

Evacuation Time Estimate Updating

A. Definition of the Regulatory Problem.

In the event of a major accident at a commercial nuclear power plant, radiological harm to the public can be prevented or greatly reduced by appropriate evacuation. During the licensing process, licensees are required to provide estimates of the time needed to evacuate the public from the various sectors and distances of the plume exposure pathway emergency planning zone (EPZ). These evacuation time estimates (ETEs) are used in the planning process to identify potential challenges to efficient evacuation, such as traffic constraints, and help develop mitigative measures. In the event of an accident at a nuclear power plant, ETEs provide information to those on site and to offsite emergency response personnel charged with recommending and selecting protective actions during the emergency, including whether evacuation or shelter-in-place is the better response to the emergency situation.

The current emergency planning regulations are ambiguous on the need to review and update the ETEs following the initial licensing of a nuclear power plant. The staff of the U.S. Nuclear Regulatory Commission (NRC) has observed that licensees have not consistently updated their ETEs, and some licensees have not conformed with recent ETE guidance. Codifying the requirement to update ETEs would provide reasonable assurance that the ETEs in licensee emergency plans and procedures are up to date and that adequate protective measures can and will be taken in the event of a radiological emergency.

B. Existing Regulatory Framework.

Title 10, Section 50.47(b)(10), of the *Code of Federal Regulations* (10 CFR 50.47(b)(10)) and Section IV of Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," provide the regulatory requirements for ETEs. As stated in 10 CFR 50.47(b)(10), "A range of protective actions has been developed for the plume exposure pathway EPZ for emergency workers and the public. In developing this range of actions, consideration has been given to evacuation, sheltering..." Section IV of Appendix E to 10 CFR Part 50, states in part, "The nuclear power reactor operating license applicant shall also provide an analysis of the time required to evacuate and for taking other protective actions for various sectors and distances within the plume exposure pathway EPZ for transient and permanent populations." Section IV.G of Appendix E to 10 CFR Part 50 requires licensees to have provisions to ensure that their emergency plan and its implementing procedures are kept up to date, but this is a general requirement and not specific to ETEs.

In November 1980, the NRC and the Federal Emergency Management Agency (FEMA) issued the initial guidance on developing ETEs in NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," (see in particular evaluation criterion II.J.8 and Appendix 4). Regulatory Guide 1.101, Revision 2, "Emergency Planning and Preparedness for Nuclear Power Reactors," issued October 1981, endorsed NUREG-0654/FEMA-REP-1. The guidance on ETEs in NUREG-0654/FEMA-REP-1 focuses primarily on the development of ETEs but does state, in Appendix 4, that "the evacuation time estimates should be updated as local conditions change (e.g., change in type or effectiveness of public notification system)." In

March 1992, the NRC issued updated guidance on ETEs in NUREG/CR-4831, "State of the Art in Evacuation Time Estimate Studies for Nuclear Power Plants." This guidance states that "as a general rule, a 10 percent increase in population indicates a need to check evacuation times" and "a reevaluation should typically be done every 3 to 5 years."

The NRC's review of licensee ETEs since initial submission indicates that licensees are inconsistent in their periodic review and updating of ETEs; some licensees update their ETEs following the decennial census and others do so at more infrequent intervals. These staff reviews also indicate that some licensee ETEs have not been updated to reflect the newer guidance that has been issued since the publication of NUREG-0654/FEMA-REP-1. In Regulatory Issue Summary (RIS) 2001-16, "Update of Evacuation Time Estimates," dated August 1, 2001, the staff alerted licensees to the possible need to update ETEs based on the 2000 census and discussed a regulatory basis for updating ETEs. It was noted that because the emergency plan is considered to be part of the final safety analysis report (FSAR), in accordance with Section III of Appendix E to 10 CFR Part 50, the updating requirements of 10 CFR 50.71(e) apply. This section states that licensees shall periodically update the FSAR to ensure that the information in the original report contains the latest information developed and is submitted at regular intervals to the NRC. However, 10 CFR 50.71(e) does not specifically mention ETEs and provides no criteria regarding when licensees should update their ETEs. Hence, 10 CFR 50.71(e) provides only a very broad, general basis for requiring the updating of ETEs.

The relatively recent reviews of ETEs in new applications under 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," has highlighted the problem of keeping ETEs up-to-date and consistent with the latest guidance. For an early site permit (ESP) application, 10 CFR 52.17(b)(1) requires that ESP applications identify physical characteristics unique to the proposed site, such as egress limitations, that could pose a significant impediment to the development of emergency plans. Supplement 2 to NUREG-0654/FEMA-REP-1, issued April 1996, provides guidance on developing emergency plans for ESP applicants. As stated in Supplement 2, the ETE analysis is an emergency planning tool that can be used to assess the feasibility of developing emergency plans for a proposed site and refers to Appendix 4 of NUREG-0654/FEMA-REP-1 for guidance on performing an ETE analysis. Each of the four ESP applications submitted to the NRC for review were for sites located adjacent to an operating nuclear power plant site. For emergency planning purposes these are considered to be one site. Three of the ETEs submitted in support of the ESP applications utilized essentially the existing ETE analysis from the emergency plans for the operating plant on the site (the fourth ESP application relied on a new ETE analysis). The staff's review of the ETEs in the ESP applications found that the initial ETE submittals raised questions concerning the methodology and assumptions used in the analyses and that, in general, it was not clear whether the ETEs fully addressed all of the criteria of Appendix 4. This indicates the need for increased regulatory oversight in the review and updating of ETEs.

The staff is focusing increased attention on the use of ETEs in developing and implementing protective actions for the public located within the plume EPZ. In SECY-03-0165, "Evaluation of Nuclear Power Reactor Emergency Planning Basis Adequacy in the Post 9-11 Threat Environment," dated September 22, 2003, the staff recommended a review of NRC protective action recommendation (PAR) guidance, including the efficacy of evacuation versus sheltering.

In a related staff requirements memorandum dated October 3, 2003, the Commission directed the staff to “[c]ontinue to evaluate the NRC protective action recommendation guidance to assure that it continues to reflect our current state of knowledge with regard to evacuation and sheltering. Update the guidance, as necessary.”

In 2004, the staff began a project with Sandia National Laboratories entitled, “Review of NUREG-0654, Supplement 3, Criteria for Protective Action Recommendations for Severe Accidents” (also known as the PAR Study). The objectives of this study were to identify and evaluate alternative PARs that could reduce dose to the public during a radiological emergency and to determine whether improvements or changes to the NRC guidance would be beneficial. The preliminary conclusions of the study include (1) protective action strategies that reduce evacuation time also reduce consequences and (2) improving the quality of the ETEs is important for recommending the best protective action.

In conjunction with the PAR Study, the NRC contracted with Sandia to review and update the NRC guidance on ETEs. The agency issued the results of the Sandia ETE study in NUREG/CR-6863, “Development of Evacuation Time Estimates for Nuclear Power Plants,” in January 2005. This recent guidance integrates new technologies in traffic management, computer modeling, and communication systems to identify additional tools useful in the development of new ETEs or updates to existing ETEs. In terms of the latter issue, NUREG/CR-6863 states that the ETE should be periodically evaluated and updated, taking into consideration the factors that affect population growth and traffic flow to determine their impact on the ETE.

C. Preliminary Options Considered to Resolve the Problem.

1. Take no action.

This option would continue to rely on the current regulatory requirements in Section IV.G of Appendix E to 10 CFR Part 50 and 10 CFR 50.71(e) as the regulatory basis for reviewing and updating the ETEs. As indicated above, these regulations do not address ETEs directly and do not include a specific requirement to periodically review and update licensee ETEs. Because the staff believes the current regulatory scheme does not provide regulatory certainty, it considered this option to be unacceptable.

2. Use voluntary program—issue updated guidance.

This option would involve the issuance of an RIS or an information notice to bring to the licensees’ attention the latest ETE guidance (found in NUREG/CR-6863) and to emphasize the need to periodically review and update their ETEs. The guidance could include specific criteria regarding trigger points for population and infrastructure change to prompt licensees to consider updating their ETEs. However, this option does not provide regulatory certainty that licensees would review and update their ETEs as recommended in the guidance, therefore the staff determined that this option is not adequate.

3. Implement proposed regulation.

Given the results of previous staff examinations of licensee ETEs, the issuance of new updated guidance on ETEs, and the increased emphasis by the NRC on the use of ETEs in the determination of the appropriate protective actions in the event of a nuclear power plant accident, the staff has concluded that the NRC regulations should be amended. The regulations should more clearly require licensees to review and update their ETEs on a periodic basis or when significant changes take place in the infrastructure of an EPZ. By establishing definite requirements regarding the review and updating of ETEs, the NRC and other stakeholders would have reasonable assurance that the ETEs in licensee and offsite emergency response organization emergency plans are up to date. These requirements would also ensure that adequate protective measures can and will be taken in the event of a radiological emergency. Thus, amending the regulations is the best course of action to ensure that licensee ETEs will be periodically reviewed and updated in an organized and systematic manner.

4. Implement some other regulatory scheme.

The NRC rulemaking process offers the opportunity for the public and the nuclear power industry to comment on the proposed changes to the regulations. If another viable scheme is proposed during this process, the staff will review it and, if it could adequately protect public health and safety, propose its implementation to the Commission for consideration.

D. Technical References and Supporting Documents.

- NUREG-0654/FEMA-REP-1, Rev. 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Sections J.8, J.10.l, and J.10.m and Appendix 4, November 1980. The NRC endorsed NUREG-0654/FEMA-REP-1 in Regulatory Guide 1.101, Rev. 2, "Emergency Planning and Preparedness for Nuclear Power Reactors," October 1981.
- NUREG/CR-4831, "The State of the Art in Evacuation Time Estimate Studies for Nuclear Power Plants," March 1992.
- NUREG/CR-6863, "Development of Evacuation Time Estimates for Nuclear Power Plants," January 2005.

E. Potential Responses from Stakeholders.

In a preliminary response to SECY-06-0200, "Results of the Review of Emergency Preparedness Regulations and Guidance," dated September 20, 2006, the Nuclear Energy Institute (NEI) indicated that the industry supports continued improvement in ETEs, but that the criteria requiring more frequent updates must be established to justify the actual need for change. NEI also stated that the NRC should engage FEMA in accepting this proposal and that

regulatory and backfit analysis should be performed in accordance with 10 CFR 50.109, "Backfitting" (NEI Review of Emergency Preparedness Staff Recommendations for Rulemaking, SECY-06-0200, draft November 1, 2006).

FEMA and State and local authorities are expected to support this rulemaking initiative since ETEs of high quality, and that are reviewed periodically and updated in accordance with established criteria, would benefit these offsite organizations and give them increased confidence both for preplanning purposes and for response to an actual emergency.

Meetings with public advocacy groups and the general public during the development of SECY-06-0200 revealed that these stakeholders have a high level of interest in NRC actions that affect offsite protective actions. One of their major concerns is evacuation, especially for high population density sites. The public advocacy groups are therefore expected to support an NRC rulemaking if they perceive it as improving the quality and accuracy of ETEs. However, they may express opposition to the fact that the NRC is not proposing a maximum ETE limit for a site.

NRC staff inspectors and reviewers support ETE rulemaking because it would provide them with clear regulatory requirements and guidance for assessing the adequacy of licensee and applicant ETE submittals.