U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-220/90-28

Docket No. 50-220

License No. DPR-63

Licensee: Niagara Mohawk Power Corporation
301 Plainfield Road
Syracause, New York 13212

Facility Name: Nine Mile Point, Unit 1

Inspection At: Scriba, New York

Inspection Conducted: November 26-30 and December 6, 1990 at Region I Office

Inspectors: Michael J. Buckley — 2/4/91
M. Buckley, Reactor Engineer Special Test Programs Section, EB, DRS — date

Leonard J. Prividy — 2/4/91
L. Prividy, Senior Reactor Engineer, Special Test Programs Section, EB, DRS — date

Jimi Yerokun — 2/4/91
J. Yerokun, Reactor Engineer, Special Test Programs Section, EB, DRS — date

Approved by: P. K. Eapen — 2/4/91
Dr. P. K. Eapen, Chief, Special Test Programs Section, EB, DRS — date

Inspection Summary: Announced Safety Issues Inspection of the licensee's implementation of NRC Bulletin 88-04.

Areas Inspected: Licensee actions to address the concerns identified in NRC Bulletin 88-04 using the inspection guidance of Temporary Instruction 2515/105.

Results: No violations or deviations were identified. The licensee has taken adequate measures to ensure that safety-related pumps are not susceptible to the concerns raised in NRC Bulletin 88-04. They took a sound and conservative approach to assure safe operation in the short term by performing a special recirculation test of the Core Spray System. The licensee intends to decide by May 31, 1991, a detailed course of action for completing their long-term resolutions. In response to several observed weaknesses concerning the documentation of the engineering evaluations, the licensee agreed to update their Project Report for Bulletin 88-04.

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DETAILS

1.0 Scope of the Inspection

The purpose of this inspection was to verify that the licensee has taken adequate measures to address the issues discussed in NRC Bulletin No. 88-04, Potential Safety-Related Pump Loss.

Discussion

NRC Bulletin No. 88-04 primarily addressed two minimum flow design concerns. The first concern involves the potential for the dead-heading of one or more centrifugal pumps in safety-related systems that have a common minimum flow line. The second concern is whether or not the installed minimum flow line capacity is adequate even during single pump operation.

When two centrifugal pumps operate in parallel and one of the pumps is stronger than the other (i.e., one pump has higher developed head for the same flow), the weaker pump may be dead-headed when the pumps are operating parallel in the minimum flow mode. The potential for dead-heading exists predominantly at low flow rates because of the flatness of centrifugal pumps characteristic curve in this range.

By letters dated July 7, 1988, September 28, 1988, and May 9, 1990, Niagara Mohawk Power Corporation (NMPC) responded to NRC Bulletin 88-04 for Nine Mile Point Unit No. 1. Based upon the preliminary evaluation noted in their initial response, NMPC indicated that only the Core Spray (CS) and Condensate Transfer (CT) Systems had the potential for any minimum flow problems. More detailed evaluations of these systems, including possible special operability tests for the CS System were completed and short term corrective actions were defined by NMPC in their most recent response dated May 9, 1990.

The inspectors reviewed drawings and system descriptions of all safety related systems with two or more parallel pumps and verified that the CS and CT systems were the only ones susceptible to the concerns discussed in the bulletin.

2.0 Core Spray System

The licensee evaluated the configuration of this system and concluded that special testing was necessary to provide assurance that the CS system pumps would operate satisfactorily during parallel pump operation.

Findings

The core spray (CS) system comprises two separate loops, 11 and 12. Each loop has two core spray pumps and two core spray topping pumps which perform a booster pump function. The discharge from the two topping pumps merges into a 12 inch diameter pipe and flows to the reactor. Each core spray pump (total of four) is rated for 3,400 gpm at 422 ft. Total Dynamic Head (TDH). The best efficiency point (BEP) for each pump is 3,600 gpm at 400 ft. TDH. Each topping pump (total of four) is rated for 3,400 gpm at 280 ft. TDH. The best efficiency point for each topping pump is 4,750 gpm at 250 ft. TDH.

For each loop, a two inch relief valve is provided in the 12 inch discharge pipe. The relief valve discharges through a three inch diameter pipe to the torus. The lift setpoint for the relief valve is 320 psig. The recirculation is designed for a minimum flow of 385 gpm. A sketch of this configuration is shown in Attachment B.

The licensee determined that no routine tests were performed to verify the adequacy of the minimum flow recirculation lines. In 1989, a special test, N1-88-6-12, Core Spray Pump Recirculation Line Operability Test, was developed and performed to confirm the adequacy of the minimum flow lines. The test results indicated that there was no dead heading during parallel pump operation.

The inspectors reviewed the results of the special test and verified the following:

- During parallel operation in the minimum flow recirculation mode, each of the two sets of pumps in loop 1 of the CS system had a flow of 250 gpm at a discharge pressure of 415 psig. During individual operation, one set had 550 gpm at 400 psig, while the other had 480 gpm at 405 psig.

- The pumps in loop 2 had a flow of 441 gpm (at 422 psig) and 494 gpm (at 423 psig) each during individual operation. During parallel operation, the pumps had flows of 180 gpm and 260 gpm each at a discharge pressure of 435 psig.

- The pumps were operated during individual and parallel operations for longer than the established minium duration of 15 minutes. Temperature rise and vibrations were within the established limits.

The inspectors found the results of the special test adequate. However, the following concerns were expressed:

1) The licensee did not have a documented analysis of the basis for the acceptance criteria (temperature, vibrations and operating times) specified in the tests.

2) The licensee had chosen not to involve the pump vendor in determining adequate flows or evaluating test results to verify acceptability.

Short-Term Resolution

The licensee discussed the basis of the acceptance criteria with the inspectors and agreed to include this in their summary report for Bulletin 88-04. The licensee also agreed to provide tests results to the vendor for independent evaluation. The results of this independent evaluation will be provided in a future licensee letter to the NRC.

The licensee stated that while tests results verified that current configuration is adequate for pumps protection, future system changes might result in an inadequate minimum flow situation. To guard against this, the licensee has established administrative controls. For example, maintenance procedure N1-NMP-081-112, "Overhaul of Core Spray Pump" was revised to require engineering reviews to assess the impact of maintenance on system configuration. During this review, engineering determines if maintenance invalidates test results, and requires additional tests, if needed.

The inspectors discussed with licensee inservice testing (IST) personnel the past operating experience concerning the CS system pumps. On October 4, 1990 CS topping pump III had failed its quarterly test required by Technical Specifications and Section XI of the ASME Code. This test evidenced a low pump differential pressure (in the required action range per the IST program) for the reference test flow rate. However, a satisfactory retest was performed several hours later. The failure was due to a malfunctioning relief valve in the minimum flow recirculation line. Problem Report 2095 was initiated on October 16, 1990, to identify the problem to Design Engineering for resolution.

The inspectors observed that the licensee had not requested verification of the minimum flow rate by the pump suppliers for the CS system pumps. NRC Bulletin 88-04 stated "the evaluation should also include verification from the pump suppliers that current miniflow rates (or any proposed modifications to miniflow systems) are sufficient to ensure that there will be no pump damage from low flow operation." The licensee agreed to contact the pump suppliers to verify the adequacy of the minimum flow rate, prior to the completion of long-term resolution action.

The inspectors discussed with the licensee their schedule for completion of the long-term resolution actions for the CS system pumps. While a modification request to install individual CS system recirculation lines had been formally initiated and approved by the Section Superintendent in March 1990, the modification completion was not expected until late 1994. Preliminary engineering work, such as pipe sizes or plant layout, had not begun yet. In a telephone conversation to the NRC Region I office on December 6, 1990, the licensee provided updated information concerning their completion schedule for the long-term resolution actions for the CS system pumps as follows:

1. The required evaluations to complete the long-term resolution actions will be accomplished by the completion of a project report. This course of action had been approved by NMPC management. The project report is the standard procedure used by NMPC to conduct technical evaluations and to authorize/control the expenditure of funds for the work. A project engineer had been assigned.

2. NMPC intended to complete the project report such that long-term resolution actions for the CS system pumps would be recommended and approved by May 31, 1991.

3.0 Condensate Transfer System

The Condensate Transfer (CT) System consists of two 100% capacity (175gpm) motor driven centrifugal single stage pumps. The 3/4 inch diameter recirculation line equipped with flow restricting orifices returns the flow to the condensate storage tanks. A sketch of the minimum flow configuration is shown on Attachment C. One pump is normally operated with the other pump in standby. The system normally provides water to various intermittent and continuous loads throughout the plant.

The licensee has verified the flow in each recirculation line to be 14 gpm through system analysis. The pump supplier was not contacted to verify the adequacy of the established minimum flow.

The minimum flow is acceptable for all modes of operation. Normal operational modes make it unlikely that the pumps would be subjected to dead heading. Current pump maintenance practices are adequate to detect and repair any transfer pump wear in a timely manner.

The inspectors verified the as built configuration of the minimum flow recirculation was as described in the system drawing (C-18048-C). Surveillance records for check valve flow (12-13GPM) were reviewed and the test flows were verified to be consistent with the analysis.

4.0 Overall Conclusion

The licensee has taken adequate measures to ensure that safety-related pumps are not susceptible to the concerns raised in NRC Bulletin 88-04. The potential for deadheading of one or more pumps in safety-related systems was adequately evaluated to ensure safe operation for the short term. The licensee intends to decide by May 31, 1991 a detailed course of action for completing their long-term resolutions. The licensee took a sound and conservative approach to assure safe operation of the CS system in the short term by performing a special recirculation test. In response to several observed weaknesses concerning the documentation of the engineering evaluations, the licensee agreed to update their Project Report for Bulletin 88-04.

5.0 Engineering and Technical Support

The inspectors observed that licensee's management was kept abreast of engineering activities. Management personnel demonstrated a good level of awareness of activites related to the issues of Bulletin 88-04.

One noted strength in the area of resolution of technical issues was that the licensee chose to perform special tests for the core spray pumps to verify the adequacy of minimum flow. However, the inspectors also observed some weaknesses. For example, the licensee did not have adequate documentation showing the basis for the Acceptance Criteria selected for the special tests performed. The licensee had also chosen not to involve the pump suppliers to verify the adequacy of minimum flows as suggested in the Bulletin.

The licensee adequately discussed the basis for the Acceptance Criteria in the special tests with the inspectors. No further concern was expressed on this issue. The licensee has also agreed to contact the pumps' suppliers for verification of adequate minimum flows.

6.0. Exit Meeting

The inspectors met with the plant staff (See Attachment A) on November 30, 1990 to discuss the preliminary inspection findings. At no time during this inspection did the inspectors provide written material to the licensee. The licensee did not identify that the inspectors were provided any proprietary information during this inspection.

ATTACHMENT A

Persons Contacted

Niagara Mohawk Power Corporation (NMPC)

*P. Bartolini, Nuclear Design, Mechanical Engineer
*W. Drews, Acting Plant Manager
*J. Driscoll, System Support and Test, Engineer
*P. Francisco, NMPC Corporate Licensing, Engineer
M. Friedman, Inservice Testing, Engineer
G. Kann, Inservice Testing, Engineer
*A. Pinter, NMPC Site Licensing, Engineer
*A. Renya, NMPC Corporate Licensing, Engineer
*R. Tessier, Plant Operations, Supervisor

MPR Associates

A. Russell, Contractor for NMPC Nuclear Design

U.S. Nuclear Regulatory Commission

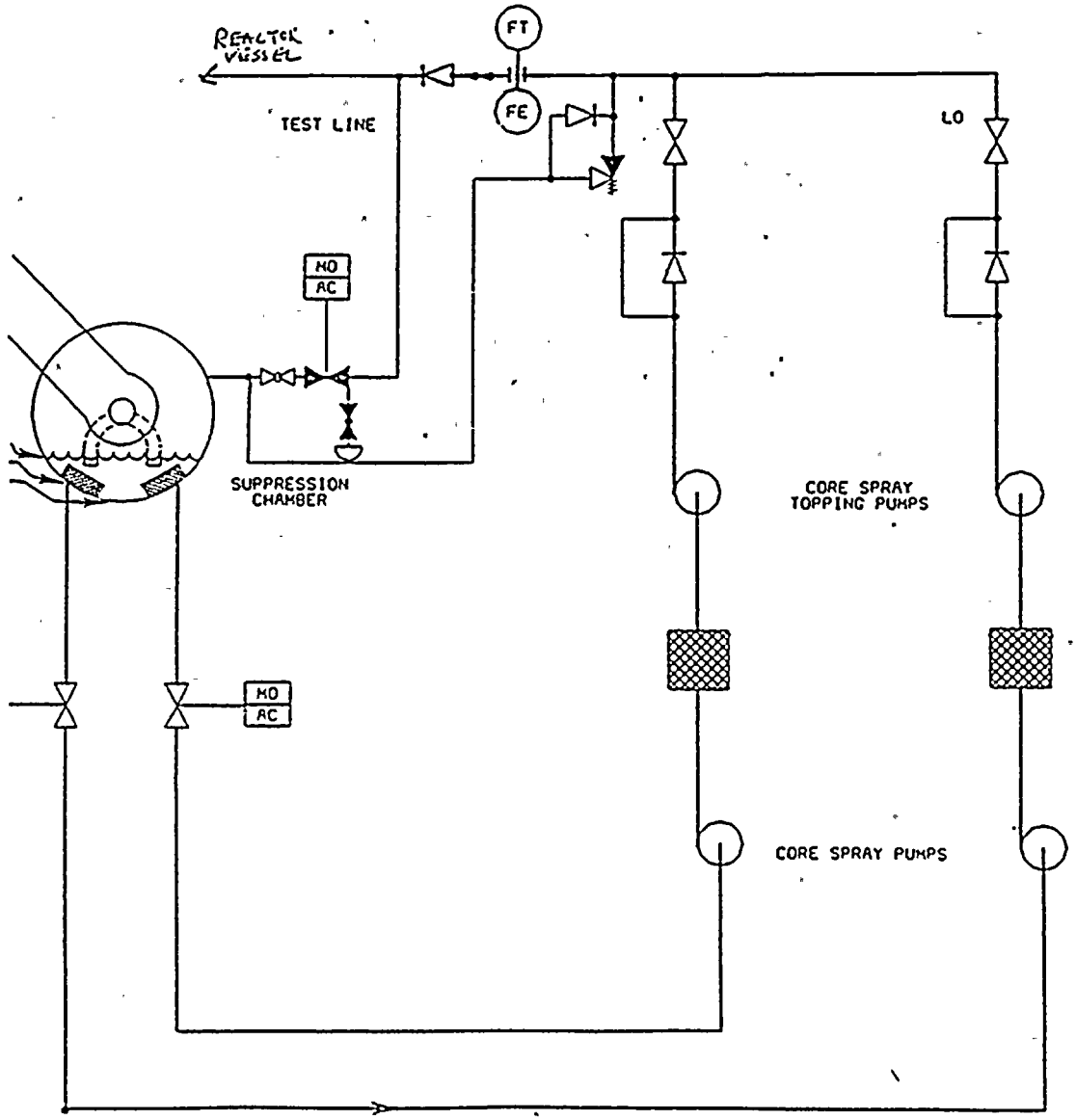
W. Cook, Senior Resident Inspector
*R. Temps, Resident Inspector

*Denotes present at November 30, 1990 exit meeting.

The inspectors also contacted other licensee personnel during the course of the inspection.

ATTACHMENT B

Core Spray Minimum Flow Configuration



ATTACHMENT C

Condensate Transfer Minimum Flow Configuration