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2 March 1979

Dr. A. T. Clark
Field Fuel Reprocessing & Recycle Branch
Division of Fuel Cycle & Material Safety
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Contract NRC-03-78-150, NMSS
Seismic Analysis of High-Level Neutralized Liquid Waste Tanks at the NFS Reprocessing Plant, West Valley, New York

Dear Dr. Clark:

As part of our work assignment with your branch we have been asked to provide review comments concerning the results of the detailed seismic evaluation studies carried out by the Lawrence Livermore Laboratory (LLL) on the high-level neutralized liquid waste tanks at the Western New York State Nuclear Service Center, West Valley, New York. This letter report contains evaluation comments based in part, but not entirely, on the report made available to us, as follows.

> Davito, A. M., R. C. Murray, T. A. Nelson, and D. L. Bernreuter, "Seismic Analysis of High-Level Neutralized Liquid Waste Tanks at the Western New York State Nuclear Service Center, West Valley, New York, Report UCRL-52485, Lawrence Livermore Laboratory, May 1978 (with Appendices).

I had occasion to review some of the plans of the vault and waste tanks, and to observe the facility generally, during a site visit on 20 March 1978 in the company of NRC and LLL staff. I have participated in a number of meetings during 1977 and 1978 with NRC staff and LLL personnel where various aspects of the liquid waste tank analysis were discussed. In the intervening periods I also have had a number of

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telephone conversations with NRC staff and LLL personnel pertaining to clarification and interpretation of points raised by my studies.

It should be appreciated that it is extremely difficult to analyze in detail a complicated, interconnected structure of the type encountered here; at best, analysis of any type, including sophisticated analysis such as those summarized in the noted reference, can provide only an estimate of the resistance. My comments are directed toward attempting to place in perspective the significance of the findings, based on the information contained in the report, as well as based on experience in dealing with the seismic resistance of similarly constructed facilities.

The Nuclear Fuel Services, Inc. (NFS), Nuclear Reprocessing Facility is located at West Valley, New York. The facility has two tanks (600,000 gallon capacity) built to store high-level neutralized liquid wastes. The tanks are located adjacent to the Process Building of the Nuclear Fuel Services Reprocessing Facility. One tank contains about 600,000 gallons of neutralized high-level liquid wastes generated by reprocessing spent nuclear fuel. The other tank is approximately one-third full of water that is slightly contaminated with radioactive material. Each carbon steel tank rests on Perlite concrete blocks that sit on a layer of pea gravel in a carbon steel pan, which in turn rests on a gravel layer. The tank and pan, and the underlying gravel layer on which the pan sits, are enclosed in a buried reinforced concrete vault with 8 ft of soil overburden.

The LLL assessment required three separate major efforts involving (a) the tank analysis, (b) the vault analysis, and (c) special studies to supplement these analyses. These studies are summarized in the noted reference and the cited appendices. The tanks involved were analyzed using finite element techniques with normal loadings (dead load, hydromechanical, thermal and accidental loadings) plus seismic contributions from earthquake excitations up to 0.20 g peak horizontal ground acceleration along with appropriate vertical acceleration. Site specific response spectra were not available for the West Valley site. The LLL group generated site specific spectra and site-specific time histories in order to carry out the vault analyses.

With regard to the tanks, and specifically the tank that is nearly full of high-level liquid waste, the analyses of the LLL group suggest that it can adequately resist an earthquake with 0.20 g zero period peak horizontal ground acceleration. I have examined their analysis approach and believe that it is carried out within the current state-of-the-art for such a complex structure. The tank is an unusual tank in that it is penetrated by six hollow columns (to permit support of the vault roof) and thus contains central support members which serve to strengthen the tank in some respects and to dampen fluid motion arising from seismic excitation. The tank is made of relatively thin (1/2 inch and 5/8 inch thick ASTM A-201 mild steel). Examination of coupons indicates little corrosion has occurred to this time.

There is no reason to believe that the tank would act in other than a ductile manner under seismic excitation, even if it were subjected to excitation which caused it to slide slightly on the Perlite blocks on which it rests. It is conceivable that sliding of the tank could lead to interaction with the vault roof support posts (columns passing through the six tank penetrations with 6 in. clearance all around) but under excitation corresponding to a 0.20 g earthquake it is felt unlikely that this could lead to any major damage if contact occurs. The LLL analyses indicate that the tank will not slide under the postulated seismic hazard. The LLL report calls attention to the fact that stress corrosion could be a problem in the future. However, on the basis of the information available, there is no reason to believe at the moment that stress corrosion has impaired the integrity of the tank. This factor should be taken into consideration over the long term if the tank and its contents are expected to remain in service for an extended period of time.

With regard to the reinforced concrete vault structure, it is known that it was cracked during an unplanned floating (bouyancy) incident during construction of the vault. The extent of cracking is not known; the fact that there is external positive water pressure on the vault and only limited influx of water into the vault suggests that this cracking is moderate at best. The finite element analysis made by the LLL group suggests that the bottom of the vault wall and the vault floor would be subjected to additional cracking in the range of 0.13 to 0.16 g, or greater, ground acceleration.

Review of the conservative nature of the loadings employed in the analysis of the vault, and the moderately low thresholds of cracking stress and interaction effects assumed, suggests to me that even at 0.20 g the extent of additional cracking in the concrete vault would be expected to be moderate. In other words, it is my opinion that the vault can withstand an earthquake characterized by 0.20 g zero period peak horizontal ground acceleration, with the possibility of some additional moderate cracking but the vault would of course be expected to be able to leak if there were no positive pressure on the outside.

With regard to the possibility of chunks of concrete falling from the vault roof onto the tank, I have examined carefully the reinforcing pattern in the roof of the vault as reported in the Appendices and it is my belief that the size of these pieces, if they were to become dislodged, would cause little problem. It is extremely unlikely in my opinion that these would puncture or penetrate the roof of the steel tank in view of the limited distance separating the vault roof and the tank roof, and in view of the tank roof thickness and the strength and ductility properties of the roof material.

Respectfully submitted,

W. J. Hall

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