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May 2, 2001

2CAN050103

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Arkansas Nuclear One – Unit 2
Docket No. 50-368
License No. NPF-6
Relocation of Technical Specification 3.6.4.3, Containment Recirculation System, to Technical Requirements Manual

Gentlemen:

Attached for your review and approval is a proposed change that would allow moving Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification (TS) 3.6.4.3, Containment Recirculation System and the associated surveillance requirements to the Technical Requirements Manual. The bases for the containment air recirculation system is to provide mixing of the containment atmosphere to prevent concentrations of hydrogen in the containment building dome following any postulated Loss of Cooling Event (LOCA). This system is non-safety related and not credited in any accident analysis. Additionally, ANO engineering evaluations have determined that this system is not needed to ensure adequate containment atmosphere mixing to prevent hydrogen stratification. The evaluations indicate that adequate recirculation is provided by a combination of containment cooling units and/or containment spray pumps. A change to the TS bases for Combustible Gas Control is also proposed to identify the systems that ensure adequate mixing of the containment atmosphere following a LOCA. Copies of the draft TS mark-up pages are included for your review.

The proposed change has been evaluated in accordance with 10CFR50.91(a)(1) using criteria in 10CFR50.92(c) and it has been determined that this change involves no significant hazards considerations. The bases for these determinations are included in the attached submittal.

Entergy Operations requests that the effective date for this TS change to be within 60 days of approval. Although this request is neither exigent nor emergency, your prompt review is requested. The ANO-2 TRM will be updated as part of the TS implementation. The proposed change request does not contain any commitments.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on May 2, 2001.

Very truly yours,

C. G. Anderson
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CGA/dm
Attachments

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ATTACHMENT

TO

2CAN050103

PROPOSED TECHNICAL SPECIFICATION

AND

RESPECTIVE SAFETY ANALYSES

IN THE MATTER OF AMENDING

LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-368

DESCRIPTION OF PROPOSED CHANGES

Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification (TS) 3.6.4.3 requires at least two independent containment recirculation fans to be operable in Modes 1 and 2. The proposed change will relocate the TS and the associated surveillance requirements (SR) to the Technical Requirements Manual (TRM). Additionally, the TS bases for Combustible Gas Control will be modified to recognize the role of the containment cooling systems (containment spray and containment cooling fans) in performing the hydrogen mixing function.

BACKGROUND

The ANO-2 Safety Analysis Report (SAR) states that combustible gas control in containment is provided by three systems. They are the hydrogen recombiner system, the containment air recirculation system, and the containment atmosphere monitoring system. Additionally, the TS bases for combustible gas control states:

> "The containment recirculation units are provided to ensure adequate mixing of the containment atmosphere following a Loss of Coolant Accident (LOCA). This mixing action will prevent localized accumulations of hydrogen from exceeding the flammable limit."

ANO engineering has evaluated this system along with the Containment Cooling System (CCS), which is comprised of the containment cooling units and the containment spray system, and has determined that either of these systems is capable of mixing the containment air without reliance on the containment recirculation fans. Furthermore, in the NRC Safety Evaluation Report (SER) for ANO-2 TS Amendment 3 dated October 4, 1987, the same conclusion was provided with regard to mixing of hydrogen in containment. The NRC stated in the SER:

> "One of the provisions of Standard Review Plan 6.2.5 is that a system be provided to mix the combustible gases within the containment following a loss-of–coolant accident. This may be accomplished through the use of a recirculation fan system, fan-cooler system, or containment spray system. We have found that each of these systems acting alone is an acceptable means for providing adequate recirculation of the containment atmosphere. In addition to any of the above systems, natural convection forces would also contribute to mixing the containment atmosphere."

Containment Recirculation Fans

There are four containment recirculation fans each with a separate duct system. The fans take suction from the containment dome and discharge air to a minimum elevation of 376 feet. Following a postulated accident, an operator starts the fans with control switches

located in the control room. Each fan has an airflow capacity of 5,000 scfm. With two fans operating, the free volume in containment can be recirculated in approximately three hours.

The system is non-safety related, although originally procured and installed as safety related. Since the system is non-safety related no credit is taken for Post-LOCA containment atmospheric mixing. However, the system can be used if available.

The containment recirculation fans are further described in ANO-2 SAR Section 9.4.5.

CEDM Shroud Cooling

The containment is equipped with four cooling units to cool the Control Element Drive Mechanism (CEDM) shroud. The units are mounted on the removable missile shield at Elevation 426 feet, 6 inches and are ducted down to the shroud. Three units operate continuously during normal conditions with one unit as a standby. The cooling units consist of a fan-coil unit containing a low efficiency filter, a cooling coil and a centrifugal type fan. The units use chilled water and are on the main chilled water system.

Containment Cooling Units

The containment cooling units are a redundant safety related system, capable of removing heat from the atmosphere in the event of a LOCA, in order to suppress any resultant increase in the containment pressure and temperature. This engineered safety feature system starts automatically upon receipt of a Containment Cooling Actuation Signal (CCAS) which is initiated as containment pressure increases above 18.3 psia. The system is secured manually after containment pressure has been reduced.

Each containment cooling unit is equipped with a vane-axial type fan and two sets of coils. One set of coils is a chilled water coil for normal cooling and the other set is a service water coil for emergency cooling following a postulated design bases accident (DBA). A bypass damper is provided on top of the unit between the chilled water coils and the service water coils. The damper is a positive opening type that will open upon receipt of a CCAS. The bypass damper may also be manually open from a hand switch located in the control room. The damper allows the steam-air mixture in containment to bypass the return air duct and the chilled water cooling coils and to pass through only the service water coils. The decrease in pressure drop due to bypassing the return air ducts and chilled water cooling coils will permit the unit to handle the necessary quantity of air for cooling purposes at the same speed as required for normal operation. Each fan has a flow capacity of 27,000 cfm. Since, at least two fans will be available post-LOCA the entire free volume of the containment can be recirculated by this system every 33 minutes.

The containment cooling units are described in ANO-2 SAR Section 6.2.2.2.2 and 9.4.5.

Containment Spray System

The purpose of the containment spray system is to keep the post LOCA containment pressure and temperature below design limits. The system does not directly re-circulate air in the containment, but it does promote natural convection in the containment by cooling the air in the containment dome.

The containment spray system, a safety related system, consists of two separate loops of equal capacity and is independently capable of handling the containment heat removal requirements. Each loop consists of a containment spray pump, shutdown cooling heat exchanger, spray header, isolation valves, and the necessary piping, instrumentation and controls. The loops are supplied with borated water from a common refueling water tank (RWT). The containment spray system actuates upon receipt of a Containment Spray Actuation Signal (CSAS) when containment pressure exceeds 23.3 psia.

A detailed system description is provided in the ANO-2 SAR, Section 6.2.2.2.1.

Previously Approved TS Amendments

Amendment 3 to the ANO-2 TS changed the surveillance requirement (SR) for TS 3.6.4.3. SR 4.6.4.3.b was changed to verify a flow rate of at least 4500 cfm per fan.

ANO-2 TS Amendment 154 was an administrative change that resulted in the page number being changed.

BASIS FOR PROPOSED CHANGE

Regulatory Guide 1.7, "Control of Combustible Gas Concentration In Containment Following a Loss-Of-Coolant Accident," requires in part that a system be provided that is capable of mixing the atmosphere in containment. Additionally the guide states that the system should meet the design, quality assurance, redundancy, energy source, and instrumentation requirements for an engineered safety feature.

There are a variety of ways of mixing the post-LOCA containment atmosphere. At ANO-2, two safety-related systems, two non-safety-related systems, and mixing by natural convection may be utilized.

The safety related systems are the containment spray system and the containment cooling units. These systems are included in TS 3.6.2.1 and 3.6.2.3, respectively. The containment cooling system and containment cooling units provide post accident cooling of the containment atmosphere. The limitations on these specifications are more restrictive than the limitations for the containment recirculation system.

The non-safety-related systems are the containment recirculation fans and the CEDM shroud cooling system. Neither of these systems is credited for mitigating the consequences of a LOCA. However, either system could be used, if available.

Natural convection mixing is thorough within containment and would be occurring post-LOCA. This would assist in the suppression of hydrogen stratification.

The safety-related containment spray and containment cooling systems are capable of providing adequate mixing of the containment and satisfy Regulatory Guide 1.7.

In addition, 10CFR50.36, Technical Specifications, includes four criteria that require the establishment of a Limiting Condition for Operation. The following provides comparison of these four criteria with the basis for the containment recirculation fans.

Criterion 1 - Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary. The containment recirculation fans are not used in the detection of a significant degradation of the reactor coolant pressure boundary.

Criterion 2 - A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. The containment recirculation fans do not challenge the integrity of containment. If an increase in hydrogen concentration were to occur in containment post-LOCA, adequate mixing of the containment atmosphere is available through use of the safety related containment cooling units and containment spray system.

Criterion 3 - A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. Based on review of the SAR Chapter 15 events, the containment recirculation fans were not credited in any design basis accident or transient analysis

Criterion 4 - A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety. The containment recirculation fans are not credited in the initiation or mitigation of any design basis accidents and therefore, do not have operating experience shown to be significant to public health and safety.

The containment recirculation fans do not fall into any of these categories. Therefore, the relocation of these specifications is acceptable.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Energy Operations, Inc. is proposing that the Arkansas Nuclear One, Unit 2 (ANO-2) Operating License be amended to allow relocation of the containment recirculation fans Technical Specification (TS) 3.6.4.3 and associated surveillance requirements to the Technical Requirements Manual (TRM).

Following a Loss of Coolant Accident (LOCA), the potential exists for pockets of hydrogen gas to be in the containment atmosphere. Adequate mixing of the containment atmosphere assists in limiting the hydrogen concentration. The containment recirculation fans, along with the containment cooling units and containment spray systems, provide a means of circulating the containment atmosphere to ensure adequate mixing of the containment atmosphere. The containment cooling units and containment spray systems are safety-related systems and required by TS 3.6.2.3 and 3.6.2.1, respectively. Adequate air mixing is assured with the use of these two systems.

An evaluation of the proposed change has been performed in accordance with 10CFR50.91(a)(1) regarding no significant hazards considerations using the standards in 10CFR50.92(c). A discussion of these standards as they relate to this amendment request follows:

1. **Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   The containment recirculation fans, along with the containment cooling units and containment spray systems, provide a means of circulating the containment atmosphere to ensure adequate mixing of the containment atmosphere. The containment cooling units and containment spray systems are safety-related systems and required by TS 3.6.2.3 and 3.6.2.1, respectively. Adequate air mixing is assured with the use of these two systems. The containment recirculation fans are not credited in the mitigation of any accidents.

   Based on an evaluation of the criterion listed in 10 CFR 50.36 (c) (2) (ii), the relocation of the containment recirculation fans to the TRM is acceptable.

   Therefore, this change does <u>not</u> involve a significant increase in the probability or consequences of any accident previously evaluated.

2. **Will operation of the facility in accordance with this proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The containment recirculation fans are not accident initiators. The function they fulfill will continue to be maintained by the containment cooling units and

containment spray pumps. Because the proposed amendment will not change the design, configuration or method of plant operation, it will not create the possibility of a new or different kind of accident.

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

3. **Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?**

Air mixing of the containment atmosphere can be accomplished following a LOCA by the containment recirculation fans, the containment cooling units, or the containment spray systems. Any one of these systems is capable of providing adequate air mixing. The proposed change does not change the design function of the containment recirculation fans. Additionally, the containment recirculation fans are not credited in any accident analysis. Since adequate mixing of the containment atmosphere is credited through the containment cooling units and spray systems, relocation of the containment recirculation fan requirements to the TRM does not result in any impact to the margin of safety.

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

Therefore, based on the reasoning presented above and the previous discussion of the amendment request, Entergy Operations has determined that the requested change does not involve a significant hazards consideration.

ENVIRONMENTAL IMPACT EVALUATION

Pursuant to 10CFR51.22(b), an evaluation of the proposed amendment has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10CFR 51.22 (c) (9) of the regulations. The basis for this determination is as follows:

1. The proposed license amendment does not involve a significant hazards consideration as described previously in the evaluation.
2. As discussed in the significant hazards evaluation, this change does not result in a significant change or significant increase in the radiological doses for any Design Basis Accident. The proposed license amendment does not result in a significant change in the types or a significant increase in the amounts of any effluents that may be released off-site.
3. The proposed license amendment does not result in a significant increase to the individual or cumulative occupational radiation exposure because this change does not in any way result in the modification or design function of the existing components.

MARKUP OF CURRENT TECHNICAL SPECIFICATIONS

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LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

CONTAINMENT RECIRCULATION SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.4.3 At least two independent containment recirculation fans shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With only one containment recirculation fan OPERABLE, restore at least two independent fans to OPERABLE status within 30 days or be in at least HOT STANDBY within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.3 Each of the above required containment recirculation fans shall be demonstrated OPERABLE:

a. At least once per 92 days on a STAGGERED TEST BASIS by:

1. Verifying that the fan can be started on operator action in the control room, and

2. Verifying that the fan operates for at least 15 minutes.

b. At least once per 18 months by verifying a flow rate of at least 4500 cfm per fan.

MARKUP OF TECHNICAL SPECIFICATION BASES

3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA. The containment isolation valves have been relocated to plant procedures.

The opening of locked or sealed closed manual and deactivated automatic containment isolation valves on an intermittent basis under administrative control includes the following considerations: (1) stationing an operator, who is in constant communication with control room, at the valve controls, (2) instructing the operator to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside containment.

3/4.6.4 COMBUSTIBLE GAS CONTROL

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with 1) zirconium-water reactions, 2) radiolytic decomposition of water, and 3) corrosion of metal within containment. These hydrogen control systems are consistent with the recommendations of Regulatory Guide 1.7 "Control of Combustible Gas Concentrations in Containment Following a LOCA", March 1971.

The containment ~~recirculation units~~ cooling units and containment spray pumps ~~are~~ provided ~~to ensure~~ adequate mixing of the containment atmosphere following a LOCA. This mixing action will prevent localized accumulations of hydrogen from exceeding the flammable limit.

3/4.6.2 DEPRESSURIZATION, COOLING, AND pH CONTROL SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

The containment spray system and containment cooling system provide post accident cooling and mixing of the containment atmosphere; however, the containment cooling system is not redundant to the containment spray system. The containment spray system also provides a mechanism for removing iodine from the containment atmosphere and therefore the time requirements for restoring an inoperable spray system to OPERABLE status have been maintained consistent with that assigned other inoperable ESF equipment.

3/4.6.2.2 TRISODIUM PHOSPHATE (TSP)

A hydrated form of granular trisodium phosphate (TSP) is employed as a passive form of pH control for post LOCA containment spray and core cooling water to ensure that iodine, which may be dissolved in the recirculated reactor cooling water following a loss of coolant accident (LOCA), remains in solution. TSP also helps inhibit stress corrosion cracking (SCC) of austenitic stainless steel components in containment during the recirculation phase following an accident. Baskets of TSP are placed on the floor of the containment building to dissolve from released reactor coolant water and containment sprays after a LOCA. Recirculation of the water for core cooling and containment sprays then provides mixing to achieve a uniform solution pH.

Fuel that is damaged during a LOCA will release iodine in several chemical forms to the reactor coolant and to the containment atmosphere. A portion of the iodine in the containment atmosphere is washed to the sump by containment sprays. The emergency core cooling water is borated for reactivity control. This borated water causes the sump solution to be acidic. In a low pH (acidic) solution, dissolved iodine will be converted to a volatile form. The volatile iodine will evolve out of solution into the containment atmosphere, significantly increasing the levels of airborne iodine. The increased levels of airborne iodine in containment contribute to the radiological releases and increase the consequences from the accident due to containment atmosphere leakage.

After a LOCA, the components of the core cooling and containment spray systems will be exposed to high temperature borated water. Prolonged exposure to the core cooling water combined with stresses imposed on the components can cause SCC. The SCC is a function of stress, oxygen and chloride concentrations, pH, temperature, and alloy composition of the components. High temperatures and low pH, which would be present after a LOCA, tend to promote SCC. This can lead to the failure of necessary safety systems or components.

Adjusting the pH of the recirculation solution to levels above 7.0 prevents a significant fraction of the dissolved iodine from converting to a volatile form. The higher pH thus decreases the level of airborne iodine in containment and reduces the radiological consequences from containment atmosphere leakage following a LOCA. Maintaining the solution pH above 7.0 also reduces the occurrence of SCC of austenitic stainless steel components in containment. Reducing SCC reduces the probability of failure of components.

The SR 4.6.2.2.b requirement to dissolve a representative sample of TSP in a sample of borated water provides assurance that the stored TSP will dissolve in borated water at the postulated post-LOCA temperatures. Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A representative sample of 3.09 ± 0.05 grams of TSP from one of the baskets in containment is submerged in 1.0 ± 0.01 liter of water at a boron concentration of 3130 ± 30 ppm and at a temperature of 120 ± 5°F. The solution is allowed to stand for 4 hours without agitation. The liquid is then decanted from the solution and mixed, the temperature adjusted to 77 ± 2°F and the pH measured. At this point, the pH must be ≥ 7.0. The representative sample weight is based on the minimum required TSP weight of 6804 kilograms, which at manufactured density corresponds to the minimum volume of 278 cubic ft, and assumed post LOCA borated water mass in the sump of approximately 4885000 lbm normalized to buffer a 1.0 liter sample. The boron concentration of the test water is representative of the maximum possible boron concentration corresponding to the calculated post LOCA sump volume producing the lowest pH. Agitation of the test solution is prohibited, since an adequate standard for the agitation intensity cannot be specified. The test time of 4 hours is necessary to allow time for the dissolved TSP to naturally diffuse through the sample solution. In the post LOCA containment sump, rapid mixing would occur, significantly decreasing the actual amount of time before the required pH is achieved. This would ensure compliance with the Standard Review Plan requirement of a pH ≥ 7.0 by the onset of recirculation after a LOCA.

3/4.6.2.3 CONTAINMENT COOLING SYSTEM

The OPERABILITY of the containment cooling system ensures that 1) the containment air temperature will be maintained within limits during normal operation, and 2) adequate heat removal capacity is available when operated in conjunction with the containment spray systems during post-LOCA conditions.

The containment spray system is redundant to the containment cooling system in providing post accident cooling and mixing of the containment atmosphere; however, the containment cooling system is not redundant to the containment spray system. As a result of the redundancy of the containment spray system with the containment cooling system, the allowable out-of-service time requirements for the containment cooling system have been appropriately adjusted. However, the allowable out of service time requirements for the containment spray system have been maintained consistent with that assigned other inoperable ESF equipment since the containment spray system also provides a mechanism for removing Iodine from the containment atmosphere.

The addition of a biocide to the service water system is performed during containment cooler surveillance to prevent buildup of Asian clams in the coolers when service water is pumped through the cooling coils. This is performed when service water temperature is between 60°F and 80°F since in this water temperature range Asian clams can spawn and produce larva which could pass through service water system strainers.