to **pay** the State for the privilege of doing **RECLAMATION**, with no thanks or compensation from the State. Now the State has virtually "shot itself in the foot", so to speak, by stopping the **FREE** Reclamation they had been enjoying for many years.

    - The State, however, is currently considering wasting more Tax-payers' money to engage in a contract with "professional" dredging companies (which as I have stated above, can only guarantee a maximum recovery rate of 95%, while the independent small-scale suction dredge miner has been show to recover a minimum or 98% of mercury in the waterways. Therefore, this constitutes a blatant waste of Tax-payer dollars in a State where the deficit is already out of control.

4. The obvious short-sightedness of the State has once again chosen to listen to "extreme" environmentalists' rhetoric and supposition rather than take a "hard look" at the scientific data that is available. (I have cited a small fraction of that scientific data in this comments paper.) Therefore, once again, this "make work" project (in my opinion) has failed to show any data that would be sufficient to make an **informed** decision.

5. When asked if the SWRCB had understood that selenium has a natural affinity to bind with mercury and neutralize the toxic effects of MethylMercury, all I got was blank stares. I then advised them that if they intended to take tissue samples from fish to examine the amount of mercury contained, without also examining the amount of selenium present in the same sample, their conclusions would be invalid and useless.

    - As I stated previously if the amount of selenium is equal to or greater than the amount of mercury, there can be NO harmful effects from ingesting those fish by humans or wildlife.

    - I must again point out that there has never been a recorded death from mercury poisoning caused by eating fish from any of California waters.

6. It was also brought up, that the State of California had no known program for the collection of mercury removed during the miner's reclamation activities. Someone from the briefing group stood up and attempted to refute this statement by pointing out that the statement was false. She went on to state that the "Bay Area" has a mercury collection point to turn in mercury.

    - I direct your attention to the State of California's Department of Toxic Substance Control:

      http://www.dtsc.ca.gov/HazardousWaste/Mercury/#Disposal_of_Mercury_Products

      and ask where are these "collection points?"

    - This is interesting since the mining community has never been advised of this or any other collection points around the State. Additionally, the briefing team's comment is of no real value, if this is the only collection point in the whole State of California. Is the State expecting people to drive or fly to the "Bay Area" to turn in the mercury they have collected?

- This is absurd! The State isn't going to reimburse anyone for their costs of travel to this one collection point, so in essence it is worthless program.

7. The State of California would be better served by funding the establishment of multiple collection stations for mercury and other toxic heavy metals recovered by small-scale suction dredge miners as part of their eco-friendly and free RECLAMATION process.

8. I would also remind you that the State of California and the Federal Government are basically "BROKE." Deficits are at all time high level, therefore, can the State or the Federal Government afford to fund these projects, which continue to leave more questions unanswered, raise new questions, and find no permanent solutions?

9. It is clearly in the best interest of ALL parties to immediately, overturn recent legislation which has made it illegal for small-scale suction dredge miners from continuing their environmentally "friendly" RECLAMATION activities, especially in the areas of high mercury contamination. These areas are mostly found in the gold bearing regions of California.

10. As a point of contention, I raise the question of: How interested can the SWRCB be in actually obtaining the public's input to these projects, if they continue to hold the "open public meetings" on weekdays at 1:00 P.M., when those fortunate enough to have a job can **not** attend?

11. If the SWRCB were really interested in listening to the public's input, these meetings would be held either on a weekday evening at 7:00 P.M. when more of the public is able to attend. Perhaps they are afraid of too much public input!

12. Why hasn't the SWRCB invited some prominent members of the scientific community to voice their opinions at these open public meetings? I know of two extremely capable scientists who would be more than happy to give a briefing on their scientific studies and evidence that supports everything I have stated in this comments paper.

13. Unfortunately, it is possible that the general public may clearly get the impression that the REAL mission of the SWRCB and other governmental agencies are more interested in "job security" than in resolving problems, once and for all! The mentality appears to be "if all the solutions are found, we will be out of our jobs!"

14. I would hope this isn't the case, but without recognition of the facts that I have presented here and the implementation of the suggestions I have made, it will only lead to the conclusion that item 13 above is the FACT!

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SALIENT POINTS FOR THE READERS TO TAKE AWAY

1. A PROJECT ONLY DEALING WITH THE RESERVOIRS IS LIKE "CLOSING THE BARN DOOR AFTER THE HORSE HAS GOTTEN OUT." TO BE MEANINGFUL, THE SOURCE OF THE MERCURY CONTAMINATION MUST BE MITIGATED OR THE PROBLEM NEVER GOES AWAY.

2. THE MAJOR SOURCE OF MERCURY IN CALIFORNIA WATERS IS CAUSED BY AIRBORNE PARTICALS, NOT SMALL-SCALE MINERS!

3. LACK OF COORDINATION BETWEEN ALL STATE AND FEDERAL AGENCIES WILL "DOOM" THE PROJECT, SINCE ONE AGENCY CAN NOT MANDATE THAT ANOTHER AGENCY MUST IMPLEMENT A SOLUTION TO MITIGATE THEIR CONTRIBUTION TO THE TOTAL PROBLEM.

4. MEASURING MERCURY LEVELS IN FISH TISSUE IS MEANINGLESS WITHOUT ALSO MEASURING THE AMOUNT OF SELENIUM LEVELS IN THE SAME TISSUE SAMPLE.

5. MERCURY BONDED WITH SELENIUM IS NOT TOXIC.

6. HIGHLY OXYGENATED WATER IS MORE CONDUCIVE TO HEALTHY WATER DWELLING SPECIES.

7. METHYLMERCURY IS LESS LIKELY TO FORM IN HIGHLY OXYGENATED WATERS.

8. SIMPLY INSTALLING AN AIREATION PROCESS TO CURRENT LAKES AND RESERVOIRS WILL REDUCE THERMOCLINES BY CONSTANTLY

MIXING THE WATER LAYERS. IT WILL ALSO INSTANTLY INCREASE OXYGENATION OF THE WATERS.

9. SUCTION DREDGING CREATES MORE HIGHLY OXYGENATED WATER.

10. DREDGES MOVE AN INSIGNIFICANT AMOUNT OF MERCURY.

11. ANNUAL SPRING FLOODS MOVE SIGNIFICANTLY MORE MERCURY THAN DREDGERS IN A YEAR.

12. COMMERCIAL DREDGE OPERATIONS CAN ONLY RECOVER A MAXIMUM OF 95% OF THE MERCURY DREDGED UP AND COSTS THE STATE AND THE TAX-PAYERS MILLIONS OF DOLLARS.

13. SMALL SCALE SUCTION DREDGE MINERS RECOVER A MINIMUM OF 98% OF MERCURY DREDGE UP AND A NO COST TO THE STATE OR ITS TAX-PAYERS.

14. THE EXPERT THAT HAS SPENT HIS WHOLE CAREER CALCULATING THE HISTORICAL EFFECTS OF MERCURY FROM MINING IS CHARLIE ALPERS, USGS RESEARCH CHEMIST.

15. MR. ALPERS CONCLUSIONS OF CALCULATING MERCURY RELATED TO DREDGING WERE FORMED FROM OBSERVATIONS MADE FROM ENCLOSED CONTAINERS UNDER HIGH SURFACE TENSION. WHAT IS OF CONCERN IS THAT THESE OBSERVATIONS WERE EXTRAPOLATED TO REPRESENT A REAL STREAM ENVIRONMENT WHERE THEY SAY HG WOULD FLOAT INDEFINITELY. THIS OF COURSE IS INCORRECT.

16. THEREFORE, WE CAN NOT PUT ANY CREDENCE IN ANY OF HIS OTHER PAPERS REGARDING CALCULATING THE TONNAGE OF MERCURY LOST INTO THE ENVIRONMENT FROM MINING. IN

REALITY, NO ONE WAS THERE TO KEEP TRACK OF HOW MUCH MERCURY WAS LOST? ALPERS IS PURELY GUESSING!

17. SEEING ALPERS' CALCULATIONS IN A NON-DREDGE STUDY, WHERE HE POINTS FINGERS AT AN EIGHT INCH SUCTION DREDGE PUTTING OUT MORE THAN IS NATURALLY MOVED ANUALLY, CAN WE BELIEVE ANY OF HIS PREVIOUS SCIENCE?

18. RIGHT NOW ALPERS IS CONSULTING WITH SIERRA FUND TO GET MORE GRANT MONEY TO STUDY HG REMEDIATION EFFORTS IN COMBIE RESERVIOR ALONG WITH NID. SOUNDS LIKE IT IS IN HIS BEST INTEREST TO FIND SUCTION DREDGING BAD (DOESN'T ANYONE SEE A CONFLICT OF INTEREST HERE?)

19. HUMPHERYS AND CDFG ARE ALSO CONSULTING WITH SIERRA FUND. ALPERS IS LISTED ON THE SIERRA FUND WEBSITE AS A PARTNER

20. CDFG AND THE WATER BOARD ARE SIERRA FUND PARTNERS ON THIS AND OTHER PROJECTS.

21. DREDGES MOVE AN INSIGNIFICANT AMOUNT OF MERCURY

22. ANNUAL SPRING FLOODS MOVE MUCH MORE MERCURY THAN DREDGERS

23. MERCURY BONDED WITH SELENIUM IS NOT TOXIC

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27. SEEING ALPERS' CALCULATIONS IN A NON-DREDGE STUDY, WHERE HE POINTS FINGERS AT AN EIGHT INCH SUCTION DREDGE PUTTING OUT MORE THAN IS NATURALLY MOVED ANUALLY, CAN WE BELIEVE ANY OF HIS PREVIOUS SCIENCE?

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30. CDFG AND THE WATER BOARD ARE SIERRA FUND PARTNERS ALSO ON DIFFERENT PROJECTS.

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SOME WEB SITES TO LOOK AT:

http://www.epa.gov/mercury/report.htm

http://wi.water.usgs.gov/mercury/

http://pubs.usgs.gov/fs/fs-016-03/

http://en.wikipedia.org/wiki/Amalgam_controversy

http://water.usgs.gov/nawqa/mercury/

http://www.usgs.gov/themes/factsheet/146-00/

http://ithyroid.com/mercury.htm

http://www.oehha.ca.gov/fish/hg/index.html

http://www.redding.com/databases/lake-mercury-levels/

http://www.youtube.com/watch?v=Wke15rWFnFg&feature=youtu.be