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2CAN090201

September 19, 2002

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

SUBJECT: Arkansas Nuclear One, Unit 2
Docket No. 50-368
License Amendment Request to Extend Allowed Outage Time for Low Pressure Safety Injection System

REFERENCES:

1. CE NPSD-995, Revision 01, "Joint Applications Report for Low Pressure Safety Injection System AOT Extension," Final Report dated November 1999.
2. Entergy Letter dated June 26, 2002, *Revision of Section 6.0, Administrative Controls For Consistency with ANO-1 Improved Technical Specifications* (2CAN060203)

Dear Sir or Madam:

In accordance with 10CFR50.90, Entergy Operations, Inc (Entergy) is proposing to modify the Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification (TS) 3.5 2 to extend the allowed outage time (AOT) to seven days for a single inoperable Low Pressure Safety Injection (LPSI) train. The proposed change is based on Joint Application Report CE NPSD-995, (Reference 1). Additionally, an allowed outage time of 72 hours is being included for other conditions where the equivalent of a single Emergency Core Cooling System (ECCS) subsystem flow is still available to both the LPSI and HPSI trains. If 100% ECCS flow is unavailable due to two inoperable HPSI or LPSI trains, an Action statement has been added to restore at least one of each HPSI and LPSI train to OPERABLE status within one hour. The Limiting Condition for Operation terminology is being changed for consistency with ECCS subsystem and High Pressure Safety Injection (HPSI) and LPSI train requirements. A change to the TS Bases 3/4.5.2 has been included which supports this change.

The proposed changes are intended to provide flexibility in scheduling LPSI system maintenance activities, reduce refueling outage duration, and improve LPSI availability during plant shutdowns as well as consistency with NUREG 1432, *Standard Technical Specifications*

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for Combustion Engineering Plants. The NRC has approved similar requests for other CE plants. This request is similar to that approved for Waterford Station on May 25, 2000 and supplemented on June 20, 2000 and for Palisades Nuclear Station dated October 2, 2000. Entergy's evaluation includes deterministic engineering analysis as well as risk informed information as set forth in Regulatory Guide (RG) 1.177.

A license amendment request for ANO-2 dated June 26, 2002 (Reference 2) is currently under NRC review, which will change one or more of the pages being modified by this amendment request. These proposed changes are not currently reflected in this proposed change.

This proposed change has been evaluated in accordance with 10CFR50.91(a)(1), using the criteria in 10CFR50.92(c), and it has been determined that this request involves no significant hazards considerations.

The next ANO-2 refueling outage is scheduled for the fall of 2003. Entergy desires approval of this amendment by May 2003 to support outage work planning. Entergy Operations requests the effective date for this change be within 60 days of approval. Although this request is neither exigent nor emergency, your prompt review is requested. There are no commitments associated with this change.

If you have any questions or require additional information, please contact Steve Bennett at 479-858-4626.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 19, 2002.

Sincerely,

R Bryant
for
Craig Anderson

CGA/sab

Attachments:

1. Analysis of Proposed Technical Specification Change
2. Proposed Technical Specification Changes (mark-up)
3. Proposed Technical Specification Bases Changes (mark-up)

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Attachment 1

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Analysis of Proposed Technical Specification Change

1.0 DESCRIPTION

This letter is a request to amend Operating License NPF-6 for Arkansas Nuclear One, Unit 2 (ANO-2). The proposed amendment would modify Technical Specification (TS) 3.5.2 to extend the allowed outage time (AOT) from 72 hours to 7 days for a single inoperable low pressure safety injection (LPSI) train. In addition, this proposed change includes other improvements in the Action statements for TS 3.5.2 in accordance with the NUREG 1432, Revision 2, *Standard Technical Specifications for Combustion Engineering Plants.*

The requested changes are sought in order to provide needed flexibility in the performance of corrective and preventive maintenance during power operation. In addition, the adoption of the proposed AOT extension reduces the risk of unscheduled plant shutdowns. This application is supported by a probabilistic safety assessment as a risk-informed submittal per the guidance of Regulatory Guide 1.177, *"An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications."*

The next ANO-2 refueling outage is scheduled for the fall of 2003. Entergy desires approval of this amendment by May 2003 to support outage work planning.

2.0 PROPOSED CHANGE

Entergy Operations, Inc. is proposing that the Arkansas Nuclear One, Unit 2 (ANO-2) Operating License be amended for TS 3.5.2 to:

1) Create a new Action statement "a" that extends the allowed outage time (AOT) for a single LPSI train to seven (7) days.

2) Modify the existing Action statement "a" to retain the 72-hour AOT for other conditions not associated with a single LPSI train. An Action statement for an equivalent of 100% Emergency Core Cooling System (ECCS) subsystem flow is being added to ensure that adequate High Pressure Safety Injection (HPSI) and LPSI injection are available. This is now Action statement "b".

3) A new Action statement "c" has been created where 100% ECCS flow equivalent to either the HPSI or LPSI trains within both ECCS subsystems is not available, then at least one LPSI train and one HPSI train are restored to Operable status within one hour. This action is commensurate with Limiting Condition for Operation (LCO) 3.0.3.

4) The LCO for 3.5.2.a, 3.5.2.b and 3.5.2.c is being changed from referencing HPSI and LPSI pumps to referencing HPSI and LPSI trains. Acronyms for LPSI and HPSI have been added.

5) The note for the Applicability while in Mode 3 regarding being greater than or equal to 1700 psia has been deleted as a note and the wording has been moved to the Applicability after Mode 3,

6) A change to the TS Bases 3/4.5.2 has been included to support this change.

The above proposed changes are consistent with the intent of NUREG 1432, Revision 2.

In addition, several changes have been made to reformat the TS and TS Bases pages. This includes moving information previously contained on the affected pages to subsequent pages, modifying the font, adding indentions to paragraphs, renumbering of unaffected actions and other similar changes. These changes are considered editorial and will not be further discussed. Only the moving of information from one page to another will be denoted as a change.

3.0 BACKGROUND

The current ANO-2 TSs address the LPSI pumps and suction flow path as a portion of the ECCS subsystem. TS 3.5.2 requires two independent ECCS subsystems to be Operable. With one ECCS subsystem inoperable, based on any component being inoperable, the subsystem must be returned to Operable status within 72 hours or the plant placed in Hot Shutdown within the following 6 hours. The proposed change will allow up to seven (7) days to restore operability to a LPSI train if that is the cause of ECCS subsystem being inoperable. The end state for Action "a" is also being changed to reduce pressurizer pressure to less than 1700 psia for consistency with the Applicability for 3.5.2. An AOT of 72 hours is being proposed for other conditions where the equivalent of 100% flow to the LPSI and HPSI trains remains available. In this case a 72-hour Action statement is acceptable to restore the affected trains. If 100% ECCS flow is unavailable due to two inoperable HPSI or two inoperable LPSI trains, an Action is being added to restore at least one HPSI train and one LPSI train to Operable status within one hour. If this cannot be accomplished, then place the plant in Hot Standby in 6 hours and reduce pressurizer pressure to less than 1700 psia within the following 6 hours. The time requirements of this action are consistent with the requirements of TS 3.0.3. These changes are generally consistent with NUREG 1432, Revision 2, *Standard Technical Specifications for Combustion Engineering Plants.*

Additionally, the current TS 3.5.2 LCO Actions "a" and "b" refer to the operability of HPSI and LPSI pumps. In actuality, the LCO should refer to HPSI and LPSI trains as being required for operability, since Action "c" requires only the flow path to be Operable. This proposed change modifies the LCO to the correct terminology from pumps to trains. A LPSI train consists of a pump, and two injection flow paths including motor operated valves, which are controlled by a common AC power source. A HPSI train consists of one pump (including one swing pump) and four injection flow paths including motor operated injection and throttle valves, which are controlled by a common AC power source. Where a HPSI train, a LPSI train and an Operable suction flowpath (as specified in the LCO) is referenced, the term ECCS subsystem is retained.

The Combustion Engineering Owners Group (CEOG) prepared topical report CE NPSD-995 entitled *Joint Applications Report for Low Pressure Safety Injection System AOT Extension*; (Reference 1). This report provides the results of an evaluation of the extension of the AOT for the LPSI system from either 24 or 72 hours to 7 days. As discussed in the report, the objectives of the extension request are consistent with the intent of the Maintenance Rule and the unavailability performance criteria and risk analysis. The AOT extension is being sought to provide needed flexibility in the performance of both corrective and preventive maintenance during power operation. Justification of this request was based on an integrated review and assessment of plant operations, deterministic/design basis factors and plant risk. Results of this study demonstrate that the proposed AOT extension provides plant operational flexibility while simultaneously reducing overall plant risk. In general, risks incurred by unexpected plant shutdowns can be comparable to and even may exceed those associated with continued power operation.

4.0 TECHNICAL ANALYSIS

4.1 Deterministic Assessment of LPSI AOT Extension

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a. Loss of coolant accident (LOCA),

b. Control Element Assembly (CEA) ejection accident,

c. Loss of secondary coolant accident, including uncontrolled steam release or loss of feedwater, and

d. Steam generator tube rupture (SGTR).

The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power. There are two phases of ECCS operation: injection and recirculation. In the injection phase, all injection is initially added to the Reactor Coolant System (RCS) via the cold legs. After the blowdown stage of the LOCA stabilizes, injection flow is split equally between the hot and cold legs. After the refueling water tank (RWT) has been depleted, the ECCS recirculation phase is entered as the ECCS suction is automatically transferred to the containment sump.

Two redundant, 100% capacity ECCS subsystems are provided. Each subsystem consists of the HPSI and LPSI trains and their associated flow paths. In MODES 1, 2, and 3, with pressurizer pressure $\geq$ 1700 psia, both ECCS subsystems are required to be Operable. This ensures that 100% of the core cooling requirements can be provided in the event of a single active failure.

A suction header supplies water from the RWT to the ECCS subsystems. Separate piping supplies each train. The discharge headers from each HPSI pump divide into four supply lines. Both HPSI trains feed into four separate injection lines. The discharge header from each LPSI pump divides into two supply lines, each feeding the injection line to two RCS cold legs. Control valves or orifices are set to balance the flow to the RCS. This flow balance directs sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the RCS cold legs.

4.1.1 Compliance with Current Regulations

A review was performed to ensure compliance with NRC rules and regulations for extending the LPSI AOT to 7 days. In addition, a review of the ANO-2 Final Safety Analysis Report (FSAR) was conducted. The results of this review are discussed in section 5.1 of this attachment.

4.1.2 Defense in Depth

The design and operation of the LPSI system is not being modified as a result of the proposed change to extend the allowed outage time from 72 hours to 7days. However, the proposed change will allow more flexibility when the system can be removed from service to perform planned maintenance of the system. The amount of time that the system can be removed from service only affects the period of time that a train of LPSI may be removed from service and not the design requirements or operation of the system.

The LPSI trains serve two functions. The first is to inject large quantities of borated water into the RCS during an emergency involving a large reactor coolant pipe rupture. Sufficient flow is delivered under these conditions to satisfy the specified functional requirements. The second is to provide flow through the reactor core and shutdown cooling heat exchangers for shutdown cooling and residual heat removal during cold shutdown.

With only one inoperable LPSI train when in Action "a", the other train of LPSI and both trains of HPSI are available to perform the required safety function. This provides a defense in depth basis to allow up to 7 days while in this condition. If however, one each of the HPSI or LPSI trains are inoperable due to other conditions, then the allowed outage time is reduced to only 72 hours. If in the case that both HPSI and LPSI trains are inoperable, due to less than 100% ECCS flow being available, then the HPSI or LPSI function is not available and action must be taken within 1 hour to restore one of the inoperable affected trains. Therefore, the above actions are commensurate with defense in depth philosophy and safety function protection.

While removing the LPSI train from service to perform either corrective or preventive maintenance there are no required compensatory actions that must be taken to maintain overall LPSI system reliability. System redundancy, independence and diversity are maintained commensurate with the expected frequency and consequences of challenges. As part of the ANO-2 Equipment Out of Service (EOOS) model, operational considerations are taken to prevent voluntary LPSI train removal when other system configuration reliability is reduced, such as components that may be out of service that would affect LPSI reliability. Such things as severe weather conditions are also taken into consideration when considering pre-planned removal of a LPSI system for maintenance.

4.1.3 Safety Margins

The proposed change maintains the same level of compliance with the codes and standards required to ensure LPSI system design and operation. The ANO-2 safety injection system is designed to meet its functional requirements even with the failure of a single active component during the injection mode of operation or with the single failure of an active or passive component during the recirculation mode of operation. By providing proper redundancy of equipment, even with the single failure noted above, the minimum required safety injection equipment is assured to be available upon demand.

10CFR50.46 provides the acceptance criteria for the ECCS. The criteria of 10CFR50.46 continue to be met for ECCS performance including peak clad temperature, maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long term

cooling. The ability of the HPSI or LPSI systems to support accident mitigation is unchanged as a result of the AOT extension.

As discussed in CE NPSD-995, the LPSI system also mitigates the steam generator tube rupture accident. In this event the LPSI system functions to maintain the RCS in shutdown cooling after the HPSI system has performed its function to maintain the core in a coolable geometry. In the event that one LPSI train is out of service and the second LPSI train fails, the operator can continue to control the event by steaming the unaffected steam generator. This cooling mechanism can be maintained indefinitely given adequate condensate. There is no change to the LPSI system design and therefore adequate design margin is maintained as a result of the proposed change.

4.2 Evaluation of Risk Impact

In addition to evaluating the impact of the AOT extension on deterministic factors associated with the plant design bases, a probabilistic safety analysis (PSA) of risks involved with applicable plant operations was performed. The analysis generally conforms to the three-tiered approach for evaluating the risk impact from an AOT extension as identified in Regulatory Position C.2.3 of USNRC Regulatory Guide 1.177.

The considerations, assumptions, methodologies, and detailed results of the risk analysis are reported in CE NPSD-995, (Reference 1). The joint applications report, as supplemented, forms the risk-informed justification/basis for the proposed license amendment. The ANO-2 evaluation provided in CE NPSD-995 was generated using the IPE models developed in response to Generic Letter (GL) 88-20, *Individual Plant Examination for Severe Accident Vulnerabilities*, and associated supplements.

The CEOG study categorized the change in risk into "at power risk," "transition risk," and "shutdown risk." Consideration of the risk factors impacted by the extension in AOT from 72 hours to 7 days demonstrated that essentially no increase in average "at power" core damage frequency (CDF) for ANO-2 (Table 6.3.2-3) exists. In order to perform a more complete analysis of the overall change in risk, accounting for avoided risks associated with reducing power and going to hot or cold shutdown was also considered.

As part of the CEOG study, an analysis was performed on the impact of the proposed LPSI AOT extension on large early release scenarios. The assessments of the three classes of events (containment bypass, severe accidents accompanied by loss of containment isolation, and containment failure associated with energetic events in containment) were considered for these scenarios. It concluded that the increased unavailability of one LPSI train would result in a negligible impact on the large early release probability for the CE fleet as well as ANO-2.

The CEOG report concluded that the overall plant risk with the proposed AOT is either risk beneficial or risk neutral.

4.2.1 Safety Assessment for Extension of LPSI AOT to 7 Days

An assessment of the change in the ANO-2 core damage frequency (CDF) for allowing ANO-2 to continue at power operation with a LPSI train being out of service up to 7 days was performed. Using the ANO-2 Internal Events Level-1 PSA model, the CDF associated with at-power plant conditions was assessed. The summary of the risk analysis provides a best estimate evaluation using current modeling techniques including a relative change in CDF values.

The current approved ANO-2 PSA model (revision 3p1) was used for this analysis. The PSA model provides only internal event at-power risks estimates. Anticipated Transients Without Scram (ATWS), Interfacing System LOCAs (ISLOCA), and external initiators such as seismic events, internal or external floods, high winds, tornadoes, etc. are not considered in this analysis since these were not available in the above model.

Although transition and shutdown risks were not considered, their contribution is expected to be beneficial as discussed in CE NPSD-995. Impact of the AOT extension on Large Early Release Frequency (LERF) is also not considered here and is enveloped by CE NPSD-995.

For the preventive maintenance cases, no other safety related components or systems were considered as being Out of Service (OOS). However, their test and maintenance events were left at their nominal values for conservatism. When one train is OOS for preventive maintenance (PM), the other train is not to be in a test and maintenance condition. For corrective maintenance (CM) the probability for the other train is left at the nominal value. For the corrective maintenance, the failure of a train implies failure of a pump, associated breaker, and injection valves. This is identified as the worst case assumption, which provides conservative results.

Preventive maintenance is defined as planned maintenance evolutions not precipitated by equipment failure. It is assumed that PM is planned such that plant risk is minimized consistent with the requirements of Maintenance Rule (a)(4). Corrective Maintenance is defined as emergent maintenance evolutions precipitated by equipment failure. Because CM is not planned, it is assumed that the plant risk may be elevated due to plant conditions that existed when the subject equipment failure occurred.

The results of the ANO-2 LPSI AOT extension risk analysis due to internal event contributors to CDF shows that for both the preventive and corrective maintenance cases all the ICCDP values calculated are well below the regulatory guideline limit provided in RG 1.177. Yearly AOT risk, as well as ICCDP and Δ CDF/yr, values are provided in Table 1.

4.2.2 Tier 1 PRA Capability and Insights

Tier 1 is an evaluation of the impact on plant risk of the proposed TS change as expressed by the change in core damage frequency (CDF), the incremental conditional change in core damage probability (ICCDP), and when appropriate, the change in large early release frequency (LERF) and the incremental conditional large early release probability. CEOG

report CE NPSD-995 explores the proposed change to a 7 day AOT utilizing current probabilistic safety analysis (PSA) methodologies to address the changes in risk when compared with current TS time limitations. This study of the risk factors that are impacted by extending the AOT for a single LPSI train from 72 hours to seven (7) days demonstrates a negligible increase in risk (<1%). In order to perform a more complete assessment of the overall change in risk, an accounting for avoided risks associated with reducing power and going to hot or cold shutdown must be considered.

This "transition risk" is important in understanding the trade-off between shutting down the plant compared with restoring the LPSI train to operability while at power. Also of interest in assessing overall plant risk is the risk avoided based on LPSI system maintenance while in Cold Shutdown. Whenever ANO-2 goes to Cold Shutdown, the LPSI system is required for decay heat removal in the shutdown cooling mode of operation. Any maintenance performed on the LPSI system during shutdown cooling operations adds to the risk of a loss of shutdown cooling event. Therefore, performing LPSI system maintenance with the unit on-line, when the LPSI system is not normally in demand, represents a decrease in shutdown risk.

Table 6.3.2-3 of CE NPSD-995 shows that there is little change in the calculated CDF for ANO-2. The report concluded that increased unavailability of the LPSI system will result in negligible impact on LERF. Thus, the RG 1.174 acceptance guideline of "very small" increases in these parameters is satisfied. In addition, the calculated ICCDP (Tables 6.3.2-1 and 6.3.2-2) is negligible (less than 5E-07) as well as the expected ICLERP, and satisfies the acceptance guideline that the proposed AOT change has only a "small" quantitative impact on plant risk as defined in RG 1.177.

Entergy has recently reevaluated the potential risk associated with extending the AOT for the LPSI system to 7 days using the current ANO-2 PSA model. The following table provides a comparison between CE NPSD-995 Tables 6.3.2-1 and 6.3.2-2 (corrective maintenance and preventive maintenance, respectively) with that evaluated for the current ANO-2 PSA model. Parameters considered to be key for comparison are the differences in core damage frequency per year (Δ CDF/yr), incremental core damage probability (ICCDP) for a 7 day AOT, and the yearly AOT extension risk. However, for the purposes of comparing to the guidance of RG 1.177, the yearly AOT risk results ensure that the change in risk is reasonably low.

Table 1 - Comparison of CE NPSD-995 and ANO-2 PSA Risk Insight Values

Parameter	NPSD-995 Corrective Maintenance	ANO-2 Model Corrective Maintenance	NPSD-995 Preventive Maintenance	ANO-2 Model Preventive Maintenance
Δ CDF/yr	1.52E-05	1.47E-05	4.2E-06	1.88E-06
ICCDP	2.92E-07	2.81E-07	8.06E-08	3.61E-08
Yearly AOT Risk*	1.93E-07	1.85E-07	2.42E-07	1.08E-07

* Yearly AOT extension risk is based on a downtime frequency of 0.33 events/year/train for corrective maintenance and 1.5 events/year/train for preventive maintenance as provided in CE NPSD-995 for ANO-2.

The results of these analyses conclude that the change in core damage frequency due to increasing the LPSI AOT from 72 hours to seven (7) days is insignificant. Additionally, when the reduction in transition and shutdown risks are considered, it can be shown that there is an overall reduction in plant risk. Thus, it is the conclusion of the study that the overall plant impact will be either risk beneficial, or at the very least, risk neutral. The adoption of the proposed AOT extension reduces the risk of unscheduled plant shutdowns. In general, risks incurred by unexpected plant shutdowns can be comparable to and even may exceed those associated with continued power operation.

4.2.3 Tier 2, Avoidance of Plant Risk

The avoidance of risk significant plant configurations identifies the potentially high risk configurations that could exist if equipment in addition to that associated with the TS change is concurrently taken out of service or other risk significant operational factors such as concurrent system or equipment testing are involved. This ensures that appropriate restrictions are placed on dominant risk significant configurations that would be relevant to the proposed TS change. Entergy has not identified any additional constraints or compensatory actions that should be included with the proposed AOT extension in order to avoid planned high-risk configurations. Assessments performed in accordance with provisions of the ANO-2 EOOS Model will ensure that potentially risk significant configurations are identified prior to removing a LPSI train from service for corrective maintenance. Similarly, implementation of the EOOS will ensure that the risk significance of unexpected configurations resulting from unplanned maintenance or conditions while in the risk-informed AOT is properly evaluated.

4.2.4 Tier 3, ANO-2 Risk Management Program

The EOOS model provides the configuration risk management program tool at ANO for compliance with 10CFR50.65, particularly with respect to paragraph (a)(4). The program provides assurance that risk significant plant equipment configurations are precluded or minimized when plant equipment is removed from service. This program is a proceduralized risk-informed assessment process to manage the risk associated with planned and unplanned plant maintenance activities. The program ensures that the risk

impact of out of service equipment is appropriately evaluated prior to performing a planned maintenance activity and soon after entering into an emergent maintenance condition. Procedures and guidelines have been developed that govern this process. These documents require an integrated (i.e., both quantitative and qualitative) review of maintenance activities to identify risk significant plant equipment outage configurations. This review is required both during the work management process and for emergent condition during normal plant operation. Appropriate consideration is given to equipment unavailability, operational activities like testing or load dispatching, and weather conditions. This program includes provisions for performing a configuration dependent assessment of the overall impact on risk of proposed plant configurations prior to, and during, the performance of maintenance activities that remove equipment from service. Risk is re-assessed if an equipment failure/malfunction or emergent condition produces a plant configuration that has not been previously assessed.

The quantitative risk assessment is performed to ensure that the activity does not pose any unacceptable risk. This evaluation is performed using the ANO-2 EOOS model, a Level-1 PSA model. The model is used to calculate core damage frequency for actual plant conditions. The EOOS risk assessment results are classified by a color code based on the increased risk of the activity. These color code classifications are described in the following table.

Color	Risk
Green	Minimal Risk – normal work controls are sufficient.
Yellow	Acceptable Risk – Plant management approval is required. Measures are taken to quickly restore the components to service. Steps are taken to ensure subsequent maintenance activities do not raise risk.
Orange	High Risk – Plant Manager approval is required for voluntary entry or notification required if this Risk category is entered due to emergent activities. Written guidance and or contingency plans are required prior to voluntarily entering this condition. Equipment maintenance activities should be worked around the clock until completion.
Red	Unacceptably High Risk – Voluntary entry into this condition is NOT allowed. Plant Manager notification is required upon entering this condition from emergent activities. Immediate steps are taken to restore any equipment impacting plant safety.

The qualitative assessment addresses a broad range of areas, including trip or transient potential, reactivity mismanagement potential, redundant equipment availability, containment integrity, cross unit impact, red train-green train separation, fire, flooding, and severe weather contingencies.

For planned activities, an assessment of the risk of the activities on plant safety is performed prior to the scheduled work. The assessment includes the following considerations:

- Maintenance activities that affect redundant structures, systems, and components (SSCs) that provide backup for the same function are minimized.

- The potential for planned activities to cause a plant transient are reviewed and work on SSCs that would be required to mitigate the transient are avoided.
- For Maintenance Rule Program High Risk Significant SSCs, the impact of the planned activity on the unavailability performance criteria is evaluated.

Emergent work is reviewed by the ANO Planning and Scheduling and Operations departments to ensure that it does not invalidate the assumptions made during the schedule development process. Prior to starting any work, the work scope and schedule are critically reviewed to assure that nuclear safety and plant operations are consistent with the expectations of management.

The probability of plant fire events is not assessed for distinct plant activities. However, following the current ANO Fire Hazards Analysis requirements and procedures provides sufficient assurance that risk associated with removing equipment is minimized. The Fire Protection Program uses a three tiered approach: (1) preventing fires from starting, (2) detecting fires promptly, suppressing them quickly, and therefore limiting fire damage; and (3) designing plant safety systems so that a fire which does start will not ultimately prevent essential plant safety functions from being accomplished. Fire prevention is accomplished through various procedures and training programs.

4.3 Quality of ANO-2 PSA Model

The ANO-2 Individual Plant Examination (IPE) model was developed by ANO Safety Analysis Design Engineering personnel with support from SAIC (now DS&S), other Design Engineering groups, and Operations. As part of the IPE development process, an expert panel review was performed on the results. This panel was composed of experienced personnel from these groups. In addition, ERIN Engineering performed an external review of the IPE model and results. The ANO-2 Probabilistic Safety Analysis (PSA) model has been updated several times since the IPE to maintain it consistent with the as-built/as-operated plant, to incorporate improved thermal hydraulic results, and to incorporate PSA methodology improvements. The updates have involved a cooperative effort involving both Entergy personnel and PSA consultant support. In each of the updates, an independent review of the revisions to the PSA model is performed. The PSA model and results have been maintained as plant calculations or engineering reports. As part of each major update, in order to ensure adequacy of the updated model, an internal review of PSA model results is performed by utilizing an expert panel. The panel is typically composed of experienced personnel from various plant organizations, including Operations, System Engineering, Design Engineering, Safety Analysis, and PSA. In addition, the CE Owners Group conducted a peer review of ANO-2 model in February of 2002. However, the results of this review have not been issued to date. It should be noted that the NRC Staff has reviewed the results of the current ANO-2 PSA model as part of its benchmarking of the ANO-2 Significance Determination Program Notebook. This review was conducted by the Staff and its contractors at the ANO site during the week of November 26, 2001. Also, the NRC Staff performed an extensive review of the risk assessment methods used in the ANO-2 PSA model as part of its review of the risk impact of the ANO-2 power uprate. This review included a site visit on December 18 and 19, 2001.

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements/Criteria

The proposed changes have been evaluated to determine whether applicable regulations and licensing basis requirements continue to be met.

General Design Criteria (GDC) Considerations - Criterion 34 regarding Residual Heat Removal requires that a system to remove residual heat be provided. The LPSI pumps when aligned to the shutdown cooling system provides this function. Criterion 35 regarding Emergency Core Cooling requires a system to provide abundant emergency core cooling be provided. The LPSI system as part of the ECCS provides a portion of this requirement. Criterion 37 regarding Testing Of Emergency Core Cooling System requires the ECCS be designed to permit appropriate periodic pressure and functional testing. Compliance with these criteria for the LPSI system are unaffected by the proposed AOT change from 72 hours to 7 days.

Safety Analysis Report (SAR) Considerations - As discussed in ANO-2 SAR Section 3.9.2.4, the LPSI pumps were ordered to the requirements of the draft ASME Code for Pumps and Valves for Nuclear Power Plants dated November 1968. The LPSI system is designed as Class II, Quality Group B. ANO-2 SAR Section 6.3.2 discusses the design and operation of the LPSI pumps for accident mitigation. This includes the flow requirements of the system, assurance of adequate cooling, pump internal design and external system features to ensure operability. ANO-2 SAR Section 6.3.3 discusses the overall accident performance of the ECCS including that of the LPSI system for mitigation of loss of coolant accidents. Table 6.3-1 provides the specific LPSI design parameters required to mitigate LOCA events. ANO-2 SAR Section 9.3.6 provides the overall design of the Shutdown Cooling System including the LPSI pumps as the driving head for compliance to GDC 34. These design requirements are unchanged by the proposed AOT extension.

Entergy has determined that the proposed changes do not require any exemptions or relief from regulatory requirements, other than the TS, and do not affect conformance with any general design criteria differently than described in the SAR. None of the SAR described functions or information is impacted by the proposed change.

5.2 No Significant Hazards Consideration Determination

Entergy Operations, Inc. is proposing that the Arkansas Nuclear One, Unit 2 (ANO-2) Operating License be amended to extend the allowed outage time (AOT) for the low pressure safety injection (LPSI) train to seven (7) days for technical specification (TS) 3.5.2. Additionally, an AOT of 72 hours is being proposed for other conditions in TS 3.5.2 where the equivalent of 100% Emergency Core Cooling System (ECCS) subsystem flow is available to at least one high pressure safety injection (HPSI) and one LPSI train. If 100% ECCS flow is unavailable to either the HPSI train or LPSI train, an ACTION has been added to TS 3.5.2 to restore at least one of the HPSI and LPSI train(s) to Operable status within one hour or place the plant in HOT STANDBY in 6 hours and to reduce pressurizer pressure to less than 1700 psia within the following 6 hours. The Limiting Conditions for Operation for TS 3.5.2 is being changed from referencing HPSI and LPSI pumps to referencing HPSI and LPSI trains.

Entergy Operations, Inc. has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10CFR50.92, *"Issuance of amendment,"* as discussed below:

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

   The HPSI and LPSI trains are part of the ECCS subsystem. Inoperable HPSI or LPSI components are not accident initiators in any accident previously evaluated. Therefore, this change does not involve an increase in the probability of an accident previously evaluated. Both the HPSI and LPSI systems are primarily designed to mitigate the consequences of a Loss of Coolant Accident (LOCA). These proposed changes do not affect any of the assumptions used in the deterministic LOCA analysis. Hence the consequences of accidents previously evaluated do not change.

   In order to fully evaluate the LPSI AOT extension, probabilistic safety analysis (PSA) methods were utilized. The results of the analyses show no significant increase in the core damage frequency. As a result, there would be no significant increase in the consequences of an accident previously evaluated. The analyses are detailed in CE NPSD-995, Combustion Engineering Owners Group *Joint Applications Report for Low Pressure Safety Injection System AOT Extension.*

   The proposed change allows a combination of equipment from redundant trains to be inoperable provided that at least the equivalent flow of a single HPSI and LPSI train of ECCS remains operable. Analyzed events are assumed to be initiated by the failure of plant structures, systems or components. Allowing equipment from redundant trains to constitute a single operable train does not increase the probability that a failure leading to an analyzed event will occur. The ECCS components are passive until an actuation signal is generated. This change does not increase the failure probability of the ECCS components. As such, the probability of occurrence for a previously analyzed accident is not significantly increased.

   Therefore, the proposed change will not involve a significant increase in the probability or consequences of any accident previously evaluated.

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

   The proposed change does not change the design or configuration of the plant. No new equipment is being introduced, and installed equipment is not being operated in a new or different manner. There is no change being made to the parameters within which the plant is operated, and the setpoints at which protective or mitigative actions are initiated are unaffected by this change. No alteration in the procedures, which ensure the plant remains within analyzed limits, is being proposed and no change is being made to the procedures relied upon to respond to an off-normal event. As such, no new failure modes are being introduced. The proposed change will only provide the

plant some flexibility in maintaining the minimum equipment required to be Operable to perform the ECCS function while in this Condition. The change does not alter assumptions made in the safety analysis and licensing basis.

Therefore, the proposed change will not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

The CE NPSD-995 and ANO-2 PSA evaluations demonstrate that the changes are essentially risk neutral or risk beneficial. The margin of safety is established through equipment design, operating parameters, and the setpoints at which automatic actions are initiated. None of these are adversely impacted by the proposed change. Sufficient equipment remains available to actuate upon demand for the purpose of mitigating a transient event. The proposed change, which allows operation to continue for up to 72 hours with components inoperable in both ECCS subsystems, is acceptable based on the remaining ECCS components providing 100% of the required ECCS flow.

Therefore, the proposed change will not involve a significant reduction in a margin of safety.

5.3 Environmental Considerations

The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10CFR51.22(c)(9). Therefore, pursuant to 10CFR51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment

6.0 PRECEDENCE

The NRC has approved similar requests for other CE plants. This request is similar to that approved for Waterford Station on May 25, 2000 and supplemented on June 20, 2000 and for Palisades Nuclear Station dated October 2, 2000.

Attachment 2

2CAN090201

Proposed Technical Specification Changes (mark-up)

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - $T_{avg} \geq 300°F$

LIMITING CONDITION FOR OPERATION

3.5.2 Two independent ECCS subsystems shall be OPERABLE with each sub-system comprised of:

a. One OPERABLE high-pressure safety injection (HPSI) ~~pump~~train,

b. One OPERABLE low-pressure safety injection (LPSI) ~~pump~~train, and

c. An independent OPERABLE flow path capable of taking suction from the refueling water tank on a Safety Injection Actuation Signal and automatically transferring suction to the containment sump on a Recirculation Actuation Signal.

APPLICABILITY: MODES 1, 2 and 3* with pressurizer pressure ≥ 1700 psia.

ACTION:

a. With one ECCS subsystem inoperable due to an inoperable LPSI train, restore the inoperable ~~subsystem~~ train to OPERABLE status within ~~72 hours~~7 days or be in HOT ~~SHUTDOWN~~ STANDBY within the next ~~12~~ 6 hours and reduce pressurizer pressure to < 1700 psia within the following 6 hours.

b. With one or more ECCS subsystems inoperable due to conditions other than "a" above and 100% of ECCS flow equivalent to a single OPERABLE HPSI and LPSI train is available, restore the inoperable train(s) to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and reduce pressurizer pressure to < 1700 psia within the following 6 hours.

c. With less than 100% ECCS flow equivalent to either the HPSI or LPSI trains within both ECCS subsystems, restore at least one HPSI train and one LPSI train to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and reduce pressurizer pressure to < 1700 psia within the following 6 hours

~~b~~d. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date.

~~SURVEILLANCE REQUIREMENTS~~

~~4.5.2 Each ECCS subsystem shall be demonstrated OPERABLE:~~

~~a. At least once per 12 hours by verifying that the following valves are in the indicated positions with power to the valve operators removed:~~

~~Valve Number~~	~~Valve Function~~	~~Valve Position~~
~~2CV-5101~~	~~HPSI Hot Leg Injection Isolation~~	~~Closed~~
~~2CV-5102~~	~~HPSI Hot Leg Injection Isolation~~	~~Closed~~
~~2BS26~~	~~RWT Return Line~~	~~Open~~

~~*With pressurizer pressure ≥ 1700 psia.~~

EMERGENCY CORE COOLING SYSTEMS

SURVEILLANCE REQUIREMENTS ~~(Continued)~~

4.5.2 Each ECCS subsystem shall be demonstrated OPERABLE:

a. At least once per 12 hours by verifying that the following valves are in the indicated positions with power to the valve operators removed:

Valve Number	Valve Function	Valve Position
2CV-5101	HPSI Hot Leg Injection Isolation	Closed
2CV-5102	HPSI Hot Leg Injection Isolation	Closed
2BS26	RWT Return Line	Open

b. At least once per 31 days by verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

1. For all accessible areas of the containment prior to establishing CONTAINMENT INTEGRITY, and

2. At least once daily of the areas affected within containment if containment has been entered that day, and during the final entry when CONTAINMENT INTEGRITY is established.

d. At least once per 18 months by:

1. Verifying automatic isolation and interlock action of the shutdown cooling system from the Reactor Coolant System when the Reactor Coolant System pressure is above 300 psia.

2. A visual inspection of the containment sump and verifying that the subsystem suction inlets are not restricted by debris and that the sump components (trash racks, screens, etc.) show no evidence of structural distress or corrosion.

e. At least once per 18 months, during shutdown, by:

1. Verifying that each automatic valve in the flow path actuates to its correct position on SIAS and RAS test signals.

2. Verifying that each of the following pumps start automatically upon receipt of a Safety Injection Actuation Test Signal:

a. High-Pressure Safety Injection pump.

b. Low-Pressure Safety Injection pump.

Attachment 3

2CAN090201

Proposed Technical Specification Bases Changes (mark-up)

EMERGENCY CORE COOLING SYSTEMS

BASES

NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements," Section 7.4 discusses surveillance requirements for the instrumentation channels used in the measurement of water level and pressure in SITs. It is the recommendation of the NUREG that when one SIT is inoperable due only to the inability to verify water level and pressure, 72 hours be allowed to restore SIT to an OPERABLE status.

If one SIT is inoperable, for a reason other than boron concentration or the inability to verify level or pressure, the SIT must be returned to OPERABLE status within 24 hours. In this condition, the total contents of the three remaining SITs cannot be assumed to reach the core during a LOCA, contrary to the assumptions of 10 CFR 50, Appendix K.

CEOG "Joint Applications Report for Safety Injection Tank AOT/STI Extension," CE NPSD-994, provides a series of deterministic and probabilistic findings that support 24 hours as being either "risk beneficial" or "risk neutral" in comparison to shorter periods for restoring the SIT to OPERABLE status. The report discusses best-estimate analysis that confirmed that, during large-break LOCA scenarios, core melt can be prevented by either operation of one LPSI pump or the operation of one HPSI pump and a single SIT.

3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two separate and independent ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the safety injection tanks is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double-ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

With one LPSI train inoperable per Action statement "a", action must be taken to restore the train to OPERABLE status within 7 days In this condition, the remaining OPERABLE ECCS subsystem is adequate to perform the heat removal function. The 7-day Action statement is reasonable to perform corrective maintenance on the inoperable LPSI train. The 7-day time is based on the findings of the deterministic and probabilistic analysis in CE NPSD-995, "Low Pressure Safety Injection System AOT Extension," April 1995, which concluded that 7 days for an inoperable LPSI train provides plant operational flexibility while simultaneously reducing overall plant risk.

In Action statement "b", if one or more HPSI or LPSI trains are inoperable except for reasons other than Action "a" and at least 100% of the ECCS flow equivalent to at least one of the individual HPSI and LPSI trains is available, the individual ECCS trains are allowed to be inoperable for up to 72 hours. The 72 hour allowed outage time is based on a reasonable amount of time to effect many repairs. A HPSI or LPSI train is inoperable if it is not capable of delivering its design flow to the RCS. The individual components within a HPSI or LPSI train are inoperable if they are not capable of performing their design function, or if supporting systems are not available. Due to the redundancy of trains within the ECCS subsystems, the inoperability of one component in a train does not necessarily render the ECCS incapable of performing its function. Similarly,

~~The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the accident analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements of throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses. The acceptance criteria specified in the Surveillance Requirements for HPSI single pump flow, HPSI differential pressure, and LPSI differential pressure does not account for instrument error.~~

~~3/4.5.4 REFUELING WATER TANK (RWT)~~

~~The OPERABILITY of the RWT as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS and CSS in the event of a LOCA. The limits on RWT minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and (2) the reactor will remain subcritical in the cold condition following mixing of the RWT and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses.~~

EMERGENCY CORE COOLING SYSTEMS

BASES

the inoperability of two different components, each in a different HPSI or LPSI train does not make the ECCS subsystem inoperable as long as at least one HPSI and LPSI train is capable of performing its required safety function which is to deliver at least 100% of its ECCS flow equivalent. This allows increased flexibility in plant operations when components in opposite trains are inoperable.

Action statement "c" addresses the condition in which 100% ECCS flow is not available to either or both of the HPSI and LPSI trains. This action requires restoration of at least one HPSI and one LPSI train to OPERABLE status within one hour. If less than 100% of the ECCS flow equivalent to the ECCS subsystems exist, the commensurate actions to LCO 3.0.3 are entered.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the accident analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements of throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses. The acceptance criteria specified in the Surveillance Requirements for HPSI single pump flow, HPSI differential pressure, and LPSI differential pressure does not account for instrument error.

3/4.5.4 REFUELING WATER TANK (RWT)

The OPERABILITY of the RWT as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS and CSS in the event of a LOCA. The limits on RWT minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and (2) the reactor will remain subcritical in the cold condition following mixing of the RWT and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses.

The available water volume limits represent the analytically assumed maximum and minimum volume of water that can be transferred from the refueling water tank to containment via the emergency core cooling system and containment spray before pump suction is switched to the sump. An RWT indicated level between 100% and 91.7%, in combination with the RAS setpoint, ensures that the analysis assumptions with respect to available borated water volume are maintained.

The limits on water volume and boron concentration of the boric acid sources, when mixed with the trisodium phosphate, ensures a long term pH value of ≥ 7.0 for the solution recirculated within containment after a LOCA. This pH limit minimizes the evolution of iodine and helps to inhibit stress corrosion cracking of austenitic stainless steel components in containment during the recirculation phase following an accident.