

Sandia National Laboratories

Albuquerque, New Mexico 87185

Dr. Asimios Malliakos
Accident Evaluation Branch
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
MS: NL/N-344
Washington, DC 20555

January 7, 1994

Dear Dr. Malliakos:

As you requested during our discussion over the phone today, I am providing preliminary comparisons between the steam condensation test performed in the Surtsey facility on November 19, 1993 and CONTAIN calculations. The main conclusion is that the rate of steam condensation occurs on the order of minutes, not seconds, and that the predictions were in reasonable agreement with the data.

The atmosphere was well mixed in the experiment: the initial concentrations by volume percent were 76.05% steam, 20.65% air (4.32% oxygen), and 3.30% helium. The initial temperature and pressure were 419 K and 0.475 MPa, respectively. This mixture was subjected to a water spray for 16.3 minutes. The spray flow rate was 30.5 gpm, spray water temperature was 321 K, and drop mass median diameter was 1080 microns. Details of the experiment are given in the December 13, 1993 letter from T. Blanchat to you. The steam concentration decreased from approximately 76% to 45% in 16 minutes. The highest concentration of steam in which a detonation was observed in a hydrogen-air-steam mixture was approximately 39% in the Heated Detonation Tube at SNL. This detonation was initiated with 100 grams of high explosive.

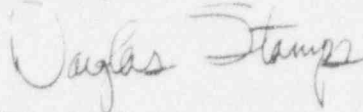
A CONTAIN calculation was also performed prior to the Surtsey steam condensation experiment. The conditions for the code calculations were somewhat different than those in the experiment: a spray flow rate of 23.3 gpm was assumed instead of 30.5 gpm, hydrogen was used instead of helium, and the initial conditions were not exactly the same. In spite of the differences, however, significant changes in the results would not be anticipated if the actual Surtsey conditions were used. The predicted average rate of pressure drop due to steam condensation was approximately 15% greater than the experimentally measured rate.

The conditions in the Surtsey facility are similar to those in the CE System 80+ containment. This was discussed in the October 1, 1993 letter from T. Blanchat to you. CONTAIN calculations indicate the water spray drops attain thermal equilibrium relatively quickly in the Surtsey facility. This would also be expected in the CE System 80+. As such, the spray mass flux becomes the important parameter governing the rate of steam condensation. The spray mass flux in the Surtsey

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steam condensation experiment was $0.181 \text{ kg/m}^2\text{s}$ compared to $0.138 \text{ kg/m}^2\text{s}$ for the CE System 80+ when only one of the two sprays systems work.

Sincerely,

A handwritten signature in cursive script that reads "Douglas Stamps". The signature is written in dark ink and is positioned above the printed name and title.

Douglas Stamps
Containment Modeling Department, 6429

Copy to:

NRC/NRR M. Snodderly
MS 1137 T. Blanchat (6422)
MS 0739 K. E. Washington (6429)
MS 0739 D. W. Stamps (6429)