Sample Upgrade Case Study II
Complete Sample Panel System Replacement
Two Steam and Water Sample Systems
380 MW Coal Fired Drum Type Boilers
Built: 1985-1990

Solutions Inc. was contracted in 2009 to furnish and install upgrades for two existing sample systems at a coal fired plant in the Southwest United States. The Unit 1and Unit 2 systems were essentially identical, with 8 samples from the condensate, feedwater and steam cycle. The upgrade addressed two main problem areas, cooling and flow.

Cooling Problems

Problem: The Original **Secondary Sample Chillers** had failed and had not functioned for years (shown at right). As a temporary fix, plant personnel had tapped into the main HVAC system chllers to feed the sample panel secondary coolers with chilled water. This caused problems in the summer months when cooling to the control rooms and other critical areas was compromised because the HVAC chillers were overloaded due to the additional heat loads from the sample coolers.

Solution

New Chiller Units were installed to replace the old sample panel chillers. The chillers are designed to maintain sample temperatures of 25º C (77º F) +/-1 ºC and are even able to maintain this temperature in the wintertime, when the primary cooling water is so cold that samples may be subcooled below 25º C.

The intertie from the plant HVAC chilled water system was isolated and left in place as a backup source.

Problem: The **original secondary cooling scheme** was designed to modulate the cooling water to the sample coolers. A temperature sensor installed in the sample at the cooler outlet sent a signal to the square temperature controllers (black boxes shown at right). These controllers operated the **pneumaticcontrol valves** (shown below) If the sample temperature was too high, the controller was supposed to open the control valve, increasing the flow of chilled water to the sample cooler shell and cooling the sample.

Problem:The controller and control valve were pneumatic powered units. The sensors were the gas-filled bulb type. Many of the control valves were full open, or full closed, indicating that the sensor had leaked the gas fill, or the controller or valve had malfunctioned.

Solution The upgraded sample rack is shown at right. There are no pneumatic controllers or control valves. The **new chiller** shown on page 1 is designed to maintain chilled water temperature at 24ºC +/- 1ºC. The integral pump provides enough flow to each sample cooler so that the heat from the hot sample flowing through the sample cooler is reduced to no more than1ºC above the cooling water temperature, exiting the sample cooler at 25ºC, +/- 1ºC.

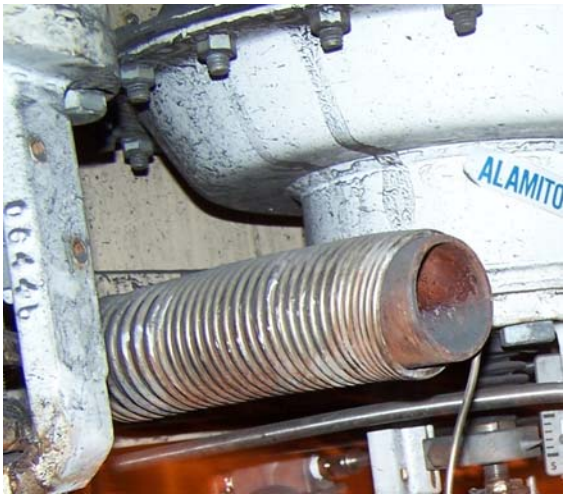
Problem: Occasional failure of primary cooling water supply or other factors had occurred in the past, and allowed hot samples to flow into the lab. This had resulted in damage to fragile and expensive instruments.

Solution **High temperature automatic shutoff valves** were installed to stop the sample flow when the sample temperature rises above 120ºF.

These valves can be manually reset when the sample temperature returns to normal.

Flow Problems

Problem: Capillary tubing coils (shown at right) were the OEM supplied means to reduce the pressure of samples such as Boiler Blow Down, Superheat Steam, etc. Many of these capillaries had been disconnected or bypassed (likely due to plugging), and were non-adjustable.



Solution The capillaries were replaced with **variable rod-in-tube type valves** (shown at left). These valves are adjustable and can handle sample pressures up to 5000 psig and temperatures to 300ºF. They were installed downstream of the primary coolers. Fine control of sample pressures and flow was accomplished with no wire drawing or wear, even with pressure drops of 2500 psig or more.

Problem: Flow to the analyzers in the lab was variable. The analyzer rotameters required constant adjustment to maintain proper flow.

Solution

The sample flow path was modified to include a "constant pressure header by means of automatic back pressure/relief valves. They are designed specifically to handle debris with a wide flow range. Flows are now adjusted upstream with a single flow control valve with excess flow to the sample sink inside the lab. A non-adjustable back pressure valve set at 42 psi was used in order to provide the sample pressures needed to transport the samples into the lab area, located approx. 50 ft. from the sample panel area

Other upgrades included:

Total flow rotameters, which allowed the Lab personnel to quickly view the total sample flow and adjust it to maintain the velocities necessary to keep magnetite and other debris suspended, avoiding sample line pluggage.

Solutions Inc. SDS-15-SS Sample Strainers and integral high pressure blowoff valves on the Boiler Blow Down samples to aid with debris removal on Unit startup.