

Nuclear Power Station Service Water Pump NPSH Hydraulic Model Using AFT Fathom™

Platinum Pipe Award 2011 Winner – Correlation to Field/Test Data

Company: Duke Energy
Location: Charlotte, NC, USA

Duke Energy is one of the largest electric power companies in the United States, supplying and delivering energy to approximately 4 million U.S. customers. Duke Energy has approximately 35,000 megawatts of electric generating capacity in the Carolinas and the Midwest, and natural gas distribution services in Ohio and Kentucky. Their commercial and international businesses own and operate diverse power generation assets in North America and Latin America, including a portfolio of renewable energy assets.

Nuclear Service Water (RN) systems circulate the water that cools the plant's heat exchangers and other components before dissipating the heat into the environment. Because this is a safety-critical system, it is essential to accurately understand how the system works under varying operating conditions, and under Design Basis Accident (DBA) Conditions.

“The roughness and scaling factors were... slightly adjusted to obtain a very accurate benchmark to actual test data (0.1 to 0.2 psig).”

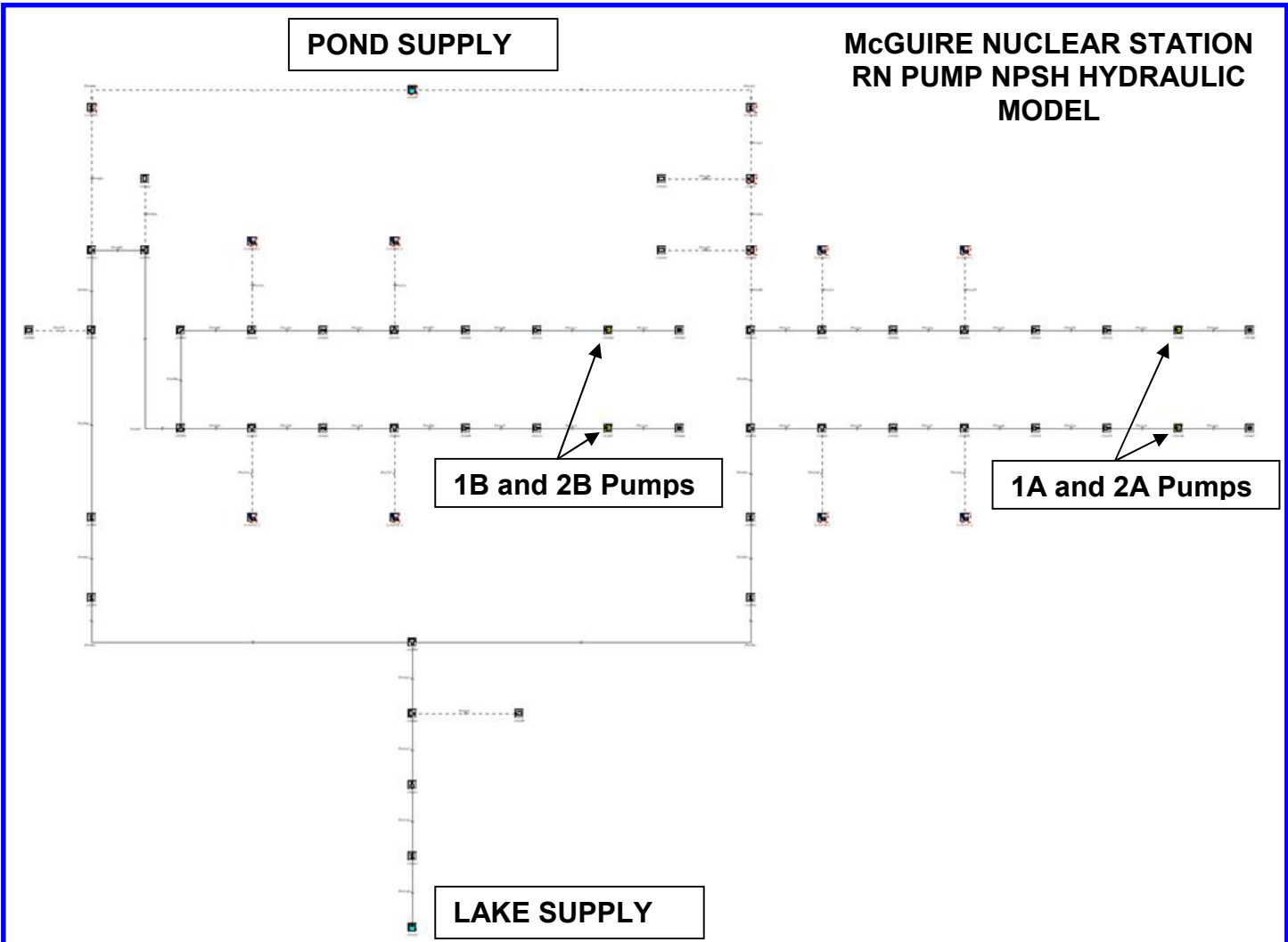
According to Norman Stambaugh, a Senior Engineer with Duke Energy, to assure that the RN system can adequately perform its safety function, it must be demonstrated that the RN pump NPSHr can be met under DBA conditions. Over the years, corrosion in the RN pump suction piping has occurred, thus reducing the NPSHa. To analyze this degradation, an AFT Fathom model of the RN pump suction piping was developed and benchmarked. This model not only accounts for the details relating to the piping configuration, but also for the details relating to the roughness and constriction of the piping due to the build-up of corrosion over time. It also provides the ability to input most limiting conditions, such as

maximum temperatures and minimum levels for the lake and pond supplies, as well as various amounts of assumed RN strainer fouling.

Using AFT Fathom, Duke Energy was able to benchmark corroded pipe performance, and accurately model the potential pressure recovery after cleaning the pipes.

McGuire Nuclear Power Station





Comparison of AFT Fathom model results to test results at McGuire Pump Station

**TABLE 5.1
McGUIRE RN PUMP NPSH HYDRAULIC MODEL BENCHMARKING RESULTS
FOR RN PUMP SUCTION PRESSURE ANALYSIS**

SCENARIO	1A RN PUMP SUCTION PRESSURE			2A RN PUMP SUCTION PRESSURE			1B RN PUMP SUCTION PRESSURE			2B RN PUMP SUCTION PRESSURE		
	model results	test results	delta	model results	test results	delta	model results	test results	delta	model results	test results	delta
	psig	psig	psig	psig	psig	psig	psig	psig	psig	psig	psig	psig
B1 (all Trains)	-4.06	-3.93	-0.13	-4.57	-5.01	0.44	-3.90	-5.80	1.90	-5.09	-4.27	-0.82
B2 (1A Train)	4.28	4.27	0.01	9.58	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
B3 (1B Train)	n/a	n/a	n/a	n/a	n/a	n/a	-1.50	-1.84	0.34	1.61	n/a	n/a



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