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

December 23, 1998

SUBJECT: ISSUANCE OF AMENDMENT NO. 194 TO FACILITY OPERATING LICENSE NO. NPF-6 - ARKANSAS NUCLEAR ONE, UNIT NO. 2 (TAC NO. MA1934)

Dear Mr. Hutchinson:

The Commission has issued the enclosed Amendment No. 194 to Facility Operating License No. NPF-6 for the Arkansas Nuclear One, Unit No. 2 (ANO-2). This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated May 18, 1998, as supplemented by letter dated December 8, 1998.

The amendment deletes the ANO-2 TS 3.6.2.2 and 4.6.2.2 requirements for the sodium hydroxide addition system and adds new limiting conditions for operation, action statements, and surveillance requirements for trisodium phosphate baskets which you stated will be installed during the next ANO-2 refueling outage (2R13). Associated bases information has been modified accordingly.

A copy of our related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,
ORIGINAL SIGNED BY:
M. Christopher Nolan, Project Manager
Project Directorate IV-1
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-368
Enclosures: 1. Amendment No. 194 to NPF-6
2. Safety Evaluation
cc w/encls: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 23, 1998

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Docket No. 50-368

Enclosures: 1. Amendment No. 194 to NPF-6
2. Safety Evaluation

cc w/encls: See next page

Mr. C. Randy Hutchinson
Entergy Operations, Inc.

Arkansas Nuclear One, Unit 2

cc:

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-368

ARKANSAS NUCLEAR ONE, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 194
License No. NPF-6

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Entergy Operations, Inc. (the licensee) dated May 18, 1998, as supplemented by letter dated December 8, 1998, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-6 is hereby amended to read as follows:

   2. Technical Specifications

      The Technical Specifications contained in Appendix A, as revised through Amendment No. 194 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. The license amendment is effective as of its date of issuance to be implemented prior to the facility's restart from refueling outage 2R13.

FOR THE NUCLEAR REGULATORY COMMISSION

M. Christopher Nolan

M. Christopher Nolan, Project Manager
Project Directorate IV-1
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: December 23, 1998

ATTACHMENT TO LICENSE AMENDMENT NO. 194

FACILITY OPERATING LICENSE NO. NPF-6

DOCKET NO. 50-368

Revise the following pages of the Appendix "A" Technical Specifications with the attached pages. The revised pages are identified by Amendment number and contain vertical lines indicating the area of change. The corresponding overleaf pages are also provided to maintain document completeness.

REMOVE PAGES	INSERT PAGES
VII	VII
XII	XII
3/4 6-10	3/4 6-10
3/4 6-12	3/4 6-12
3/4 6-13	3/4 6-13
B 3/4 1-3	B 3/4 1-3
B 3/4 5-3	B 3/4 5-3
B 3/4 6-3	B 3/4 6-3
B 3/4 6-4	B 3/4 6-4
B 3/4 6-5	B 3/4 6-5
-	B 3/4 6-6

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

BASES

SECTION | PAGE

BASES

CONTAINMENT SYSTEMS

CONTAINMENT VENTILATION SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.1.6 The containment purge supply and exhaust isolation valves shall be closed and handswitch keys removed.

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

ACTION:

With one or more containment purge supply and/or exhaust isolation valves not closed with the handswitch keys removed, place the valve(s) in the closed position with handswitch key(s) removed within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.6 The containment purge supply and exhaust isolation valves shall be determined closed at least once per 31 days.

CONTAINMENT SYSTEMS

3/4.6.2 DEPRESSURIZATION, COOLING, AND pH CONTROL SYSTEMS

CONTAINMENT SPRAY SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.2.1 Two independent containment spray systems shall be OPERABLE with each spray system capable of taking suction from the RWT on a Containment Spray Actuation Signal (CSAS) and automatically transferring suction to the containment sump on a Recirculation Actuation Signal (RAS). Each spray system flow path from the containment sump shall be via an OPERABLE shutdown cooling heat exchanger.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

With one containment spray system inoperable, restore the inoperable spray system to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.2.1 Each containment spray system shall be demonstrated OPERABLE:

a. At least once per 31 days by:

1. Verifying that each valve (manual, power operated or automatic) in the flow path is positioned to take suction from the RWT on a Containment Pressure-High-High test signal.

2. Verifying that the system piping is full of water from the RWT to at least elevation 505'(equivalent to > 12.5% indicated narrow range level) in the risers within the containment.

b. By verifying that each pump demonstrates degradation of ≤ 6.3% from its original acceptance test pump performance curve when tested pursuant to Specification 4.0.5.

CONTAINMENT SYSTEMS

TRISODIUM PHOSPHATE (TSP)

LIMITING CONDITION FOR OPERATION

3.6.2.2 The TSP baskets shall contain ≥ 278 ft^3 of active TSP.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

With the TSP not within limits, restore the TSP to within limits within 72 hours or be in at least HOT STANDBY within the next 6 hours and be in at least HOT SHUTDOWN within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.2.2 The TSP shall be demonstrated OPERABLE:

a. At least once per 18 months by verifying that the TSP baskets contain ≥ 278 ft^3 of TSP.

b. At least once per 18 months by verifying that a sample from the TSP baskets provides adequate pH adjustment of borated water.

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The boron capability required below 200°F is based upon providing a sufficient SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires either borated water from the refueling water tank or boric acid solution from the boric acid makeup tank(s) in accordance with the requirements of Specification 3.1.2.7.

The contained water volume limits includes allowance for water not available because of discharge line location and other physical characteristics. The 61,370 gallon limit for the refueling water tank is based upon having an indicated level in the tank of at least 7.5%.

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

The limits on contained 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.

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section ensure that (1) acceptable power distribution limits are maintained, (2) the minimum SHUTDOWN MARGIN is maintained, and (3) the potential effects of CEA misalignments are limited to acceptable levels.

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met.

The ACTION statements applicable to a stuck or untrippable CEA or a large misalignment (≥ 19 inches) of two or more CEAs, require a prompt shutdown of the reactor since either of these conditions may be indicative of a possible loss of mechanical functional capability of the CEAs and in the event of a stuck or untrippable CEA, the loss of SHUTDOWN MARGIN. CEAs that are confirmed to be inoperable due to problems other than addressed by ACTION a of Specification 3.1.3.1 will not impact SHUTDOWN MARGIN as long as their relative positions satisfy the applicable alignment requirements.

For small misalignments (< 19 inches) of the CEAs, there is 1) a small effect on the time dependent long term power distributions relative to those used in generating LCOs and LSSS setpoints, 2) a small effect on the available SHUTDOWN MARGIN, and 3) a small effect on the ejected CEA worth used in the safety analysis. Therefore, the ACTION

BASES

The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

The limits on contained 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.

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 the containment cooling system are redundant to each other in providing post accident cooling of the containment atmosphere. However, 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.

A hydrated form of TSP is used because of the high humidity in the containment building during normal operation. Since the TSP is hydrated, it is less likely to absorb large amounts of water from the humid atmosphere and will undergo less physical and chemical change than the anhydrous form of TSP.

The LOCA radiological consequences analysis takes credit for iodine retention in the sump solution based on the recirculation water pH being ≥ 7.0. The radionuclide releases from the containment atmosphere and the consequences of a LOCA would be increased if the pH of the recirculation water were not adjusted to 7.0 or above.

The required amount of TSP is based upon the extreme cases of water volume and pH possible in the containment sump after a large break LOCA. The minimum required volume is the volume of TSP that will achieve a sump solution pH of ≥ 7.0 when taking into consideration the maximum possible sump water volume and the minimum possible pH. The amount of TSP needed in the containment building is based on the mass of TSP required to achieve the desired pH. However, a required volume is specified, rather than mass, since it is not feasible to weigh the entire amount of TSP in containment. The minimum required volume is based on the manufactured density of TSP dodecahydrate. Since TSP can have a tendency to agglomerate from high humidity in the containment building, the density may increase and the volume decrease during normal plant operation. Due to possible agglomeration and increase in density, estimating the minimum volume of TSP in containment is conservative with respect to achieving a minimum required pH.

Sufficient TSP is required to be available in MODES 1, 2, and 3, because the RCS is at elevated temperature and pressure, providing an energy potential for a LOCA. The potential for a LOCA results in a need for the ability to control the pH of the recirculated coolant.

If it is discovered that the TSP in the containment building is not within limits, action must be taken to restore the TSP to within limits. During plant operation the containment sump is not accessible and corrections may not be possible. 72 hours is allowed for restoring the TSP within limits, where possible, because 72 hours is the same time allowed for restoration of other ECCS components. If the TSP cannot be restored within limits within 72 hours, the plant must be brought to a MODE in which the LCO does not apply. The specified Allowed Outage Times for reaching HOT STANDBY and HOT SHUTDOWN were chosen to allow reaching the specified conditions from full power in an orderly manner and without challenging plant systems.

The SR 4.6.2.2.a periodic determination of the volume of TSP in containment must be performed due to the possibility of leaking valves and components in the containment building that could cause dissolution of the TSP during normal operation. A Frequency of 18 months is required to determine visually that combined a minimum of 278 cubic feet is contained in the TSP baskets. This requirement ensures that there is an adequate volume of TSP to adjust the pH of the post LOCA sump solution to a value ≥ 7.0.

The periodic verification is required every 18 months, since access to the TSP baskets is only feasible during outages, and normal fuel cycles are scheduled for 18 months. Operating experience has shown this Surveillance Frequency acceptable due to the margin in the volume of TSP placed in the containment building.

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 3.00 ± 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 3000 ± 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 5284102 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 maximum possible post LOCA sump volume. 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 cooling system and the containment spray system are redundant to each other in providing post accident cooling of the containment atmosphere. As a result of this redundancy in cooling capability, 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.

In 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.

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 are listed in Procedure 2203.005.

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 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.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO.194 TO

FACILITY OPERATING LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO. 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated May 18, 1998, as supplemented by letter dated December 8, 1998, Entergy Operations, Inc. (the licensee) submitted a request for changes to the Arkansas Nuclear One, Unit No. 2 (ANO-2) Technical Specifications (TS). The requested amendment deletes the ANO-2 TS 3.6.2.2 and 4.6.2.2 requirements for the sodium hydroxide addition system and adds new limiting conditions for operation, action statements, and surveillance requirements for the trisodium phosphate baskets which are to be installed during the next ANO-2 refueling outage (2R13). The licensee proposes to modify the associated bases accordingly.

The information in the December 8, 1998, submittal provided clarifying information and did not expand the scope of the original application as initially noticed, or change the staff's proposed no significant hazards determination published in the Federal Register on October 21, 1998 (62 FR 56241).

2.0 BACKGROUND

In the original design of ANO-2, sodium hydroxide additive was used to control the pH of the containment spray solution in order to enhance removal of elemental iodine from the post-accident containment atmosphere and prevent stress corrosion cracking of austenitic steel components. The limits on water volumes, boron concentrations, and the sodium hydroxide system resulted in a long term pH value of between 8.8 and 11. At the time the plant was designed it was thought that these high pH values were required to remove elemental iodine. As more information was gained on iodine removal, it was found that in an iodine free solution the pH could be maintained at much lower values and still be effective in removing elemental iodine. In addition, it was found that some of the iodine is in a cesium iodide form and could dissolve in water regardless of its pH. There was no need, therefore, to control the pH of the spray water as long as it was free of dissolved iodine. However, when iodine containing water is used, as for example, during the recirculation phase spraying, the pH has to be maintained above 7, otherwise reevolution of dissolved iodine will occur. A pH higher than 7 is also necessary to minimize the potential for chloride induced stress corrosion cracking of austenitic steel components exposed to spray water and minimize evolution of hydrogen from the corrosion of zinc on galvanized surfaces and in zinc based paints. These requirements for minimum pH are discussed in Sections 6.1.1 and 6.5.2 of the Standard Review Plan (SRP). In the submittal, the licensee proposes to use borated water with the lowest pH of approximately 4.4 and control the sump water pH above 7 (minimum value of 7.06 and between 7.25 and 8.07 based on the target volumes of trisodium phosphate) using the passive design of baskets containing trisodium phosphate located in the containment sump . The licensee has proposed to locate appropriate controls for the passive system in amended Technical Specification 3/4.6.2.2, "Trisodium Phosphate (TSP)." The associated TS Bases would also be modified.

3.0 EVALUATION

3.1 Iodine Removal from Containment Atmosphere

The licensee proposes that during the injection phase of the plant response to a loss-of-coolant accident (LOCA) (i.e., the water source for emergency core cooling and containment spray systems is the refueling water tank), that containment spray will be operated with borated water without sodium hydroxide additive. The pH of this water could be as low as approximately 4.4. Using the information currently available on iodine removal and the guidance provided in Section 6.5.2 of the SRP, the licensee has demonstrated that this low value of pH would not affect removal rates of elemental and particulate iodine from the post-accident containment atmosphere. These rates are determined by the first-order removal coefficients which are independent of pH and are not affected, therefore, by elimination of the pH controlling additive. The same applies to the removal coefficient for particulate iodine which is controlled by the hydrodynamic characteristics of the sprays.

During the spray recirculation phase, water for the emergency core cooling and containment spray systems will come from the sump and will contain dissolved iodine removed from the containment atmosphere during the injection phase. In a radiation environment, this iodine could be revolatilized and released to the containment atmosphere if the pH of the solution is acidic. In order to prevent this from happening, the pH of the sump solution should be kept above 7. The licensee proposes to control the pH by having greater than 278 cubic feet (approximately 15,000 pounds) of crystalline, hydrated TSP in three baskets located in the sump. This TSP will dissolve as it comes in contact with the spray water and will maintain the long-term pH above 7.06 with the expected TSP loadings resulting in a pH of between 7.25 and 8.07. Under the worst case conditions of minimal TSP dissolution, minimum recirculation flow, and maximum sump inventory and boron concentrations, the pH of the spray water drawn from the sump is expected to remain below 7 for no more than 20 minutes following the start of sump recirculation. As the higher concentration recirculation flow water mixes with the sump solution, the pH at the sump pit will reach its equilibrium within approximately 4 to 6 hours after the start of sump recirculation. Since the expected sump pH with the TSP baskets differs from the pH values associated with the existing sodium hydroxide addition system, there will be some difference in the amount of iodine removed from the containment atmosphere and in the resulting radiation doses. These doses were, therefore, revised by the licensee.

The iodine removal coefficients (λ) used by the licensee were found to be reasonable given the planned changes in pH pertaining to the replacement of the sodium hydroxide addition system with the TSP baskets per the methodology described in Section 6.5.2. of the SRP. The change in the total amount of iodine removed from the containment atmosphere is due to a significant effect of the pH on the amount of iodine dissolved in spray solution before it becomes saturated. Saturation concentration of iodine is determined by equilibrium between its concentrations in the containment atmosphere and the sump water. This equilibrium is determined by a partition coefficient (H) for iodine between air and water which is a function of pH. It is expected, therefore, that the decontamination factor (DF), which is a measure of the amount of iodine removed from the containment atmosphere, will be decreased for lower values of pH.

Currently, sodium hydroxide will maintain the sump pH at a value between 8.8 and 11. Using trisodium phosphate this value will change to between 7.0 to 8.1 for equilibrium conditions during recirculation. This represents a marked difference and should be reflected in the decontamination factors used in dose calculations. The licensee calculated a new value for the decontamination factor using the partition coefficient and determined the actual value to be above the maximum value of DF=200 as stated in Section 6.5.2 of the SRP. Therefore, the licensee's use of DF=200 for elemental iodine results in a conservative treatment for elemental iodine removal. For particulate iodine, the licensee used a very conservative value of DF=50.

Another reason for maintaining an alkaline solution in the containment sump is to minimize corrosion of metallic surfaces. Chloride induced stress corrosion cracking of austenitic stainless steel components is considerably reduced if the pH of the solution to which the components are exposed is maintained above 7. Short exposure to low pH water during the initial injection phase and the transition period into the recirculation phase will not cause significant stress corrosion cracking. However, extended exposures to pH environments below 7 during long term core cooling operations in the recirculation phase could result in significant damage. Section 6.1.1 of the SRP (Branch Technical Position MTEB 6-1) recommends maintaining the sump pH in a 7 to 9.5 range.

Control of the sump pH is also required to minimize hydrogen generation by corrosion of aluminum and zinc on galvanized surfaces and in the organic coatings on containment surfaces. The TSP chemistry control range for sump pH more closely approximates neutral pH conditions as compared to the 8.8 to 11 range of the current sodium hydroxide pH control system. Thus, a general reduction in the generation of hydrogen from the corrosion of zinc, aluminum, and organic surfaces located inside containment would be realized during long term core cooling as a result of this change. The generation of hydrogen due to the corrosion of zinc will increase with the lower pH values during the initial injection phase. However, due to the limited duration associated with the injection phase, this effect would be offset by a considerably smaller generation of hydrogen experienced during the recirculation phase.

Based on the above evaluation, the staff concludes that the modifications to implement a passive application of trisodium phosphate pH control for ANO-2 , as proposed by the licensee, meets the requirements of General Design Criterion (GDC) 41 for providing a satisfactory means of post-accident containment atmosphere cleanup. The staff further concludes that the proposed revised TSs for surveillance of trisodium phosphate in the containment sump meet the requirements of GDC-42 for inspection of containment atmosphere cleanup systems. Therefore, the staff review concludes that, relative to iodine removal, the licensee's proposed deletion of the sodium hydroxide addition system in conjunction with the addition of a passive trisodium phosphate containment sump pH control program is acceptable.

3.2 Equipment Qualification

The staff also reviewed the replacement of the sodium hydroxide addition system with the use of trisodium phosphate baskets located on the floor of containment with respect to environmental qualification of electric equipment. The current design of the sodium hydroxide addition system maintains a post-accident injection and recirculation pH range of 8.8 to 11. With trisodium phosphate control, the pH of spray water during the injection phase could be as low as 4.4. During the recirculation phase, the pH will be maintained within a range of 7 to 8.1 under equilibrium conditions. During the transition from the injection phase to the recirculation phase, the spray water pH could remain below 7 or increase to levels as high as 12 for short periods prior to complete mixing of the sump volume. The time period above a pH of 11 was estimated to be less then 20 minutes. Due to the timing sequence of the post-accident recovery, the majority of the equipment degradation from containment spray occurs during the recirculation phase when long term core cooling is provided. Since the resulting pH level will be closer to neutral, post-LOCA corrosion of containment components will not be increased as a result of the proposed change. The staff reviewed the change in the containment spray pH and agrees that environmental qualification will not be affected.

The lower pH values for containment spray during the injection and recirculation phase that are inherent with trisodium phosphate control will affect the radiation levels inside containment. The staff has reviewed the proposed modification and concluded that the use of trisodium phosphate will have only a slight impact on post-accident radiation levels. The licensee has indicated that these changes are bounded by the current analysis such that the proposed change will not impact the environmental qualification of equipment with respect to radiation exposure limits.

Therefore, the staff concludes that the licensee's proposal is acceptable relative to equipment qualification.

3.3 Offsite and Control Room Dose Calculations

The licensee assessed the impact of the elimination of the sodium hydroxide addition system on iodine removal during a LOCA. The licensee determined that iodine removal during the injection phase can still be effectively performed by boric acid sprays without using sodium hydroxide as an additive and that long-term iodine retention in the sumps is assured as long as the equilibrium sump pH level is maintained above 7. The licensee has performed revised calculations to determine the impact of the changes in the iodine retention characteristics on offsite and control room dose assessments. The licensee revised its treatment of iodine retention along with other inputs and assumptions (e.g., decontaimination factor, sump volume, etc.) such that a general reductions in dose at the exclusion area boundary (EAB) and low population zone (LPZ) were observed. Control room doses either remained unchanged or experienced slight increases. The calculated control room dose continues to meet the requirements of General Design Criteria (GDC) 19. The staff has reviewed the changes in calculational inputs and assumptions as described in the licensee's submittal dated May 18, 1998, as supplemented by letter dated December 8, 1998, and found them to be acceptable.

The staff has assessed the capability of ANO-2 to meet the thyroid dose limits of 10 CFR Part 100 and GDC-19 with the elimination of the sodium hydroxide addition system for iodine. As a result of this assessment, the staff has concluded that the thyroid doses would not exceed the dose guidelines presently contained in 10 CFR Part 100 or GDC-19 of 10 CFR Part 50, Appendix A for either offsite locations or control room operators. Therefore, the staff finds the proposed TS amendment request acceptable.

3.4 Surveillance Requirements

The licensee proposes surveillance requirement 4.6.2.2.a and 4.6.2.2.b to demonstrate the operability of the TSP pH control program on a frequency of at least once per 18 months. TS 4.6.2.2.a verifies that a minimum value of 278 cubic feet of TSP is contained within the three TSP baskets combined to ensure sufficient product is available to maintain pH greater then 7 during the recirculation phase. TS 4.6.2.2.b requires that a sample be taken from a TSP basket to demonstrate adequate pH adjustment of borated water. The required ratio of TSP to borated water is contained in TS bases 3/4.6.2.2. Location of these parameters in the bases section is appropriate as it will allow ratio changes to be performed under the controls of 10 CFR 50.59 as long as the ratio is reflective of a minimum TSP volume of 278 cubic feet. Thus, if changes to the primary system (such as a change in fuel enrichment) results in a required change in boron, the test ratio can be adjusted to reflect this change. The boron concentration of the test water will be representative of the maximum possible concentration corresponding to the maximum sump volume following a LOCA. A representative sample of TSP will be added to 1+/- 0.01 liter of borated water without agitation. After four hours, the solution is decanted and the pH verified to be greater than or equal to 7. The test will be performed at a temperature of 120 +/- 5 degrees Fahrenheit which is acceptable as it is below the expected temperature of the containment sump following a LOCA in which recirculation would be required. The measurement of the pH of the decanted liquid will be performed at a temperature of 77 +/- 2 degrees Fahrenheit to ensure consistency in the results and the relevance of the indicated value as pH is a function of temperature. Based on the licensee's submittal dated May 18, 1998, as supplemented by letter dated December 8, 1998, the staff has concluded that the value for TSP volume and approach to measure TSP effectiveness yield conservative results and are, therefore, acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes 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 changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (63 FR 56241). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (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.

Principal Contributor: Chris Nolan

Date: December 23, 1998