APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-285/94-01

License: DPR-40

Licensee: Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
P.O. Box 399, Hwy. 75 - North of Fort Calhoun
Fort Calhoun, Nebraska

Facility Name: Fort Calhoun Station

Inspection At: Blair, Nebraska

Inspection Conducted: January 24-28, 1994

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## EXECUTIVE SUMMARY


An announced team inspection of the licensee's compliance with 10 CFR Part 50.63, "Loss of All Alternating Current Power," usually referred to as the Station Blackout Rule, was conducted during the week of January 24, 1994. The team utilized the guidance of Temporary Instruction 2515/120, "Inspection of Implementation of Station Blackout Rule, Multi-Plant Action Item A-22," to perform the inspection.

The team evaluated the licensee's analyses related to the duration of a postulated station blackout event and the licensee's ability to cope with a station blackout event. The team reviewed calculations, interviewed personnel, and performed walkdowns of involved systems and procedures.

The team found the analyses related to the coping duration, emergency diesel generator reliability, and offsite power reliability to adequately justify a 4-hour coping duration assumption. The calculations and analyses were technically sound and in accordance with the approved guidelines.

The team determined that the battery capacity was adequate to power required equipment throughout a 4-hour station blackout. The team verified that the condensate inventory was adequate for reactor core cooling during a 4-hour station blackout. The team also verified that necessary equipment would be capable of being operated throughout a station blackout event and that containment integrity would be assured.

The team determined that the station blackout coping procedures adequately addressed control room and local operator actions necessary to establish and maintain decay heat removal, minimize reactor coolant system inventory loss, minimize dc loads, and restore the availability of vital components. The team found the licensee's actions for severe weather to be acceptable. The team also determined that the training provided to licensed and nonlicensed operators adequately prepared them to cope with a station blackout.

The team found the material condition of the facility to be acceptable. The team noted some labeling and drawing problems that were considered minor in nature but of concern because of the implications for similar problems in more critical applications. An inspection followup item was initiated to evaluate the implementation of the licensee's drawing control program.

Overall, the team concluded that the licensee had implemented an excellent program for response to a station blackout. The team found the analyses and calculation documentation to be very detailed and well defined. The team also concluded that all necessary systems and equipment would be capable of cooling the reactor core throughout a station blackout event.

The team closed one inspection followup item and four licensee event reports. These issues are summarized in Attachment 3.

## DETAILS

## 1 INTRODUCTION (TI 2515/120)

A station blackout (SBO) is the complete loss of alternating current (ac) electrical power at the facility. The loss of ac electrical power precludes the use of systems and components normally used to remove reactor decay heat. Since the consequences of not removing the reactor decay heat could be severe, the Commission issued the SBO Rule, 10 CFR Part 50.63, "Loss of All Alternating Current Power." Guidance on acceptable methods of meeting the requirements of the SBO Rule were provided in Regulatory Guide (RG) 1.155, "Station Blackout." Additional industry guidance was provided by the Nuclear Management and Resource Council (NUMARC). The NRC found the guidance of NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," to be acceptable, as clarified in RG 1.155.

The SBO Rule requires that "The reactor core and associated coolant, control, and protection systems, including station batteries and any other necessary support systems, must provide sufficient capacity and capability to ensure that the core is cooled and appropriate containment integrity is maintained in the event of a station blackout for the specified duration. The capability for coping with a station blackout of specified duration shall be determined by an appropriate coping analysis."

The licensee provided the NRC information related to the implementation of the SBO Rule in letters dated April 17, 1989; March 1, 1990; October 25, 1990; May 20, 1991; and December 11, 1991. The NRC provided the results of technical reviews of those submittals by letters dated November 1, 1991, and April 13, 1992. The technical reviews concluded that the licensee's actions were acceptable but recommended that additional measures be implemented to cope with an SBO event.

This special team inspection was conducted to evaluate the licensee's ability to cope with an SBO event. In addition to reviewing the licensee's actions related to the recommended additional measures, the team verified that the assumed actions could be implemented as assumed in the analyses. The inspection included an evaluation of the adequacy of the analyses, systems and components, procedures, and training related to SBO events. The team reviewed documentation, interviewed personnel, and performed independent walkdowns of involved systems and procedures as part of the inspection.

The team also evaluated the licensee's actions in response to some previously identified inspection findings and reported events.

## 2 COPING ANALYSIS

The team reviewed the licensee's analyses and calculations related to the duration of an SBO and the data and analyses related to emergency diesel generator (EDG) reliability.

### 2.1 Coping Duration

By letter dated April 17, 1989, the licensee provided the bases for selecting a 4-hour SBO duration. The NRC reviewed the proposed SBO duration and agreed with the licensee's evaluation as documented in the safety evaluation report dated November 1, 1991. The 4-hour SBO duration was based on an offsite power design characteristic group of "P1," an emergency ac configuration group of "C," and an EDG reliability target selection of 0.95. These categories are defined in RG 1.155.

The offsite power design characteristic group "P1" was derived from an independence of offsite power characteristic of "I2," severe weather group "2," extremely severe weather group of "2," and an expected loss of offsite power of less than 1-per-20-years. The team reviewed plant documentation and Calculation FC06174, Revision 0, dated January 11, 1994, to verify that these characteristics were appropriate. The team concluded that the calculated SBO duration of 4 hours was in accordance with the NUMARC guidelines and was acceptable.

### 2.2 EDG Reliability

The team noted that the EDG reliability value (unit average) for the last 100 valid start and load run demands was determined in Calculation FC06173, Revision 0, to be 0.954. The reliability data for the last 50 and 20 valid start and load run demands were 0.959 and 0.95, respectively. Based on a review of the diesel reliability data, the team determined that the selection of a 0.95 EDG reliability target value was appropriate.

The team also reviewed the EDG reliability program to verify that the data was being trended and to ensure that the program was consistent with the guidance of RG 1.155. The team noted that the EDG target reliability was consistent with the plant category and coping duration selection and was included in the EDG reliability program (Document SEI-1). The Diesel Generator Demand Record (FC-1046) and Failure Record (FC-1046A) monitored each start and load run of the EDG and trended the reliability and failure rates. The EDG system engineer tracked the number of valid failures in the last 100, 50, and 20 valid demands (on a per EDG) and provided various reports to Station Management. The team noted that the program was adequate and that management oversight was functioning properly.

### 2.3 Conclusions

The team concluded that the calculated minimum acceptable SBO duration of 4 hours was in accordance with the NUMARC guidelines and was acceptable.

The team determined that the 0.95 EDG reliability target value was appropriate and that the EDG reliability program was functioning consistent with the guidance of RG 1.155.

## 3 COPING SYSTEMS

The team reviewed system designs and calculations related to operations required to cope with and recover from an SBO. The team verified that required actions could be implemented as needed through interviews and walkdowns. The discussion of some operator actions was integrated with the evaluation of the involved system for continuity.

### 3.1 Battery Capacity

The team reviewed Battery Capacity Calculation FC05690, Revision 2, to verify that the battery capacity was adequate to provide power to required SBO equipment for 4 hours. The team verified that the calculation included an appropriate aging factor of 1.25 and a temperature correction factor for 70°F electrolyte temperature. The team verified that the battery electrolyte temperature would not fall below 70°F since the battery rooms' ventilation system was safety-related and ventilation trouble was annunciated in the control room. Additionally, the recorded temperatures in the battery rooms during 1992 indicated that the lowest temperature was 71.5°F. The design basis load profile included operation of circuit breakers and EDG field flashing at the end of the coping duration.

The team noted that the battery capacity calculation assumed the following load shedding: 1) Emergency Lighting Panels ELP1, ELP2, and ELP5 and the 400 Hertz Cabinet at 30 minutes; 2) Emergency Bearing Oil Pump at 75 minutes; and 3) Emergency Seal Oil Pump and the Inverter 1 and Inverter 2 loads (except the feeder breakers to Panel AI-53) at 120 minutes. As discussed in paragraph 4, the team verified that Procedure EOP-07, "Station Blackout," Revision 3, Attachment 6, included appropriate steps to perform the necessary load shedding.

The team noted that the calculation identified a margin of 30.3 percent for Battery 1 and 45.7 percent for Battery 2. In response to the team's questions concerning some of the assumptions, the licensee performed additional calculations. The new calculations considered all loads as constant power loads, increased the inverter loading by 20 percent from the values measured during normal operation, increased the temperature correction factor from 1.036 to 1.04, and included an allowance for spring charging motor inrush current. The new calculations provided further verification of the adequacy of the battery capacity. The team also noted that the original calculation assumed the Seal Oil Pump was driven by a 5 HP motor but a 7.5 HP motor was actually installed. Based on the additional calculations, the team concluded that the station battery capacity was adequate. However, the battery capacity margins may be less than indicated in the original calculation.

### 3.2 Cooling Water

The team reviewed Calculation FC06175, "Emergency Feedwater Storage Tank Adequacy for Station Blackout," Revision 0. The calculation demonstrated that the emergency feedwater (EFW) storage tank had adequate cooling water inventory for decay heat removal during an SBO in accordance with EOP-07.

The EFW inventory calculation results indicated that 37,391 gallons of condensate were required for the decay heat removal during a 4-hour SBO. The Technical Specifications required a minimum useful volume of 55,000 gallons of condensate be maintained in the EFW storage tank. Therefore, the available condensate inventory was greater than that required for decay heat removal during an SBO event. The methodology used for this calculation followed the guidance provided in Section 7.2.1 of NUMARC 87-00.

In addition, the Technical Specifications required the backup water supply to the EFW storage tank from the Missouri River using the fire water system to be available. The team verified that Procedure AOP-30, "Emergency Fill of Emergency Feedwater Storage Tank," Revision 0, provided acceptable guidance to align the fire water system for filling the EFW storage tank.

3.3 Emergency Feedwater System and Steam Relief System

To establish reactor decay heat removal, certain EFW system valves and steam relief system valves would require local/manual operation during an SBO event. The team reviewed Heatup Calculations FC06176, "Room Heatup Due to Loss of HVAC During Station Blackout," Revision 0, and EA-FC-93-071, "Engineering Analysis," Revision 0, that predicted the peak temperatures in the areas where local/manual operations of equipment were required.

The EFW system flow control valves and the atmospheric steam dump valves were air operated during normal power operation and would require local/manual operation to control steam generator water levels for decay heat removal during an SBO event. These valves were equipped with handwheels to allow for local/manual operation. In addition, the EFW system flow control valves were equipped with air accumulators to allow them to be remote/manually operated three open and close cycles after a loss of instrument air.

The EFW flow control valves and the atmospheric steam dump valves were located in the main steam room. The calculated peak temperature in this room was 120°F. The manual operation of these valves required approximately 5 to 10 minutes to perform. These valves would be operated on an intermittent basis and an operator would not be continuously stationed in this area during an SBO. Therefore, access for local operation would not be restricted.

3.4 Compressed Air

The compressed air system would not be available for the mitigation of an SBO. As indicated above, the EFW system flow control valves and the atmospheric steam dump valves which were air operated during normal power operation were equipped with handwheels to allow for local/manual operation. These valves could, therefore, be local/manually operated during an SBO.

3.5 Effects of Loss of Ventilation

During an SBO event, certain ventilation systems would be lost for areas containing equipment required to mitigate the consequences of the SBO event. The SBO Rule required that licensees identify areas that contain equipment required to operate during an SBO that would be susceptible to a significant heatup following the SBO. These areas were the dominant areas of concern and the SBO mitigation equipment located in these areas was reviewed to assure operability during an SBO. The team reviewed the heatup calculations that identified the dominant areas of concern and reviewed the reasonable assurance of operability for equipment located in those areas.

The team reviewed the heatup calculations including the structural heat sinks and their associated thermal characteristics and the heat generation rate calculations for various equipment, piping and components for the areas containing equipment required to cope with an SBO. No peak area temperatures during a 4-hour SBO exceeded 120°F. The calculated peak area temperatures were less than the temperature limits described in NUMARC 87-00. Therefore, the reasonable assurance of operability for SBO equipment was acceptable.

In calculating the peak temperature in the control room, an initial temperature of 80°F was assumed. The team verified that control room temperature monitoring programs, OI-Va-3, "Control Room Ventilation System Normal Operation," Revision 3, and FC-75, "Control Room Log," Revision 46, ensured corrective actions would be taken if the control room temperature exceeded 80°F. In addition, the team verified that personnel heat loads were considered in the control room heatup calculation through the consideration of 10 operators, each generating 255 watts, during an SBO.

The team also reviewed Containment Heatup Calculation EA-FC-93-091, "Engineering Analysis," Revision 0. The team verified that the temperature profile during an SBO event was bounded by the results from a loss-of-coolant accident or a main steam line break accident.

### 3.6 Containment Isolation Valves

The team reviewed the process that the licensee used to identify those containment isolation valves not required to be controlled during an SBO. The licensee's evaluation of containment isolation valves was documented in Calculation EA-EC-89-054, "Engineering Analysis," Revision 2, Attachment 8. Attachment 8 provided a list of all the containment isolation valves and the basis for excluding some valves in accordance with NUMARC 87-00. The team found the licensee's justifications regarding the exclusion of those containment isolation valves to be consistent with, and to meet the intent of, RG 1.155.

### 3.7 Conclusions

The team determined that the battery capacity was adequate to power required equipment throughout a 4-hour SBO. The team concluded that the condensate inventory was adequate and that necessary equipment could be operated to cope with a 4-hour SBO event.

The team determined that the calculations to identify the dominant areas of concern were technically sound and that the equipment located in the dominant areas of concern had reasonable assurance of operability throughout a 4-hour SBO. The team also determined that all equipment required to function during an SBO event to shutdown the reactor and maintain the plant in hot standby were covered by a quality assurance program consistent with RG 1.155.

The team found the licensee's analyses and calculation documentation to be very detailed and well defined.

## 4 PROCEDURES AND WALKDOWNS

The team reviewed procedures utilized to cope with an SBO event and performed walkdowns of selected procedures in the control room and in the plant with licensed and nonlicensed operators, as appropriate. This review included severe weather procedures, emergency operating procedures and abnormal operating procedures utilized to cope with an SBO, and procedures utilized to restore offsite power. The walkdowns were performed to verify that the procedures used to cope with an SBO could be physically and correctly performed.

### 4.1 Severe Weather Procedures

Abnormal Operating Procedure AOP-01, "Acts of Nature," Revision 1, delineated steps to be taken in the event that tornado activity was imminent. Entry conditions for this procedure included the issuance of a tornado warning for the area or a tornado sighting in the area of the plant. However, this procedure did not identify actions that could be taken earlier to prepare the site for a tornado. Actions that could be taken to minimize the consequences of a tornado include inspecting the site for potential missiles and reducing that potential. The licensee indicated that these preparatory steps were being added to two existing standing orders and that these revised procedures would be effective on April 1, 1994, prior to the start of the tornado season. The team reviewed the changes made to Standing Order SO-G-6, "Housekeeping," and Standing Order SO-G-15, "Backshift/Weekend/Holiday Visits and Duty Assignments," which were approved on January 18, 1994, and found that they adequately addressed tornado preparation.

### 4.2 Coping Procedures

Emergency Operating Procedure EOP-07, "Station Blackout," Revision 3, provided operator actions necessary to maximize the time that the plant was maintained in a stable, safe condition. The goal of the procedure was to restore ac power to recover vital plant components and to establish the entry conditions of EOP-02, "Loss of Off-Site Power/Loss of Forced Circulation."

As discussed in paragraph 3.1, the team verified that EOP-07 provided appropriate priority to removing unnecessary dc loads from the batteries. The procedure also provided instructions for control room and local operator actions necessary to establish and maintain decay heat removal, minimize reactor coolant system inventory loss, and restore ac power to the vital buses. The procedure included a note that identified specific actions required to manipulate air operated valves in the AFW flowpath to the steam generators.

During the walkdown of Attachment 6 for dc load shedding, the team noted that the loads shown for Circuits 15 and 16 on Inverter I-BUS-2 were transposed on Drawing 11405-E-9, Sheet 3, "120 Volt AC Instrument Buses One Line Diagrams," Revision 11. The team's comparison of the procedural instructions for load shedding to the drawing resulted in the identification of additional drawing errors. Attachment 6 did not require the opening of the circuit breakers for Circuits 14 and 16 on Inverter I-BUS-1, however, the drawing indicated that Circuits 14 and 16 were emergency alarms. The licensee determined that these circuits had been removed as part of a modification implemented approximately 5 years earlier but the drawing had not been revised.

The team noted that both of the above drawing errors were made during the implementation of modifications. The licensee informed the team that the error made several years ago should not occur again because of improvements in the design control process. The error related to the transposed loads was attributed to personnel error that occurred in November 1993 during drawing revision for another modification. The licensee promptly corrected both drawing errors and initiated Incident Report 940040 to determine the cause of the errors. The licensee's actions related to this incident report will be evaluated during a future inspection (Inspection Followup Item 285/9401-01).

The team verified that no equipment required to cope with an SBO event needed heat tracing for freeze protection. The team also verified that the licensee did not rely on nonsafety-related instrumentation during an SBO event.

### 4.3 Restoration Procedures

The team reviewed the utility load dispatchers' instructions contained in the "Load Shedding and Restoration Procedures Manual" to determine the priority assigned to restoring power to the Fort Calhoun Station. The team found that "FCS shall under all conditions be given the highest priority for restoration of station service."

### 4.4 Use of EOPs and Supporting Procedures

The team performed walkdowns to verify that selected procedures provided adequate instructions for mitigating the consequences of an SBO event. The team walked down EOP-07, including Floating Steps C and G; EOP Attachments 5, 6, 12, 13, and 17; and AOP-30. These walkdowns were conducted with licensed or nonlicensed operators, as appropriate, who simulated performance of the procedural steps.

The team determined that the procedures provided clear instructions for mitigating the consequences of an SBO and verified that operator actions could be performed in a timely manner with minimal potential for error. Where local operator action was required, the team determined that emergency lighting would be available or that the action could be performed by an operator using a flashlight. Operator actions could be performed within the prescribed time limits established by the procedures and shift staffing levels were found to be sufficient to complete the required tasks. Communications between the operators and the control room could be accomplished using hand-held radios.

The operators accompanying the team on the walkthrough were knowledgeable of the procedures, familiar with the plant and the locations of equipment required to be operated by the procedures, and knowledgeable of their duties in the event of an SBO.

During the walkdowns the team identified eight instances in which the nomenclature used in the procedure to identify a component did not match the label attached to the component. These eight examples were minor in nature and would not have prevented the operator from successfully completing the tasks in a timely manner. Two additional errors were identified in which there were significant differences in nomenclature between the procedure and the labels, although in both cases the component number on the label matched the component number in the procedure.

The team also identified two examples of incomplete procedural guidance: EOP-07, Attachment 5, "Energizing 480 V Buses From 13.8 KV," Revision 1, Step 7, directed the operator to place MCC-3C2-F01, "1C3A-16 Pole Panel Board," in the OFF position. The team found that this panel board contained a number of circuit breakers and the procedure did not provide complete instructions for positioning these breakers. In addition, Step 12 of Attachment 5 directed the operator to press the emergency, "1B3B-4B-MTS 1B3B-4B, 1B4A, 1B4B, 1B4C Control Power," pushbutton. The team noted that there were two pushbuttons associated with this label and that the procedure did not specify which pushbutton to press. The team determined that although these deficiencies may have delayed the performance of the steps during an actual event, the delays would not prevent the successful completion of the required actions.

EOP-07 Floating Step 8.0, "Emergency Feedwater Storage Tank Inventory," directed operators to replenish the emergency feedwater storage tank inventory when level was less than 144 inches. The indication available to the operators in the control room, however, expressed tank level in percent of full level.

Even though the team considered the labelling discrepancies identified during the inspection to be minor in importance, the licensee initiated Incident Report 940039 to resolve the differences.

### 4.5 Walkdown Observations

In addition to the observations related to the implementation of SBO procedures, the team scrutinized the physical condition of the facility during the walkdowns. The team also evaluated the impact an SBO would have on the communications and physical security arrangements of the facility.

The team found the material condition of the facility to be acceptable. The team reviewed the physical security systems and determined that the licensee would have adequate communications and security capabilities during an SBO event because the security diesel generator and batteries would be capable of providing the necessary electrical power for those functions.

### 4.6 Conclusions

The team determined that the coping procedures adequately addressed control room and local operator actions necessary to establish and maintain decay heat removal, minimize reactor coolant system inventory loss, minimize dc loads, and restore the availability of vital components. The team found the licensee's actions for severe weather to be acceptable.

The team found the physical condition of the facility to be acceptable, but noted some labeling and drawing problems. While the drawing problems were considered minor in nature, the team was concerned because of the implications for similar problems in more critical applications. An inspection followup item was initiated to evaluate the licensee's drawing control program.

The team determined that the licensee would have adequate communications and security capabilities during an SBO event.

## 5 TRAINING

The team reviewed SBO training provided to licensed and nonlicensed operators. Lesson plans for initial and requalification training for licensed and nonlicensed operators, job performance measures (JPMs) and simulator scenarios for licensed operators, and performance evaluation checklists (PECs) for nonlicensed operators were reviewed. In addition, the team conducted plant walkthroughs and interviews to determine the operators' level of knowledge related to the performance of the procedures associated with an SBO.

Licensed operators received classroom presentations, simulator instruction, and plant walkthroughs in the form of JPMs. This training was performed during both initial license training and requalification training. The SBO lesson plan addressed and provided the basis for each step in EOP-07. The EOP floating steps were also included in this lesson plan. The four simulator scenarios reviewed by the team had different initiating events and different success paths. A review of the JPMs revealed that there were only two JPMs directly related to the performance of EOP-07 and its associated attachments. The team considered this a small number of JPMs for the number of tasks to be performed in EOP-07. The licensee stated that the small number of JPMs for all EOPs had been recognized and that additional items were being evaluated.

Nonlicensed operators received classroom presentations, in-plant training, and plant walkthroughs utilizing PECs similar to JPMs used for training licensed operators. The team noted that only one PEC was approved for EOP-07 tasks. The team considered this a small number of PECs given the number of tasks that a nonlicensed operator could be called on to perform in implementing EOP-07. The licensee provided the team with three additional PECs related to EOP-07 that were in the draft stage and indicated a goal to develop more PECs related to Abnormal Operating Procedures and Emergency Operating Procedures.

The operators accompanying the team during plant walkdowns of the SBO procedures performed their tasks extremely well. They demonstrated a good knowledge of the plant and correctly described how they would perform the tasks called for in the procedures.

The team determined that the training provided to licensed and nonlicensed operators adequately prepared them to perform those procedures required to cope with an SBO.

## 6 FOLLOWUP (92701)

### 6.1 (Open) Inspection Followup Item 285/9216-01: Instrumentation to Detect an Anticipated Loss of Shutdown Cooling

The team reviewed the status of the licensee's implementation of instrumentation to anticipate the loss of shutdown cooling. The licensee had proposed instrumentation such as shutdown cooling pump cavitation monitoring but had not finalized the design. The acceptability of the proposed instrumentation was on hold pending agreement from the Office of Nuclear Reactor Regulation on the adequacy of the proposal.

This item will remain open pending the review and acceptance of the proposed instrumentation by the Office of Nuclear Reactor Regulation.

### 6.2 (Closed) Inspection Followup Item 285/9230-01: Adequacy of 161kV Offsite Power Supply

During the followup inspection for the Electrical Distribution System Functional Inspection, the inspectors questioned the capability of the 161kV transmission system to provide adequate voltage levels during heavy grid loading conditions. The inspectors noted that the voltage levels at the 4160V facility distribution system could drop below the low offsite power relay setpoint during the sequencing of accident loads.

During this inspection, the team noted that the licensee had adjusted the offsite power relay setpoints to eliminate the potential for interrupting the accident load sequencing when powered from the offsite electrical system. The team also noted that the licensee had modified the onsite 161kV switchyard (Substation 1251) to provide a connecting point for a future transmission line in a breaker-and-a-half configuration. Similar modifications were made to Substation 1297 near Omaha, Nebraska, and the licensee was in the process of contracting the construction of a new transmission line to connect the two substations. The licensee was scheduled to complete the transmission line installation in 1994. The additional transmission line will resolve the power and voltage concerns for the existing and projected 161kV transmission grid loadings.

## 7 ONSITE REVIEW OF LICENSEE EVENT REPORTS

### 7.1 (Closed) Licensee Event Report 285/92-006: Inoperable Alarm Function on Radioactive Waste Building Stack Monitors

On January 25, 1992, the licensee discovered the annunciator circuitry for the Laboratory and Radioactive Waste Processing Building Exhaust Stack particulate, iodine, and noble gas radiation monitors would not function properly. This condition was identified while installing a modification to the radiation monitor control switch. The licensee determined that the condition would not have prevented normal release path monitoring or automatic isolation functions.

The licensee determined the causes to be personnel error and inadequate post-modification test instructions. The team reviewed the report and found the proposed corrective actions to be adequate to prevent recurrence. The team verified that the corrective actions had been completed.

7.2 <u>(Closed) Licensee Event Report 285/92-013: Inadvertent Isolation of Radiation Monitors During Containment Purge</u>

On April 8, 1992, a containment purge was in progress while work was being conducted inside a control room electrical cabinet. The technicians were in the process of replacing an unrelated power supply when an electrical lead for containment sampling valves was inadvertently moved which deengerized the valves. The electrical lead was terminated by a spade wire lug that became loose when moved. The licensee's corrective actions included: 1) revising procedures to incorporate requirements to change any spade lug connectors identified during maintenance with appropriate replacements, 2) implementing a closeout inspection of the control room cabinets to ensure that the wiring conditions were acceptable, and 3) discussing the event and its root cause with maintenance personnel.

The team verified that the corrective actions had been completed.

7.3 <u>(Closed) Licensee Event Report 285/92-026: Incore Detector Alarm Limits Non-Conservative for Monitoring Peak Linear Heat Rate</u>

On July 23, 1992, the licensee determined that the incore neutron flux monitoring system alarm limits were set non-conservatively. A reactor engineer made the discovery during a review of a Combustion Engineering Core Operating Report. The licensee determined the root causes of this event were the contractor's verification of the analysis failed to detect an error and the contractor's review procedure was inadequate.

The team noted that the licensee formed a quality improvement team with the contractor to improve communications and to clearly define the interface between the organizations. The licensee also required an evaluation, by the Nuclear Engineering Department, of future analyses performed by the contractor. The team verified that the licensee had similar procedures for other contractors.

7.4 <u>(Closed) Licensee Event Report 285/92-027: Stop Valve Upstream of Relief Valve in Chemical and Volume Control System</u>

On August 17, 1992, the licensee determined that a normally open stop valve (HCV-247) in the line between the regenerative heat exchanger and a spring-loaded check valve (CH-202) did not conform to applicable code requirements because HCV-247 could not be locked open.

The licensee attributed the root cause of this event to an inadequate design review with respect to the thermal relief function of CH-202 during the modification process in 1983. The licensee made improvements to the design change process that should prevent recurrence of this type of event. The team determined that the licensee's corrective actions to place the components in an acceptable configuration were adequate.

## 8 OVERALL CONCLUSIONS

Overall, the team concluded that the licensee had implemented an excellent program for response to an SBO. The team also concluded that all necessary systems and equipment would be capable of cooling the reactor core throughout an SBO event and that adequate containment integrity would be assured. The team found the analyses and calculation documentation to be very detailed and well defined. The team considered the licensee's procedures and training program to be good.

ATTACHMENT 1

## 1 PERSONS CONTACTED

### 1.1 Licensee Personnel

* R. Andrews, Division Manager, Nuclear Services
* G. Cavanaugh, Licensing Engineer
* J. Chase, Plant Manager
* R. Conner, Assistant Plant Manager
* J. Connolley, Lead Test and Performance Engineer
* G. Cook, Supervisor, Station Licensing
* M. Core, Supervisor, Electrical and Instrumentation Systems
* M. Elzway, Nuclear Design Engineer
* J. Gasper, Manager, Training
* R. Jaworski, Manager, Station Engineering
* L. Kusek, Manager, Nuclear Safety Review
* D. Lippy, Licensing Engineer
* R. Luikens, Emergency Operating Procedures Coordinator
* W. Orr, Manager, Quality Assurance/Quality Control
* T. Patterson, Division Manager, Nuclear Operations
* R. Phelps, Acting Division Manager, Production Engineering
* R. Short, Manager, Nuclear Licensing
* J. Tills, Assistant Plant Manager
* W. Weber, Supervisor, Reactor Performance

### 1.2 NRC Personnel

* R. Azua, Resident Inspector, FCS
* R. Mullikin, Senior Resident Inspector, FCS
* L. Smith, Senior Resident Inspector, ANO
* T. Stetka, Chief, Projects Section D
* J. Tapia, Licensing Examiner

In addition to the personnel listed above, the team contacted other personnel during this inspection.

* Denotes those persons who attended the exit meeting on January 28, 1994.

## 2 EXIT MEETING

An exit meeting was conducted on January 28, 1994. During the meeting, the team leader reviewed the scope and findings of the inspection. The licensee acknowledged the inspections findings. The licensee did not identify as proprietary any of the information provided to, or reviewed by, the team during this inspection.

## ATTACHMENT 2

### LIST OF ACRONYMS

| | |
|---|---|
| ANSI | American National Standards Institute |
| CCW | Component Cooling Water |
| EDG | Emergency Diesel Generator |
| HP | Horsepower |
| JPM | Job Performance Measure |
| MOV | Motor Operated Valve |
| NUMARC | Nuclear Management and Resource Council |
| PEC | Performance Evaluation Checklist |
| RG | Regulatory Guide |
| SBO | Station Blackout |
| SWS | Service Water System |
| QA | Quality Assurance |
| WR | Work Request |

## ATTACHMENT 3

## INSPECTION FINDINGS INDEX

- Inspection Followup Item 9401-01 was opened in paragraph 4.2,

- Inspection Followup Item 9230-01 was closed in paragraph 6.2,

- The following licensee event reports were closed in paragraph 7:

  92-006
  92-013
  92-026
  92-027

- Inspection Followup Item 9216-01 was addressed in paragraph 6.1, but remains open.