August 8, 2003

10 CFR 50.54(f)

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

Gentlemen:

In the Matter of	)	Docket No.50-390
Tennessee Valley Authority	)	

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 – RESPONSE TO BULLETIN 2003-01 - POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS

The purpose of this letter is to provide TVA's response to the subject bulletin for WBN. The bulletin, dated June 9, 2003, requested all licensees to provide a response within 60 days of the date of the bulletin to either:

Option 1 - State that the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in the NRC Bulletin, taking into account the recent research findings described in the Discussion section, and are in compliance with all existing applicable regulatory requirements, or

Option 2 - Describe any interim compensatory measures that have been or will be implemented to reduce the risk which may be associated with the potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance has been completed.

Enclosure 1 to this letter contains the WBN Unit 1 response to Option 2 of the requested information.

August 8, 2003

Enclosure 2 contains a list of commitments for interim actions. If you have any questions about this letter, please contact P. L. Pace at (423) 365-1824.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 8th day of August 2003.

Sincerely,

W. R. Lagergren

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ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
RESPONSE TO BULLETIN 2003-01
POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS

This enclosure provides TVA's response to the subject NRC bulletin for WBN. WBN is addressing the actions specified in option 2 below:

Option 2: Describe any interim compensatory measures that have been implemented or will be implemented to reduce the risk which may be associated with the potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance has been completed. If any of the interim compensatory measures listed in the Discussion section will not be implemented, provide a justification. Additionally, for any planned interim measures that will not be in place prior to your response to this bulletin, submit an implementation schedule and provide the basis for concluding that their implementation is not practical until a later date.

RESPONSE

WBN has implemented or is implementing actions as described below. The following discussion provides a background to aid in understanding the positions taken by WBN.

TVA recognized the potential for sump blockage in the design of WBN and included a number of features in the original plant design to reduce the potential for screen blockage. Further, TVA has been a participant in the Nuclear Energy Institute (NEI) Sump Task Force since its inception. WBN has taken several actions in response to the information that has been available through participation in the task force that are included in the bulletin as compensatory actions. As discussed below, design features have been installed to minimize the potential for sump blockage.

TVA has long recognized that fibrous materials in containment could be a source of sump blockage. As such, decisions were made in the original design and through the years to prevent the use of fibrous materials inside containment unless an engineering evaluation concluded that the material could not reach the sump due to loss-of-coolant-accident (LOCA) break dynamic effects, seismic dislodgement, or spray wash down. Reflective metallic stainless steel insulation is used on the reactor coolant system (RCS) and other insulated piping that could be affected by jet impingement or pipe whip from breaks in the RCS. Fibrous heating ventilation and air conditioning (HVAC) filters are not used in the WBN containment except during refueling outages. Some non-metallic insulation has been used in the ice condenser and on glycol piping associated with the ice condenser cooling piping. This usage was evaluated in the design basis of the plant and it was determined that this insulation was not in locations where it would be damaged by high energy pipe breaks and be a potential source of debris that could reach the sump screens. Other than latent dust fibers, there is no fibrous material in the WBN primary containment that could be transported to the sump screens with the following few exceptions. Based on these exceptions, TVA performed a drawing review and subsequent walkdown of containment to identify the location and amount of insulation materials which could have the potential for sump blockage during the Unit 1 Cycle 4 Refueling Outage. The reactor coolant piping is insulated exclusively with reflective metal insulation. The main steam and feedwater piping was initially insulated with reflective metal insulation. Min K (encapsulated hydrophobic) insulation with a stainless steel jacket has been used to replace a limited number of mirror insulation panels on selected main steam and feedwater piping elbows and u-bends inside containment. The panels are individual coped segments used to cover the elbows or u-bends at seven locations with no more than two panels existing at any specific location. Each elbow or u-bend is separated by a significant distance. Therefore, it is expected that the zone of destruction resulting from a high energy line break would only release the Min K insulation from no more than two of these panels. The drawing review and walkdown also identified that Min K insulation has been used as a conduit heat shield at three locations inside the crane wall. In addition, 3M M20 mat has been used in several locations. These individual applications do not concentrate a significant quantity at any one location. Therefore, the quantity of Min K/3M material that would be released during a high energy pipe break would not be expected to challenge the relatively large surface area of the containment sump screens.

As an ice condenser plant, WBN is compartmentalized and the upper compartment and most areas outside the crane wall do not see direct effects from high energy line breaks. These areas do not contribute to the break generated debris source. The upper compartment does experience spray flow and some latent debris could be washed into the sump. However, there is no dislodged debris to be washed into the sump. Similarly, most areas outside the crane wall are part of the inactive sump. Water in the inactive sump does not communicate with the active sump where the sump screens are located. Thus, debris in these areas is not a potential source for sump blockage. During plant operation, temporary shielding material used during outages is stored in the area outside the crane wall. Therefore, it does not represent a potential source for sump blockage.

The emergency core cooling system (ECCS) and Containment Spray System (CSS) suction piping is located approximately 14 feet below the containment floor elevation. The equilibrium post-LOCA water level in the lower compartment will reach 14 feet above the floor elevation resulting in a total water level above the suction piping of approximately 28 feet.

The WBN containment sump incorporates many design features that help to minimize the possibility of screen blockage. The containment sump location as shown in the attached figure is located in the containment floor below the refueling canal to provide protection from high energy pipe failures. The lower containment is an open, one-level area. The only drains which are used to route water to the sump are the two large refueling cavity drains, two accumulator room drains, and the twenty ice condenser floor drains. These drains route water to the outside of the sump screens (trash racks). As can be seen, there are two suction paths to the sump separated by approximately 320 degrees around lower containment. The water fills the floor area and covers the sump entrance. To prevent large debris from entering the inner sump, an outer trash rack covered with ¼-inch mesh screen is provided on each side of the sump inlet. This provides two entry points into the inner sump area. These two entry points are on opposite sides of the inner sump suction area. Thus, if a break were to occur near one of the sump screens, debris would have to travel around to the other side of containment to collect on the opposite screen. Debris from a break on the opposite side of containment from the two sump inlets would have to travel long distances to reach either screen. The ¼-inch mesh screens act to prevent smaller debris from entering the inner sump area. The sump screens extend from the Reactor Building shield wall to the divider wall from floor to ceiling. The total surface area available for screening of debris is greater than 200 square feet. The design just described makes the likelihood of blockage of both screens very low due to the sump configuration with the two oppositely located sump screens, the large area which the screens cover, and the distance to the inner sump.

Between the two containment sump outer screens is the containment sump suction pit. The suction pit is approximately

10 feet from either outer screen. This pit is surrounded by a six-inch high curb which is used to prevent sediment from entering the pit. Debris with a specific gravity greater than one will largely settle before reaching the sump inlet. Atop the six-inch curb is a metal cruciform which serves to assist in vortex suppression. A ¼-inch mesh screen located in the containment sump suction pit itself provides additional filtering and is used to divide the sump into two suction volumes.

The potential for small debris passing through the sump screens has been considered. The containment spray nozzles are larger than the sump screen mesh opening. There are no restrictions in the injection path that are smaller than the screen mesh openings. Potential debris ingestion by the ECCS and CSS pumps was evaluated and determined not to be a concern. Debris would either pass through or be chopped up by the impellers. Small high density particles such as metal would settle out at the bottom of the sump or in the bottom of the reactor vessel.

Other design and administrative considerations that reduce or eliminate debris sources are discussed in the responses provided below that relate to containment cleanliness.

1. **<u>Operator training on indications of and responses to sump blockage.</u>**

As discussed in Response 2 below, the applicable emergency operating procedure has been revised to provide guidance for sump blockage. A shift order has been issued to apprise the Operators of the procedure change prior to taking shift. The Licensed Operator training for the revised procedure has been incorporated into the next scheduled cycle of Operator Requalification Training which is scheduled to begin on August 11, 2003, and includes six sessions of week-long operator training. The classroom training includes the following subjects for sump blockage:

- Mechanism for sump blockage
- Available indications
- Actions in response to sump blockage
- Associated emergency operating procedure revision

The training also includes a simulator scenario that goes to sump recirculation to further familiarize the operators with the procedure revisions. This training will be completed by

September 30, 2003. This is considered acceptable since the Operators are aware of the procedure change via the shift order.

2. **Procedure modifications, if appropriate, that would delay the switchover to containment sump recirculation.**

No procedure actions were made to delay switchover to containment sump recirculation, however the following procedure actions were made to provide guidance to the operator following switchover to containment sump:

Emergency Operating Instruction, ES-1.3, *Transfer to Containment Sump*, has been revised to provide guidance for enhanced monitoring of the containment sump for blockage and compensatory actions if sump blockage occurs post-LOCA. ES-1.3, Appendix D, *Containment Sump Blockage*, provides detailed plant-specific guidance on monitoring for and responding to indications of sump clogging. This appendix is initiated after the manual realignment for sump recirculation is completed and directs recording a set of baseline data on ECCS and CSS pump parameters for use in evaluating subsequent changes which may indicate the onset of clogging. If changes in monitored parameters indicate potential sump blockage, the operating crew is directed to request assistance from the plant engineering staff in the TSC. If continued changes indicate a degrading trend, operators are directed to evaluate stopping one train of CSS and ECCS pumps (if both trains are running). If ECCS or CSS pump suction is lost, a new step in ES-1.3 directs transitioning to ECA-1.1, *Loss of RHR Sump Recirculation.*

Technical Instruction (TI)-128, *Post Accident Technical Considerations (TSC)* has been issued to include guidance to the radiological emergency technical assessment team manning the Technical Support Center (TSC) at the site and Central Emergency Control Center (CECC) concerning sump blockage. Appropriate training for the TSC technical assessment team will be conducted to familiarize the technical staff with the concern for sump blockage and cover the steps provided in the revised procedures by September 30, 2003. This training is consistent with the completion of the Operator Requalification Training.

Based on the above, TVA does not consider additional preemptive actions to be warranted at this time. This position is based on the following considerations:

Requiring operators to take preemptive actions during large break LOCAs is a major change in the philosophy used in the development of the Emergency Operating Procedures. For large pipe breaks or plant events where the progression of the event is difficult to determine, reducing ECCS flow as a preemptive measure is not considered prudent or appropriate. Such a change would require a significant modification to the plant licensing and design basis. The likelihood of sump blockage at WBN is considered to be low, given the actions taken to assure containment cleanliness, the limited quantity fibrous material in areas susceptible to high energy line break jets, and the design of the sump screens.

For the small break LOCAs, any preemptive actions during an accident would also be contrary to WBN’s current design basis and emergency operating procedures. Additional licensing review is required to support a change to WBN’s design basis and emergency operating procedures. Accordingly, TVA will perform a licensing evaluation to consider preemptive actions that delay or reduce ECCS and CSS flow during a LOCA. A licensing evaluation will be completed by December 15, 2003.

3. **Ensuring that alternative water sources are available to refill the RWST or to otherwise provide inventory to inject into the reactor core and spray into the containment atmosphere**

Guidance currently exists in emergency operating procedure, ECA-1.1 to initiate Refueling Water Storage Tank (RWST) refill once it has been determined that loss of safety injection recirculation capability exists. This procedure initiates makeup to the RWST using the chemical volume control system (CVCS) blender. This action may also be initiated if recommended by the TSC staff. If the RWST is empty and ECCS pumps must be stopped due to loss of suction, ECA-1.1 provides direction to initiate RCS makeup via an alternate source (normal charging with CCP suction aligned to the volume control tank).

TVA also notes that sump blockage for large breaks is more likely than for small breaks due to the larger amount of debris generated and the shorter times for initiation of recirculation from the sump. However large breaks result in large amounts of ice melt very early in the event. The ice melt water plus the water in the RWST floods both the lower compartment and the reactor cavity up to the hot and cold leg nozzles on the reactor vessel. This water level provides for sufficient external-vessel cooling that, if sump recirculation is lost for any reason, evaluations associated with risk assessments show that the core will remain within the reactor vessel even if core damage occurs. Thus, TVA concludes additional actions are not warranted at this time.

4. **More aggressive containment cleaning and increased foreign material control**

WBN has a formal program for inspecting and cleaning areas inside containment. WBN considers the current program to include the actions that the NRC expected in response to the bulletin. The WBN program elements are discussed below.

- TI-12.07, "*Containment Access*" and SPP-10.7, "*Housekeeping/Temporary Equipment Control*," - This technical instruction provides guidelines and criteria for entering and exiting containment. It also includes acceptance criteria for housekeeping/cleanliness to ensure no loose debris is left in containment and for storage of materials inside containment during MODE 4 and higher.

  During refueling outages, it is a plant management expectation that the lower containment coordinator complete a walk down of the work areas inside containment at least once per shift. During this walk down if any housekeeping issues are identified, someone is assigned an action to resolve the issue. This approach ensures that, at the end of an outage, uncontrolled material does not exist throughout containment. Each foreman assigned to work inside containment is held accountable for the work area. The work orders have a sign off stating that the work area has been cleaned. During the outage, major work groups have laborers assigned to them to ensure proper support is provided to perform several tasks. One major priority for these laborers is performing routine housekeeping. Cleaning may include dry or wet mopping, vacuuming, or dusting. The cleaning method performed depends on the debris and particles accumulated from that job. Cleaning is a consideration for job completion. After the major work is complete, associated equipment is removed from containment.

At the end of the outage before Mode 4 entry, teams are assembled with members from Radiological Control (RADCON) and Operations to perform a final inspection. The daily inspections and the final inspection look for loose debris, rags, clothing, flaked paint, trash, tools, wood, tape, etc. In addition, the walk down assures the floors are clear of litter, dirt, oil, and water and floor drains and exhaust vents are free of obstruction.

Any items left inside containment after containment closure must have an engineering evaluation and approval completed prior to containment closure. These items must be logged and secured into place.

TI-12.07 is the principal tool used to verify containment cleanliness. Although the procedure was not specifically written to the guidance in NEI 02-01, *Condition Assessment Guidelines: Debris Sources Inside PWR Containments,* the procedure is consistent with those guidelines for recognizing potential debris that could be transported to the containment sump following a LOCA.

- MAI-5.3, *Protective Coatings* and G-55, *Technical and Programmatic Requirements for the Protective Coating Program for TVA Nuclear Plants* - G-55 provides the programmatic requirements for planned preventive maintenance (PM) and performance of coatings inspections each outage. PM 1-COAT-271-0076, File 1, *Protective Coatings (Level 1) *1** is performed by qualified personnel each refueling outage to implement the G-55 requirement. The inspections include general containment spaces and the sump "Zone of Influence" which lies in lower containment Quadrants 3 and 4, inside the crane wall. Outside of this area, failed coatings or other non-neutrally buoyant debris would not migrate and clog the containment sump intake screens. MAI-5.3 provides requirements for maintenance of the unqualified protective coating inventory. Coating degradation identified during outage inspections in areas where failed coatings have potential to adversely impact operability of the containment sump are either repaired during that outage or placed in a stabilized condition for repair during a future outage.

- TI-61.003, "*Ice Condenser Loose Debris Log*," – This procedure records, tracks, and evaluates debris that is found in the ice condenser system to ensure that this debris cannot adversely impact sump operation.

Experience from inspections described above during prior outages, supports the conclusion that the WBN containment is very thoroughly cleaned and free of debris and dust that could adversely affect the sump prior to entering MODE 4 (or higher).

In addition to the above standard programs to assure containment cleanliness, a containment walkdown will be conducted during the Fall 2003 outage to assess debris sources to support resolution of Generic Safety Issue-191, *Parametric Evaluations for Pressurized Water Reactor Recirculation Sump Performance*, dated August 2001. This is the first accessible time to lower containment to perform such a walkdown.

5. Ensuring containment drainage paths are unblocked

The emergency sump at WBN is located in the lower compartment. There are no walls or openings that could serve as blockage points to prevent water from reaching the sump. The spray system discharges into the upper compartment. The primary path to the sump is through drains that are located in the bottom of the refueling canal. Inspections to assure that the drains are not blocked are controlled by procedure 1-SI-72-3 "*Containment Refueling Canal Drains*." These drains are accessible during plant operation and are visually inspected every 92 days.

There are 20 ice condenser floor drains which drain to the floor in lower containment on the outside of the sump screens. 1-SI-61-9, "*18 Months Ice Condenser Floor Drains Visual Inspection,*" ensures that these floor drains, associated pipe, and valves are free of ice, frost or debris and each valve seat is free of any corrosion, pitting or cracking.

There are two additional drainage paths available to supply water to the area inside the polar crane wall. These two paths are floor drains that are located in Accumulator Rooms 3 and 4. Both of these floor drains are protected by a screened enclosure. These drain paths are required by American Society of Mechanical Engineering (ASME) XI Code to be verified clear and free flowing once per inspection "period," i.e., every other outage. Procedure 1-TRI-40-901, *"Accumulator Rooms 3 and 4 Open Ended Crane Wall Drains ASME Section XI Unimpaired Flow Test,"* implements this ASME Section XI requirement.

In response to the subject bulletin, 1-SI-304-2, *"18 Month ECCS Containment Sump Inspection,"* will be revised before the upcoming Fall outage to require inspection of the drains in the accumulator rooms 3 and 4 for no blockage each refueling outage in conjunction with the sump screen inspection. These drains are generally not accessible due to high radiation during plant operation, therefore the revision to this procedure is not needed before the outage.

6. Ensuring sump screens are free of adverse gaps and breaches

After the activities during the outage which could potentially p1ace water on the containment floor are complete, and before the containment is closed, 1-SI-304-2 is performed to ensure that the containment sump suction pit is free of debris and that the sump components (screens, trash racks, etc.) show no evidence of degradation. This inspection includes checking for corrosion due to boric acid deposits and/or reaction of dissimilar metals from any metallic debris that may have entered the stainless-steel-lined sump through screen openings. During the history of plant operation, no physical damage or corrosion has been identified during these inspections. Limited foreign material has been removed from the sump during these inspections over the history of the plant operation. The foreign material removed included four-inches of water during Refueling Outage 1, a two-inch piece of gasket material during Refueling Outage 2, and one small ball of duct tape, one tie wrap, and dust were removed from sump floor bottom during Refueling Outage 4. No foreign material was identified during the Refueling Outage 3 inspection. These inspections prove the operability of the containment sump and acceptable field condition of the sump hardware (screens, interior condition, etc.) prior to startup from each refueling outage.

**WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
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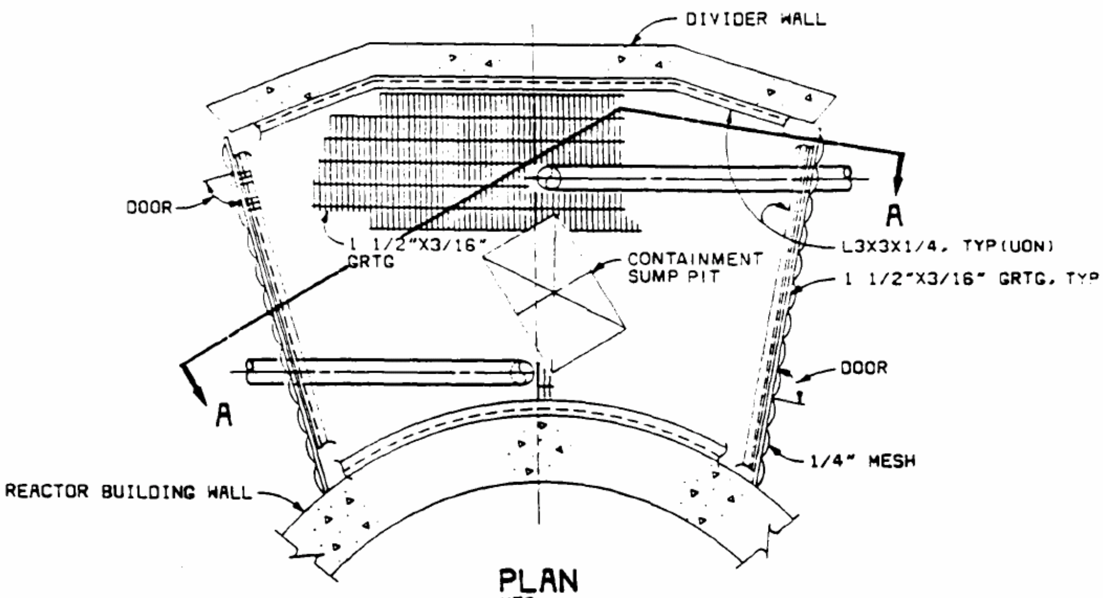
The inspection results described, support the conclusion that the WBN sump is clean, free of debris and is not degraded.

ENCLOSURE 1
ATTACHMENT 1

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
RESPONSE TO BULLETIN 2003-01
POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS



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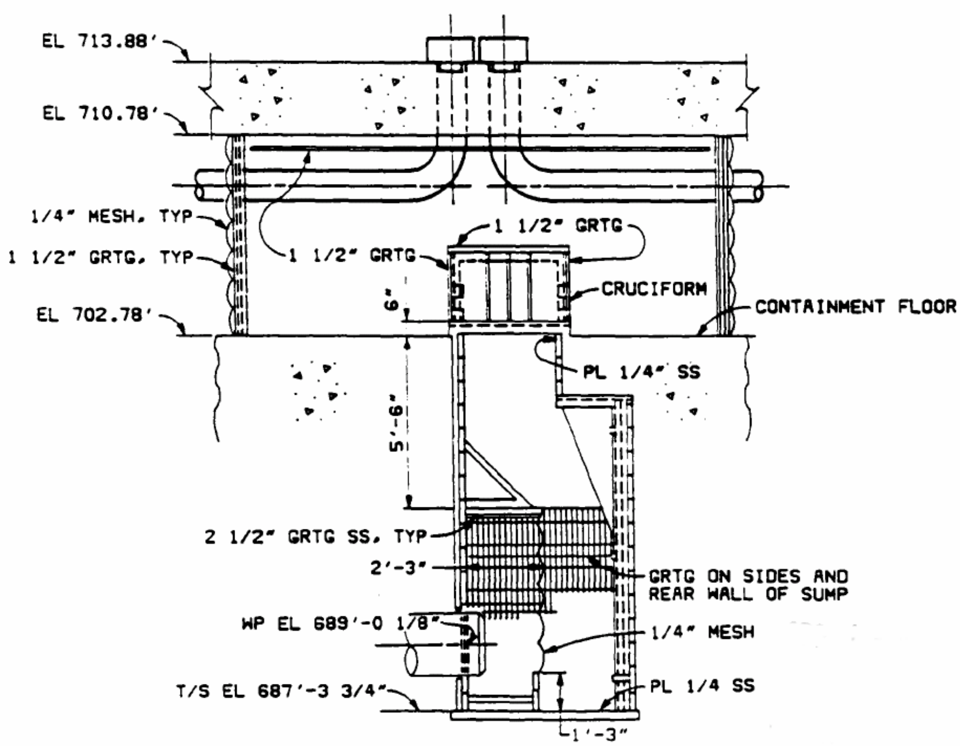

SECTION A-A
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ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
RESPONSE TO BULLETIN 2003-01
POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS
COMMITMENT LIST

1. A containment walk down will be conducted during the Fall 2003 outage to assess debris sources to support resolution of Generic Safety Issue-191, *Parametric Evaluations for Pressurized Water Reactor Recirculation Sump Performance*, dated August 2001.

2. Revise 1-SI-304-2 before the upcoming Fall outage to inspect the drains in accumulator rooms 3 and 4 every refueling outage.

3. Operator Requalification classroom and simulator training which is scheduled to begin on August 11, 2003 includes the following subjects for sump blockage:
   - Mechanism for sump blockage
   - Available indications
   - Actions in response to sump blockage
   - Associated emergency operating procedure revision

   This training will be completed by September 30, 2003.

4. Appropriate training for the TSC technical assessment team will be conducted to familiarize the technical staff with the concern for sump blockage and cover the steps provided in the revised procedures by September 30, 2003.

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5. TVA will perform a licensing evaluation to consider pre-emptive actions that delay or reduce ECCS and CSS flow during LOCA. A licensing evaluation will be completed by December 15, 2003.