



*Case*

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

January 22, 1981

MEMORANDUM FOR: Chairman Ahearne  
Commissioner Gilinsky  
Commissioner Hendrie  
Commissioner Bradford

FROM: Edward J. Hanrahan *EJH*

SUBJECT: OPE REVIEW OF HYDROGEN CONTROL MEASURES FOR SEQUOYAH

Shortly, the staff will brief the Commission with regard to whether the January 31, 1981 license condition for Sequoyah has been satisfied, i.e., "TVA shall by testing and analysis show to the satisfaction of the NRC staff that an interim hydrogen control system will provide with reasonable assurance protection against breach of containment in the event that a substantial quantity of hydrogen is generated" (emphasis added). OPE comments with regard to a Commission decision on this license condition are provided below.

The immediate decision facing the NRC is whether "reasonable assurance of protection" required by the January 31, 1981 license condition has been obtained through use of the IDIS. In this regard, two principal aspects should be considered:

- Reasonable assurance against breach of containment due to direct over-pressure from hydrogen combustion, irrespective of equipment survivability.
- Reasonable assurance against breach of containment due to failure of essential equipment to survive the effects of hydrogen combustion with the subsequent inability to maintain core integrity, possibly leading to eventual containment failure.

Given the close connection of ice condenser containment plants and the potentially significance of hydrogen effects, whatever decision is reached on Sequoyah should be applied to all ice condenser containment plants.

In compliance with its license conditions, TVA submitted to NRR on December 1, 1980 its first quarterly report on the research program for hydrogen control and a revised Volume 2 of the Sequoyah Core Degradation Program Report which provides information on TVA's proposed Interim Distributed Ignition System (IDIS) as well as longer term efforts for a "final hydrogen control system." In early January, the staff prepared a draft "Supplement No. 4 to the Sequoyah Safety Evaluation Report (SER)" containing a preliminary evaluation of the TVA submittals.

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OPE Review

OPE has reviewed the above documents with the assistance of Dr. Roger Strehlow, a nationally recognized expert in gas dynamics with particular expertise in hydrogen combustion. Dr. Strehlow's evaluation report is attached.

Dr. Strehlow concluded that a well designed and maintained glow plug igniter system which is energized only for testing or during an event which has the potential of generating hydrogen is an effective way to protect the Sequoyah nuclear plants from the possibility of breaching the containment vessel due to inadvertent combustion of accumulated hydrogen. (Dr. Strehlow also identified additional research needs and provided comments on combustion dynamics.)

Dr. Strehlow's review was related primarily to the question of reasonable assurance against breach of containment due to direct overpressure from hydrogen combustion. In this regard, Dr. Strehlow has identified mechanisms which could lead to explosion if a continuous flame is able to propagate in an ice condenser type containment. Even though he concluded the glow plugs will virtually eliminate the possibility of detonation in the containment vessel, he recommended further research be accomplished. I recommend the staff address Dr. Strehlow's comments before reaching a decision on "final hydrogen control measures."

With regard to the second question (equipment survivability), Dr. Strehlow indicated that glow plug initiated burns will be much less dangerous than spark initiated burns because glow plugs will initiate burns at lower concentrations than sparks of the type that undoubtedly initiated the TMI burn. It appears that the lower the concentration at which hydrogen burns, the better chance of equipment survivability because of reduced flame propagation at low hydrogen concentrations. Thus, glow plugs should be an improvement with respect to equipment survivability.

Based upon our own review and that of Dr. Strehlow, I believe operation of the IDIS will reduce further any probability of breach of containment in the event that a substantial quantity of hydrogen is generated. The question of whether the "reasonable assurance" criterion has been satisfied appears to hinge on the question of equipment survivability. (Equipment survivability is certainly improved by use of glow plug igniters.) Equipment survivability will be addressed further in the next Supplement to the Sequoyah SER.

Enclosure:  
As stated

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