TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

August 4, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

In the Matter of the	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

By letter from D. G. Eisenhut to H. G. Parris dated July 21, 1983, we received a request for information regarding inspections of BWR stainless steel piping for the Browns Ferry Nuclear Plant unit 3. That request for information was made pursuant to 10 CFR 50.54(f). Enclosed is our response to that request.

The enclosed response is based on NRC staff concurrence with TVA's ongoing repair program for Browns Ferry unit 1. That repair program was submitted by my letter to J. P. O'Reilly dated July 18, 1983. As you know, if any problems arise regarding the acceptability of our repair program, the enclosed response may be significantly impacted. At the request of your staff, further details on planned weld overlays will be submitted in the immediate future.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Subscribed and sworn to before
me this 4th day of August 1983.

Paulette H. White
Notary Public
My Commission Expires 9-5-84

Enclosure
cc: See page 2

A001
1/1

cc (Enclosure):

U.S. Nuclear Regulatory Commission
Region II
ATTN: James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Mr. R. J. Clark
Browns Ferry Project Manager
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20814

Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

ENCLOSURE

RESPONSE TO D. G. EISENHUT'S LETTER TO H. G. PARRIS
DATED JULY 21, 1983
REQUEST FOR INFORMATION REGARDING
BWR STAINLESS STEEL PIPING INSPECTIONS
BROWNS FERRY NUCLEAR PLANT UNIT 3

Item 1

Justification for continued operation of your facility prior to completing the inspections described by Attachment A in view of the increased evidence of cracking since the issuance of IE Bulletin 83-02.

Response

A. Leak-before-break criteria is still valid.

Based on the fact that stainless steel is a very tough and ductile material, the complete fracture of piping with IGSCC-type cracking when subjected to design, seismic, or accident loads is not possible. Another argument is based on the fact that IGSCC crack growth depends on the asymmetry of the weld sensitization and bending loads. It is an accepted fact that stainless piping can have a complete circumferential crack equal to 63 percent of the wall thickness and still meet the safety margins as required by the original construction codes. Before the crack depth reaches this size, the circumferential variations of welding residual stress and material susceptibility in the heat-affected zone, combined with the asymmetric bending loads, will lead to asymmetric crack growth and the formation of a short throughwall crack with limited leakage.

This hypothesis is verified by extensive field experience. As an added precaution, plant instrumentation which is capable of reliably detecting such limited leakage is utilized during operation.

B. Cracks found to date fall within the crack growth models.

It is a known fact that IGSCC-type cracking takes a long time to initiate to a threshold level that can be detected by ultrasonic examination techniques. Cracks in small-diameter piping (i.e., riser lines) propagate rapidly to throughwall localized leaks once crack initiation occurs. Cracks in large-diameter piping grow fairly rapidly for approximately 20-percent throughwall and then level off. Crack growth beyond 30-percent throughwall in large-diameter piping is very

slow. All cracking observed to date falls within the model described above. TVA rejects the idea that the cracks detected in Browns Ferry unit 1 initiated and grew within the last couple of years. The reason that so much cracking has been detected since IEBs 82-03 and 83-02 inspections began is because the number of welds inspected has been far greater than that required by ASME Section XI and the sensitivity of IEBs 82-03 and 83-02 techniques with regard to detecting IGSCC indications is much greater than conventional ASME Section XI examination techniques. In addition, IGSCC indications of significant depth may have been detected using earlier ASME Section XI techniques, but the amplitude from the indications was such that recording or evaluating further was not required by ASME Section XI. Given the above factors, it is not at all surprising that the amount and extent of detected cracking have increased significantly since IEBs 82-03 and 83-02 examinations have begun.

C. Analysis for structural integrity of all cracks found to date has shown that an adequate margin of safety still existed. The reason for this is that, even with a crack 360 degrees around the pipe, the crack depth could be up to 63-percent throughwall before it would infringe on the required safety margins. Cracks of this magnitude and circumference have not been found and substantiate the position stated in paragraph A.

D. Browns Ferry unit 3 has operated for a shorter period of time than unit 1 or 2; therefore, cracking, if present, should not have progressed to the point of unit 1, which still has structural margin remaining. The piping for all three units was supplied by the same pipe fabricator; therefore, the main variable affecting crack initiation and propagation is time of operation. At the time of shutdown for refueling, unit 3 will still have less operating time than unit 1.

E. Since a short operating time remains before shutdown for refueling, the probability is extremely low that any further crack growth, if cracks are present, will progress to the point where safety margin is below that required by the original construction codes.

F. Browns Ferry units are designed and have been analyzed for large LOCA.

Item 2

Identify any weld inspections which appear to satisfy the sensitivity for detection specified by IE Bulletin 83-02. The information provided should include a list of these inspections, the dates of the inspections, the extent and results of those inspections, and a description of the technique or equipment used. If you have concluded that these previous inspections should influence the scope or schedule of the inspections described in Attacment A, please provide the basis for your conclusion. Further, describe any other unique safety related feature, information or action that would justify not accelerating your current test and inspection schedule in accordance with IE Bulletin 83-02.

Response

No previously inspected welds appear to meet the sensitivity for detection criteria specified in IEBs 83-02 or 82-03.

Item 3

Describe any special surveillance measures in effect or proposed for primary system leakage in addition to the current Technical Specification requirements for your facility.

Response

A technical specification amendment for unit 3 was submitted to NRC on March 25, 1983, which limits a 2-gpm increase in unidentified leakage into the drywell in a 24-hour period. The requirements of this amendment have been administratively in place since July 1, 1983.

The current administrative measures which are in effect at Browns Ferry require drywell floor drain sump monitoring to be performed at an increased interval of once every 8 hours with a requirement to be in cold shutdown condition within 24 hours in the event that leakage increases by more than 2 gpm in a 24-hour period. This is only in effect when the reactor is in run mode and is exempted during the first 24 hours in the run mode following a startup.

Item 4

Direct and indirect costs and impact, including effects on other safety related activities, of conducting the inspections described in Attachment A: (a) at a time which you would commit to conduct the inspections consistent with Chairman Palladino's suggestion to the staff and licensees that a realistic schedule for the inspections be developed 'with the idea of accelerating the inspection as much as possible,' and (b) at the time of your next scheduled refueling outage.

Response

The earliest date for conducting the IEB inspection on Browns Ferry unit 3 is November 11, 1983, which is based upon TVA's analysis of the best available time period that does not impact our major safety-related activities and allows for proper preparation of work by available manpower. Our major concern in our analysis is completing Browns Ferry unit 1 inspections and weld repairs while completing the refueling activities and placing unit 1 back online with our present accelerated schedule. This schedule will make available the necessary manpower to be utilized for pre-shutdown planning of unit 3 outage work including preparation of IGSCC inspections.

This November 11, 1983 shutdown date coincides with our present unit 3 cycle 5 scheduled outage and agrees with our justification of continued operation as identified in item 1. As shown in attachment 1, the direct costs for this inspection are expected to be approximately $820,000 and indirect costs are commensurate with a scheduled refuel outage.

Item 5

The direct and indirect costs and impact, including effects on other safety related activities, of suspending operation to initiate the inspection described in Attachment A within each of three possible times: (a) 30 days, (b) 60 days, and (c) 90 days from August 15, 1983.

Response

The direct and indirect costs associated with the three possible shutdown times are provided in attachment 1, and the impacts to safety-related activities are shown in attachment 2.

Item 6

A discussion of the availability of qualified inspection personnel to perform the inspection described in Attachment A at your facility for the various options in items 4 and 5, above, and the steps you have taken to obtain the services of such personnel.

Response

Availability of qualified inspection personnel for:

A. Shutdown by September 15, 1983

On September 15, 1983, TVA NDE personnel will be utilized as follows:

1. Sequoyah unit 2 in-service inspection

   2 supervisors
   2 engineers
   18 technicians

2. Browns Ferry unit 1 overlay repair inspections

   1 supervisor
   3 engineers
   3 technicians

3. Watts Bar unit 1 preservice inspection

   1 supervisor
   1 engineer
   4 technicians

These figures are for TVA personnel and do not include contractor personnel. This encompasses 95 percent of TVA's NDE work force; consequently, TVA would not be able to perform additional inspection work or support a contractor to perform IEB 83-02 examinations on unit 3 at this time. Due to already accumulated radiation exposure, personnel at Watts Bar are not available to work at an operating plant.

B. Shutdown by October 15, 1983

Overlay repairs and inspections on Browns Ferry unit 1 and the in-service inspection on Sequoyah unit 2 are scheduled to be complete by October 15, 1983. If no additional inspections or overlay repairs are required on Browns Ferry unit 1, these qualified inspection personnel would be available to begin the IEB 83-02 inspections on Browns Ferry unit 3. However, as discussed in our response to item 4 above, this work cannot be fully supported without significant impact until the cycle 5 outage which is scheduled to begin on November 11, 1983.

C. Shutdown by November 15, 1983

By November 15, 1983, adequate qualified inspection personnel would be available to perform the IEB 83-02 inspections on Browns Ferry unit 3.

Attachment 1

MONETARY EFFECTS OF SHUTDOWN
OF BROWNS FERRY NUCLEAR PLANT UNIT 3
FOR IGSCC INSPECTIONS

	Shutdown Date of Sept. 15, 1983		Shutdown Date of Oct. 15, 1983		Shutdown Date of Nov. 11, 1983	
Cost in Millions	Inspection Only	Outage	Inspection Only	Outage	Inspection Only	Outage
Direct	$ 1.58	$ 1.58	$ 1.58	$ 1.31	$1.09	$ .82
Indirect	16.51	16.51	7.76	7.76	None	None
Total	$18.09	$18.09	$ 9.34	$ 9.07	$1.09	$ .82

Comments:

1. Direct costs are those costs of actually performing the inspection such as manpower, contract, etc.

   Indirect costs are those costs associated with an early shutdown of the unit such as fuel penalty costs and replacement power costs.

2. For a shutdown date of September 15, the total costs for only conducting IGSCC inspections versus starting the outage at same time are the same. This is because with overlapping outages (BFN unit 1, BFN unit 3, and SQN unit 2) the impact on manpower will involve contracting and hiring additional support manpower.

3. For a shutdown date of October 15, the cost that would be realized is less compared to the September 15 costs because the unit 1 outage will be near completion and involve fewer replacement power days.

4. A shutdown of November 11 is within the present scheduled outage window; therefore, no impact on indirect costs but an impact on direct costs will be realized from unit 3 manpower needed for refueling outage.

Attachment 2

IMPACT TO SAFETY-RELATED ACTIVITIES CAUSED BY RECIRCULATION PIPING INSPECTIONS BROWNS FERRY NUCLEAR PLANT UNIT 3

September 15, 1983 Shutdown

1. Timeframe not adequte for preoutage planning.

2. Coordination of personnel during refuel floor activities of two units would be difficult.

3. Increased manpower levels could degrade plant and personnel safety due to high level of activity in controlled areas.

4. A shortage of engineers and QA personnel would not ensure proper engineering coverage, problem resolution, and workplan completion.

5. Reduce our nuclear capacity to 40 percent (SQN unit 1 and BFN unit 2 operating).

6. Probability of meeting September peak demand is 86 percent.

7. September is the end of the fourth quarter for radiation exposure. Additional exposure could require TVA to hire and train new personnel.

October 15, 1983 Shutdown

1. Timeframe not adequate for preoutage planning.

2. Coordination of personnel during refuel floor activities of two units would be difficult.

3. A shortage of engineers and QA personnel would not ensure proper engineering coverage, problem resolution, and workplan completion.

4. Reduce our nuclear capacity to 60 percent (SQN unit 1, SQN unit 2, BFN unit 2 operating).

November 11, 1983 Shutdown

1. Reduce our nuclear capacity to 80 percent (SQN unit 1, SQN unit 2, BFN unit 1, and BFN unit 2 operating).