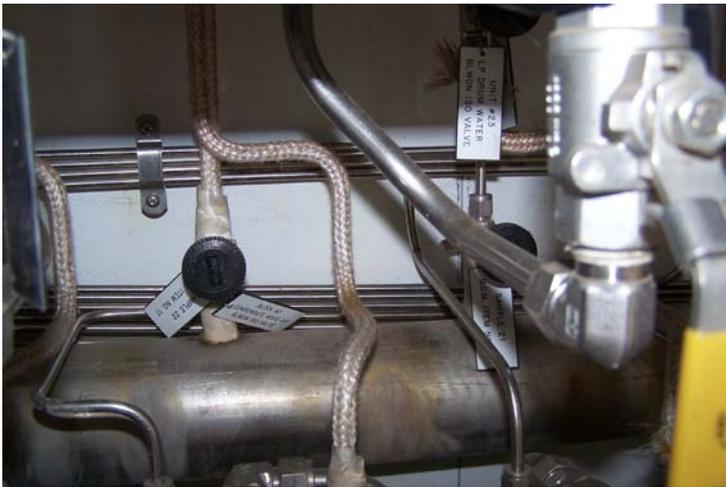


Erratic Sample Flow Case Study
Two Steam and Water Sample Systems
1789 MW Natural Gas Fired Combined Cycle - Two Power Blocks – “3 on 1”
Built: 2001-2003

Solutions Inc. was contacted in 2007 by plant personnel to recommend solutions to problems with two existing sample systems. The Block 1 system contained 25 samples from 3 Heat Recovery Steam Generators (HRSG's) and common condensate systems. The Block 2 system contained 24 samples. An on-site survey revealed problems mainly associated with inadequate and/or variable sample flows. Solutions Inc. was contracted to rebuild the two panels in 2007 and 2008. Three areas where OEM equipment caused erratic flows and the solutions are shown below.:

#1 – Blowdown Valves



Problem: The OEM blowdown valves were inadequate (black round handle **instrument type valves**– shown at left). The valves were located in a hard-to-reach areas and tended to leak due to frequent operation and plug and seat wire drawing/erosion from high pressure drops and two-phase flows.

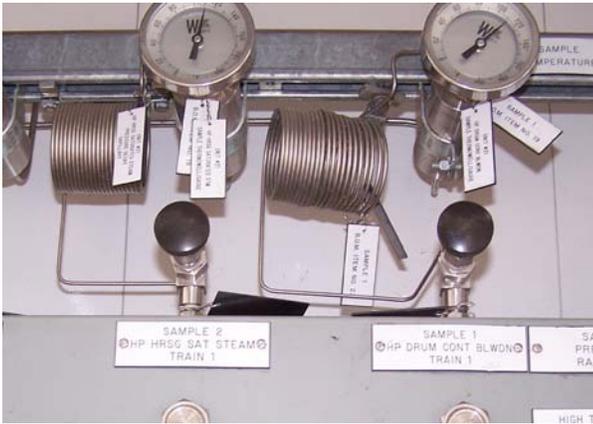
Combined cycle units subject to daily load cycling tend to produce lots of magnetite and corrosion debris that demand daily blowoff of some samples, especially HP and IP Drum Water.



Heavy duty ¼ turn blowdown valves (red handle valves shown at right) were installed in conjunction with 80 micron **debris strainers** (Solutions Inc. model SDS-15-SS shown above the valves at right). The strainers remove large debris which tends to plug downstream components such as the Sentry VREL® described below. The blowdown valves are operated frequently enough to keep the strainer element clean. High pressure blowoff lines were connected to separate header piping which directs blowdown to a remote sump.



#2 – Flow Control/Pressure reduction



Problem: Coils of very small diameter **capillary tubing** were used as fixed pressure drop devices for the HP and IP Drum samples. These capillary devices plug with magnetite and debris, and are very difficult to clear.

Solution

Capillary tubes were replaced with **Adjustable Rod-in-Tube valves (Sentry Equipment Model VREL11®)**. These were installed in conjunction with new total sample flow indicators. This allowed operators to accurately adjust the flow of the HP Drum steam and water samples and clear debris by operating the valves full-open. The new valves have black quick-operating handles. Also, the new VREL valves were installed inside the sample enclosure (building).



#3 – Back Pressure/Relief Valves

Problem: The OEM **back pressure/relief valves**, were not providing a “constant pressure header” to feed the analyzers. (Back pressure valves are shown at left, purple valve with hex nut. Note the lack of flow from the discharge tube, which was typical of all samples.) The valves were likely plugged with magnetite or other debris. The valves were tested and would not hold the back pressure steady and would not increase the discharge flow in response to increasing inlet pressure.

Functioning back pressure valves are essential to maintain a constant flow to all automatic analyzers.

Solution

Back pressure valves designed specifically to handle debris and a wide flow range were installed (**Sentry Equipment BPRVa-20**).

Flows are now adjusted with the Rod-in-Tube valves or low pressure flow control valves to provide adequate sample flow to all analyzers and excess flow to the sample sink as shown at left.

This excess flow provides a “cushion” of capacity that the back pressure valves will automatically divert to the analyzers in case of reduced sample feed pressure.

The panel rebuilds also included relocating all flow control valves (including the Sentry VREL®) to the interior of the sample shelter and adding total flow rotameters to give the operators a readout of total sample flow.

Total flows should be maintained at 6 ft/sec in order to keep magnetite and other corrosion debris suspended in the sample and not depositing on the sample tubing or components (EPRI guidelines).

Analyzer rotameters were also upgraded and tubing runs were simplified.

