Confidence-Level Assessment of the Blend Down Monitoring System

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The objective of this research is to perform a statistical analysis on the fissile mass flow monitor (FMFM) associated with the Blend Down Monitoring System (BDMS). BDMS is one of the measures taken by the United States in securing the "Megatons to Megawatts" agreement made with Russia in 1993. The purpose of the analysis is to identify the expected statistical behavior of the measurements obtained and to categorize a threshold for separating usable from unusable data. The confidence measurement used in verifying the existence of flow and providing the probability of flow is referred to as "quality." From this research, we conclude that any quality measurement having a value greater than 20% provides high confidence of the presence of flow of fissile material in the pipe. Any quality value less than this threshold can be regarded as statistical noise mistakenly identified as a measurement.

The confidence measurement quality is mathematically defined as a stretched, inverted Snedecor Fisher F-test,[1] which tests the inequality of residuals from actual BDMS data to residuals of zero-flow data. A calibration method is taken in determining the threshold value for usability, in which a simulation is set to zero flow and a histogram of the quality values obtained produces a distribution surrounding zero, i.e., nonzero. At this point, a range of probability values exists between quality values of zero and approximately 30%. A significance level can be concluded by counting the values below some threshold probability (0.5% in this case) out of the number of tests taken. If N tests are taken, and n tests out of these have less than a 0.5% probability of having a value greater than 20%, then the significance level is n/N%. From this assessment, this research has concluded that at a 95% significance level, less than 0.5% of 600,000 tests have a quality value greater than 20% at the zero-flow assumption. The outcome of this work will greatly help the quality of the measurements obtained from BDMS.

References

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Biographical Sketch

Nishka Devaser currently attends the University of Tennessee (UT) as a graduate student pursuing a M.S. degree under Dr. Belle Upadhyaya (advisor) in nuclear engineering. He received a B.S. in nuclear engineering from UT in 2005. His master's degree, concluding in December 2006, will be in instrumentation and controls of nuclear processes. He works part-time at Oak Ridge National Laboratory (ORNL) under Dr. Jose March-Leuba on the Blend Down Monitoring System team.