Ms. Katherine Haut, Chair

Central valley Regional Water Quality Control Board

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Re: methylmercury amendments/ San Joaquin, Sacrmento watersheds/April 22 agenda item

My 1906 Squibb's Materia Medica lists hundreds of formulations for the treatment of disease, and page after page makes reference to mercury. Page 316 lists tablets of mercury tannate, tablets of mercury with chalk, tablets of mercury iodide red, and tablets of mercury iodide yellow On page 294, tablets of calomel compound number 2, tablets of calomel, ipecac and soda, and a page of calomel tablets plain, pink or flavored with wintergreen. The most stunning old-tyme medicine was the children's tonic on page 334, pink-coated, with a contents of Blaud's Mass (lead), Quinine Sulphate, Acid Arsenous, Strychnine Sulphate and Corrosive Sublimate (mercury) for the ferocious treatment of anemia and debilitating conditions. The truth being told medicine poisoned in this day and age, and mercury compounds were widely and freely used to prevent and cure disease. One or two recommended tablets of children's tonic, bearingtb he Squibb brand, was normal medicine, and it wasn't till 1948 that Warkany and Hubbard made the connection between mercury and acrodynia. Whole books were written about infantile acrodynia, and acrodynia accounted for 3.6% of all admissions to a children's hospital in England. ELLENHORN'S MEDICAL TOXICOLOGY: Diagnosis and Treatment of Human Poisoning (page 1591) notes with some incredulity that before calomel's removal from teething powders, "thousands of adults are exposed to mercury compounds that cause acrodynia in children, but they are not affected."

Paul DeKruif wrote about the Microbe Hunters in the 1930's, a lasting history of the use of mercury and other compounds to eliminate infections, just as germ theory was emerging in a world of superstitution and venerated herbal practice. As more and more doctors realized that the mercury dose safe for adults was unsafe for children, more and more medicine came under scrutiny. Neurotoxiclogy in 2001 printed an submission by redwood, Bernard and Brown, "Predicted Mercury Concentrations in Hair From Infant Immunizations: Cause for Concern," which in brief concluded, that the impact of Thimerosal (vaccinal mercury) "has had on American children warrants further investigation." The same issue in another peer-reviewed article documented the "Uncertainties in the Reference Dose of Methylmercury." [Methyl mercury is abbreviated MeHg here on out in this letter.]

It seems odd that diaries in state library record the symptoms of the New Alamadin Mine poisonings, even in horses drawing wagons at the mines, at the turn of the century, but it is as if gold fever had sanitized the silver metal's evil complexion so that nobody knew it. Medicine went on treating diseases with it, industry went on using it without a tear of compunction, for a half century before an awakening

began, an awakening that's lasted half a century. A 100 years have all passed away and we forget the chilling legacies of mercury past and the horrors of the children fed on mercury medicines.

Mercury may not have forgotten us, because the sins of the past are unlike sins of the present – methylmercury, MeHg, is nothing like its progenitor metal. Metal mecury, silver-white quicksilver metal mercury and its array of colorful inorganic compounds, is relatively tame compared to MeHg. Methylmercury is fetotoxic. In doses too small to affect a mother, it poisons the unborn child. John Hopkins University Press, London and Baltimore, in a book edited by Christine Eccles and Zoltan Annau, The Toxicity of Methylmercury," Dr. Magos concludes, "Methylmercury, like other organomercurials and unlike inorganic mercuric salts, is nearly completely absorbed from the gastrointestinal tract. If you eat it, it resides in you. If you're pregnant, umbilical cord blood may have 50% more MeHg. (Suzuki et al 1971). We call this bioconcentration and bioaccumulation. MeHg is a food chain poison that builds up in the tissues of animals and the body burdens of every one who eats food and drinks water gets bigger and bigger.

This isn't rocket science. If you eat garlic, you excrete garlic. If you eat leek, you exhale leek in your breath. If you eat MeHg, you absorb it, you excrete it and you build it up inside you. The first organ MeHg attacks is the fetus. (Prenatal exposure to methylmercury" by Christine E Eccles and Zioltan Annau). Your body burden of mercury differs from your grandparents' burdens. Their exposure was to inorganic mecury; your body burden is shaped by MeHg. The food chain accounts for most of that burden. You are being poisoned, each and every one of us are being poisoned, by the subterfuge of methylmercury in the food chain.

The Arsenic and Old Lace of modern agriculture is something to take seriously. It's not by design, not by conspiracy. It is happenstance by our tinkering with the environment, and we still lack a full grasp of the consequences. Food chain poisons are rare in history. The Romans had a fondness for leaded utensils. Abundances of white snakeroot (Eupatorium) took its toll, sometimes whole communities in America, by poisoning people through milk. Food chain poisons seem more prevalent than ever as seen in the outbreaks of fecal E. coli and the prion disease called Mad Cow. Modern agriculture "biomagnified" the impacts by the way we grow, process and distribute food. MeHg finds its way into the food chain through ecological processes, a spin-off of the industrializations around us.

Two things seem to occur that give cause for the rise of MeHg. First, the human footprint seems to shifted decay away from aerobic decay to anaerobic decay in soils and in reservoir sediments. Mercury locked in soils and sediments – inorganic mercury, metal mercury though relatively stable – is methylated by microbial processes. The sulfhydryl enzymes that energize anaerobic decay, decay without oxygen, seem to shunt mercury around and methylate it, consequently dams and reservoirs seem to function ecologically as big methylation vats where MeHg is made. In soils, where carbon is sequestered, aerobic decay is more common. In impoverished soils, soils in need of restoration, occasional rains seem to lead to methylation events. Studies of prairie soils indicate that 20% organiuc matter was common when the buffalo roamed the Great Plains. Farmed soils steadily and intensively cropped range in soil organic carbon in measures as low as 3-4%. These soils are drier in the sun and wetter in the rain, predisposing methylation.

The New Scientist of April 18, 2009, reported "Arctic food is poisoned" in one headline. "Seal meat contains more mercury in low-ice years," which may be due to Arctic code that flourish more in low-ice years," because Arctic cod are higher up on the food chain than the seals' other food" and they have greater body burdens of mercury – MeHg.

The natural cycle or mercury has run for thousands of years, with mercury entering the sky from nautrla source son the ground and precipitating out again. The engine of human activities, industry, has quadrupled, by some estimates, the load of atmospheric mercury, and no one has estimated the increase in methylation that transforms this natural cycle into unnatural MeHg. MeHg is a manmade spin-off of the natural cycle. Mother Nature, if left to her own designs, would not give rise to it in the quantities that plague us today or threaten us tomorrow. To some extent, nature makes MeHg and nature breaks down MeHg in a balanced biogeochemical cycle. The cycle has been altered, and the food chain has been poisoned. The knowledge of how mercury is mobilized, methylated and biomagnified still eludes us like a hidden work of science.

We know from ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 2002, 36, 1245-1256, that "this mercury accumulates in the snowpack during the Polar spring at an accelerated rate in a form that is bioavailable to bacteria and is released in snowmelt during the summer." We know from THE SCIENCE OF THE TOTAL ENVIRONMENT 2002, 287, 61-69, "Mercury speciation in the French seasonal snow cover," that "the pH of the snow was found to be an important parameter for Hg speciation." But knowledge is scant. Science has not characterized well the cycles that govern our body burdens of MeHg.

To sum it up, MeHg poisons the next generation through the food chain. It poisons the unborn through the umbilical line of transmission. Every child is born with a body burden that no grandparent had. Mercury cycles the planet in a very natural way, but we have overloaded the cycle and we have tilted the natural cycle in favor of methylation. As the Central Valley Regional Water Quality Control Board takes action, and I am pleased that it is, and I praise its key elements of action, I realize that the toolbox of best practices will aim at stabilizing legacy mercury, that is, derail its mobilization, but the inherent problem is likely to be source mercury in the air and the loading of the atmosphere beyond the control of the Central Valley Region and methylation of mobile mercury between snowpack and estuary, between air-borne mercury and fork.

In short, translocation and methylation are the problems; the Delta makes mercury look like a water quality problem. It's the food chain, not water, at issue. We have unbalanced a geochemical cycle of mercury where water plays a role. Because MeHg is a fetal poison, because future generations are exposed in the womb, it is unlike any other poison we've encountered. Because it is a fetotoxin, it must be characterized as more than just another ordinary contaminant of water-quality concern.

Thank you for listening,

Bud Hoekstra

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