September 25, 2000

Mr. Craig G. Anderson
Vice President, Operations ANO
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72801

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT NOS. 1 AND 2 - ISSUANCE OF AMENDMENTS RE: STEAM GENERATOR LOAD HANDLING (TAC NOS. MA6573 AND MA6574)

Dear Mr. Anderson:

The Commission has issued the enclosed Amendment No. 209 to Facility Operating License No. DPR-51 and Amendment No. 221 to Facility Operating License No. NPF-6 for Arkansas Nuclear One, Units 1 and 2 (ANO-1 and ANO-2), respectively. These amendments consist of changes to the licenses in response to your application dated September 17, 1999, as supplemented by letters dated June 29, August 3, and September 15, 2000.

The amendments change heavy load handling requirements and transportation provisions that would permit the movement of the original and replacement steam generators (SGs) through the ANO-2 containment construction opening during the SG replacement outage.

The amendment changes heavy load handling requirements and transportation provisions that would permit the movement of the original and replacement steam generators (SGs) through the ANO-2 containment construction opening during the SG replacement outage.

A copy of our related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

Mohan C. Thadani, Senior Project Manager, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-313 and 50-368

Enclosures:
1. Amendment No. 209 to DPR-51
2. Amendment No. 221 to NPF-6
3. Safety Evaluation

cc w/encls: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-313

ARKANSAS NUCLEAR ONE, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 209
License No. DPR-51

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Entergy Operations, Inc. (the licensee), dated September 17, 1999, as supplemented by letters dated June 29, August 3, and September 15, 2000, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, by Amendment No. 209, Facility Operating License No. DPR-51 is hereby amended to authorize the movement of the original and replacement steam generators through the ANO-2 containment construction opening during the replacement steam generator outage in the fall of 2000, as set forth in the license amendment application dated September 17, 1999 (0CAN099903), as supplemented by letters dated June 29, 2000 (2CAN060010), August 3, 2000 (0CAN080002), and September 15, 2000 (OCAN090004), and evaluated in the associated safety evaluation by the Commission's Office of Nuclear Reactor Regulation.

3. The license amendment is effective as of its date of issuance and shall be implemented within 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Will D Reckley for

Robert A. Gramm, Chief, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Date of Issuance: September 25, 2000

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-368

ARKANSAS NUCLEAR ONE, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 221
License No. NPF-6

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Entergy Operations, Inc. (the licensee), dated September 17, 1999, as supplemented by letters dated June 29, August 3, and September 15, 2000, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, by Amendment No. 221, Facility Operating License No. NPF-6 is hereby amended to authorize the movement of the original and replacement steam generators through the ANO-2 containment construction opening during the replacement steam generator outage in the fall of 2000, as set forth in the license amendment application dated September 17, 1999 (0CAN099903), as supplemented by letters dated June 29, 2000 (2CAN060010), August 3, 2000 (0CAN080002), and September 15, 2000 (OCAN090004), and evaluated in the associated safety evaluation by the Commission's Office of Nuclear Reactor Regulation.

3. The license amendment is effective as of its date of issuance and shall be implemented within 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

William D Rockley for

Robert A. Gramm, Chief, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Date of Issuance: September 25, 2000

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 209 AND 221 TO

FACILITY OPERATING LICENSE NOS. DPR-51 AND NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NOS. 1 AND 2

DOCKET NOS. 50-313 AND 50-368

1.0 INTRODUCTION

By letter dated September 17, 1999, as supplemented by letters dated June 29, August 3, and September 15, 2000, Entergy Operations, Inc. (Entergy or the licensee) submitted a License Amendment Request, pursuant to 10 CFR 50.90. The amendment request proposes to revise Arkansas Nuclear One's (ANO's) heavy load handling requirements and transportation provisions to allow movement of the steam generators (SGs) during replacement of the ANO Unit No. 2 (ANO-2) SGs in refueling outage 2R14 scheduled for September 2000.

The licensee's letter dated June 29, 2000, was submitted in response to the Nuclear Regulatory Commission (NRC) staff Request for Additional Information that was discussed with the licensee in a telephone conference on May 24, 2000. The licensee's letter dated August 3, 2000, provided additional information, in response to discussions between the NRC staff and the licensee in a telephone conference on July 20, 2000, regarding proposed compensatory measures to be implemented in the event of a seismically induced drop of an SG, and clarifying information to the original submittal. The application was renoticed to include the June 29 and August 3, 2000, supplements as indicated in Section 5.0 of this safety evalution. The September 15, 2000, supplement provided clarifying information that did not change the scope of the application or its associated no significant hazards consideration determination.

2.0 BACKGROUND

ANO-2 is a pressurized water reactor (a Combustion Engineering design) which commenced commercial operation in 1974; its current operating license will expire in May 2014. The licensee determined that, based on analyses of the potential drop of an SG during replacement of the SGs, various ANO Unit No. 1 (ANO-1) and ANO-2 safety-related structures, systems, and components (SSCs) could be damaged. These postulated SG load drop accidents have not been previously evaluated in the Safety Analysis Report (SAR). Therefore, in accordance with 10 CFR 50.59, the proposed replacement of the ANO-2 SGs involves an unreviewed safety question (USQ). Accordingly, the licensee proposed to revise its licensing basis to (1) reflect the analysis of an SG load drop accident, (2) implement measures to preclude a drop of the

SG, and (3) provide compensatory measures to mitigate the potential hazards that could result from the drop of an SG.

NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," dated July 1980, provides regulatory guidelines for licensees to assure safe handling of heavy loads in areas where the drop of a load could impact stored spent fuel, fuel in the reactor core, or equipment that may be required to achieve safe shutdown or permit continued decay heat removal. The objectives of the guidelines are to assure that either (1) the potential for a load drop is extremely small, or (2) the potential hazards of load drops do not exceed acceptable limits. NUREG-0612 provides guidelines that are implemented in two phases.

Phase I guidelines address measures for reducing the likelihood of dropping heavy loads by providing criteria for establishing safe load paths, procedures for load handling operations, and training of crane operators; design, testing, inspection, and maintenance of cranes and lifting devices; and analyses of the impact of heavy load drops.

Phase II guidelines address alternatives for mitigating the consequences of heavy load drops, including using either (1) a single-failure-proof crane for increased handling system reliability, (2) electrical interlocks and mechanical stops for restricting crane travel, or (3) load drops and consequence analyses for assessing the impact of dropped loads on plant safety and operations. In Generic Letter (GL) 85-11, "Completion of Phase II of "Control of Heavy Loads at Nuclear Power Plants," NUREG-0612," dated June 28, 1985, the NRC concluded that satisfying the NUREG-0612, Phase I guidelines assures that the potential for a load drop is extremely small and dismissed the need for licensees to implement the requirements of NUREG-0612, Phase II. However, GL 85-11 encouraged licensees to implement actions they perceive to be appropriate to provide adequate safety.

In a letter dated October 11, 1984, we forwarded an NRC Safety Evaluation (SE) to the licensee approving the program for the handling and control of heavy loads at ANO-1 and ANO-2 under NUREG-0612, Phase I. In addition, based on specific heavy load handling concerns, the NRC requested licensees, in NRC Bulletin 96-02, "Movement of Heavy Loads over Spent Fuel, over Fuel in the Reactor Core, or over Safety-Related Equipment," dated April 11, 1996, to provide information detailing their extent of compliance with these guidelines. The licensee, in a response dated May 17, 1996, reaffirmed ANO's full compliance with the regulatory guidelines in NUREG-0612.

The proposed amendment revises ANO-2 heavy load handling requirements and transportation provisions to support removal and installation of the ANO-2 SGs. In the staff review, considerations are given to the design, installation, inspection, testing, maintenance, and operation of the SG lifting/transfer systems, safe load paths, procedures, operator training, and potential load drop accidents and consequences. Also considered are compensatory measures to be taken for mitigating the consequences of an SG drop on the safety-related SSCs.

3.0 EVALUATION

3.1 USQ

Degrading conditions in the ANO-2 original SG tubes necessitate the replacement of the original SGs. Each SG, weighing approximately 600 tons, will be moved as a whole unit through a temporary construction opening (approximately 21 feet-6 inches wide by 27 feet-9 inches high) in the containment building wall and transported to the SG storage facility. The temporary construction opening is located at approximately 50 feet directly above the existing equipment hatch. The replacement SGs will be moved from the storage facility along the same load path and into the containment building. The licensee determined that the potential drop of an SG along the removal and installation load path could damage various safety-related SSCs that support continued operations of ANO-1 and cooling functions at ANO-2 (defueled). These SSCs include: (1) diesel fuel oil supply to the ANO-1 and ANO-2 EDG day tanks, (2) power to the ANO-1 and ANO-2 fuel oil transfer pumps, (3) ANO-1 service water system (SWS) return line to the emergency cooling pond (ECP), and (4) the firewater system piping main.

Evaluation of the potential drop of the SG was not previously addressed in the SAR. The proposed SG replacement could result in the following: (1) an increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety over that previously evaluated in the SAR, (2) the creation of the possibility of an accident or malfunction of a different type than previously evaluated in the SAR, and (3) a reduction in the margin of safety as defined in the basis for any technical specification (TS). As a result, the SG replacement is a USQ in accordance with 10 CFR 50.59. The licensee plans to implement compensatory measures as discussed and evaluated in this SE to resolve the USQ.

3.2 Handling of Heavy Loads Consistent with NUREG-0612

The licensee evaluated the proposed handling of the ANO-2 SGs with respect to the applicable guidelines in NUREG-0612 as follows.

3.2.1 Safe Load Path

Primary reliance for safe load handling during the proposed replacement of the ANO-2 SGs is placed on the rigging/transfer/lifting system and the transporter used to handle and control the SGs to and from the containment building. However, the licensee performed a review of the load path from the containment building and along the haul route to identify potential interactions with equipment important to safety.

The SGs are considered as critical loads in accordance with NUREG-0612 and NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants," because they are brought through the containment building over underground safety-related SSCs that support both ANO-1 (operating at full power) and ANO-2 (defueled). According to the licensee, movement of the old SGs (OSGs) along the load path (from the containment opening to the transporter) where potential interaction with the safety-related SSCs could occur would take approximately 12-24 hours per OSG. Movement of the replacement SGs (RSGs) from the transporter onto the runway beams, and into containment would take approximately 12 hours per RSG. The resulting total time to move the OSGs and RSGs between the transporter and inside

containment is approximately 48-72 hours. While in the transporter, the SGs could be in a position to drop and cause damage to the SSCs for an additional 24 hours. Therefore, the total time when the SGs will be in a position to drop and cause damage to the safety-related SSCs is 72-96 hours.

Based on its evaluation, the licensee indicated that the safe load path is the most efficient method of moving the SGs and has the least potential for interaction between the SGs and safety-related SSCs. Based on our review, we conclude that the safe load path has been implemented in a manner consistent with guidelines in NUREG-0612.

3.2.2 Transfer/Hoisting Systems

Rigging and lifting the OSGs and RSGs inside the containment building will be performed as a planned, engineered lift in accordance with American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)." The rigging will be accomplished using the polar crane, a Temporary Lifting Device, runway beams, transfer and down/up-ending carts, and lifting trunions. The method of rigging and moving the SGs inside the containment building was evaluated under 10 CFR 50.59 and is not within the scope of the USQ. Therefore, the SG replacement activities inside the containment building are not addressed further in this SE.

Rigging the SGs outside the containment building is done using the Runway Beam Support System (RBSS) and an Outside Lifting System (OLS). The RBSS/OLS are non-safety related structures that are used to (1) assist with the SG transfer, (2) support containment opening concrete removal and replacement, and (3) provide access for personnel and materials into containment. They are designed to support the dead and operating loads of the SGs, preclude a drop of the load, and withstand the effects of external events (i.e., storm winds) that might cause the system to collapse. The RBSS/OLS are robust in design, and were previously successfully utilized for SG replacements at the South Texas Project, Unit No. 1; Braidwood Station, Unit No. 1; and Byron Station, Unit No. 1. The RBSS/OLS consist of a runway system from inside to outside containment, carts with guided rollers for transport of the heavy loads, and a concrete removal platform for removing material from the opening in the containment building wall. The runway beams are supported at the containment building wall, the fuel transfer canal wall, and on a support spanning the transfer canal. They are also supported by a 55-foot rectangular tower and two tri-pole support towers.

The OLS is a non-safety related structure that is erected over the RBSS, and used to lift the SGs and other loads from the RBSS and lower them to the transporter for transfer to the storage facility. The OLS consists of two 108-foot high support towers and an 80-foot long bridge composed of two gantry header beams equipped with a trolley and hoist. The licensee stated that they plan to install the OLS while ANO-1 or ANO-2 is in any mode or defueled condition. The licensee plans to inspect the OLS and test its reliability for handling the SG loads in accordance with ANSI/ASME B30.2 as is recommended in NUREG-0612. Therefore, prior to use, the OLS will be load-tested to 125 percent of the maximum critical load. It also will be inspected prior to and during the SG replacement.

The staff finds that the design, testing, inspection, and maintenance of the RBSS/OLS is consistent with the guidelines in NUREG-0612, Section 5.1.1(6) and Chapter 2-2 of

ANSI Standard B30.2 for cranes and lifting devices. Accordingly, we conclude that inspecting and testing the RBSS/OLS, as proposed, will help to assure the licensee of its reliability for lifting/transferring the SGs and, therefore, help to minimize the risk of dropping the SGs onto the SSCs.

3.2.2.1 RBSS/OLS Seismic Considerations

The licensee stated that both the RBSS and OLS will meet the ANO-2 requirements for wind/tornado loadings and Seismic II/I installation/construction considerations, respectively. The RBSS and the OLS are designed to withstand up to 290 mph tornado winds when unloaded without collapsing. Therefore, the RBSS/OLS are designed not to collapse under loads similar to that of tornado winds, which the licensee states, based on analysis, imposes more severe loadings than a safe-shutdown earthquake (SSE). The components of the RBSS/OLS are designed for 50 mph wind pressures plus the SG operating loads (dead load plus impact loads) per the American Institute of Steel Construction (AISC) Allowable Stress Design (ASD) method. Also, the licensee stated both the RBSS and OLS, unloaded, are designed not to exceed normal working allowable stresses under 90 mph storm winds per American Society of Civil Engineers (ASCE) Standard 7-95. The static load of the SG plus operational and seismically induced loads were considered in the design of the RBSS/OLS.

The licensee's considerations for the seismic design of the RBSS/OLS are consistent with the guidance of NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants." In addition, inspection, testing, and maintenance of the RBSS/OLS are consistent with NUREG-0612 and are acceptable.

The licensee substantiated its statement claiming that the seismic loads determined in the evaluations of RBSS/OLS are bounded by the tornado loads by providing the following information:

1. Employing a simplified model of the OLS towers and using Rayleigh's Equation, Entergy determined the fundamental frequency of the towers to be 0.77 Hz. At this frequency, Entergy estimated the seismic acceleration of the OLS towers to be 0.3g using the ANO-2 design basis response spectrum for the SSE of 0.2g at 0.5 percent damping given in Fig. 3.7.1 of the plant FSAR.

2. Entergy calculated the tornado wind forces on the OLS towers using the ASCE Standard 7-95, and found that the seismic acceleration required to generate an equivalent tornado wind force and base moment was 0.4g, which is more than the seismic acceleration of 0.3g due to a seismic event mentioned above.

The staff concurs with the licensee's conclusion that the tornado loads bound the effects of the seismic loads on the RBSS/OLS structures, and that the RBSS/OLS structures are capable of withstanding the effects of the tornado winds without collapsing, as stated above. Therefore, we have determined that these structures will be stable during the movement of the SGs from and into the ANO-2 containment.

The licensee plans to continuously monitor weather conditions before and during SG replacement activities. This will enable the licensee to, in the event of severe weather

conditions, suspend SG replacement operations and avoid exposure to conditions that could help to initiate a drop of the SG.

3.2.3 Analysis/Consequences of an SG Drop Accident

ANO-1 will be at full power and ANO-2 defueled during replacement of the SGs. The licensee evaluated the impact on plant safety due to the potential drop of an SG in the vicinity of the safety-related SSCs. Two scenarios involving a dropped SG were postulated: (1) a non-seismic SG drop, and (2) a seismically induced SG drop. Both cases of a dropped SG could result in a loss of one or more of the following safety-related systems:

- Both trains of underground diesel fuel oil supply piping to the ANO-1 Emergency Diesel Generator (EDG) day tanks;
- Both trains of underground diesel fuel oil supply piping to the ANO-2 EDG day tanks;
- Underground power to both trains of the ANO-1 fuel oil transfer pumps;
- Underground power to both trains of the ANO-2 fuel oil transfer pumps;
- Underground ANO-1 SWS return line to the ECP; and
- The underground firewater system piping main.

Absent a seismic event, only these SSCs would be damaged. The loss of the ANO-1 and ANO-2 diesel fuel oil storage and transfer system would render the associated EDGs inoperable. The loss of the ANO-1 SWS return line to the ECP would render the ECP inoperable for ANO-1. Although the firewater system is not a safety-related system, the loss of the underground firewater system piping main would render the fire suppression system throughout the plant inoperable.

Recognizing that the potential for a seismic event during the brief duration of handling the SGs is very small, the licensee postulated a seismically induced drop of an SG and found that it also could result in a loss of all normal offsite power simultaneous with damage to the safety-related SSCs. The postulated loss of all offsite power (all AC power) simultaneous with inoperable EDGs would eliminate the source of power for (1) plant shutdown and decay heat removal capability for ANO-1, and (2) Spent Fuel Pool (SFP) cooling for ANO-2.

The licensee also analyzed the consequences of a postulated drop of an SG inside containment, although it is not within the scope of the USQ. The results indicated that some SSCs would be damaged. However, damage to these SSCs would not impact ANO-2 because the unit would be defueled. The SG drop inside containment could damage electrical and control circuitry; however, it would not present any potential impact on SSCs outside containment.

3.2.3.1 Impact of SG Drop on ANO-1 and ANO-2 Fuel Oil Storage and Transfer System

Diesel fuel in the emergency fuel oil storage tanks is transferred via the fuel oil transfer pumps to the fuel oil day tanks. The diesel fuel oil is gravity fed from the day tanks to the EDGs. ANO-1 and ANO-2 each have two trains of the diesel fuel oil storage and transfer system that support two EDGs. Each train is designed to provide independent sources of fuel oil to the two associated EDGs. FSAR Sections 8.3.1.1.7.2 (ANO-1) and 9.5.4.1 (ANO-2) state that the safety related portion (Seismic Class I components) of the fuel oil storage and transfer system

for both ANO-1 and ANO-2 consists of: (1) the two emergency fuel oil storage tanks; (2) the two fuel oil day tanks; (3) the two fuel oil transfer pumps; and (4) associated piping, valves, and electrical power.

An SG drop would breach (1) underground fuel oil piping lines between the emergency fuel oil storage tanks and the day tanks, and (2) underground power cables to both fuel oil transfer pumps. A loss of (1) both trains of the ANO-1 and ANO-2 fuel oil transfer lines between the storage tanks and the day tanks, and (2) the power cables to both transfer pumps would render both the ANO-1 and ANO-2 EDGs inoperable. Consequently, during emergency conditions, the use of the EDGs as a source of electrical power would be unavailable beyond the quantity of the fuel oil maintained in the day tanks.

Following a loss of both trains of the ANO-1 fuel oil storage and transfer system, ANO-1 would enter Limiting Condition for Operation (LCO) 3.0.3, and TS 3.11.2, and begin hot shutdown and cooldown to cold shutdown conditions, respectively. Plant shutdown also will commence if a seismically induced SG drop occurs concurrent with a loss-of-offsite power. During such conditions, the EDGs will automatically start to support plant cooldown functions.

The loss of both trains of the ANO-2 fuel oil storage and transfer system would have minimal impact on ANO-2 because the reactor would be defueled. Since the EDGs support the ANO-2 SFP, a loss of the EDGs would affect the ability to keep the SFP cool. Consequently, makeup water would have to be provided to the ANO-2 SFP. In a telephone conference held with the licensee on September 6, 2000, the licensee stated that, without cooling, the ANO-2 SFP estimated time-to-boil is eight hours; however, makeup water could be transferred from the ANO-1 SWS to the ANO-2 SFP within approximately two hours (the staff did not request the licensee to document the information provided during the September 6, 2000, telephone conference because the ability to transfer makeup water from ANO-1 SWS to the ANO-2 SFP in a timely manner was consistent with the staff's experience with similar situations in other plants). Therefore, although no immediate action would be needed to restore ANO-2 SFP cooling following an SG drop, the licensee would be able to restore cooling to the ANO-2 SFP within two hours, which is well before the SFP would start to boil.

Following an SG drop, the licensee would implement compensatory measures as described below to minimize the impact on plant safety and restore the design functions of the safety related SSCs.

3.2.3.1.1 <u>Compensatory Measures to Support/Restore ANO-1 EDGs</u>

ANO-1 TS 3.7.1.C requires that both EDGs are operable when the reactor temperature is $\geq$ 200 °F. An operable EDG includes: (1) one separate emergency fuel oil storage tank with a minimum of 20,500 gallons of fuel, (2) one separate day tank containing a minimum of 160 gallons of fuel oil, (3) a separate fuel oil transfer pump, and (4) a separate starting air compressor. The emergency fuel oil storage tanks store the minimum quantity of fuel oil required to operate the EDGs for seven days. The bases for the TS is to ensure that an adequate reliable source of power is available for all electrical equipment during startup, normal operation, safe shutdown, and emergency conditions. ANO-1 FSAR, Section 8.3.1.1.7.2 states that 275 gallons of fuel oil in the day tank can run the associated EDG for approximately one hour until the contents of the day tank are exhausted.

To mitigate the potential interruption of diesel fuel oil supply to the ANO-1 EDGs and maintain the EDGs in a functional status, the licensee plans to implement temporary compensatory measures to (1) restore the fuel oil storage and transfer system and the EDGs to functional status, and (2) ensure that shutdown and decay heat removal capability is maintained. Permanent restoration of the impacted systems and the EDGs would follow.

Prior to moving the SGs, administrative controls will be used to do the following: (1) stage materials needed to implement temporary measures to restore the EDGs in appropriate locations to assure their availability following an SG drop, (2) train personnel to respond to and implement the requisite temporary measures (personnel will not be pre-staged), (3) ensure that the day tanks are completely filled to their 275 gallon capacity (beyond the quantity of 160 gallons as required by TS 3.7.1.C.1), and (4) as stated in licensee submittals dated June 29 and August 3, 2000, confirm that the alternate AC (AAC) diesel generator is available to support plant operations during a non-seismically induced drop of the SG.

Following a non-seismic SG drop, while ANO-1 is at full power, the licensee plans to implement immediately, the following: (1) notify the ANO control room; (2) prior to an assessment of the damage, enter LCO 3.0.3, and TS 3.11.2, which requires that ANO-1 commence an orderly and controlled shutdown and cool down to cold shutdown conditions, respectively; (3) install a temporary hose assembly that bypasses the damaged portion of the system to supply fuel oil from either the ANO-1 or ANO-2 emergency diesel fuel oil storage tanks to the ANO-1 fuel oil day tanks; and (4) restore temporary AC power to the ANO-1 fuel transfer pumps via the AAC diesel generator.

To compensate for the potential loss of diesel fuel oil supply to the ANO-1 EDGs concurrent with a loss-of-offsite power, following a seismically induced drop of an SG, the licensee will, as stated in the August 3, 2000, submittal, pre-stage at least two mobile fuel oil tankers (7,000 gallons each) in an appropriate location south of the ANO-1 reactor building. The tankers will be used to provide an alternate source of fuel oil for the EDGs rather than provide temporary fuel oil connections as described above. As stated by the licensee, the tankers are sufficiently robust to withstand the impact of an earthquake. During the discussions with the licensee on September 6, 2000, the licensee stated that they evaluated the impact of the Design Basis Earthquake (DBE) on the fuel oil tankers and determined that the tankers would not move or slide during the event. The licensee indicated that the tankers would be staged outside the zone of influence of any non-seismic structures, and that no cranes or other equipment that might damage the tankers during a seismic event would be permitted within striking distance of the tankers. Also, even though the tankers are not expected to move during a seismic event, the licensee plans to maintain at least three feet separation between the tankers.

Fuel oil supply from the tankers can be established within the one hour of EDG operation provided via the day tanks. Diesel fuel oil will be provided from the tankers directly to the day tanks. A major portion of the hoses between the tankers and the day tanks will be pre-routed, and temporary fittings for connecting the hoses to the day tanks will be pre-attached to minimize the connection time. The licensee stated that at a fuel oil consumption rate of 3.0 gpm, fuel oil in the tankers could run the EDGs for about 76 hours (38 hours each).

3.2.3.1.2 Compensatory Measures to Support/Restore ANO-2 EDGs

ANO-2 TS 3.8.1.2 requires that at least one train of fuel oil storage and transfer system be operable in Modes 5 (cold shutdown) and 6 (refueling); however, there are no TS requirements for the fuel oil storage and transfer system when ANO-2 is defueled. Furthermore, the EDGs are not required when ANO-2 is in the defueled condition. The emergency fuel oil storage tanks store the minimum quantity of fuel oil required to operate the EDGs for seven days. ANO-2 SAR, Section 9.5.4.1 states that based on the capacity of the emergency storage tank (22,500 gallons) plus the day tanks (520 gallons), at least a seven day total diesel fuel inventory will be available onsite in the emergency storage tanks for operation of one EDG during a loss of electric power condition. In addition, each day tank has sufficient capacity to run the EDGs for one hour.

The EDGs are not required when ANO-2 is defueled. Therefore, a loss of the diesel fuel oil storage and transfer system would have no impact on the ANO-2 EDGs while the plant is defueled. However, absent the EDGs, the licensee plans to utilize the AAC power to assure that the cooling functions of the plant are maintained. Similarly, the licensee recognized that in the event of a seismically induced SG drop and a simultaneous loss of normal offsite power, the SWS may be unavailable to provide makeup to the ANO-2 SFP. In response, the licensee plans to use the ANO-1 SWS to provide makeup to the ANO-2 SFP, as is permitted by the licensing basis under emergency conditions. Therefore, during replacement of the SGs, an accidental drop of the SG will result in little to no impact on the safety of ANO-2.

3.2.3.1.3 Adequacy of AAC to Support ANO-1 and ANO-2 Shutdown and Cooling

The AAC diesel generator was designed and installed in accordance with 10 CFR 50.63, "Loss of all alternating current power," to function during a station blackout event. Accordingly, the licensee proposes that, in the event of a non-seismic failure of the SG resulting in a loss of power to the fuel transfer pumps and a loss of the diesel fuel oil supply to the EDGs, the AAC diesel generator will be used to support shutdown and decay heat removal and to provide power to the fuel transfer pumps. As stated in ANO-2 FSAR, Section 8.3.3.2.3.3, the minimum level of fuel oil in the bulk fuel oil storage tank is sufficient to run the AAC diesel generator for a minimum of four and one half days.

The AAC generator is a reliable source of electrical power that may be aligned to supply either unit's engineered safety features or non-engineered safety features 4160-Vac switchgear (A1, A3, A4, 2A1, 2A3, and/or 2A4). Although not a Seismic Category I installation, the station blackout regulatory requirements imposed specific reliability and quality requirements for the AAC power source.

The AAC generator is rated for continuous operation at 4400 kW. The ANO-2 EDGs have a continuous rating of 2850 kW. The ANO-1 EDGs have a continuous rating of 2750 kW. ANO-1 auto-sequenced accident loads will be less than 2860 kW (2 hours out of 24-hour testing kW). With an assumed full load of one ANO-1 engineered safety features bus loaded onto the AAC generator at 2860 kW, there still exists a 1540-kW margin to the AAC generator's rated load. This margin would allow additional loading on the AAC generator from the required pumps to allow resumption of forced flow SFP cooling, if necessary. The required additional pump on ANO-1 would require 34 kW. The required pumps on ANO-2 for SFP cooling would include a

service water pump rated at 600 kW and a SFP cooling pump rated at 50 kW. With all possible loading described above, the proposed loading on the AAC generator would be 3544 kW, allowing an 856-kW margin to the rated capacity.

The AAC generator has a fuel oil day tank with automatic makeup from an external bulk storage tank, the level of which is administratively controlled to ensure a four and one half-day fuel oil supply at a rated load of 4400 kW. Considering the 3544-kW loading described above, the same required minimum level would supply a five and one half-day fuel oil supply.

Furthermore, administrative controls will be utilized to confirm the availability of the AAC generator before movement of the SGs in the vicinity of the outside lift system.

On the basis of its review, the staff finds that the AAC generator has adequate capacity to support the station blackout loads for ANO-1 and the required pumps on ANO-2 for SFP cooling, including a service water pump (600 kW) and a SFP cooling pump (50 kW). The licensee will confirm the availability of the AAC generator before movement of the SG. The staff agrees that the licensee may credit the AAC power source to provide makeup to the ANO-2 SFP for non-seismic-induced failure.

In addition, because there is control room ventilation and cooling equipment that is normally powered from ANO-2 and required for continued operation of ANO-1, the licensee will assure, via administrative controls that, prior to SG movement, one train of control room emergency air conditioning system is supplied to ANO-1.

The staff concludes that in the event of an SG drop, the proposed compensatory measures are adequate to assure that: (1) shutdown and decay heat removal capability for ANO-1 will be maintained, and (2) the ANO-1 EDGs will be promptly restored to functional status.

3.2.3.2 Additional Compensatory Measure If EDGs are not Restored

As stated in the August 3, 2000, submittal, the licensee will rely on the steam driven emergency feedwater pump, P7A, for decay heat removal should the EDGs cease functioning due to a loss of diesel fuel oil. The steam driven emergency feedwater pump would be used to provide feedwater to the ANO-1 SGs for at least five hours after the EDGs cease functioning. The batteries for P7A would be relied upon to support instrumentation enabling the licensee to monitor the reactor for the five hour period. Therefore, if needed, the licensee could use emergency feedwater pump P7A to allow an additional five hours beyond the one hour run time allowed by the capacity of the day tanks to restore the EDGs to functional status.

3.2.3.3 Impact of/Compensatory Measures for an SG Drop on SWS and Ultimate Heat Sink (UHS)

The SWS provides cooling water from the Dardanelle Reservoir or the ECP to cool safety-related equipment. It also provides safety-grade water to the emergency feedwater system and is available as a backup source of makeup water to the SFP. While normal plant operations require that the SWS supply and discharge be aligned to the Dardanelle Reservoir, the ECP is the Seismic Category I source of cooling water for safety-related equipment. Neither the

Dardanelle Reservoir and Dam nor the intake and discharge canals are classified as seismic Category I structures.

As specified in the ANO-1 SWS TS 3.11.1, the ECP is required to be operable whenever containment integrity is established with a minimum contained water volume of 70 acre-feet (equivalent to a water level of five feet) and an average water temperature of 100 °F or less. If these conditions are not satisfied, TS 3.11.2 requires that the unit is placed in "hot shutdown" within six hours and in "cold shutdown" within 30 hours. The basis for the TS is to assure that sufficient water is available in the ECP to mitigate the effects of a design-basis accident (DBA) on one unit concurrent with a failure of the Dardanelle Reservoir, while at the same time bringing the other unit to cold shutdown conditions. Therefore, if the Dardanelle Reservoir is failed or unavailable, cooling water for the safety-related equipment is taken from and discharged to the ECP. A drop of an SG onto the ANO-1 SWS return line to the ECP would render the ECP inoperable for ANO-1 because the ANO-1 SWS would not be able to discharge into the ECP. However, the Dardanelle Reservoir would continue to be available.

The impact of a seismic event on the UHS function during the ANO-1 SG replacement evolution was evaluated by the licensee. The licensee presented an analysis that was performed during the initial licensing of ANO-1 regarding the capability of the Reservoir to withstand the effects of an SSE. Although the Dardanelle Reservoir and Dam are not classified as seismic Category I, the analysis concluded that the Reservoir would not lose its water retention capability under a 0.2g seismic event, which is consistent with the DBE of 0.2g for ANO-1 and the anticipated "maximum earthquake" for the area. Likewise, as discussed in SAR Section 2.6.7.1, a similar evaluation and conclusion is presented with regard to the intake and discharge canals. The staff discussed these evaluations along with the UHS design basis with the licensee during a telephone conference on September 6, 2000.

Based on these analyses, and given the low expectation that a seismic event would occur during the ANO-2 SG replacement evolution, the licensee believes that Dardanelle Reservoir and the intake and discharge canals to the SWS intake structure can be relied upon to perform the UHS function during a seismic event. In order to compensate for the potential unavailability of the ECP following an SG drop that damages the SWS return line to the ECP, the licensee will administratively align the SWS supply and discharge to the Dardanelle Reservoir prior to and during the SG replacement activity.

The ECP is relied upon for performing the UHS function following a DBE, and the licensee's proposal to rely solely on the Dardanelle Reservoir for this purpose during the ANO-2 SG replacement activity is a deviation from the plant design basis. However, the licensee has evaluated the structural design capability of the Dardanelle Dam, along with the intake and discharge canals, and has concluded that the water supply from the Dardanelle Reservoir will remain available following a seismic event. Recognizing that this short-term departure from the plant design basis will be limited to 96 hours (the critical period during the SG replacement activity), coupled with the extremely low likelihood that a DBE will occur during this time period, and accepting the robust structural capability of the Dardanelle Dam and intake and discharge canals, the staff considers the licensee's proposal to rely on the Dardanelle Reservoir in the manner described for this one-time application to be acceptable.

3.2.3.4 Impact of/Compensatory Measures for SG Drop on the Fire Water System

The firewater system is a non-safety related system, designed to minimize the effects of fires on SSCs important to safety. A drop of an SG from the RBSS/OLS would damage the common underground fire water header that supplies water to the fire water suppression system throughout the plant and render it inoperable. Because the fire water suppression system is relied upon to remain functional during a beyond DBA, the licensee plans to analyze and procedurally control isolation of a pipe break in the firewater suppression system. Subsequent to isolating any pipe breaks that may occur in the firewater suppression system, the licensee will implement the necessary compensatory measures to suppress any fires that may occur during replacement of the SGs.

3.2.3.5 Impact of/Compensatory Measures for SG Drop from the Transporter

The licensee recognizes that an SG drop could occur anywhere along the haul route due to a failure of the transporter or a seismic event. The licensee determined that there are safety-related or safety-significant SSCs along the haul route that could either withstand an SG drop from the transporter or could be protected to preclude them from being damaged by an SG drop. As identified in the submittal dated June 29, 2000, the safety-related or safety-significant SSCs along the haul route that could withstand an SG drop include: ANO-1 and ANO-2 SWS lines, ANO-2 Circulating Water System lines, and a natural gas pipeline. Other systems, including the diesel fuel storage vault, which the licensee has determined could not withstand the impact of an SG drop, would be protected by the licensee using sandbags and other impact absorbing materials. The licensee states that the transporter is designed with sufficient capacity to support the SG plus any residual water and sludge loads that they may contain. Additional safeguards against any potential adverse impacts on safety include setting the transporter at its minimum working height to lower the center of gravity and improve retention of the SG on the transporter, and preparation and load testing of the haul route.

3.2.4 Load Handling Procedures

NUREG-0612 recommends that licensees provide an adequate defense-in-depth approach to maintaining safety during the handling of heavy loads near spent fuel and over safety-related equipment, and cited four major causes of accidents: operator errors, rigging failures, lack of adequate inspection, and inadequate procedures. The licensee stated that they will implement measures using administrative controls and procedures to preclude and prepare for these causes of load drop accidents. Accordingly, as discussed previously in this SE, the licensee plans to provide (1) comprehensive training to the SG replacement personnel in accordance with ANSI B30.2; (2) use redundantly designed and adequately tested lifting devices and lifting rigs and transportation route in accordance with ANSI B30.2; (3) perform inspection and maintenance checks on the lifting systems prior to and during movement of the SGs; and (4) use specific procedures that cover the entire SG replacement effort including the identification of required equipment, inspection, acceptance criteria prior to load movement, defining safe load paths, and steps and precautions for proper handling and movement of the SGs.

3.2.5 Consideration of Risk from SG Drop Events

The staff has considered the probabilistic risk from non-seismic SG drop accidents. The risk of such accidents is very low because of the many SSCs available to shut down and cool the reactor and the compensatory measures available to restore fuel oil to the diesels. The probabilistic risk from the seismic events is very low also because of the low initiating event probability and because the SSCs surviving a DBE can be effectively used to shut down and cool the reactor. Long term actions to restore cooling to the fuel storage pools will be necessary. As stated previously, the licensee will be able to establish fuel pool cooling following accidents in a timely manner.

The staff has also evaluated this USQ from a risk perspective and has not identified any unaddressed, potentially significant risks of postulated accidents. We further recognize that this is a one time manipulation of limited duration, that the licensee is very aware of the time of exposure and the extent of the potential hazards, and compensatory measures and equipment will be in place that can be used to mitigate the potential accidents.

3.2.6 Conclusions of SG Drop Accidents Analysis

Based on the preceding discussions, we find that the above stated considerations for movement of the SGs in the vicinity of safety-related SSCs during replacement of the ANO-2 SGs are acceptable. The movement of the SGs over safety-related SSCs presents a USQ for which the licensee has adequately analyzed and implemented compensatory measures to preclude and mitigate the potential hazards of SG drop accidents.

The design of the SG RBSS/OLS for loads that bound the seismic loads is consistent with guidance concerning seismic design in NUREG-0554. The licensee's use of the highly reliable lifting/transfer system and the RBSS/OLS, coupled with the proposed inspection, testing, and maintenance of the system, provides assurance of the systems reliability to safely handle the SGs and, therefore, presents little to no risk of an accidental drop of the SGs. In addition, the licensee's commitment to continuously monitor inclement weather conditions will enable the licensee to ensure that operations are suspended in a timely manner to avoid subjecting the RBSS/OLS to severe conditions that could help to initiate an SG drop accident.

The proposed compensatory measures to mitigate the effects of an SG drop onto the safety-related SSCs and to provide support for continued operation of ANO-1 and maintenance of needed ANO-2 systems are adequate to maintain operational safety at both plants, and to restore the functions of any safety-related systems that may be impacted. The proposed compensatory measures are suitable for handling both non-seismic and seismic initiated SG drop accidents. The proposed compensatory measures should enable the licensee to temporarily restore the diesel fuel oil storage and transfer system and the EDGs within the time allowed by the TS, and restore any safety-related support systems that may be impacted with minimal risk to safety of the plant.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued proposed findings that the amendment involves no significant hazards consideration, and there has been no public comment on such findings (65 FR 9004, February 23, 2000, and 65 FR 51352, August 23, 2000). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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