New Plant Morrow Monitors Verify Compliance
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As a generator of electric power, South Mississippi Electric must meet state and federal requirements regarding various environmental issues, including water quality, solid waste, hazardous waste, oil spill prevention, quality of storm water discharged, and air quality control. SME's six generating facilities (Plant Morrow, Plant Moselle, Benndale Combustion Turbine, Paulding Combustion Turbine, Silver Creek and Sylvarena) comprise 70% of the Association's environmental efforts expended for permitting and compliance with those regulations. Substation and transmission line projects comprise the remaining 30%.

In 1990, Congress amended the Clean Air Act to combat acid rain, writing new regulations for U.S. power plants. In order to document generating unit emissions levels, Continuous Emissions Monitoring Systems (CEMS) were installed at Plant Morrow and Plant Moselle in 1993 and later at the Silver Creek and Sylvarena facilities. CEMS equipment continually measures the emissions in the flue gases that leave industrial stacks.

In March 2005, the Environmental Protection Agency (EPA) issued the Clean Air Interstate Rule (CAIR) to cap emissions of sulfur dioxide (SO2) and nitrogen oxides (NOx). When fully implemented, CAIR was intended to further reduce SO2 emissions by over 70% and NOx emissions by over 60% from 2003 levels. Last July the rule was struck down, causing utilities nationwide to pause in making compliance plans, but in December the rule was reinstated and EPA was told to revise its provisions. Despite the uncertainty through the last half of 2008, SME continued to move forward with plans designed to meet the expected new requirements.

"These issues call for a wide variety of considerations, but at the end of the day we have to ensure that we are compliant," said Joey Ward, environmental affairs and fuels manager. "Excellence is the only acceptable answer. We constantly work to find the most cost-effective ways to meet our obligations to serve our Members."

Plant Morrow already removes much of the SO2 created from burning coal. When the exhaust gas leaves the boiler, it passes through a scrubber and is sprayed with limestone slurry. The limestone reacts with the SO2, neutralizing the pH level and lowering SO2 emissions. The scrubbed exhaust gases then exit through the stack.

"We are currently working through a contract to modify the scrubbers," said Greg Chancellor, senior project manager. "By original design, the scrubbers currently treat 62% of the boiler flue gas. The upgraded scrubbers will treat 100% of the gas and remove up to 98% of SO2. The scrubber upgrade will save the Association money each year by avoiding SO2 credit purchases while also providing more efficient usage of the limestone slurry and reductions in mercury emissions."

In addition to the scrubber modification project, which will facilitate more aggressive scrubbing and ultimately reduce emissions, the plant's stacks also needed acid-resistant internal liners and new CEMS instruments that can tolerate a lower stack temperature.
"In 2007 we decided to install new CEMS equipment on both Unit 1 and Unit 2 at Plant Morrow," said Chancellor. "Not only were the original units more than 14 years old, but several parts had become obsolete, making maintenance very difficult. We needed to go beyond meeting the current regulations knowing that tighter, stricter regulations were on the way that would require accurate monitoring instruments."

The new CEMS devices precisely measure the levels of SO2, NOx, carbon dioxide (CO2), and the flow rate of the flue gas exhausted through the plant's stack. Samples are extracted from the gas near the top of the stack and transferred via heated umbilical tubes to the analyzers in the CEMS shelter, located at the base of the stack. The emissions levels are then processed and recorded electronically.

"We received the new system in late 2008 from Teledyne Monitor Labs (TML)," said Eddie Pendarvis, instrument and electrical foreman. "Our goal was to have the system operational by the end of 2008. The CEMS shelter was delivered fully wired, and we connected the analyzers to new probes installed in the stack. TML representatives came onsite to calibrate the units and participate in the third-party Relative Accuracy Test Audits (RATAs) required by the EPA."

The probes for the original units were inserted through the wall of the stack approximately two hundred seventy feet above the ground—a position referred to as in situ—causing the instruments to come into direct contact with the gas. The new units are dilution extractive, meaning that the instruments are not located in the stack but are in the CEMS shelter. As clean, dry air supplied by a new air compressor flows by the probe on the stack, it creates a vacuum that pulls the flue gas sample from the probe and transfers it to the instruments.

"Because the old probes came into direct contact with the flue gas, corrosion was an issue," said Pendarvis. "The temperature of the gas could not fall below 180° or the moisture from the scrubbing process would react with the remaining sulfur and create sulfuric acid in the stack, which corroded the instruments. Because of the new extractive probes and the new acid-resistant liner, stack temperature is no longer an issue and allows for wet stack operation."

"In addition to the required emissions data, the CEMS units also monitor flow rate and opacity," said Jay Fairley, instrument tech I. "The stack flow rate is the measurement of the rate of gas flow in standard cubic feet. Opacity measures the amount of particulate matter in the flue gas at a point in the draft system."

Flow is measured by sending two ultrasonic sound waves across the stack's inside diameter in the shape of an X. The average speed of the two paths results in a more accurate flow measurement, especially for the Unit 1 stack which has cyclonic flow.

Electrostatic precipitators in the exhaust system remove particulate matter—primarily fly ash, which is also a regulated emission element. To measure opacity, a light beam is transmitted across the inside of the precipitator outlet ductwork. The level of light that returns to the monitor is an indication of flue gas opacity. While opacity is not a direct measurement of particulate matter emissions, it serves as a relative indicator.

“The new CEMS equipment is necessary to allow wet stack operation, a result of scrubbing more SO2,” said Rod Rogers, results engineer at the plant. “The new system is more user-friendly and appears to provide more accurate emission measurements and greater operating time. It also requires less EPA protocol gases and an inventory of fewer spare parts than the old system. Our goal is to emit less, and this new system is one component that allows us to achieve that goal.”

Another key performance indicator of the CEMS is the percentage of operating time that monitoring equipment is available to measure and record valid emissions data. CEMS data not only accounts for emissions but also demonstrates SME’s continual compliance with state and federal permit limits. “Our job is to put the best monitoring devices in place for us to properly meet the various regulations that apply to our operations,” said Hank Sossaman, environmental data coordinator, who is responsible for submitting the data to EPA on a quarterly basis. “This monitoring system is state-of-the-art, should have greater operating time, and allows us to be confident that we are in full compliance.”