To: Milt Levenson

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Subject: Removal of Airborne Radioactivity From Containment

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Recovery from the TMI-2 incident includes reduction and eventual removal of airborne radionuclides from containment. The potential for malfunction of the containment or its appurtenances, however slight, also necessitates formulation of a plan for protection of the public from this activity. Hence outlined below are several concepts for removal of airborne activity from the building.

Assumptions

1. Removal is intended primarily to protect the public. Reduction of equipment exposure is not a criteria, although it certainly is a secondary effect.

2. Deliberate attempts to reduce airborne activity may not begin until about 30 days after the incident, except for emergency actions.

3. Cost is not a major consideration.

Removal of Activity Prior to 30 Days After the Incident

This concept is based on the premise that the most significant noble gas contributors are xenon isotopes. The system will also remove some iodine, krypton, and particulates. The system would use recirculation through pressurized charcoal at ambient temperatures. It would be operated as follows:

(1) Using a 6 to 8 inch line from containment compress the effluent to about 150 psig and cool it to about 95°F.

(2) After cooling, reduce stream pressure to 75 to 100 psig to lower its relative humidity.

(3) Without further reduction of pressure or temperature, pass the stream through a large, long charcoal bed. It is estimated that many tons of charcoal filling an approximately 6 feet diameter, 20 feet long tank would be used. This charcoal bed would be used until xenon breakthrough is observed.

(4) Return the process stream to containment.

Equipment would be expected to include:

(1) One compressor rated in excess of 150 psig and 2000 fm with an after cooler capable of reducing stream temperature to 95°F.

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(2) A pressure-reduction station capable of dropping 2000 fm from 150 psig to 75 psig.

(3) A 6 feet diameter, 20 feet long tank filled with charcoal.

(4) 6 to 8 inches piping, valves, and penetrations rated at about 200 psig.

It is believed one bed of charcoal would remove the xenon activity in about 1½ days of recirculating. It would also remove some iodine and krypton, and act as a filter to remove particulate activity. Further design would address if the charcoal bed needs to be cooled. Chilling of the stream is not included to avoid the need for equipment to remove H_2O and CO_2

Removal of Activity After 30 Days After the Incident

The scheme takes into account that by 30 days after the incident the only significant noble gas activity is due to Kr^{85}. The system uses charcoal at low temperature with the effluent released to the atmosphere. It would be operated as follows:

(1). Using a 200cfm blower, force the process stream through dessicant dryers and possibly a CO_2 freeze-out heat exchanger. (Detailed design would determine the need for the heat exchanger.)

(2) Force the stream through a tank of charcoal bathed in liquid N_2 to bring its temperature to -100°F.

(3) Release the output of the charcoal tank to atmosphere.

Equipment would be expected to include:

1. One low pressure blower rated at about 200cfm.

2. Dessicant dryers

3. Possibly a CO_2 freeze-out heat exchanger

4. 1 - 2 feet diameter tank full of charcoal. Tank length and liquid N_2 requirements to be determined during engineering.

This system would be operated until Kr^{85} breakthrough is detected. It is believed that most, if not all Kr^{85} activity would be retained in the charcoal.

Another scheme for long term activity removal would be to bubble effluent from the containment through an organic solvent and back to containment. It is felt that the solvent would retain the activity; however, this concept is much more theoretical with possible exposures as yet unexplored.

Iodine and Particulate Removal

Since an accidental release in the near future would contain significant quantities of iodine and particulate activity, it may be worth considering installing a system now to begin cleanup of these radionuclides. 2 or 4 inch deep trays could be coupled with an upstream HEPA filter in a recirculation loop. Removal rate is felt to be approximately proportional to flow rate.

It must be emphasized that all the above are conceptual in nature with detailed engineering yet to be performed. We estimate that such engineering would take about three days. The concepts might also be useful in reducing gas decay tank activity and for total content.