

## Appendix O. Methods to Measure Mercury

---

This appendix contains a list of common and recommended methods to measure mercury in water tissue or sediment, and information to support the methods or quantitation limits required or recommended by the Provisions. See Appendix P for details on the methods required for monitoring storm water.

Because researchers have found that nearly all mercury in fish tissue is in the form of methylmercury (U.S. EPA 2000), analysis of tissue for mercury, is recommended as a surrogate for methylmercury to reduce the cost of measurement.

The limits listed in the State Water Board's Surface Water Ambient Monitoring Program, Bioaccumulation Oversight Group (SWAMP /BOG) protocols are the same or slightly lower than the limits listed in the published U.S. EPA method, except for tissue (Method 7473) as shown in Table O-1. These thresholds were used to draft the recommended or required quantitation limits.

### **O.1 U.S. EPA Guidance on Methods to Measure Mercury**

For analytical methods for mercury, U.S. EPA recommends "...only the most sensitive methods such as Methods 1631E and 245.7 are appropriate in most instances for use in deciding whether to set a permit limitation for mercury and for sampling and analysis of mercury pursuant to the monitoring requirements within a permit" (Hanlon 2007, U.S. EPA 2010).

**Table O-1 - Summary of Quantitation and Detection Limits of Standard Methods**

Method (Reference)	Form of mercury	Matrix	Method Quantitation Limit <sup>1</sup>	Method Detection Limit	SWAMP Protocol Quantitation Limit <sup>2</sup>
<b>1631 E</b> (U.S. EPA 2002)	Hg	Water	0.5 ng/L	0.2 ng/L	0.04 ng/L
<b>245.7</b> (U.S. EPA 2005)	Hg	Water	5.0 ng/L		
<b>245.1</b> (U.S. EPA 1994)	Hg	Water	200 ng/L		
<b>245.2</b> (U.S. EPA 1974)	Hg	Water	200 ng/L		
<b>1631 E</b> (U.S. EPA 2001a)	Hg	Tissue, sediment	0.001 mg/kg <sup>3</sup> or 0.002 mg/kg <sup>4</sup>		
<b>7473</b> (U.S. EPA 2007)	Hg	Tissue, sediment	0.05 ng (not concentration based) <sup>5</sup> , But estimated as low as 0.00002 mg/kg <sup>4</sup>	0.01 ng (not concentration based)	0.009 - 0.012 mg/kg depending of fish size
<b>1630</b> (U.S. EPA 2001b)	MeHg	Water	0.06 ng/L	0.02 ng/L	0.04 ng/L

<sup>1</sup>Also called the “reporting limit” or “minimum level.”

<sup>2</sup>Bonnema 2014, Table 27. Note: values are targets, so some analyses may have somewhat higher thresholds.

<sup>3</sup>USEPA 2001: Appendix A to method 1631. The detection limit and minimum level of quantitation in this Method usually are dependent on the level of interferences rather than instrumental limitations. The method detection limit (MDL; 40 CFR 136, Appendix B) for Hg has been determined to be in the range of 0.24 to 0.48 ng/g when no interferences are present (see Appendix A, Tables A3 and A4). The minimum level of quantitation (ML) has been established as 1.0 ng/g. These levels assume a sample size of 0.5 g.

<sup>4</sup>U.S. EPA 2010

<sup>5</sup>U.S. EPA 2007

## References

- Bonnema A. 2014. Quality Assurance Project Plan: A Study of Lakes and Reservoirs with Low Concentrations of Contaminants in Sport Fish. Moss Landing Marine Labs. Prepared for SWAMP BOG, 64 pages plus appendices and attachments.
- Hanlon JA. 2007. Memorandum: Analytical Methods for Mercury in National Pollutant Discharge Elimination System (NPDES) Permits. James A. Hanlon, Director, EPA Office of Wastewater Management, August 23, 2007
- U.S. EPA (U.S. Environmental Protection Agency). 1974. Method 245.2: Mercury (Automated Cold Vapor Technique) by Atomic Absorption
- U.S. EPA (U.S. Environmental Protection Agency). 1994. Method 245.1: Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectrometry (CVAA).
- U.S. EPA (U.S. Environmental Protection Agency). 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1: Fish Sampling and Analysis, 3rd ed. EPA/823/B-00/007. Washington, DC: U.S. Environmental Protection Agency, Office of Water. [www.epa.gov/ost/fishadvice/volume1/index.html](http://www.epa.gov/ost/fishadvice/volume1/index.html)
- U.S. EPA (U.S. Environmental Protection Agency). 2001a. Appendix to Method 1631 Total Mercury in Tissue, Sludge, Sediment, and Soil by Acid Digestion and BrCl Oxidation. EPA-821-R-01-01 January 2001.
- U.S. EPA (U.S. Environmental Protection Agency). 2001b. Draft Method 1630. Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and CVAFS. EPA-821-R-01-020. Office of Water. Washington D.C.
- U.S. EPA (U.S. Environmental Protection Agency). 2002. Method 1631. Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry. EPA-821-R-02-019. August 2002. Office of Water. Washington D.C.
- U.S. EPA (U.S. Environmental Protection Agency). 2005. Method 245.7: Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry. Revision 2.0. EPA-821-R-05-001. February 2005. Office of Water. Washington D.C.
- U.S. EPA (U.S. Environmental Protection Agency). 2007. Method 7473: Mercury in solids and solution by thermal decomposition, amalgamation, and atomic absorption spectroscopy. February 2007. In: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846).

U.S. EPA (U.S. Environmental Protection Agency). 2010. Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion. EPA823-R-10-001. April 2010. Office of Water. Washington D.C.