

U.S. NUCLEAR REGULATORY COMMISSION
REGION III

Reports No. 50-315/87010(DRP); 50-316/87010(DRP)

Docket Nos. 50-315; 50-316

Licenses No. DRP-58; DRP-74

Licensee: American Electric Power Service Corporation
Indiana and Michigan Electric Company
1 Riverside Plaza
Columbus, OH 43216

Facility Name: Donald C. Cook Nuclear Power Plant, Units 1 and 2

Inspection At: Donald C. Cook Site, Bridgman, Michigan

Inspection Conducted: April 8-16, 1987

Inspectors: B. L. Jorgensen
J. K. Heller

Approved By: *B. L. Burgess*
B. L. Burgess, Chief
Projects Section 2A

4/24/87
Date

Inspection Summary

Inspection on April 8-16, 1987 (Reports No. 50-315/87010(DRP);
No. 50-316/87010(DRP))

Areas Inspected: Special inspection of the circumstances surrounding the operation of Unit 1 outside the limits for Reactor Coolant System temperature and pressure, which are established by the Unit Technical Specifications, during a Unit cooldown on April 8, 1987.

Results: One violation was identified which involved failure to satisfy a Technical Specification ACTION requirement to restore temperature and pressure within prescribed limits within 30 minutes.

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DETAILS

1. Persons Contacted

*W. G. Smith, Jr., Plant Manager
*J. E. Rutkowski, Assistant Plant Manager, Production
*A. A. Blind, Assistant Plant Manager, Administration
*L. S. Gibons, Assistant Plant Manager, Technical Support
*K. R. Baker, Operations Superintendent
L. K. Smith, Shift Supervisor
V. Woods, Unit Supervisor
P. O'Neil, Control Operator
F. Heimbiener, Auxiliary Equipment Operator

*Denotes personnel present at the Management Interview on April 16, 1987.

2. Introduction

On April 8, 1987, Unit 1 was in the process of a slow cooldown. Under such conditions, Technical Specification 4.4.9.1 requires that reactor coolant system temperature and pressure be determined to be within the limits prescribed in Figure 3.4-3 at least once per 30 minutes. A control operator trainee was assigned the responsibility of collecting and recording plant data, including reactor coolant system (RCS) temperature and pressure every 15 minutes. A licensed Senior Reactor Operator (SRO) serving as Unit Supervisor and a licensed SRO serving as the Control Operator and responsible for plant control were present in the control room. Between the hours of 7:00 and 8:00 p.m. EDT the temperature and pressure data collected was not compared to the pressure and temperature limits of Technical Specification Figure 3.4-3. When comparisons were finally made shortly after 8:00 p.m., they showed the Unit in violation of the pressure-temperature limits at 7:15, 7:45, and 8:00 p.m. The maximum deviation occurred at 8:00 p.m. with temperature at 306 F. The recorded pressure of 1060 psig was found to be 185 psi above the 975 psig limit. Upon identification, pressure was immediately reduced to within the limit.

3. Sequence of Events

At 1:00 a.m. on April 8, the licensee commenced a Unit 1 shutdown in compliance with applicable Technical Specifications following determination that unidentified RCS leakage was 1.07 gpm. By 7:18 a.m. the Unit was in MODE 3 (HOT STANDBY) and after a charging line valve packing leak was located and isolated, leakage had been reduced to below 1 gpm. Additional inspections in containment identified another small RCS leak and also located a secondary system leak at a manway on steam generator 1-3. The decision was then made to cool the Unit down for repair.



At 10:05 a.m., a cooldown to 400 degrees F was begun. Throughout the day on April 8, continuing inspections and evaluations were performed to determine optimum plant conditions to facilitate the repairs. The licensee desired to achieve conditions permitting safe repair of the identified leaks while at the same time minimizing the challenge to the reactor coolant pump (RCP) O-ring seals which complete depressurization would entail. Thus, a slow cooldown progressed while RCS pressure remained relatively high.

The evening shift arrived to assume duties around 3:15 p.m. At this time, RCS temperature and pressure were about 385 degrees F and 1600 psig, respectively. A continued cooldown was desired, such that a continued reduction in secondary system pressure (in equilibrium with RCS temperature) could be achieved. A secondary pressure around 50 psig was desired, which would allow the licensee to attempt steam generator manway repair in place, and to permit observation of the effects of the repair attempt on the leak. The target RCS temperature was 300 degrees F. The RCS pressure target conveyed to the shift was around 1100 psig. The crew was reminded to stay within pressure-temperature limits.

The Unit 1 evening shift complement consisted of three NRC-licensed operators and five non-licensed equipment operators. In addition, a Shift Supervisor, an Assistant Shift Supervisor, and a Shift Technical Advisor, all licensed, were onsite with shared responsibilities for Unit 1 and Unit 2. Upon shift turnover, the crew which assumed duties in the main control room consisted of two licensed personnel (both Senior Reactor Operators - SROs) and a non-licensed trainee. One SRO served as the Unit Supervisor, while the other served as a control operator. The duties assigned to the trainee involved data acquisition, not plant control manipulation. The control room staffing met the staffing requirements of the Unit Technical Specifications.

The evening shift crew continued the slow cooldown in accordance with their instructions. Precise final pressure and temperature target values were not established by the crew in advance. Early in the shift the controlling concern for RCS temperature and pressure was the pressure differential across the steam generator tubes. Licensee procedure **1 OHP 4021.001.004 "Plant Cooldown From Hot Standby to Cold Shutdown," which was in use establishes, in Attachment 2, a limit of 1600 psid across the steam generator tubes. The curve otherwise duplicates Technical Specification Figure 3.4-3. As the shift progressed, RCS pressure was reduced substantially from the 1600 psid limit.

As the shift progressed, the Unit Supervisor became involved in the administrative duties of the shift, which included review of Job Orders for the following shift and day, clearances and restoration for equipment maintenance activities beginning or ending, approval of ongoing surveillance test activities, phone coverage, and other miscellaneous items. He periodically checked cooldown progress and parameters. The control operator covered both primary and secondary system panels. Some above-normal attention was being given to steam generator parameters, since one steam flow channel had failed high earlier in the day. This,



created the potential for an unwanted main steam isolation in the event of another single failure. Depressurization was running a bit ahead of cooling, and around 7:00 p.m., additional pressurizer heaters were energized as temperature settled towards 300 degrees. The control operator recalled being clearly aware of temperature and pressure, but not specifically verifying they remained within limits.

Throughout the evening shift, the Unit Plant Safety System Display (PSSD), a computerized monitoring system, displayed a temperature and pressure curve with cooldown and steam generator tube differential pressure limits. This display also indicated the existing temperature and pressure measured from a core exit thermocouple and a RCS wide-range pressure channel, respectively. Both the Unit Supervisor and the Control Operator were aware of the display and recognized that it showed conditions throughout the shift to be in compliance with the displayed limits, but they did not focus on or use the display as the controlling input for plant manipulations. Neither licensed individual recognized that the displayed limits were not consistent with the limits of Technical Specifications and the controlling procedure, a fact identified during the post-event review.

Normal shift readings were begun at about 7:00 p.m., which is customary at mid-shift time. This data collection was accomplished by the trainee, as was continued routine collection of data for Attachments 1 and 2 of the cooldown procedure, and selected special-purpose data collection related to tracking of the source-range nuclear instruments. At no point during this process did the trainee identify that he was having difficulty in keeping up with the data collection and/or comparison requirement. Shift data collection is an approximate 40 to 60 minute evolution. During the time period from 7:00 p.m. to 8:00 p.m., RCS temperature and pressure data continued to be recorded each 15 minutes as required by procedure, but the data was not compared to the Attachment 2 curve providing the limits. The pertinent data points were as shown below:

<u>Time</u>	<u>Temp</u>	<u>Press</u>	<u>Limit (P)</u>	
7:00 p	330	1090	1175	
7:15 p	320	1100	1090	NOTE: Temp/Press values shown are worst case - i.e. lowest Temp. and highest Press.
7:30 p	316	1120	1040	
7:45 p	311	1150	1020	
8:00 p	306	1160	975	
8:03 p	313	990	1010	

At approximately 8:00 p.m. EDT the shift recognized that the pressure-temperature limits had been violated and immediately reduced pressure.

Unit 1 Technical Specification 3.4.9.1 requires that RCS temperature and pressure be maintained within the limits of Figure 3.4-3 during cooldown. The "limits" shown above are from Figure 3.4-3. An ACTION required when any limit is exceeded is to restore conditions within the limits within



30 minutes. The data above show the licensee failed to maintain conditions within the limits. This is violation of Technical Specification 3.4.9.1, which is under evaluation by NRC Region III as to the appropriate enforcement action (Unresolved Item 50-315/87010-01).

4. Contributing Cause Factors

The proximate cause of the event was personnel error. A non-licensed operator in training status failed to perform a required verification at an established frequency to assure compliance and on shift licensed personnel failed to ensure that required comparisons were being made.

With regard to root cause or causes, the information obtained during this inspection points to several areas. An Enforcement Conference has been arranged between the licensee and NRC Region III representatives to explore the extent to which the following factors contributed to this event:

- a. prior planning
- b. communications - both within and from outside the shift
- c. assignments of responsibility
- d. performance expectations for tasks and for task supervision
- e. on-shift coordination

It appears possible there may have been some contribution to the event relating to each of the above. Pursuant to NRC inspection and documentation guidelines, training, which may also have been a factor, is discussed separately below.

5. Significance

The "worst case" data at 8:00 p.m. showed the pressure at 306 degrees F to be about 1160 psig, 185 psi above the limit. The 306 degree F data point was the lowest hot-leg temperature, and compares to the approximately 310 degree F shown for all four cold legs. At 310 F the pressure limit is approximately 1000 psig. The use of 306 degrees is thus conservative. Concerning pressure, the limits are contained in Technical Specification Figure 3.4-3, which has been calculated as applicable for up to 12 Effective Full Power Years (EFPY). At the time of the event, the Unit had accumulated slightly less than eight EFPY. These limits are, therefore, conservative. The licensee's consultant, Southwest Research Institute performed an evaluation specific to the event in question which concluded the structural integrity of the reactor vessel was not jeopardized. At eight EFPY, the actual acceptable operating range for the reactor vessel (utilizing Regulatory Guide 1.99 Revision 1 methodology) would include pressures up to about 1575 psig for a temperature of 306 degrees F. The technical safety significance of this event was therefore minimal.

The event is significant from the perspective that the NRC expects that control room activities will, at all times, be conducted in a highly co-ordinated and closely monitored manner, such that any parameter under operator control will be identified as requiring adjustment as it approaches any applicable limit, not after the limit is violated.

6. Training

A review of the training program and discussions with shift personnel were conducted to focus on the training and qualifications of personnel involved in this event. No programmatic deficiencies were identified. The licensee's operator training programs for both licensed and non-licensed personnel are accredited by the Institute for Nuclear Power Operations and included specific materials on fundamentals of diagnostics and on teamwork training. The diagnostics and teamwork modules were presented to the licensed personnel involved in March and April 1987.

Application of this training was ineffective in the case of the event detailed herein. Based on inspector discussions with representatives of the Training Section, the event is under active consideration for incorporation into future training as a case study.

7. Conclusion

Technical Specification requirements for RCS temperature and pressure were violated during a Unit 1 cooldown on April 8, 1987 and conditions were not restored within 30 minutes as required. Post-event analysis showed that the event lacked technical significance with respect to RCS integrity, but did, as a minimum, involve substandard performance by on-shift personnel. An Enforcement conference will be scheduled to discuss causes and corrective actions.

8. Management Interview

A management interview, attended as noted in Paragraph 1, was conducted at the conclusion of the inspection. The inspector summarized the inspection scope and findings as described herein. In addition, the inspector asked those present whether any of the information likely to be contained in this report could be considered proprietary. No such information was identified.

