Replacement of Outlet Monitors for the Continuous Emission Monitoring System
At the York County Resource Recovery Center

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INTRODUCTION

As titled this paper is a description of our experiences with our original “time shared” outlet continuous emissions monitoring system and the replacement of it. I will detail some of the inherent problems we faced through the years with the time shared monitors. I will describe what the catalyst was which required us to replace our monitors. And the preparation for and replacing of the monitors with the benefits of having done so.

FACILITY CHARACTERISTICS

The York County Resource Recovery Center (YCRRC) is a 1344-ton-per-day facility that converts raw municipal solid waste (MSW) into useful energy. The plant has three combustor boiler trains using Westinghouse O’Connor water-walled rotary combustor technology. The facility started operating in the fall of 1989.

MSW is delivered to the facility in the waste storage area, from where it is fed by crane into the feed chute and from there to the combustor. The combustor is a 13.3-foot diameter inclined cylinder that rotates at a slow speed. Combustion air is supplied to the combustor to burn the MSW and to create hot flue gas, which is used to produce steam in the boiler. Steam from the boiler is used to generate electricity for sale to GPU.

Each unit of the YCRRC is designed to burn approximately 448 tons per day of MSW with a higher heating value (HHV) of 4500 Btu/lb. The Westinghouse Data Processing Family (WDPF) system located in the central control room operates the automatic combustion control that regulates feed ram speed, combustor rotation speed, and combustion air distribution. The combustion control logic is based on set-point parameters such as flue gas oxygen level, steam flow, flue gas carbon monoxide concentration, and combustion gas temperature.

Pollutant emissions are controlled using a spray dryer absorber and baghouse for each unit. A hydrated lime \([\text{Ca(OH)}_2]\) slurry is injected into a reaction vessel where acid gases (mainly \(\text{SO}_2\) and \(\text{HCl}\)) are absorbed (lime slaking system: Wallace & Tiernan series A-758). The system is designed so that hot flue gas evaporates the atomized lime slurry to leave dry calcium salts. A fabric filter (baghouse) is used downstream of the spray dryer to collect the spray dryer reactant products, unreacted sorbent, and fly ash. Mercury emissions are controlled by an activated powdered carbon injection system (carbon injection system: Norit PAC Dosing System); the injection point is downstream of the
spray dryer absorber (spray dryer absorber: Niro Atomizer F-100), before the baghouse (fabric filter: Pulseflo).

Each boiler is designed to produce 120,000 pounds of steam per hour. The actual day-to-day throughput varies with the heating value of the MSW’s fuel. The total design steam production capacity of the facility is 360,000 pounds of steam per hour at 800deg.F and 800 psi. The facility’s turbine is designed to generate 37 MW (gross) of electricity.

CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)

The facility’s Title V Operating Permit requires the continuous monitoring of the following emissions from the flue gas: In situ O2 prior to each boiler outlet, Carbon Monoxide (CO), Oxygen (O2), Carbon Dioxide (CO2), Sulfur Dioxide (SO2) at each boiler outlet. Air Pollution Control (APC) outlet: Hydrogen Chloride (HCl), Sulfur Dioxide (SO2), Nitrogen Oxide (NOx), Oxygen (O2) and Opacity at the stack.

The facility’s boiler outlet monitoring system is a dedicated system and is the originally installed system. The original APC outlet monitoring system was a time shared system. We had two complete sets of the above listed outlet monitors. One set was the primary and one set was the back-up. The APC outlet monitoring system (primary or back-up) which was on-line would alternate between the three units, sampling each unit for a five minute interval. This was accomplished through the control of the Data Acquisition System (DAS). Through a programmed timing system the DAS would initiate the cycling of the unit sampling valves to alternate between the three units. The originally installed HCl monitors were the Bodenseewerk Spectran 677s. This style monitor requires a hot wet sample in order to analyze. To supply a hot wet sample requires a sample line to be heated to 365deg.F and insulated from the duct to the monitor. The HCl monitor was also maintained at this temperature. The sample split inside the CEMS room sending sample to the HCl monitors and sample through a condenser to dry and cool it preparing it for the SO2, NOx and O2 monitors. An in situ O2 monitor was required for the APC outlet in-order to be able to calculate the proper HCl reading.

Through the good work of our Instrument Technicians, they were able to keep this system running reliably and accurately. It was a high maintenance system though for these reasons: The heaters would fail in the sample lines. The sample lines were large and bulky. It would take at least four people most of their work day to run a sample line. The HCl monitors were very hard to set up and would require outside technical help at times to get them set up properly. There were many valves for each unit tied into common headers such as cal gas valves, purge valves, sample valves and shut off valves. Through wear and tear, any one or more valves may leak by affecting the sample for the unit being sampled. You could get carry over from another unit or cal gas. This would be a time consuming task to identify which valves were failing and then replace them. Any maintenance or auditing affected all three units data availability because to work on one unit meant the other units would not be sampled while working on the on line monitors.
As I mentioned before, in spite of the inherent problems with the system our personnel were able to keep the system running reliably and accurately. The problems primarily stemmed from the time shared aspect and not the monitors themselves. But the HCI Spectran 677s had their day in the sun and the manufacturer was no longer supporting them. By 1999 key replacement components were no longer available. We were told that when we put a search out in 1998 for a replacement cell we got the one Bodenseewerk had in their museum. We knew the end was near. Replacement of the HCI monitors was the catalyst for the change we were making for the APC outlet monitors.

**CHOICES – DECISIONS**

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<th>Parameter (CSMM reference)</th>
<th>Performance Test Requirements</th>
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<td>RATA (%)</td>
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<td>HCl (Table VI)</td>
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<td>SO2 (Table II)</td>
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<td>O2 (Table III)</td>
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Due to the strict requirements of the State the search for new HCl monitors narrowed quickly to two vendors. The newest version of the Spectran which is now Perkin Elmer MCS 100 and 200, and the MIR 9000. The Perkin Elmer is a multi sampling unit which requires a hot wet sample system. The MIR is a multi sampling unit, delivering a dry sample from the probe to the monitor.

Looking at the multi sampling capabilities of both monitors and the minimal cost to add the other parameters to the monitors we decided to change from the time shared system to dedicated monitors for each unit with a common back-up. In order to accomplish this we would have to select which monitor we would be using, get approval from the State to change our APC Outlet sampling system and put it all together following all the State requirements.

We chose the MIR 9000 system after having a demo unit set up and sampling on our #3 unit. From the time of receiving the demo unit we were able to mount the probe and probe box at the sample point, run the small sample line down to the monitor room, connect a temporary air supply and have the monitor up and running in a matter of five hours. We ran this unit for three weeks comparing its data with our monitor's data. It ran with no problems and the data was good. This gave us a good opportunity to see it and believe it.
The reasons for choosing the MIR:

- It cost significantly less
- It is a dry sample system eliminating the need for the large heated sample lines, which required maintenance.
- It is compact. We were able to mount all four monitors on one small wall. This allowed us to install the new monitors completely and have them up and running while still operating and collecting data from our old system. The Perkin Elmers, due to their size would have required us to tear out some of our old system in order to install the new. This would have created much more potential for lost data and impact our data availability and had been more of a labor intensive project.
- Significantly smaller sample cell requiring less calibration and audit gases.

Summary: Cost less, significantly less maintenance with the dedicated units than the current time shared units, simplified installation and change over from the old system to the new, daily cost savings on cal gases.

THE CHANGE OVER

PADEP has a three phase process for making any changes to the CEMS. Before you can install any equipment a “Phase I” application must be submitted. The State wants to know the probable capability of a monitoring system to meet all of the regulatory requirements. Obviously all technical data concerning the monitors, sample location and addressing the specific requirements for percent error and data availability are addressed.

After Phase I approval we purchased the equipment. Altech, MIR 9000 reps, came to our site to take measurements of where we wanted to install the monitors. They developed drawings. Our Instrument Technicians performed all the preparatory work at our site. This included running the new sample line from the sample point to the monitoring room, ran all cal gas lines, air lines, power feed and drain lines to the monitor location. Our maintenance installed new sample ports in the APC Outlet ducting. Our Data Acquisition System (DAS) provider put the program change together and the PLCs for the job.

We submitted the “Phase II” application which informs the State of the testing schedule for the new monitors and addresses all the State required testing which we will be performing to demonstrate compliance.

When the rack mounted monitors arrived on site we were able to get them into the room and mounted on the wall in about two hours. The Altech reps spent the next day wiring the monitoring system to the PLCs and making all sample, power, gas, air and drain terminations. The DAS provider was able to run the DAS program through his laptop the following day to verify all Inputs and Outputs and the program functions, calibrations, purges, zero references, alarms etc. We let the monitors run for a couple of days while the Tech reps made their checks and told us it was ready for the change over. We were able to do all this with the old system still running and collecting data. The day we changed from the original time shared system over to the new dedicated system is the
only day there was any interruption to our data collection. The DAS program had to be changed, which required shutting down the DAS to connect the new PLCs and install the new program for the dedicated monitors. We lost about eight hours of data collection time on our system that day. In our “Phase II” application we informed the State of the data collection interruption.

After the new system was in service for a few days we commenced the State required “Phase III” testing which includes: Relative Accuracy Testing, 24 hour Drift, 2 hour Drift, Calibration Error, Response Time, and Data Accuracy for the DAS. All tests were passed satisfactorily. The “Phase III” test report was submitted to the State. The State approved the system.

BENEFITS

Reduced calibration gas usage significantly
• NOx / SO2 – down 65% = $3,504
• 12% O2 – down 60% = $2,274
• HCl – down 75% = $7,560

Improved data recording. Zero data availability penalties.

Lowered maintenance time on the APC outlet monitors.

We will be able to set up a CEMS shop in the CEMS room once the old monitors are removed. The removal will open up half the room for use.