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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Replacement Steam Generator Technical Specification Bases Changes

Gentlemen:

Attached are three changes to the Arkansas Nuclear One - Unit 2 (ANO-2) Technical Specification Bases. These changes support the replacement of the steam generators which will occur during the next refueling outage, 2R14. The attachments to this letter contain a brief description and revised wording for each of the three changes.

Since these changes modify the bases of the technical specifications, a "No Significant Hazards Determination" is not required. A review of the changes in accordance with 10CFR50.59 has been completed. No unreviewed safety questions were identified.

We request that these changes be issued by September 1, 2000, with an effective date prior to startup from refueling outage 2R14. This refueling outage is scheduled to begin on September 15, 2000. Should you have any questions regarding these changes, please contact me.

Very truly yours,

Jimmy D. Vandergrift
Director, Nuclear Safety

JDV/dwb
Attachments

A001 1/1

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The following three Arkansas Nuclear One - Unit 2 (ANO-2) Technical Specification (TS) Bases changes are related to the Replacement Steam Generator (RSG) Project. Each change has been reviewed in accordance with 10CFR50.59. Each evaluation concluded that an unreviewed safety question is not involved as a result of its associated change. A brief description of each of the three changes is provided below. Attachment 2 contains the revised bases pages. Attachment 3 contains a marked-up version of each page (for information only).

TS Bases 2.1.2 (page B 2-2)

The change to ANO-2 TS Bases 2.1.2, "Reactor System Coolant Pressure," adds a description of the hydrostatic testing performed at the manufacturing facility (i.e., the shop hydro test) and the in-service leak testing that will be performed for the replacement steam generators. The bases is also changed to state that the replacement steam generators are designed to the 1989 Edition of the ASME Code, which was the latest NRC-approved edition of the ASME Code when construction of the replacement steam generators began.

The change to the description of the hydrostatic testing is necessary to properly reflect the pressure testing of the reactor coolant system with the addition of the replacement steam generators. The primary side of each replacement steam generator is hydrostatically tested in the manufacturing facility at 3125 psig by the manufacturer (ENSA) in accordance with ASME Section III, Subsection NB of the ASME code. In addition to the shop hydrostatic test, ANO-2 will perform a reactor coolant system leak test in accordance with ASME Section XI Code Case N-416-1 following the installation of the replacement steam generators that will verify the integrity of the primary pressure boundary. The use of ASME Section XI Code Case N-416-1 as an alternative to the required hydrostatic pressure tests is approved by the NRC Staff in Revision 12 of Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." The shop hydrostatic test, in combination with the in-service leak test, will demonstrate the integrity of the reactor coolant system consistent with the ASME Code and in accordance with the intent of the original technical specification basis 2.1.2.

TS Bases 3/4.4.12 (p B 3/4 4-12)

The change to ANO-2 TS Bases 3/4.4.12, "Low Temperature Overpressure Protection System," revises the limiting design basis event to this system. The Bases for this specification currently indicates the limiting event is the simultaneous injection of two high pressure safety injection (HPSI) pumps and all three charging pumps to a water-solid reactor coolant system (RCS). This represents a mass addition event. The installation of the RSGs and the implementation of changes that will lead to power uprate affect the design basis transients that determine Low Temperature Overpressure Protection system requirements. The analytical basis for the requirements was updated to account for these changes as well as other changes in plant configuration. The following is a listing of the significant changes made in the analyses:

- HPSI pump flow rate
- Charging pump flow rate
- RCS and steam generator flow rates
- Steam generator parameters, such as heat transfer area and volume
- Relief valve capacity and discharge characteristic

The analyses of two postulated limiting overpressure events 1) mass addition (simultaneous injection of two HPSI pumps and all three charging pumps to a water-solid RCS) and, 2) energy addition (the start of an idle reactor coolant pump, under water solid conditions, with the secondary water temperature of the steam generator less than or equal to 100°F above the RCS cold leg temperature) assumed the most limiting operating conditions and system configurations. The energy addition event produced the highest peak pressure. The methodology outlined in ASME Code Case N-514 was used in these evaluations.

TS Bases 3/4.6.2.2 (Pages B 3/4 6-4 and 3/4 6-5)

Changes are also necessary to ANO-2 TS Bases 3/4.6.2.2, "Trisodium Phosphate (TSP)." In support of the steam generator replacement project, the post loss of coolant accident (LOCA) sump pH calculation was revised to determine the impact of the increased RCS volume. This calculation determines the equilibrium minimum and maximum sump pH values during recirculation. The key acceptance criterion for this analysis is that the minimum pH be greater than 7.0 to assure proper cleanup of post LOCA iodine, assuming the TS minimum volume of TSP. The maximum pH has no specific limit, but is used in the evaluation of equipment environmental qualifications.

In the process of revising the calculation it was determined that the minimum post-LOCA pH is calculated assuming no RCS inventory reaches the sump, rather than a maximum RCS volume. By excluding the RCS volume which would be at a lower boron concentration than the other sump water sources, the sump boron concentration is increased. The change in pH using a 0 RCS volume is very small. The new minimum pH, is 7.05 versus the previously reported 7.06 value. The mass and boron concentration of water in the sump for the minimum pH calculation, without the RCS volume contribution, is 4883310 lbm at 3129 ppmb.

Since the new pH value is still above the minimum allowable value of 7.0, the bases for the required TSP volume is unchanged. However, the TS bases description of the parameters of the TSP surveillance test must be changed. The new test parameters are based on a sump mass and boron concentration rounded up to 4885000 lbm and 3130 ppmb respectively. The new TSP sample mass of 3.09 grams (± 0.05) in one liter of water at a boron concentration of 3130 ppmb, is representative of the sump mixture with 278 ft^3 of TSP and 4885000 lbm of water.

The bases have also been changed to characterize the mass of the sump water as the calculated value resulting in the lowest pH, rather than the maximum possible volume as currently stated. As currently stated in the bases, the test solution would be representative of the maximum boron concentration corresponding to the maximum possible sump volume following a LOCA. The objective of establishing this limiting set of conditions is to assure that the minimum volume of TSP, when added to the worst combination of water volumes and boron concentrations from the various sources of borated water, would still produce a pH of more than 7.0. In the original pH analysis, the maximum volume at the maximum boron concentration from all borated water sources, including the RCS, were combined. In the revised analysis, the contribution of the RCS was found to have a very slightly non-conservative effect. Although it is not physically possible to have a LOCA that releases the contents of the safety injection tanks without releasing the contents of the RCS, it is much simpler to ignore the RCS volume altogether than to justify any specific minimum volume. This assumption has the added benefit of making the minimum pH calculation independent of any future changes to the RCS volume or boron concentration. Although this assumption does not exactly match the statement in the bases, it is clear that the conditions generating the minimum pH value and not the maximum possible sump volume, are of primary importance in determining the minimum TSP volume and surveillance test parameters.

ATTACHMENT 2

Proposed ANO-2 Technical Specification Bases Changes
(4 pages)

Limiting safety system settings for the Low DNBR, High Local Power Density, High Logarithmic Power Level, Low Pressurizer Pressure and High Linear Power Level trips, and limiting conditions for operation on DNBR and kw/ft margin are specified such that there is a high degree of confidence that the specified acceptable fuel design limits (i.e., DNBR and centerline fuel melt temperature) are not exceeded during normal operation and design basis anticipated operational occurrences.

2.1.2 REACTOR COOLANT SYSTEM PRESSURE

The restriction of this Safety Limit protects the integrity of the Reactor Coolant System from overpressurization and thereby prevents the release of radionuclides contained in the reactor coolant from reaching the containment atmosphere.

The Reactor Coolant System components are designed to Section III of the ASME Code for Nuclear Power Plant Components. The reactor vessel and pressurizer are designed to the 1968 Edition, Summer 1970 Addenda; piping to the 1971 Edition, original issue; and the valves to the 1968 Edition, Winter 1970 Addenda[(1)]. The steam generators are designed to the 1989 Edition (no Addenda). Section III of these Codes permit a maximum transient pressure of 110% (2750 psia) of design pressure. The Safety Limit of 2750 psia is therefore consistent with the design criteria and associated code requirements.

The entire Reactor Coolant System, with the original steam generators, was hydrotested at 3125 psia to demonstrate integrity prior to initial operation. The primary side of each replacement steam generator was hydrostatically tested in the manufacturing facility prior to installation. Leak testing of the Reactor Coolant System was performed in accordance with ASME Section XI Code Case N-416-1 following the installation of the replacement steam generators.

2.2.1 REACTOR TRIP SETPOINTS

The Reactor Trip Setpoints specified in Table 2.2-1 are the values at which the Reactor Trips are set for each functional unit. The Trip Setpoints have been selected to ensure that the reactor core and reactor coolant system are prevented from exceeding their Safety Limits during normal operation and design basis anticipated operational occurrences and to assist the Engineered Safety Features Actuation System in mitigating the consequences of accidents. Operation with a trip set less conservative than its Trip Setpoint but within its specified Allowable Value is acceptable on the basis that the difference between each Trip Setpoint and the Allowable Value is equal to or less than the drift allowance assumed for each trip in the safety analyses.

The DNBR - Low and Local Power Density - High are digitally generated trip setpoints based on Limiting Safety System Settings of 1.25 and 21.0 kw/ft, respectively. Since these trips are digitally generated by the Core Protection Calculators, the trip values are not subject to drifts common to trips generated by analog type equipment. The Allowable Values for these trips are therefore the same as the Trip Setpoints.

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(1) Use of a later ASME Section III Code is acceptable, provided the Code section(s) is reconciled in accordance with Section XI.

3/4.4.12 LOW TEMPERATURE OVERPRESSURE PROTECTION SYSTEM

Low temperature overpressure protection (LTOP) of the RCS, including the reactor vessel, is provided by redundant relief valves on the pressurizer which discharge from a single discharge header. Each relief valve is isolated from the RCS by two motor operated block valves. Each LTOP relief valve is a direct action, spring-loaded relief valve, with orifice area of 6.38 in^2 and a lift setting of ≤ 430 psig, and is capable of protecting the RCS from overpressurization when the transient is either (1) the start of an idle reactor coolant pump, under water-solid conditions, with the secondary water temperature of the steam generator less than or equal to 100°F above the RCS cold leg temperature (energy addition event), or (2) simultaneous injection of two HPSI pumps and all three charging pumps to the water-solid RCS (mass addition event). The limiting LTOP design basis event is the energy addition event. The analyses assume that the safety injection tanks (SITs) are either isolated or depressurized such that they are unable to challenge the LTOP relief setpoints.

Since neither the LTOP reliefs nor the RCS vent is analyzed for the pressure transient produced from SIT injection, the LCO requires each SIT that is pressurized to ≥ 300 psig to be isolated. The isolated SITs must have their discharge valves closed and the associated MOV power supply breaker in the open position. The individual SITs may be unisolated when pressurized to < 300 psig. The associated instrumentation uncertainty is not included in the 300 psig value and therefore, the procedural value for unisolating the SITs with the LTOPs in service will be reduced.

The LTOP system, in combination with the RCS heatup and cooldown limitations of LCO 3.4.9.1 and administrative restrictions on RCP operation, provides assurance that the reactor vessel non-ductile fracture limits are not exceeded during the design basis event at low RCS temperatures. These non-ductile fracture limits are identified as LTOP pressure-temperature (P-T) limits, which were specifically developed to provide a basis for the LTOP system. These LTOP P-T limits, along with the LTOP enable temperature, were developed using guidance provided in ASME Code Section XI, Division 1, Code Case N-514 that mandates that "LTOP systems shall limit the maximum pressure in the vessel to 110% of the pressure determined to satisfy Appendix G, paragraph G-2215 of Section XI, Division 1".

The enable temperature of the LTOP isolation valves is based on any RCS cold leg temperature reaching 220°F (including a 20°F uncertainty). Although each relief valve is capable of mitigating the design basis LTOP event, both LTOP relief valves are required to be OPERABLE below the enable temperature to meet the single failure criterion of NRC Branch Technical Position RSB 5-2, unless any RCS vent path of 6.38 in^2 (equivalent relief valve orifice area) or larger is maintained.

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 calculated sump water volume and boron concentration resulting in 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 3.09 ± 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 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.

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.

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Marked-up Version of Proposed ANO-2 Technical Specification Bases Changes
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