



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 2 1981

MEMORANDUM FOR: L. Rubenstein, Assistant Director for Core and Containment Systems, DSI

FROM: W. Butler, Chief, Containment Systems Branch, DSI

SUBJECT: CSB POSITION ON COMBUSTION ISSUES RAISED BY SNL AND DR. JOHN LEE

REFERENCE: Memorandum to L. Rubenstein from W. Butler, dated April 7, 1981, "Meeting with Dr. J. Lee Re: Hydrogen Combustion"

The purpose of this memorandum is to supplement the Containment Systems Branch (CSB) position on the information presented by Dr. John Lee during the meeting of March 20, 1981. The reference memorandum summarizes the points made by Dr. Lee during that meeting, which was held to discuss the general issues related to the upper plenum igniters.

Based on our understanding of the experimental data discussed by Dr. Lee, it is clear that significant differences exist between his test conditions and the likely post accident conditions inside the ice condenser containment. The cited test data were derived from intentional acceleration of stoichiometric propane-air and methane-air mixtures. The most likely conditions inside containment would involve hydrogen at 6-10 v/o. Corresponding to the test data, a stoichiometric mixture of hydrogen-air represents 29 percent hydrogen by volume. Since the tests were clearly performed using fuel to air mixtures quite dissimilar from those of general interest to us it is our belief, buttressed by our conversations with Sandia, that presently there is no clear basis for extrapolation of the test data to the containment accident environment. Hence, the information presented by Dr. Lee does not significantly affect the staff's testimony before the Licensing Board.

The next logical question is: Are there accidents or intervals of accidents during which the ice condenser region of the containment might see hydrogen concentrations much higher than 10 v/o? As discussed at length in the McGuire hearing, the staff agrees that if the lower compartment is inerted for whatever reason, then there is a possibility that richer mixtures could exist in the ice bed or upper plenum region. The staff also maintains that the likelihood of lower compartment inerting is remote. Even if we discount the low probability of occurrence, in order for a rich mixture to reach the upper plenum igniters one must assume that the mixture is either formed instantaneously or that the flame initiated by the igniters will not propagate downward in the icd bed. The Duke consultants testified extensively on this subject at the McGuire hearing, concluding that either situation was physically impossible.

Removal of the upper plenum igniters also does not guarantee that ignition sources will not exist in that region. There is still the potential for random ignition

Contact: C. Tinkler, CSB:DSI
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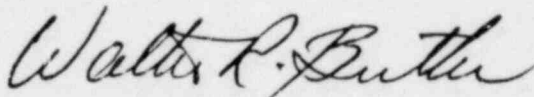
L. Rubenstein

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and the possibility that upper compartment burning will propagate back to the ice condenser region.

Finally, there is no apparent reason to assume that, for combustion purposes, the test vessel geometries simulate or scale in any fashion the geometry of the ice condenser containment. Other than to note that there are obstacles in the ice condenser region, most notably for crossflow in the ice bed, there has been no quantitative comparison given by Sandia. On the other hand, the Duke consultants testified that the ice condenser region geometry is not conducive to producing a detonation.

Based on the foregoing we can only conclude that removal of the upper plenum igniters is not justified. Furthermore, the staff contends that these igniters serve a particularly useful purpose in burning hydrogen in small quantities. A proper characterization of our views on this issue is that we think the interim hydrogen control system is perfectly adequate, yet we believe that the permanent resolution of the hydrogen control issue requires the demonstration of adequate safety margins. In keeping with this demonstration of "adequate safety margins" we believe that additional work is required to resolve these issues. We believe this is fully consistent with the approach we have taken on other issues related to deliberate ignition, e.g., investigation of a spectrum of accidents.



Walter R. Butler, Chief
Containment Systems Branch
Division of Systems Integration

cc: R. Birkel

MEETING SUMMARY DISTRIBUTION

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NRC/PDR
Local PDR
TIC/NSIC/TERA
LB#4 Rdg
H. Denton
E. Casé
D. Eisenhut
R. Purple
B. J. Youngblood
A. Schwencer
F. Miraglia
J. Miller
G. Lainas
R. Vollmer
J. P. Knight
R. Bosnak
F. Schauer
R. E. Jackson
Attorney, OELD
M. Rushbrook
OIE (3)
ACRS (16)
R. Tedesco
N. Hughes

NRC Participants:

W. Butler
J. Shapaker
C. Tinkler
J. Long
K. Parczewski
D. Hoatson
S. Lewis
E. Ketchen

bcc: Applicant & Service List

G. Lear
S. Pawlicki
V. Benaroya
Z. Rosztoczy
W. Haass
D. Muller
R. Ballard
W. Regan
R. Mattson
P. Check
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C. Berlinger
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R. Birkel