

# AFT Fathom™ Helps Flowserve Improve Reliability of a Chemical Plant Raw Brine Injection System

## Raw Brine Injection System

Oil & Gas Industry



## Flowserve Corporation

Elkton, Maryland, USA

## Platinum Pipe Award Honorable Mention - Operational Benefits and Sustainability

Phil Sneeringer, Tier 1 reliability engineer at Flowserve Corporation, used AFT Fathom to perform a reliability study of a raw brine injection system consisting of five vertical pumps and five horizontal pumps. The system was used to displace product in an underground cavern storage facility at an undisclosed North American chemical plant.

Prior to the study, many of the pumps were competing against each other hydraulically. There had been 41 repairs on the system within five years costing more than \$1.23 million, and the mean time between failures was 14.63 months.

**"There had been 41 repairs on the system within five years costing more than \$1.23 million... AFT Fathom showed us the best way to run these pumps to maintain flow and pressure [and]...to increase reliability of the system."**

"Plant Operations needed adequate flow and pressure from this system to displace product in the caverns and clarifier wells at an acceptable rate to satisfy production goals," Sneeringer said.

The first step of the reliability study involved creating a field sketch of the system as well as piping and instrumentation diagram drawings (see Figure 1). Sneeringer and the Tier 1 Reliability Team then collected actual field test data using wireless sensors and the customer's in-line sensors that tied to their distributed control system. An AFT Fathom model was built (see Figure 2), and the data was used to tune the model.

Multiple scenarios were then run (see Figure 2) to test different combinations of pumps and pressures at the

delivery point in order to improve the pump flow rates from 35-50% of BEP to 75% (see Figure 3).

Through these simulations, Sneeringer was also able to determine a better flow path to deliver the same amount of product by closing a cross-over valve that had been left open.

"AFT Fathom showed us the best way to run these pumps to maintain flow and pressure," Sneeringer said. "It allowed us to determine the best run combinations to increase reliability of the system (and)... to make recommendations on hydraulic rerates to increase production in the future."

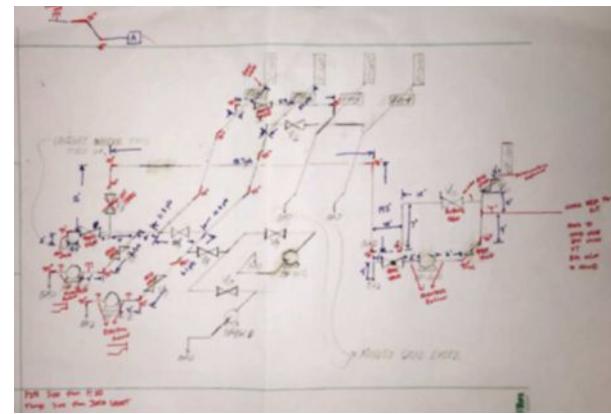
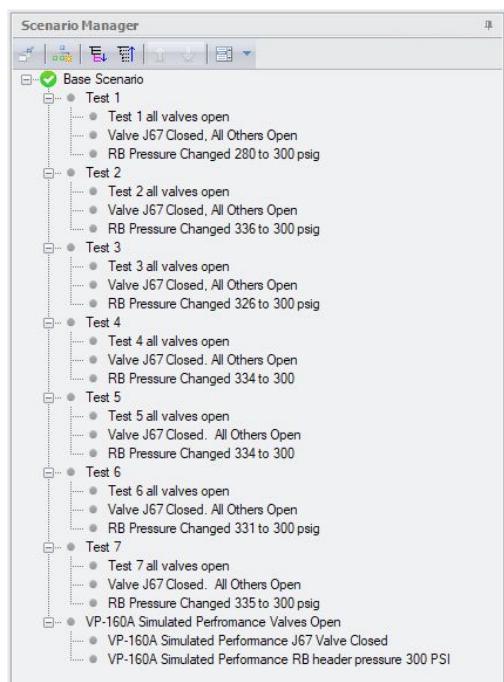
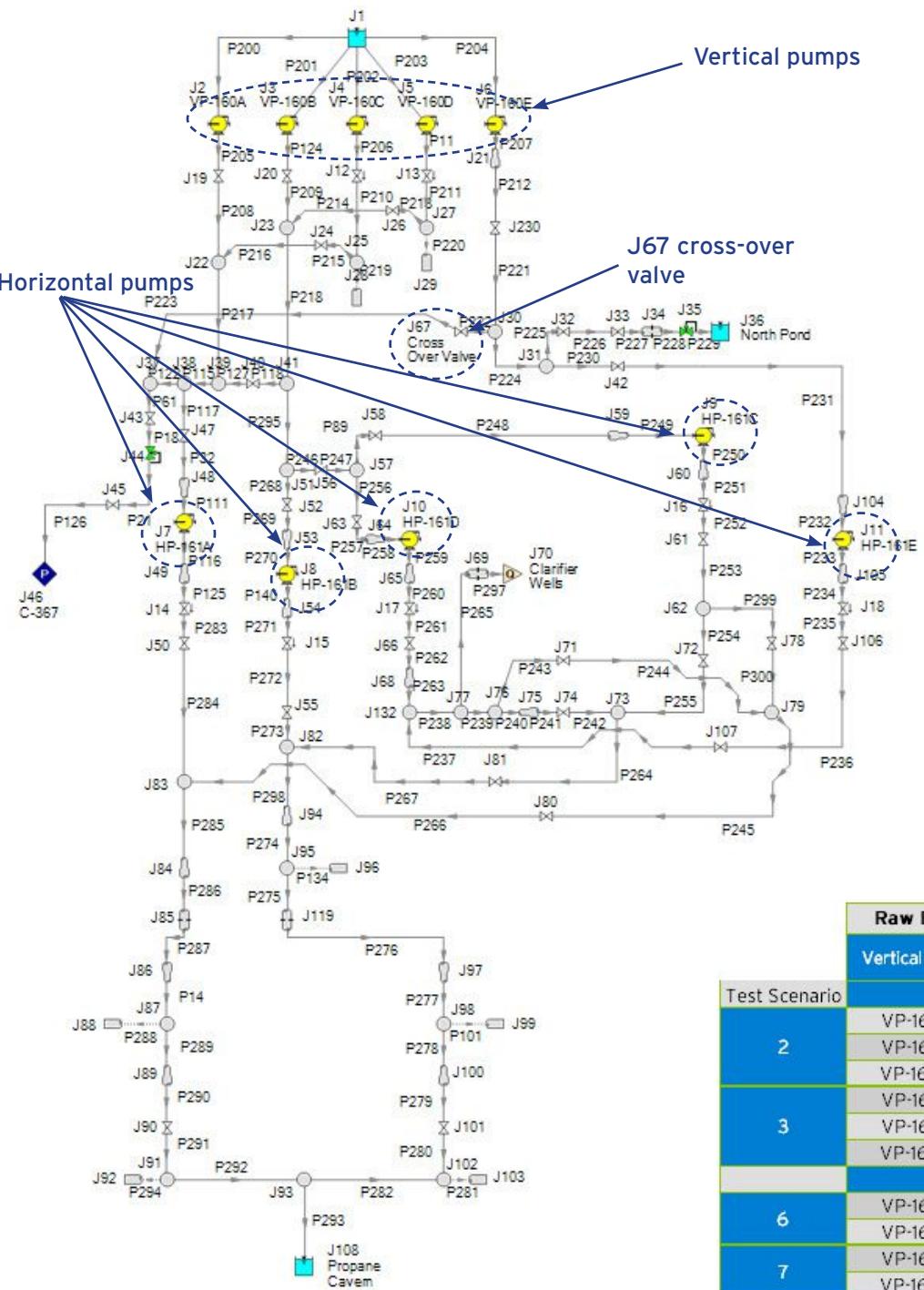


Figure 1 - The initial AFT Fathom model was created by using a field sketch of the system and P&ID drawings.

Flowserve's global team consists of more than 18,000 employees in 55 countries who put together the total solution—from project planning to lifecycle maintenance programs to some of the most proven technology on the planet. Flowserve has more than two centuries of history—and this deep experience enables them to be a go-to resource for solving the toughest challenges across all industries.



**Figure 2 - Scenario Manager in AFT Fathom used to test different combinations of pumps and pressures**

Raw Brine System Study Vertical Pump Performance				
	Vertical Pump	Flow	Best Efficiency Point	Percent of Best Efficiency
Test Scenario		Wireless Field Test Data/Three Pump Performance		
2	VP-160B	1,964	6,800	28.88%
	VP-160C	3,108	6,800	45.71%
	VP-160D	1,963	6,800	28.87%
3	VP-160B	1,585	6,800	23.31%
	VP-160C	3,929	6,800	57.76%
	VP-160D	1,585	6,800	23.31%
Wireless Field Test Data/Two Pump Performance				
6	VP-160B	3,194	6,800	46.97%
	VP-160C	3,578	6,800	52.62%
7	VP-160C	3,330	6,800	48.97%
	VP-160D	3,098	6,800	45.56%
Fathom Model Data/J67 Closed/RB Header 300 psi/Two Pump Performance				
6	VP-160B	5,150	6,800	75.74%
	VP-160C	5,079	6,800	74.69%
7	VP-160C	5,056	6,800	74.35%
	VP-160D	5,034	6,800	74.03%

**Figure 3 - Recommended operations improve efficiency from 35-50% of BEP to 75% (bottom two scenarios)**



**Figure 4 - Horizontal pumps maintain pressure in caverns and clarifier wells**