TENNESSEE VALLEY AUTHORITY

5N 157B Lookout Place

April 25, 1986

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

Dear Mr. Denton:

Your letter to W. F. Willis dated September 26, 1985 requested copies of investigation reports and related documents dealing with potentially safety-related employee concerns on TVA's nuclear plants. Copies of the requested information as outlined in TVA's October 7, 1985 letter is enclosed and covers the period of April 17, 1986 through April 23, 1986.

The enclosure contains the response to an investigation report submitted by the line organization and not yet reviewed for acceptability for concern IN-85-442-X13.

The Employee Concern Summaries for active concerns identified through the new Employee Concern Program are available at each of the sites for your review and inspection.

Please call R. F. Campbell at FTS 858-4892, if you have any questions concerning this matter.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R Gridley

R. Gridley, Director
Nuclear Safety and Licensing

Enclosures

cc (Enclosures):
Mr. James M. Taylor, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. J. Nelson Grace, Regional Administrator
U.S. Nuclear Regulatory Commission, Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. Braj K. Singh, Project Manager
Office of Nuclear Reactor Regulation
Phillips Building (MS-R-128)
U.S. Nuclear Regulatory Commission
Bethesda, Maryland 20555

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ENCLOSURE

RESPONSES TO INVESTIGATION REPORTS SUBMITTED BY LINE ORGANIZATIONS AND NOT YET REVIEWED FOR ACCEPTABILITY

RESPONSE TO CONCERN NUMBERS:

IN-85-442-X13

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : W. T. Cottle, Site Director, Watts Bar Nuclear Plant ONP

FROM : W. R. Brown, Project Manager, Watts Bar Nuclear Plant, 9-169 SB-K

DATE : March 13, 1986

SUBJECT: WATTS BAR NUCLEAR PLANT - NUCLEAR SAFETY REVIEW STAFF INVESTIGATION REPORT IN-85-442-X13 - SEISMIC TRENCHES - RELATED EMPLOYEE CONCERNS IN-85-066-001, IN-85-472-007, IN-85-496-001, AND WI-85-040-004

Reference: Your memorandum to me dated February 19, 1986, same subject

Attached is the combined Office of Construction and Office of Engineering response to the subject investigation report. I have reviewed its content and am in full concurrence.

Please contact L. J. Johnson, extension 3510, for any further information pertinent to this issue.

FOR W. R. Brown

WATTS BAR NUCLEAR PLANT SITE DIRECTOR'S OFFICE

MAR 17 '86

	Note	Action	Reply
Pat Mor			
Mod Mgr			
SR Mgr			
QS Mgr			
QA			
Personnel			
Finance			
Compliance			
Int Ofcr			
[illegible]			

WRB:BB

Attachment

cc (Attachment):
W. L. Byrd, WBN ONP
E. R. Ennis, WBN ONP
J. C. Standifer, P-104 SB-K
G. Wadewitz, PMO WBN OC

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : W. R. Brown, Project Manager, Watts Bar Nuclear Plant, 9-169 SB-K

FROM : J. C. Standifer, Project Manager, Watts Bar Engineering Project, P-104 SB-K
G. Wadewitz, Project Manager, Watts Bar Nuclear Plant Project, OC WBN

DATE : MAR 13 1986

SUBJECT: NUCLEAR SAFETY REVIEW STAFF INVESTIGATION REPORT IN-85-442-X13 - SEISMIC TRENCHES

Reference: Your memorandum to us dated February 13, 1986 (F01 860213 601)

The QTC report about the design and construction of the Trench B portion of the Underground Barrier has been reviewed.

We do not feel there have been any "breakdowns" in the design and construction of the Underground Barrier, thus no "root-causes" are identified and corrected. The Underground Barrier is a feature unique to WBN. It is not generic to any other TVA nuclear plant.

We feel the attached response to the reviewer's conclusions and observations is adequate, and we will be glad to discuss it with you.

J. C. Standifer

G. Wadewitz

HRT:BSH
Attachment
cc (Attachment)
R. C. Barnett, W9 D224 C-K (2)
C. Bonine, 12-108 SB-K
R. G. Domer, W12 A5 C-K
W. C. Drotleff, W12 A12 C-K
J. A. Kirkebo, W12 A8 C-K
J. F. Weinhold, W12 B34 C-K

This was prepared principally by H. R. Threlkeld, extension 4774.

EMPLOYEE CONCERN IN-85-442-X13

Concern: West Side ("B" Site) underground dam by Intake was not done per specification because of schedule, winter season, and rainy weather. Instead of using compactible clay, TVA used 1075 (T-1 Spec) which is 0.75"-1.5" material used mainly in trench drains as filler material. It is easy to install in bad weather, and it makes up 20± feet at the south end, and is not compacted. Also, the "B" Trench (Dam) does not contact the intake structure but: Knoxville said "if the NRC does not say anything then we will just keep quiet" and QC was told not to write an NCR. Around the trench edge and gap between trench and intake water seems to well up when the pond is at its normal level. This is a problem because the reason for building the underground dams was to keep sand under and around intake from "liquefying" during an earthquake.

Related Employee Concerns:

IN-85-066-001 (Concern not substantiated)

IN-85-472-007

IN-85-496-001

WI-85-040-004

Response: The five concerns relate to the underground barrier built on the east and west sides of the intake pump station (IPS). The concerns are directed toward the west portion of the underground barrier which is known as Trench B. The QTC reviewer, in his report, divided the concerns into three

areas. These areas of concern are (1) use and control of the placement of 1075 crushed stone, (2) a "gap" exists between the IPS and the Trench B backfill where all the sand was not excavated, and (3) a seepage area exists between the IPS and Trench B.

We do not concur with the reviewer's conclusions that the employee's concerns "render the quality of Trench B and related soil structures unacceptable." The reviewer's conclusions summarize the report's findings. Therefore, we will not repeat the reviewer's finding, but just address the conclusions. Attachment 1 contains responses to the various points of the reviewer's conclusions. The reviewer also has some observations which he indicates are "either contrary to QA program requirements for nuclear plants or inconsistant with good practice." Responses to these observations are included in attachment 2.

This was prepared principally by H. Ray Threlkeld, extension 4774.

Attachment 1

Discussion of Reviewer's Conclusions

Conclusion B.1

The 1075 material was used as backfill in Trench B to depths of up to 17 feet at the south end, and to depths of 8 feet at the CCW Blowdown lines and on top of Type A1 earthfill. The use of this material as backfill is not adequately described in the design drawings and described in the WBN FSAR. The 1075 material is not prescribed in the Construction Specifications, or described in the WBN FSAR, as a material suitable for use as compacted backfill or as a substitute for Class A backfill. To some extent, the 1075 material was installed on the basis of "verbal (oral) instructions" and "inspectors judgement," which were not prescribed design requirements and were not subsequently documented. The use of this material does not demonstrate appropriate implementation of measures established for selection and review of suitability of application of materials essential to the function of the structure.

Response:

The use of 1075 crushed stone (equivalent to ASTM D448, size 56) was prescribed in the design documents, construction drawings, and in the design report on the "as-built" conditions submitted to the NRC and not based on "verbal" instructions.

The criteria used in selecting 1075 crushed stone is based on TVA's and the geotechnical engineering profession's experience. Available test data in textbooks and TVA laboratory test data on granular material indicates that shear strength increases for granular material as the size of the stone particles and/or the percentage of larger size particles increase. The procedural specification on drawing 10N213-2 for placement was developed from TVA's favorable experience with the specified compaction equipment with regard to the equipment's ability to provide the desired compaction with the specified number of passes without causing degradation of the crushed stone particles. This experience is based on existing shear strength and test fill data on 1032 crushed stone (similar to ASTM D2940) and other similar stone used at various TVA nuclear and hydro facilities. A stone similar to 1075 crushed stone was used in the structural fill for the safety related spray ponds at Hartsville Nuclear Plant. Since 1032 crushed stone has a fine gradation, its use to establish the compaction criteria for the 1075 crushed stone is conservative.

The drawing issued for construction (10N213-2) has the materials and placement requirements and two notes that apply to the use of 1075 crushed stone. Earthfill note 1 specifies the acceptance criteria for 1075 crushed stone and the placement requirements. Earthfill note 4c specifies that 1075 crushed stone shall be used. Section 2.5.4.5.2 of the WBN FSAR describes the 1075 material and states placement will be controlled by a procedural specification. The FSAR will be revised to identify the use of 1075 crushed stone as structural fill.

Conclusion B.2

The 1075 material, in lieu of compactable Class A or A1 earthfill or 1032 granular backfill, was used to facilitate construction, i.e., schedule was given priority over quality.

Response:

Schedule was given priority over cost, and in the process the quality of the underground barrier was improved by the use of the 1075 crushed stone. The 1075 crushed stone has a higher shear strength than earthfill A1. The use of 1075 crushed stone (1) facilitated construction by allowing backfilling of the barrier trench to proceed during the winter period and (2) provided the stability needed for unexpected field conditions. During excavation it was found that the south end of trench B was deeper than expected. Stability analysis performed while the excavation was open and prior to backfilling required a material with a higher shear strength than earthfill A1. The use of 1075 crushed stone met this higher shear strength requirement. Even if the schedule had not been an issue, some alternative to earthfill A1 would have been required.

Conclusion B.3

The 1075 material was not subjected to in-place testing to maintain and verify control or compaction. In-place density, moisture, and relative density tests

were not conducted and documented, contrary to construction control, provisions for granular backfill as prescribed in WBN-QCP-2.06 and described in the WBN FSAR.

Response:

A procedural compaction specification defines a particular type of compaction equipment, specified layer thickness, and number of passes of the compaction equipment. These requirements are specified on the drawing issued for construction and takes precedence over QCP's and TVA G specifications. Procedural specifications are customarily used to control compaction of coarse granular materials, such as 1075 stone, since in-place density tests produce erratic and unreliable results on such materials. The use of a procedural specification is described in the FSAR for 1075 material, Section 2.5.4.5.2.1. Gradation test data records on the 1075 crushed stone are kept on file at the plant site, and the stone was obtained from a qualified quarry.

Conclusion C.1

The design drawing provision to "assure adequate cutoff of potentially liquefiable sands" was not adequately prescribed or implemented. The "gap" includes an undetermined quantity of questionable "sands" which were not removed in an unsuccessful attempt to tie-in the Trench B and IPS backfills.

Response:

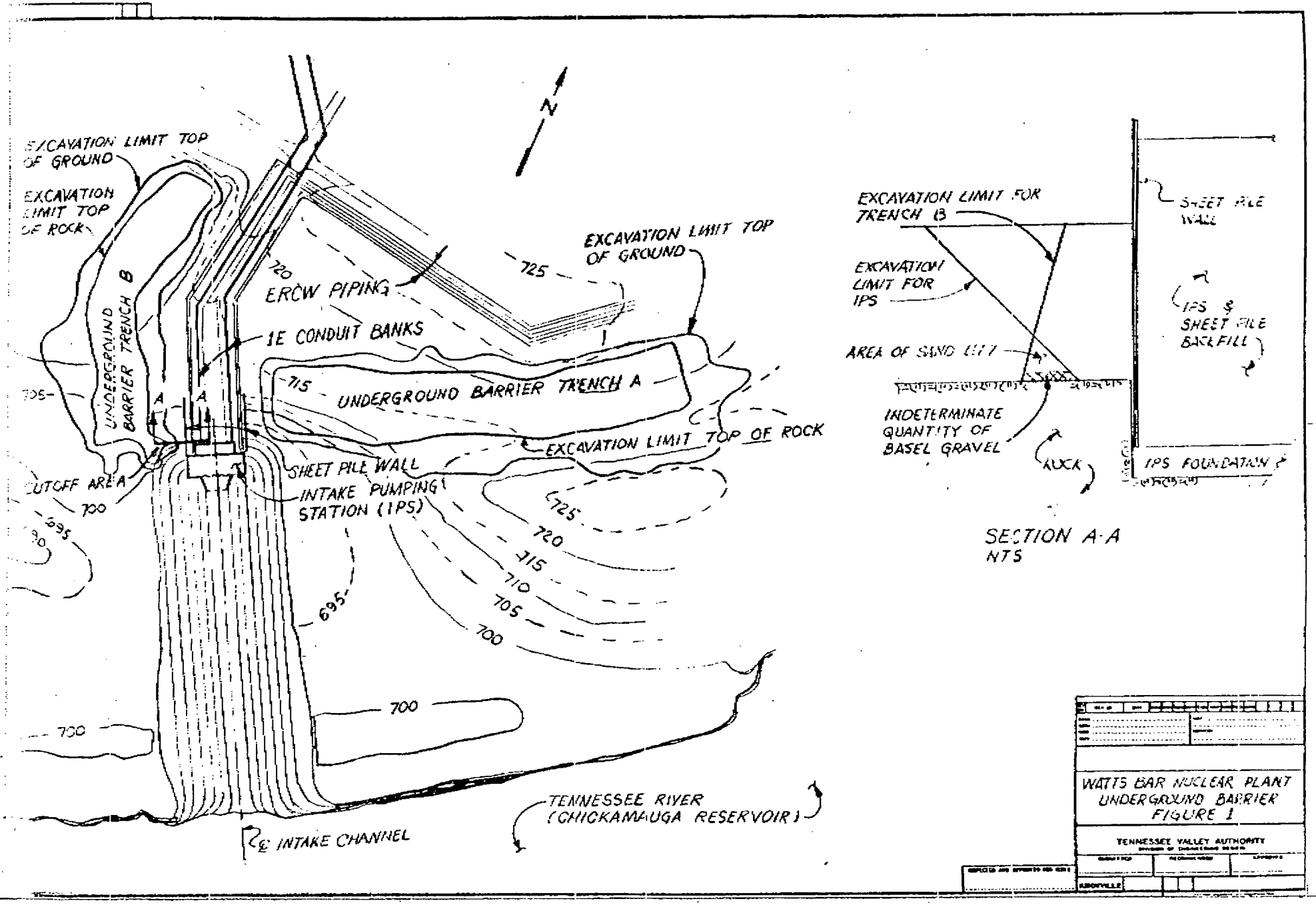
The drawing (10N213-1 and -2) issued for construction required an adequate cutoff. Based on a visual field inspection performed when the barrier trench was being excavated and other site conditions, the cutoff is adequate. The visual field inspection was done by the OE engineer responsible for the design of the underground barrier.

It is correct that for the Trench B underground barrier, some fine sands were intentionally left between the barrier trench excavation and the former IPS excavation. In lieu of making a total cutoff and possibly undermining the Category I sheet pile wall behind the IPS, the barrier trench excavation (cutoff) was extended to the extent evaluated to be adequate. This adequacy was based on (a) the geometrical relationship of the Trench B excavation and backfill with the IPS and intake channel excavation and backfill, and (b) on the fact that any loss of material from behind the underground barrier due to liquefaction must be preceded by movement of a massive amount of material on the flood plain into the river.

The geometrical relationship of the excavation and backfill limits of Trench B, the IPS, and the intake channel are such that only a small zone of sand was left in place. The excavation limits for these three features overlap except near the top of rock where the sand zone exists. Figure 1 shows the relationship of Trench B, IPS, and the Intake Channel. Section A-A on figure 1 shows the overlap of the excavation limits of Trench B and IPS. Also

Section A-A shows the small zone of in situ material left in place. The zone is estimated (based on construction photographs and visual observation of the trench excavation) to be approximately 3- to 4-feet high and 5- to 6-feet wide at the base or top of rock. This zone is probably from 100 to 125 feet in length in the area of concern. This zone also contains an indeterminate amount of nonliquefiable basal gravel. The basal gravel is the material layer just above rock at the plant and varies in thickness from 1± foot to 8± feet. This material was not removed during the over excavation of the intake channel. In fact, the basal gravel provides the foundation for the earthfill that was placed to construct the intake channel slopes.

The other site condition, that affected the engineer's evaluation that the cutoff was adequate, is that a massive volume of material would have to be moved off the flood plain and into the river to create a void where the potentially liquefiable sands behind the barrier could move.



Conclusion C.2

The above described condition was not documented as a nonconforming condition, i.e., no NCR was issued, and the condition has not been identified to the US NRC for consideration of significance as a condition adverse to quality.

Response:

A nonconformance report (NCR) was not issued since the construction was in accordance with the drawings, specifications, and verbal instructions.

Conclusion C.3

The use of 1075 material for backfill for the partial excavation (from Trench B to within 15 to 20 feet of the IPS Sheet Pile Wall) is subject to the same anomalies identified in Conclusions B above.

Response:

The responses to this conclusion are the same as to the three parts of Conclusion B given above.

Conclusion D

For the Concern aspect regarding the seepage/percolation of underground water at the surface of the slope between Trench B and the IPS Sheet Pile Wall, it is concluded that:

1. The slope presently exhibits the condition of erosion from previous flow of water from underground to the surface. This condition has not been documented and reported as a deviation nonconformance or condition needing corrective action.

2. The source and/or cause of the water flow from underground has not been identified and documented. No corrective action has been taken to preclude recurrence of the flowing, perculating or seeping underground water.

3. The potential for adverse affects of the flow of water on the stability of the slopes and subsurface materials has not been evaluated and documented.

Response:

The flow of water from the seepage area has stopped since the CCW blowdown line was repaired. The erosion area will be repaired when weather acceptable for earthfill placement is available. The affects of the past flow of water

on the stability of the slopes are neglible. The stability of the slope has not been impared by the water flow. The flow has eroded some material (topsoil at grade) which will be replaced as part of the repair solution.

Conclusion E

The Concern, all three aspects, and this Report identify potentially significant conditions adverse to quality. These conditions, including evaluation of significance, determination of cause and affect, and remedial and preventative corrective action, have not been identified, documented, reported to appropriate levels of management, and addressed in a manner consistent with quality assurance program requirements for nuclear power plants.

The satisfactory performance of the Seismic Category I (safety-related) Essential Raw Cooling Water (ERCW) systems, specifically the underground piping and conduits subject to adverse affects of potential liquefaction or supporting soils, is dependent on the satisfactory performance of the Underground Barriers (Trenches A and B) and stability of the associated slopes and subsurface materials.

The conditions identified in this report reflect nonconformance or deficiency in characteristic, documentation and procedure, which renders the quality of the Trench B and related soils structures unacceptable or indeterminate. This deficiency in design and/or construction, if left uncorrected, could adversely

affect the safety of operations of WBN, and represents a significant breakdown in a portion of the quality assurance program under 10CFR50, Appendix B.

Response:

We do not agree with the position taken in conclusions B, C, and D as noted by our responses. We feel that the design decisions taken with regard to the use of 1075 crushed stone, accepting the cutoff between the IPS and Trench B as adequate, and handling of the seepage area as reasonable and reflect sound engineering. Thus, we do not feel that the conditions identify potential significant conditions adverse to quality.

The FSAR is being revised to clarify the use and placement of the 1075 crushed stone.

Attachment 2

Discussion of Reviewer's Observations

Observation A.1

The WBN Final Safety Analysis Report (FSAR) does not accurately describe the "as-built" condition of construction of the Category I Underground Barriers (Trenches A and B) for Potential Soil Liquefaction and the Class"A" backfill around the Category I intake Pumping Station (IPS) and associated Sheet Pile Wall.

FSAR Figures 2.5-225 and 2.5-226a show "limits of class 'A' backfill" around the IPS and Sheet Pile wall. However, these "limits" are not shown on design drawings issued for construction, and are not representative of the actual boundaries of installation of compacted backfill around the Category I structures.

FSAR Sections 2.5.4 and 2.5.5, as applicable, describe features of the Underground Barriers for Potential Soil Liquefaction. However, the FSAR does not identify the extent of use of granular material (such as 1075 and 1032 crushed stone) for backfill, does not identify the use of 1075 granular material in lieu of Class A or A1 backfill, and does not clearly identify 1075 material as being subject to or exempt from the construction controls described in FSAR Section 2.5.4.5.1.4.

Response:

The FSAR will be revised to include the "as-built" information and to clarify other statements in the FSAR.

FSAR Figures 2.5-225 and 2.5-226a are drawings showing the excavation and backfill for Category I features at the plant. The drawings will be revised to show the actual excavation limits for the IPS and sheet pile wall.

Observation A.2

General Construction Specifications G-9 and T-1 do not specify and include appropriate quality standards and design requirements for installation, inspection, and testing of all materials used for Category I backfill at WBN.

General Construction Specification G-9 is referenced in WBN project documents, such as drawings, procedures and instruction, for installation, inspection and testing of granular fill materials. However, Specification G-9 does not specify or include provisions for such mateials. The Specification addresses rolled earthfill and other materials, principally for dam construction, and does not clearly indicate the applicability for power plant earthwork.

General Construction Specification T-1 is also referenced in WBN project documents for granular materials, such as Section 1032 and Section 1075. However, Specification T-1 provides material specifications only, and does not

specify or include standards or requirements for the installation, inspection and testing of these materials for use as power plant backfill.

No project construction specifications were found to have been issued to specify and include appropriate quality standards and design requirements for granular backfill installation, inspection and testing at WBN.

Response:

General Construction Specifications G-9 and T-1 provide general instruction about earthfill or granular fill placement and control. Site specific requirements (dependent on the type of feature, design requirements, equipment available, etc.) are established by the engineer and placed on drawings or in specific construction specifications. For the WBN underground barrier these requirements were on drawing 10N213-1 and -2.

Observation A.3

Design Drawing 10N213-1 and 10N213-2, issued for construction of "Underground Barriers for Potential Soil Liquefaction," permit changes or deviations from design requirements and quality standards without identification, documentation, and control of such changes or deviations.

Drawing 10N213-1, "Note A1," and Drawing 10N213-2, "Earthfill Notes" 4(a) and 4(c) (3), permit the use of "verbal (oral) instructions" for activities within

the scope of quality assurance. Personnel stated that such instructions were issued and implemented, and were not documented or otherwise identifiable or controlled.

Response:

Verbal instructions were permitted by the drawings. Prior to excavation a complete site investigation of subsurface conditions was not made. Construction excavation and backfill operation on this unique type of feature do not lend themselves to established acceptance criteria, engineering evaluation at the site was the most expedient method of getting the job done. The OE engineer, responsible for the feature design, made frequent site inspections to observe progress and to evaluate conditions as they became visible. These types of engineering evaluation of in situ conditions do not lend themselves to predetermined notes on drawings or in construction specifications. Because of the nature of these verbal instructions, and the additional information about site conditions, the stability analyses were frequently recalculated to confirm the stability of the underground barrier. At the completion of construction an analysis of the "as-built" conditions was made. This "as-built" analysis took into account the conditions that resulted from verbal instructions and unexpected site conditions. The results of the analysis, taking into account these factors, showed the underground barrier was adequate for its intended function. For the results of this analysis, refer to the analysis report (TVA letter to the NRC dated January 16, 1985 (L44 850116 809)). The FSAR is also being revised to include the "as-built" analysis.

Observation A.4

The concrete gutter, located southwest of the Intake Pumping Station sheet pile wall, is not serving its intended function. The soil on the southwest side of the gutter has been eroded due to spillover of drainage from the discharge pipe at invert elevation 706. Refer to Drawings 10N234 and 10N215.

Response:

The eroded areas will be repaired when acceptable weather for earthfill placement arrives. Seeding after the repair should prevent reoccurrence.

Observation A.5

The upper slopes of the Intake Channel, above the riprap and southwest of Intake Pumping Station and concrete gutter, have significant conditions of erosion. The erosion of soil is progressive and appears to be due to surface water runoff and a lack of adequate slope protection. Refer to Drawing 10N215.

Response:

See response to Observation A.4.