To: Washington State Department of Ecology
From: Tip Johnson
Date: October 13, 2019
Subject: Bellingham Central Waterfront

Thank you for the opportunity to comment. A family occasion regrettably prevented my attendance at the public hearing.

I am concerned with DOE's chronic avoidance of any full accounting of the mercury G-P used, and the department's failure to address the issue of any missing mercury that could be a direct, lasting and increasing threat to human health and the environment in our community. Does DOE ever intend to do a mass balance analysis of mercury used at G-P? The EPA has a worksheet for that.

According to the draft CAP, "Between 1965 and 1974, the Roeder Avenue Landfill was operated as a disposal site for wood waste and other material from the GP mill…" All three subareas are noted as containing "metals". "COCs that currently exceed cleanup levels in groundwater are metals (including arsenic, cadmium, copper, chromium, lead, mercury, nickel, zinc, and manganese)…". The Data Validation Report also mentions a lot of metals, but it appears only a couple small samples (x1.4 grams) were tested for mercury. Figure 2-2 shows a lot of soil and groundwater testing in areas of project NE and SW, but much less testing over significant areas, notably under large buildings. Overall, there is very little mention of mercury. Why is there so little emphasis on what should be a priority COC?

G-P habitually loosely interpreted, avoided or ignored environmental regulations. DOE may recall correspondence of March 25, 1977, from Warren Mowry, G-P's Environmental Control Director, in which he "respectfully reject(s)" the departments directives for safe handling of solid wastes. G-P acknowledged in these writings that they operated under the "necessity of disposing of these wastes". A year earlier DOE caught G-P illegally dumping mercury contaminated sludge in two locations, including along Whatcom Creek, a state-designated juvenile fishing stream. DOE also caught G-P illegally dumping 12 tons of mercury in the Chem-fix Slab, adjacent to the Bellingham Bay shoreline. DOE should recall the spate of problems Whatcom County residents experienced with so-called "wood waste" in various unregulated dumps used by G-P.

G-P's known use of this dump and pattern of reckless willingness to spread mercury-laden wastes around the community suggests that DOE should be taking a more active prospecting role in evaluating this and other sites.

On further review of files archived with the Mercury Victims of Whatcom County, I found the following disturbing correspondence sent on condition of anonymity from a high level technical resource within G-P.

BEGIN REFERENCED DOCUMENT

From: [redacted]
Subject: **RE: Mercury**
Date: November 23, 2004 10:42:02 PM PST
To: [redacted]
Cc: [redacted]

[redacted]

[redacted]

The constant chlorine to caustic ratio in large scale operations is about 1:1.125 for diaphragm units and about 1:1.146 for mercury cells.

The anodic reaction proceeds with an efficiency of about 97% in mercury cells and 95% in diaphragm cells according to the equation

$2Cl^- \Rightarrow Cl_2 + 2e^-$

whereas the cathodic reaction is nearly 100% in both cells according to

$2H^+ + 2OH^- + 2e^- \Rightarrow H_2 + 2OH^-$ for the diaphragm unit and

$2Na^+ + (Hg) + 2e^- \Rightarrow 2Na(Hg)$ for the mercury cell,

whereby the Na(Hg) is subsequently reacted in a secondary unit (a decomposer tower packed with graphite) with water, forming NaOH and hydrogen.

$Na(Hg) + H_2O \Rightarrow$ 1 faraday + $NaOH + 1/2H_2 + (Hg)$

Molecular weights: Na=23, O=16, H=1, NaOH=40, which means that hydrogen production is 1/40=2.5% of amount of caustic = 112 tons/40=2.8 tons per day

Since the emissions (see below) in European Euro Chlor members' mercury cell rooms were 26.6 grams Hg/chlorine capacity in 1977, we can assume that G-P plant was not any more efficient since it was built with 10 years older technology.

26.6 grams Hg/chlorine capacity = 2.66% x 100 tons of chlorine/day = 2.66 tons of mercury per day of which most is still in the soil above or under the water in the bay.

[redacted] look from G-P:s permit and calculate how much were they allowed to release in the air and with the effluent from the lagoon to the bay in 30 years. Subtract that amount from 2.66 tons x 365 days x 30 years = 29,127 tons. What was permitted to be released amounts to maybe that 127 tons so there should be 29,000 tons still mercury inside G-P property. Even if the permit allowed 1,127 tons of mercury to be released in 30 years, we still have 28,000 tons left in the soil etc.

I hope the above is of some help to you.

[redacted]

How mercury is used to make chlor-alkali chemicals
Chlorine is produced by electrolysis when an electric current is passed through a solution of brine (common salt dissolved in water). Co-products are caustic soda (sodium hydroxide) and hydrogen. All three are highly reactive, and technology has been developed to separate them and keep them separate. Stringent operating conditions are maintained to protect the health of manufacturing staff and the environment.

About 60% of Western European capacity for chlorine depend on the mercury process. The electrolytic cell has titanium anodes located above a mercury cathode, which flows along the bottom of the cell. Under the action of a direct current on brine, chlorine is released at the anode and sodium dissolves in the mercury cathode to give an amalgam.

Emissions from Euro Chlor members' mercury cell rooms				
Year	**1977**	**1985**	**1990**	**1997**
Amount	26.6	8.1	4.1	1.4
Index	100	30.5	15.4	5.3
(grams Hg/t chlorine capacity)				

The sodium amalgam passes out of the electrolytic cell into a separate reactor, away from the chlorine. Here, it reacts with water to give hydrogen and caustic soda. This regenerates the mercury, which is then returned to the electrolytic cell. Salt is added to the brine leaving the cell and the brine is recirculated. Some 2.26 tonnes of 50% caustic soda and 312 cubic metres of hydrogen result from the production of one tonne of chlorine. The mercury process produces extremely pure, high quality caustic soda, suitable for use in textile applications. Caustic soda from the mercury process is produced at a higher concentration than from alternative processes. This minimises the energy consumption involved in concentrating dilute soda to give a usable product.
The closure or conversion of mercury plants would result in the need to recover some 12,000 tonnes of mercury contained in existing cells. Careful planning and co-operation between industry and the authorities would be essential in ensuring proper storage, use or disposal of this valuable, high-quality mercury.
END REFERENCED DOCUMENT

The 'Victims' originally set this correspondence aside due to concerns it might be purposely exaggerated to lure them into making self-marginalizing statements. I submit it now because DOE should have the ability to gauge its accuracy. If true it should warrant reconsideration, review, and further investigation of this and other sites. The source points out that based on plant capacity and standards observed in Europe with more efficient equipment than was installed at G-P, the amount of mercury consumed should conservatively be around 29,000 tons. Since permitted releases to air and water were relatively small, the source concludes that at least 28,000 tons should still remain on site - unless illegally moved elsewhere. Is it possible these figures are accurate? If so, what will DOE do to discover the fate of any missing mercury?

Mercury quantities discussed in evaluation of the G_P site originally included only about 12 tons in the Chemfix slab and maybe 20 discharged to the bay. Total releases to air would need to be estimated including at least what escaped the cells and contributions from G-P's failed sludge "roaster" - some hundreds of tons in any case. This potentially leaves thousands of tons still unaccounted. Later remediation at the chlor-alkali site involved excavation and recovery of elemental mercury. I have not seen an accounting of those quantities. During the dredging of the waterway, an employee of one of the contractors reported pockets of elementary mercury again being encountered. I have not seen any official report of these observations nor any estimate of the quantity recovered. How much mercury has been located or recovered?

We know some mercury was shipped as a contaminant in G-P's product. DOE should recall the correspondence of Oct./Nov. 1972 between DOE's James Behlke and the Alaska DOEC's Ronald Hansen regarding the 25,000 gallons of mercury contaminated caustic sludge that had accumulated in the Ketchikan mill when G-P was supplying their chemicals. Alaska found "…a level of mercury contamination…unacceptable for discharge in this location". Ketchikan had to ship it back to the Bellingham mill. DOE acknowledges G-P's receipt of the material, thanking Alaska for their vigilance toward "…this critical contaminant".

Please note G-P was using this disposal site when this occurred. What happened to the material? How do you know it is not in this dump? Can DOE adequately protect human health and the environment without knowing how much mercury is missing and where it might be?

Mercury vapor monitors can be driven in transects and the results correlated with weather data to indicate the location of mercury contaminated sites. Poking a few holes and testing small samples could easily miss large deposits of mercury contaminated material. Will DOE consider more sophisticated measures to help substantiate their analysis of this site?

Elsewhere, while DOE asserts the plan will "…be protective of human health and the environment", project documents suggest that it will take more than 20 years before groundwater complies with cleanup standards. "Natural attenuation" seems to mean continued gradual releases to the environment. DOE knows mercury is a dangerous metal with grievous public health consequences, that it forms dangerous bioaccumulative, neuro-toxic ccompounds, that it persists, migrates and fluxes in the environment. Has DOE estimated how

much mercury will be released from this site over those years? What measures will be taken if future monitoring indicates higher mercury discharges than anticipated?

Project documents suggest that fences and warning signs, deed restrictions and covenants, long-term inspection, monitoring and maintenance restrictions will prevent disturbance of caps without Ecology approval. Sea level rise, storm surges and earthquakes causing liquefaction or tsunamis will not seek DOE approval. According to the USGS, a megathrust from the Cascadia subduction zone could be more than a thousand times more powerful than the earthquake that devastated Haiti in 2010. Recent NOAA models suggest that a tsunami may reach a height of 18 feet and churn around the area for hours. The effect of liquefaction can be easily seen in simple google image search (https://bit.ly/2VADBfc). Are the caps designed to withstand these forces? How will DOE protect human health and the environment in a catastrophic failure of the caps?

Finally, friends to whom I read excerpts of the project documents asked me to suggest DOE consider replacing inaccurate terms like “cleanup” and “natural attenuation”. Using “cleanup for plans that don’t clean things up sounds dishonest, as does using “natural attenuation” to continue polluting the environment. This tends to erode the public’s trust in the DOE - especially as the agency usually writing the permits authorizing such pollution. Suggestions included using “coverup” instead of “cleanup” and maybe “trickle-down dispersal” or “pollution dilution” instead of “natural attenuation”. We all appreciate DOE’s efforts to be direct, honest and trustworthy.

Thank you.