GT2100211

May 9, 2002

MEMORANDUM TO: Dr. William Shack, Chairman
Materials and Metallurgy Subcommittee

Dr. Graham Wallis, Chairman
Thermal-Hydraulic Phenomena Subcommittee

Dr. George Apostolakis, Chairman
Reliability & PRA Subcommittee

FROM: August W. Cronenberg, ACRS Cognizant Staff Engineer
Paul Boehnert, ACRS Designated Federal Official

SUBJECT: **SUPPORTING DOCUMENTS** FOR THE JOINT MEETING OF THE ACRS SUBCOMMITTEES ON MATERIALS AND METALLURGY, THERMAL-HYDRAULIC PHENOMENA, AND RELIABILITY & PROBABILISTIC RISK ASSESSMENT, MAY 31, 2002, IN ROCKVILLE, MARYLAND

The purpose of this memorandum is to forward written materials for your use in preparing for the joint meeting of the ACRS Subcommittees on Materials and Metallurgy, Thermal-Hydraulic Phenomena, and Reliability and Probabilistic Risk Assessment, for the meeting of May 31, 2002. The subcommittee will review the status of staff efforts at risk-informing 10CFR 50.46 for emergency core cooling systems. These materials include an attached Subcommittee Status Report.

Dr. Shack is scheduled to provide a brief introduction during the meeting. Attendance by the following Members and consultants (S. Banerjee, V. Schrock) is anticipated and reservations are as indicated:

Apostolakis	Residence Inn (May 29-31)	Bonaca	Residence Inn (May 29-31)
Shack	Residence Inn (May 30,31)	Kress	Residence Inn (May 29-31)
Ford	Residence Inn (May 29-31)	Sieber	Ramada (May 29-31)
Wallis	Residence Inn (May 29,31)	Rosen	Ramada (May 28-31)
Ransom	Residence Inn (May 29-31)	Leitch	Residence Inn (May 28-31)
Banerjee	Residence Inn (May 30,31)	Schrock	Residence Inn (May 30,31)

Please notify Ms. Barbara Jo White at (301) 415-7130 if you need to change or cancel the above reservations.

Attachments:

1. Subcommittee agenda.
2. Subcommittee status report.
3. SECY-02-0057: "Update to SECY-01-0133: Fourth Status Report on Study of Risk-Informed Changes to the Technical Requirements of 10CFR50 (Option-3) and Recommendations on Risk-Informed Changes to 10CFR50.46 (ECCS Acceptance Criteria)"
4. INTERNAL MEMO from S. Newberry (RES) to D. Matthews (NRR): "Transmittal of Technical Work to Support Rulemaking for Risk-Informed Alternative to 10CFR50.46/GDC 35" (PRE-DECISIONAL).
5. DRAFT REPORT by G. M. Wilkowski et al, "Technical Evaluation of Probabilistic LBB Codes and Approaches", (Nov. 30, 2001).
6. VIEW-GRAPHS: "Re-evaluation of LOCA Frequency Distributions/Overview" (PRE-DECISIONAL)
7. VIEW-GRAPHS & 1-PAGE QUESTIONNAIRE: "Elicitation of Results and Updated LOCA Frequency Distributions/Questionnaire" (PRE-DECISIONAL)

cc: ACRS Members
P. Boehnert

cc w/o Attach: J. Larkins
S. Bahadur
ACRS Staff

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
JOINT MEETING OF THE ACRS SUBCOMMITTEES ON
MATERIALS AND METALLURGY, THERMAL-HYDRAULIC
PHENOMENA, AND RELIABILITY & PROBABILISTIC RISK ASSESSMENT
MAY 31, 2002
ROCKVILLE, MARYLAND

- PROPOSED AGENDA -

		TOPIC	SPEAKER	TIME
I	Introduction		ACRS	8:30 a.m.
8.	NRC Staff Presentations			
	1.	Introductory Remarks	M. Cunningham, RES	8:40 a.m.
	2.	ECCS Reliability Requirements	M. Drouin/A. Kuritzky, RES	8:50 a.m.
	3.	ECCS LOCA Size Definition	R. Tregoning, RES	10:50 a.m.
			LUNCH	12:30 p.m. - 1:30 p.m.
	4.	ECCS Acceptance Criteria and Evaluation Model Requirements	R. Meyer/S. Bajorek, RES	1:30 p.m.
			BREAK	3:00 p.m. - 3:15 p.m.
	4.	ECCS Acceptance Criteria and Evaluation Model Requirements (Cont'd)		3:15 p.m.
	5)	Rulemaking Activities	S. Lee, NRR	4:15 p.m.
III	Meeting Wrap-up		ACRS	4:50 p.m.
IV	Adjournment			5:00 p.m.

Note: Presentation time should not exceed 50% of the total time allocated for a specific item.
Number of copies of presentation materials to be provided to the ACRS/ACNW - 35.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
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MATERIALS AND METALLURGY, THERMAL-HYDRAULIC
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MAY 31, 2002
ROCKVILLE, MARYLAND

Subcommittee Status Report

PURPOSE

The purpose of this meeting is to discuss the status of the staff efforts and industry initiatives at risk-informing 10CFR50.46 concerning emergency core cooling systems (ECCS) for reactors.

BACKGROUND

The ACRS last met on November 15, 2001, to discuss NRC staff and industry initiatives to risk-inform the technical requirements of 10 CFR 50.46 for emergency core cooling systems (ECCS) for light-water nuclear power reactors (LWRs). At that meeting the staff discussed the background for risk-informing 10CFR50.46 and the changes to Appendix K and General Design Criteria 35 (GDC-35) of 10CFRPart 50 that would be needed to support proposed rulemaking, as outlined in SECY-01-0133. The staff noted that the Commission had not yet voted on SECY-01-0133. Since the Nov. 2001 subcommittee the Commission has ruled that SECY-01-0133 is to be superseded by SECY-02-0057 (attached, "Fourth Status Report on Study of Risk-Informed Changes to the Technical Requirements of 10CFR50 and Recommendations on Risk-Informed Changes to 10CFR50.46 ECCS Acceptance Criteria"). Thus, SECY-01-0133 was closed without vote. The Commission has taken no action to date on SECY-02-0057.

Since the Nov. 15th, 2001 subcommittee, the staff has focused much of its attention on the four principal technical areas related to risk-informing the technical requirements of 10 CFR 50.46 fore ECCS, namely:

a) the ECCS reliability requirements,
b) the ECCS acceptance criteria,
c) the ECCS evaluation model requirements, and
d) the spectrum of break sizes to be considered.

Staff progress with respect to these technical areas can be summarized as follows.

a) ECCS Reliability Requirements:

In SECY-01-0133, the staff recommended changing GDC 35 to ensure an ECCS safety function reliability that is commensurate with the frequency of challenge to the ECCS safety function. This revision would permit use of more risk-informed and realistic approaches for demonstrating ECCS safety function reliability. In place of the assumptions that offsite power is not available and there is a single additional failure, two options would be offered to ensure ECCS safety function reliability:

- ECCS safety function reliability requirements, based on risk information, would define (by generic plant groups) a minimal set of equipment required to meet an established risk guideline, OR

- An ECCS safety function reliability requirement that is commensurate with the LOCA frequency where licensees, on a plant-specific basis, and with appropriate consideration of uncertainties, demonstrate compliance.

The staff continues to recommend the above changes to the ECCS reliability requirements.

b) ECCS Acceptance Criteria:

The staff has also recommended replacing the current prescriptive ECCS acceptance criteria in 10CFR50.46 with a performance-based requirement. This requirement includes demonstrating (a) adequate post-quench cladding ductility and adequate core-coolant flow area to ensure that the core remains amenable to cooling, and (b) for the duration of the accident, maintain the calculated core temperature at an acceptably low value and remove decay heat. Use of a performance-based requirement rather than the current prescriptive criteria would allow use of cladding materials other than Zircaloy or ZIRLO without licensees having to submit an exemption request.

The staff continues to recommend changing the current prescriptive ECCS acceptance criteria in 10CFR 50.46 to add a performance-based option. The technical work to support this change, includes research to explore post-quench ductility of high-burnup Zircaloy cladding. In addition, the staff is evaluating pertinent test data and is in the process of formulating a technical basis to support regulatory guidance.

c) ECCS Evaluation Model Requirements:

The staff has formulated a response to the petition (PRM-50-74; Oct. 4, 2001) by the Nuclear Energy Institute (NEI) for rule-making to amend regulations to allow licensees to voluntarily adopt the most current industry ANS standard for decay heat. As noted on page 5 of SECY-02-0057, the staff is recommending an option to the decay heat requirements in 10CFR50/App.-K that would permit the use of either the current decay-heat requirements based on either the 1971 ANS standard or the updated 1994 ANS model. The staff is now evaluating the uncertainty and conservatism in these models so that proper safety focus is maintained in evaluation of the decay heat models for Appendix-K applications.

d) Spectra of LOCA Break Sizes:

The staff is continuing a feasibility study of redefining the maximum pipe break size required to be considered as part of the ECCS performance evaluation. In 10CFR 50.46, LOCAs are defined as:

> "hypothetical accidents that would result from the loss of reactor coolant, at a rate in excess of the capability of the reactor coolant makeup system, from breaks in pipes in the reactor coolant pressure boundary up to and including a break equivalent in size to the double-ended rupture of the largest pipe in the reactor coolant system."

The feasibility of redefining the spectrum of pipe breaks for this application is dependent on whether the staff can develop an appropriate probabilistic fracture mechanics-based methodology which addresses piping failure based on known degradation mechanisms, unknown future degradation mechanisms, and the complexities of actual leakage detection/assessment. The staff has developed plans and initiated efforts to address these considerations. A major portion of this effort involves developing and modifying several probabilistic fracture mechanics and leak-rate computer codes to reflect present knowledge of pipe failure mechanisms. Additionally, the staff is considering ways to address other failure contributors that would not be analyzed by a probabilistic piping fracture mechanics code. The LOCA frequency analysis currently remains on schedule as well as identification of the pertinent technical issues. Rigorous analysis of LOCA frequencies and the uncertainties to support the redefinition of the spectrum of pipe break sizes is estimated to be complete by July 2004.

In SECY-02-0057, the staff notes that the industry has recently submitted a petition that, if granted, would allow the option of using an "alternative to the currently required double-ended rupture of the largest pipe in the reactor coolant system in ECCS evaluation models." The industry has also requested that the rulemaking sought by its petition be conducted in parallel with the technical work to redefine the spectrum of pipe break sizes, enabling the application of the alternative rule prior to the completion of the technical work.

Additional progress on these matters will be discussed at the May 31, 2002 subcommittee.

EXPECTED SUBCOMMITTEE ACTION

Since most ACRS members are expected to attend this subcommittee meeting, a status report at the next full ACRS Committee meeting of June 6-8, 2002 in not deemed necessary. The subcommittee should identify a time frame for a follow-on subcommittee to assess continued staff progress at risk-informing the technical requirements of 10 CFR50.46 for emergency core cooling systems (ECCS). The subcommittee should also identify specific items it may wish the staff to address during future meetings on the matter.