Still Crazy After All These Years: Mercury Cells in the Heart of America

James Vallette | March 22, 2016 | Newsletter

For many decades, the manufacture of polyvinyl chloride (PVC) depended upon a controversial technology invented in the 1890s that polluted the air and water with mercury. Today is World Water Day, and it's worth noting that some factories still use this toxic technology, and are pouring mercury waste into rivers, lakes and oceans around the world, including in North America.

Chlorine, an essential ingredient of polyvinyl chloride (PVC) plastic is found most readily in brine (very salty water). In the 1890s, two scientists developed a way to electrolyze brine using liquid mercury cathodes in a cell, which produced chlorine and sodium hydroxide. The elixir of mercury catalyzed the chlorine industry, and the PVC that followed. By the 1970s, the chlorine industry became the world's leading consumer of mercury.[1] The release of mercury into water exacted an increasing environmental and human health toll.

Gradually, in North America, most mercury cells have been replaced with diaphragm[2] and membrane technology. Industry representatives like to say that mercury pollution is a problem of the past. "Neither workers nor the public is exposed to dangerous levels of mercury related to PVC," insists the Society for the Plastics Industry.[3] The Vinyl Institute asserted recently that there is "no mercury cell chlorine used in PVC manufacture."[4]

But, with little attention, four chlorine plants in North America continue to run mercury cathode cells. Two plants in the United States and two in Mexico still use this 19th century technology; three of them do not plan to stop. They are among the 100 chlorine plants in 44 countries that, according to the United Nations, still use mercury cathodes.[5]

PVC's global mercury toll

Researchers have documented extensive mercury contamination in river and ocean sediments near and downstream from chlorine and vinyl chloride monomer factories that serve the polyvinyl chloride industry.[6]

Mercury deposited in sediments reacts with microorganisms to form extremely potent neurotoxic organic compounds, especially methylmercury.[7] Mercury compounds like methylmercury target the nervous system, often with devastating impacts. Symptoms of mercury poisoning include speech difficulties, tingling of the extremities, fatigue, loss of full control of bodily movements, hearing and cognitive loss, hallucinations, coma and death.[8]

Mercury compounds bio-accumulate in fish and other seafood. People who eat highly contaminated fish can suffer mercury poisoning. The most famous case is Minamata Bay, Japan, where a vinyl chloride monomer factory dumped mercury, and contributed to the poisoning of thousands of people in the 1950s, the effects of which continue today.[9]

Hardly a concern of the past, the impacts of the PVC industry's mercury use continue to grow. The recent toll from mercury pollution at chlorine, vinyl chloride monomer, and related mercury waste processing plants worldwide, reaches from the state of Tennessee[10] to Cartagena, Columbia,[11] Cato Ridge, South Africa,

[12] Tainan City, Taiwan,[13] and many other places.

Ongoing Mercury Pollution

In the United States alone, according to industry reports to the EPA Toxics Release Inventory, the PVC industry released over 738,107 pounds (369 tons) of mercury and mercury compounds to air, water, and land between 1987 and 2014, including:

- 87,903 pounds of fugitive air emissions of mercury, from plants in Ohio, West Virginia, Louisiana, New York, Alabama, Indiana and Texas. The two highest releases came from the country's remaining two operating mercury cell chlorine plants: ASHTA Chemicals in Ashtabula, Ohio and Axiall's Eagle Natrium plant in Proctor (New Martinsville), W.V.
- 24,014 pounds of air stack emissions. Again, the highest mercury releases came from the Ashtabula and Proctor plants.
- 3,368 pounds of mercury releases into water. Axiall's Proctor plant accounts for almost half of this amount: it reported the release of 1,564 pounds of mercury since 1987.
- 2,330 pounds of mercury releases into on-site facilities, including underground injection wells.
- And, at least 620,492 pounds of mercury waste transfers to off-site disposal facilities, which typically are located in lower-income communities and communities of color.[14]

In 2014, ASHTA Chemicals stated that it is in the process of eliminating its use of mercury cell technology in Ashtabula, but that the transition to membrane cell technology would not be completed until late 2016.[15] In the meantime, ASHTA projected that it would generate 2,500 pounds of mercury pollution per year through 2016.[16]

Of most concern: Axiall Corporation operates a 57-year-old mercury cell plant, dubbed Natrium, in New Martinsville, West Virginia.[17] As of today, it has no plans to stop. Chip Swearngan, the corporation's communications head, told the Healthy Building Network that "Axiall has not announced any plans related to its mercury circuit processes at its Natrium facility in West Virginia."[18]

Instead, plant operators recently petitioned the state of West Virginia, successfully, for a variance, which allows it to measure mercury levels in the Ohio River only after it has been diluted in a "mixing zone."[19] Since 1987, this facility's managers reported discharging 1,564 pounds of mercury into the Ohio River, more than any other chlorine plant in the country.[20]

And in Mexico, Industria Quimica del Istmo SA (part of CYDSA S.A.) runs two mercury cell plants,[21] one in Coatzacoalcos, Veracruz, where it has polluted a river with mercury,[22] and the other in the city of Monterrey, just south of Texas. There are no signs that CYDSA plans to decommission either plants' mercury cells.

From communities bordering these plants, to rivers flowing past these plants to the global atmosphere and wherever mercury-contaminated rain falls, the PVC industry's ongoing mercury releases reach across the globe, and will last many decades if not centuries. As long as it is uncontained and available in the environment, mercury's impacts on people and other creatures up the food chain grow over time.[23]

The continuing use of mercury in chlorine production is an act of sheer madness. Given owners' tenacious grips on obsolete equipment, voluntary action seems unlikely. In honor of World Water Day, we call for the US and Mexican governments to shut down these cells.

[1] Horowitz, Hannah, Daniel Jacob, Helen Amos, David Streets, and Elsie Sunderland. “Historical Mercury Releases from Commercial Products: Global Environmental Implications.” *Environmental Science & Technology* 48, no. 17 (2014): 10242–50. doi:http://pubs.acs.org/doi/abs/10.1021/es501337j.

[2] Also less than ideal, some plants in the US import asbestos from Brazil to use as diaphragms.

[3] Society for the Plastics Industry. “But Is Flexible PVC Really Safe?” *But Is Flexible PVC Really Safe?*, 2012. https://www.plasticsindustry.org/FVPC/VinylFAQ/content.cfm?ItemNumber=3841&navItemNumber=3842.

[4] Krock, Rich. “Update on U.S. Vinyl Industry.” Pdf presented at the Fifth Andean PVC Conference, September 25, 2012. http://www.foroandinopvc.org.co/conferencia_2012/memorias/Krock_US_vinyl_industry.pdf.

[5] United Nations Environment Programme. “UNEP Global Inventories of Chlor Alkali Facilities,” 2013. http://www.unep.org/chemicalsandwaste/Mercury/GlobalMercuryPartnership/Chlor-alkaliSector/Reports/tabid/4495/Default.aspx.

[6] Johnston, Paul, Ruth Stringer, M.C. French, and James Vallette. “Contamination of Soils and Sediments in the Vicinity of a Mercury Recovery Plant.” *Bulletin of Environmental Contamination and Toxicology* 46, no. 1 (January 1991): 74–78.

[7] Gray, John, Mark E. Hines, Harland L. Goldstein, and Richard L. Reynolds. “Mercury Deposition and Methylmercury Formation in Narraguinnep Reservoir, Southwestern Colorado, USA.” *Applied Geochemistry* 50 (November 2014): 82–90. doi:doi:10.1016/j.apgeochem.2014.09.001.

[8] Azevedo, Bruna Fernandes. “Toxic Effects of Mercury on the Cardiovascular and Central Nervous Systems.” *Journal of Biomedicine and Biotechnology*, no. 2012 (July 2, 2012). doi:10.1155/2012/949048.

[9] Boston University. “Minamata Disease.” *Minamata Disease*. Accessed March 22, 2016. http://www.bu.edu/sustainability/minamata-disease/.

[10] Oceana. “Mercury On The Hiwassee,” April 2008. http://oceana.org/sites/default/files/reports/OlinTNReport.pdf.

[11] Olivero-Verbel, Jesus. “Human and Crab Exposure to Mercury in the Caribbean Coastal Shoreline of Colombia: Impact from an Abandoned Chlor-Alkali Plant.” *Environment International* 34, no. 4 (May 2008): 476–82. doi:doi:10.1016/j.envint.2007.10.009.

[12] Papu-Zamxaka, Vathiswa, Angela Mathee, Trudy Harpham, and M. Cloete. “Elevated Mercury Exposure in Communities Living alongside the Inanda Dam, South Africa.” *Journal of Environmental Monitoring* 12, no. 2 (January 2010): 472–77. doi:10.1039/b917452d. See also: United States Department of Justice. “U.S. Files Multi-Million Dollar Action Against Borden Chemicals and Plastics for Illegal Hazardous Waste Management Practices and for Cleanup of Contaminated Groundwater,” October 27, 1994. https://www.justice.gov/archive/opa/pr/Pre_96/October94/616.txt.html .

[13] Chang, JW, MC Pai, HL Chen, HR Guo, HJ Su, and CC Lee. “Cognitive Function and Blood Methylmercury in Adults Living near a Deserted Chloralkali Factory.” *Environmental Research* 108, no. 3 (November 2008): 334–39.

[14] In addition, the retirement of mercury cells, and of entire plants that had used them, has generated enormous volumes of mercury contaminated soil, buildings, and other solid waste, much of which has been shipped to the country's largest landfill, run by Chemical Waste Management, in Emelle, Alabama. The Emelle landfill is in one of the country's poorest regions, and "over 90 percent of the residents near the landfill in Emelle are Black" according to the *Environmental Justice Atlas*. In 2012-2013 alone, the Emelle hazardous waste landfill received 103,060 pounds of liquid mercury waste from the Axiall Eagle Natrium chlorine plant in West Virginia. Chlorine plants operated by Occidental Chemical in New Castle, Delaware, Mobile, Alabama, and Lake Charles, La., Westlake Vinyls in Calvert City, Ky., and Olin in Charleston, TN, also shipped mercury contaminated debris, spent filters, and wastewater treatment sludge from mercury cells to the ChemWaste landfill in Emelle since 2001. On average, the Emelle landfill has received over 360 *tons* of mercury-contaminated waste from at least six diferent chlorine plants per reporting year since 2001.

[15] ASHTA Chemicals Inc. "Ashta Chemicals Inc. Announces Significant Capital Investment in Northeast Ohio Benefiting the Environment and Local Community," June 25, 2014. http://www.ashtachemicals.com/Uploads/ASHTA_Press_Release%206-25-14.pdf.

[16] US EPA. "Toxics Release Inventory Envirofacts Report: Ashta Chemicals, Ashtabula, Ohio," March 9, 2016. https://oaspub.epa.gov/enviro/tris_control_v2.tris_print?tris_id=44004LCPCH3509M&pPrev=3

[17] West Virginia Department of Environmental Protection. "West Virginia Department of Environmental Protection Statement of Basis: Axiall Corporation Facility (Formerly PPG Natrium Plant)," 2014. http://www.dep.wv.gov/dlr/oer/superfund/Documents/Axiall (PPG) SB final 5-6-2014.pdf

[18] Personal communication, March 22, 2016.

[19] Ward Jr., Ken. "PPG Gets Mercury Pollution Variance for W.Va. Plant." *Charleston Gazette*, October 11, 2012. http://blogs.wvgazettemail.com/watchdog/2012/10/11/ppg-gets-mercury-pollution-variance-for-w-va-plant/ and Ross, Jim. "WV Plants Seek Mercury Discharge Variances." *The (W.V.) State Journal*, March 19, 2015. http://www.statejournal.com/story/28561574/wv-plants-seek-mercury-discharge-variances

[20] US EPA. "Toxics Release Inventory Envirofacts Report: Eagle Natrium LLC, New Martinsville WV," March 9, 2016. https://oaspub.epa.gov/enviro/tris_control_v2.tris_print?tris_id=26155PPGNDSTATE&pPrev=1.

[21] United Nations Environmental Programme. "Global Mercury Cell Production Data (in Thousands of Metric Tons of Chlorine Capacity)," 2013. http://www.unep.org/chemicalsandwaste/Portals/9/Mercury/Chloralkali/Hg-cell%20chlor-alkali%20facility%20global%20inventory%20table_final.xls.

[22] Ecología y Desarrollo Sostenible en Coatzacoalcos, A.C. and Centro de Análisis y Acción en Tóxicos y sus Alternativas – CAATA, Arnika Association, and IPEN Heavy Metals Working Group. "Chemical and Petrochemical Industry Site: Coatzacoalcos Region in Mexico: Mercury Levels in Fish in the Coatzacoalcos River," April 3, 2013. http://www.ipen.org/hgmonitoring/pdfs/mexico_mercury_report-fish_final-en.pdf.

[23] Soto, D. X., R. Roig, E. Gacia, and J. Catalan. "Differential Accumulation of Mercury and Other Trace Metals in the Food Web Components of a Reservoir Impacted by a Chlor-Alkali Plant (flix, Ebro River, Spain): Implications for Biomonitoring." *Environmental Pollution* 159, no. 6 (2011): 1481–89.

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