April 3, 1979

TO: Ed Zebrowski, Group Leader
Technical Advisory Support for Three Mile Island
Nuclear Power Plant Incident

FROM: W. A. Riehl

SUBJECT: Hydrogen in Containment Room

Potential hydrogen hazards and removal measures in the containment room have been reviewed and currently appear safe and in control.

The concentration of hydrogen (by volume) has been in the range of 2 to 2.7% within the past several days. This is considered safe - whether in air or in the reactor vessel. However, in order to prevent the composition from approaching a marginal hazard zone at 4%, "recombiners" have been installed to remove the hydrogen.

The recombiners function by heating the gas to over 1300°F, thereby reacting hydrogen with oxygen to produce water and evolving additional heat. Since the autoignition temperature of hydrogen in air is 1080°F, this device could function as an igniter.

However, a safety cutout is provided. The temperature drop is monitored across the unit (inlet and exit). This is indicative of the performance of the unit as well as the precent hydrogen present at the inlet. When the hydrogen concentration exceeds 5%, the unit is automatically cut off.

In the 4 to 5% hydrogen range, unstable flames could occur. However, this could not propagate upstream against the 50 ft/sec flow velocity in the unit. This feature has been confirmed by testing the unit with 5.5% hydrogen.

As an additional backup safety feature, the unit is reportedly designed so that between 5.5% and 9% hydrogen the heat evolved from combustion would be sufficient to burn out the heater coils.

Attachment No. 2

Regarding flow rates and reduction times, the unit is designed to operate at 100 cfm with a minimum guaranteed flow rate of 50 cfm. Upon installation and checkout, the single unit now in operating is providing a . . cfm flow. For an approximately two million cubic feet room volume, fifteen days would be required to drop the concentration from 2 to 1% (assuming no additional hydrogen input).

At an initial concentration of 2% hydrogen, approximately 2600 cubic feet of hydrogen would be removed per day. Thus, this is the limit of hydrogen input in order to prevent a rise in concentration, whether the source is from the reactor or venting of the waste gas storage container.

These values are for the single recombiner now in operation. Activation of the second unit (already installed) would naturally provide a benefit proportional to the additional flow rate.

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