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MEMORANDUM

TO: Dr. D. Okrent, Chairman

FROM: Melvin W. First

DATE: January 7, 1985

SUBJECT: Comments on Agenda Item 2 - RDA Results for Mark III Design. GESSAR II Subcommittee Meeting, Dec. 4-5, 1984.

1). Possible intrusion of air into a hydrogen rich but oxygen poor containment atmosphere. A 2-way valve at the outlet of the proposed containment vent line makes it possible for air to backflow into containment if the following conditions are fullfilled: a) heating of the containment atmosphere caused by releases of steam, or a small hydrogen burn, or both, pressurized containment and the gases flow out, (b) hydrogen continues to be generated but there is no longer enough oxygen present to burn the hydrogen and the hydrogen concentration become greatly elevated, (c) heating and expansion are followed by cooling so that the pressure inside the containment now becomes less than ambient and outside air flows in, (d) sufficient air enters to initiate a minor burn inside containment that causes venting of hot gases followed by rapid cooling, backflow of a large volume of outside air sufficient to permit a major detonation.

When hydrogen burns at the lower explosive limit (4.1% H_2 in air), fuel availability is limited and the rate of burning is restrained. But when a substantially greater concentrations of H_2 is available, detonation can occur. The questions are: can the outlined sequence of events occur and, if so, how can the final explosion be prevented?

2) Feasibility of a chilled filter. The probability of venting becoming a safety requirement with a low pressure containment structure is much greater than for the conventional 45 psi structure, for which venting is designed to take place only under worst case events. Even though the plan is now only in the preliminary stage, vented gas cleaning is the critical item and requires greater delineation even in the current very preliminary stage it is in. If there is no convincing evidence up front that the gas filtering system has a reasonable chance of acceptance, there is little reason to pursue the other issues. It is surprizing, therefore, that so little attention has been paid to the design of the chilled filter. The Schematic Chilled Filter - Installation figure shows 50 tons of charcoal and 100 tons of rock. The charcoal section is priced at $250/yd^3 for 100 yd^3 or 25¢ per pound of charcoal, in place, but nuclear carbon in ESF systems runs $2.50-3.00/lb.

The rock filter is priced at $50/yd^3 or 1.2¢/lb, a cost that does not correspond in any manner with the cost of the graded sand filters installed at Hanford and Savannah River. Furthermore, a pile of ungraded rock does not an efficient particulate filter make.

When one converts 1,000 tons of rock (from the Schematic) into 500 yd^3 of rock (in the cost table), the weight corresponds to 4,000 lb/yd^3. A cubic yard of water weighs 1,682 lbs. Therefore, the specific gravity of the rock filter is 2.4, and the calculated porosity of the bed is zero, i.e., the specific gravity of silica rock is 2.4. A similar calculation for the charcoal bed shows a specific gravity of approximately 0.67, exactly the molecular weight ratio of carbon to water. The questions here are: how can this proposal be taken seriously without a more thoughtful development of the critical system components and how can any of the cost figures be taken seriously when the two cost elements examined are so grossly awry?

On the subject of costs, it is by no means obvious that the costs of a 10 psi containment vessel will be sufficiently less than a 45 psi vessel to pay for the chilled filter installation when one considers that the 10 psi containment must be just as seismically qualified, resistant to missiles, proof against floods, etc, etc. This point seems to need much more development before the low pressure containment vessel concepts merits detailed review.