Plant Labs Are Key to Operations and Compliance
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Meeting environmental responsibilities and maintaining the functionality and reliability of South Mississippi Electric's power generation units depends on an elaborate system of equipment, computers and employees. Integral components of that system are the chemistry labs, chemists, and lab technicians at Plants Moselle and Morrow.

The chemists and technicians are charged with monitoring the quality of the water, fuel and other materials that are used throughout their respective plants, and also with ensuring that the products or by-products discharged as part of the power generation process meet all regulations. While the two labs share the common goal of helping to maintain their plant's equipment and protect the environment–and lab employees at both facilities spend about an equal amount of time with tasks associated with each role–they vary in terms of their operations and daily responsibilities.

"One of the primary functions of both labs is to preserve the quality of the water that is used daily in the power generation process and then ultimately leaves the plants, whether it is discharged into receiving streams or evaporates through the cooling towers," said Rodney Culpepper, a chemist at Plant Moselle who has also worked at Morrow. "Water used in our boilers must be very clean in order to maintain the quality and reliability of our equipment and to uphold our environmental responsibility."

Both facilities chemically treat, sample and analyze the cooling tower circulating water and raw water produced from eight water wells (five at Morrow and three at Moselle) to ensure consistent water quality.

Each of the two units at Morrow use closed-loop systems that circulate 100,000 gallons of water during operation, in addition to two 90,000 gallon reserves. The three original units at Moselle circulate a total of 90,000 gallons of water continuously with two 40,000 gallon reserves. Chemist Wes Long and lab technicians Randy Hogan and Bryan Lindley analyze the water that flows through both boiler units at Plant Morrow, as do Culpepper and Lab Technician Dennis Butler at Moselle.

Plant Moselle samples water from 21 points (seven sample points on each of the three original units) that flow continuously to the lab for analysis. The sample water leaves each sample point at up to 950 degrees Fahrenheit and 1250 pounds per square inch (psi) and enters a chiller panel for conditioning prior to analysis. The chiller panel reduces the temperature to 72 degrees Fahrenheit and depressurizes the water to 10-15 psi, creating consistent sample conditions before it reaches the lab.

Those samples flow through one of 14 automated analyzers in the lab to examine the chemical content of the water. The analyzers provide Culpepper and Butler the information needed to maintain proper boiler water chemistry for each unit.

Water used at Plant Morrow undergoes special treatment before it enters the system, first flowing through a carbon filter, a demineralizer, and then a polisher. The water then travels to the lab through a system similar to Moselle's to lower its temperature and pressure for analysis.

"Water pumped from the ground would be too damaging to the plant's equipment, especially the turbine blades," said Lindley. "Before we will allow the water to flow through our boiler tubes, we want

to verify that it is as pure as it can be. We test for the presence of sodium and silica, and make sure that the pH levels are within an acceptable range."

When the analyzers indicate one substance in the water is higher or lower than optimal limits, the water is then analyzed manually to ensure the reading is accurate and not skewed due to an analyzer malfunction. If the readings from the manual test confirm the original analysis, the source of the problem has to be determined and corrected as rapidly as possible by either adding chemicals or additional high purity water to the process water. The most common chemicals added are oxygen scavengers (which tie up oxygen in water to prevent corrosion), phosphates, ammonia, and caustic soda.

One common problem is an increase in silica that often occurs during a unit start up. Silica deposits on the inside of the boiler tubes, which can lead to premature boiler tube failure. Other problems identified through the analyzers include increased amounts of copper, indicating a possible problem with the tubes inside the condensers, which are made of copper alloy, or increased amounts of iron, indicating a possible problem with the boiler tubes, which are made of iron and steel alloys.

"The analyzers also track historical readings of each sample test, aiding in the trending of the analyses," said Butler. "This also allows us to pinpoint things that occurred while the lab is unmanned, providing an explanation for a variation in sample readings." For example, when the analyzers document a change in the phosphate or pH levels in the water at a particular time, lab personnel can check with the control room to determine if the change coincides with an increase in load or the start up of a pump. Significant changes in the readings will activate an alarm in the control room during hours when the lab is unmanned, and a staff member will be called in to help remedy the condition.

Water from the boilers and cooling towers ultimately evaporates or discharges into a nearby receiving stream, demanding that SME adhere to environmental compliance regulations set forth by the Mississippi Department of Environmental Quality (MDEQ). Moselle (along with Sylvarena) discharges into Leaf River and Morrow discharges into Black Creek.

"At Morrow, all discharged water passes through the scrubber supply pond, the coal pile run off pond, or the cooling towers blowdown pond, giving us three chances to remove any restricted substances," said Lindley. "We test the water in the ponds regularly and if it does not fall within certain parameters, it must be treated before it can be released."

Both labs also try to enhance their plant's environmental integrity by incorporating environmentally-friendly products into their processes. "We make every effort to use as few harmful substances as possible," said Culpepper. "The DEQ has to approve all chemicals we use to treat the water, so this effort really pays off."

In addition to analyzing the water that processes through each plant, both labs must also approve all fuels and perform several additional tasks unique to their plants.

Culpepper and Butler collect samples of the natural gas that fuels Moselle. The gas is analyzed before it comes into the facility to ensure that it meets SME standards, thus resulting in proper performance of plant boiler and turbine equipment. The duo also has similar responsibilities for the combustion-turbine units at Sylvarena and Silver Creek.

The lab at Plant Moselle will undergo significant changes in the next year as a result of the current repowering project. One noticeable change will be the addition of a new analyzer panel that will add 39 new analyzers, increasing the lab's total count to 53, which will significantly increase the amount of samples and tests.

The lab at Plant Morrow examines the coal used to fuel the boilers to ensure the proper heat content (BTU) and the correct moisture and chemical characteristics. The lab also analyzes the limestone used in the process of scrubbing the flue gas, ensuring the presence of the appropriate levels of calcium and magnesium.

Long, Hogan, and Lindley are also responsible for the periodic testing of the plant's slurry, which is a by-product of the scrubber process. The test results indicate the effectiveness of the scrubber in removing sulfur dioxide from the flue gas. Although the test is typically performed monthly on each unit, the test is currently being performed daily on Unit 2 in order to determine what adjustments need to be made as the upgraded scrubber is being commissioned.

"Some plants outsource their lab duties or assign some of the duties to their operations staff," said Culpepper. "As in-house labs, though, we can respond to and diagnose problems as they occur rather than wait on contractors to arrive on site. It is also important that we have the ability to help prevent problems rather than react to them."

"Without the labs and the guys that run them, our plants would not stay online on a daily basis," said Long. "The labs are essential to the process of maintaining our equipment and environment."