Mercury Pollution Minimization Plans – Effective Tools for Reducing Mercury in Permitted Discharges

by Libby Ford

According to the US Environmental Protection Agency (USEPA), mercury is the pollutant that caused more surface waters to be listed on the Clean Water Act's (CWA) 303(d) list of "Priority Waters."[1] Waters included on this list have one or more water quality problems. The EPA's most recent consolidated 303(d) list[2] indicates that 8,555 waters are listed due to mercury contamination.

It is likely that a significant fraction of the mercury entering US waters is coming from air deposition ***(Figure 1).*** Worldwide, the EPA estimates that approximately 4,400 to 7,500 tons per year (TPY) of mercury is emitted to the air[3] ***(Figure 2).*** Only 48 TPY of this comes from US sources, the rest is emitted in other countries.[4] Once airborne, mercury, especially in its elemental state, can travel thousands of miles before being deposited on land or in water. Both the EPA and New York State are taking somewhat aggressive steps to reduce New York and US emissions of mercury, which should lead to future reductions in the quantities of mercury present in our surface waters.

While air deposition may be the primary cause of elevated mercury levels in water, the federal and New York State Pollutant Discharge Elimination System (known as SPDES in New York) mandates that virtually any identifiable point source discharge of mercury be controlled though a SPDES permit. Because the water quality standard for mercury in surface waters is very low (0.7 to 2.6 nanograms per liter (ng/L),[5] the calculated water quality based effluent limit (WQBEL) which is put into individual SPDES permits is typically lower than treatment systems can reliably achieve. Rather than put such limits in a permit, the New York State Department of Environmental Conservation (NYSDEC) places a higher enforceable limit in the permit and sets the WQBEL as the goal of a required Mercury Pollutant Minimization Plan (PMP).

Mercury PMPs are narrative documents, often accompanied by plans, drawings and/or maps. If there is any indication that a SPDES permittee is adding mercury to its discharge, both municipal wastewater treatment plants (often referred to as POTWs or publicly owned treatment plants) and industrial facilities receive Mercury PMP requirements as their SPDES permits are renewed or modified. While the minimum contents of the Mercury PMP are specified in the SPDES permit ***(Box 1),*** the best approach to preparing and implementing PMPs is dependent on the type of facility.

Because of the more complex and indirect nature of mercury contributions to POTWs, the EPA and the states have made available both guidance and actual POTW Mercury PMPs to help POTWs through the process ***(Box 2).*** Because public education often forms the backbone of POTW Mercury PMPs, the EPA and the states strongly encourage POTWs to coordinate with other area POTWs in both the development of their PMPs, and in their implementation activities.

Because mercury is still used within the medical field, hospitals are a class of facilities that can have mercury in their wastewater discharge. Most hospitals discharge through POTWs, so that in their Mercury PMPs, POTWs often will identify specific provisions applicable to hospitals and other medical facilities. Guidance and case studies on mercury reduction efforts at hospitals are available on the Sustainable Hospital website.[6] Several of the case studies pertain to New York hospitals.

For industries, no single game plan exists. Because of this, it is important that the emphasis in the Mercury PMP is on establishing an orderly process for identifying possible sources of discharger added mercury. In developing a Mercury PMP, industries (and other dischargers) should initially focus their PMPs on laying out a

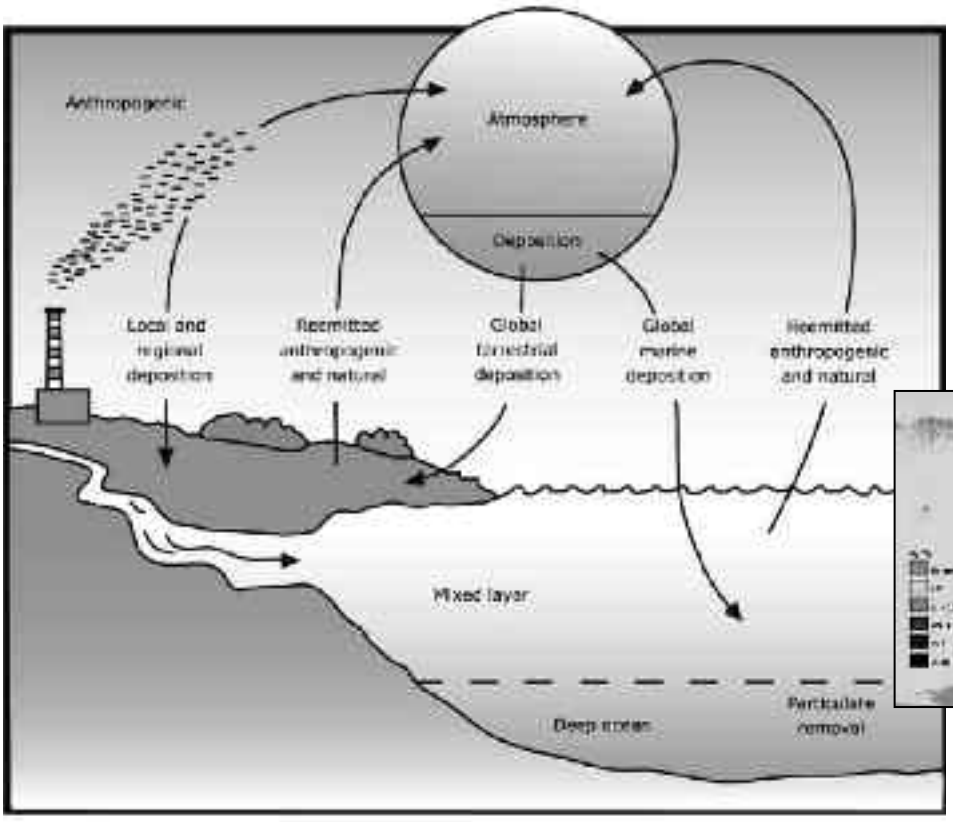

Figure 1. The Mercury Cycle[4]

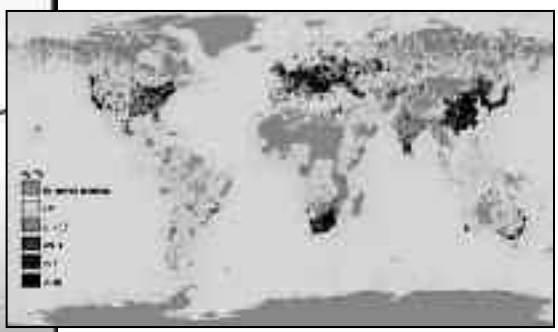

Figure 2. Where are man-made mercury emissions originating?[1] (1995, metric tons per year: darkest areas equal from 5 to 22 metric tons of mercury emissions per year.)

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Box 1: Major Elements of SPDES Required Mercury PMP

- Goal: reduction of permittee-added mercury to at or below the calculated WQBEL
- PMP submission in an "approvable" form
- On-going potential source identification, evaluation and prioritization; periodic monitoring to quantify; and, reduction tracked over time of mercury discharges
- Submission of control schedules for confirmed sources of mercury via cost-effective control measures
- Optimization of wastewater treatment system operation to maximize mercury removal
- Submission of annual approvable reports

Box 2: POTW Mercury PMP Resources on the World Wide Web

www.ci.superior.wi.us/DocumentView.asp?DID=136
www.epa.gov/R5water/npdestek/mercury_pmp_nov_04_guidance.pdf
www.epa.gov/R5water/npdestek/MercuryHolly_PMP_4-03_final.pdf
dnr.wi.gov/org/caer/cea/mercury/potw.htm
dnr.wi.gov/org/water/wm/ww/mercury/mercury_pmp.pdf

logical process, rather than going into great detail on the suspected sources. In general, the process will likely follow this sequence:

1. Identify "Possible Sources" of mercury
2. Gather available information on Possible Sources of mercury
3. Rank or prioritize Possible Sources and designate "Potential Sources"
4. Perform confirmatory testing or other analyses
5. Evaluate "Confirmed Sources" for minimization potential

Each of these steps is briefly explained below.

Identify Possible Sources of Mercury

It's always best to start with a blank slate rather than having preconceived ideas on where the facility may be adding mercury. One logical place to start is a review of all MSDSs (Material Safety Data Sheet) for chemicals used at the plant. If none of them list mercury, then all but the largest volume chemicals can probably be moved to a "Confirmed No Significant Mercury" list, because MSDSs have to list all hazardous constituents that are present in relative quantities of one percent or more. While this is not an absolute, it is a good place to start. Because of the one percent MSDS requirement, however, large volume chemicals, especially those contacting water eventually discharged, may need to be retained on the Possible Source list for further evaluation. One example is potash and other chemicals used in the wastewater treatment process.

Even though SPDES permittees are only required to minimize the mercury they add to their wastewater, consideration should be given to initially including rain and perhaps even potable/process water on the Possible Source list and later to quantifying their mercury levels. While potable water should not have detectable levels of mercury, rainfall has been found to carry relatively high levels of mercury. For example, rainwater in Cleveland, Ohio was found to have average mercury levels of 24.7 ng/L with a high of 97.1 ng/L. By quantifying the "background" levels of mercury from these sources, the permittee can later quantify the fraction of mercury in its discharge that it does not otherwise add to the discharge.

Gather Information on Possible Sources

For any chemicals placed on the Possible Source mercury list, the chemical supplier/manufacturer is a logical place to begin to gather information. Requesting the supplier to furnish a Certificate of Analyses as well as information on the quantification levels of the analytical method used, can be very instructive. If influent and effluent mercury analyses have been done (using any analytical method) the results and the limits of quantification of the analytical method used should be assembled. If mercury containing instruments (gauges, monometers, thermometers, etc.) formerly were used in the facility, their locations and the proximity to any sinks and floor drains (and any traps) may be important information to gather.

Rank Possible Sources/Designate Potential Sources

In order to make steady progress to minimize mercury, it is important to keep the effort focused and do-able. Especially during the early years of implementing the PMP, when a facility is moving from a paper plan to one that is actively being implemented, unexpected hurdles and logistical challenges should be expected. Because of this, it's best to pick a small number of Possible Sources to be the first group to be deemed Potential Sources and to move through the more detailed confirmation phase. The ranking/prioritization process should be very facility specific. If something on the list, such as sink traps where mercury-containing chemicals were/are handled, is suspected to be a large source of the permittee-added mercury, then it should be included in the first grouping.

Confirmatory Testing or Other Analyses

The standard Mercury PMP requires influent, effluent and sludge monitoring as well as monitoring of possible mercury sources. Influent and effluent monitoring must be done using EPA Method 1631[8], which can detect mercury down to the 0.5 parts per trillion. Analytical methods other than Part 1631 will probably need to be used on sludge and many possible sources because Method 1631 is a creatively clean water analytical method that doesn't work on solids and non-water mixtures.

Evaluate Confirmed Sources for Minimization Potential

The standard Mercury PMP requires that confirmed sources of mercury be evaluated and that any identified "cost effective control measures" to minimize mercury discharges to water be implemented. The Mercury PMP should conceptually lay out the process which will be followed in doing a minimization evaluation. Because the best way to do a minimization evaluation will be very specific to the confirmed source(s), it's important that the PMP not be too specific on the evaluation methodology that will be followed. Similarly, what is deemed to be cost effective will likely change over time at a facility so, at least initially, it's probably best that the PMP discuss how the determination will be made only on a conceptual basis.

Reporting

While a Mercury PMP is in effect, annual reports must be submitted to the NYSDEC. These reports are how details of the ongoing Mercury PMP effort should be recorded. These reports should demonstrate that forward progress is being made. Because it may well be a year or two before measurable reductions of mercury in the effluent occur, it is very important that the annual reports document all the work that has been done.

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The annual report should also be used to detail more than the PMP's "game plan," but also what will be done to continue efforts to minimize mercury discharge.

Conclusion

A Mercury PMP can be a very effective mechanism to identify, and then reduce a SPDES permittee's mercury discharges. To be effective, a Mercury PMP must lay out an orderly, step-wise process to move from brainstorming possible mercury sources, to confirming whether or not a potential source is an actual source of mercury. Finally, it evaluates and ideally identifies cost effective measures to minimize mercury in a SPDES permittee's discharge.

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Resources

1. http://iaspub.epa.gov/waters/national_rept.control#TOP_IMP
2. *Ibid.*
3. http://www.epa.gov/mercury/pdfs/FINAL-Mercury-Roadmap-6-29.pdf
4. *Ibid.*
5. 6 NYCRR § 703.5, the controlling standards are typically based on protecting human health (fish consumption) and/or wildlife.
6. http://www.sustainablehospitals.org/HTMLSrc/IP_Merc_CS_Michigan.html.
7. http://www.ehw.org/Air_Pollution/AIR_MercuryRpt3-23-04.pdf
8. http://www.epa.gov/waterscience/methods/method/mercury/1631-fs.html

Illustration by Michelle Heyes