

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555

February 16, 1993

NRC INFORMATION NOTICE 93-13: UNDETECTED MODIFICATION OF FLOW CHARACTERISTICS  
IN THE HIGH PRESSURE SAFETY INJECTION SYSTEM

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential for changes of system flow characteristics to go undetected as occurred at Arkansas Nuclear One (ANO) Unit 2. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On September 23, 1992, with Unit 2 shut down, Entergy Operations, Inc. (the licensee) evaluated flow imbalances that were found during testing of the high pressure safety injection (HPSI) system. The licensee determined that the flow rates through five of the system valves were less than required. Because of the low flow rates, the licensee concluded that the sum of the flow rates of the three injection paths with the lowest flow rates was less than that assumed in the plant design basis calculations which support the plant safety analysis.

The licensee investigated the event and determined that replacement stem disc assemblies, supplied as "like for like" and installed as early as 1982, were not identical to the original assemblies. Subsequent to the event, the licensee had the vendor rework spare valve discs to meet the design requirements and installed these in the five affected valves. The licensee then conducted flow balance testing to ensure that all system flow requirements were met.

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## Discussion

The licensee reviewed documentation for the affected discs and determined that, as a result of a vendor drawing error in 1978, certain design changes of the stem disc assemblies had not been incorporated into drawings for ANO Unit 2. The most significant of these was a 2 to 3 mm [1/10-inch] change in diameter at one location on the replacement discs. This change was not easily detected by visual examination. However, the as-found flow through the affected injection paths was degraded an average of 23 percent.

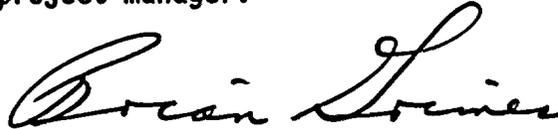
The technical specifications for ANO Unit 2, require flow balance testing after system modifications which could affect flow characteristics, but do not require periodic flow balance testing. The licensee did not recognize that the replacement stem disc assemblies were different from the original stem disc assemblies and, therefore, did not test the system after changing the components.

The licensee discovered the flow imbalances and degraded flow rates during a full flow test performed in response to Generic Letter 89-04, "Guidance on Developing Acceptable Inservice Testing Programs." During this test, the total indicated flow was found to be lower than the actual flow. After investigation, the difference was found to have been caused by a flow orifice that had been installed backwards. While investigating the problem, the licensee determined the actual system flow by isolating the hot leg injection paths and summing the indicated flows of the four cold leg injection paths. From these measurements, the licensee found that the flows varied greatly. The large variation in indicated flows of the cold leg injection paths led the licensee to find the improper discs.

Although the individual loop flows varied greatly, the total flow of the system met the acceptance criteria. Performing full flow testing alone would not have caused the licensee to find the degraded flow in parts of the system. Therefore, the flow imbalances might have remained undetected if the flow orifice had been installed correctly and investigation of the flow orifice problem not been required.

The licensee reviewed the technical specifications for similar surveillance test requirements. The licensee then evaluated the similar tests to determine whether they were adequate to fully test the system and were required to be performed at appropriate times. Upon completing this review and another review to find systems with similar valves, the licensee performed flow balance testing on the low pressure safety injection system with satisfactory results. The licensee revised the HPSI flow testing procedure to provide for confirmation of satisfactory flow balance and capacity during each refueling outage.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.



Brian K. Grimes, Director  
Division of Operating Reactor Support  
Office of Nuclear Reactor Regulation

Technical contacts: William Johnson, RIV  
(817) 860-8148

Linda Smith, RIV  
(501) 968-3290

Dennis Kelley, RIV  
(817) 860-8289

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Original signed by  
Brian K. Grimes

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LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-12	Off-Gassing in Auxiliary Feedwater System Raw Water Sources	02/11/93	All holders of OLs or CPs for nuclear power reactors.
93-11	Single Failure Vulnerability of Engineered Safety Features Actuation Systems	02/04/93	All holders of OLs or CPs for nuclear power reactors.
93-10	Dose Calibrator Quality Control	02/02/93	All Nuclear Regulatory Commission medical licensees.
93-09	Failure of Undervoltage Trip Attachment on Westinghouse Model DB-50 Reactor Trip Breaker	02/02/93	All holders of OLs or CPs for nuclear power reactors.
93-08	Failure of Residual Heat Removal Pump Bearings due to High Thrust Loading	02/01/93	All holders of OLs or CPs for nuclear power reactors.
93-07	Classification of Transportation Emergencies	02/01/93	All Licensees required to have an emergency plan.
93-06	Potential Bypass Leakage Paths Around Filters Installed in Ventilation Systems	01/22/93	All holders of OLs or CPs for nuclear power reactors.
93-05	Locking of Radiography Exposure Devices	01/14/93	All Nuclear Regulatory Commission industrial radiography licensees.
93-04	Investigation and Reporting of Misadministrations by the Radiation Safety Officer	01/07/93	All U.S. Nuclear Regulatory Commission medical licensees.

OL = Operating License  
CP = Construction Permit