JH 11-7-13

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
**Field Observation Report: Stack Testing**

| | | |
|---|---|---|
| **Facility:** Michigan Power Limited Partnership | | **SRN / ID:** N4975 |
| **Location:** LUDINGTON | **County:** MASON | **District:** Cadillac |

| | | | | | |
|---|---|---|---|---|---|
| Permit(s): | MI-ROP-N4975-2008a | | | | |
| Save | | | | | |
| Contact (s): | Becky Sparks - Facility | Staff (s): | Jeremy Howe | Date (s): | 11-5-13 |
| | Pat Gillespie - Stack Testers | | | | 11-6-13 |
| | | | | | |

| **ACTIVITY:** | |
|---|---|
| ☐ Pre-Test Site Visit/Monitoring | ☐ Relative Accuracy Test Audit (RATA) |
| ☐ Performance Specification Test (PST) | ☐ COMS Performance Test Audit |
| ☐ Cylinder Gas Audit (CGA) | ☐ Visible Emissions Observation |
| ☐ Photos Taken | ☐ Other |

**This was Relative Accuracy Test Audit (RATA) of FGTURBINE/HRSG and FGBOILERS at Michigan Power Limited Partnership (MPLP) in Ludington, Mason County during November 5-6, 2013 for the following parameters:**

**FGTURBINE/HRSG**
NOx – lb/mmBtu (Part 75)
O2 – % (Part 75)
NOx – ppm @ 15% O2 (Part 60)
CO – ppm @ 15% O2 (Part 60)

**FGBOILERS**
NOx – ppm @ 15% O2 (Part 60)
O2 – % (Part 60)

**The following individuals were involved with the test:**

DEQ
Jeremy Howe – Cadillac

Stack Testers – Environmental Stack Testing
Patrick Gillespie
616-361-6785
environmentalstacktesting@gmail.com
Brooke – gathering process data
Dennis – on stack

Facility
Becky Sparks – CEMs Tech (also former env. compliance officer)
231-843-7573 x225
bsparks@camsops.com

**Observations:**

**11-5-13**

**I arrived onsite at 0930**

I took a tour of the plant with Becky. We went out to the trailer. I met Pat and Brooke. The CEMs time was roughly 12 minutes slow of cell phone time. Testers adjusted their times to match CEMs time.

**Run 1 Began at 0931**

I went upstairs to observe sampling on the stack. The door was initially locked, so Dennis had to come down to open it. There are flights of stairs inside an enclosure next to the CO converter and stack. Once you get outside, you still have to go up a short ladder to access the ports. The ports are very close to the top of the stack (maybe a couple of feet?). I asked Dennis how far in the stack the probe was. He said that it was in a couple of feet and he would move it every 7 minutes (3 times per run). When I asked him how far these points were in the stack he said that he didn't measure because the distance wasn't so important as much as the fact that it was moved during the test three times. I went back down stairs to the trailer and talked to Pat and Brooke about the sampling methodology. They pretty much reiterated what Dennis had said. I asked them the rationale for this. They said something to the effect that a stratification test was too much trouble, so they elected to sample at three points. They were taught to move the probe so to get a representative sample. I said if they could show me where this was described in the CFR that I would be ok with it. I pulled out my copies Part 60 and 75 appendices and started to look with them. After much wading through Part 75 Appx A and B, I think I found what they were originally taught. It is actually in Part 60 Performance Specification 2 and is highlighted below:

*8.1.3.2 Select traverse points that assure acquisition of representative samples over the stack or duct cross section. The minimum requirements are as follows: Establish a "measurement line" that passes through the centroidal area and in the direction of any expected stratification. If this line interferes with the CEMS measurements, displace the line up to 30 cm (12 in.) (or 5 percent of the equivalent diameter of the cross section, whichever is less) from the centroidal area. Locate three traverse points at 16.7, 50.0, and 83.3 percent of the measurement line.* ***If the measurement line is longer than 2.4 meters (7.8 ft) and pollutant stratification is not expected, the three traverse points may be located on the line at 0.4, 1.2, and 2.0 meters from the stack or duct wall.*** *This option must not be used after wet scrubbers or at points where two streams with different pollutant concentrations are combined. If stratification is suspected, the following procedure is suggested. For rectangular ducts, locate at least nine sample points in the cross section such that sample points are the centroids of similarly-shaped, equal area divisions of the cross section. Measure the pollutant concentration, and, if applicable, the diluent concentration at each point using appropriate reference methods or other appropriate instrument methods that give responses relative to pollutant concentrations. Then calculate the mean value for all sample points. For circular ducts, conduct a 12-point traverse (i.e., six points on each of the two perpendicular diameters) locating the sample points as described in 40 CFR 60, Appendix A, Method 1. Perform the measurements and calculations as described above. Determine if the mean pollutant concentration is more than 10% different from any single point. If so, the cross section is considered to be stratified, and the tester may not use the alternative traverse point locations (...0.4, 1.2, and 2.0 meters from the stack or duct wall.) but must use the three traverse points at 16.7, 50.0, and 83.3 percent of the entire measurement line. Other traverse points may be selected, provided that they can be shown to the satisfaction of the Administrator to provide a representative sample over the stack or duct cross section. Conduct all necessary RM tests within 3 cm (1.2 in.) of the traverse points, but no closer than 3 cm (1.2 in.) to the stack or duct wall*

I asked how wide the stack was and Pat looked it up to be 15 feet (I guessed 12). I told them to go with these points. Pat got out a longer probe and marked it with the above mentioned points. He took it up to the stack and installed it between Runs 4 and 5. This didn't really change the NOx or O2 concentrations, but did bump up the CO by about 0.5 ppm.

Becky and I went to see the CEMs shack. The CEMs shack was just inside the door to the building. It is in a custom made "cabinet" with lights and climate control. It was very clean and well set up. The CEMs SNs matched what we had in MACES.

It was very evident that the turbine had just been rebuilt as the NOx and CO concentrations were next to nothing (NOx ≈ 7 ppm and CO ≈ 1 ppm). This would be good for emissions testing, but it really challenges the analyzers to see pollution at these levels. EPA has alternative methods for evaluating RATAs at low levels, so we got familiar with these in Part 60 and Part 75.

| NOx lb/mmBtu | | | |
|---|---|---|---|
| Run | RM | CEM | d |
| 1 | 0.025 | 0.027 | -0.002 |
| 2 | 0.025 | 0.027 | -0.002 |
| 3 | 0.025 | 0.027 | -0.002 |
| 4 | 0.025 | 0.027 | -0.002 |
| 5 | 0.025 | 0.027 | -0.002 |
| 6 | 0.025 | 0.027 | -0.002 |
| 7 | 0.025 | 0.027 | -0.002 |
| 8 | 0.024 | 0.027 | -0.003 |
| 9 | 0.024 | 0.026 | -0.002 |
| AVG | 0.025 | 0.027 | -0.002 |
| Sd | | | 0.000 |
| **RA** | | | **9.554** |

**NOx lb/mmBtu: Part 75, 12-month RATA frequency**
**Fails: RA ≤ 7.5%**
**Passes: alternative criteria in Appx B 2.3.1.2(f) since the difference between RM and CEM is 0.002 lb/mmBtu:**

*For units with low NOX emission rates (average NOX emission rate measured by the reference method during the RATA ≤ 0.200 lb/mmBtu), when a NOX -diluent continuous emission monitoring system fails to achieve a relative accuracy ≤ 7.5 percent, but the monitoring system mean value from the RATA, calculated using Equation A-7 in appendix A to this part, is* ***within ±0.015 lb/mmBtu*** *of the reference method mean value*

| O2 % | | | |
|---|---|---|---|
| Run | RM | CEM | d |
| 1 | 14.6 | 14.8 | -0.2 |
| 2 | 14.6 | 14.8 | -0.2 |
| 3 | 14.5 | 14.8 | -0.3 |
| 4 | 14.6 | 14.8 | -0.2 |
| 5 | 14.5 | 14.8 | -0.3 |
| 6 | 14.5 | 14.8 | -0.3 |
| 7 | 14.5 | 14.8 | -0.3 |
| 8 | 14.5 | 14.8 | -0.3 |
| 9 | 14.5 | 14.8 | -0.3 |
| AVG | 14.533 | 14.800 | -0.267 |
| Sd | | | 0.050 |
| **RA** | | | **2.099** |

**O2 %: Part 75, 12-month RATA frequency**
**Passes: RA ≤ 7.5%**

| NOx @ 15% O2 | | | |
|---|---|---|---|
| Run | RM | CEM | d |
| 1 | 6.7 | 7.3 | -0.6 |
| 2 | 6.8 | 7.4 | -0.6 |
| 3 | 6.8 | 7.3 | -0.5 |
| 4 | 6.8 | 7.3 | -0.5 |
| 5 | 6.7 | 7.4 | -0.7 |
| 6 | 6.8 | 7.4 | -0.6 |
| 7 | 6.8 | 7.4 | -0.6 |
| 8 | 6.6 | 7.3 | -0.7 |
| 9 | 6.6 | 7.2 | -0.6 |
| AVG | 6.733 | 7.333 | -0.600 |
| Sd | | | 0.071 |
| **RA** | | | **9.718** |

**NOx @ 15% O2: Part 60 PS 2**
**Passes: RA ≤ 20%**

| CO @ 15% O2 | | | |
|---|---|---|---|
| Run | RM | CEM | d |
| 1 | 1.03 | 1.64 | -0.61 |
| 2 | 0.93 | 1.64 | -0.71 |
| 3 | 0.85 | 1.64 | -0.79 |
| 4 | 0.89 | 1.64 | -0.75 |
| 5 | 1.34 | 1.64 | -0.30 |
| 6 | 1.39 | 1.64 | -0.25 |
| 7 | 1.48 | 1.74 | -0.26 |
| 8 | 1.57 | 1.93 | -0.36 |
| 9 | 1.57 | 1.93 | -0.36 |
| AVG | 1.23 | 1.72 | -0.49 |
| Sd | | | 0.22 |
| **RA** | | | **54.09** |

**CO @ 15% O2 Part 60 PS 4A**
**Fails: RA ≤ 10% RM in denominator (54%),**
**Fails: alternative criteria RA ≤ 5% emission limit in denominator (6%),**
**Passes: alternative criteria RA ≤ 5 ppm* no denominator or percent (0.6 ppm)**

*From PS4A 13.2*
*Relative Accuracy. The RA of the CEMS must be no greater than 10 percent when the average RM value is used to calculate RA, 5 percent when the applicable emission standard is used to calculate RA, or **within 5 ppmv** when the RA is calculated as the absolute average difference between the RM and CEMS plus the 2.5 percent confidence coefficient.*

**Note: ppm is not corrected to 15% O2 since this is not supposed to be in units of the emission standard*

Seeing how all monitors were going to be able to pass either straight up or using alternative criteria, I decided to leave after Run 7. I saw Becky as I left. I asked her if we were all set for tomorrow. She said the boilers were ready and they were going to make OxyChem take steam. I asked her if the boilers would be running at greater than 50% of normal load. She said that they would be producing what they could. I wasn't really sure if this meant they were going to be over 50% of normal load. I told her that if they want they can redefine what a normal load is at an artificially lower level, but then this would be the max that they could run at until the next RATA. She wondered why this was important since we weren't testing an emission limit, but challenging the analyzers. I told it was because it is a requirement of PS2. She told me that MPLP would shove whatever steam they could to OxyChem for the test. I'm still not sure if that is more than 50% of normal load. It is my

understanding that when companies are doing compliance tests, they need to obtain the necessary production levels. Unsellable product is not a reason for insufficient production during testing.

**I left the site around 1400**

**11-6-13**

**I arrived onsite at 0900**

I had a talk with Becky about the boiler CEMs setup. I was a little confused by what was in MACES. She told me that there is one CEMs and that it switches between Boiler A and Boiler B exhaust every 7 minutes.

Becky and I went over to the CEMs shack for the boilers. This was identical to the one for the turbine. I noticed an error in the SN for the O2 monitor (entered a 1 instead of a / ). MPLP measures dry, so they have a cooler in the CEMs shack to condense the water out. Happy with their setup, Becky and I went out to the testing trailer.

Pat and Brooke said that they were doing the strat test today because they wanted Dennis off the stack (the weather was horrible with heavy rain and wind). The strat test coincided with Run 1 and 2. I think they did the strat test through two ports, which isn't necessary (I need to check on this). They were just about done by the time I was aware of this.

Pat, Brooke and Becky explained to me that they were going to RATA the boiler CEMs with Boiler A running today and then re-RATA the CEMs tomorrow with Boiler B running. Adding to the confusion, the CEMs cannot sample from just one stack, so roughly half of each run was invalid. The whole situation really confuses me for the following reasons.

- RATA runs are supposed to be at least 21 minutes long, meaning they consist of 21 separate one-minute readings. Each run had roughly 11 valid one-minute readings since the CEMs was pulling Boiler B exhaust half the time (they elected to have each run be 22 minutes long)
- It seems odd to RATA the CEMs twice each year. The only thing different is the sample line to each boiler, but the instruments are the same. If there was a problem with the sample line, it would be caught in the daily calibration checks.

The three of them assured me that this is the way it has always been done. These deviations would have been ideal to put in the approval letter. However, given the fact that the site is unusual I told them I wasn't going to stop what they were doing if this is indeed the way it has always been done. I told them that I would check into this to make sure. In my opinion, each boiler should have a CEMs. That is the way it is at every other place. Short of that, it seems a reasonable approach to me would be to RATA Boiler A exhaust one year (extending each run to collect 21 valid minutes) and then doing the same using Boiler B exhaust the following year. Or along the same lines, do 5 runs (with 21 valid minutes) on Boiler A and 4 runs on Boiler B each year.

Brooke and Becky discussed what would be the appropriate way to document steam load with me (graph/chart, resolution). I told them a chart or graph would be fine as long as the readings were in 15 minute increments or less. Brooke went to the control room and came back with an example graph with 1 minute readings. Becky told her to tell them to lower the vertical axis to be just above the highest point since there wasn't any numbers for scale other than at the top of the graph. I added that really they only needed to send one graph as long as it displayed load continually and started before Run 1 and ended after the last run had finished.

| NOx lb/mmBtu | | | |
|---|---|---|---|
| Run | RM | CEM | d |
| 1 | 0.029 | 0.033 | -0.004 |
| 2 | 0.028 | 0.032 | -0.004 |
| 3 | 0.028 | 0.032 | -0.004 |
| 4 | 0.028 | 0.032 | -0.004 |
| 5 | 0.029 | 0.032 | -0.003 |
| 6 | 0.029 | 0.032 | -0.003 |
| 7 | 0.029 | 0.032 | -0.003 |
| 8 | | | |
| 9 | | | |
| AVG | 0.029 | 0.032 | -0.004 |
| Sd | | | 0.001 |
| **RA** | | | **13.938** |

**NOx lb/mmBtu: Part 60 PS 2**
**Passes: RA ≤ 20%**

Once I get the report, I will probably take all the valid minutes from both boilers and combine them to get a more run-of-the-mill RATA. Since they were going to re-RATA the same instruments, I elected not to come back the final day.

**I left the site around 1230**

Overall, I felt pretty good about the test. Becky was very knowledgeable about how the CEMs work and RATAs in general. Pat and Brooke seemed very knowledgeable about how to collect the data, but a little unclear on what the requirements are in the CFR. Every tester has things about the CFR that they are unclear about (methods, performance specifications, Part 60 vs Part 75). However, they were one of the most open and helpful stack testers that I have worked with. They continually checked with me to see if I was ok or needed to see something and offering to print off results. They constantly asked for my input on matters. Even when I messed up and asked for the CO ppm corrected to 15% O2, they went and did it without much of a fuss because it was what I wanted. Personally, I would prefer to work with testers that are open with me and respect the methods as they are. In short, they worked with me instead of getting in endless debates about the scientific merits of the methods or rules.

Also, while I was there I noticed some sort of a natural gas oven with a short stack that was onsite, but was fenced off and had a MichCon sign on it. Becky was saying that they preheat the natural gas by running it through this oven to get more Btus out of it. The flame had gone out during testing, so MPLP called MichCon to get it going again. It appears this oven runs all the time and had a small window that I could see the flames inside. I'm not sure what the permit status is of this or if it needs one.

Staff: Jeremy Howe CC: Date: 11-7-13