Mr. C. Randy Hutchinson
Vice President, Operations ANO
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72801

June 13, 1997

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 (ANO-1) ULTIMATE HEAT SINK FOR SAFE SHUTDOWN AND ACCIDENT MITIGATION (TAC NO. M94948)

Dear Mr. Hutchinson:

As discussed in our letter to you dated October 25, 1995, the Nuclear Regulatory Commission (NRC) staff has questioned the accuracy of information that has been submitted concerning the ultimate heat sink (UHS) for ANO-1. We have completed our review of your response to our request for additional information dated February 23, 1996, as well as a review of various supplements and amendments to the license application for ANO-1, our Safety Evaluation Report (SER) dated June 6, 1973, ANO-1 Technical Specification requirements for the UHS, and your initial submittal of the Updated Final Safety Analysis Report dated July 15, 1982. The results of our review are included as an enclosure to this letter.

You stated that the Dardanelle Reservoir is the UHS for ANO-1 for mitigation of the design-basis loss of coolant accident. This assertion seems to be predicated on information that was provided in Table 9-9.2.3 submitted with Amendment No. 22 to the license application for ANO-1 dated December 14, 1971, and does not take into consideration the preponderance of information that exists on this issue. We have found that the information in Table 9-9.2.3 is inconsistent with the information that was submitted relative to the UHS and service water system during the licensing of ANO-1.

The NRC staff would like to meet with you to discuss our concerns and to understand why you consider that UHS operability and EQ requirements are satisfied and information submitted to the NRC is complete and accurate. Please coordinate a suitable, near term, date to meet with the staff to discuss this matter.

Sincerely,
ORIGINAL SIGNED BY:
George Kalman, Senior Project Manager
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-313

DF01

Enclosure: NRC Review
cc w/encl: See next page
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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 13, 1997

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George Kalman

George Kalman, Senior Project Manager
Division of Reactor Projects III & IV
Office of Nuclear Reactor Regulation

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NRC REVIEW OF THE ANO-1 ULTIMATE HEAT SINK

INTRODUCTION

The licensee for Arkansas Nuclear One, Unit 1 (ANO-1), has asserted that the Dardanelle Reservoir is the ultimate heat sink (UHS) for mitigating the design basis loss-of-coolant accident. As described in a letter to the Nuclear Regulatory Commission (NRC) dated April 14, 1989, the licensee stated:

> "The design basis for ANO-1 was established with the Dardanelle Reservoir providing the ultimate heat sink (UHS) for normal shutdown and emergency recovery following a design basis LOCA. Consistent with this design basis, the original DBA LOCA containment pressure/temperature analysis - and all subsequent reanalyses submitted to the NRC - have been performed with a constant SW temperature associated with use of the Dardanelle Reservoir as the UHS. Subsequent to the original design, an emergency cooling pond (ECP) was added to the site. However, from a DBA LOCA containment pressure/temperature analysis perspective, the basis remains for the utilization of the Dardanelle Reservoir for LOCA recovery."

ASSESSMENT

While the NRC staff agrees that the Dardanelle Reservoir is the UHS for normal power operation, the licensing basis for ANO-1 specifically credits use of the ECP as the UHS for mitigation of design-basis accident conditions. The staff's view is supported by the licensee's Application for License for ANO-1, including Supplements and Amendment to the Application, the staff's licensing safety evaluation report (SER), the ANO-1 Technical Specifications, and the original ANO-1 updated final safety analysis report (UFSAR) submittal, as discussed below.

Supplement No. 3 to the Application for License dated May 3, 1968

Response to Question 2.7 states:

> "The emergency shutdown cooling water will be supplied from an emergency reservoir...."
>
> The licensee's response did not credit the Dardanelle Reservoir for providing emergency shutdown cooling water.

Supplement No. 4 to the Application for License dated June 5, 1968

Response to Question 11.1.1:

> The licensee included the emergency reservoir and pipeline in the listing of Class I structures, systems, and components.

ENCLOSURE

The Dardanelle Reservoir was not identified as a Class I structure. This is significant because only Class I structures are relied upon for mitigation of the design-basis LOCA (see the discussion associated with Amendment 30 below).

Correction to Supplement No. 6 to the Application for License dated July 11, 1968

Relative to the service water system, Section 9.3.1, "Design Basis," was revised to state:

"In the unlikely event of the complete loss of cooling water from the Dardanelle Reservoir due to the failure of the Dardanelle Dam, water will be supplied by gravity flow from the emergency reservoir...."

Supplement No. 7 to the Application for License dated August 15, 1968

Response to Question 16.1 states:

"The emergency reservoir will be sized to provide a 30-day cooling water supply. The size of the reservoir is based on the assumption that decay heat will initially be removed by utilizing one of the emergency feedwater pumps and the condensate normally available on site, thereafter cooling will be as described in Question 2-7 of Supplement 3.

Preliminary calculations show that, assuming an initial temperature of 85 °F, the reservoir temperature will increase approximately 10 °F, to 95 °F in about a day and maintain that temperature thereafter."

Amendment No. 21 to Application for Licenses dated September 27, 1971

Emergency Cooling Pond discussion on Page 1-71 states:

"The cooling pond will serve as a heat sink for normal plant shutdown of either Unit 1 or 2 as well as the source of emergency cooling water for simultaneously shutting down both Unit 1 and 2 in the unlikely event of a loss of the Dardanelle Reservoir water inventory. It is sized to contain sufficient water for dissipating the total combined heat transferred to the Unit 1 and 2 service water systems as a result of the Design Basis Accident in one unit and a normal plant shutdown of the other unit..."

Miscellaneous discussion on Page 1-71 and 1-71a:

The licensee indicated that the Reservoir Water Canals were considered to be common facilities for Units 1 and 2 and stated that "Failure of any of these shared systems will be of no serious consequence since none of the shared systems are safety related."

This indicates that the licensee was not relying on water from the Dardanelle Reservoir via the Reservoir Water Canals for accident mitigation purposes.

Amendment No. 22 to the Application for License dated December 14, 1971

Response to Question 9.2.3 states:

"The service water piping is such that adequate flow is delivered to all components under all modes of operation. The Table following this response summarizes the line sizes, flow paths, temperatures, NPSH and flows for the limiting modes of operation." For DBA conditions, the table (Table 9-9.2.3) only provided information relative to operation using the Dardanelle Reservoir as the UHS, and failed to recognize use of the ECP as the most limiting mode of operation.

Given all of the other information that was provided by the licensee relative to the UHS and the service water system (both prior to and following this amendment submittal), the table is in error and should be corrected.

Amendment No. 24 to the Application for Licenses dated February 29, 1972

Discussion pertaining to Class 1 Seismic systems and equipment:

"This class includes piping systems and equipment whose failure could cause uncontrolled release of radioactivity or those essential for safe shutdown and immediate or long-term operation following a loss-of-coolant accident."

The ECP is designated as Seismic Class 1 whereas the Dardanelle Reservoir is not. Therefore, the Dardanelle Reservoir was not credited for "safe shutdown and immediate or long-term operation following a loss-of-coolant accident."

Amendment 25 to the Application for License dated March 31, 1972

Response to GDC Criterion 44, "Cooling Water," states:

"Structures, systems and components important to safety are cooled by the service water system. The service water system is redundant with two 100% capacity trains and three 100% capacity pumps which can be operated either from offsite power or from onsite emergency power. The ultimate heat sink for the service water system is either the Dardanelle Reservoir or the emergency cooling pond."

Amendment 26 to the Application for License dated April 21, 1972

Response to Question 9.5.4 states:

"The pond is a Class 1 structure..."

The significance of this is provided in the discussion associated with Amendment 30, below.

Response to Question 9.6.1:

In addressing ECP operating modes to be permitted by Technical Specifications, the licensee indicated that the ECP could support the operation of up to 2 service water pumps simultaneously on each unit for mitigation of a LOCA on one unit and concurrent shutdown of the other unit.

While this response superseded the information provided by Amendment 22, Table 9-9.2.3 was not corrected to reflect these "modes of operation."

Response to Question 9.6.3 states:

"The basis for the Technical Specification for the ultimate heat sink is that the pond function for a minimum period of thirty (30) days..."

Response to Question 9.6.4 states:

"Since there is slightly more stored energy in Unit 2, the operating condition which results in the minimum margin to Technical Specification limits is a Unit 2 DBA and a concurrent Unit 1 shutdown..."

Response to Question 9.6.5 states:

"A minimum water level necessary for safe plant operation is specified based on 30 day emergency cooling pond operation following a Unit 1 Design Basis Accident...A new minimum pond level will be specified for concurrent Unit 2 operation to allow for emergency cooling pond operation following a Unit 2 DBA with a Unit 1 shutdown."

Amendment 30 to the Application for License dated September 15, 1972

Q List:

The licensee added the ECP to the Q List. As quoted from the Q List, "The basic purpose of this list is to specifically identify those items within the scope of the Nuclear Quality Assurance Program...
The list is to include all Class 1 structures, systems, and equipment. Class 1 structures, systems and equipment are those whose failure could cause uncontrolled release of radioactivity or those essential for the safe shutdown and the immediate and long-term operation following a loss of coolant accident...."

The Dardanelle Reservoir was not included on the Q List as a Class 1 structure and was therefore not considered "essential for the safe shutdown and the immediate and long-term operation following a loss of coolant accident..."

SER dated June 6, 1973

Section 1.2, "General Plant Description," states:

"The ANO-1 power plant is one of two pressurized water nuclear plants proposed to be operated at the Arkansas Nuclear One site... The only shared engineered safety feature will be the emergency cooling pond, an ultimate heat sink for both units."

Consistent with the information that was submitted by the licensee, the staff only credited the ECP as the ultimate heat sink for ESF purposes.

Section 2.4.1, "Hydrologic Description," states:

"The minimum navigational pool level of the Dardanelle Reservoir is...to provide two feet of storage for power generation...The ultimate heat sink for the ANO-1 plant includes a 14-acre man-made emergency cooling water storage pond..."

Consistent with the information that was submitted by the licensee, the staff credited the Dardanelle Reservoir as the UHS for normal operation of the plant while the ECP was recognized as the source of emergency cooling water.

Section 2.4.6, "Cooling Water," states:

"During normal operation, 1700 cfs of cooling water for once-through cooling for ANO-1 is to be taken from Dardanelle Reservoir through the intake canal...and discharged back into the reservoir through the discharge canal...The emergency cooling pond will serve as a heat sink for normal plant shutdown of either Unit 1 or Unit 2, as a source of water for simultaneously shutting down both units in the event of a loss of the Dardanelle Reservoir water inventory, or a plant accident... The staff has concluded that the emergency cooling pond as a primary portion of the Ultimate Heat Sink is adequate..."

Consistent with the information that was submitted by the licensee, the staff only credited the Dardanelle Reservoir for normal operation of the plant while the ECP was specifically recognized for accident mitigation.

Section 3.2, "Classification of Structures, Components, and Systems," quotes from the FSAR:

"Class 1 structures, systems and equipment are those whose failure could cause uncontrolled release of radioactivity or those essential for safe reactor shutdown and the immediate and long-term operation following a loss of coolant accident..."

Since the Dardanelle Reservoir is not a Class 1 structure, it cannot be relied upon for accident mitigation purposes.

Section 9.3.1, "Service Water System," states:

"The service water system (SWS) provides cooling water to all components essential for the plant's safe shutdown...The SWS, which acts as an intermediate heat sink for all vital components, receives its water supply from the Dardanelle Reservoir during normal operation and the emergency cooling pond during accident conditions..."

Section 9.3.4, "Ultimate Heat Sink," states:

"Two sources of cooling water are available for reactor equipment to use as an ultimate heat sink, the Dardanelle Reservoir and an onsite emergency cooling pond. The emergency cooling pond is a seismic Category I structure which will be used for both normal and emergency operations. Cooling water flow from the Dardanelle Reservoir will be terminated and flow from the emergency pond will be initiated during normal plant shutdown, accident conditions, and whenever the reservoir drops to an unacceptable low level... Cooling water will be supplied by gravity flow from the pond through seismic Category I supply lines to the service water pumps located in the intake structure... Based on our evaluation of the Ultimate Heat Sink, we conclude that the design, which meets the position set forth in Regulatory Guide 1.27, "Ultimate Heat Sink," is acceptable."

Technical Specifications

Specification 3.11 states specific requirements for the emergency cooling pond to assure a sufficient supply of cooling water inventory. There is no TS associated with the Dardanelle Reservoir.

UFSAR Submittal dated July 15, 1982

The UFSAR submittal generally incorporated and reflected the information that was provided in the Application for License, including Supplements and Amendments that were made to the original application, except that the licensee's response to GDC 44 for cooling water systems was not included in the UFSAR (see Amendment 25 to the Application for License dated March 31, 1972).

CONCLUSIONS

Based on the information reviewed by the staff and discussed above, it is clear that the UHS for ANO Unit 1 consists of both the Dardanelle Reservoir and the ECP. However, it is also clear that the Dardanelle Reservoir is only relied upon for dissipating heat during normal power operation of the unit while the ECP is credited for dissipating heat during emergency shutdown and accident conditions. Further, the ECP must be able to perform its accident mitigating function assuming the worst-case single failure consistent with the design basis of the plant.

The staff found that the information contained in Table 9-9.2.3 (submitted with Amendment No. 22) was not consistent with the preponderance of information that was submitted on this subject during plant licensing. Licensees have recently been reminded of their responsibilities to maintain their FSARs accurate and up-to-date, and this inconsistency should be corrected at the next FSAR update.

Principle Contributor: James Tatum, SPLB

Date: June 13, 1997