



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

March 18, 2011

MEMORANDUM TO: ACRS Members

FROM: John Lai, Senior Staff Engineer */RA/*  
Reactor Safety Branch – B  
Advisory Committee on Reactor Safeguards

SUBJECT: CERTIFICATION OF THE MINUTES OF ACRS SUBCOMMITTEE  
ON RELIABILITY AND PRA REGARDING THE DEVELOPMENT  
OF LEVEL 3 PRA ON NOVEMBER 17, 2010, IN ROCKVILLE,  
MARYLAND

The minutes for the subject meeting were certified on March 8, 2011. Along with the transcripts and presentation materials, this is the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc w/o Attachment: E. Hackett  
C. Santos  
A. Dias  
Y. Diaz

cc w/ Attachment: ACRS Members

**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

MEMORANDUM TO: John Lai, Senior Staff Engineer  
Reactor Safety Branch – B  
Advisory Committee on Reactor Safeguards

FROM: John W. Stetkar, Chairman  
Subcommittee on Reliability and PRA

SUBJECT: CERTIFICATION OF THE MINUTES OF THE MEETING OF THE  
SUBCOMMITTEE ON RELIABILITY AND PRA REGARDING THE  
DEVELOPMENT OF LEVEL 3 PRA ON NOVEMBER 17, 2010, IN  
ROCKVILLE, MARYLAND

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting on November 17, 2010, are an accurate record of the proceedings for that meeting.

/RA/

3/8/2011

Date

\_\_\_\_\_  
John W. Stetkar, Chairman  
Subcommittee on Reliability and PRA

Certified By: John W. Stetkar  
Certified on March 8, 2011

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
MINUTES OF THE MEETING OF THE SUBCOMMITTEE ON RELIABILITY AND PRA  
REGARDING THE DEVELOPMENT OF LEVEL 3 PRA ON  
NOVEMBER 17, 2010, IN ROCKVILLE, MARYLAND**

**INTRODUCTION**

On November 17, 2010, the ACRS Subcommittee on Reliability and PRA held a meeting in Room T-2B1, 11545 Rockville Pike, Rockville, Maryland. The purpose of the meeting was for the staff to brief the Subcommittee on the plan for developing a level 3 PRA.

Mr. Hossein Nourbakhsh was the designated federal official for this meeting. The Subcommittee received no written comments from external stakeholders. The Subcommittee received no request from the public to make oral statements. The Subcommittee Chairman convened the meeting at 1:00 pm and adjourned at 4:53 pm.

**ATTENDEES**

ACRS Members

John Stetkar, Subcommittee Chairman  
Dennis Bley, Member  
Joy Rempe, Member  
William Shack, Member

ACRS Consultant

Thomas Kress

ACRS Staff

Hossein Nourbakhsh, Designated Federal Official

NRC Staff

Christiana Lui, RES  
Donald Helton, RES  
Dan Hudson, RES  
Kevin Coyne, RES  
Marty Stutzke, RES  
Selim Sancaktar, RES  
Raj Iyengar, RES  
Eric Powell, NRO  
Lauren Killian, RES  
Dan O'Neal, RES  
Alan Kuritzky, RES  
Mark Blumberg, NRR

Others

Thomas Zachariah, PWROG  
Doug True, ERIN Engineering

The presentation slides and handouts used during the meeting are attached to the transcript. The presentations to the Subcommittee are summarized below.

### **OPENING REMARKS BY CHAIRMAN STETKAR**

John W. Stetkar, Chairman of the ACRS Subcommittee convened the meeting by introducing the ACRS members and consultant present. Chairman Stetkar stated that the purpose of this meeting was for the Subcommittee to hear the staff's plan for developing a Level 3 PRA. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for the deliberation by the full Committee. The rules for participation in the meeting were announced as part of the notice of the meeting previously published in the Federal Register.

### **SUMMARY OF THE MEETING**

Christiana Lui of RES addressed the Subcommittee with her opening remarks and introduced the staff and the discussion topics for the afternoon.

#### Project Planning

Dan Hudson of RES stated that the last NRC-sponsored level 3 PRAs were conducted over 20 years ago. The results were documented in several NUREG/CR reports and summarized in NUREG-1150.

He stated that the scope of NUREG-1150 was limited to full-power operation with the consideration of internal events and with limited external events for two of the five plants.

He stated that the objectives of developing the new Level 3 PRA were to update the understanding of plant site accident risk, to develop a "risk analysis toolbox", and to provide training for the NRC staff.

He stated that the new level 3 PRA should be comprehensive, integrated with common assumptions, methods, and data, and incorporate state-of-art information.

He briefly discussed the interfaces of working groups for the level 3 PRA scoping study and the schedule for the upcoming activities.

#### Technical Approach

Marty Stutzke of RES showed a diagram of the project scope for the level 3 PRA study. It included single-unit and multi-unit reactor accidents, spent fuel handling and onsite storage accidents, and other release sources such as radioactive waste streams. It excluded risk from routine operations, terrorism, spent fuel transportation, and offsite waste disposal.

He briefly reviewed the previous PRA projects performed ranging from reactor to spent fuel accidents, various reactor operating modes, and different types of analyses from level 1 to level 3.

Marty described the type of risk metrics under consideration for level 3 PRA.

He discussed the perspectives on future uses of level 3 PRA which include better understanding of the risk significance from various contributors in an integrated fashion.

Marty discussed the site selection options and site selection attributes.

Marty then presented a chart with information on various stages of the SPAR models for multi-unit sites, and other available supporting information for specific plants. He stated that it is difficult to draw generic conclusions from a single site PRA study because there are variations in features at the site's location and variations in plant design and operation.

Marty described the experience with the various working groups. For level 1 PRA, there may be a need to go back and refine the SPAR models in order to effectively interface with level 2, external events, and HRA. For external hazards, Marty mentioned that the "big three", i.e., internal floods, internal fires, and seismic events should be quantified and in addition, aircraft impact assessment should also be considered.

Marty discussed the ongoing effort of the HRA working group. There are many different approaches for full power, internal events, level 1 HRA. Some work has been done on shutdown and low power HRA, and spent fuel handling. The staff may apply the HRA methods learned from the fire study in NUREG-1921 to other external events.

Marty described the work done so far for the spent fuel pool by NMSS. He raised the possibility that a feasibility study may be performed to determine if there is a need to include non-spent fuel risks into the level 3 PRA.

Marty described the technical elements proposed by the non-reactor risk working group.

Marty discussed the requirements and goals for the documentation for level 3 PRA. He mentioned that the need to record analyst deliberations is his number one goal.

He discussed the staff training opportunities and options for maximizing the training during the project.

### Level 2 PRA and Interface to Level 3 PRA

Don Helton of RES described the background of modeling techniques for level 2 PRA. He said that three SPAR models were available and they have a number of strengths and weaknesses. He mentioned that an "advanced" dynamic method is under development but is not suitable for a full-scope PRA.

He explained the three options for level 2 PRA. Option 1 utilizes a traditional approach of mapping Level 1 PRA cutsets to plant damage states. These plant damage states are binned into plant damage state bins which are fed into one or more containment event trees. Option 2 is similar to Option 1, but contains some enhancements. It utilizes a combination of existing state-of-the-practice technology and best practices that are not off-the-shelf to link the Level 1 models to the containment event trees. Option 3 attempts to employ the strengths of a dynamic PRA approach, but the dynamic PRA is still under development.

He then discussed some of the technical issues for level 2 PRA. He noted that tighter coupling should be developed among level 2 PRA phenomenological analysis, system response, and operator actions.

## Developing Options for Proceeding

Dan Hudson of RES discussed the pros and cons of different approaches for developing level 3 PRA.

## **DISCUSSION OF AGENDA ITEMS**

Member Bley and Member Rempe asked what the “risk analysis toolbox” contains. Marty Stutzke stated that it contains the SPAR models, SAPHIRE software, handbooks, etc. With the availability of the “risk analysis toolbox”, the user can perform the PRA in a consistent manner.

Consultant Kress suggested use of one index for risk metrics comparison. He suggested use of the “offsite economic cost risk” as the common baseline.

Chairman Stetkar stated that it is a good idea to only collect plant information once for PRA external events hazard analyses.

Chairman Stetkar stated that one should not underestimate the effort for fire PRA analysis at shutdown conditions.

Member Bley stated that there were some studies done by psychologists years ago that people can perform a task well (even though they may not remember it), but not complex cognitive processes during seismic events.

Consultant Kress suggested a way to calculate the risk for spent fuel movements between refueling outages. Member Bley indicated that the Army’s chemical weapons demilitarization program has performed PRAs. Marty Stutzke also mentioned that there was some work done on land mine risks which could be relevant to the spent fuel pool work.

Members and the NRC staff discussed the priority and technical elements of performing the spent fuel pool risk assessments. Members suggested that a review team to follow the work is worth consideration.

Members and the NRC staff discussed the options for staff training. Members stated their experience of sending staff offsite or bringing contractors onsite for training purposes.

Chairman Stetkar asked Don Helton to provide the documents of dynamic methods for PRA to the ACRS members.

Member Rempe asked if uncertainties are quantified in the MELCOR analyses. Will it be significant? Don Helton stated that an uncertainty analysis was done in the context of MELCOR simulations under the SOARCA project.

Members asked why the level 3 PRA working group is not yet established. Member Bley urged that the level 2 working group should include level 3 people. Member Bley also stated that uncertainties should be addressed early for the integration among all phases.

Chairman Stetkar asked if there are any plans for the staff to cooperate with people outside the agency who perform level 2 PRA. Don Helton said that three of the most active level 2 groups are here in the U.S. RES tries to stay engaged in the international community.

Member Rempe suggested that there could be a collaborative approach in which individuals can come from outside to help develop level 3 PRA.

Christiana Lui of RES stated that NEI has shown interest in helping to pilot level 3 PRA work in the context of PRA standards.

### **OBSERVATIONS AND COMMENTS FROM SUBCOMMITTEE MEMBERS**

Following the presentations from the staff, Chairman Stetkar asked if members would like to make comments or observations.

Member Rempe recommended that the staff start narrowing down on preferred options with some vetting of exploring the feasibility to those options, so the staff can have a strong case to present to the Commission.

Member Bley stated that he is delighted to see this project moving ahead. He would like to see uncertainty integrated early for the level 3 PRA development. He is looking forward to seeing the Commission paper.

Consultant Kress stated that he is glad to see that societal risks are captured in the analysis. He would like to see the project supported by the Commission.

Chairman Stetkar stated that he would like to see a level 3 working group formed and reiterated that uncertainty should be treated in an integrated fashion.

### **SUBCOMMITTEE DECISIONS AND ACTIONS**

Staff suggested that another Subcommittee meeting be scheduled to discuss the potential option that the staff advocates. Chairman Stetkar asked the staff to work out the schedule with the ACRS staff. The Chairman then adjourned the meeting by thanking everyone for attending the meeting.

### **BACKGROUND MATERIALS PROVIDED TO THE SUBCOMMITTEE**

1. Notes to J .Lai, "Options for level 2 PRA and Interface to level 3 PRA ", November 2010 (ML103060390)
2. M. Stutzke, "The Advisory Committee on Reactor Safeguards, 'Review and Evaluation of the Nuclear Regulatory Commission Safety Research Program,' NUREG-1635", October 2010 (ML103060386)
3. Notes to J. Lai, "New Level 3 PRA Scoping Study – SECY Paper Development", November 2010 (ML103060385)
4. N. Mamish, "State-Of-The-Art Reactor Consequence Analysis Study and The Proposed New Level 3 Probabilistic Risk Analysis", October 5, 2010 (ML102780604)
5. Staff Requirements Memorandum, "Briefing on Research Programs, Performance, and Future Plans", M100218, March 19, 2010 (ML100780578)

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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, One White Flint North, 11555 Rockville Pike, Rockville, MD, (301) 415-7000, downloading or view on the Internet at <http://www.nrc.gov/reading-rm/doc-collections/acrs/agenda/2010/> or it can be purchased from Neal R. Gross and Co., 1323 Rhode Island Avenue, NW, Washington, D.C. 20005, (202) 234-4433 (voice), (202) 387-7330 (fax), [nrgross@nealgross.com](mailto:nrgross@nealgross.com) (e-mail).

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