EDO Principal Correspondence Control

FROM: George E. Apostolakis, ACRS

DUE: 07/18/02

EDO CONTROL: G20020365
DOC DT: 06/17/02
FINAL REPLY:

TO:

Travers, EDO

FOR SIGNATURE OF : ** GRN **

CRC NO:

Travers, EDO

DESC:

Recommendations Proposed by RES for Resolving Generic Safety Issue-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident"

DATE: 06/18/02

ROUTING:

Travers
Paperiello
Kane
Norry
Craig
Burns/Cyr
Collins, NRR
Nieh, OEDO
ACRS File

ASSIGNED TO: RES

CONTACT: Thadani

SPECIAL INSTRUCTIONS OR REMARKS:

Prepare response to ACRS for EDO signature. Add Commissioners and SECY as cc's.

USE SUBJECT LINE IN RESPONSE.

Template: EDO-001

E-RIDS: EDO-01

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

June 17, 2002

Dr. William D. Travers
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Dr. Travers:

SUBJECT: RECOMMENDATIONS PROPOSED BY THE OFFICE OF NUCLEAR REGULATORY RESEARCH FOR RESOLVING GENERIC SAFETY ISSUE-189, "SUSCEPTIBILITY OF ICE CONDENSER AND MARK III CONTAINMENTS TO EARLY FAILURE FROM HYDROGEN COMBUSTION DURING A SEVERE ACCIDENT"

During the 493rd meeting of the Advisory Committee on Reactor Safeguards, June 6-8, 2002, we reviewed the recommendations proposed by the Office of Nuclear Regulatory Research (RES) to resolve Generic Safety Issue (GSI)-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident." During this review, we had the benefit of discussions with the NRC staff, a representative of the Union of Concerned Scientists, members of the public, and a representative of the Tennessee Valley Authority. We also had the benefit of the documents referenced.

## RECOMMENDATION

RES should complete its additional analyses to quantify the uncertainties prior to providing the technical assessment results to the Office of Nuclear Reactor Regulation (NRR), and NRR should factor the uncertainties into the final resolution of GSI-189.

## DISCUSSION

GSI-189 was proposed in response to SECY-00-0198, "Status Report on Study of Risk-Informed Changes to the Technical Requirements of 10 CFR Part 50 (Option 3) and Recommendations on Risk-Informed Changes to 10 CFR 50.44 (Combustible Gas Control)." In SECY-00-0198, the staff recommended that safety enhancements that have the potential to pass the backfit test be assessed for mandatory application through the generic issue process.

During severe accidents, ice condenser and pressure-suppression Mark III containments condense steam and concentrate hydrogen to the extent that they would become vulnerable to a hydrogen detonation. In 1980, these plant types were retrofitted with powered igniters and air

return fans[1] to provide controlled burning of the hydrogen over the time period of production to limit the concentration and preclude a hydrogen detonation. During a station blackout (SBO) event, however, alternating current (AC) power to the igniters and fans would not be available. The issue, therefore, is whether it would be feasible and cost-beneficial to provide backup AC power supplies to the igniters and/or the air return fans.

RES conducted an analysis to provide technical input to NRR to support a regulatory analysis for potential backup power options that could be used to resolve this GSI. It consists of a cost/benefit analysis following the appropriate regulatory analysis guidelines.

The scope of the study included the following four options.

1. A pre-staged dedicated diesel generator to provide backup AC power only to the igniters.

2. A pre-staged dedicated diesel generator to provide backup AC power to both the igniters and the air return fans.

3. A low-cost "off-the-shelf" portable diesel generator to provide backup AC power only to the igniters.

4. Use of passive autocatalytic recombiners for hydrogen control in lieu of igniters and/or air return fans.

A fifth option of a low-cost "off-the-shelf" portable diesel generator to provide backup AC power to both the igniters and the fans was considered to be impractical because the required power was deemed to be too large for a portable diesel.

RES performed analyses by using the MELCOR and CONTAIN computer codes to assess the change in the conditional probability of containment failure with and without the availability of AC power. The MELCOR analysis was also used to assess whether the use of igniters alone (without the air return fans) would be sufficient to prevent a hydrogen detonation.

On the basis of its analyses, RES concluded that providing backup power to igniters alone would be sufficient to preclude a hydrogen detonation, and only the low-cost option (Option 3) passed the regulatory analysis cost-benefit criterion.

We believe that these results are highly uncertain, with regard to both the costs and benefits and the judgment that igniters alone would preclude a hydrogen detonation. RES is continuing its technical analysis to better quantify the uncertainties that affect these judgments. We expect that the resulting uncertainty determination will include assessment of the uncertainty related to the use of a control volume code (MELCOR) to determine detailed hydrogen concentration distributions as well as general model uncertainties. As recognized by the regulatory analysis guidelines, the ultimate resolution of this issue should consider these uncertainties. We recognize that the computed cost-benefit ratio based on point values indicates that Option 2, above, does not pass the backfit screening. However, this cost-benefit

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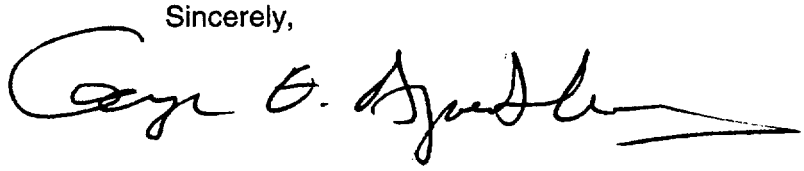
[1] Air return fans are a feature of ice condenser plants only.

ratio is close to being acceptable. When the uncertainties are factored into the assessment, the analysis could yield a different conclusion.

We would like to review the results of the additional analyses and the proposed RES recommendation to NRR for resolving GSI-189.

ACRS member Victor H. Ransom did not participate in the Committee's deliberations regarding this matter.

Sincerely,



George E. Apostolakis
Chairman

References:


1. Memorandum dated May 13, 2002, from Farouk Eltawila, Office of Nuclear Regulatory Research, to John T. Larkins, ACRS, Subject: RES Proposed Recommendation for Resolving Generic Safety Issue 189: "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident."
2. Information Systems Laboratories, Inc. report entitled, "Backup Power for PWRs with Ice Condenser Containments and for BWRs with Mark III Containments under SBO Conditions: Impact Assessment," dated May 1, 2002
3. Brookhaven National Laboratory draft letter report entitled, "Benefit Cost Analysis of Enhancing Combustible Gas Control Availability at Ice Condenser and Mark III Containment Plants," dated April 25, 2002.
4. Draft report entitled, "Hydrogen Control Calculations for the Sequoyah Plant Station Blackout Scenario," April 2002
5. NUREG/CR-5586, "Mitigation of Direct Containment Heating and Hydrogen Combustion Events in Ice Condenser Plants," October 1990.