UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

November 3, 1970

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ACCIDENT ANALYSIS FOR THREE MILE ISLAND (DOCKET 50-289)

The accident analysis section of our draft Interim Report on Three Mile Island has a discussion on the decontamination factors required in order to just meet Part 100 guidelines. Recently (October 20, 1970) the Site, Environmental and Radiation Safety Group released a comprehensive evaluation of the B&W R&D efforts on the use of alkaline sodium thiosulfate.

On the basis of that report, and related dose calculations, we are scheduling a meeting with Met-Ed (tentatively November 24). The attachments to this memo outline the points we intend to discuss:

Table A - Acceptability of Alkaline Sodium Thiosulfate

Table B - Dose Calculations

Table C - Possible Design Changes by Met-Ed

A meeting notice will be generated. We intend to pursue point 1 of Table C concerning leak rate reduction. This implies acceptability of 241 Rem as a 2-hour dose value; management concurrence is requested.

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TABLE A

ACCEPTABILITY OF ALKALINE

SODIUM THIOSULFATE

Alkaline sodium thiosulfate solution is acceptable for use, provided that:*

1. "A pH monitoring system, designed to operate under post-LOCA conditions, is available."

The Met-Ed sampling system is described in the FSAR, pp 9-11 through 9-13, and on Figure 9-7. Samples can be taken from the discharge of either decay heat cooler (see the symbols CE-118 and CE-119 on Figures 9-7 or 9-10). Remote sampling valves are provided. It appears that, for the decay heat cooler samples, no isolation valve is automatically closed, as the sample point is already outside containment.

We do not know, and must determine:

Is pH monitoring equipment available at the sample sink, and can a sample of decay heat cooler outlet, with its 'load' of fission products, be handled?

2. "Capability to replenish sodium hydroxide to maintain a minimum solution pH of 8.0 should be required."

The Chemical Addition system is described in Section 9.2 of the FSAR (pp 9-8 through 9-11) and on Figures 9-4 and 9-5. A caustic mix tank is provided for use with demineralizer regeneration and radwaste treatment. No apparent connection to the sodium hydroxide storage tank of the reactor building spray system is evident. Therefore we must ask Met-Ed to describe (and provide) the



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* Quotations denote the exact statements from the SERSG evaluation.

means of refilling the NaOH storage tank (tank BS-T2; capacity 12,750 gals with 20,500 lbs NaOH) within 7 days (arbitrary?) of its discharge during an accident.

3. "Very stringent limitations should be placed on the use of aluminum and all copper containing materials which could come in contact with the spray or sump solution." ("The total weight of exposed aluminum should not exceed 300-500 lbs and the total amount of exposed copper should be minima ')

In the TMI-1 FSAR, Supplement No. 1, Part I, pages 5-5 and 5-6 it is noted that there is only 54.1 lbs of exposed aluminum, but there is a significant amount of copper. The exposed copper consists of the polar crane pickup busses (162 $ft^2$) and grounding cable (359 $ft^2$). Met-Ed calculates that only 410 lbs of sodium thiosulfate will be removed by copper reaction during the assumed 2-week spray operation. There is also 76,500 lb of copper in the reactor building cooler tubes. Met-Ed assumes that 10% of the spray drops get entrained in the ducts, and the demister is 99% efficient. The calculated thiosulfate consumptiion is 15 lbs. We should investigate further:

a. How much exposed copper is reacted with if the sprays run 90 days?

b. Will the demister survive the initial pressure wave?

c. What are the test data supporting the 10% duct entrainment, 99% demister efficiency claims?

d. Is copper deterioration a common mode failure mechanism for the reactor building coolers?

In regard to the reactor building coolers we will soon ask for a summary of supporting test data and analyses.

4. "Additional R&D should be required to adequately define the storage stability of the sodium thiosulfate solution, or alternatively, a frequent inspection schedule should be imposed."

In Supplement 1, Part I, page 5-5, Section 5.3.3, storage stability of thiosulfate is discussed. On page 4-3, Section 4.3.2.6, it is stated that samples are periodically taken from the borated water storage tank, the sodium hydroxide tank, and the sodium thiosulfate tank. We will notify Met-Ed that the tech specs must contain

a. sampling frequency and methods

b. acceptable limits on the thiosulfate available.

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(c) For the particulates fraction 0.05

fraction remaining = 0.05 (no removal)

Total remaining in 2 hours = 0.113 + 0.070 + 0.05 = 0.233

Overall reduction factor = 4.3

$$\text{Two-hour dose} = \frac{1380}{4.3} = 321 \text{ rem.}$$

Case 2. HEPA Filters

(a) Organic fraction remaining 0.070 (as in Case 1)

(b) Inorganic and particulate fraction remaining $= \frac{0.90}{7.5} = 0.120$

Total fraction remaining = 0.07 + 0.12 = 0.19

Overall reduction factor = 5.2

$$\text{Two-hour dose} = \frac{1380}{5.2} = 267 \text{ rem.}$$

Thus the consequences are just over Part 100, without HEPA's, and just under, with HEPA's.

TABLE C

POSSIBLE DESIGN CHANGES BY MET-ED

At present the dose consequences (321 rem) are over Part 100 guidelines and unacceptable. We intend to discuss remedial measures with Met-Ed, including:

1. Reduction in leak rate. The current leak rate is 0.2% per day. A reduction to 0.15% would lower dose to 241 rem.

2. Increasing the flow rate in the spray system, or increasing the number of spray pumps. This is not a very promising area to pursue. The number of spray pumps (2) equals the number of diesels (2). If additional spray pumps were added, the postulation of one diesel failure could well bring the predicted performance back to the present value. On the other hand if all spray pumps worked, the delivery lines and nozzles would probably be under-designed. Wholesale design changes would probably be needed, and it is rather late for that.

3. Installation of HEPA's, which would lower the 2-hour dose to 267 rem. The fan coolers are already designed; some modifications would be required. The fractional dose reduction, from 321 rem to 267 rem (a change of -54 rem) seems small in comparison to the difficulty and expense.

4. Installation of charcoal filters inside containment. The dose reduction has not yet been computed, but the final figure would be less than 267 rem, as HEPA's would be required in front of the charcoal.

5. Meteorology. We used TID meteorology (Type F, 1 m/sec, with building wake correction) in our calculations. We have not completed our meteorology review, as the applicant has not yet filed all of the onsite measurements. If the 2-hour $\chi/Q$ can be lessened by 1/3, the 2-hour dose will go from 321 rem to 214 rem.

We will discuss these five alternatives with Met-Ed.

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