



# Federal Emergency Management Agency

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Division of Emergency Preparedness  
and Engineering Response  
Office of Inspection and Enforcement  
U.S. Nuclear Regulatory Commission

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SUBJECT: Generic Safety Concerns Regarding Alert and Notification  
Systems

This is in response to your memorandum dated September 15, 1986, in which you requested that FEMA provide further assistance in the formulation of a response to Chairman Zech's memorandum dated August 7, 1986. His memorandum discussed generic safety concerns raised by the Shearon Harris (SH) Licensing Board regarding the adequacy of prompt alert and notification systems at night.

In the SH letter dated May 16, 1986, the Board reached the conclusion that "the practical effect of the FEMA and NRC staff positions on nighttime alerting within the 15 minutes based on sirens and informal alerting are that (1) in the summer, about 10% of the people will not be alerted (more in hot climates) and (2) in the winter in cold climates, 15-30% of the people will not be alerted". The Board based its conclusion with respect to the summer nighttime condition on FEMA's testimony from the SH operating license proceedings. The Board's conclusion relative to cold climates was based on a 1982 NRC contractor analysis titled "Evaluation of the Prompt Alerting Systems at Four Nuclear Power Stations," NUREG/CR-2655, PNL-4226 which projected siren alerting rates under winter nighttime conditions. Ultimately, the Board held that the Commission's requirement of "essentially 100%" means a notification system capable of alerting greater than 95% of the emergency planning zone (EPZ) residents within the first 5 miles. Thus, the SH Licensing Board interpretation of 10 CFR 50 Appendix E regulatory requirements that the "design objective of the prompt public notification system shall be to have the capability to essentially complete the initial notification of the public within the plume exposure pathway EPZ within about 15 minutes" has been equated to alerting greater than 95% of the population within 5 miles of the site (something less than 90% was acceptable in the 5-10 mile area) under probable worst case conditions within 15 minutes. Following is a discussion of FEMA's position concerning the adequacy of the current standards for nighttime conditions in light of the SH Board interpretation of the Commission's emergency notification regulations.

I). The conclusion reached by the Board in response to the hearing contention, was that 91% of the 10-mile EPZ population would be alerted within 15 minutes for summer nighttime conditions. The 91% estimate included an analysis of the acoustical output of the sirens, calculation of the probability that the given sound level would awaken the individuals who reside in the EPZ, and a prediction of the extent to which awakened individuals would informally notify friends, relatives, neighbors and other members of the community. The Board held that

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the predicted 91% was insufficient for the first 5 miles of the EPZ. However, they accepted the system as adequate based on the applicant's commitment to distribute tone alert radios to about 600 homes within the first 5 miles. This raised the expected level of alerting above the 95% threshold. It is important to note that the difference of 4% between the SH Board's accepted level of 95% and the predicted level of 91% represents approximately 24 homes ( $600 \times .04$ ) in the 5-mile zone and is less than 1/2 of one percent of the total number of homes in the 10-mile EPZ. Also, considering the typical summer nighttime meteorological conditions at the SH site, it is unlikely that the entire 5-mile area would be exposed to the plume in the first 15 to 30 minutes under most accident scenarios. This would further reduce the number of households/individuals potentially at risk. If as an example, one quarter of the area was exposed in the first 15 minutes, the fraction of the population not initially alerted that would be subject to additional risk would be approximately 2 to 3 percent (100% less 91% times 1/4). Based on these results, FEMA remains satisfied that the design of the SH alert and notification system, prior to enhancement with tone alert receivers, meets the intent of the Commission regulations.

II). As stated previously, 10 CFR 50 Appendix E requires that the initial notification be essentially completed within about 15 minutes. FEMA believes that the flexibility implied in the phrase "within about 15 minutes" is pertinent to this issue of judging the adequacy of alert and notification systems. This belief stems from an examination of what occurs in the sequence of events during an actual emergency. Most commercial nuclear power plant alert and notification systems rely primarily on sirens to alert the population. However, it is important to note that most plans call for back-up notification by police, fire, and other emergency vehicles which would be deployed during an emergency situation. These backup systems would provide important ongoing benefits in terms of alerting the population residing within 5 miles of the site who may not have received the initial notification within the first 15 minutes. Furthermore, the primary systems, typically sirens, would continue to operate beyond the initial 15 minutes. The repeated sounding of the sirens in conjunction with the abovementioned backup systems would provide an effective means of alerting the fraction of the population not initially alerted.

Thus, FEMA's interpretation of the design objective terminology in 10 CFR 50 Appendix E is to assure that the system provides coverage of the population through primary means within 15 minutes with sufficient backup capability to complete the coverage of the non-alerted population as soon as possible thereafter. This interpretation is consistent with the statements of consideration for the Final Rule on Emergency Planning where "The Commission recognize[d] that not every individual would necessarily be reached by the actual operation of such a system under all conditions of system use." This interpretation is reinforced by two pertinent statements in NUREG-0654/FEMA-REP-1, Appendix 3:

- 1) This design objective does not, however, constitute a guarantee that early notification can be provided for everyone with 100% assurance or that the system when tested under field conditions will meet the design objective in all cases; and,

- 2) That special arrangements will be made to assure 100% coverage within 45 minutes of the population who may not have received the initial notifications within the entire plume exposure EPZ.

The primary system at SH was predicted to notify 91% of the population within 15 minutes. Further soundings of the sirens supplemented by route alerting provide the capability to alert those individuals who may not have received the initial signal.

Based on discussion points in #I and #II, the SH Board decision which prescribed a greater than 95% alerting level within 5 miles of the site in 15 minutes appears to FEMA to be an extreme interpretation of the intent of the Commission's language that "the design objective of the prompt public notification system shall be to have the capability to essentially complete the initial notification of the public within the plume exposure pathway EPZ within about 15 minutes".

III). The other major issue discussed in the SH Board correspondence concerns the adequacy of alert systems under winter nighttime conditions. The members of the Indian Point Licensing Board raised related concerns regarding the adequacy of alert systems during stormy winter nights. The SH Board conclusions were based on the winter nighttime alerting percentages for four plants which were calculated in the NUREG/CR-2655 analysis. These percentages were adjusted upward by the Board by 10 to 20 percentage points based on testimony. The adjusted figures for the four plants predicted a probable range for winter nighttime alerting from 70 to 85%. This corresponds to 15-30 percent of the people who would not be alerted within the first 15 minutes, a condition viewed by the SH Board as not meeting the "essentially complete" regulatory requirement.

However, one of the SH licensing board recommendations in their letter of May 16, 1986, stated that if such alerting levels (70-85%) are acceptable and correspond to an absence of undue risk in the first 5 miles of the EPZ, then the present regulatory language should be clarified and if necessary changed. FEMA believes this recommendation may be appropriate. This belief stems from the options available as protective actions under severe accident conditions. During a release at night (defined as 1 a.m. to 6 a.m. in the SH proceedings) those individuals failing to hear the sirens because they are sleeping indoors would already be in a sheltered condition. The structures providing shelter in the colder climates should provide greater shielding protection and prevention from intrusion than in hot climates. Thus, for the most likely protective action recommendation of shelter during stormy winter nights, there should be virtually no additional risk to the non-alerted population within the first 5-mile zone because they are already in a sheltered situation. For the more unlikely protective action recommendation of immediate evacuation, FEMA questions that a dose savings would result in alerting 95 percent versus 70 to 85 percent of the population in the first 15 minutes in light of the total time required to evacuate residents surrounding nuclear power plants during inclement winter nighttime weather conditions. In the other situation where a precautionary evacuation would be recommended before an impending release, those who may not have heard the sirens initially could still be alerted in time to complete an orderly and effective evacuation.

Under either protective action, shelter or evacuation, during inclement winter nights, it is unlikely that enhancements to the alert systems would substantially increase the overall effectiveness of the emergency response to a given accident

situation resulting in additional protection to the public health and safety. Thus, meeting the absence of undue risk criteria during a stormy winter night condition may not necessarily depend on alerting levels as high as 95% in the first 15 minutes based on the above discussion.

In summary, FEMA currently makes its determination regarding the adequacy of the prompt alert and notification systems based on the standards and criteria set forth in NUREG-0654 Appendix 3 and FEMA-REP-10, "Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants", a document which further clarifies the acceptance criteria. FEMA-REP-10 requires that the siren systems be designed to produce certain minimum outdoor sound levels based on summer daytime weather conditions. Summer is the time least favorable for outdoor sound propagation, therefore, systems designed against this standard are reasonably conservative. FEMA believes that the daytime condition is the situation that is more critically dependent on a high percentage alert of the EPZ population within about 15 minutes, because this is the time when individuals are more likely to be out of doors, thus increasing their potential for exposure.

The SH decision has raised a fundamental question as to what percentage of the persons in the EPZ must receive some sort of alert notice of an emergency in order to protect them from undue risk for all reasonably anticipated conditions. Further review of this issue may be required from a policy perspective.