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Marchese/Speis Input

to Dr. Dave Okrent, ACRS

"General Feelings on Containing a Core Melt"

Re: Memo from Quittschreiber, "Request for Input to Commissioner Gilinsky's Questions on Core Melt," dated April 18, 1980

April 25, 1980

ATTACHMENT 3

1. Refractory materials exist (e.g., MgO) which are considerably more benign than concrete is in terms of interactions with molten core debris and which would significantly reduce the associated production of water vapor, non-condensible and combustible gases generated by melt-concrete interactions.

2. A core retention device could not only prevent failure of containment via preventing melt-through of lower basemat, but could have a significant mitigating effect on the upper containment loading conditions by decreasing the pressure, hydrogen, aerosol and activity transients.

3. We believe that a core retention device will mitigate significantly core meltdown accident consequences by:

   a. reducing both the airborne releases caused by sparging of activity out of the core melt (thus reducing the vaporization fraction of the atmospheric releases) and the higher containment pressure when core melt material interacts with concrete; and

   b. reducing the likelihood of containment basemat penetration, thereby reducing the likelihood of ground water contamination via melt-through.

4. If containment fails prior to the melt contacting the core retention device, the major value of such a device in this case (insofar as airborne releases are concerned) would be to reduce the driving forces for leakages caused by non-condensible gas generation and sparging of activity out of the core melt debris.

5. An actively cooled core retention device would have the added advantages of (a) permanently retaining the core melt debris within the confines of the containment building, and (b) dissipating the core melt decay heat to the atmosphere, rather than retaining the heat of the melt inside of the containment building.

6. The value of minimizing the sparging phenomena and the vaporization releases extends broadly across the core melt spectrum but would have greatest importance to the risk dominating sequences. This value would be achieved primarily through reduction of the sparging induced release of tellurium and to some lesser extent it would reduce other isotopes. Since tellurium may be one of the dominant contributors to the health risks (from airborne releases), a core retention device could have a significant value in reducing the health risks from airborne releases.

7. For those nuclear plant sites located on soils of high permeability and in close proximity to major water resources, the use of a core retention device would be of greater relative value insofar as liquid pathway releases are concerned. Also, the use of a passive core retention device would have some value in terms of providing added time for interdictive measures to be taken against ground water contamination, thus further reducing the probability of such contamination.

8. If a controlled-vent-filter containment system proves desirable, a core retention device would significantly reduce the gas, vapor, aerosol, and activity loadings on such a system.

9. A core retention device could eliminate the water vapor evolved by melt-concrete interactions, thereby reducing melt-water reactions and the associated H_2 production in the region of the core retention device.

10. Conceptual designs of core retention systems for each of the reactor containment types should be undertaken; studies should be of the integrated, system type.

11. Need to consider special backfit problems associated with installing a core retention system in existing plants.

12. Those existing plants that either have a poor liquid pathway situation (with respect to rapid transport of core melt activity) or are located in areas of high population density should be given special emphasis.

13. Need to decide on whether to <u>delay</u> the melt-through penetration of the basemat or whether to <u>permanently retain</u> the core debris within the confines of the containment building.

14. In connection with Item 13, both passive and actively cooled core retention systems should be examined. Studies of passive systems should also consider natural circulation cooling around the extremities of a refractory bed of material.

15. After conceptual design studies are completed, the required R&D can be better focused to support the final design of the most promising of the core retention systems.

16. Primary problems which will require core melt R&D are in areas of materials interactions, heat transfer and fission product behavior.

17. For future plants, we believe that it is both technically feasible and practical to incorporate a core retention system into the reactor containment building that will significantly mitigate the consequences of core melt accidents.

18. For existing plants, we feel that the feasibility and practicality has to be examined on a case-by-case basis, including but not limited to considerations of high population density sites, liquid pathway problems, and containment types. The practicality of installing a core retention device in the lower reactor cavity region should be examined in terms of space availability, access, shielding, radiation levels and costs.

19. Besides NRC and its contractors, Reactor Manufacturers and A&E firms need to take this problem seriously and perform actual conceptual design studies of real core retention systems.

20. The combination of a stronger containment (i.e., higher design pressure) coupled with containment heat removal and core retention systems is a very desirable concept for future plants to preclude the need for venting in order to relieve pressure following a core melt accident. Public acceptance of nuclear power would be greatly enhanced if we could claim that we can contain the worst of the nuclear accidents.