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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

OF REQUEST FOR RELIEF

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR POWER PLANT, UNIT 2

DOCKET NO. 50-260

1.0 INTRODUCTION

Technical Specification 4.6.G.1 for the Browns Ferry Nuclear Power Plant (BFN), Unit 2 provides inservice inspection (ISI) requirements for American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components. This specification states that ISI shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda, as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Alternatives may be used, as provided by 10 CFR 50.55a(a)(3), when authorized by the NRC, if (1) the proposed alternatives would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for BFN Unit 2, which is in its second ISI interval, is the 1986 Edition.

The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

Pursuant to 10 CFR 50.55a(g)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME

ENCLOSURE

Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law, will not endanger life, property, or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

On May 21, 1993, the NRC staff granted relief from ASME Code Section XI requirements for inservice inspection of cap screws from leaking control rod drive (CRD) housing connections. This relief request, designated SPT-4, permitted the Tennessee Valley Authority (TVA, or the licensee) to defer a VT-3 visual inspection of these cap screws to the next refueling outage. By letter dated September 1, 1994, the licensee proposed a revision to this relief request to inspect cap screws from disassembled CRD housing connections, in lieu of the VT-3 inspection of cap screws on CRD housings that had exhibited leakage during startup from the last refueling outage.

The licensee's revised relief request was discussed in a telephone conversation with NRC staff representatives on September 26, 1994. Following this discussion, TVA provided additional information on October 3, 1994, including a new revision of relief request SPT-4, reflecting the additional information. In part, TVA committed to inspect cap screws removed from CRD housing connections which were observed to be leaking at the end of the BFN Unit 2 Cycle 7 fuel cycle.

During this inspection, TVA found several cap screws from leaking CRD housing connections and CRD housing connections disassembled for maintenance which showed indications of intergranular stress corrosion cracking (IGSCC). This discovery invalidated a portion of TVA's original justification for relief. As a result, a further revision of SPT-4 was submitted by TVA on November 2, 1994.

The NRC staff's evaluation of this request is given below.

2.0 DESCRIPTION

Revised Request for Relief SPT-4, Inspection Requirements for Control Rod Drive Cap Screws

Component Identification

CRD cap screws, connecting the CRDs to the reactor pressure vessel CRD nozzle flanges. There are 8 cap screws per CRD housing-to-flange connection, and 185 CRDs for a total of 1480 cap screws. These cap screws are described in Chapter 3.4 of the BFN Updated Final Safety Analysis Report (UFSAR).

ASME Code Section XI Inspection Requirements

The licensee requests relief from three ASME Code requirements. The licensee described these requirements in their November 2, 1994 submittal as follows:

I. IWA-5250(a) - The source of leakage detected during the conduct of a system pressure test shall be located and evaluated by the Owner for corrective measures as follows:

(2) if leakage occurs at a bolted connection, the bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100.

II. IWB-2430(a) - Examinations performed in accordance with Table IWB-2500-1 that reveal indications exceeding the acceptance standards of Table IWB-3410-1 shall be extended to include additional examinations at this outage. The additional examinations shall include the remaining welds, areas, or parts included in the inspection item listing and scheduled for this and the subsequent period. If the examinations for that inspection item are not scheduled in the subsequent period, the most immediate period containing scheduled examination shall be taken as the subsequent period.

III. IWB-2500(a) - Components shall be examined and tested as specified in Table IWB-2500-1. Table IWB-2510-1, Examination Category B-G-2, Item No. B7.80 - Surface examination (Visual, VT-1) of CRD housing bolts, studs, and nuts when disassembled. The acceptance standard is IWB-3517. Deferral of the inspection to the end of the interval is not permissible.

The requests for relief for these three requirements are hereafter referred to as SPT-4(I), SPT-4(II), and SPT-4(III), respectively.

Proposed Alternative Examination

In its letter of November 2, 1994, the licensee proposed the following alternative examinations:

SPT-4(I)

During the Unit 2 Cycle 7 and subsequent refueling outages, if CRD leakage is observed during an operational system pressure test, TVA will evaluate and document the acceptability of the CRD leakage. If the leakage is determined to be acceptable, no further inspections will be performed prior to start-up. During the next refueling outage, the CRDs that exhibited leakage during the operational system pressure testing will have their cap screws inspected in accordance with Code requirements. VT-1 inspections will also be performed on the cap screws from the CRD connections

that are disassembled for routine maintenance. A fluorescent magnetic particle surface examination will be performed in accordance with ASME Section XI if determined necessary as a result of the VT-1 examination.

SPT-4(II)

During the Unit 2 Cycle 7 refueling outage, 8 of 152 CRD cap screws showed indications of cracking in excess of the ASME code allowables. In lieu of performing an expanded sample of CRD cap screws during this outage, TVA will replace the remaining (1,128) stress corrosion cracking susceptible cap screws during the next refueling outage (Unit 2 Cycle 8) with the new design that includes a higher strength material cap screw and the new design washer to facilitate drainage.

SPT-4(III)

Since TVA will be replacing the 1,128 stress corrosion cracking susceptible cap screws, performing an inservice inspection of the cap screws being replaced is of little practical benefit and is offset by the increase in personnel dose exposure and costs that are associated with these examinations. None of the 1,128 cap screws, which are susceptible to stress corrosion cracking, will be considered for re-use.

Licensee's Basis for Request

The licensee's basis for relief is quoted below:

Basis for Relief SPT-4(I), SPT-4(II), and SPT-4(III)

The previous BFN history of Control Rod Drive (CRD) leakage, the industry and BFN specific experience with cracking of CRD cap screws, and the reduction in expected radiation exposure associated with deferring additional inspections until after Unit 2 is chemically decontaminated during the Cycle 8 Outage provides the basis for these relief requests.

SPT-4(I) Inspection of CRDs that Exhibit Leakage

In accordance with the requirements of Table IWB-2500-1, Examination Category B-P, Item No. B15.10, a leakage test of the reactor pressure vessel pressure retaining boundary is conducted prior to plant startup following each reactor refueling outage. The leakage test is conducted at nominal system pressure (1005 psig at the RPV dome) immediately prior to the startup of the unit. This examination includes the 185 CRD connections located on the bottom of the reactor pressure vessel. During re-pressurization following unit refueling, it is not uncommon to have small amounts of leakage at some of the CRD connections. This leakage is typically on the order of 1 to 30 drops per minute and the Nuclear Steam Supply System (NSSS) supplier, General Electric (GE), has informed Boiling Water Reactor (BWR) owners

that leakage from these cap screw connections is a common occurrence. In most instances, this leakage stops within 8 hours of the connection being pressurized to 1000 psig.

BFN inspection results provide additional evidence to support this conclusion. By TVA letter to NRC, dated April 8, 1993, TVA stated that leakage from the CRD connections would be documented and evaluated based on the GE recommendations during the Class 1 component leakage test following refueling during the Cycle 6 outage. The Unit 2 Cycle 6 inspection showed 36 CRDs were initially leaking during the RPV System Leakage Test. Maintenance is normally recommended for leaks that are greater than 30 drops per minute (DPM), which do not exhibit a decreasing trend. Two of the three worst case leaking CRDs quickly showed a decrease to less than 30 DPM and the remaining worst case CRD leaker showed a leakage of approximately 40 DPM with a decreasing trend. The leakage rates for the other 33 CRDs were well below 30 DPM. These leakage rates were evaluated by TVA and GE and determined to be acceptable.

TVA's April 8, 1993 letter requested a deferral until the next refueling outage for the VT-3 examination of the eight cap screws at the 36 bolted CRD connections that exhibited leakage. This request was modified on May 5, 1993 to only address Unit 2. The request was approved for Unit 2 in NRC letter to TVA, dated May 21, 1993.

Only 4 of the 36 connections that were leaking at the beginning of Unit 2 Cycle 7 were leaking at the end of Unit 2 Cycle 7 operation. One additional leaking CRD was identified that was not leaking at the beginning of the cycle.

The relatively small increase in safety that could be attributed to the performance of a visual examination of the CRD cap screws when CRD leakage is detected during an operational system pressure test is offset by the increase in personnel dose exposure (approximately 0.1 Man/Rem per CRD) and cost that are associated with these examinations. Instead, TVA will evaluate and document the acceptability of the CRD leakage. If the leakage is determined to be acceptable, no further inspections will be performed prior to start-up. During the next refueling outage, the CRDs that exhibited leakage during the operational system pressure testing will have their cap screws inspected in accordance with Code requirements.

SPT-4(II), Relief from Sample Expansion, and SPT-4(III), Relief from Examination of Cap Screws Replaced by a New Design

Industry experience as documented in GE Nuclear Energy Services Information Letter (SIL) No. 483, Revision 2, dated August 5, 1992, has shown that the older CRD cap screws are susceptible to stress corrosion cracking. Due to this susceptibility, GE

recommended inspection, and if indications were found, these cap screws should be replaced with the new design that includes higher strength and more corrosion resistant material cap screws and the new design washer to facilitate drainage.

As documented in SIL 483, GE has determined that CRD cap screw cracking does not generically effect structural integrity and plant safety. This evaluation is based in part on the following:

1. three uniformly distributed uncracked cap screws are capable of supporting the CRD loads, and the probability that through-wall cracks will occur in five or more cap screws on a single CRD is extremely small;

2. if such a failure were to occur, leakage at the connection would precede failure, and the leak detection system and/or drywell temperature monitoring system would detect this leakage at very low leakage rates;

   It should be noted that Browns Ferry Technical Specification 3.6.C.1 requires unidentified reactor coolant leakage into primary containment not exceed 5 gallons per minute (gpm). In addition, total reactor coolant system leakage into primary containment is prohibited from exceeding 25 gpm. The average Unit 2 Cycles 6 and 7 unidentified and identified leakage rates were well below these limits.

3. the CRD support structure under the reactor vessel would allow the CRD to drop a maximum of one inch in the event of total bolted joint failure;

4. the evaluation of the loss of one CRD from any cause has been considered in the plant safety analysis report.

BFN Experience with Cap Screw Cracking

The revised cap screw design is being incorporated at Browns Ferry. The cap screws for 26 CRD units were changed during the Unit 2 Cycle 6 refueling outage. The cap screws for eighteen CRD units were changed to the new bolting design during the Unit 2 Cycle 7 refueling outage.

The cap screws, which are removed, are examined in accordance with Section XI of the ASME Boiler and Pressure vessel code. None of the 208 cap screws examined during the Unit 2 Cycle 6 refueling outage exhibited indications of cracking.

In the relief request, dated September 1, 1994, TVA provided the Staff with the results of additional reviews of this issue, which concluded that bolt failures have a low probability of occurrence on the CRD cap screws at BFN for the reasons provided below:

1. Approved lubricants are used at BFN and are controlled by procedures. The primary lubricant for this application is Never-Seez, which does not contain molybdenum disulfide. Molybdenum disulfide has been identified as a contributor to cracking. In addition, the atmosphere in the drywell is required by Technical Specifications to be inerted with nitrogen during power operations. This would deprive the CRD cap screws of free oxygen that would aid in chemical and stress corrosion cracking.

2. The CRD cap screws at BFN are torqued under administrative controls to 350 foot pounds, which results in a preload stress of approximately 50 percent of the yield strength.

3. Chemical attack from borated water can lead to bolt failures. Unlike pressurized water reactors, BFN does not use borated water in its primary coolant system for reactivity control during normal operating conditions. The reactor coolant system used demineralized water and is monitored for chemical composition and contaminants.

During the review of the September 1, 1994 relief request, the Staff verbally requested additional information, including the performance of an under-vessel inspection of the CRDs immediately after the start of the Unit 2 Cycle 7 refueling outage. Response to the Staff's requests were provided in a revised relief request, dated October 3, 1994. The results of this inspection support the GE judgment that CRD leakage is reduced or stops after the system achieves normal operating pressures and temperatures.

Of the 152 cap screws examined during the Unit 2 Cycle 7 refueling outage, either because the CRDs were being replaced or the cap screws were being inspected due to CRD leakage observed during the under-vessel inspection, only 8 cap screws showed indications of cracking in excess of the inspection criteria provided in Paragraph IWB-3410 of the 1986 Edition of the ASME Code. All 8 cap screws in those CRDs that were being replaced or had cap screws that were being inspected due to CRD leakage, were replaced with the higher strength and more corrosion resistant material cap screw and the new design washer to facilitate drainage. A record of the CRD leakages during Unit 2 Cycles 6 and 7 is provided in Table 1 for those CRDs, whose bolts exhibited indications of stress corrosion cracking.

Two bolts, with visual indications in excess of the ASME allowables, were found in both CRDs 06-27 and 18-39. One bolt, with visual indications in excess of the ASME allowables, was found in CRDs 06-19, 18-35, 22-19, and 34-59. However, when the bolts from CRD 06-19 were bagged, identification of which bolt had visual indication in excess of the ASME allowables, was lost. There were three bolts from CRD 06-19 that had indications, either above or below the ASME allowables. Therefore, a total of ten

bolts (three bolts from CRD 06-19 and the remaining seven bolts with definite indications in excess of ASME allowables) were submitted for further laboratory analysis. Therefore, this ten bolt sample included the eight bolts that were originally identified with visual indications in excess of the ASME allowables. Details regarding the indications, hardness, and tensile testing results for these cap screws is provided in [TVA's November 2, 1994 submittal.]

The ten CRD cap screws exhibited corrosion pitting and numerous linear crack-like indications in and near the transition region between the head and shank. Although the fluorescent magnetic particle examination indicated eight of the cap screws to possess circumferential indications greater than ¼ inch in length, observation under a stereo microscope revealed the cracks to be short, discrete and typically non-connected. The close proximity of the numerous cracks in a given region provided the appearance of a continuous indication.

Each of the eight cap screws, which did not meet the flaw acceptance criteria, were sectioned perpendicularly through the largest observable surface indication in order to expose the nature and depth of the underlying flaw. Each cross-section was micrographed. Shallow, multi-branching blunted cracks were typically found. In all cases, the cracks contained observable oxides and had been arrested. In many cases, the underlying cavity had the appearance of an elongated corrosion pit rather than a stress corrosion crack. These flaws appeared to be previous shallow stress corrosion cracks, perhaps initiated in the bottom of a corrosion pit, that had subsequently arrested while pitting corrosion continued.

Each of the ten cap screws were evaluated for hardness. Rockwell hardness values ranged from 29 to 31.5 HRC. These values indicate adequate tensile strength with good ductility for this alloy. Two cap screws (from CRDs 06-19 and 18-35), which possessed a large region of circumferential defects, were subjected to a full size axial tensile test. Both met the minimum load requirements of 125 ksi imposed by the fastener specification. Chemical analysis showed all required elements to be within the specification for the specified steel, with the exception of a single carbon analysis that showed 0.01 percent below the specification requirements. This deviation is not significant to the structural integrity of the cap screw or a factor for the observed cracking.

In accordance with Paragraph IWB-3142 of the 1986 Edition of the ASME Code, TVA and GE have evaluated the cap screws with indications of stress corrosion cracking and have determined that this specific condition did not effect structural integrity and plant safety for the following reasons:

1. The observed indications were reviewed by GE. The indications were consistent with the overall BWR experience in terms of crack morphology and depth and it was concluded that the indications did not represent a new phenomena.

2. The results of the hardness, tensile and metallurgical testing and analysis show the BFN cap screws are within nominal tolerances for the specific steel specified for this application.

3. The maximum depth of the observed cracking was 0.055 inches. GE SIL No. 483, Revision 2, states that the deepest crack measure to date was 0.077 inches. A crack that deep (0.077 inches) would not prevent an individual bolt from performing its structural function.

4. Conservatively assuming all the cracks would grow at a rate of 0.05 inches per 18 month cycle and the cracks extended 360 degrees around the bolt, there would be sufficient bolt area to meet the ASME Code stress limits at the end of the next cycle.

5. The low frequency of cap screw cracking observed at BFN.

6. Full size tensile testing performed on two cap screws, that were selected based on the degree of their surface indications, demonstrated that the existing cracks did not influence the failure mode or reduce the fastener load carrying capacity. Fracture of the screws occurred in the shank, approximately midway between the threaded bolt shank and the location of the cracking in the head-to-shank transition region. The failure in both screws was ductile, with significant necking of the section.

The[re] are a total of 185 CRDs for Unit 2. Of these, 44 CRDs have had their cap screws replaced with the new design. In order to minimize future stress corrosion cracking in the CRD cap screws, TVA will replace the stress corrosion cracking susceptible cap screws in the remaining 141 CRDs during the Unit 2 Cycle 8 refueling outage with the new design that includes a higher strength material cap screw and the new design washer to facilitate drainage.

The relatively small increase in safety that could be attributed to expanding the examination of additional cap screws is offset by the increase in personnel dose exposure (approximately 0.1 Man/Rem per CRD or approximately 14 Man/Rem if the entire remaining population of cap screws requires examination) and costs that are associated with these examinations. Reduction in expected radiation exposure are associated with deferring additional

inspections since TVA intends to chemically decontaminate during the Cycle 8 Outage. In lieu of this expanded sample, TVA will replace the remaining 1,128 cap screws that are susceptible to cracking during the Unit 2 Cycle 8 refueling outage.

Since TVA will be replacing the remaining 1,128 cap screws that are susceptible to stress corrosion cracking during the Unit 2 Cycle 8 refueling outage, performing an inservice inspection of the cap screws being replaced is of little practical benefit and is offset by the increase in personnel dose exposure and costs that are associated with these examinations. None of the 1,128 cap screws that are susceptible to stress corrosion cracking will be considered for re-use.

3.0 EVALUATION AND CONCLUSIONS

The staff evaluation for the three requests for relief are discussed below.

SPT-4(I) Inspection of Cap Screw from Leaking CRD Housing Connections

The ASME Code Section XI inspection requirements for BFN Unit 2 are discussed in section 2.0, above. IWA-5250(a) requires that if leakage is detected during system pressure tests, the source of the leakage shall be located and evaluated by the owner. For bolted connections, corrective measures require the removal of the bolting for perfomance of a VT-3 visual examination for corrosion.

The licensee has requested relief from removal and visual examination of cap screws from CRD housings leaking at the beginning of a fuel cycle during system pressure testing. The licensee proposes to evaluate any leakage observed in accordance with the recommendations of the vendor, General Electric. During the refueling outage, the licensee plans to inspect the cap screws from the CRD housings which exhibited leakage during the beginning-of-cycle system pressure testing.

In addition, the licensee proposes to perform a VT-1 visual examination of cap screws from CRD connections disassembled for maintenance, with supplemental fluorescent magnetic particle examination, if necessary.

The licensee has stated that leakage of the CRD housings occurs primarily when the primary system is pressurized prior to heat-up and/or during CRD scram time testing, and that this leakage decreases when the vessel metal reaches normal operating temperature. This assertion was confirmed by examination of the CRD housings at the beginning of the BFN Unit 2 Cycle 7 outage, when very little leakage was observed.

Documentation and evaluation of CRD housing leakage observed at the beginning of a fuel cycle provides reasonable assurance regarding the integrity of the connections for operations during the subsequent fuel cycle. It is expected that beginning-of-cycle leakage is a function of the CRD housing connection seal, not due to cap screw failure due to IGSCC or some other mechanism. A decreasing trend of this leakage is evidence that the seal performance is

improving, which would not be expected if a cap screw has failed. Therefore, deferral of inspection of cap screws from CRD housings leaking at the beginning of a fuel cycle is acceptable.

Inspection of cap screws from CRD housings disassembled for maintenance renders useful information regarding the performance of the overall cap screw population, and provides a means to detect degradation before CRD housing leakage performance is affected. Therefore, these inspections are also acceptable.

However, at the end of a fuel cycle, continuing or new CRD housing leakage could indicate deterioration of the cap screws. Therefore, the staff has determined that in addition to the proposed alternative examinations, the licensee must perform end-of-cycle inspections for CRD housing leakage and perform a VT-1 inspection of all eight cap screws from any leaking housings. This additional requirement provides a means to detect cap screw degradation which may have occurred during a fuel cycle.

The staff concludes that the alternative examinations proposed by the licensee, with the additional inspections required by the staff as discussed above, provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative examinations, with the additional staff requirements discussed above, is authorized.

SPT-4(II) Relief from Sample Expansion Requirements

The ASME Code Section XI inspection requirements for BFN Unit 2 are discussed in section 2.0, above. IWB-2430(a) requires that if indications exceeding established acceptance standards are found, then the component sample be expanded and additional examinations performed.

The licensee estimates that these additional examinations would result in personnel radiation exposure of approximately 0.1 man-Rem per CRD, or about 14 man-Rem if the sample expansion requires examination of all remaining CRD cap screws. The licensee has performed analyses, which are described above, which it claims demonstrate a high level of confidence in the continuing ability of the cap screws to fulfill their design function. Therefore, the licensee claims the radiation exposure associated with compliance with the Code requirements constitutes a hardship without a compensating increase in the level of quality and safety.

The licensee has performed extensive examinations and evaluations of ten cap screws with indications discovered during the BFN Unit 2 Cycle 7 refueling outage. The tests included full tensile strength testing of two cap screws. These cap screws satisfied the minimum specified load requirement of the fastener specification. These cap screws failed in a ductile manner in the shank region, approximately midway between the threaded region and the cracking location. Furthermore, the largest indication found by the licensee is smaller than that required to adversely affect the cap screw performance. Therefore, the indications do not affect the ability of the cap screws to meet their design requirements.

The failure of one CRD connection has been evaluated in the plant updated final safety analysis report (UFSAR), section 3.4.6.4.c. However, the licensee also notes that, based on vendor analysis, three uniformly distributed cap screws can support the CRD loads. No CRD housing connection included more than two cap screws with indications. It is not expected that five cap screws within a single CRD connection would exhibit indications which could compromise their ability to fulfill their design function. None of the 208 cap screws examined during the BFN Unit 2 Cycle 6 outage exhibited indications of cracking. Only 8 of the 152 cap screws examined during the BFN Unit 2 Cycle 7 outage exhibited indications of cracking in excess of the inspection criteria of the 1986 Edition of the ASME Code. Given that very few cap screws have shown any signs of cracking, and that the performance of those cap screws with indications is expected to be satisfactory, the mechanical integrity of the CRD housing connection is not expected to be adversely affected.

However, if the failure of a CRD housing is postulated, it is expected that this connection would leak prior to failure. If unidentified leakage exceeds five gallons per minute, then the BFN Unit 2 Technical Specifications require the reactor to be placed in cold shutdown within 24 hours. Repairs to reduce leakage to acceptable bounds would be required before resuming power operations. Therefore, the licensee should be able to detect deterioration of a CRD connection and take appropriate corrective action prior to failure of that connection.

Based on the performance of the cap screws tested by the licensee, the low probability of failure of five cap screws within a single CRD connection, and the ability of the plant to detect leakage indicative of deterioration, the staff concludes that compliance with the ASME Code requirements for sample expansion would impose a hardship (in the form of personnel radiation exposure) without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), relief is granted from compliance with the IWB-2430(a) sample expansion requirements. The licensee has committed to replace all remaining original design cap screws with an improved design during the BFN Unit 2 Cycle 8 refueling outage. Therefore, this relief applies only to the BFN Unit Cycle 7 refueling outage.

SPT-4(III) Relief from Inspection of Cap Screws Removed for Replacement

The licensee has committed to replace all remaining original design cap screws with an improved design during the BFN Unit 2 Cycle 8 refueling outage. The licensee is requesting relief from the IWB-2500(a) requirements to examine the original components.

Examination of the original design cap screws to be replaced during the BFN Unit 2 Cycle 8 refueling outage would not provide any useful information regarding the improved design cap screws, which will constitute the entire cap screw population at the end of that outage. The staff concludes that the licensee's proposed alternative provides an acceptable level of quality and

safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative is authorized. This relief is granted on a one-time basis, and applies only to the removal of the original design cap screws.

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Dated: November 14, 1994