

**CERTIFIED**  
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MINUTES OF THE ACRS SUBCOMMITTEE ON  
RELIABILITY AND PROBABILISTIC ASSESSMENT  
WASHINGTON, D.C.  
APRIL 30, 1980

The Subcommittee on Reliability and Probabilistic Assessment met with representatives of the NRC Staff and its consultants on April 30, 1980, to discuss the PAS budget, research on the flood program, Interim Reliability Evaluation Program, and the development of quantitative safety criteria. A notice of the meeting appeared in the Federal Register on April 15, 1980. There were no written or oral statements from members of the public. The entire meeting was open to members of the public.

Principal participants at the meeting were the following:

- | <u>ACRS</u>               | <u>NRC Staff and Others</u> |
|---------------------------|-----------------------------|
| D. Okrent, Chairman       | W. Vesely, NRC              |
| J. Mark, Member           | F. Rowsome, NRC             |
| M. Bender, Member         | R. Budnitz, NRC             |
| J. Ebersole, Member       | R. Bernero, NRC             |
| W. Mathis, Member         | W. Bivins, NRC              |
| S. Saunders, Consultant   | M. Temme, IEEE              |
| R. Wilson, Consultant     | A. Garcia, SAI              |
| W. Lowrance, Consultant   |                             |
| W. Kastenber, Fellow      |                             |
| J. M. Griesmeyer, Fellow  |                             |
| G. Quittschreiber, Staff* |                             |
- \*Designated Federal Employee

MEETING WITH THE NRC STAFF (OPEN SESSION)

1.0 Subcommittee Chairman's Opening Remarks

Dr. Okrent, Subcommittee Chairman, introduced the members of the subcommittee and noted the purpose of the meeting. He pointed out that the meeting was

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being conducted in accordance with the provisions of the Federal Advisory Committee Act and the Government in the Sunshine Act and that Mr. Gary Quittschreiber was the Designated Federal Employee for the meeting. He stated no requests for oral statements nor written statements from members of the public had been received with regard to the meeting.

### 2.0 Probabilistic Analyses Staff Research Budget

R. Budnitz, NRC/PES provided some general comments on the NRC research budget noting that the research program as it presently exists and as it has existed in the past is LOCA oriented. It is presently being changed to be risk analysis oriented and will be significantly reoriented toward risk analysis in the future. Budnitz informed the Subcommittee that it appeared certain that the FY 81 budget for the NRC will be cut significantly. Since the research budget accounts for about half of the total NRC budget and, since the non research budget is mostly for salaries, most of the NRC budget cut will come from the research area. The following will be given the highest funding priority in the FY 82 research budget (FY 81 cannot be significantly redirected):

1. Risk Assessment
2. Phenomena of severe accidents and mitigation
3. Plant operational safety
4. Siting
5. Seismic and structural engineering

R. Bernero NRC/PES provided a brief discussion on the ACRS comments on risk assessment in its latest report to Congress on the FY 81 budget and the present activities of PAS. No significant disagreement from members of the Subcommittee were noted; however, suggestions for the following were mentioned:

- PAS should investigate the possible development of a method to uncover design errors.
- PAS should investigate the possible development of a method of quality assurance for reliability analysis.

- PAS should provide ACRS with FY 82 PAS budget and details of action taken on ACRS recommendations in written form by the end of May.

R. Bernero told the Subcommittee that reliability analysis or systematic analysis techniques should be applied to safety review and inspection analysis techniques to evaluate effectiveness. This should be done to determine whether the safety yield is proportional to the resources going into these programs.

### 3.0 Flood Risk Study

Members of the NRC Staff and JBF Associates discussed the presently funded research programs to predict flood occurrence (probabilities versus flood level). A code, FLOE, has been developed and is operational to predict flows. PAS has performed a preliminary analysis of flooding on the Susquehanna River and has calculated  $3 \times 10^{-4}$  for the occurrence of the probable maximum flood (PMF). It was noted that there are two orders of magnitude uncertainty at the 5 and 95% confidence levels. Also, it was noted that occurrence of the PMF does not necessarily mean core damage but may only require certain actions, such as installing protection barriers.

Dr. Okrent expressed his dissatisfaction that the NRC had not brought this matter to the attention of the ACRS and the public at a much earlier date.

Mr. Wagner, NRC/PAS discussed the formal basis for assessing impact of floods on nuclear plants. The importance of the flood event was stated to result from common cause failure of multiple system components submerged in water due to a single event. Okrent suggested that the computer code was interesting but that possibly some knowledgeable individual who knows the plant might arrive at the same answers simply by looking at elevations of critical systems.

### 4.0 Interim Reliability Evaluation Program Status and Findings

The Subcommittee was given a briefing on the IREP evaluation at Crystal River by Mr. A. Garcia, Science Application, Inc.. Mr. Garcia indicated that the

evaluation was much more difficult than had been initially anticipated due to the many interdependencies. PAS does not presently plan to use Crystal River as a model for the IREP for other plants. It is expected that industry will be asked to perform a large portion of the IREP analysis for the remainder of the plants. Rowsome said they were trying to find procedures and approaches that can be readily implemented by utilities instead of the NRC.

Rowsome noted that industry is starting to use risk assessment techniques to justify changes on backfitting. The NRC is welcoming the proposed risk assessment but will not give blanket exemption from ratchets. Rowsome said that a number of companies are volunteering personnel for work in IREP.

#### 5.0 NRC Staff's Program to Develop Quantitative Safety Goals

W. Vesely, NRC/PAS, discussed the schedule for the NRC/RES sponsored program for numerical risk criteria. Vesely said that by late August 1980 they will have some criteria formulated for review. The final report for Senate, Commission and ACRS review will be ready by January 1981. Vesely suggested a one year review of the final report before acceptance. He added that in addition to criteria they will look at the following:

- modeling techniques
- modeling systems
- kinds of equations to use
- what accident sequences to cover
- what quantitative approaches to use
- how to propagate uncertainties
- what data bases to use

W. Vesely suggested that an unacceptability level approach could be used in conjunction with IREP to define what is intolerable to the NRC. This would not replace existing criteria; but, as experience is gained it may replace some of the deterministic criteria such as the single failure criteria. Vesely mentioned three criteria that are being considered.

1. Probability versus Core damage ( $10^{-3}$ /reactor year unacceptability level)



2. Probability versus release category
3. Probability versus health effects ( $10^{-5}$  individual fatality).

#### 6.0 IEEE Program to Develop Quantitative Safety Goals

Mark Temme, representing IEEE, discussed the IEEE Working Group 5.4 organization, objectives, and schedule for development of risk criteria for nuclear power plants. Temme indicated he would like to have the quantitative safety criteria serve as the bases for nuclear safety such that rules, regulations, and regulatory guides would be related to these criteria.

Temme hoped to have a draft standard on safety goals in about one year. Part of the IEEE task will be to demonstrate how the criteria are met.

#### 7.0 Risk Management Framework for LWRs

J. M. Greismeyer, ACRS Fellow, discussed a proposed framework on risk management decision rules for LWRs. He proposed the following as a set of possible acceptable quantitative decision rules:

##### Hazard State Limits

1. Significant core damage  $< 1$  in 200 reactor years
2. Large scale core melt  $< 1$  in 1000 reactor years
3. Large scale uncontrolled release  $< 1$  in 5000 reactor years

##### Individual Risk Limits

- $\leq 10^{-5}$ /year risk of early death
- $\leq 6 \times 10^{-5}$ /year risk of delayed death

##### Societal Risk Limit

- $\leq 10$  equivalent deaths/year due to reactor accidents

##### Societal Risk Reduction

ALARA

### Risk Fee

Pay risk fee to the NRC at a rate equal to the societal risk times the marginal cost limit.

Special science court would hear arguments and make final legal determination of estimated levels of risk.

Subcommittee member comments were favorable toward the approach that Griesmeyer suggested. W. Kastenbergh discussed the application of some of the proposed criteria with regard to specific plants. Application of the criteria looked feasible for the plants discussed.

### 8.0 Comments on Task Force Report, NUREG-0667

J. Ebersole discussed an item in Task Force Report, NUREG-0667. The draft NRC Staff proposal recommends that license applicants be given the option of selecting either primary system cooling (feed & bleed) or secondary system cooling (emergency feedwater) as the acceptable qualified method of cooling the core following a seismically induced loss of main feedwater. It was the general feeling of J. Ebersole that the emergency feedwater system should be seismically qualified. D. Okrent suggested PAS quantify its decision by stating the risk it was accepting.

### 9.0 Consultants Comments on Proposed Criteria and Concluding Remarks

W. Lowrance summarized the general feelings of the Subcommittee with regard to risk criteria. He concluded:

1. quantitative risk ceilings for high technology are needed and are being used.
2. arriving at the numbers to use for the criteria will be very difficult since they cannot be derived empirically.

Lowrance suggested that the hazard state limits be tied together and based on biological health effects. He suggested that the system should be checked to determine the sensitivity of the numbers and the implications for design.

R. Wilson agreed with Griesemeyers approach for separate and societal risk. He felt that it was not the individual that cared about additional risk aversion for large risks but society in general or an individual thinking about society. Okrent and Wilson discussed the problem of having uncertainties for large risks. It was suggested that uncertainties were not so important for individual risk, since for the case of cancer it is not relevant to an individual whether the uncertainty is due to a basic randomness of the cancer process or due to lack of knowledge of the parameters. Uncertainty for societal risk can involve a very large number of people; therefore, more confidence may be needed for large accidents and this should be factored into the risk aversion criteria.

Wilson suggested that any proposed criteria for reactors be tested on other industries, such as chemical industry, so they can be balanced.

A meeting has been scheduled for July 1, 1980 to continue the discussion of quantitative safety goals. Industry will be asked to participate in that meeting with discussion of their specific proposals for safety criteria.

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Note: For additional details, a complete transcript of the meeting is available in the NRC Public Document Room, 1717 H St., N.W., Washington, D.C. 20555 or from International Verbatim Reporters, Inc., 499 South Capitol Street, S.W., Suite 107, Washington, D.C. 20002, (202) 484-3550. Viewgraphs shown at the meeting are provided in the meeting transcript and in the ACRS office file for this meeting.