AFT Fathom™ Provides Critical Accuracy at Dupont

CASE STUDY

Absorber System

Chemical & Petrochemical Industry

Applied Flow Technology

Dupont Engineering
Wilmington, Delaware, USA
Platinum Pipe Award Winner - Correlation to Test/Field Data

Dupont's vast capabilities in the development and production of chemicals requires extensive underlying resources. Among these are Dupont Engineering who are tasked to support the demands of Dupont's wide ranging activities, including a highly developed specialization in the application of pumps. It was this capability that was called upon to solve a recurring problem at Dupont's Experimental Station.

The Experimental Station is a corporate "university" where new chemicals are developed and safe disposal of chemicals is essential for operation. Key to this safe disposal is an incinerator where combustion breaks complex compounds down into simpler compounds that are the absorbed by a caustic solution circulation system. Critical to the absorber system's operation was a circulating pump that was continually failing.

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Judy Hodgson, a Pump Consultant at Dupont Engineering, was called in to solve the Experimental Station's problem. Judy determined that the recurring failure of the pump's rubber lining and bearings was due to excessive operating speed. A reduction in operating speed to solve the pump failures could not, however, be allowed to create another, more serious problem; inadequate flow in the absorber system.

With no historical data available to indicate where the pump was operating, Judy modeled the caustic circulation system's sump, circulating pump, heat exchanger, spray nozzles and interconnecting piping using AFT Fathom (see Figure 1). Knowing pumps don't operate just at a design point, Judy performed a comprehensive analysis of the operating envelope, studying the effects of pump speed, heat exchanger fouling and liquid level. As a result of this analysis, it was concluded that pump speed could be reduced to 1150 RPM, a level commensurate with good service life of the pump lining and bearings, while providing the required circulation rate of 1,280 gpm (see Figure 2). EPA requirements mandated testing to demonstrate the revised pump speed would produce the required flow in the absorber system. Test results were within 1 gpm and 0.1 psi of that predicted by AFT Fathom, less than 0.1% error.

Judy explained that Dupont's Best Practice for Pump Application Design specifies AFT Fathom for system modeling and analysis; "We are actively directing our full service design contractors to use Fathom on all of our projects". Dupont's standardization on AFT Fathom followed a comprehensive comparison of available pipe flow software, selecting AFT Fathom for the ease of use of its drag & drop interface, Visual Report, extensive output and graphing capabilities and its ability to easily investigate different scenarios. Indeed, all operating scenarios of Dupont's pumping systems are now analyzed before making decisions on pumps.

Dupont needs little introduction, being a world leader in the development and production of chemicals with over 150 facilities in more than 90 countries and 92,000 employees.

Emphasizing the benefits, Judy stated; "The speed, accuracy and thoroughness of Fathom, including its documentation capabilities is an order of magnitude better than our previous in-house programs. Fathom does the work for us! Complete documentation is a mouse click away. Multiple scenario runs take only a minute or two. With all possible scenarios run, there's no need to add fudge factors to pumps."

AFT Fathom's capabilities are both deep and wide, as illustrated by the many applications by Dupont, including:

- Boiler feedwater
- Brine supply
- Cooling water
- Fluorobenzene supply
- Hydroheater supply
- Extruder cooling water
- Caustic supply
- Oil supply

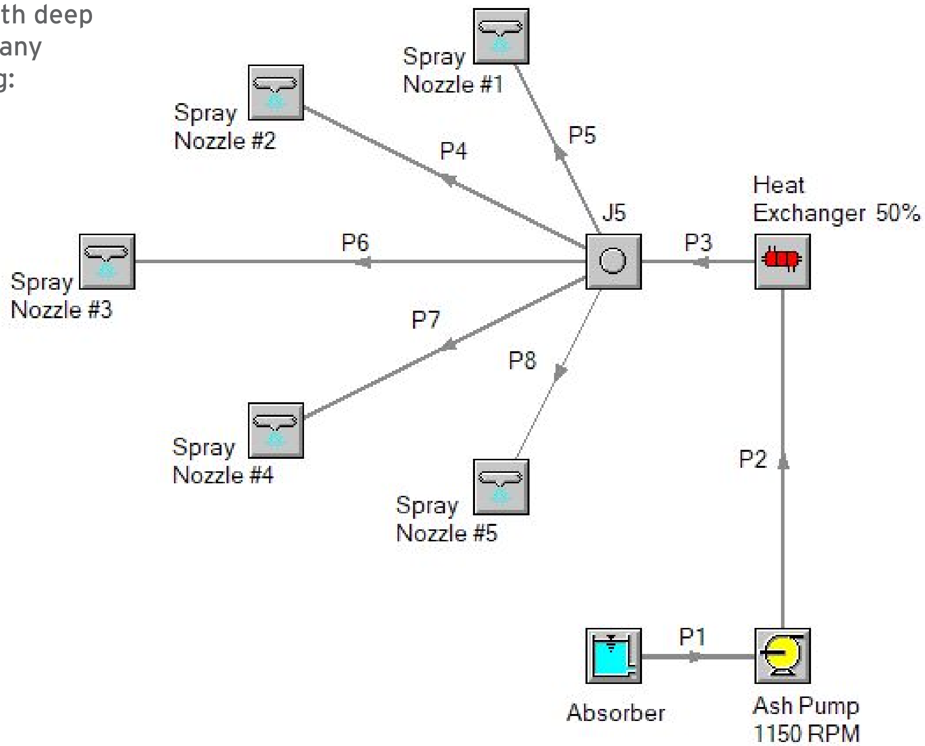

Figure 1 **-** A circulating pump drawing caustic solution from the absorber discharges through a heat exchanger to a distribution hub (J5) to five spray nozzles.

Pipes

Pipe	Name	Vol. Flow Rate (gal/min)	dH (feet)	Velocity (feet/sec)	dP Stag. Total (psid)	dP Static Friction Total (psid)	dP Gravity (psid)	Pipe Nominal Size	Length (feet)
1	Suction	1,280	0.261	5.2	0.115	0.115	0.00	10 inch	10
2	Pump Discharge	1,280	1.298	8.2	9.852	0.574	9.28	8 inch	28
3	From Heat Exchanger	1,280	6.471	8.2	7.277	2.859	4.42	8 inch	35
4	Pipe	253	0.079	2.8	0.919	0.035	0.88	6 inch	10
5	Pipe	251	0.078	2.8	1.360	0.034	1.33	6 inch	10
6	Pipe	256	0.081	2.8	0.478	0.036	0.44	6 inch	10
7	Pipe	259	0.083	2.9	0.037	0.037	0.00	6 inch	10
8	Pipe	260	0.452	6.6	-0.242	0.200	-0.44	4 inch	10

All Junctions | Branch | Heat Exchanger | Pump | Reservoir | Spray Discharge

Jct	Name	Vol. Flow Rate Thru Jct (gal/min)	Elevation Inlet (feet)	P Static In (psia)	dP Stag. Total (psid)
1	Absorber	1,280	5.8	13	0.093
2	Ash Pump 1150 RPM	1,280	1.0	15	-60.992
3	Spray Nozzle #2	253	34.0	34	20.485
4	Heat Exchanger 50%	1,280	22.0	66	24.386
5	Branch	N/A	32.0	35	0.000
6	Spray Nozzle #1	251	35.0	33	20.044
7	Spray Nozzle #3	256	33.0	34	20.926
8	Spray Nozzle #4	259	32.0	35	21.367
9	Spray Nozzle #5	260	31.0	35	21.646

Figure 2 - AFT Fathom output data