400 Chestnut Street Tower II

August 11, 1980

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Schwencer:

In the Matter of the Application of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

References: 1. R&D Associates letter, H. W. Hubbard to V. Gilinsky dated July 25, 1980

2. R&D Associates letter, H. W. Hubbard to V. Gilinsky dated August 4, 1980

In response to R. L. Tedesco's letter to H. G. Parris dated July 29, 1980, TVA provided comments on the R&D Associates Report, Reference 1, in my letter to you dated August 5, 1980. Enclosure 1 responds to the request in Mr. Tedesco's letter for information on TVA's review of the R&D Associates Report, Reference 2. Enclosure 2 responds to a request by NRC during the meeting on July 29, 1980, for TVA to calculate the result of a 600 kg burn of hydrogen uniformly distributed in the Sequoyah Nuclear Plant containment.

If you have any questions, please get in touch with D. L. Lambert at FTS 857-2581.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L M Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

B021
s
1/1

Enclosures

8008150363

P

ENCLOSURE 1

Comments on R&D Associates Report of August 4, 1980

1. We agree that 300 Kg (660 pounds) to 600 Kg (1,320 pounds) of hydrogen uniformly mixed and adiabatically burned without heat removal would lead to containment failure. We have been reporting that we can accommodate about 450 pounds of hydrogen with these assumptions. However, much depends on the rate of hydrogen accumulation in the containment, the usage of distributed controlled ignition system to burn off the hydrogen before it reaches a high concentration level, and heat removal systems. Since hydrogen is generated in the lower compartment, the ignition of the hydrogen rich content there would cause a flow through the ice condenser. It would be very conservative to ignore such an efficient passive heat sink. The containment spray system would also remove heat since there is always moisture droplets in the containment.

2. The containment spray system acts as a heat sink in the macroscopic sense and the water droplets (not just steam) should have a tendency to retard burning. We believe that heat removal systems are positive factors in safety.

3. We agree with R&D on the philosophy of distributed controlled ignition. We feel that since we cannot rule out uncontrolled ignition (as in the case of TMI), a distributed controlled ignition system would be of benefit. Also, we reason that whatever negative effect a controlled ignition may have, one has to assume for an uncontrolled ignition anyway.

4. The heating and cooling calculations regarding the RHR heat exchangers are only approximately correct. The heat removal capability (Btuh) of the heat exchangers are expected to be different from that in the normal cooldown mode due to inlet conditions being different.

5. The purpose of the fan-induced circulation is not to back up the emergency core cooling system failure.

6. The subject of inerting was studied in detail at TVA. We did not start with an assignment to justify why not to inert. Rather, we started with a design study to inert, found out what was needed in design and modifications, evaluated the final product in terms of safety, operation, and design, and then we concluded that nitrogen inerting was not the proper solution to the hydrogen problem. These were presented and documented in the ACRS meetings. Furthermore, TVA is actively studying Halon as a post-accident inerting agent, using outside consultants.

7. In general, the calculations provided by R&D are accurate. However, much of the pressure calculations are based on adiabatic burn with no heatsinks. The state-of-the-art has progressed beyond that kind of simple, scoping, and conservative calculations. We are using computer code with multinode, ice condenser heat sink, etc., to arrive at more realistic values. These would affect some of the conclusions drawn by R&D Associates.

ENCLOSURE 2

Question on 600 Kg Hydrogen Burn

During the July 29, 1980, meeting we were asked the following question: "What are the results of distributing 600 Kg of hydrogen uniformly within the Sequoyah containment and then detonating it?" Walt Butler of the NRC staff was asked for clarification on this question on August 6, 1980. He suggested that we answer the following questions instead.

1. Consider a simple geometry, such as a sphere, having the volume of the Sequoyah containment and determine if the containment could withstand the detonation loads due to 600 Kg of hydrogen uniformly distributed inside the containment.

   Response - A 68 percent metal-water reaction would generate 600 Kg of hydrogen. If all the hydrogen is released to the containment and uniformly distributed, it would represent about 18 percent by volume of hydrogen. This could be a detonable mixture.

   We have instead considered the case of 100 percent metal-water reaction (about 2,000 pounds of hydrogen and about 25 percent of hydrogen by volume). We considered that the containment was a simple cylinder (which is structurally weaker than a sphere) consisting of only a 1/2-inch-thick steel shell(the minimum shell thichness at Sequoyah). We used the "impulse" loading information provided by C. K. Chan.[1] We have concluded that failure of the containment wall due to detonation shock wave is not expected to occur; however, even though the containment can withstand the detonation loading, due to it's short duration, the resulting relatively long term pressure due to the oxidation of a large amount of hydrogen would exceed the ultimate capability of the containment. This would be true for 600 Kg of hydrogen uniformly distributed and completely burned in one short period.

2. Consider whether or not the lower compartment of the containment can withstand the effects of detonation and resulting long term pressure from the adiabatic burn if 18 percent hydrogen is distributed uniformly in the lower compartment.

   Response - The detonation case here is bounded by question 1 above. Therefore, the containment shell can withstand the detonation load.

   We have also found that in this case the containment can withstand, within the ultimate capability of the containment, the relatively long term peak pressure due to the adiabatic burn.

---

1. C. K. Chan, "On the Failure Modes of Alternate Containment Designs Following Postulated Core Meltdown," UCLA-ENG-7661, June 1976, Principal Investigator D. Okrent, pp. 58, 59, 60, and 93.