



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

January 31, 2008

MEMORANDUM TO: William J. Shack, Chairman, ACRS Subcommittee on Regulatory Policies and Practices

FROM: Harold VanderMolen, Senior Staff Engineer, ACRS

SUBJECT: THE MINUTES OF THE MEETING OF THE SUBCOMMITTEE ON REGULATORY POLICIES AND PRACTICES REGARDING THE STATE-OF-THE-ART REACTOR CONSEQUENCE ANALYSIS (SOARCA) PROJECT ON NOVEMBER 16, 2007 IN ROCKVILLE, MARYLAND

A working copy of the minutes for the subject meeting is attached for your review. Please review and comment on them at your earliest convenience. If you are satisfied with these minutes, please sign, date, and return the attached certification letter.

Attachments: Certification Letter
Minutes

cc w Attachments: ACRS Members

cc w/o Attachments: F. Gillespie
C. Santos
S. Duraiswami
A. Dias
J. Delgado



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FROM: William J. Shack, Chairman, ACRS Subcommittee on Regulatory Policies and Practices

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I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting on November 16, 2007, are an accurate record of the proceedings for that meeting.

/RA/ _____ 5/7/2008 _____
William J. Shack Date
Chairman, Subcommittee on
Regulatory Policies and Practices

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MEETING OF THE ACRS SUBCOMMITTEE ON
REGULATORY POLICIES AND PRACTICES
MEETING MINUTES – NOVEMBER 16, 2007
ROCKVILLE, MARYLAND

INTRODUCTION

The ACRS Subcommittee on Regulatory Policies and Practices held a meeting on November 16, 2007, in Room T-2 B3, 11545 Rockville Pike, Rockville, MD. The purpose of this meeting was to discuss the State-of-the-Art Reactor Consequence Analysis (SOARCA) project. The meeting was closed to public attendance to prevent disclosure of information the premature disclosure of which would be likely to significantly frustrate implementation of a proposed agency action pursuant to 5 U.S.C. 552(b)(9)(B). Dr. Hossein Nourbakhsh was the Designated Federal Official for this meeting. There were no written comments or requests for time to make oral statements. The meeting was convened by the Subcommittee Chairman at 8:30 a.m. on November 16, 2007 and adjourned at 3:14 p.m.

ATTENDEES

ACRS Members

W. Shack, Chairman
S. Abdel-Khalik, Member
G. Apostolakis, Member
J. S. Armijo, Member
M. Bonanca, Member
M. L. Corradini, Member
T. Kress, Consultant
J. Sieber, Member
J. Stetkar, Member
G. Wallis, Consultant
H. Nourbakhsh, Designated Federal Official

Principal NRC Speakers

R. Prato, RES
A. Istar, RES
J Schaperow, RES

Other NRC Staff

S. Bahadur, RES
J. Flack, ACRS
F. Gillespie, ACRS
R. Sherry, RES
R. Sullivan, NSIR
J. Yerokun, RES

Also Present

R. Gauntt, Sandia National Laboratories

A complete list of attendees is in the ACRS Office File and will be made available upon request. The presentation slides and handouts used during the meeting are attached to the office copy of these minutes.

OPENING REMARKS BY CHAIRMAN SHACK

William Shack, Chairman of the ACRS Subcommittee on Regulatory Policies and Practices convened the meeting at 8:30 a.m. Dr. Shack stated that the purpose of this meeting was to discuss the staff's efforts associated with the State-of-the-Art Reactor Consequence Analysis SOARCA Project. He further stated that the Subcommittee would gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee. The meeting was closed to public attendance to prevent disclosure of information the premature disclosure of which would be likely to significantly frustrate implementation of a proposed agency action pursuant to 5 U.S.C. 552(b)(9)(B). Dr. Shack acknowledged that no written comments or requests for time to make oral statements had been received.

DISCUSSION OF AGENDA ITEMS

Introductory Remarks

Dr. Bahadur, the Deputy Division director for Systems Analysis in the Office of Nuclear Regulatory Research provided some introductory remarks regarding the SOARCA project. Dr. Bahadur noted that a previous presentation to the Subcommittee had provided an overview of the project and the approach to be followed, in addition to the initial sequence selection and some preliminary results. Dr. Bahadur noted also that a presentation had been made the previous day to the ACNW on the staff's current thinking on dose thresholds. Dr. Bahadur then went on to introduce Mr. Robert Prato, the SOARCA project manager in Research.

SOARCA Project Overview

Mr. Prato then presented an overview of the SOARCA project. The objective of SOARCA is to develop a state-of-the-art, more realistic evaluation of severe accident progression, radiological release, and offsite consequences for dominant accident sequences.

Mr. Prato went on to describe the approach, which is to use the MELCOR and MACCS codes in an integrated manner to quantify the dominant accident sequences with a complete uncertainty analysis.

Accident sequences

There was considerable discussion between Mr. Prato, Mr. Tinkler, and several Members of the Subcommittee regarding the restriction of the analysis to those accident sequences which were dominant based on core damage frequency, rather than performing a full Level III PRA. The concern was that the use of a cutoff based on a sequence's core damage frequency could eliminate an accident sequence which might have a relatively low core damage frequency but might involve containment bypass or other possibilities of higher consequences given the core damage event. Such a sequence could be a significant contributor to the plant's total risk profile even though this sequence might not be dominant when measured by core damage frequency. Moreover, a group of such sequences might sum up to a significant contribution to the total risk, even though the sequences might individually be below the core damage frequency cutoff.

The essence of the staff's replies was that, although a full Level III PRA would certainly be desirable, performing such a study would go well beyond the scope described in the Commission's Staff Requirements Memo which instructed the staff to perform the SOARCA

project. In addition, the staff felt that the core damage frequency threshold was sufficiently low that it was unlikely that any significant accident sequence would be mistakenly eliminated.

Several Members suggested that the staff, at minimum, provide more complete justification for the choice of 10^{-6} per reactor-year for the core damage frequency threshold.

Modeling

Mr. Prato described a number of improvements to the MELCOR and MACCS models, and also mentioned that some severe accident scenarios are no longer considered credible (e.g., direct containment heating or catastrophic failure of large dry containments). In addition, several regulatory actions such as the ATWS rules and the station blackout rule have reduced the likelihood of severe accidents, and the PRAs have incorporated these changes. The SOARCA program is using the enhanced SPAR models.

Some Members responded by pointing out that the modeling of human behavior is still primitive in these new analyses, and in sequences in the 10^{-6} range, human reliability may be the major factor. The core damage frequency might not be as low as the analyses predict. However, it was also pointed out that the older human reliability models may contain significant conservatism.

Some Members also asked about how the failure probabilities of the various containment systems were included. Mr. Sherry replied that such systems were assumed to be either available or unavailable depending on the availability of the support systems as determined in the Level I analysis. A failure probability was not estimated.

SOARCA Approach

The SOARCA approach is based on full power operation. Plant-specific sequences with a core damage frequency of 10^{-6} (or 10^{-7} for bypass events) were included. There was consideration of external events and of the mitigative measures that have been required of licensees to protect against aircraft impact (the so-called "B.5.b" measures).

- The SOARCA project has performed sensitivity analyses to assess the impact of the different safety measures.
- The accident progression analysis is based on 25 years of research and the consequent development of MELCOR and MACCS.
- The consequence analysis uses a newer MACCS model for off-site dispersion modeling.
- The consequence analysis also used site-specific evaluations of public evaluation based on updated emergency plans.

SOARCA insights

Mr. Prato described the following insights gained during the SOARCA analyses:

- The sequences are dominated by external events, particularly by seismic events. The PWR analyses also include bypass events.
- A number of sequences (alpha mode failure, high pressure melt ejection, ATWS) which were significant in older analyses either had a significantly lower probability of occurrence or were not considered to be feasible.

- The B.5.b mitigative measures significantly lowered the likelihood of core damage or containment failure.

In the ensuing discussion, several Members expressed concern regarding the staff's approach to the treatment of evacuation planning for seismically-initiated events, where the effects of the earthquake (e.g., damaged bridges) could interfere with the population's ability to evacuate or the capability to respond to the event (e.g., preventing firefighting equipment from responding). Currently, the agency does not require the effects of earthquakes to be incorporated into emergency response or evacuation planning, and the staff does not wish to re-open a licensing decision as part of a research effort. Therefore, the staff's approach is to perform a sensitivity study in which the evacuation speed is reduced, and the effect of this slow-down on risk is observed. Several Members criticized this approach, pointing out that, for example, a severe earthquake could damage bridges or render some roads impassible, thereby not slowing down but preventing evacuation. Given a knowledge of the severity of the seismic event, it should be feasible for the project to model the effect on evacuation and emergency response in a more detailed and realistic manner, if this analysis is to be a state-of-the-art, truly realistic evaluation.

Mr. Sullivan also discussed the use of the linear no-threshold ("LNT") assumption in estimating latent cancer fatalities, pointing out that there is disagreement within the NRC staff. The official position of the agency is to use the LNT assumption for regulatory purposes, but SOARCA is intended to be a realistic best-estimate. The ACNW will also be briefed on the details and assumptions of these calculations. However, the ACNW has also expressed a preference for just reporting public dose rather than latent cancer fatalities.

Structural Analyses

Mr. Istar briefly discussed the structural analysis of the Surry plant analysis, but the Subcommittee decided to move on the presentations on initial results without further discussion.

Peach Bottom Results

Mr. Schaperow gave a presentation on the results for the Peach Bottom analysis. Based on the SPAR model for that plant, and with credit for the B.5.b mitigative measures, only the seismically-induced sequences meet the threshold for inclusion in the analysis. These sequences result in a long term station blackout. Based on the health physics position of a five rem per year threshold for latent cancer fatalities, there are no early and no latent cancer fatalities estimated for these sequences. If the B.5.b mitigative measures are not included, the consequences rise to about 25 latent cancer fatalities and no early fatalities. This is far below the estimates of the 1982 siting study, which estimated 92 early and 2700 latent fatalities.

Surry Results

Mr. Schaperow gave a presentation on the results for the Surry analysis. Unlike the Peach Bottom analysis, this time there were four accident scenarios that met the threshold: long term station blackout, short term station blackout, steam generator tube rupture, and interfacing systems LOCA. In the interest of time, Mr. Schaperow focused on the short-term station blackout scenario, which was initiated by an external event (seismic, flooding, or fire). Moreover, some of the other scenarios, e.g., the bypass sequence accident progression analysis without the B.5.b measures, are still in progress. When the B.5.b measures are included, there are no early fatalities and no detectable latent cancer fatalities. Without the

B.5.b measures, the long time to core damage and containment failure are still quite effective in reducing consequences, resulting in few latent cancer fatalities and no early fatalities.

There was some ensuing discussion, with several Members suggesting that a set of sensitivity studies be done to evaluate the impact of the various assumptions individually, particularly the effectiveness of the evacuation and the latent cancer dose threshold.

Discussion

Chairman Shack then opened the meeting for general discussion. The overall discussion was concerned primarily with the upcoming full committee meeting. Some highlights:

- The representative from NSIR pointed out that, for legal reasons, the staff had to be careful not to re-open licensing issues on seismic design and evacuation planning.
- The preliminary results that were presented at this meeting are considered pre-decisional. If the full committee meeting is to be open to the public, these results cannot be discussed in that meeting. The staff does not want this material to be publicly available until all reviews have been completed and the staff is prepared to defend it.
- The sense of the subcommittee is that the methods and the sequences, particularly the sequences involving the loss of a vital AC bus, need to be discussed.
- The Commission would like the full Committee's views on the use of a dose threshold.

The possibility of postponing the full committee discussion to the February meeting was discussed, but the sense of the subcommittee appears to be that the methods and sequences should be discussed at the December meeting, with portions closed to the public if necessary.

SUBCOMMITTEE DECISIONS AND ACTIONS

The members agreed to continue their review of the SOARCA project in a future subcommittee meeting as the staff makes further progress in its analysis.

BACKGROUND MATERIALS PROVIDED TO THE SUBCOMMITTEE PRIOR TO THIS MEETING

1. Subcommittee status report, including agenda
2. Memorandum from Jimi Yerokun, Chief, Special Projects Branch, Division of Systems Analysis, RES to Cayetano Santos, Chief, Reactor Safety Branch, ACRS, "Documents for ACRS Subcommittee Review of SOARCA Project," October 22, 2007 (ML072920389)

Note: Additional details of this meeting can be obtained from a transcript of this meeting available for downloading or viewing on the Internet at <http://www.nrc.gov/ACRSACNW> or can be purchased from Neal R. Gross and

Co., Inc., (Court Reporters and Transcribers) 1323 Rhode Island Avenue, NW.,
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