

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-285/92-16

Operating License: DPR-40

Licensee: Omaha Public Power District (OPPD)
444 South 16th Street Mall
Mail Stop 8E/EPA
Omaha, Nebraska 68132-2247

Facility Name: Fort Calhoun Station (FCS)

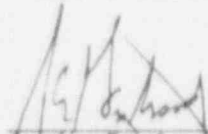
Inspection At: Blair, Nebraska

Inspection Conducted: July 27-31, 1992

Inspectors: Howard F. Bundy, Reactor Inspector, Test Programs Section
Division of Reactor Safety

Michael E. Murphy, Reactor Inspector, Test Programs Section
Division of Reactor Safety

Approved:


James E. Gagliardo, Chief, Test Programs
Section, Division of Reactor Safety

9/17/92
Date

Inspection Summary

Areas Inspected: Routine, announced inspection of the licensee's actions on programmed enhancements in response to Generic Letter 88-17, "Loss of Decay Heat Removal," and followup on the status of a previous inspection finding.

Results:

- The licensee's responses to GL 88-17 and the NRC followup questions were responsive to GL 88-17 programmed enhancement recommendations with three exceptions (paragraphs 1.2.1.2 and 1.2.1.3).
- The licensee's administrative controls and procedures for preventing loss of decay heat removal appeared suitable for minimizing the potential for reactor coolant system perturbations while shutdown (paragraph 1.2.2 and 1.2.6).
- The reduced inventory operation procedures were satisfactorily supported by engineering analyses, and appropriately required a briefing of plant

personnel by the plant manager prior to entering the reduced inventory condition (paragraph 1.2.2 and 1.2.4).

- The abnormal procedure for responding to the loss of decay heat removal was comprehensive, well organized, and had been validated during simulator training (paragraph 1.2.2).
- The instrumentation for monitoring normal decay heat removal operations appeared satisfactory with the exception that there were no provisions for control room alarms for monitoring core exit temperature with fuel in reactor vessel and the reactor vessel head removed as recommended by Generic Letter 88-17 (paragraph 1.2.1.2).
- The alarm setpoints for low reactor coolant system level, high core exit temperature, and low shutdown cooling flow did not appear to be appropriate for all operating conditions that might be encountered (paragraphs 1.2.1.2 and 1.2.1.3).
- The installed instrumentation for detecting anticipatory loss of the decay heat removal pump was not consistent with the recommended guidance of Generic Letter 88-17. During the exit meeting, the licensee committed to address this issue with the NRC office of Nuclear Reactor Regulation (paragraph 1.2.1.3).
- The equipment specified by Generic Letter 88-17 was available to provide reliable decay heat removal and emergency reactor coolant system inventory makeup (paragraph 1.2.3).
- The communication system for use during reduced inventory operations was acceptable (paragraph 1.2.3).
- Unresolved Item 285/9034-01 was closed.

Summary of Inspection Findings:

- Inspection Followup Item 285/9216-01 was opened (paragraph 1.2.1.3).

Attachments:

- Attachment 1 - Persons Contacted and Exit Meeting
- Attachment 2 - Documents Reviewed

DETAILS

1 PROGRAMMED ENHANCEMENTS IN RESPONSE TO GENERIC LETTER (GL) 88-17 - LOSS OF DECAY HEAT REMOVAL (TI 2515/103)

1.1 GL 88-17 Recommendations and Inspection Scope

GL 88-17 provided recommended licensee actions to prevent and, if necessary, to respond to loss of decay heat removal (DHR) events during operations with the reactor coolant system (RCS) partially drained. Recommendations were made in GL 88-17 in two categories:

- Expeditious actions, which were to be implemented prior to operating in reduced inventory conditions, and
- Programmed enhancements, which were to be developed in parallel with the expeditious actions and were to replace, supplement, or add to the expeditious actions.

The NRC's review of the licensee's expeditious actions was documented in NRC Inspection Report 50-285/89-34 issued on October 25, 1989. The purpose of this inspection was to ascertain the status of the programmed enhancements as committed to by licensee letters dated February 10, 1989, April 12, 1990, September 4, 1991, and May 21, 1992.

1.2 Licensee's Actions in Response to GL 88-17 Programmed Enhancement Recommendations (TI 2515/103)

The inspector's comments on the licensee's actions are provided below. The inspector reviewed the documents listed in Attachment 2, interviewed selected personnel, and walked down installed instrumentation and equipment. Findings in each of the six areas of programmed enhancements are summarized below.

1.2.1 Instrumentation

1.2.1.1 Level Instrumentation

GL 88-17 recommendations were satisfied for level instrumentation. Two independent RCS level indications (LI-197 and LIS-119) were available in the control room when at reduced inventory. Either indicator would actuate a low level alarm at two inches below the centerline of the hot leg. Also, a sight gauge in containment was continuously monitored at reduced inventory. During vortex testing in 1988, the licensee determined that with normal DHR flow, the onset of vortexing began at approximately nine inches below the hot leg centerline. This was the basis for setting the low RCS level alarm at two inches below the hot leg centerline. The inspector observed that the low level alarm would be more useful if the setpoint were raised when operating at an RCS level

above hot leg centerline, he questioned why the low level alarm setpoint was not adjusted based on the desired RCS level during decay heat removal operations.

1.2.1.2 CET Monitoring

CET indications with continuous monitoring and high temperature alarms were available in the control room as required by Generic Letter 88-17. The licensee had made provisions for connecting two temporary cables to provide CET monitoring capability while removing or installing the head. The licensee had made no provisions for monitoring CET after the RV head had been removed. Procedures allowed for up to 12 hours of operation at mid-loop without CET indication. The inspector questioned the prudence of the licensee's provisions for allowing operation at reduced inventory without CET indications when the reactor vessel head is removed. The CET alarm setpoints, which were set at approximately 700°F, would be too high to be of any value during reduced inventory operations. The inspector questioned why the setpoints were not reduced to less than 200°F to detect a temperature increase prior to the onset of boiling.

1.2.1.3 DHR System Monitoring

The monitoring capability for normal DHR system operation was adequate. Various DHR system temperature, pressure, and flow indications were available. However, the only alarm associated with these indications was a shutdown cooling system low flow alarm. The system flow was normally 1500 gpm. With the setpoint at 1000 gpm, it was of little use for detecting degraded system operation prior to actual loss of flow.

It was determined during the vortex testing in 1988 that with two of the four loop injection valves closed, maximum flow rate was 2600 gpm. The licensee was studying an initiative to close two of the four loop injection valves during shutdown cooling operations to avoid losing DHR because of failure of the flow controller.

1.2.1.4 Visible and Audible Indications of Abnormal Conditions

As discussed above there were adequate indications and alarms for normal DHR operations. However, the alarms were inadequate for detecting anticipatory loss of DHR. The licensee was considering installing a shutdown cooling system high flow alarm to provide early warning of loss of flow control which could cause pump runout and possible vortexing if the RCS level were at mid-loop. There were pump motor amperage indicators without alarms for the low pressure safety injection (LPSi) and containment spray (CS) pumps. Vortex testing (Document 22) had been performed on a LPSI pump with the RCS level at the centerline of the hot leg. Based on noise and vibration at the pump, it was determined that vortexing began at approximately 2800 gpm. However, the pump continued to operate. It was also determined that the installed instrumentation was not sensitive enough to detect the onset of vortexing. The inspector reached a similar conclusion while watching simulator scenarios of loss of DHR. GL 88-17 recommends that instrumentation be installed which will sense the onset of vortexing and the

anticipatory loss of the DHR pump. Installed instrumentation did not satisfy this recommendation. The licensee committed at the exit meeting to timely resolution of this issue with NRR. The region will track implementation of the resolution to this issue as an Inspection Followup Item (285/9216-01). Trend data was not readily available for most parameters.

1.2.2 Procedures

The procedures and administrative controls in effect suitably covered reduced inventory and mid-loop operations. The outage management procedure (Document 25) appropriately addressed mid-loop activities. The inspector noted that a personnel briefing by the plant manager was required prior to going to reduced inventory. The inspector verified that this was performed during the last refueling outage and was well received. Also, prior to going to reduced inventory, the Operations Coordinator, Outage Projects, and the Operations Supervisor were required to review work in progress, and work scheduled to start during the reduced inventory condition.

The abnormal operating procedure (Document 29) was comprehensive and well organized. Discussions with senior reactor operators indicated that it had been appropriately validated during simulator training.

1.2.3 Equipment

The equipment available to provide reliable DHR and emergency RCS inventory makeup was acceptable. The LPSI or CS pumps could be used for normal DHR recirculation. However, RCS temperature had to be 120°F or less prior to using the CS pumps. High pressure RCS makeup could be achieved with either the high pressure safety injection or charging pumps. Significant RCS makeup by gravity flow was not possible for this plant.

The Gaitronics system was normally used for reduced inventory operations. It was suitable, but not always convenient. There were also telephones at some locations. The licensee had an outstanding initiative (Document 20) to purchase a radio system to enhance communications.

1.2.4 Analysis

A 1988 engineering evaluation (Document 33) appeared comprehensive and supportive of plant procedures and training lesson plans. The testing (Document 22) performed during the last refueling outage appeared to provide suitable data to support proposed procedure changes relating to the postulated failure of the DHR flow control valve.

1.2.5 TS Changes

Neither the licensee nor the inspector identified the need for any TS changes required to support DHR operations.

1.2.6 RCS Perturbations

Administrative controls and procedures in place appeared to be effective to minimize the potential for RCS perturbations. Specific provisions to minimize RCS perturbations were discussed above. The inspector reviewed lesson plans (Documents 34 and 35) relating to reduced inventory operations and found them comprehensive. The inspector also verified that personnel who may perform duties which might inadvertently perturb the RCS had received appropriate training. They had been given authority to stop all work which could cause RCS perturbations.

The simulator training plans (Documents 36 and 37) relating to loss of DHR appeared creative and instructive. The inspector witnessed simulator scenarios of loss of DHR and found them realistic.

2 LICENSEE ACTIONS ON PREVIOUS INSPECTION FINDINGS (92701)

(Closed) Unresolved Item 285/9034-01: "Disparity Between Emergency Diesel Generator Surveillance Testing as Conducted by the Licensee and the (IS) Requirements."

This item was identified as an unresolved item pending the licensee's submittal of additional information. The licensee submitted additional information in a letter to NRR, dated September 4, 1990. The submittal was reviewed by the NRC and it was determined by the NRC reviewers that additional information was needed to supplement the September 4, 1990, input. In a telephone conversation between the NRC reviewers and licensee representatives on September 17, 1990, the licensee was urged to provide additional information to resolve this issue. The licensee provided the requested information in a letter (LIC-90-0599), dated October 9, 1990.

The NRC review of the licensee's information concluded, in a memorandum dated January 16, 1991, that the licensee was not fully meeting the intent of the TS, but that their diesel generator testing activities were technically adequate and satisfactory. The review concluded that the licensee was not in violation of their TS, but the reviewers noted that the licensee may wish to consider revisions to the surveillance testing requirements of the TS to accurately reflect their actual testing practices.

ATTACHMENT 1

1 PERSONS CONTACTED

OPPD

*J. Adams, Senior Nuclear Design Engineer
*R. Andrews, Division Manager, Nuclear Services
J. Borger, Senior Reactor Operator
C. Carlson, Shift Supervisor
J. Clayton, Supervisor, Emergency Planning
R. Clemens, Supervisor, Outage Projects
*G. Cook, Supervisor, Station Licensing
M. Core, Supervisor, Electrical/I&C Engineering
G. Creamer, Senior Reactor Operator
D. Eid, Engineer, Station Licensing
*M. Erans, Supervisor, System Engineering
J. Friedrichsen, System Engineer
*S. Gambhir, Division Manager, Engineering
*J. Gasper, Manager, Training
*W. Gates, Division Manager, Nuclear Operations
*D. Gorence, Acting Supervisor, System Engineering
G. Guliani, Supervisor, Operations Training
*K. Henry, Lead System Engineer
*J. Hernion, Supervisor, Nuclear Licensing
W. Hunt, Contract Trainer
R. Hyde, Supervisor, Maintenance Training
R. Jaworski, Manager, Station Engineering
*L. Kusek, Manager, Nuclear Safety Review
C. Linden, Operating Event Response Coordinator
R. Luikens, Emergency Operating Plan Coordinator
T. Matthews, Licensing Engineer, Responses
*W. Orr, Manager, Quality Assurance/Quality Control
*T. Patterson, Manager, FCS
T. Peterson, Nuclear Design Engineer
*R. Phelps, Manager, Design Engineering
A. Richard, Assistant Manager, FCS
G. Riggs, Senior Reactor Operator
C. Schaffer, System Engineer
*C. Simmons, Engineer, Station Licensing
J. Tills, Supervisor, Operations
D. Trausch, Supervisor, Operations

NRC

*R. Azua, Resident Inspector
W. Lyon, Senior Reactor Engineer

*Denotes those in attendance at exit meeting on July 31, 1992.

2. EXIT MEETING

The inspector met with licensee representatives on July 31, 1992, and summarized the scope and findings of this inspection. The licensee did not identify, as proprietary, any of the material provided to, or reviewed by, the inspector during this inspection.

ATTACHMENT 2

Documents Reviewed

1. Letter LIC-89-045, OPPD to NRC, "Response to GL 88-17," dated February 10, 1989
2. Letter NRC to OPPD, "Comments on OPPD Response to GL 88-17, FCS," dated May 18, 1989
3. Letter LIC-90-0161, OPPD to NRC, "Clarification of Commitments Regarding GL 88-17," dated February 20, 1990
4. Letter LIC-90-0284, OPPD to NRC, "GL 88-17 Enhancements," dated April 12, 1990
5. Letter, NRC to OPPD, "Programmed Enhancements for GL 88-17, Loss of DHR - FCS, Unit 1," dated August 10, 1990
6. Letter LIC-91-201R, OPPD to NRC, "GL 88-17 Enhancements," dated September 4, 1991
7. Letter, NRC to OPPD, "GL 88-17 Enhancements - FCS, Unit 1," dated December 5, 1991
8. Letter LIC-92-018R, OPPD to NRC, "GL 88-17 Enhancements," dated January 31, 1992
9. Letter LIC-92-170R, OPPD to NRC, "Completion of GL 88-17 Actions," dated May 21, 1992
10. Record of Telephone Conversation, S. Bloom and W. Lyon (NRC) to R. W. Short, et al (OPPD), "GL 88-17 Letter LIC-92-018R," dated February 6, 1992
11. Memorandum PED-FC-90-1913, S. K. Gambhir to J. W. Chase, "Closure to CID 890151, Feasibility of Temporary Temperature Indication," dated April 25, 1990
12. Memorandum PED-SYE-90-1428J, J. D. Kecy to PRC Chairman, "Station Modification Acceptance and Review Team (SMART) Comments Regarding MR-FC-89-019, Shutdown Cooling (SDC) Low Flow Alarm and Safety Injection Pressure and Pump Amperage Upgrade," dated November 2, 1990
13. Memorandum LIC-90-0933, T. G. Therkildsen to J. D. Kecy, "PED-SYE-90-1428J," dated November 19, 1990
14. Memorandum PED-FC-91-1941, R. L. Phelps to R. L. Jaworski/J. W. Chase, "Modification MR-FC-89-019 - SDC Low Flow," dated January 31, 1991
15. Memorandum PED-SYE-91-0623, S. K. Gambhir to J. W. Chase, "CID 900082/04, GL 88-17 Commitment Clarification," dated June 6, 1991

16. Memorandum PED-SYE-91-0635, M. T. Frans to PRC Chairman, "SMART Comments Regarding MR-FC-89-019, SDC Flow and Safety Injection Pressure and Pump Amperage Upgrade," dated June 10, 1991
17. Memorandum LIM-91-0324, T. G. Therki'dsen to PRC Chairman, "MR-FC-89-019," dated June 24, 1991
18. Memorandum PED-FC-92-662, R. L. Phelps to R. W. Short, "CID 900082/04," dated April 13, 1992
19. Memorandum FC-1198-89, J. R. Shuck to J. J. Fisicaro, "CID 890152/02, Communication Review," dated June 28, 1989
20. Commitment ID 890152, "Purchase New Radio System," dated October 4, 1991
21. Memorandum PED-FC-90-1913, S. K. Gambhir to J. W. Chasa, "Closure of CID 890151, Feasibility of Temporary Temperature Indication," dated April 25, 1990
22. Memorandum PED-SYE-92-0434, M. T. Frans to PRC Chairman/R. W. Short, "Closure of CID 900751/02, Potential for Loss of SDC While at Low RC Levels," dated May 1, 1992
23. Memorandum PED-FC-92-930, J. L. Skiles to M. T. Frans, "Closure of LPSI Loop Injection Valves During SDC Operation," dated June 11, 1992
24. Memorandum PED-FC-92-341, J. C. Adams to R. L. Phelps, "Review of Response to GL 88-17, Loss of DHR," January 17, 1992
25. Procedure SO-M-104, Revision 0, "Outage Planning and Execution"
26. Procedure OI-CO-4, Revision 3, "Refueling Containment Integrity"
27. Procedure IC-ST-AE-0002, Revision 1, "Containment Equipment Hatch O-Ring Type B Leak Rate Test"
28. Procedure OP-6, Revision 4, "Hot Shutdown to a Cold or Refueling Condition and Conduct of SDC Operations"
29. Procedure AOP-19, Revision 0, "Loss of SDC"
30. Procedure EM-OT-EX-0102, Revision 0, "Installation of Core Exit Thermocouple Connection"
31. Procedure PE-RK-AE-0501, Revision 2, "Replacing Equipment Hatch"
32. Procedure OI-SC-1, Revision 6, "SDC Initiation"
33. "Engineering Evaluation of RCS Loss of SDC at Mid-Loop Conditions," dated September 1988

34. Lesson Plan 7-7-42, Revision 1, "Shutdown Risk Management - Instructor Handbook"
35. Lesson Plan 7-7-42, Revision 1, "Shutdown Risk Management - Student Handbook"
36. Simulator Scenario Guide 08-12-40, Series A, "Loss of SDC - RCS Drained," dated August 30, 1990
37. Simulator Scenario Guide 08-12-34, Series A, "LOCA While on SDC," dated August 30, 1990