May 17, 2001

Ms. Shawn Coyne-Nalbach
Standards Administrator
American Nuclear Society
555 North Kensington
LaGrange Park, Illinois 60526-5592

Dear Ms. Coyne-Nalbach:

On January 26, 2001, draft American Nuclear Society (ANS) standard, BSR/ANS-58.21, "External Events PRA Methodology Standard" was made available for public review and comment. We are pleased to have an opportunity to comment on this draft.

PRA quality is a central issue to risk-informed regulation, and one that the Commission has repeatedly raised to the staff. The Commission has also continually looked to the PRA standard to address this issue. Such a standard will provide the NRC staff with a more focused technical review of the PRA, while ensuring safety of decisions, and efficient use of both NRC and industry resources.

Since the American Society of Mechanical Engineers (ASME) and ANS are developing different pieces of the PRA standard, it is essential that close communication continue to occur between the two organizations to ensure both a seamless interface and a complete standard.

The staff has reviewed the subject standard using criteria developed in the staff paper to the Commission, SECY-00-162, "Addressing PRA Quality in Risk-Informed Activities," dated July 28, 2000. Detailed comments are provided in enclosure 1. Our Advisory Committee on Reactor Safeguards (ACRS) met on February 1, 2001, with members of the ANS Working Group developing this standard. The ACRS's comments are documented in its letter of February 9, 2001 to the Executive Director for Operations (enclosure 2). The following is an overall summary of the combined comments.

- The External Hazards PRA standard is found to be well-written and addresses important issues that should be addressed when performing an external hazard risk study.

- The inclusion of the commentary to explain and amplify the supporting level requirements is found to be a particularly useful feature that reduces chances of misinterpretations.

- Specific comments relate to scope, clarification, and interpretation of supporting level requirements and analyses required to meet them.

We hope that these comments will assist the ANS Working Group in developing the final standard. It is our intent to continue to support the ANS in this crucial initiative. Please contact Dr. Nilesh Chokshi at (301) 415-6013 if you have any questions. He is a member of the Working Group and has kept Dr. Budnitz, Chairman of the Working Group informed of the comments as they have been developed.

Sincerely,

/RA/ signed by Thomas L. King

Thomas L. King, Director
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

Enclosure: As stated

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Enclosure 1

COMMENTS ON THE DRAFT STANDARD
BSR/ANS-58.21, EXTERNAL EVENTS PRA METHODOLOGY STANDARD

The staff members of the Office of Nuclear Regulatory Research (RES), the Office of Nuclear Reactor Regulation (NRR), the Office of Nuclear Material Safety and Safeguard (NMSS), and Region II have reviewed the subject standard using criteria developed in the staff paper to the Commission, SECY-00-162, “Addressing PRA Quality in Risk-Informed Activities,” dated July 28, 2000. These comments provide perspectives of users from the different offices with needs for the different applications. This would benefit the ANS Working Group in developing the final standard by allowing it to judge whether the intent of the requirements have been clearly understood and interpreted by knowledgeable users, where more clarifications are needed, where there are gaps and the standard needs to be strengthened, and what needs to be done to facilitate the implementation of the standard. After briefly summarizing overall comments, the comments are separated in two categories as general and specific.

Overall Comment

The draft standard is found to be well-written, and addresses important issues that should be addressed when performing an external hazards risk study.

The inclusion of the commentary to explain and amplify the supporting level requirements is a particularly useful feature of the standard.

Specific comments are provided which relate to scope, clarification, and interpretation of supporting level requirements and analyses required to meet them.

General Comments

Although the scope of the standard clearly states that it is intended for external events PRA of a nuclear power reactor at full power, the basic structure of the analysis and most of the requirements would be directly applicable to external events PRA’s in situations encountered in NMSS. Specifically, for engineered processes, equipment, and structures with nuclear hazards regulated by NMSS much of this standard would apply. One difference is that end states, types of consequences, and target populations for NMSS facilities would differ from a power reactor, and among one another. That is, for NMSS licensees there is a wider array of consequences than CDF and LERF. In general, NMSS potential applications lack the designed-in system-interaction complexity of a power reactor but are instead of a wider variety of types of equipment. Hence, Section 3.4.2 on Systems Analysis for a non-reactor application would emphasize the need to address this variety and unintended system interactions.

The standard does an excellent job of describing all the required tasks, features, and products of a credible and scrutable external events PRA. Specific methods for seismic hazard development and structural response calculations are not given explicitly, but this is the correct approach. These subjects should have their own standards, especially dealing with consensus methods and magnitudes in estimating uncertainties. To a large extent, the lack of specificity in these areas is addressed by the very good list of references.

Of particular value are the emphasis in this standard on justification, documentation, epistemic uncertainty quantification, use of screening and bounding techniques, and peer review. These are the qualities that make for a PRA that, even if not perfect, is scrutable, reviewable, and useable.

From the perspectives of the Accident Sequence Precursor (ASP) Program and the Risk-Based Performance Indicator (RBPI) Program, the standard provides a reasonable basis for developing practical SPAR models for external events for future use in regulatory articles. The standard also appears to be practical and compatible with anticipated efforts to develop RBPIs for external events. The ASP Program uses the Standardized Plant Analysis Risk (SPAR) models to perform its precursor analyses. The SPAR Model Development Plan addresses development of models that span the following: (1) Level 1, Revision 3 SPAR Models - internal event initiators occurring during full power operation; (2) Level 1 models - internal event initiators occurring during shutdown/low power operation; (3) LERF/Level 2 models; and (4) Level 1 models - external event initiators (seismic events, flooding, fires, high winds, etc.). The RBPI development effort utilizes the Level 1, Revision 3 SPAR models to identify risk-significant indicators for the initiating events and mitigating systems cornerstones of safety.

Although the draft standard is well-written, and addresses most of the important issues that should be addressed when performing an external hazards risk study, some specific concerns need to be addressed. The inclusion of the commentary to explain and amplify the supporting level requirements is a particularly useful feature of the standard, and will reduce considerably the inevitable misinterpretation of the brief statements documenting the supporting level requirements. Such a section would prove beneficial to the ASME Standard. However, some of the commentary is unclear (even to someone who has performed several external hazards PRAs) and needs to be more accurate as discussed in the specific comments below.

The overall impression given, however, is that trying to meet many of the supporting level requirements of the standard would require an analysis beyond the capability of current generally available methods. This is particularly true of the hazard analyses (e.g., REQ.-ANA-A2 and REQ.-WIND-A1). For many applications, a conservative estimate of the hazard curve will suffice, without the need to formally quantify uncertainties. Perhaps this is intended to be covered in Section 3.6.4, under high level requirement C. There is somewhat of a lack of parallelism between the demonstrably conservative analysis discussed in HLR-OTH-C and the detailed analysis in Section 3.7. The conservative analysis should follow the same general requirements as in the detailed analysis, but there is no requirement for fragility analysis, even a very conservative fragility analysis, in Section 3.6.4. Instead, there is some discussion in the commentary on REQ.OTH-C4. The treatment of other external hazards might be a good case for different capability categories, as developed in the ASME Standard.

The seismic hazard analysis requirements need to be clear with respect to the use of the LLNL and EPRI hazard curves. For most of the applications envisaged, for example, Option 2 of RIP50, use of the LLNL or EPRI hazard curves should be sufficient. While this is recognized in the text in the first paragraph of Section 3.4.1.1, it is not so easy to find such a statement in Section 3.4.1.3.

The standard does not address mission time requirements for an external events analysis. Currently many internal events analysis are using 24 hour mission times. This may not be adequate to place the plant in a stable condition after an external initiating event. Rather than stating a time, the standard should require the user to determine a time that allows for recovery actions to be complete, and the plant be in a stable mode. If this is less than 24 hours, 24 hours can be set as a minimum.

The standard does not have specific guidance for periodic review and update of the external events risk study. We believe that such guidance should be included.

Specific Comments

Several of the comments are essentially the same that were made on the July 28, 2000 draft, and remain valid for this draft.

Section 1 Introduction

Section 1.1: The standard states that one of its objectives is to "prescribe a method for adapting these requirements for specific applications." The word “adapting” should be changed to “applying” to convey the proper intent.

Section 1.3.3: The discussion on LERF is important and well stated. However, there does not appear to be any specific requirement related to this discussion, nor is there any commentary. For the seismic case, for example, a suitable high level requirement within which to address this issue might be HLR SA-E.

Section 1.4: In Section 1.4, Types of Applications, the standard points out a distinction between it and the proposed ASME Standard on internal events PRA. Unlike the three-category approach used by the ASME Standard, the draft ANS Standard has been written for only one category of PRA capability, corresponding to the ASME Standard's Category II. The ANS Standard then refers to the ASME Standard for a detailed discussion of typical applications. It does not provide any clarification in Section 1.4 about specific applications. According to Section 1.9, "Risk-Assessment Application Process: Section 6," Section 6 of this standard incorporates by reference the requirements found in Section 3 ("Risk Assessment Application Process") of the proposed ASME Standard. That section of the ASME Standard describes requirements for a process that shall be used to determine the capability of a PRA to support various applications. Although an earlier version of the draft ASME standard was reviewed some time ago, the standard has been extensively revised since then to address review comments generated by the industry and the NRC. The latest version of the ASME Standard does not have examples of applications associated with capability categories. Therefore, phrases such as "the applications contemplated for ASME's Category I, II" etc. need to be re-examined.

Section 1.9: This section does appropriately state that only those PRA elements required to support the application need to meet the technical capability level of the standard. It further states that supplementary analyses may be used in place of, or to augment, those elements which do not fully meet the technical capabilities represented by the requirements in Section 3 of the proposed ASME Standard on internal events PRA. The first subsection of Section 6 of the draft ANS Standard, 6.1, "General Requirement," states that the risk-assessment process covered under this standard shall be performed according to the requirements contained in Section 3 of the proposed ASME Standard. These requirements apply except where the ASME Standard's requirement is specific to internal events, whereas the ANS Standard covers external events. The second subsection, 6.2, "Applications Using a Seismic-Margin Assessment or a Screening/Conservative Analysis," states that the Section 3 requirements in the proposed ASME Standard apply equally well to applications using a Seismic Margins Assessment, or a screening or demonstrably conservative analysis that meets the draft ANS Standard. Beyond these references to Section 3, there is no detail in the draft ANS Standard regarding specific applications.

<u>Section 2 Definitions</u>

Several of the definitions are imprecise, confusing, or incorrect. Specific examples include the following:

Aleatory uncertainty: The parenthetic phrase (which must also treat epistemic uncertainty) is inaccurate when referring to the probabilistic model, and should be deleted. The probability model used to reflect the random process may have terms superimposed on it to represent epistemic uncertainty (e.g., the superposition of the second lognormal on the fragility curve to represent uncertainty in the median capacity) but it is not fundamentally the model of the aleatory process.

[The following comments were made on the July 28, 2000 version of the Standard, and still apply.]

Component: As written, this could include almost everything. The examples help, but the definition begs for some qualifying clauses, such as, "that performs a function associated with the operation of systems required to maintain ..., respond to... etc...."

Dependency: This has a clear dictionary definition. Why not replace it with a definition of Dependent Event or Dependent Failure, terms that are more specific to PRA?

Epistemic uncertainty: Second sentence- Suggest adding the words in bold - "Epistemic uncertainty is reflected in **ranges of values for parameters**, a range of viable models, etc."

Event tree: Delete "a quantifiable logical network," and replace by "an inductive logic model."

Failure Probability:The way it is used in PRAs this is better defined as "the probability that a component, system or function fails when demanded, which is often estimated as the ratio of the number of failures to the number of demands."

Failure Rate: As above, for PRA purposes this is better defined as "the probability of failure in a unit time, often estimated as the ratio etc."

Spectral acceleration: Adding the words "pseudo-absolute response" in the definition makes things less, not more comprehensible. Perhaps this is so technical a term that no simple definition can be given?

Uncertainty: uncertainty is not a representation of anything. Uncertainty is better described, in this context, as a measure of the inexactness in the state of knowledge about the parameter values and models used in constructing the PRA. In the context of the PRA standard the uncertainty is epistemic. Delete reference to random variability of a parameter. Random variability is an aleatory uncertainty which is built into the probabilistic structure of the logic model.

Chapter 3 PRA Technical Requirements

Section 3.4.1: The overall impression that the hazard analysis section leaves is of a detailed and demanding set of requirements. Without considerable work, would an average licensee be able to convince himself that the Livermore or EPRI curves would satisfy these requirements? Furthermore, is such a detailed hazard analysis necessary for most applications in a risk informed as opposed to a risk-based environment?

Section 3.4.1.1: The discussion of "levels" of hazard analysis is confusing, and seems to be irrelevant for the purposes of the standard, which should define the minimum set of requirements for a good industry practice hazard analysis. One suggestion is to delete this discussion altogether.

Section 3.4.1.3: The word "all" creeps into some of the supporting requirements, e.g., HAB2, HAC1. Is this appropriate for a standard? Use of the word "all" is avoided in the ASME Standard.

REQ.-HA-A2: Is it appropriate in a standard to say what is preferable? The standard should define the minimum requirement. If the use of peak ground acceleration is acceptable, but is not the preferred method, it would be better to state the requirement in a functional way, e.g., "use the same parameter to characterize hazard for both hazard and fragility," and leave the preferences to the commentary.

Requirement HA-D2 and D3: There is a reference to "the level of analysis identified for REQ. HA-A4." On checking in HA-A4, there is no discussion of the level of analysis. This is a leftover from the previous version.

Section 3.4.2: **High level requirement A**: There is no requirement for a systematic process to identify the "important seismic-caused initiating events and "all other important failures including seismic-induced SSC failures." These could include, for example, SSCs whose failures were screened out on low probability in the internal events PRA model (See related comments on Sections 3.7 and 3.8). Should there be a requirement for something like a seismic FMEA to identify the impact of the potential seismically caused failures on the functions being performed? Such a systematic process would help in the identification of the full impact of the failure. For example, a failure of the supports of a heat exchanger could not only impact the local function of the heat exchanger (providing cooling to the specific location), but could also impact the secondary side by causing a break in that system which would have a much more far-reaching impact by failing cooling to several locations.

REQ.-FR-A1: specifies a scope of fragility determination for systems modeled in the event trees and fault trees. Systems not modeled can cause problems by contributing to flooding or II/I problems. The walkdowns would pick up some of this, but the scoping is done prior to the walkdowns. Fire systems are typically not modeled as part of the internal model, except as a source of makeup, but can be major contributors to flooding. Other unmodeled systems that can contribute to flooding in a seismic event could be nonsafety related closed cooling water systems, and condensate/feedwater or circulating water systems. Using the current screening criteria, these could be missed. Internal risk studies focus mainly on active component failures. Seismic and fire events create scenarios with equipment failures that would not make it past the truncation for their active failures. The screening criteria for this section need to be changed.

REQ.-SA-B3: This is the first time that screening is discussed. It is not stated clearly what is being screened, but presumably it is those seismic failure modes of SSCs that need not be included in the logic model. As a corollary to the comment on HLR-A in Section 3.4.2 above, it would be helpful to have a new supporting requirement that a screening process be defined based on the impact of the failure, or on the basis of the fragility. In the latter case, the discussion or commentary could refer to supporting level requirement FR-B1.

In addition, the issue of correlation is important enough that it should be discussed as a separate requirement.

REQ.-SA-B6: Event and fault tree models are generally constructed so that success states are implicit. It is the successes that provide the success paths. The commentary seems to suggest that the reason why including success states are important is because "some SSCs ... will not fail, or will fail with only a modest probability." The explicit inclusion of success states is more important when the failure probabilities are relatively high, as then the probability of the corresponding success path is lower.

REQ.-SA-B9: Wouldn't this be better placed under HLR-A, since it is an identification issue. Given the concerns about correlations, is it clear that it is only a very small LOCA that is of concern? Is it conceivable that a small LOCA could occur from multiple failures of small pipes?

REQ.-SA-B10: The commentary seems to suggest that the primary treatment is "analyze" the issue away, or modify the plant. This may be seen as encouragement to argue the issue away.

REQ.-SA-D1: It would be helpful to specify what the earthquake specific issues are. Of particular interest are those SSCs not explicitly modeled in the PRA, because their passive failures under nonseismic conditions are considered to be of low probability.

REQ.-SA-E1: In the commentary, the third paragraph is a long discussion of "the typical" systems-analysis approach. While the approach described may have been used, it should not be designated as "the typical" approach. At least one approach that was used for many seismic PRAs, was based more on modifying the event trees and the functional fault trees for each event tree branch rather than the system fault trees. This was generally done assuming complete correlation of seismically caused failures between similar SSCs in locations, which leads to a single seismic failure for a system. Since this paragraph does not do justice to the methods used, appears to be inaccurate in some of its details, and furthermore is unnecessary, it should be deleted. The second and fourth paragraphs are the most important points here.

The issue of screening is discussed in the second paragraph. It is already addressed in SA-B3, and further in FR-B1. Reference should be made to these SLRs. See below for comments on the correlation issue.

REQ.-SA-E2: There is a big difference between "cutset by cutset" and "sequence by sequence." This requirement allows a very large range of flexibility. The intent appears to be to enable the analyst to identify the contributors to the seismic sequences. How this is achieved, and how detailed a breakdown is possible, will be a function of the solution method. The requirement should be rewritten to capture the real intent.

REQ.-SA-E1 and E5: The commentary for both these requirements addresses the need to treat correlation between seismic failures. Req. SA-B3 also deals with this issue in the context of screening. This leads to a rather repetitive set of requirements and discussions. One way to consolidate the discussion would be to have a high level requirement to deal with correlations, and deal with the various aspects of correlations (screening, quantification, sensitivity analyses (HA-E7)) as detailed requirements. In the discussion in SA-E1, references to examples of two acceptable methods are given. Do these methods include the assumption of complete correlation of failure for like components in similar locations? This was an approach used in several seismic PRAs, including the original Zion PRA.

REQ.-SA-E7: The discussion here addresses the full (complete) response correlation raised in the previous comment. While it is certainly useful to try to understand the impact of such an assumption, the performance of sensitivity studies could be very complicated. The modification of the system logic model may have been done on the assumption of a complete correlation. To model a less than complete correlation would require a further modification of the logic model to break out the impact of the seismic event on the different trains of a system for example. Perhaps what is needed is more an understanding, based on other studies, what the potential impact could be. While, in principle, this is an important issue, is there any evidence that it is important from a practical standpoint given the types of applications anticipated?

REQ.-SM-B3: This requirement indicates that offsite power shall be assumed to be lost. The study should also consider the impact of having offsite power available, if it can create conditions that make the event worse. A nonsafety related pump that continues to pump water out of a broken pipe could create problems that would not be analyzed if power is assumed to be lost.

Section 3.6 PRA for "Other" External Events Requirements for Screenings and Conservative Analysis

REQ.-OTH-C3: As written this is both incomplete and too demanding. This requirement should also include each aspect of the PRA model, not just the systems analysis. However, it is not necessary to require an ASME category II approach. What is necessary is that it be demonstrably conservative. All that is required is the second sentence is suitably modified to include each aspect of the PRA model.

REQ.-OTH-C4: This appears to refer to the assembly of the risk determination. A new supporting level requirement related to the assessment of the damage on the plant SSCs (corresponding to the fragility analysis) should be introduced.

Section 3.7 PRA for "Other" External Events

General Comments on Section 3.7

An important requirement that is missing is that there should be a process for identifying those SSCs that are vulnerable to the hazard in question. These SSCs may include ones that are not in the internal events PRA model. The identification of the vulnerable SSCs is an important part of this analysis, since without it, the analysis could be very time consuming and inefficient, and furthermore, could miss the most significant SSCs. As an example, for high wind analyses, it is typical to assume that none of the equipment protected by being inside a tornado proof building is affected by the direct wind effect. However, there are sometimes components such as diesel generator exhaust pipes and air intakes that may not be as well protected. Also turbine buildings are not typically designed for tornadic winds; the metal siding sometimes found on such buildings could come loose and act like missiles with the potential of causing damage to air cooling units on roofs of adjacent buildings. (On further looking into the report, some discussion can be found in the commentary on REQ.-WIND-B1.)

The requirements as written appear to be very demanding with respect to the treatment of uncertainty, see ANA-A2 and ANA-B3, WIND-A1 and WIND-A2. The technology for dealing with some of the external events is not as advanced as it is for seismic events, and cruder methods are used. It should be sufficient to require that the hazard and fragility estimates are conservative, particularly if the CDF is a small contributor to the total. For example, a step function fragility curve, with the step at an appropriately conservative value of the parameter characterizing the hazard may be adequate in many cases. Also, in the calculation of transportation risks, the conservative use of 95th percentile meteorology (X/Q's) is often acceptable and preferred to the quantification of uncertainty with respect to the meteorological data. It is perhaps difficult to see where the distinction between the demonstrably conservative analysis and the detailed analysis begins. Some of this discussion could, if suitably toned down be included in Section 3.6. Written as it is, it is almost a guarantee that no detailed analyses would be performed.

Criteria for screening should consider not just the impact of an increase in equipment failure rates, but also potential impact on the initiating event likelihood. For external events, changes that can impact the hazard curves for existing hazards should also be considered. Aging can impact the likelihood of failure of piping or flexible expansion joints in large water systems. Changes to existing industry outside the facility can change the hazard curves associated with transportation or hazardous substances.

On page 76, the paragraph on Aircraft Impact PRA allows for the use of the DOE standard for the hazard and fragility evaluations. We believe that the DOE standard is consistent with the ANS standard in most aspects; the big difference is in the treatment of uncertainties. While the ANS standard requires or implies the need for a propagation of uncertainties, the DOE standard deals with point estimates, and specifies requirements such that the point estimates will be somewhat conservative.

The use of point estimates (in a conservative fashion) should be allowed for the other events in the ANS standard (in lieu of accounting for uncertainties) and be consistent with the ASME standard in the nature of applications.

Specific Comments on Section 3.7

High level requirement C: The wording should be modified to follow that of HLR-SA-A from the seismic PRA section, since that specifically calls out the need to include "all other important failures ..., including seismic induced SSC failures." The current requirement focuses on initiating events, and the need to include SSC failures caused by the hazard is at best hinted at in the commentary for the supporting requirements.

REQ.-ANA-A1, Pg 79: The last part of the requirement "... to the extent necessary for the purposes of the analysis" is open ended and it leaves it up to the user to determine what is actually required. This comment applies also to requirement ANA-B1.

REQ.-ANA-A2, Pg 79: This requirement calls for the use of an "accepted methodology" without specifying an example of an accepted methodology. On page 8 of the standard, the term "acceptable method" is used as a permissive, and refers to a particular method/reference. In the case of ANA-A2, it is not clear what the accepted methodology is. This comment also applies to requirement ANA-B2, and FLOOD-A3 through FLOOD-A6.

REQ.-ANA-A3, Pg 79: The commentary refers to the ASME PRA standard as one where there are requirements for expert elicitation. The ASME Standard is currently being revised, and it would be prudent to re-visit this commentary after the completion of the ASME standard.

Section 3.8 High Wind Analysis

General Comment on Section 3.8

Many of the references are very old, and some are more than 15 years old. This is indicative that detailed analyses are typically not required. A detailed wind hazard analysis and missile analysis can be very time consuming, and the methods identified as acceptable are essentially the product of a very few consultants (Twisdale for tornados). However, for most nuclear plants, the risk from high winds is very small because the structures are designed for something on the order of F5 tornados. The most vulnerable parts of a nuclear plant are: a) the offsite power connections and distribution system and it is typically assumed that a severe enough event leads to a non-recoverable loss (>24 hours) of offsite power, and b) other components that perform a supporting role, such as diesel fuel oil tanks, and cooling system components such as cooling units which, particularly for the older plants may not be protected and can be vulnerable to both the direct wind effects and windborne missiles. What is missing from the standard is a requirement to perform a detailed search for such components. A focused screening can obviate the need for a detailed wind hazard analysis. (See comment on Section 3.7 above.)

Specific Comments on Section 3.8

Section 3.8.1, Pg 83: In the first sentence, it is stated that "detailed PRA analysis of high winds has been carried out for very few US nuclear power plants ...." According to a working draft of the NRC's IPEEE Insights report, 25 plants have PRAs for high winds (including tornadoes and hurricanes).

High level requirement C: The comment for Section 3.7, HLR C applies here also.

Section 3.9 External Flooding PRA

Section 3.9.1, Pg 88: In the first sentence, it is stated that "Detailed PRA analysis of external flooding has been carried out for very few US nuclear power plants ...." According to a working draft of the NRC's IPEEE Insights report, 14 plants have PRAs for external flooding.

Section 3.9.2, Page 89: The technical requirements for external flooding tend to concentrate on the obvious sources of flooding and rely somewhat on the internal flooding analysis. In several IPEEE analyses, the dominant contributors to external flooding were "secondary" effects, e.g., roof ponding causing the failure of the roof and subsequent failure of equipment in the building, or water leakage through building walls causing failure of electrical equipment along the wall.

Appendix A:

Equation A-2, taken from the Zion PRA is a poor example, since it only contains seismic failures. In general, the Boolean expression should contain a mixture of nonseismic and seismic failures.

Enclosure 2

I

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

February 9, 2001

Dr. William D. Travers
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

SUBJECT: DRAFT ANS EXTERNAL EVENTS PRA METHODOLOGY STANDARD

During the 479th meeting of the Advisory Committee on Reactor Safeguards, February 1-3, 2001, we met with representatives of the American Nuclear Society (ANS) External Events Working Group to discuss draft BSR/ANS-58.21, "External Events PRA Methodology Standard." We also had the benefit of the documents referenced.

The traditionally called "external" events, e.g., earthquakes, high winds, and external floods, have been found to be among the major contributors to risk for many plants due to the potential for dependent failures of plant safety systems. The assessment of these risk contributors requires the integration of a number of diverse technical disciplines and provision for the utilization of expert opinion. Because the occurrence of external events of sufficient magnitude to cause plant damage is rare and statistical evidence is sparse, expert judgment is required to develop the necessary probability distributions for risk assessments. The resulting assessments thus involve large uncertainties.

The ANS Standard does a good job in defining the requirements for a state-of-the-art assessment of the risk (including uncertainties) from external events. The commentary, including notes and references, that accompanies each requirement provides valuable information and guidance for meeting individual elements of the Standard. Thus, the ANS Standard resembles a traditional "design-to" standard.

An important feature of the proposed ANS Standard is that it was designed to be consistent with the standard for internal events under development by the American Society of Mechanical Engineers (ASME) so that users can apply both standards "in concert." We agree with the ANS External Events Working Group that, to achieve this consistency, the two standards must use identical definitions of terms.

The proposed ANS Standard avoids some of the weaknesses that we identified in our letters dated March 25, 1999 and July 20, 2000, concerning the ASME Standard. The ANS Standard provides an approach similar to that of Category II of the ASME Standard. It also provides guidance for seismic margin analyses that corresponds roughly to Category I of the ASME Standard. The ANS Standard, however, provides a good discussion of the limitations of these bounding analyses.

During the meeting, we offered a number of detailed comments on the Standard that the ANS representatives agreed to consider. We look forward to reviewing the proposed final ANS Standard following the reconciliation of public comments.

We commend the ANS External Events Working Group for the quality of this initial effort.

Sincerely,

George E. Apostolakis
Chairman

References:

1. Letter dated January 24, 2001, from Shawn M. Coyne-Nalbach, American Nuclear Society, to Michael T. Markley, Advisory Committee on Reactor Safeguards, transmitting Draft BSR/ANS-58.21, "External Events PRA Methodology Standard" (December 25, 2000).
2. Letter dated July 20, 2000, from Dana A. Powers, Chairman, Advisory Committee on Reactor Safeguards, to William D. Travers, Executive Director for Operations, NRC, Subject: Proposed Final ASME Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications.
3. Letter dated March 25, 1999, from Dana A. Powers, Chairman, Advisory Committee on Reactor Safeguards, to William D. Travers, Executive Director for Operations, NRC, Subject: Proposed ASME Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications (Phase 1).