ENCLOSURE
YELLOW CREEK NUCLEAR PLANT - UNIT 1
PLACEMENT OF EARTHFILL IN ERCW SPRAY POND
10CFR50.55(e)
NCR YC-077
CONSTRUCTION QA AUDIT DEFICIENCIES YC-C-80-07
FINAL REPORT

Description of Deficiency

During a QA audit conducted by TVA, seven items were noted which appeared to be in noncompliance with TVA general construction specification G-9. These items concern the placement and inspection of earthfill in the unit 1 ERCW spray pond. They are:

1. Polyethylene and roots left in earthfill.
2. Earthfill was placed with insufficiently compacted material.
3. Earthfill was in and against standing water.
4. Earthfill was placed on previously placed earthfill that had a dry surface and had not been scarified.
5. Foundation surface was not rolled before placing earthfill.
6. No moisture checks were made.
7. No evidence of required steps taken after one-point proctor tests failed to fall within the established family of curves.
8. Penetrometer was not always being used.

Safety Implications

The concerns expressed in the audit were referred to TVA's Division of Engineering Design for evaluation. It has been determined that items 1, 3, 5, 6, 7, and 8 are all within the intent of G-9, and no corrective action is required. Therefore, these conditions create no safety hazard. However, some additional testing will be conducted in some cases to verify TVA's evaluation and disposition (see corrective action).

Items 2 and 4 require that some earthfill be removed and reworked in order to establish the adequacy of construction (see corrective action). Therefore, these items, if uncorrected, could have adversely affected the integrity of the ERCW spray pond and could lead to its failure to perform the intended safety function.

Corrective Action

1. Auditors observed six pieces of polyethylene less than the size of a handkerchief in the fill. Occasionally a piece two inches square was sighted. Approximately six to eight roots were observed. All roots were less than 1/2 inch in diameter and less than one foot long. There were days, or periods of days, where the auditors observed no roots at all. Although the specification states that no unsuitable material shall be allowed to be included in the fill, this was not intended to be an absolute value. It is unrealistic to assume that the fill used in a construction project of this magnitude could be root free. Therefore, it is TVA's judgement that the amount of unsuitable material included in the fill is insignificant and will not

impact the integrity of the spray pond. Therefore, no corrective action is required.

To minimize this concern in the future, two laborers will be assigned to the continuous task of removing all visible unsuitable material during fill placement.

2. All of the insufficiently compacted material was completely removed and the replacement fill was recompacted. The area in question was approximately 15 by 35 feet and six to nine inches thick. An inplace density test will be taken in this area to verify proper compaction. This testing will be completed by July 11, 1980.

3. The portions of G-9 which relate to water and seepage state in part that "there shall be no free water on the foundation when earthfill is placed upon it" and "provisions shall be made to handle rainwater and seepage water so there is no free water on foundation or fill surfaces on or against which fill is to be placed." Within the intent of G-9, "free water" means standing water, ponded water, or flowing water whose magnitude and volume is such that the adequte compaction within all the specification requirements cannot be met. A foundation surface that is damp or slightly wet is not considered "free water" if the water will not affect the proper placement of the overlying fill. TVA has determined that the earthfill in question is adequate, and no corrective action is required.

   To completely justify our position, an inplace density test will be taken in each area. It is expected that our tests will be completed by July 11, 1980.

4. The material placed on the dry surface will be removed to the top of the first lift. The top surface will then be dampened and scarified. This will be followed by spreading replacement fill to achieve a compacted layer of approximately six inches. In addition, after completing compaction, an inplace density test will be taken in this area.

5. The area in question is the in situ chert foundation at the bottom of the spray pond. Approximately 1/3 to 1/2 of the bottom surface was rolled. However, the roller drum was tending to bounce along, breaking some of the chert into smaller pieces. As a result, the rolling was discontinued. Before beginning backfilling, the foundation team required rolling of the bottom surface where it was necessary to scrape off material to achieve the prescribed grade. It was felt that the process of scraping off material above grade would disturb and loosen the top few inches at grade. Therefore, the team required rolling the surface to produce a firm, tight base. Based on the observations of the roller drum, the surface had adequate firmness. Accordingly, the foundation is considered to be adequate and no corrective action is required.

   To further increase our assurances as to the reliability of the

unit 1 spray pond liner, TVA plans to double the number of block samples tested over the present requirements for the bottom of the pond. It is expected that testing will be completed by September 1, 1980.

6. In general, the natural moisture content of the borrow soils is fairly close to the specified moisture content limits for fill compaction. Experience and test results on fill operations for similar soils in the turbine building area have indicated that there is no problem in controlling the field moisture content for achieving specified compaction level. TVA believes that this compaction is adequate and that no corrective action is required.

   For future earthfill operations, moisture content tests will be made daily and as often as dictated by soil changes. For the inplace fill, the number of block samples will be doubled to assure that shear strength of inplace fill meets design requirements. It is expected that the block samples will be completed by September 1, 1980.

7. Earthfill test number SP-1 indicated the 1-point proctor curve fell slightly below the Class VII b curve. The difference between the maximum densities for SP-1 and Class VII b is 3.9 pcf. The field density test indicated that the soil was compacted to 100 percent of the maximum dry density of Class VII b which is conservative; and, therefore, no corrective action is required.

   Earthfill test SP-5 fell between Class III-SM and Class IV-SC. The inspector classified this soil as Class III-SM. Atterberg limit tests indicated this soil had a plasticity index of 9.71 which means that the soil should have been clasified as Class IV SC. Density test indicated 101.2 percent compaction which was 6.2 percent above the specified. The soil classification has been changed to Class IV-SC. No other corrective action is required since the compaction is conservative.

8. The penetrometer test serves as an index test only to assure overall adequacy of fill compaction, and the field inspector will still have to rely upon his judgment. Before the initiation of earthfill operations, test fills were constructed for all borrow soil classes using all types of rollers available at the site. These test fills provided information to achieve the specified density. Additionally, a penetrameter was used when the inspector suspected the adequacy of fill compaction.

   A total of 13 sand-core denity tests have been conducted through June 20, 1980. In all cases, the level of compaction (varying from 95 to 106 percent) was equal to or higher than the specified 95 percent. Therefore, TVA believes that the compaction fill is adequate, and no corrective action is required. In the future, TVA will use penetrometer tests for all fill operations as a supplement to the tests specified in Section II of General Construction Specification G-9.

In addition, quality control inspectors in the QC-materials and civil unit have been retrained in the requirements relating to earthfill placement on the ERCW spray pond.