AFT Fathom™ Results Agree With Power Plant Field Data - Temperature Control Problem Resolved

CASE STUDY

Circulating Water System

Power Generation Industry

Applied Flow Technology

Ameren Missouri
St. Louis, Missouri, USA
Platinum Pipe Award Honorable Mention - Correlation to Test/Field Data

Stephen Williams, consulting engineer at Ameren Missouri, used AFT Fathom to model a circulating water system at the Sioux Power Plant, a supercritical coal-fired power plant located near St. Louis. The system is a high flow, low pressure system that provides cooling water.

Temperature control of the existing system was problematic. The heat exchangers had become extremely fouled over ~45 years of service and had lost significant heat transfer capability. Due to this loss, control valves typically operated at or near full open condition. New heat exchangers were needed to restore the heat transfer capability of the system and new control valves must be able to reliably regulate temperature across the range of expected operating conditions.

> "Accurate modeling of expected system pressure, pressure drop, valve Cv and resulting valve position was critical"

A Fathom model was constructed to test valve performance based on the manufacturer's published Cv data. The expected design and winter minimum flow rates are 6,840 gpm (1,550 m3/h) and 1,390 gpm (316 m3/h), respectively. For the model, these flow rates were "hard coded" in the control valve properties screen.

Very few valves were available that would fit in the existing piping configuration. Multiple models were constructed and verified that a single valve would not work. Large valves did not have sufficient turndown to accurately control the low end flow, while smaller valves would fail to achieve full flow at fully open conditions. A 24 inch (61 cm) valve would have to be used for the high end of the flow range and a smaller valve for the low range flows.

Based on the model results, a parallel valve arrangement was selected using a 10 inch (25.4 cm) Fisher V150 V notch control valve in parallel to the 24 inch butterfly valve. The control logic was setup such that the 24 inch valve would be used above 20% open, and the 10 inch V notch valve would be used for flows below. Fathom determined the control cutover point to be at 3,500 gpm (800 m3/h).

To validate model performance, field data was collected and compared to the model data (see Figure 1).

Asked to describe the benefits of using AFT Fathom, Williams said "Fathom allowed the engineer to model multiple valve selections and configurations to determine what control scheme would provide best temperature control over the range of flows and resultant pressure drops. Since this is a high flow, low pressure system, accurate modeling of expected system pressure, pressure drop, Valve Cv and resulting valve position was critical."

Ameren companies serve 2.4 million electric customers and more than 900,000 natural gas customers across 64,000 square miles in Illinois and Missouri. Ameren Missouri is the largest electric power provider in Missouri, generating almost 10,500 megawatts of Ameren's total capacity of 16,000 megawatts. Their 4,000 employees account for more than one third of Ameren's total workforce. And they serve 1.2 million customers in Missouri, including 127,000 gas customers.

	Field Data	AFT Fathom Predictions
1A CWP discharge Pressure	**8.8 psig** (60.7 kPa g)	**9.22 psig** (63.6 kPa g)
1B CWP discharge Pressure	**8.7 psig** (60 kPa g)	**8.86 psig** (61.1 kPa g)
B JAW inlet Pressure (manual reading)	**6.5-6.7 psig** (44.8-46.2 kPa g)	**5.18 psig** (35.7 kPa g)
B JAW Outlet Pressure (digital manometer)	**12.83 psia** (88.5 kPa)	**12.3 psia** (84.8 kPa)
Total Flow	**~277,000 gpm** (62,900 m^3/h)	**280,988 gpm** (63,822 m^3/h)
B Cooler Flow	**11,090 gpm** (2,519 m^3/h)	**11,368 gpm** (3,101 m^3/h)

Figure 1 - AFT Fathom model data compared to field data

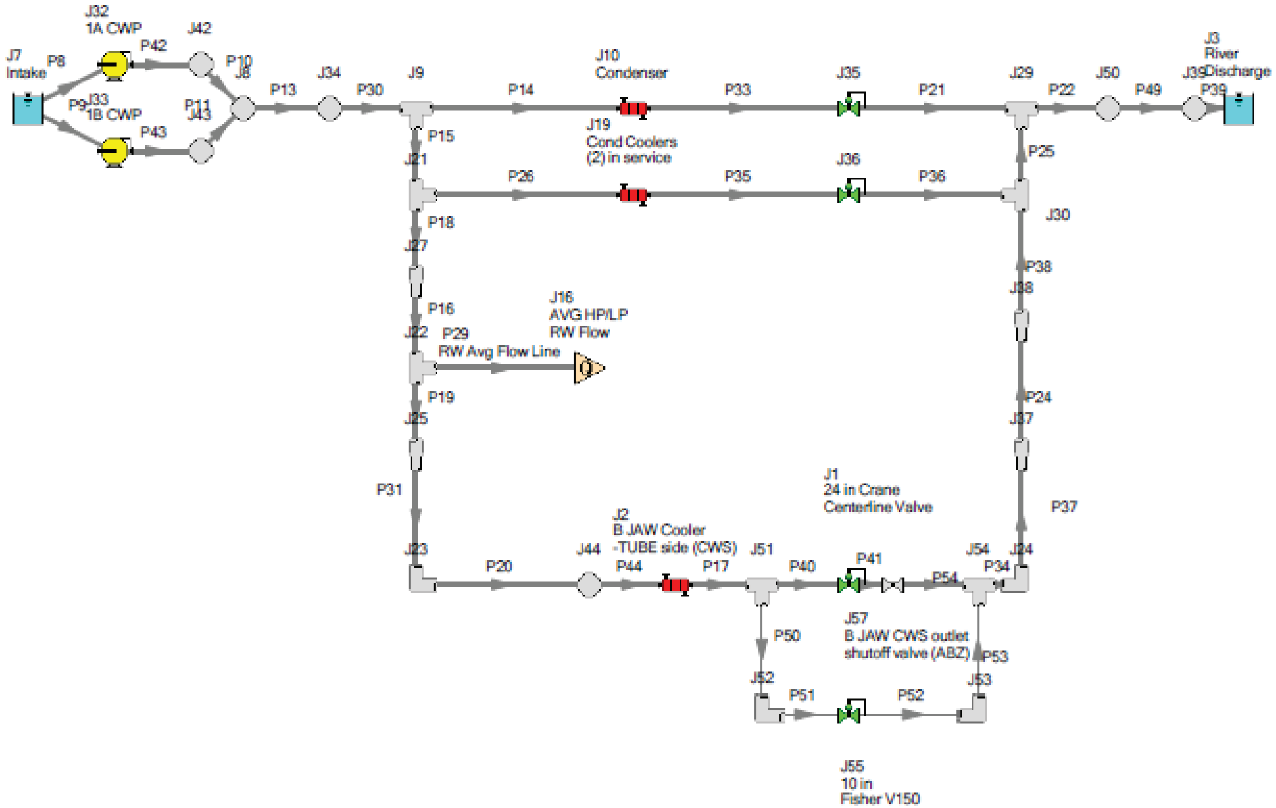

Figure 2 - AFT Fathom model showing new control valve arrangement