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10 CFR 50.90

2CAN121705

December 28, 2017

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

SUBJECT: Exigent License Amendment Request
Allowance to Exclude Exercise of Control Element Assembly 4 with respect to Surveillance Requirement 4.1.3.1.2 for the Remainder of Cycle 26
Arkansas Nuclear One, Unit 2
Docket No. 50-368
License No. NPF-6

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) hereby requests an amendment to the Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specifications (TSs) to exclude exercising Control Element Assembly (CEA) 4 for the remainder of operating Cycle 26, currently scheduled to end in September, 2018. The proposed amendment would modify a Note to Surveillance Requirement (SR) 4.1.3.1.2 such that CEA 4 may be excluded from SR performance for the remainder of Cycle 26. The proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c).

This amendment is necessary due to a degrading Upper Gripper Coil (UGC), located atop the Reactor Vessel head, which is the coil that normally holds the CEA in place. This degradation was first identified in the fall of 2017 during performance of SR 4.1.3.1.2. However, further degradation of the UGC was noted in December 2017 during a verification of the amperage drawn by the UGC as it held the CEA in place. Should the UGC fail during CEA movement, the CEA will drop into the core, resulting in a reactivity transient and subsequent power reduction, and could result in a plant shutdown if the CEA is deemed to be unrecoverable. Therefore, Entergy requests CEA 4 be excluded from being exercised during the remaining three performances of SR 4.1.3.1.2, which will permit entry into refueling outage 2R26 when repairs can be completed. This is a one-time only change request.

The next performance of SR 4.1.3.1.2, after applying a 25% allowance permitted by SR 4.0.2, is required by January 22, 2018. Approval of the proposed amendment is, therefore, requested by January 18, 2018. Once approved, the amendment shall be implemented as soon as practicable and prior to the time in which SR 4.1.3.1.2 must be completed.

In accordance with 10 CFR 50.91(a)(6), a licensee requesting an exigent change to the TSs must explain the exigency and why such could not be avoided. An exigent request is generally one that permits more than seven days, but less than five weeks for NRC review and approval of the request, in order to avoid an unnecessary plant transient, test, inspection, system realignment, shutdown, or delayed startup.

As discussed previously, degradation of the CEA 4 UGC was identified on September 29, 2017, and the ANO NRC Project Manager was notified in October 2017 of a potential TS change to exclude CEA 4 from exercise testing during the remainder of Cycle 26 operation if the coil continued to degrade further over time. The Lower Gripper Coil (LGC) was energized to hold the CEA in place over the next SR interval (92 days) instead of the UGC. The established plan was to exercise the CEA during the next scheduled test in January 2018 and, if unacceptable UGC degradation was noted, a TS amendment request would be promptly submitted, which would provide at least three months for NRC review and approval of the change (the 92-day SR interval can be extended for an additional 23 days in accordance with SR 4.0.2 if necessary). Note that both the UGC and LGC are utilized during CEA movement. The operational concern with completing SR 4.1.3.1.2 is CEA 4 could drop if the UGC is degraded sufficiently at the time of the exercise test such the UGC fails. UGC degradation or failure will not prevent the CEA from inserting into the core as designed in response to a reactor trip signal.

In December 2017, amperage readings obtained on the subject UGC during additional monitoring indicated a progressive increase in amperage over time. The previous measurement of ~5 amps rose to ~7 amps on December 12, 2017. Engineering judgement concluded that the potential of a CEA drop would be substantial during performance of the January 2018 exercise test, since the rate of degradation is non-linear and, therefore, it is not possible to predict when the coil would degrade to the point of failure. Because the rate of degradation cannot be predicted, rescheduling the exercise test to occur as soon as practical would not completely eliminate the potential for CEA 4 to drop. Based on this potential and because the requirements of SR 4.1.3.1.2 must be verified by January 22, 2018, the requested TS change is necessary to avoid a plant transient, reactivity excursion, and potential plant shutdown should a drop of CEA 4 occur during the exercise test. Because approval of this change is required within approximately three weeks, Entergy believes the 10 CFR 50.91(a)(6) requirements supporting an exigent change to the ANO-2 TSs are applicable.

ANO-2 UGCs were replaced in refueling outage 2R19 (March 2008) and will be replaced again in 2R26 (fall 2018) with high temperature coils, to address an identified industry issue associated with Combustion Engineering-type UGCs provided by Westinghouse.

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

This letter contains no new regulatory commitments.

If there are any questions or if additional information is needed, please contact Stephenie Pyle at 479-858-4704.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on December 28, 2017.

Sincerely,

ORIGINAL SIGNED BY RICHARD L. ANDERSON

RLA/dbb

Enclosure: Evaluation of the Proposed Change

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Enclosure to

2CAN121705

Evaluation of the Proposed Change

EVALUATION OF THE PROPOSED CHANGE

1.0 SUMMARY DESCRIPTION

The proposed amendment would modify Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification (TS) Surveillance Requirement (SR) 4.1.3.1.2 to exclude exercise of Control Element Assembly (CEA) 4 for the remainder of the current fuel cycle, Cycle 26. Cycle 26 is currently scheduled to end in the fall of 2018. The SR requires that each CEA not fully inserted in the core shall be determined to be operable by movement of at least five inches in any one direction at least once per 92 days.

Attachment 1 of this Enclosure provides a markup page of the existing TS which illustrates the proposed change. Attachment 2 of this Enclosure provides a revised (clean) TS page. Because the Note is self-explanatory and because the exception will only be applicable until the end of Cycle 26, no changes to the associated TS Bases are proposed at this time.

2.0 DETAILED DESCRIPTION

2.1 CEAs

The ANO-2 CEAs are clustered into groups of five "fingers" sharing a common Control Element Drive Mechanism (CEDM). Four fingers are assembled in a 4.05-inch square array around the fifth central finger. The individual fingers in a given CEA are spaced so as to enter the CEA guide tubes in the corresponding fuel assembly. The fuel assembly structure is designed to guide the CEAs. This design results in relatively free movement of the CEAs.

ANO-2 has 81 CEAs that are used for reactivity control. The CEAs are divided into nine groups, of which two are Shutdown Groups designated Groups A and B, six are Regulating Groups designated Groups 1 through 6, and one group is designated as Group P (similar to a regulating group). CEA 4 is in Shutdown Bank B. The shutdown groups are the first withdrawn during startup and the last inserted during a planned shutdown. During a reactor startup, Groups 1 through 5 must then be withdrawn in a prescribed sequence and with the prescribed overlap. Groups 6 and P are the last groups to be withdrawn during reactor startup. During power operations, insertion of Groups 1 through 5 and Shutdown Banks A and B is prohibited, except to complete performance of the SR 4.1.3.1.2 CEA exercise test. Because CEA 4 is in Shutdown Bank B, this CEA must remain fully withdrawn at all times when the reactor is critical, except during performance of SR 4.1.3.1.2.

2.2 Control Element Drive Mechanism Control System (CEDMCS)

The CEDMCS performs the following functions:

- Add large amount of negative reactivity when the Reactor Trip Circuit Breakers (RTCBs) are opened via commands from the Reactor Protection System Trip paths.

- Provide for rapid insertion of CEAs when a secondary plant load rejection occurs.

- Provide a stable and controlled approach to criticality during plant startup from Mode 3 to Mode 2.

- Provide for reactivity control at all power levels and Axial Shape Index (ASI) control at higher power levels (> 15%). The extent of CEA motion for ASI control varies over core life.

- Provide for "Cocked Rod" Protection during plant heatup and cooldown (Shutdown Banks A and B fully withdrawn to provide immediately large insertion of negative reactivity if needed).

- Permit exercise of each CEA as required by TS SR 4.1.3.1.2.

The CEDMCS is an electromechanical device that uses induced magnetic fields to operate a mechanism for moving a CEA. The pressure housings for the CEDMs are threaded onto nozzles on the Reactor Vessel head and seal welded. A hollow, grooved drive shaft extends through the drive mechanism to the top of the control element assembly. Latches in the drive unit engage the grooves on the CEA extension shaft and provide means for lifting, holding, and inserting the CEA. Coils mounted in a coil stack assembly slide over the mechanism pressure housing and rest upon a locating shoulder. These coils provide the magnetic flux that operates the mechanical parts of the drive within the pressure housing. Linear motion of these parts causes operation of latching devices, which translate the motion of the parts to the CEDMCS drive shaft. Holding and moving the CEA occurs when power is sequentially applied to the coils. Each mechanism has five electrical coils. Power to these coils is controlled by the CEDMCS. The coils and external electrical components are cooled by forced airflow from the CEDMCS cooling units.

The proper sequencing of each coil causes withdrawal and insertion of the CEA. A reactor trip is accomplished by rapid insertion of the CEAs when the CEDMCS coils are de-energized. When this happens, the latches are disengaged from the drive shaft and the CEAs fully insert into the core by means of gravity.

The coil designations from top (of stack) to bottom are as follows:

Lift Coil (LC)

Upper Gripper Coil (UGC)

Pull Down Coil (PDC)

Load Transfer Coil (LTC)

Lower Gripper Coil (LGC)

Withdrawal or insertion of CEAs is accomplished by applying programmed voltage levels, in the proper sequence, to the five CEDM coils. There are three possible states for each coil:

- High voltage (~ 140 ± 5 VDC) to quickly energize the coil,

- Low voltage (~ 40 ± 5 VDC) to maintain the coil energized, or

- Off

The initial condition of a CEA prior to receiving a motion command is the "holding" mode. In this mode the UGC is energized at low voltage engaging the Upper Gripper latch within the drive shaft. During normal plant operation when conditions do not require CEA movement, all 81 CEAs will be in the “holding” mode with the UGC energized at low voltage.

During performance of CEA maintenance activities, the subgroup containing the CEA on which the maintenance is to be performed is placed on a Hold Bus. The purpose of the Hold Bus is to allow maintenance to be performed on an individual subgroup without dropping the associated CEAs. This is accomplished by placing an alternate low voltage supply in parallel with, and downstream of, the normal low voltage supply. Once a subgroup has been placed on the Hold Bus, its normal power may be de-energized. The CEAs will remain in place due to the voltage applied to the UGCs; however, the associated CEAs cannot be manually inserted or withdrawn while on the Hold Bus. Only one subgroup can be assigned to the Hold Bus at a time. If a reactor trip signal is received while a subgroup is assigned to the Hold Bus, the Hold Bus is de-energized and all CEAs within the subject subgroup, as well as the remaining CEAs, will insert into the core.

The CEDMCS is described in Section 7.2.1 of the ANO-2 Safety Analysis Report (SAR).

2.3 Current TS Requirements

SR 4.1.3.1.2 requires that each CEA not fully inserted in the core shall be determined to be OPERABLE by movement of at least 5 inches in any one direction at least once per 92 days.

2.4 Reason for the Proposed Change

This amendment is necessary due to a degrading Upper Gripper Coil (UGC), located atop the Reactor Vessel head, which normally holds the CEA in place. This degradation was first identified in the fall of 2017 during performance of SR 4.1.3.1.2. As a result, the LGC was energized to hold the CEA in place over the next SR interval (92 days). Further degradation of the UGC was noted through monitoring of UGC amperage such that current trends indicate the potential for UGC failure during the next exercise test (January 2018). Should the UGC fail during CEA movement, the CEA will drop into the core, resulting in a reactivity transient and subsequent power reduction, and could result in a plant shutdown, if the CEA is determined to be unrecoverable.

2.5 Description of the Proposed Change

The proposed change will modify a Note to SR 4.1.3.1.2, previously applicable to CEA 18 during Cycle 24 operation, as follows:

> Note 1 - Movement of CEA 4~~18~~ is not required for the remainder of Cycle 26~~4~~. If an outage of sufficient duration occurs prior to the end of Cycle 26~~4~~, maintenance activities will be performed to restore the CEA.

3.0 TECHNICAL EVALUATION

Over the past several years an industry issue has been identified associated with Combustion Engineering (CE) type UGCs provided by Westinghouse. ANO, Palo Verde, St. Lucie, and Millstone have experienced at least one degrading UGC. Westinghouse has recognized this as an industry issue and began developing a High Temperature Upper Gripper (HTUG) coil for the CE plants. This HTUG has been designed after the Westinghouse coil design.

During the fall 2017 quarterly CEA exercise test, the CEA 4 UGC current trace indicated more "noise" than expected. The current draw was measured to be 5 amps (normal ~ 4 amps). This was considered an indication of UGC degradation. All UGCs are currently scheduled to be replaced in the next ANO-2 refueling outage 2R26 (fall 2018) with a new high temperature coil.

Following the fall 2017 CEA exercise, the LGC was energized to hold CEA 4 in place in order to limit further degradation of the UGC. In order to track potential degradation between SR intervals, CEA 4 UGC amperage was measured December 12, 2017. The measured current draw of 7 amps was observed, after which CEA 4 was transferred back to the LGC. CEA 4 is the only coil exhibiting this behavior at this time.

The CEA drives are electromechanical devices that convert electrical energy into mechanical motion. The CEA coils provide the magnetic flux that operates the mechanical parts of the drive within the pressure housing. Linear motion of these parts causes operation of latching devices, which translate the motion of the gripper assembly to the CEDMCS drive shaft.

Failure Modes

The primary failure modes of an inductor (coil) are:

- One or more winding shorts
- An open coil

Heating is the primary driver of both failure modes. The heating is primarily internal and largely a result of the coil being energized.

The majority of the failure modes are related to the coil dielectric or insulation breakdown. The shorted-winding condition is the most common cause of coil failure. It occurs when the insulation resistance, or dielectric, fails within a winding, allowing a secondary, or parasitic, current path. Although a single shorted turn in a winding may not have an immediate effect on a coil's performance, the point of dielectric failure becomes a source of additional heat. This localized heat buildup causes further insulation breakdown. Furthermore, the shorted turns reduce the overall circuit resistance resulting in additional current draw and additional heat generation (I^2R heating).

CEA 4 troubleshooting has indicated an increase in current which is believed to be caused by shorted turns in the coil winding. An open coil has not been observed for CEA 4. The possible causes of the shorted turns in the coil winding are as follows:

- Short term high current causing overheating and winding insulation break down
- Thermal and age related degradation of the coil insulation
- Excessive voltage resulting in insulation break down
- Manufacture defect which results in localized heating

The coil will burn open at an estimated 20 amps; however, the supply breaker will trip between 12-16 amps. The degrading material condition indicates a significant increase in the probability of the supply breaker tripping after the coil is re-energized and subsequently exercised. Therefore, further exercising of this CEA significantly increases the potential for CEA dropping into the core.

The increase in current draw most likely indicates an initial turn-to-turn short followed by additional turn-to-turn faulting. These shorts most likely occur during the exercise when the CEA is energized. When the CEDMCS selects a coil, it applies a high voltage of 140 VDC which ensures gripper engagement, followed by application of a holding voltage of 40 VDC after the mechanical action takes place. The turn-to-turn shorts indicate a degraded dielectric which is resulting in localized heating. The coil will further degrade with continued use or if energized. The degradation is not linear or predictable. The localized heating can result in further turn-to-turn shorts which will increase current draw, or will result in the coil burning open. Either condition has the high potential of causing the CEA to drop into the core.

Monitoring the health of the coil and predicting failure is not feasible. A simple ohm measurement is not possible due to the long electrical runs from the CEDMCS room to the Reactor Vessel head, which along with EMI/RFI (electromagnetic and radio frequency interference) due to other operating equipment, result in induced currents on the coil leads. The induced currents and noise result in inaccurate ohm measurements. Degraded inductance would result in a degraded magnetic field needed to keep the Upper Gripper engaged. Due to the electrical noise in the cabinet, the inductance of the coil cannot be measured with the plant online. In previous cycles, measurements were taken prior to repairing CEA-18 and CEA-8. The results are as follows:

- CEA-18 final current draw measurement was ~10 amps. Post shutdown inductance measurement was ~8 mH. Inductance measurements on a known good gripper coil are ~80-83 mH.
- CEA-8 final current draw measurement was ~5 amps. Post shutdown inductance measurement was ~15.8 mH.

Given the data provided above it can reasonably be assumed the inductance on CEA-4 has degraded significantly to the point the CEA could drop without tripping the individual CEA breaker and most likely would result in an unrecoverable CEA.

Another method used at ANO to verify coil resistance applies a known voltage to the coil. The coil is in series with a known value resistor. The measurement of the voltage drop across the resistor provides the means to calculate the coil resistance. This second method is not advisable due to apparent localized heating in the coil. Energizing the coil for the measurement will result in additional heating and further degradation or failure. Additionally, the lower resistance is a result of the failure and does not predict location or source of the internal heating. The probability of the coil burning open is equal to the probability of further turn-to-turn shorts; neither of which can be predicted reliably.

All UGCs were replaced in refueling outage 2R19 (March 2008) and will be replaced again in 2R26 (fall 2018) with high temperature coils. Further exercising of this CEA significantly increases the potential for CEA drop, which would result in a reactivity excursion and power reduction, and could lead to a shutdown of the reactor. Therefore, Entergy requests NRC approval to not perform the remaining three SR 4.1.3.1.2 CEA exercise tests that are due to be performed before repairs can be completed in the upcoming fall 2018 refueling outage 2R26. Coil replacement requires access atop the Reactor Vessel head.

The current trace previously discussed can be caused by degradation in the gripper coil or degradation of the firing circuit. The power switch components or the coil driver card could also fire the circuit improperly generating higher current draw and improper traces. The coil driver card failures typically result in a full firing of the circuitry even when not activated. A degraded power switch opto-isolator could also provide a similar trace. However, the increase in the current draw and the observed similar traces for a previous coil failure make the opto-isolator a secondary cause and not the most probable.

In addition, to troubleshoot and repair a failed opto-isolator or coil driver card normally requires use of the Hold Bus and the UGC to hold the rod in place while the power switch is removed. Further troubleshooting in this regard is not considered in the best interest of nuclear safety since the failure modes of the UGC previously described could result in a plant transient and/or shutdown (i.e., the rod would drop into the core if the UGC failed during troubleshooting efforts).

The purpose of SR 4.1.3.1.2 is to verity that the CEAs are moveable and trippable (i.e., free from mechanical binding). This is accomplished by moving each CEA in the Manual Individual Mode, i.e., only one CEA is moved at a time by the Control Room Operator. Instrument and Control technicians normally verify proper operation of the CEDMCS coils during performance of this test. The technician utilizes a digital recorder with storage/print capabilities, which plots the voltage and current supplied to each coil during a withdrawal or insertion sequence. These traces can be used during troubleshooting efforts to determine if the CEDMCS is energizing the CEA coils in the proper sequence and is applying the proper voltages for the optimum length of time. Successful movement of the CEAs indicates no mechanical binding exists.

As stated in Reference 1, the possibility of warped CEAs, which could result in mechanical binding, is minimal since the ANO-2 CEAs were replaced in 1995. The ANO-2 CEAs were also replaced in 2008. In addition, the five finger design of the CEAs ensures relatively free movement. Because of the design of the CEDMCS, electrical problems will not prevent insertion of a CEA into the core when the reactor trip breakers are opened. However, mechanical failures, which would result in less than full insertion of a CEA upon reactor trip, could be significant, although are much less common and have not been noted during testing. ANO-2 has not experienced mechanical binding. As stated in Reference 1, only two documented instances of individual CEAs failing to insert fully when dropped had been previously recorded. In both cases, the CEA dropped to approximately 11 inches above the bottom of the core. The cause in each case was debris in the fuel assembly, not mechanical binding. SR 4.1.3.1.2 would not detect this condition, since the CEAs moved freely in the upper portion of the core. No further occurrences of CEAs failing to fully insert have been identified since the Reference 1 request.

With respect to Combustion Engineering plants such as ANO-2, only a single case of stuck CEA binding has been identified (Calvert Cliffs – Reference 2).

All postulated failure modes are associated with the coil and associated control circuitry. The RTCBs are upstream of the control and power switch assemblies. The RTCBs open upon an automatic or manual reactor trip signal, removing all power from both control and holding circuitry. All coils on each CEA subsequently de-energize resulting in all CEAs inserting into the core. This design is fail-safe in that a loss of power itself, regardless of whether a reactor trip signal has been generated, will result in the CEAs inserting into the core.

As described previously, the CEDMCS is an electromechanical device such that the various grippers associated with each CEA are magnetically coupled to the subject coil; there is no physical (mechanical) coupling between the CEDMCS circuit/coil and the associated gripper. Heating, which is the primary driver of coil degradation, is associated with the internal heating of the coil windings. Any postulated failure mechanism that could prevent rod insertion (such as mechanical binding of the CEA itself) is not influenced or impacted by coil failure or, control or holding circuitry failures. Therefore, there are no postulated failure mechanisms where the coil or associated circuitry could physically prevent rod insertion once the RTCBs have opened (or power is otherwise lost).

In addition, the postulated failure modes would not affect the RTCBs. Although not directly related to the identified condition of CEA 4, the system is designed in accordance with single failure criteria such that all circuitry will be de-energized even if one RTCB fails to open upon a reactor trip. The control circuitry does not impact the RTCB nor is there a failure mode associated with the control circuitry which would prevent the loss of holding power when the RTCBs open. The control circuity and/or power source interacts with the lifting device magnetically and is not electrically connected to the mechanical “grippers” which perform the actual movement of the CEA. The CEAs are designed to fail safe on loss of power. Therefore, once power is lost (normally by opening of the RTCBs), no failure mode exists within the CEDMCS control or power circuitry that could interfere with control rod insertion.

Reactivity Impact

Because CEA 4 is trippable and is expected to remain so, no additional reactivity considerations need to be taken into consideration. However, to further demonstrate the acceptability of excluding CEA 4 during future performances of SR 4.1.3.1.2 for the remainder of Cycle 26, the following reactivity information is provided.

The TS definition of Shutdown Margin (SDM) is:

> Shutdown Margin shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming all control element assemblies are fully inserted except for the single assembly of highest reactivity worth which is assumed to be fully withdrawn.

ANO-2 TSs 3.1.1.1 (Modes 1 through 4) and 3.1.1.2 (Mode 5) specify that SDM shall be greater than or equal to that specified in the Core Operating Limits Report (COLR). The Cycle 26 COLR SDM operating limit is 5.0% $\Delta k/k$ in Modes 1 through 5. Calculations were performed at various Effective Full Power Days (EFPDs) throughout the remainder of Cycle 26 operation, and Entergy has determined that a minimum SDM of 6.0167% $\Delta k/k$ would exist following a reactor trip assuming both CEA 4 and the single CEA of highest reactivity worth fail to insert, well above the 5.0% $\Delta k/k$ SDM requirement of the COLR. This value was calculated at End of Cycle conditions which were determined to bound operation through the remainder of Cycle 26. It should be noted that the preceding discussion does not reflect the response of the Control Room Operator. Procedures require emergency boration of the Reactor Coolant System at a minimum rate of 40 gpm (gallons per minute) with 2500 ppm (parts per million) of borated water if one or more CEAs fail to fully insert into the core following a reactor trip. Reactivity control is of primary importance in accident mitigation and Operator training.

The COLR is developed using the NRC approved methodologies listed in Section IV of the COLR. When performing TS SRs to verify that adequate SDM is present, plant procedures use models and methods approved for use by the NRC by acceptance of the Entergy topical report ENEAD-01-P-A, “Qualification of Reactor Physics Methods for the Pressurized Water Reactors of the Entergy System” (Reference 3). The calculations performed to assure adequate SDM would exist, assuming both CEA 4 and the single CEA of highest reactivity worth failed to insert, utilized the same models and methods as those utilized to perform the TS SRs.

Based on the above, it can be shown analytically that SDM in excess of the COLR limit will be present at all times for the remaining portion of Cycle 26 should CEA 4 fail to insert into the core.

Summary

Based on the above, Entergy believes justification for an exigent amendment request exists and that excluding CEA 4 from further exercise testing for the remainder of Cycle 26 is warranted. Precedent is listed in Section 4.2 of this Enclosure below. Entergy has reviewed the precedent, including any associated Requests for Additional Information, and has included all relevant information within this amendment request.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Plant," requires, in part, safety system designs with adequate margin to ensure specified acceptable fuel design limits are not exceeded. The applicable General Design Criteria (GDC) for CEA design requirements included the following:

GDC-23, “Protection System Failure Modes,” requires that the protection system be designed to fail into a safe state;

GDC-25, “Protection System Requirements for Reactivity Control Malfunctions,” requires that the protection system be designed to assure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems;

GDC-26, "Reactivity Control System Redundancy and Capability," insofar as it requires that two independent reactivity control systems be provided, with both systems capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes;

GDC-27, “Combined Reactivity Control Systems Capability,” requires that the reactivity control systems be designed to have a combined capability, in conjunction with poison addition by the emergency core cooling system, of reliably controlling reactivity changes under postulated accident conditions, with appropriate margin for stuck rods to assure the capability to cool the core is maintained;

GDC-28, “Reactivity Limits,” requires that the reactivity control systems be designed to assure that the effects of postulated reactivity accidents can neither result In damage to the reactor coolant pressure boundary greater than limited local yielding, nor disturb the core, its support structures, or other reactor vessel Internals so as to significantly impair the capability to cool the core; and

GDC-29, “Protection Against Anticipated Operational Occurrences,” (AOOs) requires that the protection and reactivity control systems be designed to assure an extremely high probability of accomplishing their safety functions in event of AOOs.

The amendment request has concluded that CEA 4 is not mechanically bound and its failure to insert would not result in inadequate SDM should both CEA 4 and the CEA having the highest reactivity worth fail to insert following a reactor trip. Delaying SR performance for approximately nine months until the UGC can be replaced has no impact on the CEA’s ability to move. Nevertheless, because required SDM will continue to be met given the aforementioned scenario (two CEAs remain fully withdrawn post-trip), no fuel design limits will be challenged as a result of this amendment request should it be approved. In addition, the amendment request has no impact on the second reactivity control system at ANO-2 (boration). Therefore, compliance with the aforementioned regulation is maintained.

4.2 Precedent

This amendment request is similar to that approved for ANO-2 due to degradation of CEA 43 in 2001 (Reference 1) and CEA 18 in 2015 (Reference 4).

This amendment request is also similar to that approved for the Palo Verde Nuclear Generating Station, Unit 2, in 2015 (Reference 5) and the Millstone Power Station, Unit 2, in 2017 (Reference 6).

4.3 No Significant Hazards Consideration Analysis

Entergy Operations, Inc. (Entergy) has evaluated the proposed changes to the TS 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 a Note associated with Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification (TS) Surveillance Requirement (SR) 4.1.3.1.2 to eliminate the requirement to move Control Element Assembly (CEA) 4 for the remainder of the current fuel cycle, Cycle 26. Cycle 26 is currently scheduled to end September, 2018. The SR requires that each CEA not fully inserted in the core shall be determined to be operable by movement of at least five inches in any one direction at least once per 92 days.

Basis for no significant hazards consideration determination: As required by 10 CFR 50.91(a), Entergy analysis of the issue of 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

   One function of the CEAs is to provide a means of rapid negative reactivity addition into the core. This occurs upon receipt of a signal from the Reactor Protection System (RPS). This function will continue to be accomplished with the approval of the proposed change. Typically, once per 92 days each CEA is moved at least five inches to ensure the CEA is free to move. CEA 4 remains trippable (free to move) as illustrated by the last performance of SR 4.1.3.1.2 in the fall of 2017. However, due to abnormally high coil voltage and current measured on the CEA 4 Upper Gripper Coil (UGC), future exercising of the CEA could result in the CEA inadvertently inserting into the core, if the UGC were to fail during the exercise test. The mis-operation of a CEA, which includes a CEA drop event, is an abnormal occurrence and has been previously evaluated as part of the ANO-2 accident analysis. Inadvertent CEA insertion will result in a reactivity transient and power reduction, and could lead to a reactor shutdown if the CEA is deemed to be unrecoverable. The proposed change would minimize the potential for inadvertent insertion of CEA 4 into the core by maintaining the CEA in place using the Lower Gripper Coil (LGC), which is operating normally. The proposed change will not affect the CEAs ability to insert fully into the core upon receipt of a reactor trip signal.

   No modifications are proposed to the RPS or associated Control Element Drive Mechanism Control System (CEDMCS) logic with regard to the ability of CEA 4 to remain available for immediate insertion. The accident mitigation features of the plant are not affected by the proposed amendment. Because CEA 4 remains trippable, no additional reactivity considerations need to be taken into consideration. Nevertheless, Entergy has evaluated the reactivity consequences associated with failure of CEA 4 to insert upon a reactor trip in accordance with TS requirements for Shutdown Margin (SDM) and has determined that SDM requirements would be met should such an event occur at any time during the remainder of Cycle 26 operation.

   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

   CEA 4 remains trippable. The proposed change will not introduce any new design changes or systems that can prevent the CEA from perform its specified safety function. As discussed previously, CEA mis-operation has been previously evaluated in the ANO-2 accident analysis. Furthermore, SDM has been shown to remain within limits should an event occur at any time during the remainder of operating Cycle 26 such that CEA 4 fails to insert into the core upon receipt of a reactor trip signal.

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

SR 4.1.3.1.2 is intended to verify CEAs are free to move (i.e., not mechanically bound). The physical and electrical design of the CEAs, and past operating experience, provides high confidence that CEAs remain trippable whether or not exercised during each SR interval. Excluding further exercising of CEA 4 for the remainder of Cycle 26 operation does not directly relate to the potential for CEA binding to occur. No mechanical binding has been previously experienced at ANO-2. CEA 4 is contained within a Shutdown CEA Bank and is not used for reactivity control during power maneuvers (the CEA must remain fully withdrawn at all times when the reactor is critical). In addition, Entergy has concluded that required SDM will be maintained should CEA 4 fail to insert following a reactor trip at any point during the remainder of Cycle 26 operation.

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 Conclusions

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. NRC Safety Evaluation Report dated October 22, 2001, *"Arkansas Nuclear One, Unit 2 – Issuance of Amendment Re: Allowance to Eliminate Movement of Control Element Assembly #43 for the Remainder of Cycle 15"* (TAC No. MB2779) (2CNA100104) (ML012960550)

2. Calvert Cliffs Nuclear Power Plant, Unit No. 1, letter dated June 5, 2006 (ML061580322)

3. NRC letter dated September 29, 1995, *Topical Report ENEAD-01-P, Rev. 0, "Qualification of Reactor Physics Methods for Application to Pressurized Water Reactors of the Entergy System"* (TAC Nos. M88565, M88566, and M88567) (0CNA099509)

4. NRC Safety Evaluation Report dated April 29, 2015, *"Arkansas Nuclear One, Unit 2 – Issuance of Amendment Re: Revise Technical Specification Surveillance Requirement to Eliminate Movement of Control Element Assembly 18 for the Remainder of Operating Cycle 24"* (TAC No. MF5698) (2CNA041502) (ML15096A381)

5. NRC Safety Evaluation Report dated September 25, 2015, *"Palo Verde Nuclear Generating Station, Unit 2 – Issuance of Amendment to Amend Technical Specification Surveillance Requirement to Eliminate Movement of Control Element Assembly 88 for the Remainder of Unit 2, Operating Cycle 19 (Exigent Circumstances)"* (TAC No. MF6678) (ML15266A005)

6. NRC Safety Evaluation Report dated February 7, 2017, *"Millstone Power Station, Unit No. 2 – Issuance of Amendment Re: Technical Specification Surveillance Requirement 4.1.3.1.2 for Control Element Assembly 39"* (CAC No. MF8935) (ML17018A000)

ATTACHMENTS

1. Technical Specification Page Markups

2. Retyped Technical Specification Page

Enclosure Attachment 1 to

2CAN121705

Technical Specification Page Markups

ACTION: (Continued)

e. With more than one CEA misaligned from any other CEA in its group by more than 7 inches (indicated position), be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each CEA shall be determined to be within 7 inches (indicated position) of all other CEAs in its group at least once per 12 hours.

4.1.3.1.2 Each CEA not fully inserted in the core shall be determined to be OPERABLE by movement of at least 5 inches in any one direction at least once per 92 days. (Note 1)

Note 1 - Movement of CEA 4~~18~~ is not required for the remainder of Cycle 264. If an outage of sufficient duration occurs prior to the end of Cycle 264, maintenance activities will be performed to restore the CEA.

Enclosure Attachment 2 to

2CAN121705

Retyped Technical Specification Page

ACTION: (Continued)

e. With more than one CEA misaligned from any other CEA in its group by more than 7 inches (indicated position), be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each CEA shall be determined to be within 7 inches (indicated position) of all other CEAs in its group at least once per 12 hours.

4.1.3.1.2 Each CEA not fully inserted in the core shall be determined to be OPERABLE by movement of at least 5 inches in any one direction at least once per 92 days. (Note 1)

Note 1 - Movement of CEA 4 is not required for the remainder of Cycle 26. If an outage of sufficient duration occurs prior to the end of Cycle 26, maintenance activities will be performed to restore the CEA.