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April 26, 1979

The Honorable Joseph M. Hendrie  
Chairman, United States Nuclear  
Regulatory Commission  
Washington, D.C. 20555

Dear Dr. Hendrie:

We have been following closely the events surrounding the incident at Three Mile Island. This is both out of personal interest and due to the fact that my colleagues and I have worked closely with the nuclear industry for many years. One particular aspect of the incident that has been repeatedly discussed in the various news accounts concerns the problem of the hydrogen bubble. Several times it was stated that officials were surprised by the magnitude of the quantity of hydrogen produced.

I am writing to you for two reasons: First, we would like to know more about the hydrogen production question; secondly, we would like to offer a possible explanation of the phenomenon as we understand it. We would like to know if there was, in fact, more hydrogen produced than calculations predict. If analysis of the accident indicates that the quantity of hydrogen was anomalously high, it is possible that the calculations failed to include the contribution from the radiolysis of steam. As I am sure you know, the procedures used to calculate hydrogen production are described in Regulatory Guide 1.7. Water is decomposed both by the metal-water reaction and by radiolysis. However, the Guide does not specifically take into account the enhanced radiolysis of steam. The G-value for steam has been shown to be much higher than for water. Under certain conditions it could be higher by a factor of 10-30. This was pointed out in a comment to NRC on the Regulatory Guide by Dr. Norman Lurie and Dr. David Vroom of IRT's staff (copy enclosed). Thus, if abundant quantities of steam were present, this enhanced radiolysis could possibly explain the large amount of hydrogen produced.


The possible impact of the higher G-values for steam on the safety of nuclear reactors following a loss-of-coolant accident was identified by Drs. Lurie and Vroom during the course of their ERDA study on the application of laser fusion to the production of hydrogen. Although their investigations were in an unrelated field, their background in nuclear technologies enabled them to quickly identify the potential impact of their findings on the LOCA situation.

The Honorable Joseph M. Hendrie  
April 26, 1979  
Page 2

In this regard it may also prove helpful to you and your staff to refer to a proposal submitted to NRC approximately three years ago in which we proposed to investigate the question of steam radiolysis (IRT proposal number 4876-109 dated April 22, 1976). References to the literature on this subject and further arguments are given in that document.

It is our hope that this information will help in the analysis of the Three Mile Island incident and that any possible deficiencies in the methods used for accident analysis be illuminated. If we can be of further help in this matter, please feel free to call upon us. Dr. Lurie and Dr. Vroom will be pleased to discuss this matter with you or any of your associates.

Yours sincerely,

  
Joseph John, Ph.D.  
Vice President

JJ:ls

cc: Dr. N. Lurie  
Dr. D. Vroom