

D851016

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Palladino:

SUBJECT: ACRS REPORT ON IMPACTS OF NATURAL PHENOMENA ON OFF-SITE
EMERGENCY RESPONSE

During its 306th meeting, October 10-12, 1985, the Advisory Committee on Reactor Safeguards, in response to the oral requests made by Commissioners Asselstine, Bernthal, and Zech during our meeting with the Commission on July 11, 1985, met with the NRC Staff to review and evaluate the relative importance of various natural phenomena which could initiate, or occur in coincidence with, accidents at nuclear power plants and which have the potential for significant impacts on off-site emergency response. The specific matters addressed were:

1. The range of probabilities for the occurrence of various natural phenomena,
2. Their relative potential for causing severe core damage, and
3. Their relative potential for having a significant impact on off-site emergency response.

These matters were also the subject of a joint meeting of our Subcommittees on Site Evaluation and Extreme External Phenomena held on October 9, 1985.

Our evaluations were made in the following context:

1. The probability for occurrence, the severity, and the potential contribution of individual natural phenomena to nuclear power plant accidents are site-specific. The potential impact of various natural phenomena on off-site emergency response is also site-specific. For example, although the effects of hurricanes may be an important consideration for plants located in coastal areas, they would not be important for plants located in the Midwest. Similarly, the effects of blizzards might be a consideration for plants located in the North, but would not be significant for plants located in the Sunbelt.
2. The capabilities of nuclear power plants to resist the impacts of various natural phenomena cover a wide range. For example, plant designs to withstand the impacts of a design basis tornado are based on events that may have a probability of occurrence as low as 10^{-6} /yr. Plant designs to withstand the impacts of earthquakes, on the other hand, are based on events that may have a probability of occurrence of 10^{-2} to 10^{-4} /yr.

3. Warning times in advance of the impact of natural phenomena vary over a wide range. The arrival time of a hurricane or a tsunami may in some cases be anticipated from tens of hours to several days, whereas an earthquake normally occurs without warning. As a result, supplementary precautionary measures that may be taken in preparation for a hurricane are generally not possible in the case of an earthquake.
4. There is a wide variation in the spatial impact of natural events. The extent of the impact of a tornado may be limited to a small area, whereas the impact of a flood, hurricane, or earthquake may be widespread. Although a tornado that strikes a nuclear power plant might have some detrimental effect on the plant itself, the impact on off-site facilities, and particularly on the capabilities for off-site emergency response, might be negligible.

In our evaluations, we reviewed SECY 85-283, "Final Amendments to 10 CFR Part 50, Appendix E; Consideration of Earthquakes in Emergency Planning," dated August 21, 1985 and discussed key issues with our consultants and the NRC Staff. As a result of these deliberations, a considerable amount of data addressing portions of the three items cited above was assembled. On the basis of our review of this information, we make the following observations:

1. Probabilistic Risk Assessments indicate that some natural phenomena, such as heavy rains, blizzards, and fog, are not important as accident initiators. However, because the occurrence of such phenomena is relatively frequent compared to the occurrence of other natural events such as earthquakes and tornadoes, the potential for their occurrence contemporaneously with a major nuclear power plant accident due to some other cause must be taken into consideration in off-site emergency planning. Current regulations recognize this need, and we believe they are adequate.
2. The potential impacts of those natural phenomena, such as hurricanes, external floods, and tsunamis, for which warning times can be provided, can be considerably ameliorated by shutting a nuclear power plant down prior to their arrival. For example, this type of precautionary action was taken by the operators of several East Coast nuclear power plants during Hurricane Gloria in September 1985. The wisdom of incorporating requirements for such actions into the Technical Specifications should continue to be assessed through evaluation of appropriate probabilistic risk assessments on a plant-specific basis. This could also be done as part of the severe accident policy review.
3. At the present time there is some question as to the frequency with which extremely rare, natural phenomena must occur to be considered in off-site emergency planning. We believe that useful guidance on this subject is available in the Standard Review Plan, Section 2.2.3, which provides limitations on off-site hazards that must be considered in nuclear power plant safety evaluations. For example, Section 2.2.3 recommends that off-site events having a probability of occurrence greater than 10^{-6} /yr of causing on-site accidents leading to off-site doses in excess of the limits prescribed in 10 CFR Part 100 must be taken into consideration.

Based on the above considerations and observations, we offer the following recommendations:

1. Our review indicates that, of all natural phenomena, an earthquake is the only event that normally provides no warning of its impending occurrence and that has a significant potential for causing severe core damage and contemporaneous major disruption of off-site emergency response. The peak ground acceleration of an earthquake having this potential, however, is generally considered to be several times the safe shutdown earthquake and its probability for occurrence is low. Nonetheless, because such earthquakes have a finite probability of occurrence, we recommend that such events receive appropriate limited consideration in off-site emergency planning. For further discussion on this matter, see our letter to you of June 10, 1985.
2. The probability for the contemporaneous occurrence of an earthquake that impairs the capabilities for off-site emergency response and a major nuclear power plant accident due to some other cause is extremely remote. For this reason, the contemporaneous occurrence of two such events need not be specifically considered from the standpoint of off-site emergency planning.
3. Of secondary importance, compared to earthquakes, are tornadoes, hurricanes, and external floods. Tornadoes are placed in this category because of their limited spatial impacts and the conservatism that exist in the designs of nuclear power plants to resist their impacts. Although hurricanes and external floods are both of concern because of their potential for causing extended disruptions in the supply of off-site power, the occurrence of these two natural phenomena is preceded, in general, by a warning time of hours to days. This fact, coupled with the fact that nuclear power plants are designed to cope with the impacts of these events, should considerably limit their contributions to severe core damage and the associated need to consider their impacts on off-site emergency response.

Sincerely,

David A. Ward
Chairman

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