

MEMORANDUM

DATE: November 16, 2012

SUBJECT: Determination of Representative Detection Level (RDL) and 3 X RDL Values for Mercury Measured Using Sorbent Trap Technologies

FROM: Robin R. Segall
Measurement Technology Group, AQAD

Barrett H. Parker
Measurement Policy Group, SPPD

TO: Toxics Rule Docket
EPA-HQ-OAR-2009-0234

This memorandum describes the process that was used to develop a representative detection level (RDL) as well as 3 X RDL values for mercury measured using sorbent trap technology. We based these values on information in the record concerning the best performing electric utility steam generating units (EGUs) designed for coal with a heating value greater than or equal to 8,300 BTU/lb. As explained further below, we have developed the RDL and 3XRDL values assuming short sampling periods so that compliance monitoring methods could provide timely data for operation of mercury control systems.

General Method for Determining RDLs

As explained in the note from Peter Westlin and Raymond Merrill to SPPD Management and MACT Rule Writers, we determine the representative detection level (RDL) based on the average of the reported pollutant specific method detection levels (MDLs) for the best performing units (those in the floor); we consider the resulting average MDL representative or characteristic of acceptable performance of source emissions testing and thus an RDL.¹ We use a multiplication factor of three with the RDL to increase the RDL pollutant concentration to a level where, when measured by the compliance test method, the precision of the test method approximates that of other EPA methods as estimated by the ASME study, nominally 10 to 20 percent relative standard deviation.^{2,3} This three times the RDL (3 X RDL) value expressed in

¹ Note from Peter Westlin and Raymond Merrill to SPPD Management and MACT Rule Writers “Data and procedure for handling below detection level data in analyzing various pollutant emissions databases for MACT and RTR emissions limits,” revised April 5, 2012.

² (ReMAP): PHASE 1, Precision of Manual Stack Emission Measurements; American Society of Mechanical Engineers, Research Committee on Industrial and Municipal Waste, February 2001.

³ The factor of three used in the 3XRDL calculation is based on a scientifically accepted definition of level of quantitation – simply stated, the level where a test method performs with acceptable precision. The level of quantitation has been defined as ten times the standard deviation of seven replicate analyses of a sample at a concentration level close to the MDL

units of the emission standard is then compared to the MACT floor value to ensure that the resulting emission limit is in a range that can be measured with reasonable precision. In other words, if the 3 X RDL value were less than the calculated floor or emissions limit (e.g., calculated from the UPL), we would conclude that measurement variability has been adequately addressed; if it were greater than the calculated floor or emissions limit, we would adjust the emissions limit to comport with the 3 X RDL value to address measurement variability.

Concerns Raised By Petitioners

With regard to the mercury emission limit for new EGUs designed for coal with a heating value greater than or equal to 8,300 BTU/lb, some petitioners asserted that the frequency of measurement contemplated for the sorbent trap monitoring system option in the final rule may not provide sufficiently timely feedback for operation of EGUs and mercury control systems.

The petitioners also suggested that the mercury emission limit for new EGUs designed for coal with a heating value greater than or equal to 8,300 BTU/lb be adjusted upward to allow for compliance monitoring using Hg CEMS, which would provide the frequency of feedback needed to operate the process and control systems.

We understand the petitioners' concerns regarding timely feedback on process and control systems. In response to these concerns, EPA evaluated the sorbent trap monitoring systems and assessed whether these systems could be utilized over the shorter time periods petitioners maintain are needed to provide more timely data.⁴ In promulgating the MATS rule, we thought that most facilities would opt for 1 to 2 week sampling periods when operating sorbent trap monitoring systems, but we now understand the need for more frequent data necessitating much shorter sampling periods. With shorter sampling periods approaching the frequency of CEMS, comes a need to examine the MDL/RDL for sorbent trap-based mercury measurements which was more than adequate for the sampling periods originally contemplated for sorbent trap monitoring systems. Though we didn't use the sorbent trap monitoring systems to collect data under the ICR, the technology used in the sorbent trap monitoring systems is identical to that of the short term method for mercury, Method 30B and, thus, it is reasonable to rely on the MDL information provided for the Method 30B testing conducted under the ICR to develop an RDL value for the sorbent trap monitoring systems.

A few petitioners raised an issue with Hg CEMS, suggesting that we adjust the limit to allow the use of Hg CEMS to demonstrate compliance. However, part III of the ICR required testing for mercury using Method 30B, a sorbent trap-based measurement method and, thus, there were no Hg CEMS data produced as a result of the ICR testing requirements. Though some Hg CEMS data for mercury were submitted under the ICR, none of the best performing units in the floor

(which translates to approximately three times the MDL which is defined as three times the standard deviation of seven replicate analyses of a sample at a concentration level close to the MDL (40 CFR Part 136, Appendix B)).

⁴ We note that we continue to believe that the final Hg limit can be measured using a sorbent trap monitoring system, but we acknowledge the monitoring frequency concern raised in reconsideration petitions.

provided us with any Hg CEMS data. This meant that for the MACT floor, we had no CEMS data that we could use to establish the level at which measurement precision for the Hg CEMS would be in a range similar to that of other EPA test methods; therefore, we had no way to adjust the new source emissions limit based on the use of Hg CEMS.

Determining RDLs for Sorbent Traps

We reviewed all available Method 30B sorbent trap testing and laboratory information for each EGU contained in the pool of best performing units designed for coal with a heating value greater than or equal to 8,300 BTU/lb and collected the reported method detection level for each EGU. As shown in Table 1 below, 24 out of 43 best performing EGUs reported MDL values. We calculated the arithmetic average of these available MDL values to yield the representative detection level (RDL).

The calculated average RDL of 1.1 nanograms of mercury was converted into the format of a new source emissions limit in pounds per gigawatt-hour (lb/GWh) by making appropriate unit conversions, dividing by the sampling rate in liters per minute (L/min), dividing by the sampling collection time in minutes (min), multiplying by a representative heat rate (11,180 BTU/KWh),⁵ and multiplying by 1.40 (a factor correcting the oxygen concentration to 6 percent). That product, when multiplied by 3 (in order to obtain the 3XRDL value) and rounded up, is 3.0E-03 lb/GWh.

The calculation is as follows:

$$3XRDL = 3 * \left[\left(\frac{1.1 \text{ ng} \cdot \text{min}}{0.5 \text{ L}} \right) \left(\frac{11,180 \text{ BTU}}{30 \text{ min} \cdot \text{KWh}} \right) (1.40) \right] \left(\frac{6.11E-07 \text{ lb} \cdot \text{L} \cdot \text{KWh}}{\text{ng} \cdot \text{BTU} \cdot \text{GWh}} \right),$$

and, when rounded, = 3.0E - 03 $\frac{\text{lb}}{\text{GWh}}$.

A sampling rate of 0.5 L/min was used in the calculation, and it is based on an informal survey of vendor information on the normal sampling rates for commercially available sorbent trap monitoring systems. To provide facilities with monitoring data as timely as that for Hg CEMS, we first considered use of a 15-minute sampling period with the sorbent trap monitoring systems. However, about 10 minutes are required to change out and leak check each new pair of sorbent tubes, leaving only 5 minutes of actual sample collection time to represent each 15-minute sampling period, so a 15-minute period was deemed inappropriate. We settled on a 30-minute sampling period (comprised of a 10-minute sorbent tube change out and a 20-minute sample collection period) as a reasonable compromise.

⁵ This is the average heat rate of the units used to determine the RDL value.

Facility ID	EGU	MDL, nanograms
3130	Unit 1	0.293
3130	Unit 2	0.293
7213	Unit 1	0.81
10043	Boiler 1	0.81
10143	Boiler 1	0.293
10566	Boiler 1	0.81
10566	Boiler 2	0.81
10603	31	0.172
10671	Unit 1a	2.4
10671	Unit 1b	2.4
10671	Unit 2a	2.4
10671	Unit 2b	2.4
10673	Boiler A	2.4
10673	Boiler B	2.4
10678	Boiler 1	2.4
50776	Boiler 1	0.25
50888	Boiler 1	0.81
50974	Boiler 1	0.174
50974	Boiler 2	0.174
50976	B1	0.062
54081	Unit 1	0.52
54081	Unit 2	0.81
54081	Unit 3	0.81
54081	Unit 4	0.81
Average (or RDL)		1.1

Table 1. Mercury Sorbent Trap Method Detection Levels for Best Performing EGUs