JUL 8 1981

RECEIVED JUL 13 1981 U.S. NUCLEAR REGULATORY COMMISSION

Docket Nos.: 50-327/328

Mr. H. G. Parris
Manager of Power
Tennessee Valley Authority
500A Chestnut Street, Tower II
Chattanooga, Tennessee 37401

Dear Mr. Parris:

SUBJECT: REQUESTS FOR INFORMATION ON HYDROGEN CONTROL

Enclosed are requests for additional information on hydrogen control that is needed by October 1, 1981 in order to meet the license condition of January 31, 1982.

The enclosure has been sent to Duke and AEP for responses on their ice condenser plants. We suggest that you coordinate your efforts with the other participants in the research program on hydrogen combustion and control to eliminate any duplication of effort.

Sincerely,

Original signed by
Robert L. Tedesco

Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

Enclosure: As stated
cc: See next page

*See previous white

OFFICE	DL:LB#4*	DL:LB#4*	AD/L				
SURNAME	CStahle:eb	EAdensam	RTedesco				
DATE	7/7/81	7/7/81	7/7/81				

1. Describe the permanent hydrogen igniter system installed inside containment. Provide and justify the criteria used for the system design. Include in your discussion the proposed surveillance testing, and technical specifications for the permanent system.

2. List the rooms within containment for which there is no direct coverage by igniters and justify exclusion of these regions.

3. Discuss the effects of igniter operation in lean (0-4 v/o) hydrogen mixtures for sustained durations (24 hours) on the ability of the igniter to subsequently perform its intended function. Describe the testing performed to evaluate the temperature effects of surface recombination and possible igniter degradation.

4. Provide a complete discussion of the accident symptoms which will result in actuation of the igniter system. Considering a spectrum of accidents, identify the minimum time period in which actuation is required. Identify and justify the mode of actuation, i.e., automatic or remote manual.

5. With regard to the Fenwal igniter test program provide the following information:

   a) Summary of the data from the Phase 2 Fenwal tests in a format similar to that provided for the Phase 1 tests in the TVA Core Degradation Program Report, Vol. 2. Include the calculated $\Delta P/\Delta P$ max value.

   b) Description and justification of the scaling of the spray flow tests to the ice condenser upper or lower compartment sprays.

   c) Description and justification of the scaling of the steam-hydrogen transient injection tests.

ENCLOSURE

6. Submit a topical report on the CLASIX code; in this regard:

   a) Describe in detail the version of the CLASIX code used to perform the revised analyses, including a discussion of models, methods for solution, assumptions and input parameters.

   b) Describe the efforts and results to verify the revised CLASIX code, i.e.,

      i) Provide comparative analyses to show the effects of model changes from the initial version as described in the TVA Core Degradation Program Report, Vol. 2. As a minimum comparative calculations should be provided to isolate and identify the effects of adding heat sinks, upper plenum volume, fan head characteristics.

      ii) Quantify the effects of incorporating the radiation heat transfer model and describe the results of analyses to verify this model in its application to containment heat transfer.

      iii) Provide a discussion of the program to verify the revised CLASIX code against other containment codes and experimental data. Include a discussion of both the Fenwal and EPRI hydrogen test data. Comparison of CLASIX prediction of hydrogen combustion tests should also describe the code input parameters where user options may affect the comparison.

   c) Discuss the treatment of hydrogen addition to a volume in which combustion is calculated to be taking place.

   d) Discuss in detail the treatment of the intermediate deck doors and the effect of the doors functioning as check valves on upper plenum burning and downward flame propagation. Discuss modeling of vents around the doors.

e) Provide the results of calculations to determine the sensitivity to selection of timestep sizes.

f) Discuss initialization of the CLASIX code with results of LOTIC 1 analysis;

i) Discuss application of LOTIC 1 to small break analysis especially prior to fan operation or for breaks without fan operation.

ii) Discuss use of LOTIC 1 for analysis of superheated atmosphere conditions.

g) Provide the results of analysis to identify the effectiveness of the ice bed in removing heat from a highly superheated steam-air-hydrogen mixture. Provide figures showing ice bed heat transfer coefficients, flow rates.

h) Discuss the potential for preferential flow to the ice bed (maldistribution) during various accidents. What is the probability and consequence of the break release point being adjacent to the lower doors with the hydrogen-steam release jetting into 1 or 2 bays of the ice condenser rather than uniformly mixing in the lower compartment. Discuss the possible effects of partitioning the ice bed model in the circumferential direction as well as modeling the lower compartment as several subvolumes.

i) Describe any plans for future modification of the CLASIX code.

7. Provide a discussion of the results of analyses of the S_2D transient using the revised CLASIX code as discussed above addressing the following;

   a) Identify and provide the results of a base case reference analysis and discuss the rationale for selection of the base case, e.g., representation of a best estimate or bounding calculation. Provide justification for the characterization of this analysis. The results should include plots of pressure, temperature and gas concentrations for the various regions of the containment.

   b) Provide the results of sensitivity studies to determine the effect of operation of 1 or 2 trains of fans and sprays.

   c) Provide the results of analyses to determine the effect of various hydrogen combustion assumptions considering the following:

      i) combustion of lean hydrogen mixtures with partial combustion;

      ii) complete combustion of hydrogen at various setpoints;

      iii) the use of different combustion assumptions in separate regions of the containment;

      iv) combustion of hydrogen assuming various flame speeds; identify a best estimate and bounding value for flame speeds; and

      v) simultaneous ignition at multiple igniter sites.

   d) Identify periods in the transient where hydrogen combustion is limited or precluded by the quantity of oxygen available in the compartment.

e) Identify the analysis(es) to be used as the basis for determining the maximum temperature response of essential equipment. Provide justification for the case(s) selected.

f) Where pressure effects are a major consideration in determining the survivability of equipment, such as the air return fans, identify and justify the analysis used as the basis for assuring the equipment will function as intended.

g) Considering the capability of the containment shell, crane wall, and the operating deck perform an analysis to determine the maximum concentration of hydrogen which could be tolerated to burn to completion in the upper compartment considering multiple ignition sites and appropriate flame speeds.

h) Since the original S_2D transient analyses did not mechanistically consider termination of the accident it is necessary to identify the effects of core recovery. Therefore, either demonstrate that various modes of core recovery do not adversely affect the hydrogen and steam release rates and therefor the containment pressure and temperature response or provide the results of analyses which address the more likely scenarios involving core recovery.

i) Provide the fan head curve used in the CLASIX model. In order to demonstrate the effects of variable fan flow provide figures of fan flow as a function of time.

8. Identify the spectrum of accidents which you have considered in your evaluation of the distributed ignition system. Discuss the rationale for selection of the various accidents. Discuss the basis for assumptions regarding termination of the accident prior to core slump if applicable. Provide the assumptions and results of CLASIX analyses performed to evaluate the containment atmosphere pressure and temperature results, similar to that provided for the S_2D transient, for the various accident sequences selected.

9. Provide a quantitative evaluation of the probability and effects of forming a fog, comprised of water droplets, inside containment. This evaluation should address the following items:

   a) Identification of the range of droplet sizes and requisite volumetric density to preclude combustion of hydrogen or affect combustion characteristics such as flame propagation. Provide the basis, including experimental evidence, to support these conclusions.

   b) Consideration of the probability and consequences of fog formation in the various regions of the containment (e.g., lower compartment, ice condenser).

10. Provide a quantitative evaluation of the probability and effects of producing supersaturated steam conditions in the various containment compartments. Discuss the effects these conditions may have on igniter performance. Reference any test data used to support your conclusions.

11. The utility arguments presented to date on the issue of transition to detonation in the ice bed appear to be focused about two points:

   1) The upper plenum igniters will burn H_2-mixtures as they first become flammable, if richer mixtures begin to be formed the flame front will

propagate downward in the ice bed where sufficient steam is condensed to support a flame; and

2) The geometry of the ice condenser upper plenum is not conducive to producing detonations.

a) Please provide any references to supporting test data derived from a configu· tion which is analogous to the phenomena described in item 1.

b) It appears that the argument presented in item 1 relies upon a generally stable horizontal flame. Discuss the implications of localized downward flame propagation and consequential crossflow through the ice bed.

c) Discuss the applicability of the EPRI tests, designed to study transition to detonation, to the ice condenser geometry.

d) Discuss the applicability of EPRI tests designed to study the effects of obstacles to the geometry of an ice condenser plant.

e) Provide the L/D value applicable to the ice condenser region and evaluate the acceleration of burns initiated in the lower compartment which propagate through the ice condenser.

12. Provide analysis to address the consequences of continuous or near continuous burning in the ice bed or upper plenum region. Describe the models, assumptions, and results of analysis to evaluate the decompositon or burning of materials in this region. Consider the effects of 2-3 dimensional heat transfer in the process. Address the likelihood of inadvertently supplying oxygen to support combustion of foam behind the wall panel ducts.

13. Describe the testing performed to demonstrate that upper plenum igniters will properly function in an environment of prolonged hydrogen burning.

14. Describe and justify the criteria used to determine adequate coverage of the ice condenser upper plenum region with igniters to insure combustion while minimizing exhaust of unburnt gas to the upper compartment. Identify the minimum number of igniters needed to accomplish the intended objective.