

# WOLF CREEK

NUCLEAR OPERATING CORPORATION

Bart D. Withers  
President and  
Chief Executive Officer

July 5, 1990  
WM 90-0118

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Station PL-137  
Washington, D. C. 20555

- Reference: 1) Letter dated May 25, 1989 from F. J. Hebdon,  
NRC to B. D. Withers, WCNOG  
2) ET 89-C076, dated September 22, 1989 from  
F. T. Rhodes, WCNOG to NRC  
3) Letter dated March 27, 1990 from D. V. Pickett,  
NRC to B. D. Withers, WCNOG

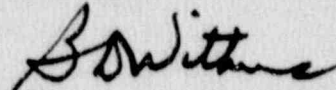
Subject: Docket No. 50-482: Response to Request for  
Additional Information Concerning Seismic Design  
Considerations for Certain Safety-Related Vertical  
Steel Tanks

Gentlemen:

Reference 1 requested information concerning seismic design considerations for the Wolf Creek Generating Station (WCGS) Refueling Water Storage Tank (RWST) which was subsequently provided in Reference 2. Reference 2 provided the results of a reanalysis of the RWST which was performed in accordance with the guidance of Draft Revision 2 of the Standard Review Plan Section 3.7.3. The NRC Staff performed an audit of the reanalysis on February 14, 1990 which resulted in a request for additional information (Reference 3).

The Attachment provides the Wolf Creek Nuclear Operating Corporation (WCNOG) response to the request for additional information. If you have any questions concerning this matter, please contact me or Mr. H. K. Chernoff of my staff.

Very truly yours,



Bart D. Withers  
President and  
Chief Executive Officer

BDW/jra

Attachment

cc: R. D. Martin (NRC), w/a  
D. V. Pickett (NRC), w/a  
M. E. Skow (NRC), w/a  
J. S. Wiebe (NRC), w/a

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**QUESTION 1:**

During the audit, it was discovered that the forces and stresses on the roof angle connecting the cylinder and the roof under the postulated seismic loadings were not available. Hence the adequacy of the angle and the angle welds could not be verified. Provide information (summarize results) related to the adequacy of the connection under the postulated seismic loads.

**RESPONSE:**

Forces on the tank roof angle connecting the cylinder and the roof, under the postulated seismic loadings including the sloshing effects, were calculated. The angle and the connecting welds were evaluated for these loads and were found to be structurally adequate. All stresses remain within the Code allowables under the postulated seismic loads.

**QUESTION 2:**

During the audit, it was discovered that the conclusion of "no tension" in any part of the tank anchor bolts and foundation was based on the use of an AISI formula, which the staff considers inappropriate. Provide information (summarize results) regarding the adequacy of the affected tank areas under the postulated seismic loadings. Specifically, the following items should be included:

- a. Adequacy of the anchor bolts and the bolt lugs (or chairs).
- b. Adequacy of the tank shell in tension and in compression.
- c. Stresses in foundation media and the adequacy of the reinforced concrete section under the sump.
- d. Potential for overturning of the tank and the foundation.
- e. Potential for sliding of the tank and the foundation.

The method of combining the responses of the three components of the postulated earthquakes should be in accordance with the FSAR commitment.

**RESPONSE:**

In order to address items "a" thru "e", the method of combining the responses of the three components of the postulated earthquakes is discussed first.



The RWST seismic design calculation used the "component factor method", which is special case of the square-root-sum-of-squares (SRSS) method, for combining the three components of the postulated earthquakes. A supplemental analysis has been provided in the calculation to compare this method to the SRSS method. This supplemental analysis demonstrates that the techniques utilized provide more conservative results than the SRSS method. Therefore, the method of combining the responses of the three components of the postulated earthquakes is in accordance with the Updated Safety Analysis Report (USAR) commitments.

The following provided information and summarizes results of the evaluation of the affected tank areas under the postulated seismic loadings as specifically noted in items "a" thru "e" above:

a) The analysis for determining the tank anchor bolt tension was based on an AISI formula which yielded "no tension" in the anchor bolt. This conclusion was seemingly in conflict with the foundation slab analysis which showed uplift under the footing. The analysis for determining bolt tension has been revised to use classical methods in order to be consistent with the foundation analysis. The revised analysis results in uplift on the tank anchor bolts. The analysis for transmitting shear and uplift loads from the tank to the foundation has been revised to include the bolt uplift loads calculated by the revised analysis. By utilizing static friction between the tank bottom and the concrete footing, it has been demonstrated that tank sliding will not occur and, therefore, the bolts will not experience any shear loads. The bolts, including all components, have been evaluated for the resulting uplift loads and were found to be structurally adequate.

b) Based on the discussion provided above regarding combining the three components of the postulated earthquakes, the analysis for checking the adequacy of the tank shell, as provided in the calculation, remains valid. It should be noted that the tank shell design is governed by compression, rather than tension, due to a much lower allowable stress in compression. The tank shell was found to be structurally adequate for all loading combinations.

c) Additional analysis has been provided in the calculation for evaluating the tank foundation media, including the reinforced concrete section under the sump, for the loads from the seismic reanalysis. The calculation conservatively evaluated the main foundation slab by assuming that all the load from the sump area was taken by the main slab and the sump section did not contribute any strength to the main slab. The reinforced concrete section under the sump was evaluated for its adequacy to span between the main slab areas. All reinforced concrete sections of the main foundation slab and under the sump were found to be structurally adequate and the stresses remain within the Code allowables.

d) Based on the discussion provided above regarding combining the three components of the postulated earthquakes, the analysis for checking overturning of the tank foundation as provided in the calculation remains valid. The factor of safety against overturning is in accordance with the USAR commitment.

e) Based on the discussion provided above regarding combining the three components of the postulated earthquakes, the analysis for checking sliding of the tank foundation as provided in the calculation remains valid. The factor of safety against sliding is in accordance with the USAR commitment.