

May 16, 2000

MEMORANDUM TO: ACRS Members

FROM: **/RA/**  
Noel Dudley, Senior Staff Engineer

SUBJECT: CERTIFICATION OF THE SUMMARY/MINUTES OF THE JOINT ACRS  
SUBCOMMITTEE MEETING ON MATERIALS AND METALLURGY AND  
ON RELIABILITY AND PROBABILISTIC RISK ASSESSMENT  
CONCERNING POTENTIAL REVISIONS TO THE PTS RULE  
ACCEPTANCE CRITERION, APRIL 27, 2000 - ROCKVILLE,  
MARYLAND

The minutes of the subject meeting, issued on May 1, 2000, have been certified as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc: Technical Support Branch  
Operations Support Branch (3 copies)

cc via e-mail:  
J. Larkins  
H. Larson  
S. Duraiswamy  
ACRS Fellows and Technical Staff  
E. Barnard

Issued: May 1, 2000  
CERTIFIED: May 13, 2000

# CERTIFIED

ACRS-3201

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
MINUTES OF JOINT ACRS SUBCOMMITTEE MEETING ON  
MATERIALS AND METALLURGY AND  
RELIABILITY AND PROBABILISTIC RISK ASSESSMENT  
POTENTIAL REVISIONS TO THE PTS RULE ACCEPTANCE CRITERION  
APRIL 27, 2000  
ROCKVILLE, MARYLAND

The ACRS Subcommittees on Materials and Metallurgy and on Reliability and Probabilistic Risk Assessment met on April 27, 2000, to hold discussions with representatives of the NRC staff concerning the draft Commission paper, "Reevaluation of the Pressurized Thermal Shock Rule (10CFR50.61) Screening Criterion." The entire meeting was open to public attendance. Mr. Noel Dudley was the cognizant ACRS staff engineer for this meeting. The meeting was convened at 1:00 p.m. and was adjourned at 3:45 p.m.

## ATTENDEES

### ACRS

G. Apostolakis, Co-Chairman  
W. Shack, Co-Chairman  
J. Baron, Member  
M. Bonaca, Member  
T. Kress, Member

R. Seale, Member  
J. Sieber, Member  
G. Wallis, Member  
N. Dudley, ACRS Staff

### NRC REPRESENTATIVES

M. Cunningham, RES  
E. Hackett, RES  
M. Mayfield, RES

S. Malik, RES  
T. King, NRR  
H. Woods, RES

There were no written comments or requests for time to make oral statements received from members of the public. One member of the public attended the meeting. A list of meeting attendees is available in the ACRS office files.

## INTRODUCTION

Dr. George Apostolakis, Chairman of the Reliability and Probabilistic Risk Assessment Subcommittee, explained that the purpose of the meeting was to review a draft Commission paper concerning options for potential revisions to the pressurized thermal shock (PTS) rule acceptance criteria. He noted that the Subcommittee was introduced to this subject at its March 16, 2000 meeting, concerning the PTS Technical Basis Reevaluation Project.

**POTENTIAL REVISIONS TO PTS ACCEPTANCE CRITERION** : Mr. Mark Cunningham and Mr. Edwin Hackett, RES

Mr. Mark Cunningham, RES, presented a draft Commission paper that provided options and a recommendation for reevaluating the PTS screening criterion. He stated that the purpose of the paper is to obtain an early Commission decision on the staff's recommendation. Mr. Cunningham explained that the PTS rule issued in 1983 is an adequate protection rule with a probabilistic risk assessment criterion of less than  $5 \times 10^{-6}$  through-wall cracks per reactor year. He described how the staff determined the value for the criterion. He noted that the rule assumes that a through-wall crack is equivalent to a large opening in a reactor vessel, which results in core damage.

Mr. Edwin Hackett explained that recent material research results provide a better understanding of material properties such as flaw distributions, irradiation embrittlement correlations, fracture toughness, and beltline fluence calculations. He described how improvements in the fracture mechanics computer code and in the understanding of material properties could result in a more accurate PTS screening criterion.

Mr. Cunningham presented the different regulatory approaches and assumptions embodied in the following Commission guidance:

- Safety Goal Policy Statement,
- Station Blackout and Anticipated Transient Without Scram (ATWS) Rules,
- Backfit Rule, and
- Regulatory Guide 1.174.

On the basis of the above Commission guidance, Mr. Cunningham outlined the following options for revising the PTS screening criterion:

- A. Make no change to the core damage frequency value (CDF) underlying the screening criterion.
- B. Utilize a CDF consistent with those for the Station Blackout and ATWS Rules.
- C. Apply the Regulatory Guide 1.174 principles and acceptance guidelines to define the allowable change in the PTS acceptable CDF.
- D. Apply the Regulatory Guide 1.174 principles and acceptance guidelines assuming CDF and large, early release frequency (LERF) are equivalent.

Mr. Cunningham explained that the staff recommended Option C because it was most consistent with the Commission's most recent PRA policy implementation guidance and would explicitly include the consideration of defense-in-depth and safety margin issues. He stated that the staff plans to issue the draft Commission paper in May 2000.

**DISCUSSIONS**

The Subcommittee members asked what criteria the staff used to differentiate between an adequate protection rule and a safety-benefit rule. The staff stated that there are no criteria and that it uses qualitative judgement. The Subcommittee members and the staff discussed requirements for performing a cost-benefit analysis when revising either type of rule.

The Subcommittee members and the staff discussed the derivation of the present criterion of  $5 \times 10^{-6}$  per year and the allocation of risk between event scenarios. They discussed the uncertainties associated with the mean surface reference transition temperatures and the calculated CDFs used to determine the present criterion. Dr. Apostolakis suggested explaining, in the proposed Commission paper, how the event scenarios were used to determine that the criterion would provide adequate protection.

The Subcommittee members and the staff discussed whether the uncertainties associated with the materials properties were aleatory or epistemic. They also discussed the types of vessel failures that might result from a through-wall crack during a PTS event.

Dr. Kress proposed an additional option, which would include developing processes for deriving a quantitative value for adequate protection, allocating the risk among the PTS event scenarios, and integrating defense-in-depth and uncertainty considerations. He noted that the staff would need to develop a guiding set of principles for these processes and would need Commission approval. The Subcommittee members noted that these principles could be used to guide future efforts related to risk-informing the regulations.

Dr. Bonaca noted that the staff had not determined the amount of work that would be required to implement the different Options. The Subcommittee members and the staff agreed that tools for calculating LERF do not exist and would be time consuming to develop. The staff suggested that LERF values could be derived for specific types of containments and that detailed plant-specific LERF calculations might not be needed. Mr. Sieber recommended that responsibility for deriving and justifying LERF be left to the licensees. The staff noted, however, that it would still have to develop a regulatory guide to describe methods of analysis that would be acceptable.

Dr. Bonaca noted that since the staff stated that the comprehensive evaluation of Option C, which considers risk in terms of LERF and defense-in-depth more explicitly, could show the need for a more restrictive CDF screening criterion, then the staff may not be able to justify Options A and B, which would maintain or relax the present CDF criterion without assessing LERF considerations. He recommended that the staff reviews this issue to determine if Options A and B are indeed justifiable.

The staff stated that it would consider revising the proposed Commission paper based on its discussions with the Subcommittee members.

## **SUBCOMMITTEE COMMENTS, CONCERNS, AND RECOMMENDATIONS**

Mr. John Sieber supported Dr. Kress' proposed option that would include developing guidelines for calculating LERF, allocating risk among principle accident scenarios, and integrating defense-in-depth and uncertainty considerations. He stated that this approach would be complex and would require approval by the Commission. He noted that the guidelines would be applicable to other risk-informed rulemaking efforts. Mr. Sieber also supported Option C because it provides flexibility and places the burden of calculating LERF on the licensees. He stated that Option C would not have as good a technical basis as Dr. Kress' proposed option.

Dr. Bonaca stated that he would support Option C or Dr. Kress' option, if the staff would proceed with it. He stated that Options A and B may not be justifiable because they would allow reduction in the CDF criterion without an appropriate assessment of LERF considerations.

Dr. William Shack recommended not using any option that would require the calculation of LERF. He suggested adopting Option A until further guidance is developed, or adopting Option D that assumes containment failure when the reactor vessel fails and uses LERF as the bounding criterion.

Dr. Thomas Kress stated that a methodology or set of principles for assessing LERF would have to be developed before considering the effects of containment on the criterion.

Dr. Graham Wallis stated that Option A may be the best option until the staff can justify the other options.

Dr. Robert Seale recommended waiting for the staff to develop a process for risk-informing the regulations. He would support Option D if the licensees were allowed to consider LERF. He noted that it is hard to compare Station Blackout and ATWS scenarios with the scenarios that lead to PTS events.

Dr. Apostolakis stated that he did not know enough to make any recommendations on the Options. He suggested that the staff rewrite the Commission paper as a status report instead of recommending an option.

### **STAFF AND INDUSTRY COMMITMENTS**

The staff agreed to brief the full Committee regarding the draft Commission paper at the May 11-13, 2000 ACRS meeting.

The staff agreed to brief the joint Subcommittee on the status of the PTS Technical Basis Reevaluation Project activities in September 2000.

### **SUBCOMMITTEE DECISIONS**

Materials and Metallurgy and Reliability and PRA Subcommittees  
April 27, 2000

The Subcommittee requested that the staff make a presentation at the May 11-13, 2000 ACRS meeting, including a summary of the draft Commission paper, background on the event trees used in the PTS scenarios, and the benefits associated with each option.

The Subcommittee recommended that a report be prepared at the May 11-13, 2000 ACRS meeting, concerning this matter.

**FOLLOW-UP ACTIONS**

None

**PRESENTATION SLIDES AND HANDOUTS PROVIDED DURING THE MEETING**

The presentation slides and handouts used during the meeting are available in the ACRS office files or as attachments to the transcript.

**BACKGROUND MATERIAL PROVIDED TO THE SUBCOMMITTEE:**

1. Draft SECY, "Reevaluation of the Pressurized Thermal Shock Rule (10CFR50.61) Screening Criterion," received via e-mail April 20, 2000.

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NOTE: Additional details of this meeting can be obtained from a transcript of this meeting available in the NRC Public Document Room, 2120 L Street, N.W., Washington, D.C. 20006, (202) 634-3274, or can be purchased from Ann Riley & Associates, LTD., 1025 Connecticut Ave., NW, Suite 1041, Washington, D.C. 20036, (202) 842-0034.

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