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10 CFR 50.90

0CAN022102

February 8, 2021

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: License Amendment Request
One-Time Change to Support Proactive Upgrade of the Emergency Cooling Pond Supply Piping

Arkansas Nuclear One, Unit 1 and Unit 2
NRC Docket Nos. 50-313 and 50-368
Renewed Facility Operating License Nos. DPR-51 and NPF-6

As required by 10 CFR 50.90, Entergy Operations, Inc. (Entergy) hereby requests an amendment for Arkansas Nuclear One, Unit 1 and Unit 2 (ANO-1 and ANO-2) Emergency Cooling Pond (ECP) Technical Specifications (TSs), ANO-1 TS 3.7.8 and ANO-2 TS 3.7.4.1, to allow the ECP to remain operable on a one-time basis for up to 65 days to perform proactive upgrades to the ECP supply piping . This change will allow Entergy the time to perform upgrades on ECP piping from the ECP to the Service Water System (SWS) intake bays prior to a spring outage for each unit.

This proposed amendment request provides a risk-informed assessment of the change as set forth in Regulatory Guides (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, and RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," Revision 1.

Approval of the proposed amendment is requested by March 31, 2022. Entergy currently plans to begin upgrade of the ANO-1 ECP piping upgrade 65 days before the start of a future ANO-1 spring outage. Likewise, the ANO-2 ECP piping upgrade is currently planned to begin 65 days before the start of a future ANO-2 spring outage. Once approved, the amendment shall be implemented within 30 days.

The enclosure provides a description and assessment of the proposed changes. In addition, the enclosure concludes that the proposed amendment does not involve a significant hazards consideration. Attachment 1 of the enclosure provides the existing TS pages marked up to show the proposed changes. Attachment 2 of the enclosure provides existing TS Bases pages for both units marked up to illustrate the proposed changes, for information only, and will be incorporated in accordance with the plants' TS Bases Control Programs upon implementation of the approved amendment. Attachment 3 of the enclosure provides retyped (revised) TS pages.

The proposed change includes new commitments as summarized in Attachment 4 of the enclosure. Supporting information associated with the aforementioned risk assessment is provided in Attachment 5 of the enclosure. Attachment 6 contains simplified drawings of the temporary pumping system that will be available to supply ECP inventory to the SWS bays during the ECP piping upgrade period.

In accordance with 10 CFR 50.91, Entergy is notifying the State of Arkansas of this Amendment Request by transmitting a copy of this letter and enclosures to the designated State Official.

If there are any questions or if additional information is needed, please contact Riley Keele, Manager, Regulatory Assurance, Arkansas Nuclear One, at 479-858-7826.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on February 8, 2021.

Sincerely,

Ron Gaston

RWG/dbb

Enclosure: Evaluation of the Proposed Change

Attachments to Enclosure:

1. Technical Specification Page Markups
2. Technical Specification Bases Page Markups – Information Only
3. Retyped Technical Specification Pages
4. List of Regulatory Commitments
5. Probabilistic Risk Assessment
6. Temporary ECP Pump System Configurations – Information Only

cc: NRC Region IV Regional Administrator
NRC Senior Resident Inspector – ANO
NRC Project Manager – ANO
Designated State Official – Arkansas

Enclosure

0CAN022102

Evaluation of the Proposed Change

EVALUATION OF THE PROPOSED CHANGE

1.0 SUMMARY DESCRIPTION

The proposed amendment would modify Arkansas Nuclear One, Unit 1 (ANO-1) Technical Specification (TS) 3.7.8, "Emergency Cooling Pond (ECP)," and ANO, Unit 2 (ANO-2) TS 3.7.4.1, "Emergency Cooling Pond," to permit the ECP to be considered operable for up to 65 days in support of a proactive upgrade on the ECP piping supply to the Service Water System (SWS) intake bays. The requested change involves no significant hazards consideration.

2.0 DETAILED DESCRIPTION

2.1 System Design and Operation

Ultimate Heat Sink (UHS)

The UHS sources for both ANO-1 and ANO-2 are the Dardanelle Reservoir and the ECP. While the Dardanelle Reservoir is the preferred source, the Seismic Category 1 ECP is available in the unlikely event of the loss of the Dardanelle Reservoir. The design basis of the UHS is to provide sufficient heat removal for up to 30 days to support a normal shutdown of one unit, a normal shutdown of both units, or a normal shutdown of one unit with a simultaneous emergency shutdown of the other unit assuming a coincident loss of coolant accident (LOCA) on that unit.

As stated above, the UHS consists of two water sources:

a. The ECP with the following associated Seismic Category 1 reinforced concrete structures:

    1. Pipe inlet structure,

    2. Pipe outlet structure, and

    3. SWS intake structure

b. The Dardanelle Reservoir with the associated Seismic Category 1 reinforced concrete SWS intake structure.

The design basis safety functions of the UHS are assured following:

a. The most severe natural phenomena associated with the site location, including earthquake, tornado, flood, or drought, taken individually,

b. Site-related events, such as canal blockage, ice formation, transportation accidents, oil spills, or fires that historically have occurred or that may occur during the plant lifetime, and

c. any single failure of a man-made structure, including failure of the downstream Dardanelle Dam, or any upstream dam or dams.

Both the ECP and the Dardanelle Reservoir feed the SWS pump bays separately. The ECP and associated unit ECP supply pipe provides the necessary water volume to support SWS cooled loads to meet the SWS design basis. The normal intake flow from the Dardanelle Reservoir is provided with traveling screens for debris removal. There is no single failure that could prohibit the UHS from meeting its design basis as required by the General Design Criteria (GDC) of 10 CFR 50, Appendix B, or Regulatory Guide (RG) 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 1 (Reference 1).

Dardanelle Reservoir (Lake Dardanelle)

The Dardanelle Reservoir is part of the Arkansas River navigation project. The project provides a minimum 9-foot navigation depth from the mouth of the Arkansas River at the Mississippi River to Catoosa, Oklahoma, near Tulsa, on the Verdigris River, a distance of more than 500 miles. There are 17 locks and dams in the system. The Dardanelle Dam is located downstream of the ANO SWS intake and was designed and built by the Army Corps of Engineers to withstand the Probable Maximum Flood (PMF) and associated wind effects.

The Dardanelle Reservoir is the primary heat sink for both ANO-1 and ANO-2. The Dardanelle Reservoir is the source of cooling water for the SWS for both ANO-1 and ANO-2 during normal operating conditions. Switchover from the reservoir to the ECP may be accomplished by actuation of the motor operated sluice gates in the SWS intake structure, and either remote manual actuation of the SWS discharge return valves to the ECP if the ECP is used for normal shutdown or automatic actuation of the SWS discharge return valves to the ECP during accident conditions.

The station can obtain the required minimum cooling water from the Dardanelle Reservoir through the canals based on the low water level of 335 ft Mean Sea Level (MSL) in the Reservoir. At any water level below 335 feet in the intake canal, the station cannot be assured of obtaining sufficient cooling water for continuous rated power operation, both units will be shut down, and the water source shifted to the ECP.

Emergency Cooling Pond

The Dardanelle Reservoir provides the primary heat sink during normal plant operation while the ECP is a backup Seismic Category 1 source for plant safe shutdown, if necessary, under normal or accident conditions. The ECP serves as a heat sink for simultaneously shutting down both units in the unlikely event of a loss of the Dardanelle Reservoir water inventory or blockage of the intake structure.

Each unit is designed with separate intake and discharge water lines from the ECP to the respective SWS pump bays. The ECP supply to the SWS intake structures is a gravity flow line. As stated previously, the SWS of either unit can be aligned to discharge to the ECP. The ends of the lines terminating at the ECP are housed in Category 1 structures to prevent blockage of the pipe entrance and outlet. In addition, screens are provided on the ECP intake structure to prevent the inclusion of soil or foreign objects in the water delivered from the ECP.

The ANO-1 ECP TS Bases describes analysis assumptions for the worse case initial conditions considering the loss of the Dardanelle Reservoir. The operating limits are based on conservative heat transfer analyses for the worst-case initial conditions that could be present considering an ANO-2 design basis accident (DBA) concurrent with a normal shutdown of ANO-1 and a loss of the Dardanelle Reservoir water inventory. The ANO-1 and ANO-2 Safety Analysis Reports (SARs) provide the details of the assumptions used in the analysis. The minimum ECP requirements take into account: 1) water loss from evaporation due to heat load and climatological conditions, 2) fire pump usage, 3) ECP bottom irregularities, 4) water level at the suction pipe at the ECP, and 5) operator action in transferring the SWS discharge from the Dardanelle Reservoir to the ECP.

An indicated level of 5.05 ft corresponds to the TS-required volume of 70 acre-feet. An additional 0.15 ft is appropriate to account for measurement, calculation, and other uncertainties, resulting in the minimum ECP indicated level to ensure a 70 acre-feet volume of 5.2 ft. Operator action is credited in the inventory analysis for a loss of Lake Dardanelle event to transfer the SWS discharge to the ECP. Specifically, SWS returns are transferred to the ECP shortly after the Dardanelle Reservoir loss of inventory event begins and pump suctions are transferred later in the event, depending on pump bay level. In the time frame between the transfer of the SWS returns and the later transfer of SWS suctions to the ECP, Dardanelle Reservoir water is transferred to the ECP, increasing level by at least 4.5 inches. This additional water is required, along with that maintained in the ECP, to ensure a 66.9-inch depth, which in turn ensures a 30-day supply of cooling water. The ECP is designed in accordance with RG 1.27, which requires a 30-day supply of cooling water.

Service Water System

The SWS provides required cooling water flows to Emergency Safeguards Features (ESF) equipment served by the system, as well as to various non safety-related portions of the plant. Structures, systems, and components (SSCs) important to safety are cooled by the SWS. Each unit's SWS is designed with two redundant 100% capacity trains and three 100% capacity pumps which can be operated from offsite power or from onsite emergency power. The SWS consists of Seismic Category 1 and non-Seismic Category 1 portions. Non-Seismic Category 1 portions of the system are automatically isolated from the system upon receipt of appropriate ESF actuation signals.

The normal and preferred SWS source of water during normal and accident conditions is the Dardanelle Reservoir. The flow from the reservoir is provided with traveling screens for debris removal. When the Dardanelle Reservoir is not available, the ECP provides the necessary cooling water to the SWS.

Normal and Emergency Operation

During normal power operation, the SWS is supplied by the preferred source, the Dardanelle Reservoir. However, when the Dardanelle Reservoir is not available the SWS will be temporarily supplied from the ECP. During emergency operations (DBA) the SWS is expected to remain supplied by the preferred Dardanelle Reservoir source. However, in the case of a failure of the downstream Dardanelle dam, the ECP will provide the UHS function.

The SWS components inside the intake structure include the SWS pumps and motors, basket strainers, pump discharge piping and associated valve operators, intake sluice gates and the gate operators, and sodium bromide/sodium hypochlorite injection piping. The intake structure also contains the bar gates, traveling water screens, prescreens, and screen wash water piping.

2.2 Current TS Requirements

ANO-1 has previously converted to the improved standard TS of NUREG-1430, "Standard Technical Specifications Babcock and Wilcox Plants" (Reference 2). ANO-2 has not converted to the improved standard TS of (NUREG-1432, "Standard Technical Specifications Combustion Engineering Plants" (Reference 3). The ANO-2 TSs are based on NUREG-0212, "Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors" (Reference 4).

ANO-1 ECP TS 3.7.8 requires the ECP to be operable in Modes 1, 2, 3, and 4. If the ECP is inoperable for reasons other than a degradation of the ECP structure, the unit is required to be placed in Mode 3 within 6 hours and in Mode 5 in 36 hours.

ANO-2 ECP TS 3.7.4.1 also requires the ECP to be operable in Modes 1, 2, 3, and 4. If the ECP is inoperable for reasons other than a degradation of the ECP structure, the unit is required to be placed in Mode 3 within 6 hours and Mode 5 in the following 30 hours.

2.3 Reason for the Proposed Change

Entergy Operations, Inc. (Entergy) has submitted a relief request to the NRC for approval to use Carbon Fiber Reinforced Polymer (CFRP) at ANO to proactively upgrade the ECP supply piping from the ECP to the SWS intake bays. The proactive upgrade to the ECP piping is currently planned to take place 65 days before the start of a spring refueling outage for each unit individually.

While the ECP piping is being proactively upgraded, the ECP will be inoperable with respect to regulatory compliance. Currently, both the ANO-1 and ANO-2 TSs require a shutdown when the ECP is inoperable. The time needed to install the CFRP far exceeds normal refueling outage durations. To reduce an unnecessary burden of an extended plant shutdown, Entergy requests approval of a TS amendment to allow the ECP to be considered operable, based on a temporary pumping system (discussed later) for up to 65 days while the respective proactive upgrade to the ECP supply piping for each unit is taking place.

2.4 Description of the Proposed Change

The proposed change to ANO-1 and ANO-2 TSs will add a Note to the Limiting Condition for Operation (LCO) that would allow the ECP to be considered operable on a one-time basis for up to 65 days during the proactive upgrade to the ECP supply piping, provided a loss of the Dardanelle Reservoir is not in progress and provided a temporary pumping system is available that is capable of supplying the SWS from the ECP. The following LCO Note is being proposed for ANO-1 and ANO-2.

> The ECP may be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SW System intake bays provided:
>
> a. A loss of Lake Dardanelle event is not in progress, and
>
> b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

3.0 TECHNICAL EVALUATION

3.1 Background

The supply piping between the ECP and the SWS intake bays are experiencing natural degradation due to microbiological influenced corrosion (MIC). As a proactive measure, Entergy is planning to perform upgrades to the piping. The planned upgrade involves using a Carbon Fiber Reinforced Polymer (CFRP) Composite System wrap on the internal surfaces of the ECP supply piping. Entergy submitted a relief request on July 15, 2020, to allow use of the CFRP in buried piping (Reference 5).

The length of ECP supply piping for upgrade is approximately 2300 ft for each unit. The upgrade is currently scheduled to take 60 days for each unit. During the upgrade, the respective unit's ECP supply piping will be unavailable and, therefore, the ECP will be considered inoperable. The current TS for each unit requires the ECP to be restored to an operable status or the unit shutdown to Mode 3 within 6 hours. Entergy prefers to perform the proactive upgrade to the ECP supply piping while online and prior to a spring refueling outage. Therefore, Entergy is requesting an amendment to the ANO-1 and ANO-2 TSs to allow the ECP to remain operable for up to 65 days prior to a spring refueling outage of each unit. The extra five days provides some margin to account for unforeseen circumstances, with the respective refueling outage providing any additional time that may be required to complete the CFRP installation. During this 65-day period, supply to the SWS will be from Lake Dardanelle (normal alignment); however, a temporary above ground engine-driven pumping system will also be made available to supply the SWS bays from the ECP should a loss of Lake Dardanelle occur. If during the 65-day piping upgrade a loss of Lake Dardanelle event were to occur, the ECP will be considered inoperable and the Actions of respective unit's ECP LCO applied (i.e., the respective unit will be required to be in Mode 3 in 6 hours and Mode 5 in 36 hours).

For the purposes of the proposed LCO Note, a loss of Lake Dardanelle is considered an event that renders the Dardanelle Reservoir unavailable for an extended period of time, likely with no known time for recovery. Such events include failure of the downstream Dardanelle Dam, notification from the Army Corps of Engineers of more than a momentary draw down of lake level below 335 ft MSL, a major oil or chemical spill which renders Lake Dardanelle unfit for use to support cooling of station equipment, or any other event that would result in more than temporary lowering of the intake canal below 335 ft MSL.

There are other events, especially a phenomenon referred to as "shad runs", that can occur in the late fall and early winter months which require operator action to ensure an inventory source remains available to the SWS bays. Historically, the intake traveling screens have occasionally become clogged due to large shad fish kills when rapid changes to lake temperatures occur during the initial winter months. To prevent/limit these occurrences, Entergy installs fish nets (shad nets) at the entrance to the ANO intake canal from the Dardanelle Reservoir during the winter to capture shad should a temperature transient occur in the lake and cause a fish kill. The shad nets are deployed as delineated in the environmental permit to minimize the amount of shad that wash into the SWS intake canal. Abnormal Operating Procedures (AOPs) provide the actions necessary to respond to shad runs and other temporary bay level events, which may include temporarily aligning one or more SWS bays to the ECP. Such temporary events that are appropriately addressed by station procedures are not considered loss of Lake Dardanelle events for the purposes of the proposed LCO Note.

The intent of the "loss of Lake Dardanelle" portion of the LCO Note is to ensure prompt action is taken to enter the shutdown actions of the respective ECP TS should the Dardanelle Reservoir experience an event requiring the SWS bays to be transferred to the ECP for an extended period of time. This is considered a conservative action even though the temporary pumping system will be capable of supplying all safety-related SWS loads of both SWS loops (the accident analyses assumes only one SWS loop is available) for the unit undergoing the ECP piping upgrade. However, based on the temporary pump capability, it is not necessary to require immediate entry into the ECP TS shutdown actions for temporary level deviations such as during recovery from shad runs. Station procedures provide the necessary actions, which may include a shutdown of the unit depending on the circumstances present, for conditions that may require temporary use of the ECP temporary pumping system to supply the SWS bays. Attachment 2 of this enclosure provides a markup of the TS Bases which includes the appropriate Operator guidance with respect to proper application of the proposed LCO Note.

3.2 Justification

As stated previously, Lake Dardanelle is the preferred source for the SWS and is normally aligned to the SWS unless maintenance or surveillance testing is required. A review of station operator logs for the past 5 years determined the SWS has been aligned from the ECP, while in Modes 1, 2, 3, or 4, approximately 1% of the time excluding surveillance testing.

Lake Dardanelle is a reservoir formed by the Dardanelle Lock and Dam. The dam is controlled by the Army Corps of Engineers. Failure of the dam is considered to be practically impossible (although assumed to occur in the safety analysis). It is designed to withstand the Design Basis Earthquake (DBE) of 0.2g, probable maximum flood, and wind effects.

Entergy will install a temporary pumping system to supply water from the ECP to the SWS intake bays as a backup to Lake Dardanelle to ensure inventory can be supplied to the SWS if a loss of Lake Dardanelle occurs (as defined previously) or if temporary use is needed for non-loss of Lake Dardanelle events. See the *Contingency Section* below for more details on the temporary pumping system.

A probabilistic risk assessment (PRA) was performed to determine the risk to each unit during the upgrade (see Section 3.3 and Attachment 5). The probabilistic evaluations found that the risk increase to the plant during the period of the ECP piping upgrade with the temporary pumping system available are within the NRC risk increase criteria. The most limiting PRA case that maintains the risk increase less than 1×10^{-6} for Core Damage Frequency (CDF) and less than 1×10^{-7} for Large Early Release Frequency (LERF) shows that the amount of time the normal ECP supply can be unavailable with the temporary pumping system available is:

- 85 days (CDF) and 99 days (LERF) for ANO-1, and
- 75 days (CDF) and 88 days (LERF) for ANO-2.

Following are discussions of the contingencies (modeled in the PRA) and the defense in depth measures (not modeled in the PRA) that will be taken by Entergy to ensure that an acceptable safety margin is maintained during the ECP supply piping upgrade. The two contingency requirements included in the proposed LCO Note are mandatory for utilizing the TS Note and allowing the ECP to be considered operable during the ECP upgrade period. If either of the contingencies are not met, the affected unit will be required to immediately enter the applicable ECP TS Action(s) (6 hours to be in Mode 3 and 36 hours to be in Mode 5). The defense in depth measures that ANO will perform enhances the margin to safety and are described later.

Contingencies

A temporary ECP diesel-driven pumping system will be utilized as a compensatory measure in the highly unlikely event the preferred UHS source (Dardanelle Reservoir) is lost or becomes temporary unavailable (as discussed previously) during the proactive upgrade of the ECP supply piping. Proper SWS bay level will be maintained by the pump using a mechanical float control valve to regulate flow from the temporary ECP pump. The temporary pumping system will be sized to provide adequate flow to support the safety-related equipment of both trains of the SWS to safely shutdown the unit under normal or accident conditions (the other ANO unit will maintain full ECP flow capacity from its normal ECP suction line). In accordance with the LCO Note, the temporary pumping system may be removed from service for testing or to support any necessary maintenance provided its availability can be restored within 72 hours, consistent with the TS allowed time to restore an inoperable SWS loop. In both cases, single failure criterion would not be met and, therefore, time to recover from the condition is appropriately limited. This 72-hour allowance in which the temporary pumping system may be unavailable is considered reasonable since the likelihood of a loss of the Dardanelle Lake or SWS bay inventory event occurring in a 72-hour period during the 65-day ECP piping upgrade is low.

Furthermore, if an external flood event is projected to exceed an elevation of 350 ft MSL, the ANO-2 buried ECP piping upgrade activities will be terminated and the ECP piping closed to restore a flow path from the ECP to the ANO-2 SWS pumps within 48 hours. This is prudent since the ANO-2 SWS sluice gate control circuits are not designed to remain available during post-flood conditions. An external flood event is not of concern for ANO-1 since the portions of the control circuits for the SWS bay sluice gates susceptible to flood damage are located above the Maximum Permissible Flood (MPF) level described in the SAR.

The following measures in support of the temporary ECP pumping system are considered regulatory commitments and will be maintained during the 65-day ECP piping upgrade. These commitments will expire at the end of the 65-day preventative maintenance window.

- The temporary pump will be tested and minimum flow requirements verified prior to removing the installed ECP supply piping from service.
- The Army Corps of Engineers will be briefed on the ECP piping upgrade activities and on the increased sensitivity of Lake Dardanelle level during the period of the ANO ECP piping upgrade. The Army Corps will be requested to minimize any activity and provide advanced notification of activity that could impact the lake level or amount of debris in the lake.
- The 65-day allowance for the ECP to remain operable during the ECP supply piping upgrade will be applied only prior to a spring outage to provide additional margin to the TS maximum ECP temperature limit.
- The temporary pump system will be started to ensure its continued availability on a weekly basis.
- Personnel trained to start the pump will be dedicated and onsite 24 hours a day, stationed in reasonable proximity of the pump, during the ECP piping upgrade when the ECP temporary pump is being relied upon as a backup for the Dardanelle Reservoir, with direct communications with the respective ANO Control Room.

- During the ANO-2 ECP piping upgrade, equipment will be staged near each ECP pipe opening to allow pipe closure, within 48 hours, when external flooding is projected to exceed 350 ft MSL.
- No elective maintenance or elective testing will be performed that could challenge the Dardanelle Reservoir SWS suction source.
- The SWS pumps, bays, traveling screens, and sluice gates that are important for ensuring cooling water is provided to the supported SSCs will be given protected train status.
- The intake traveling screens will be inspected for debris and general physical condition at least once per shift.
- The accessible portions of the temporary ECP system piping will be inspected weekly.
- Fish nets will be installed in the Dardanelle Reservoir SWS intake canal when required by existing winter operations procedural guidance and inspected for any gross physical damage or large quantities of debris twice a week, weather permitting, to ensure the nets remain intact and capable of performing the intended function.
- An adequate fuel supply will be maintained to supply the temporary pump for approximately 24 hours of continuous operation.
- At least once per week, a briefing will be conducted for applicable personnel to ensure individuals remain cognizance of the cues that would prompt Operator action to start the temporary pumping system and open the discharge valve.
- The ECP level will be maintained ≥ 5.5 ft during the 65-day preventative maintenance window.

The first three items above are performed prior to initial entry into the 65-day ECP piping upgrade window. Because unforeseen circumstances could arise that may temporarily prevent meeting one of the other ongoing commitments during the maintenance window, Entergy intends to consider the ECP to remain operable in such an event provided action is taken to restore the commitment without delay. This is considered reasonable since failure to meet one or more ongoing commitments does not immediately render the temporary ECP pumping system unavailable. The markup of the respective TS Bases included in Attachment 2 of this enclosure provides the Operator guidance necessary to properly apply the proposed LCO Note.

Plant Operation with Application of the LCO Note

During normal power operation, the SWS is expected to be supplied by the preferred source, the Dardanelle Reservoir. If the Dardanelle Reservoir is lost (as defined previously) during the 65-day piping upgrade, a unit shutdown will be required. The temporary ECP pumping system will be capable of supplying the SWS with the necessary flow to facilitate a normal plant shutdown or a shutdown during accident conditions.

During shutdown operations (Mode 5) the ECP is not required to be operable by the TSs and the SWS is expected to be supplied by the preferred source, the Dardanelle Reservoir. However, when needed for shutdown risk mitigation, the ECP is maintained available as a backup SWS supply source, except for short periods during the outage when surveillance testing is performed or maintenance is required. The temporary system will be designed to provide adequate flow to support shutdown operation.

With respect to shutdown operations, both unit's ECP TSs are applicable only in Modes 1, 2, 3, and 4. Any unit shutdown that may occur during the 65-day ECP piping upgrade window requiring entry into Mode 5 would render the LCO Note no longer applicable. To support restart of the unit during the 65-day ECP piping upgrade period, the TS Bases is modified to provide Operator guidance for reapplying the proposed LCO Note upon entry into Mode 4 from Mode 5. Any subsequent application of the LCO Note following initial application requires the 65-day time period to have commenced retroactive to the initial application of the LCO Note. For example, if a unit shutdown occurs 10 days following the commencement of the ECP piping upgrade and the unit remains in Mode 5 for 12 days, the proposed LCO Note may be reapplied upon entry into Mode 4 during plant restart; however, the time remaining in the original 65-day ECP piping upgrade window has now been reduced to 43 days (65 - 10 - 12 = 43).

During emergency operations (DBA), the SWS is expected to be supplied by the preferred source, the Dardanelle Reservoir. However, in the case of a failure of the Dardanelle dam or intake canal blockage, the ECP can provide the UHS function. The temporary system will be designed to provide adequate flow to both SWS trains to remove design basis heat loads during emergency operation. The ECP temperatures will be lower during the ECP supply piping upgrade because the modification will be performed during the pre-spring months, which will provide additional margin to the current design basis 100 °F maximum ECP temperature.

Based on the SAR, the capability of transferring SWS suction from Dardanelle Reservoir to the ECP within two hours of notification of a potential failure of the Dardanelle Dam must be maintained. To ensure this capability, a formal agreement between Entergy and the U.S. Army Corps of Engineers has been previously established (reference ANO Emergency Plan, Section 1.2.1.3) to ensure ANO is promptly notified of an imminent loss of Lake Dardanelle.

Existing procedures direct Operators to transfer the suction of the SWS pumps from the reservoir to the ECP if bay level drops below 333 ft MSL. This is accomplished by first initiating manual closure of the Dardanelle Reservoir sluice gate and then opening the ECP supply sluice gate once level in the SWS bay starts to drop. This sequence minimizes ECP inventory loss to the lake. The same sequence would be followed when the temporary system is in place but rather than opening the ECP sluice gate, the temporary pump would be started since the pump discharges directly into the respective SWS pump bay.

Temporary Pumping System

The temporary pumping system will consist of a diesel-driven pump, fuel tank, suction strainer, high density polyethylene (HDPE) and carbon steel (CS) suction and discharge piping, and valves to control flow. The pump and fuel tank will be located adjacent to the ECP with a containment system to prevent any potential fuel spill from entering the ECP. The fuel tank capacity will provide sufficient fuel supply to run the pump for approximately 24 hours without refueling.

To minimize debris from entering the system, temporary strainers will be installed in the ECP with a screen mesh equivalent to the existing ECP intake screens. The strainers will be sized to meet the pump net positive suction head (NPSH) requirements at the current design basis ECP temperature and level. While the temporary ECP system is in place, stop logs will be installed in the ECP intake to allow access to the ECP pipe. The stop logs will be designed to withstand seismic, hydrostatic pressure, and appropriate wind loads.

The HDPE piping will be run from the submerged strainer up to the pump skid and then generally above ground to the SWS intake building. The routing has been chosen to minimize potential tornado missile damage by locating the pipe adjacent to robust structures. The pipe will transition to CS prior to entering the SWS intake building through existing doorways and then be routed along the floor down into two of the three SWS pump bays through existing openings. The pump bay without the temporary ECP pipe will be drained to allow upgrade of the section of the buried ECP piping entering the bay.

Once the upgrade is completed for a given bay, it will be reflooded and the temporary ECP pipe to the bay will be installed and tested. Each of the other two bays will then be taken out of service one at a time, drained, and have its buried ECP piping upgraded. Two SWS pump bays will have temporary ECP supply available at all times. The SWS pump bay level will be maintained by a flow regulating valve installed in the temporary ECP pipe feeding each pump bay actuated by a mechanical float installed in the pump bay. To improve the temporary system reliability, external electrical power will not be required for the system. The only device requiring electrical power will be the engine control panel which is supplied by the engine DC battery.

Exposure to Low Temperatures

The temporary ECP system pump and piping will be exposed to ambient conditions during the winter/early spring season. This area of Arkansas can experience temperatures below freezing for several days during this time period. To preclude freezing within the temporary ECP system, temporary heating to the pump area, and insulating the piping or establishing sufficient minimum flow through the piping will be performed.

Seismic Considerations

Although the temporary ECP supply system does not fully meet the quality, seismic, or tornado missile design basis, the temporary ECP pump and piping will be restrained or protected to ensure functionally during high wind and seismic events.

The temporary ECP pumping system is a commercial non-safety related system being installed as a compensatory measure. However, to provide high confidence that the system to remain functional during a seismic event, the system piping and equipment anchorage will be analyzed to withstand seismic loads generated from the current ANO maximum DBE ground acceleration of 0.20g. The seismic capability of the temporary equipment will be established through qualitative evaluation using generic industry data compared with the ANO DBE. Restraints will be provided, if necessary, such that the system will remain functional during a seismic event. The temporary pump skid and wind barriers will be located far enough from the ECP edge such that the pond embankment will not be affected by the skid during a seismic event.

Wind Considerations

The wind load is considered minimal due to the shape factor of the pipe and that the pipe will be on the ground or inside the intake structure. To reduce the risk of wind damage to the pump and fuel tank, both will be enclosed by barriers. The barriers around the pump will have sufficient wind loading capacity to resist the ANO-2 80 mph maximum wind speed which is bounding for the two units.

The temporary piping and equipment will be restrained to limit movement and stresses due to wind, seismic, and thermal expansion within ASME code or Plastic Pipe Institute limits.

Fire Considerations

The diesel and electric fire pumps take suction from the ANO-1 "A" and "C" SWS pump bays, respectively. When the "A" or "C" SWS pump bay is removed from service, the corresponding fire pump will also be removed from service. An alternate fire water supply source will be established for the out of service fire pump as required by the ANO-1 and ANO-2 Technical Requirements Manuals (TRMs). The overall fire risk to the site with respect to the temporary pump system has been evaluated in accordance with NFPA 805 implementation methodology as defined in the Fire Hazards Analysis (FHA). See Attachment 5 for the evaluation of fire risk due to the temporary ECP pump system. In order not to increase the combustible loading in the SWS intake building and potentially affect redundant SWS trains, the portion of the temporary pipe routed in the SWS intake building will be made from non-combustible material. Defense-in-depth and safety margins for the fire systems will be maintained by utilization of an alternate fire water supply when the fire pump is removed from service.

Intake Building Considerations

During installation and use of the temporary ECP piping, one or both of the SWS intake building access doors will be removed to allow routing the temporary ECP pipe into the SWS bays. Temporary security measures will be in place to limit access to the building. Temporary closure of the door opening will be provided, when needed, to maintain ambient temperatures inside the Intake Building during extreme cold weather conditions.

External Flood Considerations

The existing maximum design flood level for the ANO site is 361 ft MSL. The new piping will be routed and constrained such that it does not alter the external flood level or cause major redirection of flood drainage. The temporary ECP pump will be located below the maximum flood level and will not be available to provide ECP supply to the SW pump bays during an external flood. Due to adverse impact to the ANO-2 sluice gate control circuits during a flooding event, SWS pump suction is transferred to the ECP prior to flood level entering the SWS Intake Building. The MPF flood analysis as discussed in the SAR concludes that the rise in the Dardanelle Reservoir level would be relatively slow and predictable over a 5-day period. When the Dardanelle reservoir reaches the flood stage (345 ft MSL), ANO AOPs require the installation of flood barriers and the sealing of openings that could allow flood water to affect SSCs required for safe shutdown. In support of the revised ECP LCO, equipment will also be removed from the buried ECP pipe, the access opening closed, and the buried ECP pipe returned to service to provide flow, if needed, to the SWS pump bays from the ECP.

Internal Flood Considerations

The temporary ECP piping will be supported to resist the current ANO design basis seismic ground response of 0.20g. The piping will not be a new source of flooding due to pipe breaks for ANO-1 since the ANO-1 licensing basis does not include evaluation of breaks in seismically qualified piping. However, a pipe break is considered a new source of flooding for ANO-2 because the ANO-2 licensing basis does include evaluation of seismically qualified pipe breaks. The existing design basis evaluations related line breaks in the SWS Intake Building demonstrates that existing floor openings on the 354 ft elevation have adequate capacity to drain break flow and mitigate flooding before it can impact safety related equipment. All components of ESF equipment located in the intake structure whose operation could be degraded by flooding have been located above the 361 ft level of the intake structure. Existing floor openings have sufficient margin to mitigate flooding from pipe breaks even with the ECP temporary piping reducing the flow area through the floor opening into the respective SWS bay such that the water level at the 354 ft elevation remains well below the 361 ft PMF level.

Testing and Preparedness

Entergy will test the temporary ECP pump and piping to ensure it can deliver the minimum required flow to the SWS in the time required for starting the system. The transfer of SWS pumps to ECP suction is currently designed to be a manual action. The manual startup of the temporary ECP supply pump/piping system has also been shown to be acceptable (see Section 3.4 and Attachment 5). Weekly starts of the temporary ECP pump will be performed to ensure continued pump reliability. In addition, weekly visual inspections of the temporary above grade ECP piping will also be completed to verify the continued integrity of the temporary system.

A dedicated individual trained to operate the pump will be stationed onsite when the temporary pump is being relied upon as a backup to the Dardanelle Reservoir. Having a dedicated individual available to start the pump and initiate flow will minimize the pump start delay time, minimizing the time in which inventory reaches the SWS intake bays.

FLEX

The existing diverse and flexible coping strategies (FLEX) utilize five separate tanks as potential sources of makeup water to the Spent Fuel Pool (SFP) and Qualified Condensate Storage Tank (QCST). If none of the tanks are available due to wind damage, two alternate sources are provided. The first method uses the diesel fire pump taking suction from the associated SWS bay. The second method installs a portable pump at the ECP taking suction with hoses from the ECP. The ECP temporary pump, having enhanced wind protection features, can be utilized for refilling the QCST in addition to the established FLEX features. The alternate equipment haul path will be blocked in two places by the temporary HDPE pipe where it crosses the haul road. The primary haul path is not affected. Existing FLEX deployment strategies account for potential large debris blocking a haul path and the existing FLEX haul equipment has the resources and capability to remove the section of HDPE pipe crossing the road if the alternate haul path is needed. The FLEX strategies will still provide an indefinite coping capability to prevent damage to the fuel in the reactors and SFPs and to maintain the containment function by using installed equipment, on-site portable equipment, and pre-staged off-site resources.

Summary of Measures to Increase Operating Margin

The ECP upgrade will take place during the winter and early spring. During this time the lake and ECP temperatures will be lower than during other parts of the year. This maximizes the cooling capability of the SWS and reduces the heat removal burden on the ECP.

In addition, performing the work just prior to a spring outage will ensure the 65 days are not exceeded since the unit is scheduled to shutdown for the spring refueling outage at the end of 65 days even if the upgrade is not completed. In Modes 5 and 6, the ECP is not required to be operable. The unit would not be allowed to startup from the refueling outage thereafter until the buried ECP supply line is returned to service and the line is capable (i.e., operable) of supplying the required ECP volume to the SWS intake bays.

The current ECP volume TS limit is 70 acre-ft (a level of 5.2 ft); however, the level is normally maintained ≥ 5.5 ft. During the ECP supply piping upgrade, this level range will be maintained, providing significant margin to the TS limit.

In addition, TS surveillance requirements (SRs) and PMs that have the potential to require SWS suction to be transferred to the ECP (including the activities associated with sluice gates, strainers, screens, etc.) will be performed, where possible, prior to the start of the ECP piping upgrade or after the ECP piping upgrade is completed. The SWS pumps, bays, traveling screens, and sluice gates that are important for ensuring cooling water is provided to the supported SSCs will be given protected train status. This will lessen the likelihood of inadvertent loss of required equipment.

Traveling screens will be inspected for debris and general physical condition at least once per shift. This will ensure proactive cleaning of the screens to ensure excessive debris does not hinder SWS flow from Lake Dardanelle. The shad nets will also be inspected for any gross physical damage or large quantities of debris twice a week, weather permitting, to ensure the nets remain intact and capable of performing the intended function.

An opening is provided in the net to allow local public access to the shore area. Prior to 2018, the opening was located upstream of the intake canal entrance. The normal lake and canal current would direct some of the dead fish through the net opening and into the canal. To prevent this, in 2018, the net opening was moved downstream from the canal opening so that any dead fish would either float past the opening or onto shoreline. As discussed previously, for the purposes of the proposed LCO Note, events that temporarily clog a SWS traveling screen or pump strainer are not considered a loss of Lake Dardanelle event. Station procedures dictate actions to recover from such events and provide limits for when a unit shutdown may be required should recovery actions be unsuccessful. These events are not expected to be long-lived as would be the case for the analyzed loss of Lake Dardanelle event. The proposed TS Bases changes supporting the subject LCO Note provides appropriate Operator guidance (see Attachment 2).

3.3 Risk Assessment Summary

As discussed in RG 1.177 the NRC has identified a four-element approach to evaluating proposed changes to a plant's design, operations, and other activities that require NRC approval. The four elements are as follows:

- Element 1: Define the Proposed Change (Sections 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, and 3.3)
- Element 2: Perform Engineering Analysis (Section 3.3 and Attachment 5)
- Element 3: Define Implementation and Monitoring Program (Sections 3.1 and 3.2)
- Element 4: Submit Proposed Change (ANO Letter 0CAN022102)

A risk assessment (Attachment 5) was performed to support this license amendment request. The basis of the risk assessment evaluated the 65-day period during the ANO ECP supply piping upgrade on one ANO unit at a time, in which the normal ECP system would be taken out of service and replaced with a temporary system to supply the SWS bays. While the proposed change does not involve TS completion times or surveillance frequencies, RG 1.177 and, by reference, RG 1.174 were used to determine the acceptability of the risk impact with respect to meeting the intent of the Commission's Safety Goal Policy Statement. The information below is a summary of the information in the PRA Report located in Attachment 5 of this submittal.

PRA Model

As modeled in the PRA, the ECP provides a shared heat sink between ANO-1 and ANO-2, utilizing each unit's SWS, for removing operating heat from safety-related components and decay heat from the reactor core and transferring it the ECP. The ECP system normally provides the SWS bays by gravity flow via mostly buried piping. During the 65-day ECP supply piping upgrade, the SWS will be supplied from the ECP with a temporary pumping system with the piping above ground.

The risk assessment considered the following features of the temporary pumping system:

- A skid-mounted, diesel-driven pump (DDP), with an attached secondary fuel tank (SFT), located close to the ECP intake and shoreline and surrounded by the DDP structure consisting of stacked concrete blocks or other suitable barriers;

- A strainer on the DDP suction located near the bottom of the ECP, with a check valve and manually operated butterfly discharge isolation valve near the DDP;

- A total of about 3000' of HDPE piping running above ground from the ECP to the DDP suction and then from the DDP discharge to the intake structure;

- Prior to entering the intake structure for each unit, the piping branches to separate feeds for SWS pump bays A and C, then transitions to carbon steel to supply the pump bays from above;

- One locked-open manual butterfly isolation valve to each SWS pump bay (not modeled); and

- One mechanical float-actuated level control valve for controlling level in each associated SWS pump bay.

Engineering Analysis

For a one-time change to a TS requirement, RG 1.177 identifies the risk metrics of merit to be the Incremental Conditional Core Damage Probability (ICCDP) and the Incremental Conditional Large Early Release Probability (ICLERP). These risk metrics account for the limited time in which the plant configuration change exists. In particular, the guidance in Sections 2.4 and 2.5 of RG 1.174, for annualized risk expressed as the change in Core Damage Frequency (ΔCDF) and the change in Large Early Release Frequency (ΔLERF), is not applicable because the amendment request does not propose a permanent TS change and does not result in a permanent change to the CDF or LERF.

The risk assessment comprised a blend of qualitative, quantitative, and reasonably bounding analyses.

- Transition risk was not addressed because no change is proposed to any requirement for a controlled shutdown (i.e., the time allocated to transition through hot standby to hot shutdown or to cold shutdown) after the ECP was removed from service (inoperable).

- Shutdown risk was addressed because ECP operability is proposed to be redefined, and the ECP is a system potentially needed for decay heat removal.

- The risk assessment focused on increased contributions to at-power risk because the conditions under which the ECP would be considered operable are proposed to be modified while remaining at-power.

- The at-power (ICCDP) (or at-power ICLERP) was calculated as the respective risk increase between a conditional configuration and a baseline configuration for the duration of 65 days that is proposed by the request.

- For Internal Events, Internal Flood, and Internal Fire, each respective at-power ICCDP (or at-power ICLERP) was based on the quantification of a suitable PRA model for that hazard.

- For seismic and high winds hazards where no suitable PRA model exists, each respective at-power ICCDP (or at-power ICLERP) was determined from a reasonably bounding analysis based on a simplified hazard model of a Loss of Offsite Power (LOOP) with no recovery and with the Alternate AC Diesel Generator (AACDG) and electrical bus crosstie postulated as representative surrogate failures.

- The risk assessment considered other hazards from the Individual Plant Examination for External Events (IPEEE) Program.

Refer to Attachment 5 for more details on the specific treatment of the above features and the associated risk modeling, and the calculated risk measures including uncertainty and sensitivity analysis.

An evaluation of the risk impacts and the compensatory actions that could mitigate the risk increase is as follows. As a bounding configuration, the risk assessment assumed the SWS pump bay B and SWS pump B would be out of service for the entire 65-day period.

The following compensatory actions were not specifically credited in the PRA but would mitigate some portion of the associated risk.

- A weekly briefing would maintain responsible personnel cognizant of the cues that would prompt operator action to start the DDP and open the discharge valve.

- Weekly start testing of the DDP would promote reliable execution of the operator action to start the DDP.

- A weekly walkdown of the temporary pumping system would ensure the normally locked open or locked closed manual isolation valves are maintained in the proper alignment.

See the full report in Attachment 5 for the evaluation of Uncertainty and Sensitivity Analysis.

Conclusion

The comparison of the change in plant risk relative to the acceptance guidelines shows that ANO-1 and ANO-2 maintain an ICCDP less than 1 X 10^{-6} and an ICLERP less than 1 X 10^{-7}. Therefore, the risk impact of the proposed one-time TS change was demonstrated to be acceptable based on the guidance in RG 1.177. This provides reasonable assurance that the risk increase is small and consistent with the intent of Commission's Safety Goal Policy Stations for the operations of nuclear power plants.

The most limiting PRA case that maintains the risk increase less than 1 X 10^{-6} for CDF and less than 1 X 10^{-7} for LERF shows that the amount of time the normal ECP supply can be unavailable with the temporary pumping system available is:

- 85 days (CDF) and 99 days (LERF) for ANO-1, and
- 75 days (CDF) and 88 days (LERF) for ANO-2.

Because an extended time interval between NRC approval of the LAR and the actual upgrade of the ECP supply piping may exist, Entergy will reassess the risk impact against the acceptance guidelines for a small risk increase as defined in RG 1.177 (ICCDP < 1E-6 and ICLERP < 1E-7) prior to entry into the 65-day preventative maintenance window. If either criterion is not met, Entergy will inform the NRC before proceeding. This is considered a regulatory commitment and is include in Attachment 4 of this enclosure.

3.4 Defense-in-Depth Principles

In addition to the contingencies and proactive measures to prevent anomalies (discussed above), the Work Management Program and the associated procedures and programs that implement the Maintenance Rule Program provide for controls and assessments to ensure system reliability, establishing the defense-in-depth principles described in RG 1.177 and RG 1.174. The following elements, as identified in RG 1.174, Section 2.1.1.2, have been evaluated. The impact of the proposed change on these elements is as follows:

- Preserve a reasonable balance among the layers of defense.

  Prevention of core damage depends on the ability to continuously remove decay heat after an initiating event with the UHS. During the ECP piping upgrade, if a DBA were to occur, the reservoir would remain available and provide a source of cooling to the SWS for decay heat removal. Should a failure occur in the Lake Dardanelle dam, the temporary ECP pumping system would be available to supply cooling water to the SWS. The temporary ECP system will be sized to deliver the design basis SWS flowrate to support two loops of SWS operation during normal shutdown or emergency shutdown (DBA). A dedicated person trained on operating the temporary pump system will be onsite 24 hours a day with direct communication to the Control Room during the ECP piping upgrade to start the pump when required such that the existing operations staff will not be challenged with additional actions.

  Dam operation or maintenance activities that could reduce the reservoir level will be coordinated with the Army Corp of Engineers to avoid the ECP upgrade window. Likewise, operation and maintenance activities that could reduce the ability of the intake screens and fish nets to remove debris will also be schedule outside the ECP upgrade window. Periodic inspections will be performed on the screens and fish nets to detect degradation and allow repair before loss of function. These actions will be taken to minimize the challenges to the plant due to a potential loss of reservoir level.

The installation of the temporary ECP pumping system as described in Section 3.1 and the temporary pipe spool pieces to restore the ECP buried pipe, provides defense-in-depth. This defense-in-depth measure is aimed at ensuring availability of the ECP as an UHS and maintaining the required flow to the SWS should an external flood occur. The current ECP design for delivering supply to the SWS pump bays is passive, except for the sluice gates. The temporary ECP pumping system is an active system. These differences were taken into account in the PRA and found to be a small increase to the overall plant risk. These defense-in-depth measures have been established to prevent core damage, containment release, and to preserve consequence mitigation. The ability of the Entergy staff to respond to an emergency at ANO is not impacted by this change.

- Preserve adequate capability of design features without an overreliance on programmatic activities as compensatory measures.

  The proposed change will allow the ECP to remain Operable while upgrades are being performed on ECP supply piping to the SWS. The ECP is one of two systems that makeup the UHS. The preferred system normally used to satisfy the UHS requirements for ANO, the Dardanelle Reservoir, will remain available and aligned to the SWS. A temporary pumping system from the ECP to the SWS will be installed as a compensatory measure to mitigate a loss of lake event. The temporary system (discussed in Section 3.2) is designed to provide the necessary flow to the SWS as the current ECP pipe supplies to the SWS during shutdown and emergency operation. There will be programmatic activities (see Section 3.2) established to enhance the reliability of the reservoir and the temporary pumping system. The addition of the temporary pumping system, the pre-planned ability to re-close the ECP pipe, and the availability the Dardanelle Reservoir ensures that there is not an overreliance on the programmatic activities. Therefore, the proposed change preserves adequate capability of design features without an overreliance on programmatic activities as compensatory measures.

- Preserve system redundancy, independence, and diversity commensurate with the expected frequency and consequences of challenges to the system, including consideration of uncertainty.

  The UHS function is provided by either the Lake Dardanelle Reservoir or the ECP for redundancy. The capability of the temporary pumping system has been shown to provide the necessary flow to meet the design basis SWS flow requirements. The interaction of the temporary pumping system with the ECP does not degrade the ECP ability to remove decay heat or its ability to withstand external events. The pump piping and valves used by the temporary system remain independent from offsite and onsite power. The ability of the temporary pumping system to withstand the wind and seismic events has been shown through risk insights to be equivalent to the existing ECP delivery system for the 65-day duration of the planned upgrade activity. Since the temporary ECP spool pieces will provide the ability to supply flow to the SWS pumps during a flood, ECP functionality will be restored to support safe shutdown. Therefore, the temporary ECP pumping system and piping provides an acceptable means to remove decay heat from the SWS and maintains UHS redundancy.

Independence between the two UHS sources will be maintained since operation and design of the existing Dardanelle Reservoir sluice gates that separate the two sources are not impacted by the temporary designs. The temporary ECP pumping system or piping spool pieces do not introduce any additional interactions between the two sources.

The method of cooling and the inventory quantity provided by the ECP will not change by use of the temporary ECP pumping system and piping, ensuring it remains diverse from the Dardanelle Reservoir.

The PRA analysis indicates that the proposed temporary ECP pumping system provides acceptable system redundancy, independence, and diversity commensurate with the expected frequency and consequences of challenges to the system, including consideration of uncertainty.

- Preserve adequate defense against potential Common Cause Failures (CCFs).

  Currently, there are no CCFs that could render both the Dardanelle Reservoir and the ECP incapable of supplying inventory to the SWS. As described in Section 2.1, both systems, the ECP and the Dardanelle Reservoir, feed the SWS pump bays separately. The temporary pumping system that will be in place while the ECP supply piping is being upgraded, will also feed the SWS from the ECP and is also separate from the Dardanelle Reservoir. Therefore, the proposed change preserves adequate defense against potential CCFs.

- Maintain multiple fission product barriers.

  The proposed change does not impact the three fission barriers. The SWS bays will continue to be supplied by the preferred source, the Dardanelle Reservoir, and if the Dardanelle Reservoir is not available, the temporary ECP pumping system is capable of supplying the required inventory to the SWS bays to meet the design basis. The probabilistic evaluations found that the risk increase to the plant during the period of the ECP upgrade with the temporary ECP pumping system available are within the NRC risk increase criteria (CDF $< 1 \times 10^{-6}$ and LERF $< 1 \times 10^{-7}$). Therefore, the proposed change maintains the multiple fission product barriers.

- Preserve sufficient defense against human errors.

  Entergy will provide management oversight and support for emergent issues to ensure the impact on the UHS is thoroughly evaluated. Defense-in-depth measures include a trained person with communication from the control room available to start and monitor the temporary ECP pumping system. The 65-day ECP allowance is scheduled to end at the start of a spring refueling outage which provides a backstop that prevents extension of the 65-day allowance. The temporary pumping system will be pre-staged and tested prior to the start of the 65-day allowance. Temporary ECP piping spool pieces will be staged shortly after opening the ECP buried piping. Pre-job briefs will be conducted prior to and during the evolution to reinforce good human performance behaviors and other barriers that reduce risk. Other defense-in-depth measures will be established, as outlined in Section 3.1, providing additional barriers that are intended to minimize the potential for human errors. Therefore, the proposed change preserves sufficient defense against human errors.

- Continue to meet the intent of the plant's design criteria.

  The intent of the ANO-1 and ANO-2 design criteria with respect to this activity is to ensure an ultimate heat sink is available for at least 30 days to support normal, shutdown, and emergency operations. The temporary ECP pumping system is a compensatory measure which provides an alternate means of delivering ECP water to the SWS pump bays. The temporary equipment is intended to provide features that maintain the ECP's ability to fulfill its required design function when utilized as planned during piping upgrade period. Although the temporary equipment and piping material will not be designed or manufactured to nuclear quality standards, the temporary pumping system will be tested to nuclear quality standards as identified in the ANO-1 and ANO-2 SAR. A system hydrostatic and functional test will be performed prior to placing the temporary pumping equipment in service to ensure the pressure boundary material meets design pressure and the equipment performs as designed. In addition, periodic pump test and physical inspections on accessible portions of the system will be performed to detect any future material degradation or reliability concerns. These measures will provide equivalent quality methods that demonstrate reasonable assurance as to the materials and equipment ability to function as designed.

  The temporary system pump, associated controls, fuel tank, and valve's seismic capability is substantiated through comparison to generic industry data. Based on the robustness of the temporary pumping system, the PRA found that the system provided sufficient capability to resist seismic events that have the potential to occur during the pipe upgrade window. A similar approach was taken with respect to wind resistance and tornado missile protection. While the system does not provide complete protection against high winds and tornado missiles, the PRA found that the wind capacity of the temporary ECP pumping system and the site features do provide sufficient protection against the potential wind events that could occur during the piping upgrade window. The external flooding event is not considered to occur coincident with any other events.

  Additional details regarding compliance with the 10 CFR 50, Appendix A, GDC are provided in Section 4.1 of this enclosure.

3.5 Safety Margin

An assessment of the principles from RG 1.177 and RG 1.174 have been evaluated to ensure sufficient safety margin is being maintained as a result of the proposed TS change.

The proposed change does not alter the assumptions or inputs in the accident analyses. The worst-case event with regard to the ECP is the loss of the Dardanelle Reservoir coincident with LOCA on ANO-2 with a normal shutdown of ANO-1 in progress. The temporary system and piping are sized to deliver the maximum design basis demand. The ECP maximum temperature, volume, flow requirements, and structural capability are not changed. Although the temporary equipment will not be manufactured under a 10 CFR 50, Appendix B, program, installation testing and inspections will demonstrate the functional and pressure capability of the equipment to meet design requirements which will provide reasonable assurance that the equipment is free of defects. While the physical protection of the temporary pumping system from wind and seismic events does not fully meet the SAR assumptions, enhanced capability to resist tornado and seismic events have been provided in the design of the temporary system.

The PRA results for the 65-day piping upgrade indicate that the risk is within the NRC guidance for acceptable change. Therefore, this TS change will not significantly affect safety margin in that sufficient safety margin is maintained and the accident analyses acceptance criteria are met.

The evaluations in Sections 3.1 through 3.4 and in this section have concluded the proposed licensing amendment is consistent with the principle (from RG 1.174 and RG 1.177) that sufficient safety margins are maintained.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

ANO-1 was not licensed to the 10 CFR 50, Appendix A, GDC. ANO-1 was originally designed to comply with the 70 "Proposed General Design Criteria for Nuclear Power Plant Construction Permits," published in July 1967. However, the ANO-1 Safety Analysis Report (SAR) provides a comparison with the Atomic Energy Commission (AEC) GDC published as Appendix A to 10 CFR 50 in 1971.

In addition, ANO-2 was not licensed to the 10 CFR 50, Appendix A, GDC. ANO-2 was originally designed to comply with the 70 "Proposed General Design Criteria for Nuclear Power Plant Construction Permits," published in July 1967. However, like ANO-1, the ANO-2 SAR provides a comparison with the AEC GDC published as Appendix A to 10 CFR 50 in 1971.

- GDC-5, *Shared of Structures, Systems, and Components* (SSCs)

  GDC 5 for ANO-1 and ANO-2 requires SSCs important to safety shall not be shared between nuclear power units unless it is shown that their ability to perform their safety function will not be significantly impaired by the sharing.

  The ECP serves as the source of emergency cooling water for simultaneously shutting down both ANO-1 and ANO-2 in the unlikely event of a loss of the Dardanelle Reservoir water inventory. The ECP is sized to contain sufficient water for dissipating the total combined heat transferred to the ANO-1 and ANO-2 SWSs during the design basis LOCA in one unit and a normal plant shutdown of the other unit, while limiting the cooling pond temperature to a maximum of 116 °F. The ECP is also sized to provide adequate fire protection water as part of the design basis. Separate suction and discharge water lines are used for supplying pond water to the ANO-1 and ANO-2 SWSs. The terminating ends of the lines at the cooling pond are housed in seismic Category 1 structures to prevent blockage of the pipe entrance and outlet.

- GDC-44, *Cooling Water*

  GDC-44 for both ANO-1 and ANO-2 requires a system to transfer heat from SSCs important to safety to a UHS to be provided. The system safety function shall be to transfer the combined heat load of these SSCs under normal operating and accident conditions. The UHS is also required to have redundancy and be able to withstand a single failure.

The ANO-1 and ANO-2 SSCs important to safety are cooled by the SWS. The SWS is redundant with two 100 percent capacity trains and three 100 percent capacity pumps which can be operated either from offsite power or from onsite emergency power. Two redundant sources of cooling water are available for reactor equipment to use as a UHS, the ECP and the Dardanelle Reservoir. These two sources feed the SWS separately and there is no single failure that could prohibit the UHS from meeting its design basis.

RG 1.174, "An Approach for using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 6), and RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications" (Reference 7), are applicable to this amendment request. The NRC staff has defined an acceptable approach to analyzing and evaluating proposed TS changes. This approach supports the NRC's desire to base its decisions on the results of traditional engineering evaluations, supported by insights (derived from the use of PRA methods) about the risk significance of the proposed changes. Decisions concerning proposed changes are expected to be reached in an integrated fashion, considering traditional engineering and risk information, and may be based on qualitative factors as well as quantitative analyses and information.

In implementing risk-informed decision making, TS changes are expected to meet a set of key principles. Some of these principles are written in terms typically used in traditional engineering decisions (e.g., defense-in-depth). Although written in these terms, it should be understood that risk analysis techniques can be, and are encouraged to be, used to help ensure and show that these principles are met. These principles include the following:

1. The proposed change meets current regulations unless it is explicitly related to a requested exemption or rule change.
2. The proposed change is consistent with defense-in-depth philosophy.
3. The proposed change maintains sufficient safety margins.
4. When proposed changes result in an increase in CDF or risk, the increases should be small and consistent with the Commission's Safety Goal Policy Statement.
5. The impact of the proposed change should be monitored using performance measurement strategies.

Each of these key safety principles are met as described in Sections 3.3 through 3.5 and Attachment 5.

RG 1.27, Revision 1, "Ultimate Heat Sink for Nuclear Power Plants" (Reference 1), is applicable to this amendment request. RG1.27, Revision 1, requires the UHS to perform two principal safety functions: (1) dissipation of residual heat after reactor shutdown and (2) dissipation of residual heat after an accident. In considering a multiple unit station, it is recognized that the design of each nuclear reactor unit includes sufficient safety in depth that it is highly unlikely that more than one reactor unit will be in an accident condition at any particular time. On this basis, the UHS complex serving multiple units should be capable of providing sufficient cooling water to permit simultaneous safe shutdown and cooldown of all units it serves and to maintain the units in a safe shutdown condition. Also, in the event of an accident in one unit, the UHS should be able to dissipate the heat for that accident safely, to permit concurrent safe shutdown and cooldown of the remaining units, and to maintain all of the units in a safe shutdown condition.

The UHS complex, whether composed of single or multiple water sources, should be capable of withstanding, without loss of the sink safety functions, the following events:

- The most severe natural phenomena expected taken individually,
- The site-related events (e.g. transportation accident, river diversion) that historically have occurred or that may occur during the plant lifetime.
- Reasonably probable combination of less severe phenomena and/or site-related events.
- A single failure of man-made structural features.

The UHS should consist of at least two sources, including the necessary retaining structures, each with the capability to perform the safety functions. While not discussed in RG 1.27, Revision 1, Operator action is allowed as discussed in RG 1.27, Revision 3, to switch from one UHS source to another.

The UHS sources for both ANO-1 and ANO-2 are the Dardanelle Reservoir and the ECP. While the Dardanelle Reservoir is the preferred source, the ECP is available in the unlikely event of the loss of the Dardanelle Reservoir. The design basis of the ANO UHS meets RG 1.27 by providing sufficient heat removal to shutdown one unit normally, shutdown both units normally, or shutdown of one unit normally with a simultaneous emergency shutdown of the other unit due to a LOCA.

Both the ECP and the Dardanelle Reservoir feed the SWS bays separately. There is no single failure that could prohibit the UHS from meeting its design basis as required by GDC 44 and Regulatory Guide 1.27.

The proposed change does not affect compliance with these regulations or guidance and will ensure that the lowest functional capabilities or performance levels of equipment required for safe operation are met.

4.2 Precedent

The following precedent is associated with extended outages of safety related equipment and not necessarily associated with modification of a UHS supply pipe.

- Brunswick – Control Room Emergency Ventilation System Instrumentation allowed to be considered Operable for a maximum of 63-Days during the upgrade of the control room air conditioning system (Reference 8)
- Seabrook – 60-Day Allowed Outage Time (AOT) received for CR HVAC to replace chilled water piping (Reference 9)
- Surry – 45-Day and 14-Day AOT received for CR and emergency switchgear room AC, and mechanical equipment room chilled water piping (Reference 10)
- Susquehanna – 14-day AOT received for RHR, UHS and ESW to replace buried ESW piping over 4 refueling outages (Reference 11)
- Callaway – 7-Day AOT received for essential SW to replace piping (Reference 12)

- Harris – 7-Day AOT received for Essential Chilled Water to perform maintenance (Reference 13)
- Limerick– 7-Day AOT received for SFC, RHR, RHRSW, ESW, and EDG to replace RHRSW piping (Reference 14)

4.3 No Significant Hazards Consideration Analysis

Entergy Operations, Inc. (Entergy) has evaluated the proposed changes to the Technical Specifications (TSs) using the criteria in 10 CFR 50.92 and has determined that the proposed changes do not involve a significant hazards consideration.

Entergy proposes a change to Arkansas Nuclear One, Unit 1 (ANO-1) TS 3.7.8, "Emergency Cooling Pond (ECP)," and ANO, Unit 2 (ANO-2) TS 3.7.4.1, "Emergency Cooling Pond," to allow the ECP to be considered operable on a one-time basis for up to 65 days during the proactive upgrade to the ECP supply piping, provided a loss of Lake Dardanelle event is not in progress and the Service Water System (SWS) is capable of being supplied from the ECP by a temporary pumping system should a loss of Lake Dardanelle occur. The proposed change permits the temporary pumping system to be unavailable for up to 72 hours, consistent with the TS allowance for an inoperable SWS loop, in order to perform testing or maintenance.

Basis for no significant hazards consideration determination: As required by 10 CFR 50.91(a), the no significant hazards consideration is presented below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed change has been evaluated using the risk-informed processes described in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications." The risk associated with the proposed change was found to be acceptably small and, therefore, not a significant increase in the probability or consequences of an accident previously evaluated.

   In addition, the proposed change does not affect the initiators of analyzed events or the assumed mitigation of accident or transient events. During the 65 days in which the ECP supply piping is being upgraded, cooling water to the SWS will continue to be supplied by the Dardanelle Reservoir, which is the preferred source during normal and emergency operation. The ultimate heat sink (UHS) and SWS will continue to perform the required functions during the 65-day period. If the temporary pumping system were to become unavailable for more than 72 hours or if a loss of Lake Dardanelle were to occur, the affected unit will be required to shutdown within 6 hours. Permitting the temporary pumping system to be removed from service for up to 72 hours is consistent with the time in which one of the two safety-related SWS loops may be inoperable in accordance with the TSs. In either case, safety functions are maintained by the availability of the Dardanelle Reservoir and the remaining operable SWS loop. As a result, accident probabilities and accident consequences are not affected by this proposed change.

Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   The proposed change does not involve a change in the UHS inventories relied upon to respond to plant transients. There is no alteration to the parameters within which the plant is normally operated or in the setpoints, which initiate protective or mitigative actions. The UHS and SWS will continue to perform the required safety functions since the Dardanelle Reservoir will remain available and a temporary pumping system will be capable of supplying the design basis ECP inventory to the SWS intake bays. Consequently, no new failure modes are introduced by the proposed change that would cause a new or different kind of accident.

   Therefore, this change does not create the possibility of a new or different kind of accident from an accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No

   Margin of safety is established through the design of the plant structures, systems, and components, the parameters within which the plant is operated, and the establishment of the setpoints for the actuation of equipment relied upon to respond to an accident or transient event. The proposed change does not prevent the UHS and SWS to perform the required safety functions. The preferred source of cooling water (Dardanelle Reservoir) to the SWS for normal and emergency conditions is expected to remain available. In addition, compensatory actions are also required to ensure the ECP inventory is available via a temporary pumping system or the buried pipe from the ECP to the SWS intake bays. Furthermore, the proposed change has been evaluated using the risk-informed processes described in RG 1.174 and RG 1.177 and found that the risk associated with the proposed change was found to be acceptably small.

   Therefore, this change does not involve a significant reduction in a margin of safety.

Based upon the reasoning presented above, Entergy concludes that the requested change involves no significant hazards consideration, as set forth in 10 CFR 50.92(c), “Issuance of Amendment.”

4.4 <u>Conclusions</u>

In conclusion, based on the considerations discussed above, (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.

5.0 ENVIRONMENTAL CONSIDERATION

The proposed change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, and would change an inspection or surveillance requirement. However, the proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed change.

6.0 REFERENCES

1. Regulatory Guide (RG) 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 1, (ML13038A084), March 1974.

2. U.S. Nuclear Regulatory Commission (NRC) NUREG-1430, Revision 4, "Standard Technical Specifications Babcock & Wilcox Plants," (ML12100A177), published April 2012.

3. NRC NUREG-1432, Revision 4, "Standard Technical Specifications Combustion Engineering Plants," (ML12102A165), published April 2012.

4. NRC NUREG-0212, Revision 0, "Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors," (ML17266A003), dated March 15, 1977.

5. Entergy Operations, Inc. (Entergy) letter to NRC, "Proposed Alternative to ASME Boiler & Pressure Vessel Code Section XI Requirements for Repair/Replacement of Emergency Cooling Pond (ECP) Supply Piping in accordance with 10 CFR 50.55a(z)(1)," Arkansas Nuclear One, Unit 1 and Unit 2, (0CAN072001) (ML20218A672), dated July 15, 2020.

6. RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, (ML17317A256), January 2018.

7. RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," Revision 1, (ML100910008), May 2011.

8. NRC letter to Carolina Power and Light Company, "Issuance of Amendment No. 191 to Facility Operating License No. DPR-71 and Amendment No. 222 to Facility Operating License No. DPR-62 Revising Technical Specifications Associated with the Control Room Emergency Ventilation System – Brunswick Steam Electric Plant, Units 1 and 2 (TAC Nos. MA0112 and MA0113)," (ML020370049), dated February 6, 1998.

9. NRC letter to North Atlantic Energy Service Corporation, "Seabrook Station Unit No. 1 – Issuance of Amendment Re: Control Room Air Conditioning Allowed Outage Time Extension (TAC No. MA5937)," (ML011920184), dated September 17, 1999.

10. NRC letter to Virginia Electric and Power Company, "Surry Power Station, Unit Nos. 1 and 2, Issuance of Amendments Regarding Replacement of Main Control Room and Emergency Switchgear Room Air-Conditioning System Chilled Water Piping (TAC Nos. MD4622 and MD4623)," (ML073480287), dated January 23, 2008.

11. NRC letter to Susquehanna Nuclear, LLC, "Susquehanna Steam Electric Station, Units 1 and 2 – Issuance of Amendment Nos. 275 and 257 Re: Temporary Changes to Allow Replacement of the Emergency Service Water System Piping (EPID L-2019-LLA-0004)," (ML19248A844), dated January 17, 2020.

12. NRC letter to Union Electric Company, Callaway Plant, Unit 1 – Issuance of Amendment Re: One-Time Extension of Completion Time for Essential Service Water System Piping Replacement (TAC No. MD7252), (ML082810643), dated October 31, 2008.

13. NRC letter to Shearon Harris Nuclear Power Plant, "Shearon Harris Nuclear Power Plant, Unit 1 – Issuance of Amendment No. 176 Regarding the Extension of the Essential Services Chilled Water System Allowed Outage Time and Removal of an Expired Note from Technical Specifications (EPID L-2019-LLA- 0025)," (ML20050D371), dated March 31, 2020.

14. NRC letter to Exelon Nuclear, "Limerick Generating Station, Units 1 and 2 – Issuance of Amendments Re: Allowed Outage Time Extensions to Support Residual Heat Removal Service Water Maintenance (TAC Nos. ME3551 and ME3552)," (ML111960066), dated July 29, 2011.

ATTACHMENTS

1. Technical Specification Page Markups

2. Technical Specification Bases Page Markups

3. Retyped Technical Specification Pages

4. List of Regulatory Commitments

5. Probabilistic Risk Assessment

6. Temporary ECP Pump System Configurations

Enclosure, Attachment 1

0CAN022102

Technical Specification Page Markups
(4 pages)

3.7 PLANT SYSTEMS

3.7.8 Emergency Cooling Pond (ECP)

LCO 3.7.8 The ECP shall be OPERABLE.

---NOTE--
The ECP may be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SWS intake bays provided:

a. A loss of Lake Dardanelle event is not in progress, and

b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Degradation of the ECP noted pursuant to SR 3.7.8.4 below or by other inspection.	A.1 Determine ECP remains acceptable for continued operation.	7 days
B. Required Action and associated Completion Time of Condition A not met. OR LCO not met for reasons other than Condition A.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

Move to next page

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.8.1	Verify that the indicated water level of the ECP is greater than or equal to that required for an ECP volume of 70 acre-ft.	In accordance with the Surveillance Frequency Control Program

Moved from Page 3.7.8-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.8.1	Verify that the indicated water level of the ECP is greater than or equal to that required for an ECP volume of 70 acre-ft.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.2	-------------------------------NOTE----------------------------- Only required to be performed from June 1 through September 30. --- Verify average water temperature is ≤ 100 °F.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.3	Perform soundings of the ECP to verify: 1. A contained water volume of ECP ≥ 70 acre-feet, and 2. The minimum indicated water level needed to ensure a volume of 70 acre-feet is maintained.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.4	Perform visual inspection of the ECP to verify conformance with design requirements.	In accordance with the Surveillance Frequency Control Program

PLANT SYSTEMS

3/4.7.4 EMERGENCY COOLING POND

LIMITING CONDITION FOR OPERATION

3.7.4.1 The emergency cooling pond (ECP) shall be OPERABLE[1] with:

a. A minimum contained water volume of 70 acre-feet.

b. An average water temperature of ≤ 100 °F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the volume and/or temperature requirements of the above specification not satisfied or, with the requirements of Action b not met, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. If degradation is noted pursuant to 4.7.4.1.d below or by other inspection, perform an evaluation to determine that the ECP remains acceptable for continued operation within 7 days.

SURVEILLANCE REQUIREMENTS

4.7.4.1 The ECP shall be determined OPERABLE:

a. In accordance with the Surveillance Frequency Control Program by verifying that the indicated water level of the ECP is greater than or equal to that required for an ECP volume of 70 acre-feet.

b. In accordance with the Surveillance Frequency Control Program during the period of June 1 through September 30 by verifying that the pond's average water temperature at the point of discharge from the pond is within its limit.

c. In accordance with the Surveillance Frequency Control Program by making soundings of the pond and verifying:

1. A contained water volume of ECP ≥ 70 acre-feet, and

2. The minimum indicated water level needed to ensure a volume of 70 acre-feet is maintained.

d. In accordance with the Surveillance Frequency Control Program by performance of a visual inspection of the ECP to verify conformance with design requirements.

Note 1: The ECP may be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SWS intake bays provided:

a. A loss of Lake Dardanelle event is not in progress, and

b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

Enclosure, Attachment 2

0CAN022102

Technical Specification Bases Page Markups – Information Only
(6 pages)

LCO

The ECP is a backup system that is required to be OPERABLE to support the SWS. To be considered OPERABLE, the ECP must contain a sufficient volume of water at or below the maximum temperature that would allow the SWS to operate for at least 30 days following the design basis event without exceeding the maximum design temperature of the equipment served by the SWS. To meet this condition, the ECP initial temperature should not exceed 100 °F, and the volume of water should not fall below 70 acre-feet during normal unit operation.

The LCO is modified by a Note which permits the ECP to be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SWS intake bays provided:

a. A loss of Lake Dardanelle event is not in progress, and

b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

For the purposes of the proposed LCO Note, a loss of Lake Dardanelle is considered an event that renders the Dardanelle Reservoir unavailable for an extended period of time, likely with no known time for recovery. Such events include failure of the downstream Dardanelle Dam, notification from the Army Corps of Engineers of more than a momentary draw down of lake level below 335 ft mean sea level (MSL), a major oil or chemical spill which renders Lake Dardanelle unfit for use to support cooling of station equipment, or any other event that would result in more than temporary lowering of the intake canal below 335 ft MSL.

Other events that may require short duration use of the temporary pumping system such as clogging of SWS traveling screens are controlled by station procedures and are not considered a loss of Lake Dardanelle event with respect to this LCO Note.

Once the LCO Note is applied, the Note may be reapplied during startup should a unit shutdown occur during the 65-day period. If a unit shutdown occurred early in the 65-day maintenance window, the LCO would be exited upon entry into Mode 5; however, the LCO Note may be reapplied when entering Mode 4 from Mode 5, with the start of the 65-day allowable period being retroactive to the initial application of the LCO Note prior to the unit shutdown. For example, if a unit shutdown occurs 10 days following the commencement of the ECP piping upgrade and the unit remains in Mode 5 for 12 days, the proposed LCO Note may be reapplied upon entry into Mode 4 during plant restart; however, the time remaining in the original 65-day ECP piping upgrade window has now been reduced to 43 days (65 - 10 – 12 = 43).

The temporary pumping system is considered capable of supplying the SWS from the ECP provided it can be aligned to at least two SWS bays without delay during a loss of Lake Dardanelle event. Application of this LCO Note also requires the following compensatory and/or defense-in-depth measures to be maintained during the 65-day ECP supply piping upgrade. Unforeseen circumstances which may invalidate one or more measures listed below are acceptable provided action is initiated immediately to restore the associated capability.

LCO (continued)

- The temporary pump will be tested and minimum flow requirements verified prior to removing the installed ECP supply piping from service.
- The Army Corps of Engineers will be briefed on the ECP piping upgrade activities and on the increased sensitivity of Lake Dardanelle level during the period of the ANO ECP piping upgrade. The Army Corps of Engineers will be requested to minimize any activity and provide advanced notification of activity that could impact the lake level or amount of debris in the lake.
- The 65-day allowance for the ECP to remain operable during the ECP supply piping upgrade will be applied only prior to a spring outage to provide additional margin to the TS maximum ECP temperature limit.
- The temporary pump system will be started to ensure its continued availability at least weekly.
- Personnel trained to start the pump will be dedicated and onsite 24 hours a day, stationed in reasonable proximity of the pump, during the ECP piping upgrade when the ECP temporary pump is being relied upon as a backup for the Dardanelle Reservoir, with direct communications with the respective Control Room.
- No elective maintenance or elective testing will be performed that could challenge the Dardanelle Reservoir SWS suction source.
- The SWS pumps, bays, traveling screens, and sluice gates that are important for ensuring cooling water is provided to the supported SSCs will be given protected train status.
- The intake traveling screens will be inspected for debris and general physical condition at least once per shift.
- The accessible portions of the temporary ECP system piping will be inspected weekly.
- Fish nets will be installed in the Dardanelle Reservoir SWS intake canal when required by existing winter operations procedural guidance and inspected for any gross physical damage or large quantities of debris twice a week, weather permitting, to ensure the nets remain intact and capable of performing the intended function.
- An adequate fuel supply will be maintained to supply the temporary pump for approximately 24 hours of continuous operation.
- At least once per week, a briefing will be conducted for applicable personnel to ensure individuals remain cognizant of the cues that would prompt operator action to start the temporary pumping system and open the discharge valve.
- The ECP level will be maintained ≥ 5.5 ft during the 65-day preventative maintenance window.

The first three items above are performed prior to initial entry into the 65-day ECP piping upgrade window. Because unforeseen circumstances could arise that may temporarily prevent meeting one of the other ongoing commitments during the maintenance window, the LCO Note remains applicable (i.e., the ECP may be considered to remain operable) provided action is taken to restore the commitment without delay. This is considered reasonable since failure to meet one or more ongoing commitments does not immediately render the temporary ECP pumping system unavailable.

LCO (continued)

With the conditions associated with the LCO Note as defined above not met, the ECP may no longer be considered OPERABLE and Condition B becomes applicable.

APPLICABILITY

In MODES 1, 2, 3, and 4, the ECP is a backup system that is required to support the OPERABILITY of the equipment serviced by the SWS and is required to be OPERABLE in these MODES.

In MODES 5 and 6, the OPERABILITY requirements of the ECP are determined by the systems it supports. Although the systems it supports may be required to be OPERABLE, the ECP is not required to meet the same OPERABILITY requirements in MODES 5 and 6 as it must in MODES 1, 2, 3, and 4. The definition of OPERABILITY embodies the principle that a system can perform its function(s) only if all necessary support systems are capable of performing their related support functions. If the supported system is capable of performing its safety function without reliance on the ECP, then the ECP is not required to be OPERABLE. Similarly, operation with the ECP in a less than fully qualified state is acceptable provided an assessment has been performed to determine that the supported system remains capable of performing its safety function. It is important to recognize that single failure criteria is not applicable in MODES 5 and 6. Therefore, the availability of Lake Dardanelle as a heat sink during periods of ECP unavailability may be acceptable provided the probability of a loss of lake and the time to respond to a loss of lake event are considered when planning ECP unavailability periods.

ACTIONS

A.1

If degradation is noted during performance of SR 3.7.8.4 or during other inspection, the impact on ECP OPERABILITY must be assessed. As discussed in the SR 3.7.8.4 Bases below, an engineering evaluation is performed of any apparent changes in visual appearance or other abnormal degradation to determine OPERABILITY. The Completion Time associated with this action is reasonable based on the low probability that a loss of the Dardanelle Reservoir would occur in any 7-day period. If, by evaluation, the ECP is determined to be inoperable at any point during the 7-day evaluation period, the ECP must immediately be declared inoperable and Action B applied.

B.1 and B.2

If the ECP is inoperable, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

3/4.7.4 EMERGENCY COOLING POND

The limitations on the E~~e~~mergency C~~c~~ooling P~~p~~ond (ECP) volume and temperature are based on worst case initial conditions which could be present considering a simultaneous normal shutdown of Unit 1 and emergency shutdown of Unit 2 following a LOCA in Unit 2, using the ECP as a heat sink. The minimum indicated ECP level of 5.2 feet is based on soundings and includes measurement, calculation, and other uncertainties (equivalent to 0.15 feet) to ensure a minimum contained water volume of 70 acre-feet (equivalent to an indicated level of 5.05 feet), crediting operator action to initiate makeup to the ECP upon a loss of Dardanelle Reservoir event as discussed below. These soundings ensure degradation is within acceptable limits such that the indicated level is consistent with the required volume and the pond meets its design basis. The measured ECP temperature at the discharge from the pond is considered a conservative average of total pond conditions since solar gain, wind speed, and thermal current effects throughout the pond will essentially be at equilibrium conditions under initial stagnant conditions. Visual inspections are performed to ensure erosion, undercut caused by wave action, or any physical degradation is within acceptable limits to enable the ECP to fulfill its safety function. An engineering evaluation shall be performed by a qualified engineer of any apparent changes in visual appearance or other abnormal degradation within 7 days to determine operability.

The limitations on minimum water level and maximum temperature are based on providing a 30-day cooling water supply to safety-related equipment without exceeding their design basis temperature and is consistent with the recommendations of Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Plants," March 1974. Operator action is credited in the inventory analysis during the transfer of the S~~s~~ervice W~~w~~ater S~~s~~ystem (SWS) to the pond. Specifically, pump returns are transferred to the pond shortly after a loss of lake event and pump suctions are transferred later in the event depending on pump bay level. In the time frame between the transfer of the returns and suctions to the pond, lake water is pumped into the pond, increasing level by at least 4.5 inches. This additional water is required, along with that maintained by Technical Specifications, to ensure a 66.9-inch pond depth, which ensures a 30-day supply of cooling water.

The LCO is modified by a Note which permits the ECP to be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SWS intake bays provided:

a. A loss of Lake Dardanelle event is not in progress, and

b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

For the purposes of the proposed LCO Note, a loss of Lake Dardanelle is considered an event that renders the Dardanelle Reservoir unavailable for an extended period of time, likely with no known time for recovery. Such events include failure of the downstream Dardanelle Dam, notification from the Army Corps of Engineers of more than a momentary draw down of lake level below 335 ft mean sea level (MSL), a major oil or chemical spill which renders Lake Dardanelle unfit for use to support cooling of station equipment, or any other event that would result in more than temporary lowering of the intake canal below 335 ft MSL.

Other events that may require short duration use of the temporary pumping system such as clogging of SWS traveling screens are controlled by station procedures and are not considered a loss of Lake Dardanelle event with respect to this LCO Note.

Once the LCO Note is applied, the Note may be reapplied during startup should a unit shutdown occur during the 65-day period. If a unit shutdown occurred early in the 65-day maintenance window, the LCO would be exited upon entry into Mode 5; however, the LCO Note may be reapplied when entering Mode 4 from Mode 5, with the start of the 65-day allowable period being retroactive to the initial application of the LCO Note prior to the unit shutdown. For example, if a unit shutdown occurs 10 days following the commencement of the ECP piping upgrade and the unit remains in Mode 5 for 12 days, the proposed LCO Note may be reapplied upon entry into Mode 4 during plant restart; however, the time remaining in the original 65-day ECP piping upgrade window has now been reduced to 43 days (65 - 10 – 12 = 43).

The temporary pumping system is considered capable of supplying the SWS from the ECP provided it can be aligned to at least two SWS bays without delay during a loss of Lake Dardanelle event. Application of this LCO Note also requires the following compensatory and/or defense-in-depth measures to be maintained during the 65-day ECP supply piping upgrade. Unforeseen circumstances which may invalidate one or more measures listed below are acceptable provided action is initiated immediately to restore the associated capability.

- The temporary pump will be tested and minimum flow requirements verified prior to removing the installed ECP supply piping from service.
- The Army Corps of Engineers will be briefed on the ECP piping upgrade activities and on the increased sensitivity of Lake Dardanelle level during the period of the ANO ECP piping upgrade. The Army Corps of Engineers will be requested to minimize any activity and provide advanced notification of activity that could impact the lake level or amount of debris in the lake.
- The 65-day allowance for the ECP to remain operable during the ECP supply piping upgrade will be applied only prior to a spring outage to provide additional margin to the TS maximum ECP temperature limit.
- The temporary pump system will be started to ensure its continued availability at least weekly.
- Personnel trained to start the pump will be dedicated and onsite 24 hours a day, stationed in reasonable proximity of the pump, during the ECP piping upgrade when the ECP temporary pump is being relied upon as a backup for the Dardanelle Reservoir, with direct communications with the respective Control Room.
- During the ANO-2 ECP piping upgrade, equipment will be staged near each ECP pipe opening to allow pipe closure, within 48 hours, when external flooding is projected to exceed 350 ft MSL.
- No elective maintenance or elective testing will be performed that could challenge the Dardanelle Reservoir SWS suction source.
- The SWS pumps, bays, traveling screens, and sluice gates that are important for ensuring cooling water is provided to the supported SSCs will be given protected train status.
- The intake traveling screens will be inspected for debris and general physical condition at least once per shift.

- The accessible portions of the temporary ECP system piping will be inspected weekly.
- Fish nets will be installed in the Dardanelle Reservoir SWS intake canal when required by existing winter operations procedural guidance and inspected for any gross physical damage or large quantities of debris twice a week, weather permitting, to ensure the nets remain intact and capable of performing the intended function.
- An adequate fuel supply will be maintained to supply the temporary pump for approximately 24 hours of continuous operation.
- At least once per week, a briefing will be conducted for applicable personnel to ensure individuals remain cognizant of the cues that would prompt operator action to start the temporary pumping system and open the discharge valve.
- The ECP level will be maintained ≥ 5.5 ft during the 65-day preventative maintenance window.

The first three items above are performed prior to initial entry into the 65-day ECP piping upgrade window. Because unforeseen circumstances could arise that may temporarily prevent meeting one of the other ongoing commitments during the maintenance window, the LCO Note remains applicable (i.e., the ECP may be considered to remain operable) provided action is taken to restore the commitment without delay. This is considered reasonable since failure to meet one or more ongoing commitments does not immediately render the temporary ECP pumping system unavailable.

With the conditions associated with the LCO Note (as defined above) not met, the ECP may no longer be considered OPERABLE and Condition B becomes applicable.

ACTION "a" permits the use of the provisions of LCO 3.0.4.c. This allowance permits entry into the applicable MODE(s) while relying on the ACTION.

3/4.7.5 FLOOD PROTECTION

The limitation on flood protection ensures that facility protective actions will be taken in the event of flood conditions.

Enclosure, Attachment 3

0CAN022102

Retyped Technical Specification Pages
(3 pages)

3.7 PLANT SYSTEMS

3.7.8 Emergency Cooling Pond (ECP)

LCO 3.7.8 The ECP shall be OPERABLE.

--NOTE--
The ECP may be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SWS intake bays provided:

a. A loss of Lake Dardanelle event is not in progress, and

b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Degradation of the ECP noted pursuant to SR 3.7.8.4 below or by other inspection.	A.1 Determine ECP remains acceptable for continued operation.	7 days
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> LCO not met for reasons other than Condition A.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.8.1	Verify that the indicated water level of the ECP is greater than or equal to that required for an ECP volume of 70 acre-ft.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.2	------------------------------NOTE---------------------------- Only required to be performed from June 1 through September 30. -- Verify average water temperature is ≤ 100 °F.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.3	Perform soundings of the ECP to verify: 1. A contained water volume of ECP ≥ 70 acre-feet, and 2. The minimum indicated water level needed to ensure a volume of 70 acre-feet is maintained.	In accordance with the Surveillance Frequency Control Program
SR 3.7.8.4	Perform visual inspection of the ECP to verify conformance with design requirements.	In accordance with the Surveillance Frequency Control Program

3/4.7.4 EMERGENCY COOLING POND

LIMITING CONDITION FOR OPERATION

3.7.4.1 The emergency cooling pond (ECP) shall be OPERABLE[1] with:

a. A minimum contained water volume of 70 acre-feet.

b. An average water temperature of ≤ 100 °F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the volume and/or temperature requirements of the above specification not satisfied or, with the requirements of Action b not met, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. If degradation is noted pursuant to 4.7.4.1.d below or by other inspection, perform an evaluation to determine that the ECP remains acceptable for continued operation within 7 days.

SURVEILLANCE REQUIREMENTS

4.7.4.1 The ECP shall be determined OPERABLE:

a. In accordance with the Surveillance Frequency Control Program by verifying that the indicated water level of the ECP is greater than or equal to that required for an ECP volume of 70 acre-feet.

b. In accordance with the Surveillance Frequency Control Program during the period of June 1 through September 30 by verifying that the pond's average water temperature at the point of discharge from the pond is within its limit.

c. In accordance with the Surveillance Frequency Control Program by making soundings of the pond and verifying:

1. A contained water volume of ECP ≥ 70 acre-feet, and

2. The minimum indicated water level needed to ensure a volume of 70 acre-feet is maintained.

d. In accordance with the Surveillance Frequency Control Program by performance of a visual inspection of the ECP to verify conformance with design requirements.

Note 1: The ECP may be considered OPERABLE on a one-time basis for up to 65 days during upgrade of the ECP supply piping to the SWS intake bays provided:

a. A loss of Lake Dardanelle event is not in progress, and

b. A temporary pumping system is capable of supplying the SWS from the ECP. The temporary pumping system may be unavailable for testing or necessary maintenance provided its availability is restored within 72 hours.

Enclosure, Attachment 4

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List of Regulatory Commitments

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
The temporary pump will be tested and minimum flow requirements verified.	✓		Prior to removing the installed ECP supply piping from service
The Army Corps of Engineers will be briefed on the ECP piping upgrade activities and on the increased sensitivity of Lake Dardanelle level during the period of the ANO ECP piping upgrade. The Army Corps will be requested to minimize any activity and provide advanced notification of activity that could impact the lake level or amount of debris in the lake.	✓		Prior to removing the installed ECP supply piping from service
The 65-day allowance for the ECP to remain operable during the ECP supply piping upgrade will be applied only prior to a spring outage to provide additional margin to the TS maximum ECP temperature limit.	✓		Prior to removing the installed ECP supply piping from service
The temporary pump system will be started to ensure its continued availability.		✓	Weekly until buried ECP piping is returned to service
Personnel trained to start the pump will be dedicated and onsite 24 hours a day, stationed in reasonable proximity of the pump, during the ECP piping upgrade when the ECP temporary pump is being relied upon as a backup for the Dardanelle Reservoir, with direct communications with the respective ANO Control Room.		✓	Ongoing until buried ECP piping is returned to service
During the ANO-2 ECP piping upgrade, equipment will be staged near each ECP pipe opening to allow pipe closure, within 48 hours, when external flooding is projected to exceed 350 ft MSL.		✓	Ongoing until buried ECP piping is returned to service

COMMITMENT	TYPE (check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
No elective maintenance or elective testing will be performed that could challenge the Dardanelle Reservoir SWS suction source.		✓	Ongoing until buried ECP piping is returned to service
The SWS pumps, bays, traveling screens, and sluice gates that are important for ensuring cooling water is provided to the supported SSCs will be given protected train status.		✓	Ongoing until buried ECP piping is returned to service
The intake traveling screens will be inspected for debris and general physical condition.		✓	Once per shift until buried ECP piping is returned to service
The accessible portions of the temporary ECP system piping will be inspected.		✓	Weekly until buried ECP piping is returned to service
Fish nets will be installed in the Dardanelle Reservoir SWS intake canal when required by existing winter operations procedural guidance and inspected for any gross physical damage or large quantities of debris to ensure the nets remain intact and capable of performing the intended function.		✓	Bi-weekly (weather permitting) until buried ECP piping is returned to service
An adequate fuel supply will be maintained to supply the temporary pump for approximately 24 hours of continuous operation.		✓	Ongoing until buried ECP piping is returned to service
A briefing will be conducted for applicable personnel to ensure individuals remain cognizant of the cues that would prompt Operator action to start the temporary pumping system and open the discharge valve.		✓	Weekly until buried ECP piping is returned to service
The ECP level will be maintained ≥ 5.5 ft.		✓	Ongoing during the 65-day preventative maintenance window

COMMITMENT	TYPE (check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Entergy will reassess the risk impact against the acceptance guidelines for a small risk increase as defined in RG 1.177 (ICCDP < 1E-6 and ICLERP < 1E-7) and will inform the NRC before proceeding if either criterion is not met.	✓		Prior to removing the installed ECP supply piping from service

Enclosure, Attachment 5

0CAN022102

Probabilistic Risk Assessment

PROBABILISTIC RISK ASSESSMENT

1. Risk Assessment and Probabilistic Risk Assessment (PRA) Insights

A risk assessment (Reference 1) was performed to support a risk-informed License Amendment Request (LAR) which would add a Note to Technical Specification (TS) Limiting Condition for Operation (LCO) 3.7.8, "Emergency Cooling Pond (ECP)," for Arkansas Nuclear One, Unit 1 (ANO-1) and LCO 3.7.4.1, "Emergency Cooling Pond," for ANO, Unit 2 (ANO-2). Although the proposed TS changes did not involve any change to a Completion Time (CT) or Surveillance Frequency, the risk assessment (Reference 1) followed the principles outlined in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications" (Reference 4), to determine the acceptability of the risk impact with respect to meeting the intent of the Commission's Safety Goal Policy Statement. ANO has no other risk-informed submittal currently under NRC review.

The provisions of Appendix B to 10 CFR Part 50 do not apply to the PRA.

ELEMENT 1: DEFINE THE PROPOSED CHANGE

Description of the TS Changes Being Proposed and the Reasons for Seeking the Changes

The LCO Note would permit the ECP to be considered operable on a one-time basis for up to 65 days, provided a loss of Lake Dardanelle event is not in progress and a temporary pumping system is capable of supplying the Service Water System (SWS) from the ECP. The LAR is required to permit the online implementation of a proactive upgrade of the ECP intake piping to the SWS pump bays which is anticipated to require more time than would be otherwise permitted. This proactive upgrade would be performed during the winter months and just prior to shutting down for a spring refueling outage.

As planned, the proactive upgrade would be implemented on only one unit at a time and will remove from service the ECP buried supply to all three SWS pump bays. In addition, each SWS pump will be removed from service, one at a time, to allow draining the associated pump bay and upgrading the ECP pipe end supplying the pump bay. At all times, two 100% capacity redundant SWS loops will remain in-service with suction from the Dardanelle Reservoir and with the ECP temporary pumping system available if needed. Consequently, there will be three unit-specific configurations. These configurations are designated AC, BC and AB for upgrading the buried ECP piping terminating in pump bays B, A, and C, respectively.

The risk assessment (Reference 1) considered the equipment alignment when working on SWS pump bay B, Configuration AC, to be the most limiting and the relevant equipment alignments are:

CONFIGURATION AC: ANO-1 Equipment Alignments When Working on SWS Pump Bay B

SG-1, Sluice Gate from Lake Dardanelle to SWS Pump Bay A	OPEN
SG-2, Sluice Gate from Lake Dardanelle to SWS Pump Bay C	OPEN
SG-3, Sluice Gate between SWS Pump Bay A and SWS Pump Bay B	CLOSED
SG-4, Sluice Gate between SWS Pump Bay B and SWS Pump Bay C	CLOSED

SG-5, Sluice Gate from ECP buried piping to SWS Pump Bay A	CLOSED
SG-6, Sluice Gate from ECP buried piping to SWS Pump Bay B	OPEN
SG-7, Sluice Gate from ECP buried piping to SWS Pump Bay C	CLOSED
SG-8, Sluice Gate at Inlet to ECP buried piping	OPEN
Temporary pumping system discharge to SWS Pump Bay A	Installed
Temporary pumping system discharge to SWS Pump Bay C	Installed

CONFIGURATION AC: ANO-2 Equipment Alignments When Working on SWS Pump Bay B

2CV-1470-1, Sluice Gate from Lake Dardanelle to SWS Pump Bay A	OPEN
2CV-1472-5, Sluice Gate from Lake Dardanelle to SWS Pump Bay B	CLOSED
2CV-1474-2, Sluice Gate from Lake Dardanelle to SWS Pump Bay C	OPEN
2CV-1471-1, Sluice Gate from ECP buried piping to SWS Pump Bay A	CLOSED
2CV-1473-5, Sluice Gate from ECP buried piping to SWS Pump Bay B	OPEN
2CV-1475-2, Sluice Gate from ECP buried piping to SWS Pump Bay C	CLOSED
2SW-1, Sluice Gate at Inlet to ECP buried piping	OPEN
Temporary pumping system discharge to SWS Pump Bay A	Installed
Temporary pumping system discharge to SWS Pump Bay B	Not Installed
Temporary pumping system discharge to SWS Pump Bay C	Installed

The risk assessment (Reference 1) qualitatively considered the risk associated with Configuration AC to bound the risk associated with Configuration BC, for which the equipment alignments when working on SWS pump bay A, are:

CONFIGURATION BC: ANO-1 Equipment Alignments When Working on SWS Pump Bay A

SG-1, Sluice Gate from Lake Dardanelle to SWS Pump Bay A	CLOSED
SG-2, Sluice Gate from Lake Dardanelle to SWS Pump Bay C	OPEN
SG-3, Sluice Gate between SWS Pump Bay A and SWS Pump Bay B	CLOSED
SG-4, Sluice Gate between SWS Pump Bay B and SWS Pump Bay C	OPEN
SG-5, Sluice Gate from ECP buried piping to SWS Pump Bay A	OPEN
SG-6, Sluice Gate from ECP buried piping to SWS Pump Bay B	CLOSED
SG-7, Sluice Gate from ECP buried piping to SWS Pump Bay C	CLOSED
SG-8, Sluice Gate at Inlet to ECP buried piping	OPEN
Temporary pumping system discharge to SWS Pump Bay A	Not Installed
Temporary pumping system discharge to SWS Pump Bay C	Installed

CONFIGURATION BC: ANO-2 Equipment Alignments When Working on SWS Pump Bay A

2CV-1470-1, Sluice Gate from Lake Dardanelle to SWS Pump Bay A	CLOSED
2CV-1472-5, Sluice Gate from Lake Dardanelle to SWS Pump Bay B	OPEN
2CV-1474-2, Sluice Gate from Lake Dardanelle to SWS Pump Bay C	OPEN
2CV-1471-1, Sluice Gate from ECP buried piping to SWS Pump Bay A	OPEN
2CV-1473-5, Sluice Gate from ECP buried piping to SWS Pump Bay B	CLOSED
2CV-1475-2, Sluice Gate from ECP buried piping to SWS Pump Bay C	CLOSED
2SW-1, Sluice Gate at Inlet to ECP buried piping	OPEN
Temporary pumping system discharge to SWS Pump Bay A	Not Installed
Temporary pumping system discharge to SWS Pump Bay B	Installed
Temporary pumping system discharge to SWS Pump Bay C	Installed

The risk assessment (Reference 1) also qualitatively considered the risk associated with Configuration AC to bound the risk associated with Configuration AB, for which the equipment alignment when working on SWS pump bay C are:

CONFIGURATION AB: ANO-1 Equipment Alignments When Working on SWS Pump Bay C

SG-1, Sluice Gate from Lake Dardanelle to SWS Pump Bay A	OPEN
SG-2, Sluice Gate from Lake Dardanelle to SWS Pump Bay C	CLOSED
SG-32, Sluice Gate between SWS Pump Bay A and SWS Pump Bay B	OPEN
SG-4, Sluice Gate between SWS Pump Bay B and SWS Pump Bay C	CLOSED
SG-5, Sluice Gate from ECP buried piping to SWS Pump Bay A	CLOSED
SG-6, Sluice Gate from ECP buried piping to SWS Pump Bay B	CLOSED
SG-7, Sluice Gate from ECP buried piping to SWS Pump Bay C	OPEN
SG-8, Sluice Gate at Inlet to ECP buried piping	OPEN
Temporary pumping system discharge to SWS Pump Bay A	Installed
Temporary pumping system discharge to SWS Pump Bay C	Not Installed

CONFIGURATION AB: ANO-2 Equipment Alignments When Working on SWS Pump Bay C

2CV-1470-1, Sluice Gate from Lake Dardanelle to SWS Pump Bay A	OPEN
2CV-1472-5, Sluice Gate from Lake Dardanelle to SWS Pump Bay B	OPEN
2CV-1474-2, Sluice Gate from Lake Dardanelle to SWS Pump Bay C	CLOSED
2CV-1471-1, Sluice Gate from ECP buried piping to SWS Pump Bay A	CLOSED
2CV-1473-5, Sluice Gate from ECP buried piping to SWS Pump Bay B	CLOSED
2CV-1475-2, Sluice Gate from ECP buried piping to SWS Pump Bay C	OPEN

2SW-1, Sluice Gate at Inlet to ECP buried piping	OPEN
Temporary pumping system discharge to SWS Pump Bay A	Installed
Temporary pumping system discharge to SWS Pump Bay B	Installed
Temporary pumping system discharge to SWS Pump Bay C	Not Installed

How the Affected Systems, Components, or Parameters are Modeled in the PRA

As modeled in the PRA, the ECP provides a shared heat sink, utilizing the SWS, for removing operating heat from safety-related components and decay heat from the reactor core and transferring it the ECP. Normally, the ECP serves as a backup for the SWS supply coming from Lake Dardanelle. Each buried pipe, one per unit, supplies water from the ECP through the associated sluice gates to the SWS pump bays A, B, and C on the respective unit. Operation of the ECP requires a combination of automatic and manual actions. Upon an applicable Engineered Safety Features (ESF) actuation, the SWS discharge automatically transitions from the returning to the lake to returning to the ECP. Operators then manually transfer the SWS suction from the Dardanelle Lake intake canal to the ECP. Water flows by gravity from the ECP through buried pipe to the appropriate SWS pump bay when the Control Room Operator opens the associated sluice gates from the ECP and closes the sluice gates from the Dardanelle Lake intake canal.

For Configuration AC, the risk assessment (Reference 1) modeled (or did not model) the following features of the temporary pumping system:

- A skid-mounted, diesel-driven pump (DDP), with an attached secondary fuel tank (SFT), located close to the ECP intake and shoreline. The DDP structure will be surrounded by stacked 6' x 2' blocks to a height of 8';
- A strainer on the DDP suction located near the bottom of the ECP, with a check valve and manually operated 24" butterfly discharge isolation valve near the DDP;
- A total of about 3000' of high density polyethylene (HDPE) piping running above ground from the ECP to the DDP suction and then from the DDP discharge to the intake structure,
- Prior to entering the intake structure for each unit, the piping branches to separate feeds for SWS pump bays A and C, then transitions to carbon steel (totaling about 70' for ANO-1 and 70’ for ANO-2) to supply the pump bays from above;
- One (per bay, totaling two per unit) locked-open 20" manual butterfly isolation valve (not modeled),
- One (per bay, totaling two per unit) mechanical float-actuated level control valve for controlling level in each associated SWS pump bay.

The temporary pumping system would be operated locally, including a manual start of the DDP, manual opening of the 24" butterfly discharge isolation valve, and, after about 20 hours of operation, alignment of a secondary fuel tank. The motive force to close each float-actuated level control valve would be provided by the upstream water pressure, such that no plant dependency would be introduced.

ELEMENT 2: PERFORM ENGINEERING ANALYSIS

Selection of Risk Metrics

For a one-time change to a TS requirement, RG 1.177 (Reference 4) identifies the risk metrics of merit to be the Incremental Conditional Core Damage Probability (ICCDP) and the Incremental Conditional Large Early Release Probability (ICLERP). These risk metrics account for the limited time in which the plant configuration change exists. In particular, the guidance in Sections 2.4 and 2.5 of RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 25) for annualized risk expressed as the change in Core Damage Frequency (ΔCDF) and the change in Large Early Release Frequency (ΔLERF) is not applicable because the LAR does not propose a permanent TS change and does not result in a permanent change to the CDF or LERF.

PRA Studies Related to the Proposed Change

The risk assessment (Reference 1) comprised a blend of qualitative, quantitative, and reasonably bounding analyses.

Transition risk was not addressed because the LAR does not propose to change any requirement for a controlled shutdown (i.e., the time allocated to transit through hot standby to hot shutdown or to cold shutdown) after the ECP is determined to be inoperable.

Shutdown risk was addressed because the LAR proposes to redefine operability for the ECP, which is a system potentially needed for decay heat removal. Because there was no suitable shutdown model, the risk assessment (Reference 1) addressed shutdown risk qualitatively. Since the temporary pumping system was designed to support the SWS as a functional alternative to the buried pipe and associated sluice gates, no significant increase in shutdown risk was identified.

The risk assessment (Reference 1) focused on increased contributions to at-power risk because the LAR proposed to modify the conditions under which the ECP would be considered operable while remaining at-power. Because the temporary pumping system was credited to maintain the operability of the ECP, the PRA did not treat the TS change proposed by the LAR as online or corrective maintenance. Likewise, the duration of 65 days was not treated as a change to an Allowed Outage Time or a Completion Time.

The at-power ICCDP (or at-power ICLERP) was calculated as the respective risk increase between a conditional configuration and a baseline configuration for the duration of 65 days that is proposed by the LAR. For the baseline configuration, the SWS pump bays were modeled as being supplied by the buried pipe from the ECP through the associated sluice gates. For the conditional configuration, the SWS pump bays were modeled as being supplied by the temporary pumping system instead of the normal ECP supply to the SWS pump bays. These metrics were determined with average equipment unavailability (i.e., nominal equipment out of service as permitted by the TS).

$$\text{ICCDP} = \Delta\text{CDF} * 65 \text{ days} = (\text{CDF}_{\text{TS Change}} - \text{CDF}_{\text{Baseline}})*(65 \text{ days})*(24 \text{ hours/day})/(8760 \text{ hours/year})$$

$$\text{ICLERP} = \Delta\text{LERF} * 65 \text{ days} = (\text{LERF}_{\text{TS Change}} - \text{LERF}_{\text{Baseline}})*(65 \text{ days})*(24 \text{ hours/day})/(8760 \text{ hours/year})$$

For Internal Events, Internal Flood, and Internal Fire, each respective at-power ICCDP (or at-power ICLERP) was based on the quantification of a suitable PRA model for that hazard. No change was made to these models to determine the $CDF_{Baseline}$ (and $LERF_{Baseline}$) for the baseline configuration. The applicability and acceptability of these baseline PRA models are addressed in Section 3.3.

For seismic and high winds hazards, where no suitable PRA model exists, each respective at-power ICCDP (or at-power ICLERP) was determined from a reasonably bounding analysis based on a simplified hazard model given a Loss of Offsite Power (LOOP) with no recovery and with the assumed failure of the Alternate AC Diesel Generator (AACDG) power supply and electrical breaker crosstie were postulated as representative surrogate failures. The development of those simplified hazard models is described in this section.

The risk assessment (Reference 1) considered other hazards from the Individual Plant Examination for External Events (IPEEE) Program. On a generic basis, a review of insights from NUREG-1742, "Perspectives Gained from the Individual Plant Examination of External Events (IPEEE) Program" (Reference 5), indicated external flooding as the only potential risk contributor of concern. The risk assessment (Reference 1) qualitatively screened external flooding because the temporary pumping system (which is not normally in operation and which is routed largely outside the main structures) would not change the external flooding profile or create another external flooding threat of consequence. On a site-specific basis, additional reviews (References 6 and 7) did not identify any other external hazard that would be significantly impacted by the temporary pumping system.

Changes Made to the PRA for Use in the TS Change Evaluation

For Internal Events, Internal Flood, and Fire, changes were made to determine the $CDF_{TS\ Change}$ (and $LERF_{TS\ Change}$) for the conditional configuration. Although the PRA models for ANO are unit specific, the PRA changes necessary to evaluate the TS change were the same for each unit, with some minor adjustments.

Internal Events

For the conditional configuration, the fault tree logic for the Internal Events model was changed to include flagging the flow path from the ECP through the buried pipe and associated sluice gates to the three SWS pump bays as failed and adding logic with Basic Events (BEs) to represent the relevant failure modes for components comprising the proposed temporary pumping system and the associated Human Failure Events (HFEs). Random failure probabilities were assigned based on plant Type Codes in the existing PRA model or on generic data from NUREGs. A Human Reliability Analysis (HRA) was performed to establish appropriate Human Error Probabilities (HEPs).

The failures represented by the BEs and the associated failure probabilities were:

Failure Description	Probability	Source
DDP Suction Strainer Plugs Fails during 24-Hour Mission Time	2.71E-05	Type Code: FLO PG
DDP Fails to Start on Demand	2.17E-03	Type Code: EDP FS
Discharge Check Valve Fails to Open on Demand	9.24E-06	Type Code: CKV CC
24" Manual Discharge Isolation Valve Fails to Open on Demand	4.59E-04	Type Code: XVM CC
DDP Fails to Run during First Hour	9.80E-04	Type Code: EDP F1
DDP Fails to Run during Hours 2 through 24	4.45E-02	Type Code: EDP FR
Secondary Fuel Tank Fails during 24-Hour Mission Time	4.32E-07	NUREG/CR-6268
Manual Fuel Transfer Valve Fails to Open on Demand	4.59E-04	Type Code: XVM CC
Level Control Valve SWS Bay A Fails to Open	1.33E-03	NUREG/CR-6928 HCV
Level Control Valve SWS Bay C Fails to Open		
Common Cause Failure of Both Level Control Valves to Open	2.64E-05	NUREG/CR-6268
Operator Fails (Cognitive) to Start DDP and Open Discharge Valve	2.18E-04	ANO-1 HRA
	1.17E-03	ANO-2 HRA
Operator Fails (Execution) to Start DDP and Open Discharge Valve	2.00E-03	HRA Calculator (SPAR-H)
Operator Fails to Open Fuel Transfer Valve	1.00E-03	HRA Calculator (SPAR-H)
Forklift Operator Impacts HDPE Piping	2.21E-05	See below

The level control valve operation was modeled as being similar to a hydraulic operated valve. The float is a mechanical arm and was assumed to be as reliable as a solenoid-type operator. Since the two level control valves are of similar design and function, the common cause failure was included using the alpha factor method generic value for two components taken from NUREG/CR-6268, "Common-Cause Failure Database and Analysis System: Event Data Collection, Classification, and Coding" (Reference 8).

The cognitive and execution portions of the HFE for starting the DDP and opening the DDP 24" discharge isolation valve were modeled separately to address a cognitive dependency with an existing HFE for transferring the SWS suction from Lake Dardanelle to the ECP. The operator inadvertent start of the DDP was not modeled due to the presence of the 24" manual discharge isolation valve preventing inadvertent flow to a pump bay.

The failure of the HDPE piping due to accidental impact from a forklift was modeled after observation of routine forklift movement near the proposed routing near the Cooling Tower. The probability of a single forklift event during the 24-hour mission time was based on an estimated frequency of non-fatal forklift accidents 8.3E-6/(forklift-hour) (Reference 10) and eight 20-minute forklift round trips per 24-hours.

No Test and Maintenance (TM) unavailability was modeled for the weekly testing because the proposed test would deadhead the pump against an initially closed 24" manual discharge isolation valve, and an operator action was already modeled to open that valve to initiated DDP operation. Because the possible misalignment of the normally locked (open or closed) manual isolation valves was considered unlikely, no Latent Human Error (LHE) was modeled. No spurious transfer of a manual valve was modeled because the relatively very low probability. The loss of service water initiating event frequency was not changed because the temporary pumping system was designed to support the SWS as a functional alternative to the buried pipe and associated sluice gates. No new internal initiating event was considered necessary because the temporary pumping system is independent of the plant and has no power, cooling, or control dependencies.

Assumptions for Internal Events

- Both units were assumed to be operating at-power during the 65 days proposed by the LAR.
- For the 65-day duration, the alignment of the SWS suction and discharge is expected to be from/to Lake Dardanelle.
- For the 65-day duration, the SWS pumps A and C were assumed to be aligned and running and not subject to unavailability due to planned testing or maintenance. SWS pump bay B and SWS pump B were assumed to be unavailable.
- The complete loss of the intake canal due to a shad kill event was assumed to be encompassed by the existing traveling screen plugging event based on a comparison of the respective frequencies.
- The time available to mitigate blockage due to a shad kill event was assumed to be 30 minutes.

<u>Internal Flooding</u>

For the conditional configuration, the fault tree logic for the Internal Flood model was changed to be consistent with the changes described for the Internal Events model. No new Internal Flood scenario was postulated outside the intake structure for the HDPE piping because the routing would generally avoid electrical manholes and PRA credited equipment, any equipment qualified for outdoor use would not be particularly vulnerable to spray, and the absence of physical structures would otherwise preclude the accumulation and retention of water. No new Internal Flood scenario was postulated inside the intake structure because the short lengths of pipe translate to a relatively low event frequency for spray or flood events, and the open door, coupled with no DDP operation while at standby, was credited to limit accumulation.

Assumptions for Internal Flooding

- Both units were assumed to be operating at-power during the 65 days proposed by the LAR.
- For the 65-day duration, the alignment of the SWS suction and discharge is expected to be from/to Lake Dardanelle.
- For the 65-day duration, the SWS pumps A and C were assumed to be aligned and running and not subject to unavailability due to planned testing or maintenance. SWS pump bay B and SWS pump B were assumed to be unavailable.

<u>Internal Fire</u>

For the conditional configuration, the fault tree logic for the Internal Fire model was changed to be consistent with the changes described for the Internal Events model. No new Internal Fire scenario was postulated because the DDP, as the only new ignition source, only had itself as a target and because the proposed routing of the HDPE piping would avoid making the HDPE a target for existing ignition sources.

Assumptions for Internal Fire

- Both units were assumed to be operating at-power during the 65 days proposed by the LAR.
- For the 65-day duration, the alignment of the SWS suction and discharge is expected to be from/to Lake Dardanelle.
- For the 65-day duration, the SWS pumps A and C were assumed to be aligned and running and not subject to unavailability due to planned testing or maintenance. SWS pump bay B and SWS pump B were assumed to be unavailable.

<u>Seismic Events</u>

Because no suitable PRA model existed, a simplified seismic PRA model was developed, addressing seismic equipment selection, seismic hazard, and seismic fragility. The risk assessment (Reference 1) assumed a dual unit LOOP, without recovery, to be the most likely surrogate failure and obtained the Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) by quantifying the Internal Events fault tree with the LOOP initiator set to 1.0 and all other initiators were set to zero. Seismic failure of the overall plant was assumed to result in a CCDP (or CLERP) of 1.0. Additional failure probabilities were postulated for seismic events based upon plant and equipment susceptibility to the hazard distribution.

Guidance from INL/CON-11-22248, "Development of Simplified Probabilistic Risk Assessment Model for Seismic Initiating Event" (Reference 11), was considered in the selection of the equipment to include in a simplified seismic PRA. Equipment that were not associated with the TS change were screened because those contributions were assumed to contribute to both the baseline configuration and the conditional configuration, having no impact on the delta risk assessment. As a conservative simplification, the buried piping from the ECP was assumed to have no seismic contribution in the baseline configuration (failure probability = 0) and to be unavailable (failure probability = 1) in the conditional configuration. As a backup to Lake Dardanelle, the bounding case for the ECP (with or without the temporary pumping system) would involve a loss of the intake canal water supply from Lake Dardanelle. For a seismic event, the risk assessment (Reference 1) postulated the failure mode to be the loss of the Lake Dardanelle dam and screened other SWS equipment failures where the availability of the ECP neither mitigated the seismic failure nor altered the seismic risk profile with the equipment failed due to a seismic event. For example, at the point that the availability of the Cooling Tower becomes a seismic concern, the temporary pumping system would provide no risk mitigation. Because LOOP, without recovery, was postulated as a surrogate failure, the Emergency Diesel Generators (EDGs), which are cooled by SWS, were also selected for the simplified seismic PRA. Of the equipment comprising the temporary pumping system, the strainer, manual valves, and piping were determined to be seismically rugged such that only the DDP, including the SFT, and the DDP structure were selected for the simplified seismic PRA. The seismic ruggedness of the float-actuated level control valve was assumed to be encompassed by the DDP. In selecting the DDP structure, the stacked blocks were postulated to topple during a seismic event and cause a loss of the DDP.

Therefore, within the limits of the general plant vulnerability to seismic events, the equipment selected for the simplified seismic PRA comprised the Lake Dardanelle dam, offsite power, the EDGs, the DDP (including the SFT), and the DDP structure.

In characterizing the seismic hazard, the risk assessment (Reference 1) converted the Mean Peak Ground Acceleration (PGA) curve tabulated for ANO in Table A-1a of Entergy Operations, Inc. (Entergy) letter to NRC 0CAN031404 (Reference 12) into seven discrete intervals of Mean PGA and determined an associated annual frequency of exceedance based on the geometric average of the upper and lower bounds of each interval. For each interval, the seismic capacity was derived for the selected equipment based on either generic estimates or the use of available High Confidence of Low Probability of Failure (HCLPF) capacity (i.e., 95% confidence of less than 5% probability of failure). As a point estimate based on a single mean fragility curve, the median ground peak acceleration capacity was determined from the HCLPF capacity and the composite uncertainty (β_C) representing both the epistemic (modeling) and aleatory (randomness) uncertainties:

$$F(mgpa) = HCLPF * e^{(2.325 * \beta_C)}$$

Where: β_C is the fragility logarithmic standard deviation.

The risk assessment (Reference 1) estimated the seismic fragility for the selected equipment. The plant-level fragility of 0.68g, with a β_C uncertainty of 0.35, was taken from a previous estimate (Reference 13) for ANO-1, resulting in 0.3 for the HCLPF. This plant-level fragility was assumed to be unaffected by the TS change and risk neutral. The HCLPF of 0.2g for the Dardanelle Dam was taken from a previous evaluation (Reference 14) for ANO, that concluded the dam would remain functional, and the risk assessment (Reference 1) assumed the more conservative β_C uncertainty of 0.35. The LOOP fragility of 0.3g, with a β_C uncertainty of 0.4, was taken from a generic estimate (Reference 15), resulting in 0.12 for the HCLPF. The risk assessment (Reference 1) noted that the failure mode was controlled by structural failures such as the ceramic insulators and assumed it to be insensitive to high frequency input. No amplification factor was applied since the components would be at ground level. For the EDGs, the IPEEEs (References 6 and 7) identified the oil storage tanks to be the limiting components with a HCLPF of 0.2g. However, based on the Electric Power Research Institute (EPRI) methodology (Reference 17) for developing seismic fragilities, the risk assessment (Reference 1) increased the HCLPF to 0.32g and assumed a β_C uncertainty of 0.40, with complete correlation of the EDGs. Complete correlation was assumed for the DDP and the DDP structure, the HCLPFs were estimated to be 0.2g, with the β_C uncertainties of 0.45, based on a review of generic information (Reference 15). The risk assessment (Reference 1) assumed the DDP was completely uncorrelated with the onsite EDGs. For the DDP structure, the failure mode was assumed to be toppling which would damage the DDP or the SFT.

For the seven discrete seismic event frequencies, the resulting probabilities of seismic failure of the selected equipment at the interval midpoint are summarized as:

Seismic Event			Equipment Failure Probability					
Interval	**Occurs Between**	**Frequency (/yr)**	**Plant**	**Dardanelle Dam**	**EDG**	**LOOP**	**DDP**	**DDP Structure**
1	0.1g and 0.3g	1.07E-04	2.47E-04	1.00E-02	2.33E-04	1.47E-01	1.00E-02	1.00E-02
2	0.3g and 0.5g	1.74E-05	6.64E-02	2.16E-01	3.86E-02	7.53E-01	2.16E-01	2.16E-01
3	0.5g and 0.75g	5.65E-06	4.10E-01	5.82E-01	2.57E-01	9.64E-01	5.82E-01	5.82E-01
4	0.75g and 1.0g	2.29E-06	7.68E-01	8.30E-01	5.75E-01	9.96E-01	8.30E-01	8.30E-01
5	1.0g and 1.5g	8.59E-07	9.60E-01	9.60E-01	8.60E-01	1.00E+00	9.60E-01	9.60E-01
6	1.5g and 3.0g	1.49E-07	1.00E+00	9.99E-01	9.95E-01	1.00E+00	9.99E-01	9.99E-01
7	3.0g and 10g	1.00E-07	1.00E+00	1.00E+00	9.99E-01	1.00E+00	1.00E+00	1.00E+00

As seismic acceleration increased, the component and structural fragilities increased, which increased the CCDP until the risk reaches 1.0. In letter 0CAN031404 (Reference 12), the plant median capacity was estimated to be reached at 0.7g, and a CCDP of 1.0 was estimated to be reached at approximately 1.25g.

A simplified seismic PRA model was constructed to convolute the frequencies of the seismic events and the equipment failure probabilities. The operation of the temporary pumping system was more relevant at lower seismic accelerations as the other failures of major components and structures control the risk at the upper intervals. For seismic intervals 6 and 7, only the plant level failure probability was modeled. More equipment failure probabilities were added for lower seismic intervals. For seismic intervals between 1 and 5, seismically induced Station Black Out (SBO) was included as a combination of LOOP and EDG failure probabilities. For seismic intervals between 1 and 4, the temporary pumping system, with associated failure probabilities, was credited for mitigating some portion of the risk. For seismic intervals between 1 and 3, the common cause failures of the EDGs were included for the SBO. For seismic intervals 1 and 2, the DDP HFE was included with the seismic contributions.

The simplified seismic PRA model was quantified with the ECP available, to obtain the $CDF_{Baseline}$, and with the ECP unavailable but with credit for the temporary pumping system, to obtain $CDF_{TS\ Change}$. To obtain the $LERF_{Baseline}$ and $LERF_{TS\ Change}$, the fraction of core damage events that lead to a large early release was assumed to be 10%.

Assumptions for Seismic Events

- Dual unit LOOP, with no recovery, postulated as the surrogate failure.
- The AACDG power supply was assumed to be failed because it can supply only one unit at a time.
- The unit crosstie using the AACDG supply bus was assumed to be failed by the external event.
- For the 65-day duration, the initial alignment of the SWS suction and discharge is from/to Lake Dardanelle.

- For the 65-day duration, the SWS pumps A and C were assumed to be aligned and running and not subject to unavailability due to planned testing or maintenance. SWS pump bay B and SWS pump B were assumed to be unavailable.
- The fraction of core damage events that lead to a large early release was assumed to be 10%.

High Winds

Because no suitable PRA model existed, a simplified high winds PRA model was developed, addressing high winds equipment selection, high winds frequency, missile strike probability, and wind loading fragility. The risk assessment (Reference 1) assumed a dual unit LOOP, without recovery, to be the most appropriate surrogate failure and postulated a loss of the intake canal water supply from Lake Dardanelle combined with the loss of the safety-related Condensate Storage Tank (Q-CST) to be the most limiting case. The postulated failure mode would be the loss of makeup to the Emergency Feedwater (EFW) from the Q-CST. The loss of the Q-CST required supplemental inventory to be supplied to the EFW from the SWS. During equipment selection, other SWS equipment failures were screened because the availability of the ECP neither mitigated the high winds induced failure nor altered the high wind or tornado risk profile with the equipment failed due to high winds. As was the case for the seismic hazard, at the point that the availability of the Cooling Tower becomes a high winds concern, the temporary pumping system would provide no risk mitigation.

Additional failure probabilities were postulated for high winds based upon plant and equipment susceptibility to the hazard distribution. For the temporary pumping system, the equipment selected for the simplified high winds model comprised the DDP, where the DDP structure provides protection except for high angle trajectory missiles, the DDP structure, where toppling from wind loading was addressed by structure failure, and the HDPE piping, where the proposed placement of Jersey Barriers on both sides providing missile protection for 10% of the exposed piping.

In characterizing the high winds hazard, tornadoes, and extreme straight-line winds were considered but hurricanes were excluded based on the geographical location. The risk assessment (Reference 1) used data on tornado-borne missiles and frequencies based on damage classes from the Tornado Missile Risk Evaluator (TMRE) evaluations (Reference 18) for ANO. Damage classes F0 and F1 were screened based on limited impact.

Data on extreme straight-line winds were developed from ANSI/ANS-2.3.2001 (Reference 19). For the wind speed range of a challenging straight-line wind, the lower bound (111 mph) was chosen to be consistent with the tornado hazard, and the maximum predicted wind speed (137 mph) was chosen as the upper bound. For this single bin, the risk assessment (Reference 1) assigned 4.47E-4 (/yr) as the frequency of exceedance based on the geometric mean of the frequencies of the upper and lower bounds.

For the Q-CST, the risk assessment (Reference 1) used the missile strike probability from a previous calculation (Reference 20). For the HDPE piping, the risk assessment (Reference 1) built upon the existing TMRE work to estimate the missile strike probability. Relative to the previous work, the risk assessment (Reference 1) used a conservative missile count for the zones in and adjacent to the proposed routing of the HDPE, as well as the amount of exposed area. Reasonable shielding provided by nearby buildings and other structures was credited with consideration for the probable direction for tornado tracks. The DDP structure was not considered susceptible to damage from missile strike and was credited with protecting the DDP (and SFT).

To estimate the potential damage due to wind loading, the risk assessment (Reference 1) considered the DDP structure to be similar to a masonry block wall with no grouted joints and estimated the probability of failure as comparable to a semi-enclosed structure (URM3) (Reference 21). The HDPE piping was not considered susceptible to damage from wind loading due to the anchorage by the Jersey barriers.

For the windspeed ranges of concern, the frequencies of exceedance and the resulting probabilities of failure due to high winds of the selected equipment are summarized as:

Wind		Windspeed Range (mph)	Frequency of Exceedance (/yr)	Probability of Damage By		
				Missile Strike		Wind Loading
Case	Event			Q-CST	HDPE Piping	DDP Structure
F2	Tornado	103-135	6.69E-04	3.05E-04	2.23E-02	0.50
F3	Tornado	136-168	1.53E-04	1.00E-03	7.33E-02	0.90
F4	Tornado	169-209	3.58E-05	2.28E-03	1.26E-01	0.98
F5	Tornado	210-277	5.96E-06	6.75E-03	3.19E-01	1.00
F6	Tornado	277-300	2.64E-07	1.05E-02	4.94E-01	1.00
W1	Straight-Line	111-137	4.47E-04			0.55

A simplified high winds model was constructed to convolute the frequencies of the wind events and the equipment failure probabilities. The temporary pumping system, with associated failure probabilities, was credited for mitigating some portion of the risk only for wind cases W1, F2, F3, and F4. For wind cases F5 and F6, only the surrogate plant-level failure probability was modeled.

Like the seismic hazard, the simplified high winds PRA model was quantified with the ECP available, to obtain the $CDF_{Baseline}$, and with the ECP unavailable but with credit for the temporary pumping system, to obtain $CDF_{TS\ Change}$. To obtain the $LERF_{Baseline}$ and $LERF_{TS\ Change}$, the fraction of core damage events that lead to a large early release was assumed to be 10%.

Assumptions for High Winds

- Dual unit LOOP, with no recovery, postulated as the surrogate failure.
- The AACDG power supply was assumed to be failed because it can supply only one unit at a time.
- The unit crosstie using the AACDG supply bus was assumed to be failed by the external event.
- For the 65-day duration, the initial alignment of the SWS suction and discharge is from/to Lake Dardanelle.

- For the 65-day duration, the SWS pumps A and C were assumed to be aligned and running and not subject to unavailability due to planned testing or maintenance. SWS pump bay B and SWS pump B were assumed to be unavailable.
- The fraction of core damage events that lead to a large early release was assumed to be 10%.

2. Summary of the Risk Measures Calculated Including Intermediate Results

Tier 1 – Evaluation of Impact on Plant Risk of the Proposed TS Change

The PRA models were quantified at appropriate truncation levels to ensure that significant underestimation, caused by truncation of cutsets, did not occur. ANO-2 Internal Events LERF would only quantify at 1E-10, but this was judged sufficient to examine the delta risk.

Because the Internal Events, Internal Flood, and Internal Fire models quantify CDF (and LERF) with a unit specific plant availability factor, P-A-F, (0.90 for ANO-1 and 0.89 for ANO-2), the ∆CDF (and ∆LERF) was adjusted to obtain the ICCDP (and ICLERP). For the seismic events and high winds contributions, this adjustment was only necessary for the surrogate LOOP CCDP (and CLERP) input from the Internal Events model, as the plant availability factor was not included in the quantification of the other inputs.

For the 65-day duration proposed by the LAR, the risk measures are summarized, with intermediate results, as:

Table 1: ANO-1 ICCDP by Hazard				
Hazard	**$CDF_{TS\ Change}$(/yr)**	**$CDF_{Baseline}$(/yr)**	**Multiplier**	**ICCDP**
Internal Events	6.79E-06	6.14E-06	(65*24/8760)/0.90	1.29E-07
Internal Flooding	3.83E-07	3.95E-07	(65*24/8760)/0.90	0.00E+00*
Internal Fire	3.68E-05	3.68E-05	(65*24/8760)/0.90	0.00E+00
High Winds	4.26E-07	4.94E-08	(65*24/8760)	6.71E-08
Seismic Events	1.08E-05	7.59E-06	(65*24/8760)	5.72E-07
Total ANO-1				7.67E-07

Table 2: ANO-2 ICCDP by Hazard				
Hazard	**$CDF_{TS\ Change}$(/yr)**	**$CDF_{Baseline}$(/yr)**	**Multiplier**	**ICCDP**
Internal Events	2.69E-06	1.54E-06	(65*24/8760)/0.89	2.30E-07
Internal Flooding	3.96E-06	3.94E-06	(65*24/8760)/0.89	4.00E-09
Internal Fire	5.31E-05	5.31E-05	(65*24/8760)/0.89	0.00E+00
High Winds	7.36E-07	3.56E-07	(65*24/8760)	6.77E-08
Seismic Events	1.09E-05	7.62E-06	(65*24/8760)	5.84E-07
Total ANO-2				8.86E-07

Table 3: ANO-1 ICLERP by Hazard				
Hazard	**$LERF_{TS\ Change}$(/yr)**	**$LERF_{Baseline}$(/yr)**	**Multiplier**	**ICLERP**
Internal Events	2.23E-08	1.74E-08	(65*24/8760)/0.90	9.70E-10
Internal Flooding	1.49E-08	1.57E-08	(65*24/8760)/0.90	0.00E+00*
Internal Fire	6.54E-06	6.54E-06	(65*24/8760)/0.90	0.00E+00
High Winds	4.26E-08	4.94E-09	(65*24/8760)	6.71E-09
Seismic Events	1.08E-06	7.59E-07	(65*24/8760)	5.72E-08
Total ANO-1				6.48E-08

Table 4: ANO-2 ICLERP by Hazard				
Hazard	**$LERF_{TS\ Change}$(/yr)**	**$LERF_{Baseline}$(/yr)**	**Multiplier**	**ICLERP**
Internal Events	9.36E-08	8.54E-08	(65*24/8760)/0.89	1.64E-09
Internal Flooding	5.01E-08	2.11E-08	(65*24/8760)/0.89	5.80E-09
Internal Fire	6.46E-06	6.45E-06	(65*24/8760)/0.89	2.00E-09
High Winds	7.36E-08	3.56E-08	(65*24/8760)	6.77E-09
Seismic Events	1.09E-06	7.62E-07	(65*24/8760)	5.84E-08
Total ANO-2				7.46E-08

* Zero is assigned for the decrease in risk which was attributed to the eliminate of a flooding scenario.

Tier 2 – Identification and Avoidance of Potentially High-Risk Configurations

As a bounding configuration, the risk assessment (Reference 1) was performed with the SWS pumps A and C, and associated sluice gates, aligned for operation, while the proactive upgrade was being implemented for SWS pump bay B. Under these conditions, the removal of a credited SWS pump from service, or the misalignment of the associated sluice gates, would present a high-risk configuration.

As the proactive upgrade transitions through the three configurations, existing TSs will ensure that two SWS pumps, including the associated sluice gates, are aligned for operation.

Tier 3 – Configuration Risk Management Program for Controlling Maintenance and Operational Risks

Based on a review of the dominant risk contributors in the Tier 2 evaluation, no change is proposed for the normal Configuration Risk Management Program (CRMP). The dominant risk contributors are external hazards for which no PRA model exists. These risks are driven by the estimated frequency of the external hazards and the postulated consequences. Neither of those factors are influenced by maintenance and operational activities permitted by existing and proposed TSs. As part of normal plant operation, the CRMP already addresses tornado response and the availability of Lake Dardanelle (Reference 8). Likewise, the existing TSs require operation of two SWS pumps.

Comparison of the Change in Plant Risk Relative to the Acceptance Guidelines

With an ICCDP less than 1.0E-06 and an ICLERP less than 1.0E-07, the risk impact of the one-time TS change proposed by the LAR was demonstrated to be acceptable based on the guidance in RG 1.177 (Reference 4). This provides reasonable assurance that the risk increase is small and consistent with the intent of Commission's Safety Goal Policy Stations for the operations of nuclear power plants.

Summary of the Risk Impacts and Compensatory Actions that could Mitigate the Risk Increase

As a bounding configuration, the risk assessment (Reference 1) assumed the SWS pump bay B and SWS pump B would be out of service for the entire 65 days proposed by the LAR. However, the risk impact could be mitigated to the extent that the implementation of the proactive upgrade can limit the duration of the SWS pump being out of service due to the drain down of the SWS pump bay.

The following compensatory actions were not specifically credited in the PRA but would mitigate some portion of the associated risk.

- A weekly briefing would ensure responsible personnel are cognizant of the cues that would prompt operator action to start the DDP and open the discharge valve.
- Weekly start testing of the DDP would promote reliable execution of the operator action to start the DDP.
- A weekly walkdown of the temporary pumping system would ensure the normally locked open or locked closed manual isolation valves are maintained in the proper alignment.

Evaluation of Uncertainty and Sensitivity Analysis Performed

Uncertainty was given appropriate consideration in the analyses and interpretation of the findings. However, a detailed uncertainty assessment was not performed for all aspects since the risk insights were driven by the seismic initiating event. Qualitatively, uncertainty exists in the assumptions made to develop the simplified models for seismic events and high winds. Other hazards were screened.

Parameter uncertainties include equipment failure rates, initiating event frequencies, and HEPs. The hazard curve was taken as a mean value bounding PGA curve. The uncertainty for large seismic events can span several orders of magnitude and could alter the results. This impact was limited to some extent by the assumption that the higher acceleration seismic events would result in similar core damage for both the baseline and conditional configurations. The plant-level fragility was based on the IPEEE results that were developed prior to year 2000. Methods and inputs to the floor response spectra have changed, and the IPEEE may be no longer valid. As documented in the risk assessment (Reference 1), the work performed and documented in letter 0CAN031404 (Reference 12) examined this uncertainty and found that the IPEEE still bounded the current state of knowledge.

As a sensitivity, the risk assessment (Reference 1) considered a β_C uncertainty of 0.45, prior to selecting the β_C uncertainty of 0.35 for the Dardanelle Dam. The smaller uncertainty was conservatively selected because the reduced uncertainty spread resulted in the median being closer to the HCLPF.

Model uncertainty, especially completeness uncertainty, exists in the simplified models. However, these simplified models provided an appropriate level of detail for the simple design of the temporary pumping system and the single function provided as an alternative to the Dardanelle Lake source. No new initiating event was introduced, and no system success criterion or accident sequence progression was changed.

The treatment for uncertainties from NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk Informed Decision Making" (Reference 22), is applicable for risk assessments supporting a regulatory submittal. This risk assessment concluded that the temporary pumping system would allow a proactive upgrade of the ECP intake piping to the SWS intake structure for a 65-day period while meeting numerical acceptance criteria for increase in ICCDP and ICLERP.

Due to the simple configuration for the temporary pumping system, these changes in risk arose predominantly from the high winds and seismic events. That is, the risk assessments for Internal Events, Internal Flooding, and Fire did not show a significant change in risk during the period when the buried ECP piping is unavailable. External flooding was screened. The PRA model was modified with the appropriate level of detail for this activity, modeling the intake strainer, DDP, check valve, manual valve, fuel oil supply, and level control valve. The protective structure credited for the high winds hazard was considered for seismic fragility, and the temporary piping was evaluated for damage. Note that this temporary pumping system does not introduce any new initiating events or alter system success criteria or accident sequence progression. The temporary pumping system was only credited in the event of failure of the Dardanelle Dam or other events causing loss of supply to the SWS intake structure.

The installation of the alternate pathway did not introduce new fire ignition sources or new fire targets or provide additional combustible loading in fire areas; therefore, it was screened. Except for a small segment in the SWS intake structure, the temporary pumping system was largely exterior to the power block and did not create any additional internal flood source. Because the temporary pumping system was normally isolated, this contribution was screened.

The treatment of uncertainties for the temporary pumping system was limited to those hazards that contribute to a change in risk: high winds and seismic events. For the seismic hazard, the DDP and the DDP structure were selected for fragility development along with consideration of the Dardanelle Dam, a LOOP, the EDGs (and fuel oil supply), and the plant level fragility. The uncertainty for the DDP and DDP structure used an uncertainty characterization, or βc of 0.45. The uncertainty estimate is typically in a range between 0.35 and 0.45 (Reference 13), with the larger value indicating more uncertainty about the median, consistent with guidance in ASME/ANS RA-Sb-2013 (Reference 23) for seismic fragility analysis. In a similar fashion for high winds, the DDP was selected for fragility develop. The DDP would be protected by the DDP structure. Thus, the high wind fragility of the DDP was based on the fragility curve for the DDP structure, curve URM3 (Reference 24), as an average wall response.

The failure of the DDP structure is an important failure mode for high winds. A sensitivity was conducted to estimate the impact of assuming a lower fragility. The sensitivity assumed a more conservative estimate for wall performance embodied by class URM4, and the fragility assessment for the DDP wall was reassessed. Using the lower fragility, a higher probability of failure was generated. The sensitivity case resulted in a factor of two increase in probability of failure due to wind loading for the same wind loading. This increased probability of failure was applied for the lowest windspeeds encompassing the straight-line wind (W1) and the lowest analyzed tornado (F2) initiators. The change had no impact on the higher tornado classes because the base case assessment already predicted wall collapse. The revised probabilities were included in the model and the model was quantified. The results of the sensitivity were compared to the current change in risk to determine the sensitivity of the overall risk increase to the DDP wall fragility. The conservative wall fragility increased the baseline risk increase by approximately 2% for both ANO-1 and ANO- 2 assessments. This was considered a small increase and would not alter the current conclusions or time estimates.

In modeling one SWS pump being removed from service, consideration was given to altering the common cause grouping from a group of three to a group of two. A sensitivity study concluded the small increase in SWS failure probability would have a negligible impact on the overall results, based on the small impact on the probability and the low importance of the common cause failure events.

3. Section 1 and 2 References

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23. ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," February 2009.
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4. Applicability and Acceptability of the PRA Models

Peer Reviews, Outstanding Findings, and Supporting Requirements Not Meeting Capability Category II

The PRA models have been subjected to a series of Peer Reviews against the ASME/ANS PRA Standards, as endorsed by Regulatory Guide 1.200, and in accordance with applicable industry guidance. Model changes have been implemented to resolve Findings, and those Findings have been subjected to closure reviews. The results of those reviews are summarized to document the acceptability of the PRA models.

Internal Events Peer Reviews

For the ANO-1 Internal Events At-Power PRA, each applicable Supporting Requirement (SR) in Part 2 of ASME/ANS RA-Sa-2009 (Reference 8), as endorsed by RG 1.200, Revision 2 (Reference 24), has been assessed as meeting at least Capability Category (CC) II with no open Finding and Observation (F&O). An August 2009 Peer Review (Reference 1) was conducted for ANO-1 against Part 2 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 05-04, "Process for Performing Internal Events PRA Peer Reviews using the ASME/ANS PRA Standard," Revision 2 (Reference 25). A September 2019 Focused Scope Peer Review (Reference 2) of the LERF Technical Element (TE) was conducted for ANO-1 against Part 2 of ASME/ANS RA-Sa-2009, as endorsed by Regulatory Guide 1.200, Revision 2, using the process described in NEI 05-04, Revision 2. A Finding Level F&O Independent Assessment (Reference 3) was performed in accordance Appendix X of NEI 05-04, Revision 3 (Reference 27), and concluded that all ANO-1 Finding F&Os from prior peer reviews were closed after model maintenance and that each applicable SR was met at CCII or better.

For the ANO-2 Internal Events At-Power PRA, each applicable SR in Part 2 (except SR QU-D3) of either ASME/ANS RA-Sb-2005 (Reference 7), as endorsed by RG1.200, Revision 1 (Reference 26), or ASME/ANS RA-Sb-2009 (Reference 8), as endorsed by RG 1.200, Revision 2 (Reference 24), has been assessed as meeting at least CCII with no open Finding F&O. A July 2008 Peer Review (Reference 4) was conducted for ANO-2 against Part 2 of ASME/ANS RA-Sb-2005, as endorsed by RG 1.200, Revision 1, using the process described in draft Revision 1 of NEI 05-04. A September 2019 Focused Scope Peer Review (Reference 5) of the LERF TE was conducted for ANO-2 against Part 2 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 05-04, Revision 3 (Reference 27). A Finding Level F&O Independent Assessment (Reference 6) was performed in accordance Appendix X of NEI 05-04, Revision 3 (Reference 27), and concluded that all ANO-2 Finding F&Os from prior peer reviews were closed after model maintenance and that each applicable SR was met at CCII or better.

1) As documented in LTR-RAM-II-08-020 (Reference 4), SR QU-D3 from ASME/ANS RA-Sb-2005 was not assessed as meeting CCII for which a Suggestion F&O QU-D3-01 was initiated. SR QU-D3 from ASME/ANS RA-Sb-2005 (Reference 7) is now SR QU-D4 from ASME/ANS RA-Sb-2009 (Reference 8), which requires for CCII/III a comparison of results to those from similar plants and the identification of cause for significant differences.

Suggestion F&O QU-D3-01 noted, *ANO2 used the Mitigating Systems Performance Indicator (MSPI) cross comparison report. The MSPI cross comparison compared component importances of similar plants for the five systems in the MSPI program. These are EDGs, Emergency Feedwater (EFW), High Pressure Safety Injection (HPSI), Residual Heat Removal (RHR), and Cooling Water. However, the MSPI comparison is based on component and system importance. The MSPI report does not allow comparison by Initiating Event and Sequence Type, which is the intention of the requirement, as indicated by the example.*

Suggestion F&O QU-D3-01 has been resolved sufficiently for SR QU-D3 to be assessed as meeting CCI/II/III. As documented for Model Change Request (MCR) A2-3139 in the MCR Database (Reference 9), Section 5.3 was added to the I&Q report based on a comparison provided by Entergy. The comparison was updated to reflect recent model changes. Tables 4 and 5 of the Quantification notebook were verified to be updated with current results.

Internal Flooding Peer Reviews

For the ANO-1 Internal Flooding At-Power PRA, each applicable SR in Part 3 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, has been assessed as meeting at least CCII with no open Finding F&O. An April 2017 Peer Review (Reference 11) was conducted for ANO-1 against Part 3 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 05-04, Revision 2 (Reference 25). A Finding Level F&O Independent Assessment (Reference 3) was performed in accordance Appendix X of NEI 05-04, Revision 3 (Reference 27), and concluded that all ANO-1 Finding F&Os from prior peer reviews were closed after model maintenance and that each applicable SR was met at CCII or better.

For the ANO-2 Internal Flooding At-Power PRA, each applicable SR in Part 3 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, has been assessed as meeting at least CCII with no open Finding F&O. An April 2017 Peer Review (Reference 12) was conducted for ANO-2 against Part 3 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 05-04, Revision 2 (Reference 25). A Finding Level F&O Independent Assessment (Reference 6) was performed in accordance Appendix X of NEI 05-04, Revision 3 (Reference 27), and concluded that all ANO-2 Finding F&Os from prior peer reviews were closed after model maintenance and that each applicable SR was met at CCII or better.

Internal Fire Peer Reviews

For the ANO-1 Internal Fire At-Power PRA, each applicable SR in Part 4 (except SR CF-A2 and SR HRA-D1) of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, has been assessed as meeting at least CCII with no open Finding F&O. A January 2010 Peer Review (Reference 13) was conducted for ANO-1 against Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in draft Version E of NEI 07-12, "Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines" (Reference 28). A November 2012 Focused Scope Peer Review (Reference 14) of certain High Level Requirements (HLRs) for the Fire Scenario Selection (FSS) TE was conducted for ANO-1 against Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 07-12, Revision 1 (Reference 28). A June 2014 Focused Scope Peer

Review (Reference 15) of certain HLRs for the Fire HRA TE was conducted for ANO-1 against Part 2 and Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 05-04, Revision 3 (Reference 27). A Finding Level F&O Independent Assessment (Reference 3) was performed in accordance Appendix X of NEI 07-12, Revision 1 (Reference 28), and concluded that all ANO-1 Finding F&Os from prior peer reviews were closed after model maintenance and that each applicable SR was met at CCII or better.

1) As documented in LTR-RAM-II-10-003 (Reference 13), SR CF-A2 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which a Suggestion F&O CF-A2-01 was initiated. SR CF-A2 from ASME/ANS RA-Sb-2009 (Reference 8) requires for CCI/II/III the characterization of the uncertainty associated with the applied conditional failure probability.

   Suggestion F&O CF-A2-01 noted, *The summary report, Appendix D for Task 10 characterizes the uncertainty associated with method employed in determining failure probabilities. The conclusion of this report is that the "application of circuit failure probabilities is considered to have minimal impact on the results." Though it may be that a detailed analysis technique was followed for dominant scenarios, these failures are still in the dominant sequences. Therefore, the accuracy and uncertainty associated with these values would have a significant impact on the results.*

   Suggestion F&O CF-A2-01 has been resolved sufficiently for SR CF-A2 to be assessed as meeting at CCI/II/III. As documented in ENTCORP50-ANO1-01 (Reference 16), the Uncertainty analysis for the ANO-1 FPRA model includes propagation of uncertainty for circuit failure model probabilities. The Hot Short Probabilities (HSPs) were incorporated using a similar approach to the fire ignition frequencies. A type code was developed for each HSP utilized in the ANO-1 model. The mean and its associated variance were assigned based on the information in NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE)" (Reference 29). This was done to correlate uncertainty in the HSPs associated with each fire scenario. This approach avoided the inappropriate assumption that the scenario frequencies are independent of each other. Latin Hypercube sampling was performed to propagate parametric uncertainties through the ANO-1 FPRA model to generate probability distributions for ANO-1 fire CDF and LERF.

2) As documented in LTR-RAM-II-10-003 (Reference 13), SR HRA-D1 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which no F&O was initiated. SR HRA-D1 from ASME/ANS RA-Sa-2009 (Reference 8) requires for CCII the inclusion of operator recovery actions that can restore the functions, systems, or components on an as-needed basis to provide a more realistic evaluation of significant accident sequences.

   The assessment of SR HRA-D1 noted, *One recovery action is incorporated into the PRA model for multiple loss of DC breaker for 4160 bus events, which have an accident sequence associated with them. The event found indicates that recovery actions were incorporated for significant sequences rather than universally. The identification of all recovery actions used in the model is documented in Attachment D of ANO-1 Fire HRA Notebook (Report 0247060006.03-U1). Most fire-specific recoveries used screening values so this was set as CC-1.*

This issue has been resolved sufficiently for SR HRA-D1 to be assessed as meeting CCII. The ANO-1 HRA methodology was revised consistent with the approach used to address ANO-2 National Fire Protection Association (NFPA) 805 LAR NRC requests for additional information (RAIs). As documented in ENTCORP50-ANO1-01 (Reference 16), the revised methodology uses the NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines," (Reference 30) methodology with detailed HEPs developed for each HFE credited in the FPRA. All events used in the FPRA have been developed and documented using the same methods used for the internal events HEPs.

For the ANO-2 Internal Fire At-Power PRA, each applicable SR in Part 4 (except SR PP-B2, SR PP-B3, SR PP-B5, SR CS-B1, and SR IGN-A10) of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, has been assessed as meeting at least CCII with no open Finding F&O. A September 2009 Peer Review (Reference 17) was conducted for ANO-2 against Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in draft Version E of NEI 07-12. A December 2011 Focused Scope Peer Review (Reference 18) of certain HLRs for the FSS TE was conducted for ANO-2 against Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 07-12, Revision 1 (Reference 28). Another November 2012 Focused Scope Peer Review (Reference 19) of certain HLRs for the FSS TE was conducted for ANO-2 against Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 07-12, Revision 1 (Reference 28). A June 2014 Focused Scope Peer Review (Reference 20) of certain HLRs for the Fire HRA TE was conducted for ANO-2 against Part 2 and Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 05-04, Revision 3 (Reference 27). An October 2016 limited Focused Scope Peer Review (Reference 21) of certain SRs for the FSS TE was conducted for ANO-2 against Part 4 of ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2, using the process described in NEI 07-12. A Finding Level F&O Independent Assessment (Reference 6) was performed in accordance Appendix X of NEI 07-12, Revision 1 (Reference 28), and concluded that all ANO-2 Finding F&Os from prior peer reviews were closed after model maintenance and that each applicable SR was met at CCII or better.

1) As documented in LTR-RAM-II-09-046 (Reference 17), SR PP-B2 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which a Suggestion F&O PP-B3-01 was initiated and Finding F&O FSS-B1-02 was cross referenced. SR PP-B2 from ASME/ANS RA-Sa-2009 (Reference 8) requires for CCII/III, a justification of the judgment, that the credited partitioning element that lacks a fire-resistance rating, will substantially contain the damaging effects of fires given the nature of the fire sources present in each compartment separated by the nonrated partitioning element.

   Suggestion F&O PP-B3-01 noted, in part, *ANO stated that non-rated fire barriers were not credited. Plant Partitioning and Fire Frequencies Development Report 0247-06-0006.01, Rev. 1 (Entergy Calculation CALC-08-E-0016-01, Rev. 0) Section 2.2, Fire Compartment Identification, states "The fire analysis compartments used for the fire risk assessment are identical to the fire zones used for the Fire Protection Program as documented in the previous section. This approach allows the fire risk assessment to rely on the existing programmatic controls and design requirements for maintaining the integrity of the associated compartment boundaries. Based on the documentation provided in the Fire Hazards Analysis the boundaries for these compartments have fire withstand ratings consistent with the requirements of the Fire Protection Program." However, fire barrier rating information is not provided for any other locations (not part of* *the Appendix R program) that were added for the fire PRA. Also, a few other fire zones, such as the Unit 2 (2199-G) control room which is not entirely separate from the Unit 1(129-F) control room, are not well-defined enclosed rooms. (Refer to F&O PP-B3-01) Potential fire effects on adjacent physical analysis units are considered in the fire scenario development - see the Scenarios Report (0247-0006.05 Rev. 0). Further discussion regarding compartment interactions is included in the Multi-Compartment Analysis (0247-0006.03 Rev. 0).*

Although Suggestion F&O PP-B3-01 remains OPEN and SR PP-B2 has not been assessed as meeting CCII, the use of the Fire model is acceptable for this application because providing a justification for crediting partitioning elements that lack a fire-resistance rating would not impact the fire risk results.

2) As documented in LTR-RAM-II-09-046 (Reference 17), SR PP-B3 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which a Suggestion F&O PP-B3-01 was initiated. SR PP-B3 from ASME/ANS RA-Sa-2009 (Reference 8) requires for CCII/III a justification of the judgment that spatial separation, if credited as a partitioning feature, is sufficient to substantially contain the damaging effects of any fire that might be postulated in each of the fire compartments created as a result of crediting this feature.

   Suggestion F&O SR PP-B3-01 noted, in part, *ANO2 needs to provide additional definition of the fire ratings of the barriers used to define fire areas apart from the fire rated barriers used for the Appendix R zones. Specifically, in Section 2.2, provide a discussion of why fire zones that are not well-defined enclosed rooms (such as the Unit 2 and Unit 1 control rooms) are considered appropriate fire compartments, why the spatial separation used to separate portions of the turbine buildings for Units 2 and 1 are adequate fire barriers and why the louvered glass windows between the Unit 1 and Unit 2 control rooms constitutes a three-hour fire barrier or provides adequate fire separation.*

   Although Suggestion F&O PP-B3-01 remains OPEN and SR PP-B3 has not been assessed as meeting CCII, the use of the Fire model is acceptable for this application because providing a justification for crediting spatial separation would not impact the fire risk results.

3) As documented in LTR-RAM-II-09-046 (Reference 17), SR PP-B5 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which a Suggestion F&O PP-B5-01 was initiated. SR PP-B5 from ASME/ANS RA-Sa-2009 (Reference 8) requires for CCII/III the definition and justification for the basis and criteria applied when active fire barrier elements (such as normally open fire doors, water curtains, and fire dampers) are credited in partitioning.

   Suggestion F&O SR PP-B5-01 noted, *The ANO fire protection group stated that the fire PRA partitioning does not credit any active fire barriers. Fire dampers that are used in the plant were not credited in the definition of any fire barriers in the analysis. However, Section 2 of the Plant Partitioning and Fire Frequencies Development Report 0247-0006.01, does not explicitly reference the fact that they are not used as fire barrier elements is not mentioned in (Entergy Calculation CALC-08-E-0016-01, Rev. 0). SR PP-B5 was classified as Capability Category I because ANO2 did not credit active fire barrier elements as partitioning elements. To achieve Capability Category II/III, ANO2 should credit active fire barrier elements as partitioning elements and then define and justify the basis for crediting the active fire barrier elements as partitioning elements.*

Although Suggestion F&O PP-B5-01 remains OPEN and SR PP-B5 has not been assessed as meeting CCII, the use of the Fire model is acceptable for this application because providing a definition and justification for crediting active fire barriers would not impact the fire risk results.

4) As documented in LTR-RAM-II-09-046 (Reference 17), SR CS-B1 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which a Suggestion F&O CS-B1-01 was initiated. SR CS-B1 from ASME/ANS RA-Sa-2009 (Reference 8) requires for CCII/III all electrical distribution buses credited in the Fire PRA plant response model be analyzed for proper overcurrent coordination and protection and any additional circuits and cables whose failure could challenge power supply availability due to inadequate electrical overcurrent protective device coordination be identified.

   Suggestion F&O CS-B1-01 noted, *Documentation that: 1) all electrical distribution buses credited in the fire PRA model were addressed as part of the ANO fire safe shutdown analysis with respect to proper over-current coordination and protection, and 2) that no additional circuits and cables whose failure could challenge power supply availability due to inadequate electrical over-current protective device coordination was not included in the main report. Description of the process used and evidence supporting conclusions also was not included.*

   Although Suggestion F&O CS-B1-01 remains OPEN and SR CS-B1 has not been assessed as meeting CCII, use of the Fire model is acceptable for this application because providing documentation of the analysis of over-current coordination and protection would not impact the fire risk results.

5) As documented in LTR-RAM-I-11-064 (Reference 18), SR IGN-A10 from ASME/ANS RA-Sa-2009 was not assessed as meeting CCII for which a Suggestion F&O IGN-A10-01 was initiated. SR IGN-A10 from ASME/ANS RA-Sa-2009 (Reference 8) requires for CCII a mean value of, and a statistical representation of, the uncertainty intervals for significant fire ignition frequencies be provided.

   Suggestion F&O IGN-A10-01 noted, *IGN-A10 relates to the reporting of fire ignition frequency uncertainty intervals. ANO-2 meets this SR at CC-I, which requires providing a characterization (qualitative discussion) of the uncertainty intervals for significant fire ignition frequencies. In order to meet CC-II, ANO-2 would need to provide a statistical representation of the uncertainty interval for significant ignition sources. This can be accomplished by providing an ignition frequency distribution for each ignition source, which could be reported as the mean value (already reported by ANO-2), alpha, and beta terms for each fire ignition source. Note that the alpha and beta terms provided in NUREG/CR-6850 represent plant-level distributions, and they are not the same alpha and beta terms for the ignition source-level distributions. The plant-level distributions effectively need to be "apportioned" to get the ignition source-level distributions. Suggested Resolution – Calculate and report a frequency distribution, reporting the alpha and beta terms, for risk significant ignition sources (i.e., those modeled as individual scenarios). Note that Suggestion F&O is not intended to challenge the capability category assessment of the original ANO-2 full fire PRA peer review. The focused scope review documented in this letter (LTR-RAM-I-11-064) focused solely on transient ignition sources (not fixed), and this F&O was written because the transient frequency uncertainty intervals have not been calculated for each significant transient ignition source.*

Although Suggestion F&O IGN-A10-01 remains OPEN and SR IGN-A10 has not been assessed as meeting CCII, the use of the Fire model is acceptable for this application because not characterizing the uncertainty intervals for significant transient ignition sources would not impact the fire risk results.

Summary of Plant Changes that are Not Yet Incorporated into the PRA

To ensure fidelity with the "as-built" and "as-operated" plant, the PRA models are maintained and upgraded in accordance with Entergy procedures which have been Peer Reviewed consistent with the PRA Configuration Control requirements provided in the ASME/ANS PRA Standard. Entergy procedures define the process to be followed to implement scheduled and interim PRA model changes and to control the PRA model files. In particular, the procedures define the process for identifying, tracking, and implementing model changes, and for identifying and tracking model improvements or potential issues that may affect the model. Identified model changes are tracked via MCRs, which are entered in the Entergy MCR database. Periodic PRA model updates/upgrades are typically performed at least once every four years, with the option of extending the frequency for up to two years, such that the total model change cycle does not exceed six years. Extensions must be justified by showing that the PRA model continues to adequately represent the as-built, as-operated plant and must be approved by management.

Because an extended time interval between NRC approval of the LAR and the actual upgrade of the ECP supply piping, Entergy will reassess the risk impact against the acceptance guidelines for a small risk increase as defined in RG 1.177 (ICCDP < 1E-6 and ICLERP < 1E-7) prior to entry into the 65-day preventative maintenance window. If either criterion is not met, Entergy will inform the NRC before proceeding. This is considered a regulatory commitment and is include in Attachment 4 of this letter.

The unincorporated plant changes in the MCR database were reviewed for potential impacts on the acceptability of the PRA models. The scope of the review included MCRs with a grade of "A", "B", or "C". As defined by Entergy procedure EN-DC-151, "PRA Maintenance and Update" (Reference 22), the grade designations mean:

"A" – Extremely important and necessary to assure technical adequacy (i.e., acceptability) of the PRA or quality of the PRA

"B" – Important and necessary to address but may be deferred until the next PRA update.

"C" – Considered desirable to maintain maximum flexibility in PRA applications and consistency in the industry, but NOT likely to significantly affect results or conclusions.

The MCR database contain no MCR with a grade of "A", as defined above. And the review identified no "B" or "C" MCR that would significantly impact the delta risk assessment for the LAR. In reaching this conclusion, the review considered what hazard was affected, and whether the MCR would specifically affect the function, reliability, and availability of the particular components within the baseline configuration or the proposed temporary pumping system, and whether the anticipated incorporation of the plant change would affect the risk significance of the temporary pumping system more than the baseline configuration.

Cumulative Risks

ANO has tracked the risk metrics as the various PRA models were maintained and upgraded over the years. A review of those historical trends demonstrates that ANO has a risk management philosophy that does not just use the PRA to systematically increase risk. The PRA is also used to help reduce risk where appropriate and where it is shown to be cost effective.

ANO-1 Historical Risk Tracking						
Year	**IE-CDF (/yr)**	**IE-LERF (/yr)**	**IF-CDF (/yr)**	**IF-LERF (/yr)**	**Fire-CDF (/yr)**	**Fire-LERF (/yr)**
2020	6.53E-06	3.47E-08	3.95E-07	1.57E-08		
2019	6.53E-06	5.54E-08			3.73E-05	6.85E-06
2018					3.70E-05	6.33E-06
2017					7.62E-05	8.74E-06
2016	2.93E-06	1.58E-07				
2014					5.95E-05	5.15E-06
2010			1.04E-06	1.73E-07		
2009	2.88E-06	5.82E-08	6.17E-08	1.01E-08		
2008		3.98E-07	1.07E-07	1.84E-07		
2006	2.42E-06					
2001	5.88E-06					
2000	6.15E-06					
1996	1.46E-05	7.12E-07				

ANO-2 Historical Risk Tracking						
Year	**IE-CDF (/yr)**	**IE-LERF (/yr)**	**IF-CDF (/yr)**	**IF-LERF (/yr)**	**Fire-CDF (/yr)**	**Fire-LERF (/yr)**
2019	1.61E-06	8.54E-08	3.93E-06	5.18E-08		
2017					6.40E-05	6.83E-06
2016	1.41E-06	4.45E-08				
2015					6.16E-05	1.22E-06
2013					6.47E-05	1.39E-06
2010		1.08E-07	8.04E-07	5.63E-08		
2009		1.08E-07				
2008	9.47E-07					
2007		1.14E-07				
2006	3.02E-06					
2005	5.20E-06					
1996		6.30E-07				
1994			5.24E-07			

5. Section 4 References

1. "Arkansas Nuclear One Unit 1 PRA Peer Review Report Using ASME PRA Standard Requirements," PWR Owners Group, August 2009.
2. ENTGS009-ANO1-PR-1000, "ANO-1 Power Plant Probabilistic Risk Assessment Focused-Scope Peer Review (LERF)," Revision 0, ENERCON, September 6, 2019.
3. PSA-ANO1-08-FNO-CL, "ANO-1 PRA Finding Level Fact and Observation Independent Assessment," Revision 0, Entergy Nuclear, April 9, 2020.
4. LTR-RAM-II-08-020, Regulatory Guide (RG) 1.200, "PRA Peer Review Against the ASME PRA Standard Requirements for the Arkansas Nuclear One, Unit 2 Probabilistic Risk Assessment," Westinghouse, July 2008.
5. ENTGS009-ANO2-PR-1000, "ANO-2 Power Plant Probabilistic Risk Assessment Focused-Scope Peer Review (LERF)," Revision 0, ENERCON, September 6, 2019.
6. PSA-ANO2-08-FNO-CL, "ANO-2 PRA Finding Level Fact and Observation Independent Assessment," Revision 0, Entergy Nuclear, April 9, 2020.
7. ASME/ANS RA-Sb-2005, "Addenda to ASME/ANS RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," December 2005.
8. ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," February 2009.
9. MCR Database.
11. ENTGANO150-REPT-001, "Arkansas Nuclear One Unit 1 Internal Flooding Probabilistic Risk Assessment Peer Review," Revision 0, ENERCON, April 14, 2017.
12. ENTGANO150-REPT-002, Arkansas Nuclear One Unit 2 Internal Flooding Probabilistic Risk Assessment Peer Review, Revision 0, ENERCON, April 14, 2017.
13. LTR-RAM-II-10-003, "Fire PRA Peer Review Against the Fire PRA Standard Supporting Requirements from Section 4 of the ASME/ANS Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications for the Arkansas Nuclear One, Unit 1 Fire Probabilistic Risk Assessment," Westinghouse, January 2010.
14. "Focused Scope Peer Review ANO-1 Fire PRA FSS-A, C, D, E and H," Kazarians & Associates, November 2012.
15. "Arkansas Nuclear One Unit 1 Fire HRA Peer Review Report Using ASME/ANS PRA Standard Requirement," Curtis-Wright Scientech, June 2014
16. ENTCORP50-ANO1-01, “Arkansas Nuclear One – Unit 1, PRA Technical Adequacy to Support Relocation of Technical Specification Surveillance Requirements to an Owner Controlled Program," Revision 0, ENERCON, February 28, 2018.
17. LTR-RAM-II-09-046, "Fire PRA Peer Review Against the Fire PRA Standard Supporting Requirements from Section 4 of the ASME/ANS Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications for the Arkansas Nuclear One, Unit 2 Fire Probabilistic Risk Assessment," Westinghouse, September 2009.

18. LTR-RAM-I-11-064, "Focused Scope Fire PRA Peer Review for Arkansas Nuclear One Unit 2," Westinghouse, December 2011.

19. "Focused Scope Peer Review ANO-2 Fire PRA FSS-A, C, D, E and H," Kazarians & Associates, November 2012.

20. "Arkansas Nuclear One Unit 2 Fire HRA Peer Review Report Using ASME/ANS PRA Standard Requirement," Curtis-Wright Scientech, June 2014.

21. "Arkansas Nuclear One, Unit 2 Fire PRA Focus Scope Peer Review Report," Revision 0, Jensen Hughes, 10/06/2016.

22. Entergy procedure EN-DC-151, "PRA Maintenance and Update," Revision 8.

23. Entergy procedure COPD-024, "Risk Assessment Guidelines," Change 070.

24. Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, March 2009.

25. Nuclear Energy Institute (NEI) 05-04, "Process for Performing Internal Events PRA Peer Reviews using the ASME/ANS PRA Standard," Revision 2, November 2008.

26. Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 1, January 2007.

27. NEI 05-04, "Process for Performing Internal Events PRA Peer Reviews using the ASME/ANS PRA Standard," Revision 3, November 2009.

28. NEI 07-12, "Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines," Revision 1, June 2010.

29. NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE)," October 2012.

30. NUREG 1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines," July 2012.

Enclosure, Attachment 6

0CAN022102

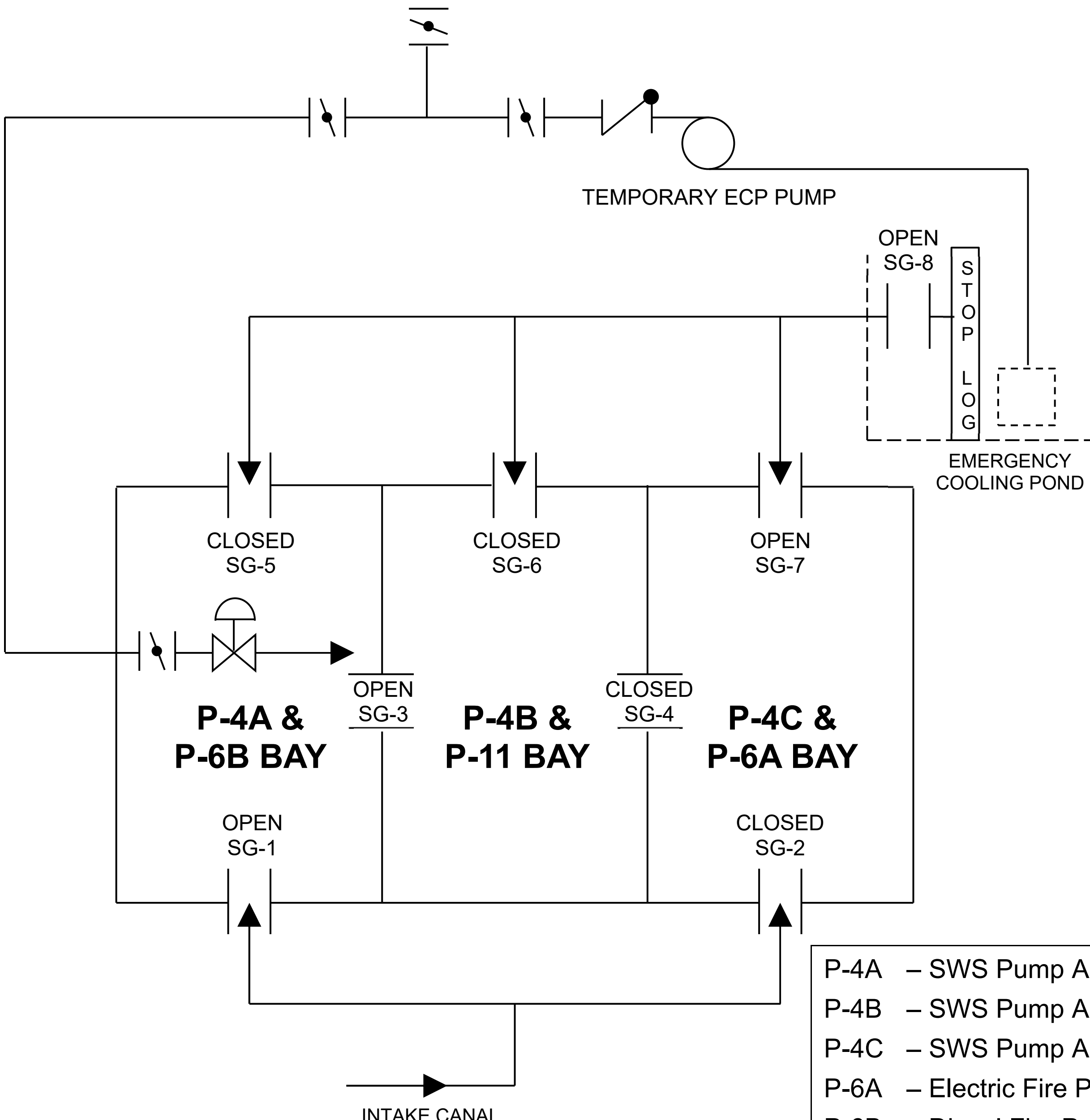
Temporary ECP Pump System Configurations – Information Only

TEMPORARY ECP PUMP SYSTEM CONFIGURATIONS

The following simplified drawings provide an overview of the temporary Emergency Cooling Pond (ECP) pumping system based on a given Service Water System (SWS) pump bay being removed from service in support of the planned ECP supply piping upgrade.

ANO-1 Supply to "A" and "B" SWS Pump Bays

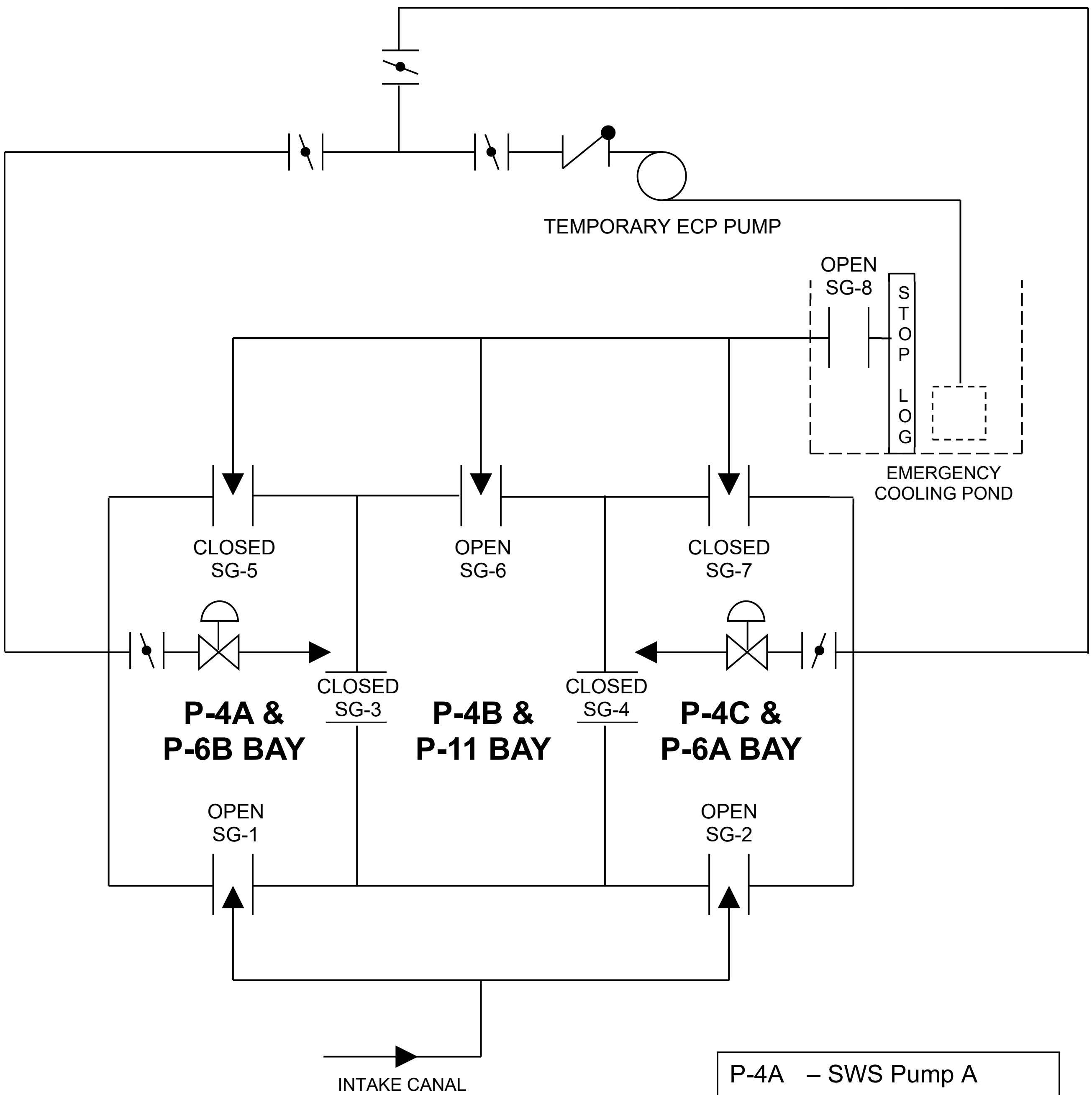
("C" SWS Pump Bay Removed from Service)



P-4A	– SWS Pump A
P-4B	– SWS Pump A
P-4C	– SWS Pump A
P-6A	– Electric Fire Pump
P-6B	– Diesel Fire Pump
P-11	– Jockey Fire Pump

ANO-1 Supply to "A" and "C" SWS Pump Bays

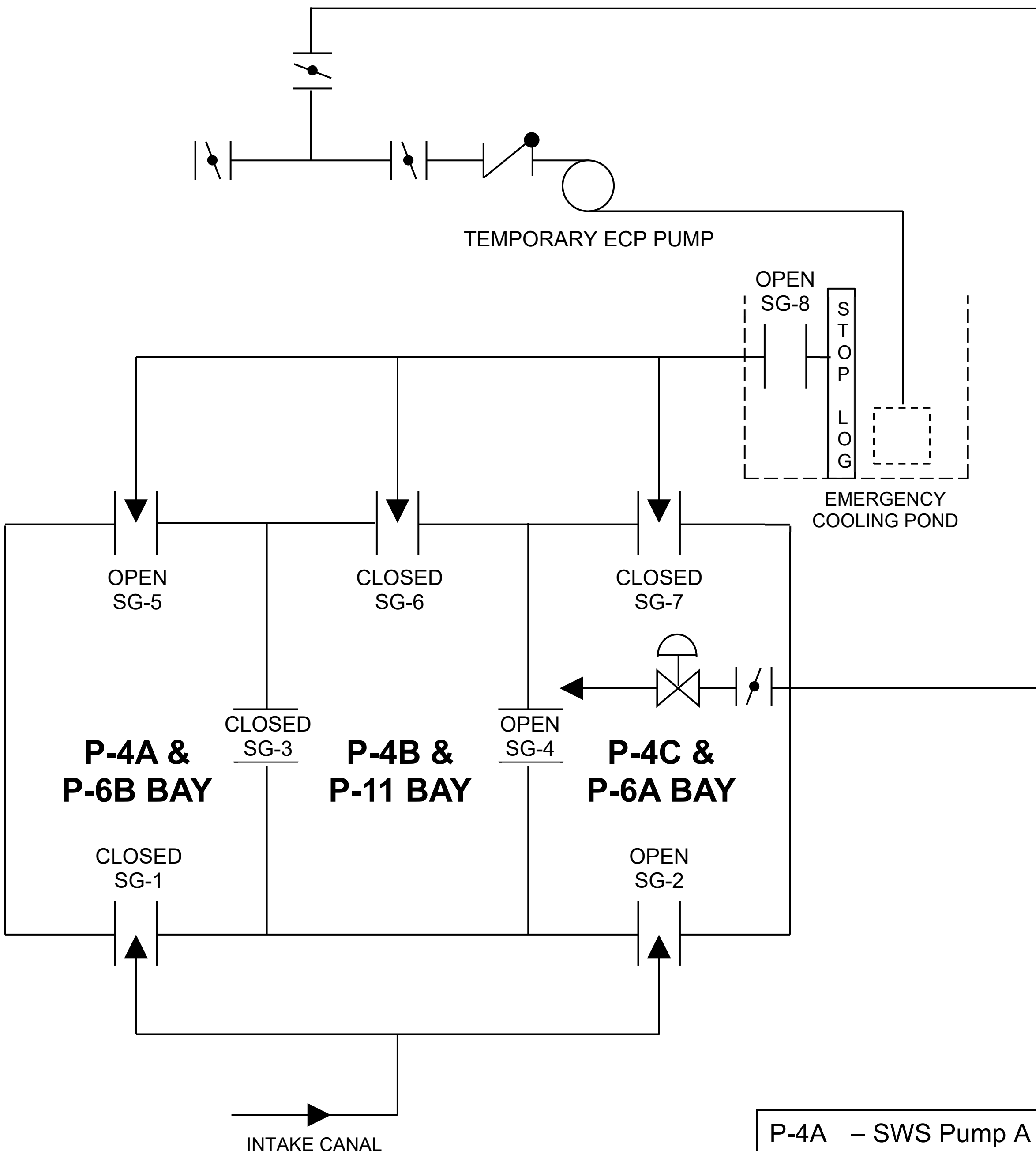
("B" SWS Pump Bay Removed from Service)



P-4A	– SWS Pump A
P-4B	– SWS Pump A
P-4C	– SWS Pump A
P-6A	– Electric Fire Pump
P-6B	– Diesel Fire Pump
P-11	– Jockey Fire Pump

ANO-1 Supply to "B" and "C" SWS Pump Bays

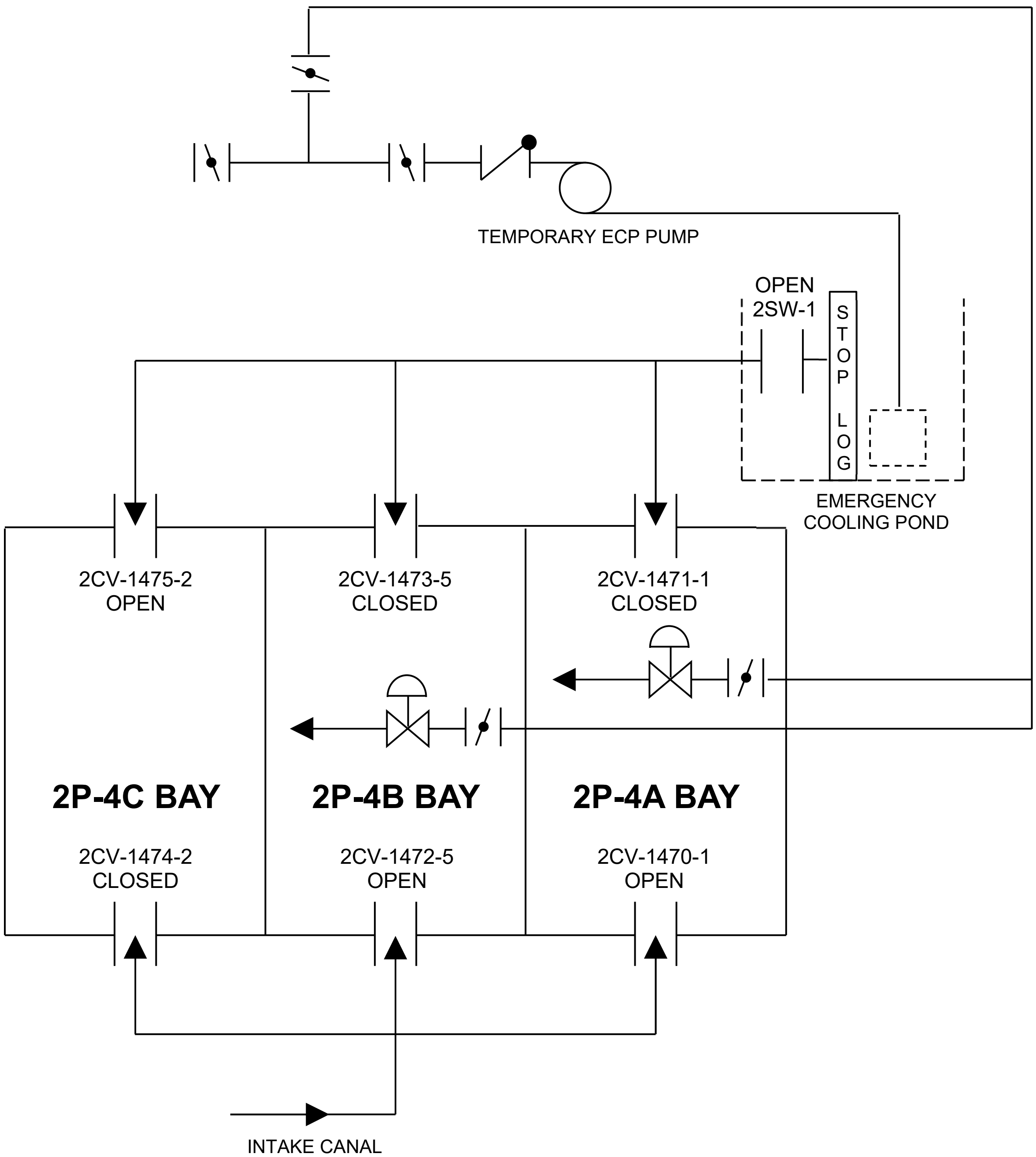
("A" SWS Pump Bay Removed from Service)



P-4A	– SWS Pump A
P-4B	– SWS Pump A
P-4C	– SWS Pump A
P-6A	– Electric Fire Pump
P-6B	– Diesel Fire Pump
P-11	– Jockey Fire Pump

ANO-2 Supply to "A" and "B" SWS Pump Bays

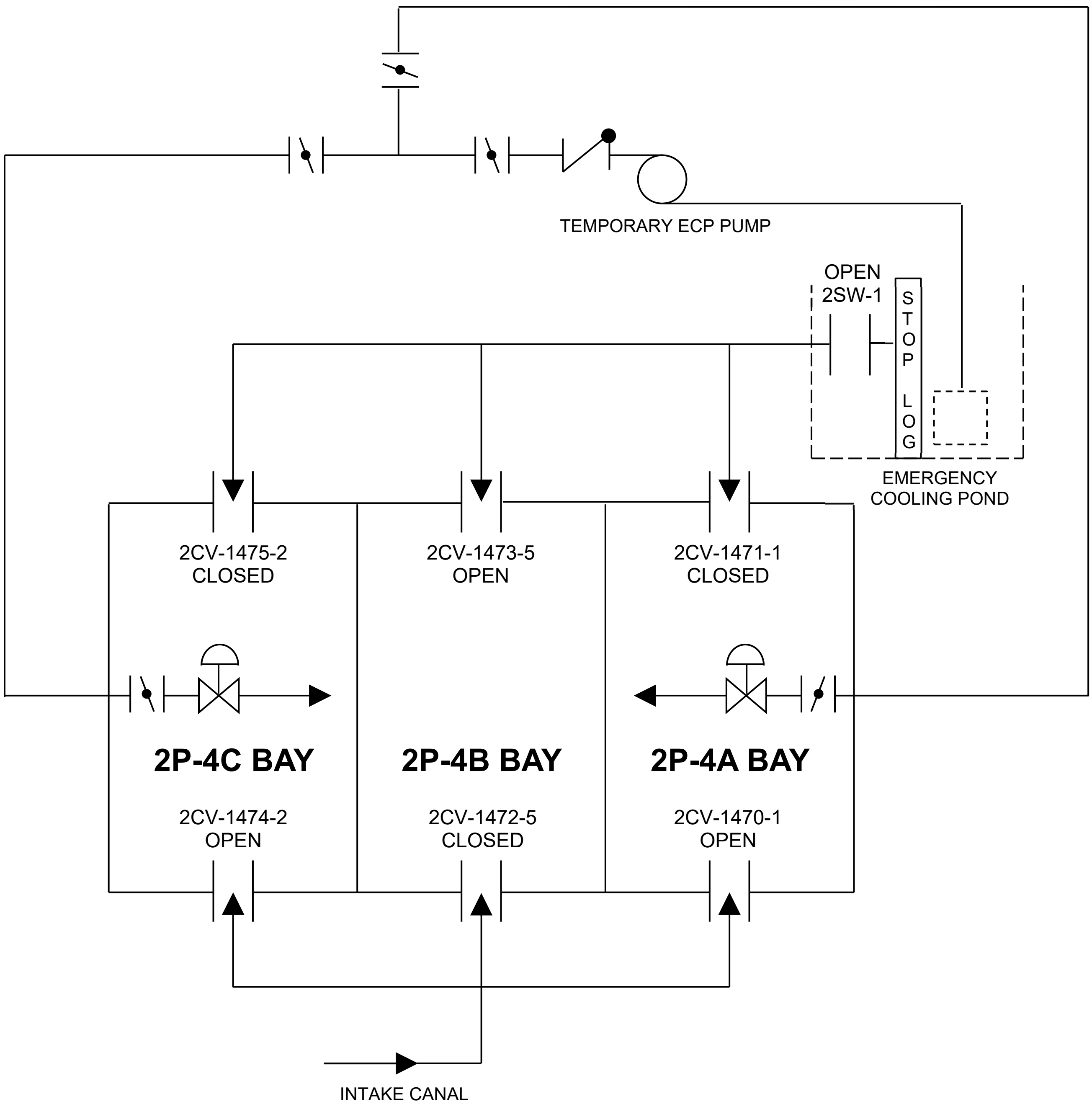
("C" SWS Pump Bay Removed from Service)



2P-4A	– SWS Pump A
2P-4B	– SWS Pump A
2P-4C	– SWS Pump A

ANO-2 Supply to "A" and "C" SWS Pump Bays

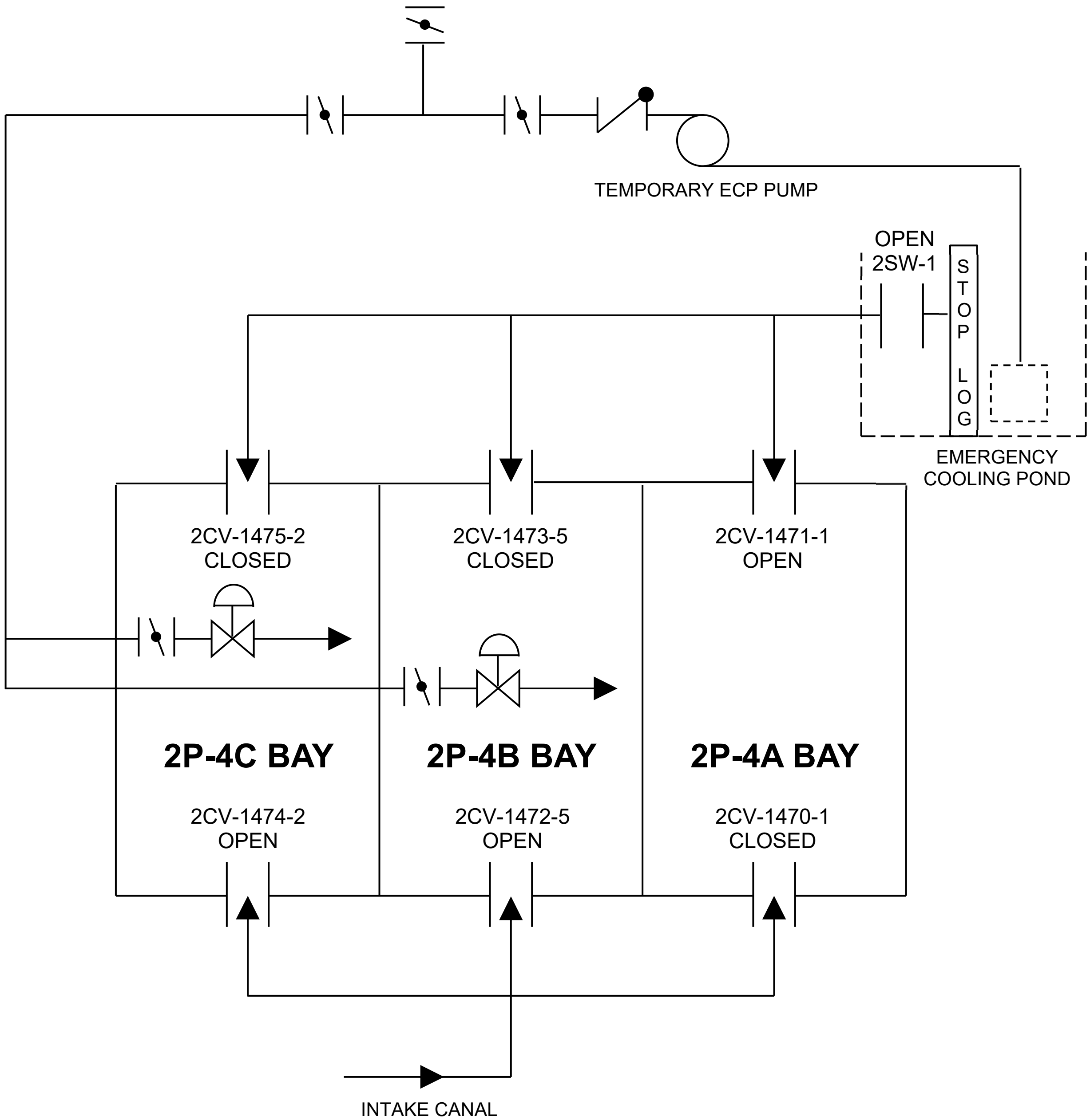
("B" SWS Pump Bay Removed from Service)



2P-4A	– SWS Pump A
2P-4B	– SWS Pump A
2P-4C	– SWS Pump A

ANO-2 Supply to "B" and "C" SWS Pump Bays

("A" SWS Pump Bay Removed from Service)



2P-4A	– SWS Pump A
2P-4B	– SWS Pump A
2P-4C	– SWS Pump A