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SUBJECT: Responds to NRC 890130 ltr re violations noted in Insp Repts
 50-259/89-04, 50-260/89-04 & 50-296/89-04.

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Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket No. 50-259
50-260
50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - RESPONSE TO NRC INSPECTION REPORT
NUMBERS 50-259/89-04, 50-260/89-04, AND 50-296/89-04

On January 30, 1989, NRC issued the subject inspection report related to recent TVA activities which led to a partial reload of the BFN unit 2 core without adequate core neutron monitoring. In the inspection report, NRC cited three apparent violations being considered for enforcement action and three additional unresolved items to be satisfactorily addressed. TVA's reload activities and the potential enforcement items were the subject of an enforcement conference in Rockville, Maryland on February 2, 1989.

TVA accepts full responsibility for not adequately monitoring the core during core reload activities. Neutron monitoring is an essential part of any core loading activity. While we were in strict compliance with approved technical specifications, we recognize that TVA must apply additional conservatism to activities at BFN. Our goal of returning shutdown units to operation in a professional manner and eventually becoming an industry leader can only be realized by diligently working to ensure safe and efficient nuclear operations over and above a strict compliance approach to doing business.

At the enforcement conference, TVA committed to provide a written response to NRC's concerns listed in the January 30, 1989 inspection report. Accordingly, in this submittal TVA is addressing those concerns with particular emphasis on the potential enforcement issues and unresolved items.

I. Overview

TVA recognizes that the unit 2 core should have been more closely monitored during the recent fuel loading. Had TVA taken a more conservative safety-conscious approach, this event could have been prevented. The failure to adequately monitor the core occurred because of the unique circumstances surrounding the reload procedures and plant technical specification 3.10.B.1.b.2. The technical specification and

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Final Safety Analysis Report (FSAR) did not specifically require a minimum count rate for fuel loading, thus leading to the reload with the fuel array neutronically decoupled from the source range monitors (SRMs).

Following questions from the NRC inspector regarding the adequacy of core monitoring, TVA recognized the concern on January 5, 1989, and took action to halt fuel load after 74 of 764 assemblies had been loaded. In addition, TVA took steps beginning January 6, 1989, to reconfirm that all 74 fuel assemblies were correctly loaded, and to relocate one SRM immediately adjacent to the loaded bundles to monitor core reactivity changes. TVA has also committed to develop and submit technical specifications and FSAR changes to ensure adequate core monitoring in the future. A more extensive list of TVA's planned and completed actions to address this event is provided in enclosure 1.

TVA personnel inappropriately concluded, based on past practice and the approved technical specifications, that no minimum neutron count rate was necessary and that reload procedures were adequate. It was subsequently concluded that no unreviewed safety question existed. The screening reviews, 10 CFR 50.59 reviews, and cross-disciplinary reviews of the procedures were adequately performed given the approved technical specifications. Following this event, TVA thoroughly reviewed the screening and cross-disciplinary reviews of the reload procedure changes. This review was a rigorous and extensive effort conducted by the plant Reactor and Systems Engineering sections with subsequent upper management overview. Another team led by Quality Assurance also conducted an independent review of the procedure changes and the associated screening and cross-disciplinary reviews. TVA has concluded that the procedure reviews conducted were adequate and the unreviewed safety question determinations reached the correct conclusions. The review conducted by the plant Reactor and Systems Engineering sections has been documented and assimilated into information packages for each individual procedure and is available for NRC review.

It is also appropriate to point out that the TVA interface with GE was significantly less than it should have been as the result of a decision made by TVA in 1987 to reduce the GE involvement in plant operations. There were insufficient routine TVA/GE communications of the content and frequency that would be expected between the reactor system vendor and the owner. Isolated inputs have been obtained from GE where they would be directly applicable. However, TVA should have maintained better contact with GE to ensure sufficient interchange of information gathered from the GE Boiling Water Reactor (BWR) industry-wide perspective. TVA had identified this weakness before the January 9, 1989 NRC/TVA meeting and initiated actions to improve the interface.

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In addition to improving the core monitoring interface, periodic meetings have been established between TVA and GE management on plant improvement items. GE has assigned a fulltime project manager to BFN to act as a member of the plant staff and provide advice and assistance to plant management. The TVA/GE engineering interface on plant problems has been strengthened through frequent GE representation in key plant meetings, including the plant manager's staff meeting, the technical services staff meeting, and the plant daily status meeting.

TVA has learned from this event that greater management attention must be placed on developing an organization where all personnel strive to go beyond minimum regulatory or procedural compliance. This commitment must incorporate an attitude of questioning strict compliance with technical specifications and procedures where strict compliance alone does not include a level of safety consciousness commensurate with a commitment to excellence. TVA management is diligently working to achieve these goals.

II. Potential Enforcement Issues

Apparent Violation 260/89-04-01 stated that there was a potential failure to comply with 10 CFR 50.59 by proceeding with unmonitored core loading of unit 2.

Technical specifications 3.10.B.1.b.2 and 3.10.B.1.b.3 allow fuel loading sequences without continuous observable monitoring of reactivity changes. These technical specifications, resulting from amendments in 1979 and 1984 respectively, allow the core to be monitored entirely by SRMs. In addition, fuel may be loaded with less than 3 counts per second (cps) on the SRMs provided the SRM response is checked every eight hours and the fuel is loaded in a spiral pattern. No minimum SRM count rate is specified in technical specification 3.10.B.1.b.2 or the safety evaluation that supports the change. The 1984 amendment added the flexibility of first loading four irradiated fuel assemblies around each SRM to attain 3 cps and then loading in a spiral sequence. This provides observable output of SRMs only. However, observable core monitoring is not available until a sufficient number of bundles is loaded to overcome neutron attenuation caused by geometry effects.

TVA has learned from conversations with GE and other utilities that there is no standard industry practice for full core reload. Some of the full core reload practices used are:

1. Loading the fuel starting from the center of the core and spiraling outward. SRMs are used to monitor the core during core alterations. The source count rates will be essentially zero until enough fuel has been loaded into the core for the SRMs to provide indication. TVA utilized this process during this event.

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2. Other plants load two to four irradiated fuel assemblies around each SRM before they begin loading the rest of the core. Once these assemblies are in place, the core is loaded in a outward spiral pattern beginning from the center of the core. Placing two to four assemblies around a SRM does meet the intent of the technical specifications in that a source count rate will be seen. However, this count rate is caused by the assemblies around the SRM and not necessarily from those in the center of the core. Because of neutron attenuation, the SRMs do not directly monitor all core alterations until the center island of assemblies is directly adjacent to the SRMs.
3. Newer plants spiral the fuel assemblies around an SRM. This technique has been used for initial core loads. This method has one SRM always monitoring the core while the other SRMs are checked with a neutron source once per shift until enough assemblies are loaded that all the SRMs are on scale. However, the second SRM does not come on scale until a significant number of assemblies are loaded.
4. Loading irradiated fuel assemblies around each SRM and then bridging fuel assemblies from the SRMs to the core center. The core is then loaded in an outward spiral pattern beginning from the center of the core.

TVA was not alone in the practice of inadequate core neutron monitoring. Accordingly, TVA advised BWR utilities of this event through the Nuclear Network and the BWR Owners Group, with particular emphasis on those plants having technical specifications similar to those at BFN.

Beginning on January 3, 1989, TVA began loading the unit 2 core in accordance with technical specification 3.10.B.1.b.2 as described in item 1 above. The SRMs did not provide continuous observable monitoring of initial core reactivity changes. The fuel array was neutronically decoupled from the SRMs because of the distance between the fuel and the neutron detectors. Further background on this event is provided in TVA's Licensee Event Report Number 260/89001, filed with NRC on January 26, 1989.



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TVA agrees that these technical specifications do not ensure continuous observable monitoring of the reactor core during refueling activities. TVA performed a short-term technical specification assessment limited to core alterations and other technical specifications required to support fuel loading. No concerns were identified which required immediate technical specification changes. Some items requiring clarification by administrative control were identified and corrected before the resumption of fuel load activities. In addition, TVA will revise the technical specifications and FSAR to ensure consistency in the licensing basis and adequate monitoring for future reloading.

Before fuel load TVA reviewed the reload procedures in accordance with the applicable plant procedures necessary to satisfy 10 CFR 50.59. Screening reviews and safety evaluations are conducted pursuant to Site Director Standard Practice (SDSP) 27.1, "Evaluation of Changes, Tests, and Experiments - Unreviewed Safety Question Determination," for changes to plant procedures or new procedures. Following the halt to reloading on January 5, 1989, TVA again reviewed the BFN screening reviews and safety evaluations conducted since the plant shutdown for the changes to the plant procedures utilized for the recent reload. Those procedures are:

- General Operating Instruction 2-(GOI)-100-3, "Refueling Operations"
- Technical Instruction (TI)-147, "Fuel Loading After A Complete Core Unloading"
- TI-14, "Special Nuclear Material Control"
- Surveillance Instruction 2-(SI)-4.10.B, "Demonstration of SRM System Operability During Core Alterations"

TVA concluded that the screening reviews or safety evaluations were technically correct for the procedure revisions, although some administrative errors were found.

In addition, as documented in an attachment to the January 26, 1989 Licensee Event Report, TVA performed a safety evaluation of the loading of 74* fuel assemblies in the unit 2 core without continuous SRM monitoring. While not intended to justify the lack of adequate core monitoring, this safety evaluation demonstrated that no unreviewed safety question existed. The safety evaluation reconfirmed that inadvertent criticality is not credible given the engineered safeguards and core design and, therefore, the reload without core monitoring did not increase the probability or consequences of any accident previously analyzed. Also, in the bases for technical specification 3.10, the only margin of safety addressed is the minimum SRM count rate during startup

* Shutdown margin analyses included in the safety evaluation were conservatively based on a 76 fuel assembly core model.



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required to ensure that the assumptions of the rod drop accident analysis are met. The core loading was accomplished in the refuel mode (only one control rod withdrawal possible) and with the SRM downscale rod block (less than 3 cps) operable precluding any control rod withdrawal. Therefore, no margin of safety was reduced.

TVA recognizes that the reviews performed on these procedures did not identify the need for continuous observable core monitoring. This occurred because of the following factors. First, as confirmed by TVA's unreviewed safety question analysis performed following the event, the practice of core monitoring is not required to preclude refueling accidents. Inadvertent criticality is prevented during core alterations by the margin of safety provided in the core design and through refueling interlocks. Moreover, the BFN FSAR evaluation of refueling accidents and abnormal operational transients does not take credit for continuous SRM neutron flux monitoring to preclude inadvertent criticality. SRM neutron flux monitoring during refueling serves, however, to provide an additional level of assurance over and above the primary design factors which preclude inadvertent criticality.

Second, there was a tendency for the engineers, reviewers, and operators to rely on the technical specifications. The reactor engineers had considered source neutron strength after the extended shutdown and were aware that given the planned loading sequence and the fuel/detector geometry, observable monitoring would not be available with the SRMs during the early stages of fuel loading. However, based on the technical specifications, it was assumed that these circumstances had been considered and were approved. TVA now recognizes that there was no rigorous questioning of the procedures or aggressive attention to fundamental measures that can improve performance or enhance safety beyond the minimum. TVA acknowledges that this type of attitude must be changed and is emphasizing the importance of taking measures over and above the minimum strictly required.

The inspection report notes on page 5 that the technical specifications were amended in 1979 to allow fuel loading with SRM count rates less than 3 cps under certain conditions and that the FSAR, Section 7.5.4.1, states that neutron detectors shall be provided which result in a count rate of no less than 3 cps with all control rods fully inserted. The report further states that the FSAR was not updated when the technical specifications were changed, so the change in technical specification 3.10 was ". . . clearly in direct contradiction with the FSAR requirement."

TVA notes that the FSAR, Section 7.5.4, was subsequently updated by amendment 1 in 1983 to remove references to fuel loading and is in agreement with the technical specifications.



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The inspection report further states on pages 6 and 16 that an adequate 10 CFR 50.59 evaluation of 2-GOI-100-3, "Refueling Operations," should have questioned the applicability of technical specification 3.10.B.1.b.2 to the present refueling. The report states that "the irradiated fuel (used in unit 2) should have been considered equivalent to fresh fuel because of the decay of the neutron levels in the fuel during the extended shutdown." The reactor engineers in this case were concerned that the long shutdown would result in decay of the fuel radioisotopes to the extent that less than 3 cps would be registered by the SRMs if technical specification 3.10.B.1.b.3 was used to load fuel assemblies directly adjacent to the SRMs. However, TVA did not consider the fuel to be decayed to the extent that no source neutrons would be available. TVA has completed an analysis, included with this submittal as enclosure 2, that shows an adequate supply of neutrons was available. Had technical specification 3.10.B.1.b.3 been used, the resultant core loading would still have been partially unmonitored because of neutron attenuation between the fuel assemblies loaded in the core center and the SRM locations. Therefore, in this situation neutron attenuation was the issue and not the extent of decay of neutron levels from the irradiated fuel.

Furthermore, if fuel loading had proceeded in accordance with technical specification 3.10.B.1.b.3, a slightly less conservative situation was possible because withdrawal of a single control rod would not have been blocked by the SRM downscale rod block. TVA did not intend to take improper advantage of the technical specifications. As discussed earlier, TVA personnel tended to rely on the technical specifications. TVA now recognizes that both technical specification 3.10.B.1.b.2 and 3.10.B.1.b.3 did not properly consider neutron attenuation.

Apparent Violation 259,260,296/89-04-02 stated that there was a failure to implement the requirements of procedure SDSP 27.1, "Evaluation of Changes, Tests, and Experiments - Unreviewed Safety Question Determination," to perform adequate unreviewed safety question determinations, as evidenced by numerous inadequacies in the 10 CFR 50.59 reviews of fuel loading procedures.

As documented in the inspection report, NRC reviewed 13 screening reviews performed between June and December 1988, in accordance with SDSP 27.1. These 13 screening reviews related to refueling procedures and their revisions. NRC reported several deficiencies in implementation of SDSP 27.1. TVA admits that administrative deficiencies existed in the documentation of these reviews but a failure to implement the technical intent of SDSP 27.1 did not occur.



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TVA has assessed the reviews conducted in accordance with SDSP 27.1 and 10 CFR 50.59 for the revisions to the four procedures related to refueling and/or reloading. It is important to realize that in this case the TVA screening reviews address the changes made in these procedures and not the entire procedure. TVA concluded that the reviews were proper and that the conclusions were correct. The errors noted by NRC were administrative in nature. TVA's specific responses to the deficiencies noted by NRC in implementation of SDSP 27.1 are as follows:

1. NRC Concern: Thirteen screening reviews were assessed. Each review includes three questions requiring an answer and a justification for the answer. Of the 39 total justifications required, 19 were considered by the inspector to be incomplete, "illogical," or otherwise unacceptable.

TVA Response: These screening reviews were assessed by the plant Reactor and Systems Engineering groups with subsequent upper management overview. This review indicated that the majority of the thirteen procedure revisions were administrative changes. Administrative errors did occur--including the need for better documentation of the basis for a determination and more precise articulation of the reviewer's rationale. In each case, however, the review found that the documentation reflects the correct conclusion that no Unreviewed Safety Question Determination (USQD) was needed. Quality Assurance also conducted an independent review of the screening reviews and drew the same conclusions.

TVA's new 10 CFR 50.59 instruction defines the technical requirements for performing 10 CFR 50.59 reviews, addresses the administrative errors noted in the inspection report, and incorporates industry enhancements. When this new program is fully implemented, it will increase the discipline of the safety evaluations. This program includes the following elements:

- establishes consistent reviewer qualifications for all sites,
- use of selected NUMARC guidance for standardized definitions and use of the seven USQD questions,
- strengthened safety evaluation reviews by requiring reviews by a group in Nuclear Engineering or the plant staff,
- strengthened FSAR updates, and
- establishment of 10 CFR 50.59 libraries.

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2. NRC Concern: There are five locations on each screening review form to list the applicable research documents. This resulted in a total of 65 locations for research citations required for the sample of 13 screening reviews. Of these 65 locations, two were blank, four listed "all," and six stated that no FSAR or technical specifications applied. From this, the inspector questioned whether the FSAR and technical specifications were properly researched.

TVA Response: TVA's recent assessment of the screening reviews confirms that the conclusions of the screening reviews were correct. The deficiencies noted in the screening review process are administrative. The need to better document the reference search is a part of the 10 CFR 50.59 program improvements described previously.

3. NRC Concern: On the 13 screening reviews evaluated by the NRC inspector, there are five instances where the inspector concluded that the wrong box on the form ("No" instead of "N/A") was checked.

TVA Response: TVA agrees that administrative errors existed. Checking "No" instead of "N/A" in response to Question 1 ("does the proposed change involve a change in the facility (or plant operating characteristics) from that described in the SAR and which could impact nuclear safety?") did not impact the conclusions. This does not represent a breakdown in the 10 CFR 50.59 program.

As discussed previously, TVA is implementing a new 10 CFR 50.59 instruction. This instruction incorporates recent industry guidance to enhance the program and also addresses administrative and documentation deficiencies. The actions taken to improve the 10CFR 50.59 program should address NRC's concern.

Apparent Violation 259,260,296/89-04-03 stated that there was a failure to provide adequate cross-disciplinary review of procedures impacting plant safety.

The NRC inspectors reviewed the four plant procedures that controlled the fuel loading process: 2-GOI-100-3, "Refueling Operations," TI-147, "Fuel Loading After A Complete Core Unloading," 2-SI-4.10.B, "Demonstration of SRM System Operability During Core Alterations," and



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TI-14, "Special Nuclear Material Control." The inspectors concluded that only TI-14, which provides the specific fuel movement steps, had been reviewed by the Plant Operations Review Committee (PORC). In addition, the inspectors concluded that the technical specifications and plant procedure SDSP 7.4, "Onsite Technical Review and Approval of Procedures," required cross-disciplinary review for these fuel loading procedures and that none of the procedures had received appropriate cross-disciplinary reviews.

With respect to these fuel loading procedures, TVA considers that BFN complied with the applicable cross-disciplinary review provisions of SDSP 7.4. SDSP 7.4 delineates the technical review process required by technical specification 6.5.3. SDSP 7.4 requires cross-disciplinary review if:

- the procedure may affect equipment under another group's control,
- another group will be required to perform physical actions not included in previously approved instructions, or
- parts of the procedure are beyond the expertise of the group making the revision.

It is important to emphasize that SDSP 7.4 also applies to revisions to a procedure. While a procedure may be safety-related or have implications for safety, a revision may not. Therefore, the revision may not require cross-disciplinary review.

In some cases, there is an overlap in the technical review, affected section review (as specified in SDSP 2.11, "Implementation and Change of Site Procedures and Instructions"), and cross-disciplinary review process. Depending upon the nature of the change being made, affected section review may be considered as cross-disciplinary review. For example, when a revision delineates a change in the conduct of operations of another section, but does not affect equipment under that group's control or require physical action by that group not included in previous instructions, an affected section review adequately serves as a cross-disciplinary review.

In light of the above, TVA has reevaluated the review process for each revision of the four refueling/fuel load procedures and concluded that appropriate cross-disciplinary/affected section reviews were conducted in accordance with SDSP requirements.

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The specific revisions included in the reevaluation of the revision histories are listed below.

- TI-147, "Fuel Loading After A Complete Core Unloading," Revisions 0, 1, 2, and 3
- TI-14, "Special Nuclear Material Control," Revisions 4, 5, 6, 7, 8, 9, 10, and 11
- 2-GOI-100-3, "Refueling Operations," Revisions 0, 1, 2, 3, and 4
- 2-SI-4.10.B, "Demonstration of SRM System Operability During Core Alterations," Revisions 0 and 1
- MRTI, "Master Refueling Test Instruction," Revisions 1, 2, 3, and 4

For TI-147, 2-GOI-100-3, 2-SI-4.10.B and MRTI, these are all revisions to the procedures beginning with the first major revision for each since the shutdown of unit 2 in 1984. For TI-14, these are all revisions to the procedure associated with fuel loading since the shutdown of unit 2 in 1984.

The NRC Inspection Report noted that an issue involving inadequate review and approval of procedures was recently raised in Inspection Report 259, 260, 296/88-36, but TVA's corrective actions focused only on addressing the specific procedure questioned by NRC. TVA will address any generic concerns in the inspection report when it is received.

III. Unresolved Items

Unresolved item 259,260,296/89-04-04 questioned the validity of technical specifications which allow unmonitored core alterations.

TVA agrees with the history of the technical specification changes as presented in the inspection report, including the superficiality of justifying the 1979 amendment because NRC had previously approved a similar change at another plant. TVA considered both technical specifications 3.10.B.1.b.2 and 3.10.B.1.b.3 to be acceptable because the fuel being loaded contained irradiated assemblies. TVA did not consider the fuel to be decayed to the extent that source neutrons would not be available. (See enclosure 2.) TVA was concerned that the long shutdown would result in decay of the fuel to the extent that 3 cps might not be registered on the SRMs by only loading fuel assemblies directly adjacent to the SRMs. Had TVA loaded the core using technical

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specification 3.10.B.1.b.3, some count rate would have been monitored but this would only have indicated SRM operability. The resultant core loading would still have been unmonitored for some time because of the neutron attenuation between the assemblies being loaded in the core center and the SRM locations.

Following the termination of fuel load activities, TVA performed a short-term technical specification assessment limited to core alterations and other technical specifications required to support fuel loading. No concerns were identified which required immediate technical specification changes. As a result of this assessment, some items requiring clarification by administrative control were identified and corrected before the resumption of fuel load activities. TVA will submit changes to the SRM technical specifications reflecting improvements to insure observable core monitoring.

In addition, as a result of this event a previously planned technical specification assessment program was enlarged in scope and rescheduled. This program is in progress and the results of this assessment will be available by March 31, 1989.

Unresolved item 259,260,296/89-04-05 involves the adequacy of the procedure review process including the responsibilities of the PORC.

Technical specification 6.5.1.6 lists the activities for which PORC is responsible. The technical specification allows PORC to delegate performance of review activities but requires PORC to maintain cognizance of and responsibility for the reviews.

The qualified technical reviewer process was initiated in December 1987 as part of this delegation of the performance of review activities and is described in SDSP 7.4, "Onsite Technical Review and Approval of Procedures." SDSP 7.4 implements the technical review requirements of technical specification 6.5.3. The reviewer is required to receive documented technical reviewer training and must be cognizant of the area being reviewed.

The qualified technical reviewer verifies that the procedure is technically correct, complies with all technical specifications and other applicable requirements, is adequate for performing the task involved, and is in compliance with plant administrative requirements. The reviewer also verifies that the screening review and/or the safety evaluation has been performed.

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To maintain cognizance of the qualified technical reviewer process, PORC instituted an oversight role for the qualified reviewer process. A ten percent sample of the procedures processed through the qualified reviewer process are reviewed by PORC. A very small percentage of these procedures have resulted in questions from PORC, and these questions are normally of an editorial nature.

As part of this oversight role of the qualified technical reviewer process, 2-GOI-100-3, "Refueling Operations," (revision 0) was reviewed by PORC on December 6, 1988. PORC had no comments on the procedure. The revision reviewed was the initial upgraded version. Therefore, the entire 2-GOI-100-3 was reviewed and accepted by PORC.

Based on the fact that the qualified technical reviewer verifies if a screening review and/or safety evaluation has been done, that ten percent of the procedures processed through the qualified technical reviewer process are PORC reviewed, and that the questions PORC has had with these procedures are generally editorial in nature, TVA concludes that both the procedure review process and PORC overview of the implementation of the independent qualified reviewer process are adequate.

Unresolved Item 259,260,296/89-04-06 involves the adequacy of the reportability determination for this event, pending review of TVA's basis for not reporting it under 10 CFR 50.72, and pending disposition pursuant to 10 CFR 50.73.

TVA determined that this event did not meet any of the 10 CFR 50.72 or 10 CFR 50.73 reporting criteria. An item-by-item justification of this position is given in enclosure 3. TVA did, however, submit a voluntary Licensee Event Report, Number 260/89001, on January 26, 1989, in order to give NRC the facts about this event.

IV. Corrective Actions

TVA took action January 5, 1989, to halt the BFN unit 2 fuel load after 74 of 764 fuel assemblies had been loaded. That evening TVA senior management initiated a series of telephone conference calls between TVA fuel engineers and GE fuel experts to discuss the situation. An initial action plan was developed with specific instructions on steps to be taken including a core verification which reconfirmed that all 74 fuel assemblies were correctly loaded. An SRM was relocated adjacent to the loaded assemblies to monitor core reactivity.

TVA requested GE to recommend a loading and instrumentation strategy. A team of GE experts arrived onsite Saturday, January 7 and developed a reload sequence to recommence fuel load. The fuel loading procedures were revised to incorporate the GE recommendations, to allow the use of fuel loading chambers, and to ensure that fuel loading practices were comparable to the best practices in the industry.

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The Senior Vice President of Nuclear Power and several of his vice presidents, who had already been involved in the formulation of the initial action plan, arrived onsite January 8 and completed a detailed action plan. The following day, that plan was discussed with the NRC staff. Fuel loading resumed January 16, 1989. A detailed listing of TVA's corrective actions is provided in enclosure 1.

TVA also completed several short-term actions to enhance the Nuclear Experience Review (NER) program. These are listed in enclosure 1 and include an independent review of the NER program by a team made up of GE, Westinghouse, INPO, and TVA personnel. TVA is evaluating the recommendations from this review. A senior TVA manager with SRO qualifications has been designated to head the NER program.

TVA also completed a short-term technical specification assessment. An assessment team headed by the Quality Assurance organization specifically reviewed all technical specifications applicable or potentially applicable to refueling/shutdown. The technical specifications were reviewed against applicable regulatory requirements, guidance documents or acceptance criteria, Standard Technical Specifications, and good operating practices. TVA concluded that no immediate technical specification changes in the refueling/fuel load area were needed before resuming fuel load. However, there were several items requiring the addition of administrative controls. These controls were implemented before resumption of fuel load. In addition, TVA identified areas for evaluation of further potential enhancements. The results of this review were presented to NRC at the January 9, 1989 TVA/NRC management meeting.

Additionally, TVA is currently conducting a longer term technical specification self-assessment program. This assessment is being conducted by a team headed by Quality Assurance. This team is evaluating the effectiveness of the technical specification change control program, evaluating present technical specification interpretations, reviewing the consistency of technical specifications with the design basis and Standard Technical Specifications, and reviewing the adequacy of the implementation of technical specification requirements. Results of this assessment will be provided to TVA management by March 31, 1989.

V. Summary

TVA responds as follows to the potential enforcement issues and unresolved items in the inspection report.

1. Apparent Violation 260/89-04-01 stated that there was a potential failure to comply with 10 CFR 50.59 by proceeding with unmonitored core loading of unit 2.



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TVA recognizes that technical specifications 3.10.B.1.b.2 and 3.10.B.1.b.3 did not properly and conservatively consider the effects of neutron attenuation on the response of the SRMs. Corrective actions as discussed in enclosure 1 have been initiated. However, extensive review and analyses demonstrated that there was no unreviewed safety question and no violation of 10 CFR 50.59.

2. Apparent Violation 259,260,296/89-04-02 stated that there was a failure to implement the requirements of procedure SDSP 27.1, "Evaluation of Changes, Tests, and Experiments - Unreviewed Safety Question Determination," to perform adequate unreviewed safety question determinations, as evidenced by numerous inadequacies in the 10 CFR 50.59 reviews of fuel loading procedures.

TVA agrees that there were a number of administration errors in screening reviews for procedure changes. However, detailed rereviews determined that there was no effect on the conclusions. A new 10 CFR 50.59 manager's instruction together with formal implementation and training will address these deficiencies and should improve safety evaluations.

3. Apparent Violation 259,260,296/89-04-03 stated that there was a failure to provide adequate cross-disciplinary review of procedures impacting plant safety.

A thorough reevaluation of the review process for each revision of the four refueling/fuel load procedures since the shutdown of unit 2 determined that appropriate cross-disciplinary/affected section reviews had been conducted.

4. Unresolved item 259,260,296/89-04-04 questioned the validity of technical specifications which allow unmonitored core alterations.

TVA performed a reassessment of technical specifications related to core loading and required to support core loading and determined that no immediate technical specification changes were necessary before resuming fuel loading. Some items requiring clarification by administrative controls were identified and corrected before the resumption of fuel load.

5. Unresolved item 259,260,296/89-04-05 involves the adequacy of the procedure review process including the responsibilities of the PORC.

TVA rereviewed the procedure review process and determined that the process is adequate.

6. Unresolved Item 259,260,296/89-04-06 involves the adequacy of the reportability determination for this event, pending review of TVA's basis for not reporting it under 10 CFR 50.72, and pending disposition pursuant to 10 CFR 50.73.

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This event was thoroughly rereviewed and it was determined that it did not meet the requirements for reportability under 10 CFR 50.72 or 10 CFR 50.73.

TVA acknowledges that observable monitoring of core neutrons should have been ensured during fuel loading. The comprehensive actions identified in enclosure 1 and previously discussed with NRC demonstrate TVA's commitment to learn from this incident, to upgrade performance at BFN, and to develop an improved safety consciousness in the responsible TVA personnel.

TVA's continuing commitment to safe operation of its nuclear facilities is demonstrated by:

- ° the expedient and indepth investigation of this event,
- ° the comprehensive reevaluation of the processes involved, and
- ° the extensive corrective actions discussed herein are described in enclosure 1.

If you need any additional information regarding these matters, please telephone me at (615) 751-4776.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



C. H. Fox, Jr.
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Enclosures

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Enclosure 1

IMMEDIATE AND LONG-TERM CORRECTIVE ACTIONS

On January 5, 1989, fuel loading at Browns Ferry unit 2 was halted to evaluate the concern that reload procedures did not ensure adequate core flux monitoring in all circumstances. TVA had completed loading 74 bundles out of the 764 that form a complete core. By that evening, TVA had initiated discussions with General Electric (GE). On January 6, 1989, a plan was developed with specific instructions on immediate steps to be taken to address the concern. These immediate steps included reconfirmation that all 74 fuel assemblies were properly loaded and relocation of one source range monitor (SRM) to an intermediate range monitoring location in direct contact with the 74 loaded bundles.

By January 8, 1989, a TVA team led by the Senior Vice-president of Nuclear Power further developed the action plan to address this issue and on January 9, 1989, discussed the plan with the NRC staff. This action plan--incorporating both its immediate and long-term response-- represents a comprehensive attempt to address both the specific circumstances of this event and the broader implications. Please note that in the January 26, 1989 letter from C. H. Fox to NRC concerning LER 260/89001, the major points of this action plan were listed as commitments for completing corrective actions. This action plan incorporated the following elements and specific tasks.

A. CORE MONITORING

1. Converted Intermediate Range Monitor (IRM) F to a SRM in Core location 24-29 with fuel monitoring and trip capability (Completed)
 - safety evaluation established and approved
 - IRM F properly stored/inventoried/documentated
 - assessed the adequacy of procedure changes, supporting screening reviews, and safety evaluations for this change

2. Procured fuel loading chambers (FLC) to be used for recommencement of fuel load (Completed)
 - Installation and calibration instruction (established, approved, safety evaluation approved)
 - training provided



Enclosure 1

B. RELOAD PLANS

1. Accomplished remaining reload under technical specification 3.10.B.1.b.1. with a minimum of three SRMs/FLCs operable and greater than 3 cps. This is comparable with the best industry practices. (Completed)
 - reviewed process for adequacy of procedure changes
 - assessed adequacy of procedure changes, supporting screening reviews, and safety evaluations
 - 2-SI-4.10.B, "Demonstration of SRM System Operability During Core Alterations" revised (approved, safety evaluation approved, training completed)
2. Maintained one SRM/FLC in quadrant of fuel movement and one SRM/FLC in adjacent quadrant operable (Completed)

Note: Installed SRMs plus two dunking chambers being used.

- provided training, including lessons learned, revised procedures, and philosophy
 - prepared an initial assessment of technical specifications for accuracy and consistency with safety evaluation report (SER) and technical specification bases and interpretations for fuel loading (See sections D-F for additional details on completed and planned corrective actions)
3. GE developed reload sequence to recommence fuel loading (Completed)
 - GE developed loading sequence, approved
 4. TVA improved the GE/Site interface (Completed)
 - evaluated and strengthened TVA/GE relationship, including the process for preparing the core loading sequence (e.g., GE involvement, procedures used, use of GE recommendations)
 - evaluated and strengthened the GE/site interface between TVA/GE engineering on plant problems
 - established periodic meetings with GE senior management on plant improvement items

C. MODIFIED REFUELING PROCEDURE

1. The reload sequence has been incorporated into a modified refueling procedure similar to that used for initial core loading (Completed)
 - procedures and safety evaluations were provided to NRC residents
 - group review of procedures was documented



Enclosure 1

2. The refueling prerequisites have been clearly defined in the following procedures (Completed)
 - 2-GOI-100-3, "Refueling Operations," (approved, safety evaluation approved)
 - Technical Instruction 147, "Fuel Loading After A Complete Core Unloading," (approved, safety evaluation approved)
 - 2-SI-4.10.B (approved, safety evaluation approved)
 - vendor information appropriately incorporated into procedures for fuel load (vendor concurrence obtained and documented)
3. TVA performed a short-term technical specification assessment and determined that no technical specification change was required for completion of reload (Completed)
 - see discussion of technical specification assessments below
 - NRC immediate concerns have been resolved by revisions to administrative procedures
4. TVA has completed a review of industry practice for fuel load and a comparison to Browns Ferry fuel load procedures. The objective was to ensure that the refueling procedures are comparable with the best practices of other utilities (Completed)
5. Applicable personnel have been trained on procedure revisions and monitoring of source range instrumentation (Completed)
 - training completed
 - lessons learned established and incorporated into training
6. GE reactor engineer overview was maintained for remaining fuel load activities (Completed)
 - GE reactor engineer rode the fuel loading bridge
 - GE provided troubleshooting of problems on the bridge
 - GE made recommendations to the Shift Operations Supervisor as needed

D. SHORT-TERM TECHNICAL SPECIFICATION ASSESSMENT

1. A short-term technical specification assessment was completed with no immediate changes identified (Completed)
 - reviewed technical specifications applicable or potentially applicable to refueling/shutdown
 - reviewed technical specifications against fuel load systems, safety evaluation reports, Service Instruction Letters (SILs), BFN Interpretation Manual, and BWR 4 Standard Technical Specifications for consistency and good operating practices
2. Several items identified were clarified by further administrative controls or verified to already be adequately administratively controlled. (Completed)



Enclosure 1

- operable SRM/FLC in the quadrant where core alterations are being made and in an adjacent quadrant (technical specification 3.10.B.1)
- core alteration supervision if residual heat removal and core spray inoperable (technical specification 3.5.A and 3.5.B)
- reactor building isolation functions to be operable when secondary containment integrity is required (technical specification 3.2.A)
- emergency equipment cooling water pumps necessary while refueling (technical specification 3.5.C.1)

E. ADMINISTRATIVE TECHNICAL SPECIFICATION IMPROVEMENTS

1. Submitted TVA standardized Browns Ferry technical specifications, for section 6, "Administrative Controls" to the NRC (Completed)
2. The plant procedure was revised to incorporate provisions from item 1 that could be incorporated before receipt of the approved technical specification change regarding the Plant Operations Review Committee (Completed)
3. Reviewed the PORC Procedure Review List and suggested revisions (Completed)

F. LONG-TERM TECHNICAL SPECIFICATION ASSESSMENT

1. A long-term technical specification assessment is currently being conducted with QA oversight
 - evaluating the technical specification change program effectiveness
 - evaluating Browns Ferry technical specification interpretations against requirements
 - evaluating technical specification consistency with design basis, Standard Technical Specifications, and good operating practices
2. Results of the assessment will be provided to TVA management by March 31, 1989
3. TVA will submit to NRC any needed revisions to the technical specifications resulting from this assessment

G. NUCLEAR EXPERIENCE REVIEW (NER)

1. Immediate Actions (Completed)
 - = Developed a program that:
 - assigns project manager for each significant experience review,
 - requires action plan for significant issues,
 - imposes schedule for initiation of action plan,
 - establishes a single point of contact at sites and engineering,
 - and prepares guidance for prompt notification to senior management.



Enclosure 1

2. Follow-up Actions

- TVA has performed a critical independent review of the existing NER process with GE, Westinghouse, INPO, and TVA personnel. (Completed)
- has established an action plan to implement recommendations
- will establish necessary programmatic changes and monitor effectiveness by May 15, 1989

H. 10 CFR 50.59 PROCESS

1. A new corporate management directive on 10 CFR 50.59, utilizing selected NUMARC guidance, has been issued (Completed)
 - establishes consistent reviewer qualifications for all sites.
 - addresses administrative deficiencies identified in Inspection Report 89-04
 - strengthens safety evaluation reviews by requiring reviews by a group in Nuclear Engineering or the plant staff
 - strengthens FSAR updates
 - will establish 10 CFR 50.59 libraries

Implementation at the sites will be effective by April 28, 1989.

I. GE/TVA INTERFACE ENHANCEMENTS

1. Short-term actions have been taken with respect to the reload plan and modified refueling procedure (Completed)
 - see sections B.3 and B.4, and C.6 above for details
2. TVA has evaluated the GE/site interface and is implementing improvements
 - see section B.4 above
 - Oversight Review Team - GE management, site management, corporate management
 - GE assigned a fulltime project manager to provide advice and assistance to plant management
 - GE representative frequently attends plant manager's staff meetings, technical services staff meetings, and plant daily status meetings.

Enclosure 2

CORE MONITORING DURING BFN UNIT 2, CYCLE 6 FUEL LOADING

In reference 1, NRC states that during the reloading of the initial 74 fuel bundles for the BFN unit 2 core in January 1989, TVA may have taken ". . . nonconservative and improper advantage of existing technical specification wording in performing unmonitored core alterations." In a later part of the same reference, it is stated that the section of the technical specification used to allow unmonitored core alterations should not have been applied since it applies only if both fresh and irradiated fuel are loaded and ". . . In this case, the irradiated fuel should have been considered equivalent to fresh fuel because of the decay of neutron levels in the irradiated fuel during the extended shutdown."

The SRMs in the core were recording less than 3 cps during the fuel loading as allowed by the technical specifications. The reference 1 statements imply that the low count rate was due to a lack of neutrons caused by the decay of the sources of neutrons in the fuel during the long shutdown. The failure of the SRMs to obtain readings of 3 cps or greater during the early stages of fuel loading operations was not due to an inordinately low neutron source. Rather, the failure to obtain a significant count rate during initial core loading was due to the location of the SRMs with respect to the loaded fuel bundles. Issues related to both source strength and neutron attenuation are addressed in the following sections.

Source Strength

There are three significant sources of neutrons in irradiated fuel.

1. "Photoneutrons" arising from gamma-n reactions.
2. Neutrons from spontaneous fission of heavy actinides.
3. Neutrons produced by alpha-n reactions.

Greater than 99 percent of all photoneutrons are produced by precursors with half lives of less than one day (based on table 3 on page 2-3 in reference 2); therefore, photoneutrons will not contribute significantly to the total core neutron source after a shutdown of more than a few days. Only the spontaneous fission and alpha-n reaction sources for neutrons are of importance during typical reactor refueling operations.

The sources of neutrons in irradiated fuel due to spontaneous fission and alpha-n reactions have been estimated as a function of fuel burnup and time after shutdown using the ORIGIN code (reference 3). ORIGIN results for BWR fuel are depicted in figure 1. From this figure it can be seen that the source of neutrons in irradiated fuel is influenced strongly by the exposure

Enclosure 2

of the fuel, but that the strength of the source for a given exposure varies relatively slowly with length of shutdown for times greater than a few months. The fuel neutron source after 4 years of shutdown is still approximately 25 percent of the value obtained for a 3-month shutdown and approximately 50 percent of the value after a 1-year shutdown. Table 1 shows the estimated total neutron source from the BFN unit 2 core configuration after loading 74 fuel assemblies for outage lengths of 0.25, 1.0, and 4.0 years.

The significance of the BFN unit 2 fuel neutron source can be appreciated by comparing it with normal subcritical multiplication effects. The total number of neutrons in the subcritical core is related to the total neutron source by the subcritical multiplication formula (reference 4).

$$n/n_0 = 1/(1-k)$$

Where n is the total number of neutrons in the core, n_0 is the total number of source neutrons and k is the core's effective multiplication factor. For a k of 0.9, the total source neutrons are multiplied by a factor of 10 by the core and for a k of 0.95 the total neutron population is 20 times greater than the source strength. The factor of two difference in the neutron population that could arise entirely from reasonable core reactivity differences during refueling operations is of the same magnitude as the change in irradiated fuel source strength following several years of shutdown.

To ensure adequate neutron counts for startup of BFN unit 2 following the long outage, TVA inserted seven Cf-252 neutron sources prior to refueling operations. One of these sources was located near the center of the 74-bundle configuration which existed at the time fuel loading was halted. The strength of each of the seven Cf sources is estimated to be $1.0E+9$ neutrons per second. These Cf sources represent another significant neutron source in addition to the exposed fuel discussed above.

The BFN unit 2 core refueling has been completed. The four SRMs had the following count rates as of 1/30/89; SRM A = 80 cps, SRM B = 60 cps, SRM C = 100 cps, SRM D = 46 cps. These SRM count rates are comparable to those observed in other BWR units following outages of 70 days to 18 months.

The neutron population for the BFN unit 2 core was well within the bounds expected to occur for normal refueling outages.

Neutron Attenuation

As stated earlier, the failure of the SRMs to obtain readings of 3 cps or greater was due to the location of SRMs with respect to the loaded fuel bundles rather than an inadequate neutron source. Up to the time fuel loading was halted with 74 fuel assemblies in the core, none of the SRMs were closer than a foot, and two of the four detectors were more than 2 feet from the nearest fuel bundle.



Enclosure 2

The attenuation of thermal neutron flux with distance from the fuel can be estimated by treating the core as an infinite plane source of fast neutrons and using Fermi age theory to compute the relative thermal neutron flux at varying distances from the source assuming the intervening medium is pure water (reference 5). The Fermi age theory approximation is known to have limitations when applied to water systems but is adequate for order of magnitude analyses. Additional estimates for the reduction in thermal neutron flux as a function of distance from the source were obtained from references 6, 7, and 8. Figure 2 graphically depicts the range of attenuation estimates from the various references. Based upon the most conservative estimates, the expected detector count rate will decrease at least two decades per foot (30 cm) of water imposed between the core and the detector.

In order to obtain a 3 cps reading on an SRM located 2 feet from the core, the same SRM positioned adjacent to the fuel would have to record a count rate greater than 20,000 cps. Typically, count rates for SRMs located within the fueled region during a fuel loading have been substantially less. Based on the attenuation depicted in figure 2, the maximum distance the SRM could be located outside the loaded core and still obtain appreciable readings is 9-12 inches. This estimate ignores the effects of structural material and inserted control blades between the fuel and detector, but these effects and the actual source geometry would be expected to make only a small change in the thermal neutron attenuation rate.

Figure 3 depicts the core configuration at the time fuel loading was halted (74 fuel assemblies), and also shows the core locations for the four SRMs (A, B, C, and D). When fuel loading was halted, SRMs A, B, and D had no meaningful count rates. SRM C, located approximately one foot from the nearest fuel and 2 feet from the nearest Cf-252 source, was reading only 0.2 to 0.4 cps. SRM D was moved from core location 16-21 (approximately 2.8 feet from fuel) to IRM F tube at core location 24-29, immediately adjacent to loaded bundles and one foot from a Cf-252 source. SRM D obtained a count rate of 40 cps following this move.

Conclusions

The total BFN unit 2 neutron sources were fully adequate for core refueling operations. SRM count rates obtained during refueling operations and for the completed core are consistent with previous observations at BFN and at other BWR reactors. The failure of the SRMs to obtain readings of 3 cps or greater during initial refueling operations was due to the location of SRMs with respect to the loaded fuel bundles. Even with very short outages or the addition of neutron sources, SRM counts of greater than 3 cps cannot reasonably be expected until fuel is loaded into cells immediately adjacent to detector locations.

References:

1. NRC letter from Frank R. McCoy to Oliver D. Kingsley, Jr., "Notice of Violation," dated January 30, 1989.
2. Nuclear Engineering Handbook, Harold Etherington, McGraw-Hill, New York, 1958.
3. ORNL Radiological Database.
4. Control of Nuclear Reactors and Power Plants, M. A. Schultz, McGraw-Hill, New York, 1961, page 16.
5. The Elements of Nuclear Reactor Theory, Samuel Glasstone & Milton C. Edlund, D. Van Nostrand, Inc., 1952, page 186.
6. Neutron Physics, K. H. Beckurts & K. Wirtz, Springer-Verlag, Berlin, 1958, page 352.
7. "Measured Neutron Attenuation at the Bulk Shielding Reactor," personal communication, L. F. Miller, University of Tennessee, February 7, 1989.
8. "General Electric BWR General Core Startup Test Procedure," APED-4851, October 1963.

Table 1

SOURCE NEUTRONS FOR 74-BUNDLE CONFIGURATION

	<u>Fresh</u>	<u>Once Burned</u>	<u>Twice Burned</u>
Avg Exp (GWD/MT) Assemblies	0.00 29	9.02 20	20.75 25
MT/Assy	0.18181	0.18181	0.18181
Time Shutdown (Years)	-	3.8	4.3
Source (n/s/MT)			
T = 90 Days	0.00	1.450E+07	1.360E+08
T = 1 Year	0.00	5.843E+06	7.263E+07
T = 4 Years	0.00	2.206E+06	3.677E+07
Source (n/s)			
T = 90 Days	0.00	5.272E+07	6.181E+08
T = 1 Year	0.00	2.125E+07	3.301E+08
T = 4 Years	0.00	8.021E+06	1.671E+08

 Total Source Strength (n/s) for 74-Bundle Configuration

T = 90 Days	6.709E+08
T = 1 Year	3.514E+08
T = 4 Years	1.751E+08

FIGURE 1
 NEUTRON GENERATION RATE / MTU
 BWR REACTOR - GE 8X8 FUEL

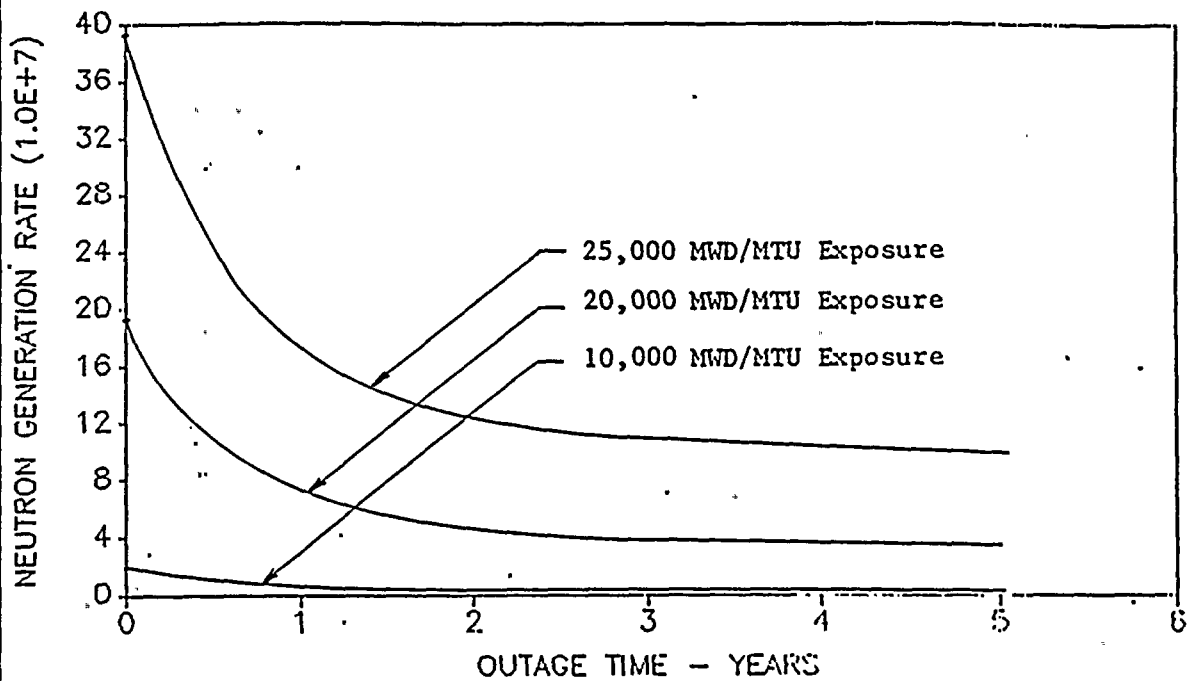
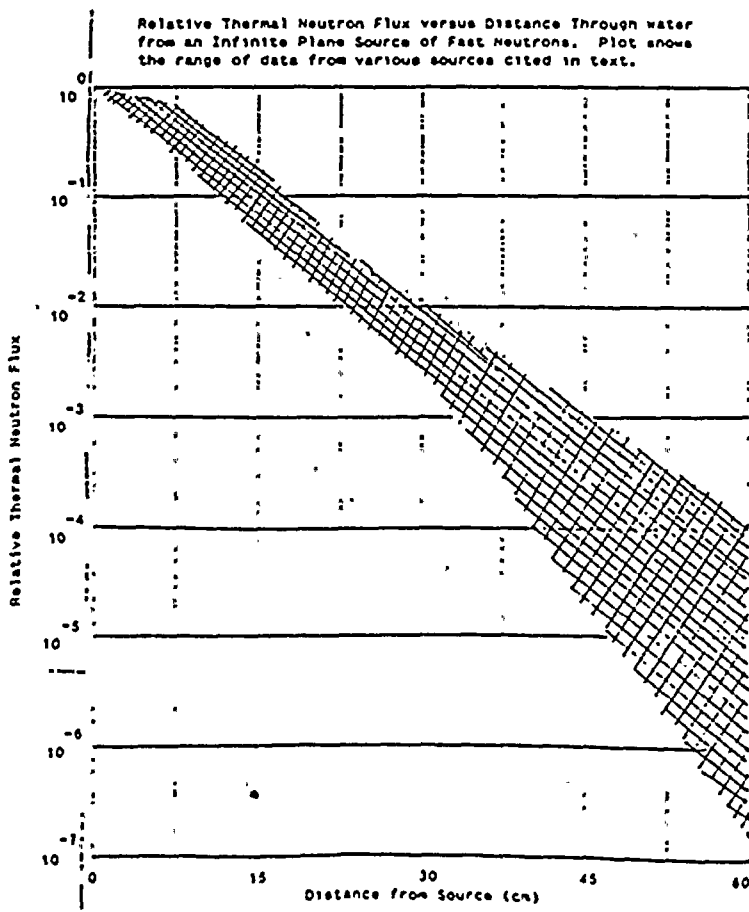
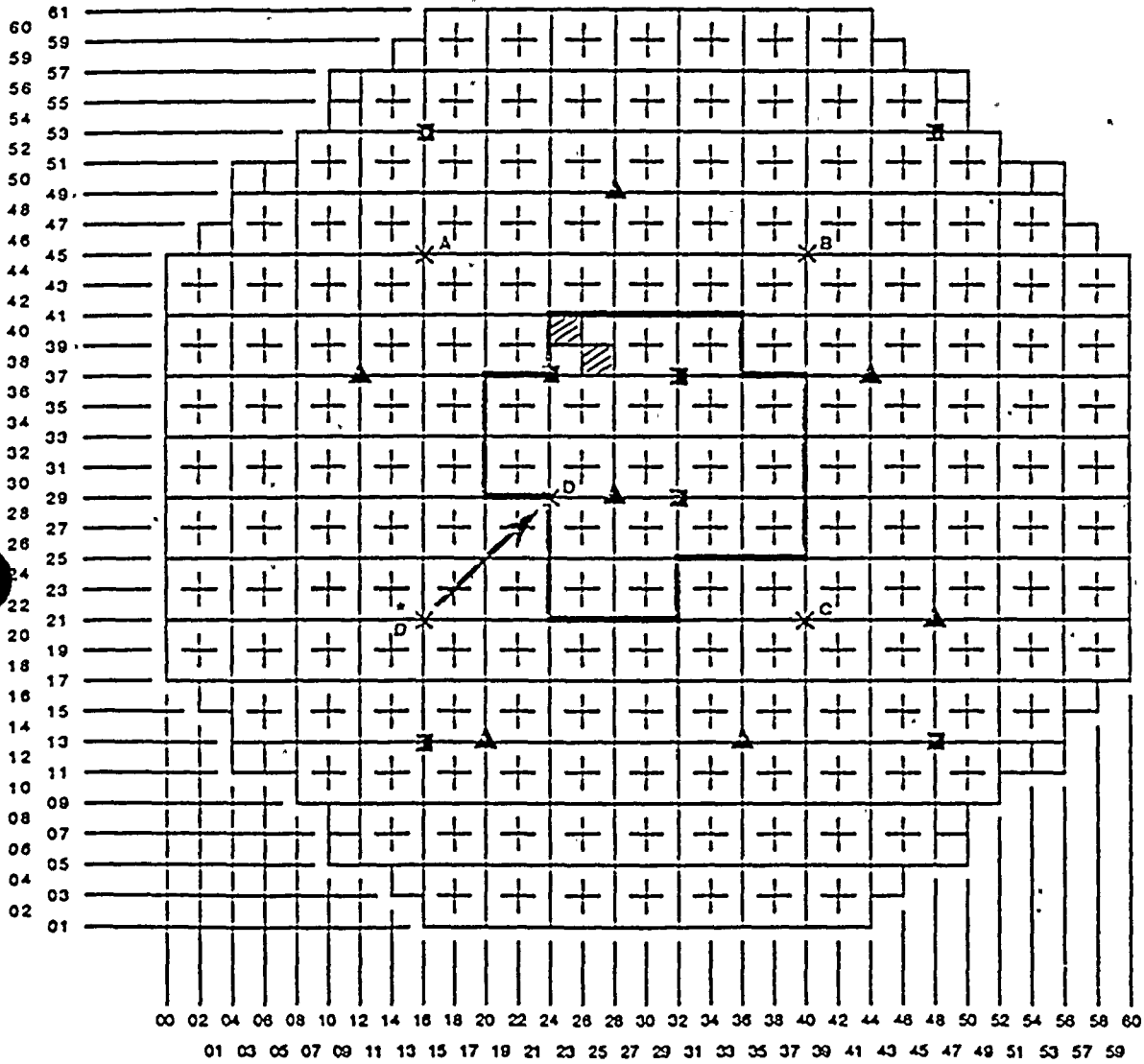


FIGURE 2



BROWNS FERRY UNIT 2
 CORE CONFIGURATION AS OF 1/05/89
 74 BUNDLES LOADED

- RM DETECTOR
- × SOURCE RANGE MONITOR
- ▲ NEUTRON SOURCE LOCATION



Detector not connected

Empty Fuel Locations after 74 Bundles Loaded

FIGURE 3

Enclosure 3

JUSTIFICATION FOR NONREPORTABILITY UNDER

10 CFR 50.72 and 10 CFR 50.73

- 10 CFR 50.73(a)(2)(i)(A) and 10 CFR 50.72(b)(1)(i)(A) (Plant Shutdown)

This condition occurred during refueling activities with the reactor vessel head off. The unit was in a shutdown condition throughout this event, therefore, no shutdown occurred.

- 10 CFR 50.73(a)(2)(i)(B) - No corresponding 10 CFR 50.72 requirement.
- (Operation outside the technical specifications)

Refueling operations were being conducted in accordance with technical specifications, section 3.10/4.10. The required surveillances were being performed.

Neutron monitoring requirements for core loading are presented in technical specifications, section 3.10.B.1. Technical specification 3.10.B.1 requires two operable SRMs during core alterations. Section 3.10.B.1.b.2 was the method being used to prove SRM operability. This section allows less than 3 cps on the SRMs provided they are response checked at least once every eight hours with a neutron source, and the core is loaded in a spiral sequence. The source checks were being performed at eight-hour intervals and the fuel was being loaded in a spiral sequence.

By the technical specification requirements, the SRMs were operable and the method of loading fuel was in compliance. Technical specifications were not violated.

- 10 CFR 50.73(a)(2)(i)(C) and 10 CFR 50.72(b)(1)(i)(B) (Deviation from technical specification pursuant to 10 CFR 50.54(x))

No deviations from the plant's technical specifications were needed or taken pursuant to 10 CFR 50.54(x). This condition was not a deviation from the technical specifications; refueling operations were conducted in accordance with the technical specifications.

- 10 CFR 50.73(a)(2)(ii), 10 CFR 50.72(b)(1)(ii), and 10 CFR 50.72(b)(2)(i) (Condition resulting in the plant, including principal safety barriers being seriously degraded, or that resulted in the plant being in an unanalyzed condition that significantly compromises plant safety; a condition outside the design basis; or in a condition not covered by operating or emergency procedures)

100



Enclosure 3

This condition did not degrade the condition of any of the principle safety barriers or the plant in general. Inadvertent criticality was prevented during core alterations by the margin of safety provided in the core design and by refueling interlocks. In addition, there was no destructive mechanism generated for the physical degradation of any components.

According to the safety evaluation submitted in the letter from C. H. Fox to NRC dated January 26, 1989, and subsequent core verification which reconfirmed that fuel assemblies were loaded correctly, the plant was never in an unanalyzed condition that significantly compromised plant safety. The safety evaluation demonstrated that no unreviewed safety question existed and that inadvertent criticality under these circumstances was not credible, given the engineered safeguards and core design. The analysis also showed that multiple errors/failures would be required simultaneously to approach criticality.

This condition was not outside the design basis of the plant.

The SRMs provide a monitoring function but do not have a safety design basis function according to technical specifications and the FSAR. The SRMs do not initiate any functions or actions which are needed according to the accident analyses to mitigate the effects of an accident.

The fuel is designed such that its structural and physical integrity will provide the initial barrier to the release of fission products, and will maintain the fuel in an analyzed geometry capable of being made or kept subcritical at any time with the highest worth control rod fully withdrawn. According to the safety analysis, there was no credible mechanism for a reactivity excursion which could have challenged the design function of the fuel and resulted in damage to the fuel clad barrier.

The refueling activities were covered by procedures. 2-GOI-100-3, "Refueling Operations," was the procedure covering the overall refueling process. TI-147, "Fuel Loading After A Complete Core Unloading," covered the loading sequence and TI-14, "Special Nuclear Material Control," covered the control and accountability of fuel assemblies. Operating Instruction 92, "Source Range Monitors Operating Instructions," covered SRM operation. 2-SI-4.10.B, "Demonstration of SRM System Operability During Core Alterations," addressed SRM operability requirements during core alterations.

10 CFR 50.73(a)(2)(iii) and 10 CFR 50.72(b)(1)(iii) (Natural Phenomenon or External Condition)

There was no natural phenomenon or other external condition during this event which could have threatened the safety of the plant.

- 10 CFR 50.73(a)(2)(iv), 10 CFR 50.72(b)(2)(ii); and 10 CFR 50.72(b)(1)(iv) (Engineered Safety Feature Actuations)

There were no manual or unplanned automatic actuations of Engineered Safety Features during this event. There were no initiation signals generated by this condition. This condition should not have resulted and did not result in Emergency Core Cooling System (ECCS) alignment or discharge into the reactor coolant system. No initiation signals were generated. No ECCS components were affected.

- 10 CFR 50.73(a)(2)(v), 10 CFR 50.73(a)(2)(vi), 10 CFR 50.73(a)(2)(vii), and 10 CFR 50.72(b)(2)(iii) (Event or condition that alone could have prevented fulfillment of the safety function of structures or systems or which caused multiple trains or channels to become inoperable)

The SRM channels were operable according to technical specification 3.10.B.1.b.2. This condition prevented continuous observable count rates by the SRMs. However, the technical specifications and FSAR do not define a safety function for the SRMs. According to accident analyses, the SRMs are not needed to shut down the reactor, maintain it in a safe shutdown condition, or mitigate the consequences of an accident. The SRMs are not designed to provide or initiate heat removal functions or control radioactive releases.

- 10 CFR 50.73(a)(2)(viii), 10 CFR 50.73(a)(2)(ix), and 10 CFR 50.72(b)(2)(iv) (Airborne or liquid radioactivity release)

There were no airborne or liquid radioactivity releases caused by this condition.

- 10 CFR 50.73(a)(2)(x) and 10 CFR 50.72(b)(1)(vi) (Event which posed an actual threat to plant safety)

There was no actual threat to the safety of the plant. According to the safety analysis, there was no credible mechanism for a reactivity excursion which could have challenged the design function of the fuel and resulted in damage to the fuel clad barrier.

Site personnel were not hampered in performance of their duties because of this condition.

- 10 CFR 50.72(b)(1)(v) - No corresponding 50.73 requirement - (Event that results in a major loss of response or assessment capability)

12345



This condition did not affect offsite response capability or communications capabilities. The SRM monitoring function was not effective because of this condition. The low SRM count rate prevented early assessment of excess reactivity events. Technical specification 3.10.B.1.b.2 allowed loading fuel in a manner which did not provide continuously observable monitoring of the changes in core reactivity during fuel loading. However, the SRM monitoring function is not a safety design basis function according to the technical specifications and the FSAR. Therefore, this condition did not result in a major loss of emergency assessment capability.

- 10 CFR 50.72(b)(2)(v) - No corresponding 50.73 requirement - (Transport of radioactively contaminated personnel offsite)

No personnel were contaminated or injured because of this condition; therefore, no transport to a medical facility was required.

- 10 CFR 50.72(b)(2)(vi) - No corresponding 50.73 requirement - (Event for which a news release is planned)

This condition did not create a situation that threatened the health or safety of the public or onsite personnel or protection of the environment. TVA did not supply news releases concerning this condition. BFN did respond to press inquiries when presented. No other government agencies were notified because of this condition.

- 10 CFR 50.72(a)(3) - No corresponding 50.73 requirement - (Declaration of emergency classification)

This condition did not meet any of the emergency classification criteria and no declaration of emergency occurred.

10-10-68

