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GUIDE FOR THE EVALUATION OF ALERT AND NOTIFICATION SYSTEMS FOR NUCLEAR POWER PLANTS

Prepared for:

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INTRODUCTION

The Federal Emergency Management Agency (FEMA), created in 1978, has overall federal responsibility for offsite radiological emergency planning and preparedness functions. This responsibility, which includes coordinating, evaluating, and approving state and local offsite radiological emergency planning and preparedness for commercial nuclear power plants, was officially assigned to FEMA by the President in December 1979. The Nuclear Regulatory Commission (NRC), which is responsible for onsite safety, assesses overall nuclear power plant safety, using FEMA's findings on offsite radiological emergency planning and preparedness. The NRC is responsible for determining whether new commercial nuclear power plants should be licensed and whether existing plants should continue operating. However, new plants can be licensed to begin operating, and existing plants can continue to operate without formal FEMA approval and certification to the NRC on the adequacy of offsite radiological emergency planning and preparedness in accordance with FEMA's rule, Title 44 of the Code of Federal Regulations, Part 350 (44 CFR 350).

FEMA and the NRC jointly developed federal criteria, published in November 1980, for assessing both onsite and offsite nuclear power plant radiological emergency planning and preparedness in a document titled Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG-0654/FEMA-REP-1, Revision 1.* These criteria include 16 planning standards -- 15 related to both onsite and offsite planning and preparedness issues and one related only to onsite safety issues. These 16

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*U.S. Nuclear Regulatory Commission and Federal Emergency Management Agency, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980.

standards are mandated in NRC and FEMA regulations for use in onsite and offsite nuclear power plant radiological emergency planning and preparedness.

FEMA's rule, 44 CFR 350, "Review and Approval of State and Local Radiological Emergency Plans and Preparedness" (September 28, 1983), is the regulation establishing policy and procedures for FEMA review and approval of state and local offsite radiological emergency plans and preparedness. This rule also references the 16 planning standards originally delineated in NUREG-0654/FEMA-REP-1, Revision 1. Of these 16 planning standards, three apply directly to the review and evaluation of alert and notification systems: E, Notification Methods and Procedures; F, Emergency Communications; and N, Exercises and Drills. In addition, NUREG-0654/FEMA-REP-1, Revision 1, Appendix 3, applies directly to alert and notification systems. This guide only elaborates on the three NUREG-0654/FEMA-REP-1, Revision 1, alert and notification system-related planning standards, seven of their 15 evaluation criteria, and requirements in NUREG-0654/FEMA-REP-1, Revision 1, Appendix 3.

In September 1983, FEMA implemented interim guidelines for assessing the adequacy of a nuclear power plant's alert and notification system in a document titled Standard Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants, FEMA-43. Prior to the issuance of FEMA-43, FEMA approvals of offsite radiological emergency plans and preparedness included a caveat statement that the alert and notification systems would be evaluated at a later date. This document supersedes FEMA-43 and addresses the basis for a federal evaluation of the alert and notification aspects of a state and local offsite radiological emergency plan.

The following table indicates the chapters in this guide that address the NUREG-0654/FEMA-REP-1, Revision 1, and Appendix 3, planning standards, evaluation criteria, and requirements that apply to alert and notification systems.

FEMA-43	NUREG-0654/FEMA-REP-1, Revision 1	
	Planning Standard	Evaluation Criteria Included
Chapter 1	E	5, 6
Chapter 2	F	1
Chapter 3	N	1, 2, 3, 5

Each planning standard comprises a separate chapter. To further facilitate cross referencing of this guide, the page numbers of the chapters are prefixed by the NUREG-0654/FEMA-REP-1, Revision 1, planning standard letter (i.e., E, F, and N).

Each planning standard and its associated criteria are quoted within each chapter. Additional guidance and an explanation are provided as follows:

1. Areas of Review. This section briefly describes the scope of the review and defines aspects of the emergency response plan that should be addressed under the evaluation criterion. The applicability to licensee, state, and local plans is as specified in NUREG-0654/FEMA-REP-1, Revision 1, and only those portions of the evaluation criterion applicable to the state and local offsite radiological emergency plans will be reviewed under this guide.

2. Acceptance Criteria. The objective of this section is to define as precisely as possible what will be accepted by the reviewer as adequate. Specific conditions and technical parameters to be satisfied are included, along with a rationale for their use. Whenever possible, acceptance criteria are specified in quantitative terms. Special attention is placed on identifying the information that should be provided to support the review.

The technical and administrative review using this guidance will result in the following acceptability determination:

- Acceptable - meets or exceeds standards; or
- Unacceptable or marginally acceptable - corrective actions recommended.

An element is deficient when FEMA determines that the function or activity is not addressed in a satisfactory manner. A function or activity is not satisfactory when the function or activity does not support a finding that the system is adequate to provide prompt alert and notification of the public in the event of a radiological emergency.

FEMA's ten regional offices prepare both interim and final findings on various aspects of offsite radiological emergency planning and preparedness. FEMA regional offices are assisted in this effort by Regional Assistance Committees comprised of representatives from other federal agencies with expertise in emergency planning and preparedness. These agencies are committed through federal regulations to assist FEMA in reviewing offsite plans. FEMA headquarters and the Federal Radiological Preparedness Coordinating Committee, which is the headquarters counterpart to the Regional Assistance Committees, review final evaluations of offsite radiological emergency planning and preparedness prepared by the FEMA regional offices. The Federal Radiological Preparedness Coordinating Committee includes the following member-agencies: the NRC; the Environmental Protection Agency; and the Departments of Agriculture, Health and Human Services, Commerce, Energy, Interior, Transportation, and Defense. FEMA chairs both the Federal Radiological Preparedness Coordinating Committee and the Regional Assistance Committees. These committees provide FEMA and state and local governments technical offsite radiological emergency planning and preparedness expertise.

This guide has been developed to elaborate upon FEMA's rule 44 CFR 350 and NRC's NUREG-0654/FEMA-REP-1, Revision 1, to provide guidance for meeting planning standards E, F, and N and for reviewing and approving alert and notification systems to the:

- Regional Assistance Committees as they assist state and local government officials in the development of radiological emergency response plans (44 CFR 350.6);
- States in the preparation of an emergency plan and subsequent application for formal review and FEMA approval (44 CFR 350.7);
- FEMA Regional Directors in the evaluation of a state plan (44 CFR 350.11);
- FEMA Associate Director in making a determination of adequacy regarding a state plan (44 CFR 350.12);
- NRC in the review of FEMA's findings and determination on the adequacy of state plans; and
- NRC licensees in their design and documentation of alert and notification systems.

Although efforts have been made to ensure completeness, this document may not cover certain alert and notification situations. Each of these cases will be handled on an individual basis.

This guide is supplemented by four appendices describing procedures for preparation and submission of an alert and notification system design report, design report map requirements, the alert and notification public survey methodology, and routine siren testing procedures and operability requirements. These appendices are:

- Appendix 1: "Procedures for Preparation and Submission of a Design Report Describing Alert and Notification Systems";
- Appendix 2: "A Summary of Design Report Map Requirements";

- Appendix 3: "A Summary of the Alert and Notification Survey Methodology"; and
- Appendix 4: "A Summary of Design Report Routine Siren Testing Procedures and Operability Requirements."

These appendices have been included in this guide to aid licensees and state and local governments in the preparation of an alert and notification system design report.

CHAPTER 1

NUREG-0654/FEMA-REP-1, Revision 1, PLANNING STANDARD E - NOTIFICATION METHODS AND PROCEDURES

Planning Standard E in NUREG-0654/FEMA-REP-1, Revision 1, requires that:

> "Procedures have been established for notification, by the licensee of State and local response organizations and for notification of emergency personnel by all response organizations; the content of initial and followup messages to response organizations and the public has been established; and means to provide early notification and clear instruction to the populace within the plume exposure pathway Emergency Planning Zone have been established."

Evaluation Criterion E.5 in Planning Standard E requires that:

> "State and local government organizations shall establish a system for disseminating to the public appropriate information contained in initial and followup messages received from the licensee including the appropriate notification to appropriate broadcast media, e.g., the Emergency Broadcast System (EBS)."

E.5.1 Areas of Review

Evaluation Criterion E.5 addresses the system(s) used to disseminate information to the public during a nuclear power plant emergency. The review under Evaluation Criterion E.5 ensures that responsible state and local government organizations have adequate administrative procedures to communicate appropriate information to the public and that the physical capabilities exist to disseminate this emergency information.

The public will generally be informed by some form of broadcast media. All appropriate media are encouraged to participate.

E.5.2 Acceptance Criteria

An acceptable emergency plan under Evaluation Criterion E.5 should describe a system of disseminating information to the public that meets the following criteria:

1. Lists the broadcast stations and broadcasting systems that are to be selected so as to ensure that:

   - Transmission signal(s) are of adequate strength within the coverage area under review; and

   - Capability exists to broadcast official information 24 hours a day, 7 days a week. If a selected station does not have a backup power supply, then an alternate station should be identified and included in the emergency plan.

2. Depicts procedures and individual responsibilities for each organization and commitments between agreeing parties to honor these responsibilities in case of an offsite radiological emergency. These procedures should address activation authorization and designate individuals, by title, responsible for notification system activation. Actual authentication codes should not be identified.

3. References or includes some form of documentation, available for review, that states the station's or broadcast system's ability to participate in the public notification process. The emergency plan should identify, by title, points of contact accessible 24 hours a day, 7 days a week. Participation in a "Local Emergency Broadcast System Operational Area Plan" is considered satisfactory.

4. Clearly defines intervals for broadcasting official information statements for each class of nuclear power plant emergency action level. It is recommended that the maximum broadcast interval be no more than 15 minutes (for official information during actual general emergencies) until the emergency is declared officially to be over.

5. Includes a commitment that the Emergency Operations Center (EOC) or the media center will have the capability to monitor the broadcast of official information messages (radio and television). Incorrectly transmitted information should be immediately identified to the station(s) by the EOC's authorized point of contact.

Evaluation Criterion E.6 in Planning Standard E requires that:

> "Each organization shall establish administrative and physical means, and the time required for notifying and providing prompt instructions to the public within the plume exposure pathway Emergency Planning Zone. (See Appendix 3.) It shall be the licensee's responsibility to demonstrate that such means exist, regardless of who implements this requirement. It shall be the responsibility of the State and local governments to activate such a system."

E.6.1 Areas of Review

Evaluation Criterion E.6 addresses the required means to alert and notify the public within a nuclear power plant's EPZ in a situation involving real or potential radiological hazards. Evaluation Criterion E.6 requires the establishment of both the administrative procedures and the physical means for notifying the public within an EPZ.

The administrative procedures must describe the interaction of the various organizations, as well as the responsibility of each organization in this linkage. Activation of the alert and notification system includes all actions from the process by which a decision to alert the public is made, through the communications chain, to the actual capability to provide an alert signal and instructional message within a nuclear power plant's EPZ. The implementation of an alert and notification process commences with a telephone call from onsite personnel to offsite personnel responsible for activation of the alert and notification system.

The physical means must address the methods and equipment incorporated for alerting the public. A fully effective alerting system may employ a number of means which could include, but not be limited to, a combination of the following physical methods: fixed sirens; mobile siren vehicles; tone alert

radios; aircraft; automatic telephone dialers and switching equipment; modulated power lines; and police, fire, and rescue vehicles or personnel. Accordingly, a coordinated program of alert and notification system development, implementation, and routine testing and maintenance is encouraged. Regardless of the physical means (or any combination thereof) selected and implemented, Evaluation Criterion E.6 requires that the licensee provide a design report describing the alert and notification system. During FEMA's review of the alert and notification system, the design report will be reviewed and must be determined to be acceptable prior to activating the system for the purposes of conducting a public telephone survey to satisfy the alert and notification aspects of 44 CFR 350.9(a).

E.6.2 Acceptance Criteria

An acceptable design report under Evaluation Criterion E.6 should describe how the administrative procedures and the physical means are utilized to ensure initial alert and notification of the public within a nuclear power plant's EPZ and how these administrative procedures and physical means can and will be consistent with 44 CFR 350.12(b)(1). The development and use of innovative, cost-effective approaches is encouraged when notifying and providing prompt instruction to the public within a nuclear power plant's EPZ.

Administrative Procedures

A description of acceptable administrative procedures should include, at a minimum:

- Specification of those organizations or individuals, by title, responsible for activating the alert and notification system, including any alternates necessary

to ensure that such organizations or individuals will be notified and mobilized in time to perform their responsibilities.

- Discussion of the alert and notification activation procedures and an analysis of the amount of time required to implement these procedures, demonstrating that once the appropriate official has decided to activate the alert and notification system, the 15-minute design objective of NUREG-0654/FEMA-REP-1, Revision 1, p. 3-3 (discussed below), will be met.

- Specification of procedures and safeguards employed to ensure that a legitimate and clearly understood command to activate the alert and notification system is conveyed from the appropriate officials to the persons responsible for physically activating the system, and that these persons recognize, understand, and take appropriate actions in response to such a command.

Physical Means

As specified in Appendix 3 of NUREG-0654/FEMA-REP-1, Revision 1, the physical means must effectively alert the public:

"The minimum acceptable design objectives for coverage by the system are:

a) Capability for providing both an alert signal and an informational or instructional message to the population on an area wide basis throughout the 10 mile EPZ, within 15 minutes.*

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*NUREG-0654/FEMA-REP-1, Revision 1, (page 11) also contains the following footnote regarding EPZ size determinations:

"These radii are applicable to light water nuclear power plants, rated at 250 MWt or greater. The FEMA/NRC Steering Committee has concluded that small water cooled power reactors (less than 250 MWt) and the Fort St. Vrain gas cooled reactor may use a plume exposure emergency planning zone of about 5 miles in radius and an ingestion pathway emergency planning zone of about 30 miles in radius. In addition, the requirements for the alerting and notification system (Appendix 3) will be scaled on a case-by-case basis."

b) The initial notification system will assure direct coverage of essentially 100% of the population within 5 miles of the site.

c) Special arrangements will be made to assure 100% coverage within 45 minutes of the population who may not have received the initial notification within the entire plume exposure EPZ."

An effective alert and notification system may include more than one physical alerting method. Each physical means should be addressed in the design report. The design report must show that the integrated physical alerting system meets the above criteria. The design report should also address each major system component as specified in the following sections in this guide. The alert and notification method for institutions (such as recreational areas, schools, factories, hospitals, shopping centers, jails, and large office buildings) should be analyzed on a case-by-case basis and documented in the design report (see section E.6.2.4.2 of this guide, "Use of Institutional Alerting Systems"). The basis for any special requirements or exceptions should also be included in the design report. The design report, where appropriate, must include maps of a nuclear power plant's EPZ (see Appendix 2: A Summary of Design Report Map Requirements). The intent of the design report should be to demonstrate that the guidelines of NUREG-0654/FEMA-REP-1, Revision 1, and Appendix 3, are satisfied.

The following sections address the acceptance criteria for components comprising a totally integrated alerting system.

E.6.2.1 Fixed Sirens

Wherever proposed as part of an alert system, the siren system design and its routine testing procedures and maintenance program should be documented in the design report (see Appendix 4: A Summary of Design Report Routine Siren Testing Procedures

and Operability Requirements). The design report should also include maps depicting siren sound contours for C-weighted sound pressure levels (see Appendix 2: A Summary of Design Report Map Requirements), a description of how the sound pressure level contours were calculated, and any assumptions used including those from NUREG-0654/FEMA-REP-1, Revision 1. The sound contours may be based on Appendix 3 of NUREG-0654/FEMA-REP-1, Revision 1, including the use, in the absence of intervening topographical features, of the 10 dB loss per distance doubled sound attenuation factor used in FEMA CPG 1-17.* However, topographical features that act as sound barriers must be considered in such contour calculations. If the FEMA CPG 1-17 attenuation factor is not used, the design calculation should, at a minimum, account for the effects of topographical features, temperature, relative humidity, wind direction, wind speed, measured siren sound output, and siren location and height. Average summer daytime weather conditions may be used. Average daytime should be that period of time, during the day, that meteorologists define as representing neutral or unstable weather conditions.

To facilitate FEMA's evaluation of the computation, the design report should contain plant meteorological tower data representing 3 months of summer daytime conditions. The following parameters, taken from the lowest and intermediate tower positions, should be included: wind speed, wind direction, temperature, relative humidity or dew point, and barometric pressure. The data may be averaged or presented in an hourly format.

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*Federal Emergency Management Agency, "Outdoor Warning Systems Guide," CPG 1-17, March 1, 1980.

The reasonableness of the method for determining the siren sound output and the resulting siren sound pressure level contours should be documented in the design report. The validity of the sound pressure level contour calculation depends upon the validity of the determination of siren sound output at 100 feet from the siren. There are at least two ways to determine siren sound output:

- Onsite field measurements around at least one of each type of siren used within the EPZ; or
- Anechoic, semi-anechoic, or reverberation chamber tests in a qualified laboratory on sirens that are representative of each type of siren used within the EPZ.

Since consensus standards are not available for field and chamber siren measurements, the rationale for the employed measurement procedures must be detailed in the design report.

The design report should provide a list of all sirens and should contain the following information for each siren: unique identifier, siren type, sound output in dBC at 100 feet, and mounting height.

The design report demonstrates compliance with NUREG-0654/ FEMA-REP-1, Revision 1, criteria for those geographical areas covered by fixed sirens by showing that either:

- The expected siren sound pressure level generally exceeds 70 dBC where the population exceeds 2,000 persons per square mile and 60 dBC in other inhabited areas; or
- The expected siren sound pressure level generally exceeds the average measured summer daytime ambient sound pressure levels by 10 dB (geographical areas with less than 2,000 persons per square mile).

If the design report documents that the siren sound pressure levels exceed a measured ambient by 10 dB, then the following information should be provided:

- A description of how the average summer daytime ambient sound pressure levels were determined, including survey locations and the rationale for their selection;
- Identification of actual measurements including frequency range, time span, and location;
- Any assumptions used to determine the measured ambient along with rationale for those assumptions;
- Relationships of population density to measured ambient levels;
- Effects of major transportation routes; and
- Effects of any commercial activities in the area.

If the estimated siren sound pressure level does not generally meet the specified level based on either population density or a 10 dB differential between the measured average summer daytime ambient sound pressure level and the estimated siren sound pressure level, the siren system should be enhanced by the addition of sirens or by other alerting methods. These methods must be described in the design report.

Once the siren system is installed and operational, the licensee should develop and implement a routine siren testing and operability program (see Appendix 4: A Summary of Design Report Routine Siren Testing Procedures and Operability Requirements). This routine siren testing and operability program should include regularly scheduled testing of the siren system including but not limited to: silent, growl, and full-scale tests. NUREG-0654/FEMA-REP-1, Revision 1, suggests the following frequency:

- Silent tests should be conducted at least every two weeks;
- Growl tests should be conducted at least quarterly and whenever preventive maintenance is performed;
- Full-scale testing should be conducted at least annually and as required for formal exercises; and

- Other siren testing programs will be reviewed on a case-by-case basis.

The maintenance of the siren system should include prompt repair of any components not performing as expected during a test. This maintenance program should also include records of tests and repairs performed. The operability of a siren system is considered acceptable when an average of 90% of the sirens (as determined by a simple average of all regularly conducted tests) can be demonstrated as being functional over the 12-month period immediately preceding the submittal of the design report. Special conditions (e.g., siren systems that have not been operational for 12 months) will be considered on a case-by-case basis. A description of the routine siren testing procedures and a summary of the operability records should be included in the design report. This summary should contain a description of the computations used to determine the average operability of the siren system.

E.6.2.2 Mobile Siren Vehicles

Whenever mobile siren vehicles* are employed as part of the primary alerting system, the rationale for their use should be documented in the design report. A comprehensive description of the individual mobile siren configuration(s) and routine siren testing procedures and operability program (see Appendix 4: A Summary of Design Report Routine Siren Testing Procedures and Operability Requirements) should also be included in the design report. This description should specify those aspects of the

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*Mobile siren vehicles, as discussed in this section of the guide, are dedicated warning vehicles and do not include police, fire, or rescue vehicles. For acceptance criteria related to the use of police, fire, or rescue vehicles, see section E.6.2.4 of this guide, "Special Alerting."

siren design ensuring that the mobile siren vehicle is recognized by the public as part of a nuclear power plant's alert and notification system rather than mistaken for an emergency vehicle requiring clearance of the roadway. Furthermore, sound attenuation computations should be included in the design report. These sound attenuation computations should be made in order to predict distances, perpendicular to the vehicle's direction of travel, where 60 dBC and 70 dBC sound pressure levels occur. The attenuation calculations for mobile siren vehicles, a description of how the sound pressure level distances are calculated, and a discussion of how a vehicle's planned speed provides an effective signal duration to alert the intended population should be included in the design report.

Furthermore, the design report should include a description, including any assumptions made, of any analyses or calculations necessary to verify that individuals within the mobile alert areas can be provided an alert signal and informational message within 15 minutes of the initial decision to activate (or within 45 minutes of such decision when the design objective is to ensure coverage of a population who may not have received the initial notification). Such calculations should include conservative estimates of the time required to execute any necessary procedures, to obtain or position any necessary equipment, and to conservatively estimate equipment capabilities. When the individual responsible for activating the alert system does not directly control the necessary equipment or personnel responsible for activating the alert system, the design report should contain or reference suitable written agreements. These written agreements should ensure that the individual responsible for activation can place such equipment or personnel under his or her control within the times estimated in the design report.

The geographical areas covered by mobile siren vehicles should be clearly delineated on the map(s) submitted with the design

report (see Appendix 2: A Summary of Design Report Map Requirements). The proposed route and elapsed time (measured from the initial time of alert) of each vehicle along its route should be shown in the design report. The geographical areas along the routes should be covered by sound pressure levels as indicated below:

- Areas with population densities below 2,000 persons per square mile, equal to or above 60 dBC; and
- Areas with population densities above 2,000 persons per square mile, equal to or above 70 dBC.

In accordance with this guide's discussion of fixed sirens (see section E.6.2.1, "Fixed Sirens"), the design report should state when the ambient background noise level has been determined to be less than 50 dBC. The mobile siren coverage should be computed and depicted to show coverage at least 10 dB above the average measured outdoor daytime ambient.

If the design report depicts mobile siren sound pressure levels exceeding the average measured outdoor daytime ambient by 10 dB, the following information should be provided:

- A description of how the average summer daytime ambient sound pressure levels were determined, including survey locations and the rationale for their selection;
- Identification of actual measurements including frequency range, time span, and location;
- Any assumptions used to determine the measured ambient along with the rationale for these assumptions;
- Relationships of population density to measured ambient levels;
- Effects of major transportation routes; and
- Effects of any commercial activities in the area.

In summary, mobile siren vehicles satisfy NUREG-0654/FEMA-REP-1, Revision 1, criteria when:

- The expected siren sound pressure level generally exceeds 70 dBC where the population density exceeds 2,000 persons per square mile and 60 dBC in other inhabited areas;

- The expected siren sound pressure level generally exceeds the average measured summer daytime ambient sound pressure levels by 10 dB (geographical areas with less than 2,000 persons per square mile); or

- The sound produced by a mobile siren vehicle is of such nature and duration along its route that it can be clearly recognized by the public as a part of a nuclear power plant's alert and notification system.

Total elapsed time for mobile siren alerting (including vehicle transit time to initiation of the route) should not exceed 45 minutes when the design objective of the mobile siren usage is to ensure coverage of the population who may not have received the initial notification.

E.6.2.3 Tone Alert Radios

A tone alert radio is defined in this guide as a radio receiver containing circuitry that allows the radio to receive a signal that can activate an audible tone and provide a voice message. If tone alert radios are proposed as part (or all) of a nuclear power plant's alert and notification system, the rationale for their use should be included in the design report. The design report should also contain a description of the tone alert radio(s) utilized, including: the manufacturer, the model number, any operating instructions, and photographs. The geographical area covered by tone alert radios must be indicated on the map(s) submitted with the design report (see Appendix 2: A Summary of Design Report Map Requirements).

Although absolute control of tone alert radios is forfeited once they are given to the public for use in residences, the following steps can be taken to ensure that the public (in geographical areas where the radios are used as a primary alerting method) is offered the opportunity to benefit from the

availability of tone alert radios. At a minimum, an effective and continual tone alert radio distribution and maintenance program should be established that includes the following:

- Tone alert radios should be offered to the public in geographical areas (where needed) and a "best-effort" attempt must be made to place the radios. A record system (register) containing an accurate list of addresses (names are optional) must be maintained for those geographical areas using the tone alert radios. The addresses of residents refusing tone alert radios should also be noted.

- A maintenance program offering operating checks should be available at least annually to the public in geographical areas using the tone alert radios. This maintenance program and the register program (mentioned above) may be integrated.

- Tests offering the public a means to self-test its receivers are desired at least monthly. However, a final determination of testing frequency rests with appropriate state and local government officials. These test results need not be monitored.

- Written guidance should accompany the tone alert radio. These instructions should address, where applicable, a tone alert radio's:

  - General usage;
  - Self-testing frequency and method;
  - Suggested location (to facilitate efficient monitoring);
  - Maintenance program; and
  - Telephone numbers for repair or replacements.

  As a reminder, this written guidance should be provided annually to each tone alert radio recipient. This portion of the tone alert program may also be integrated with the register and maintenance programs (mentioned above).

- A determination should be made that the broadcast medium for initiating the tone alert signal has adequate availability (24 hours a day, 7 days a week), signal strength, and signal quality.

When a tone alert program (as defined above) has been implemented, NUREG-0654/FEMA-REP-1, Revision 1, criteria are satisfied for the tone alert portion of an alert and notification system.

E.6.2.4 Special Alerting

As indicated in NUREG-0654/FEMA-REP-1, Revision 1, Appendix 3, certain alerting methods may be more cost effective than sirens, mobile siren vehicles, or tone alert radios. Since special alerting methods encompass a broad variety of innovative alerting techniques, it is not possible to cover all situations within this guide. The following examples provide only general guidance regarding special alerting methods:

- Use of institutional alerting mechanisms (e.g., in schools, factories, hospitals, shopping centers, jails, hotels, motels, centralized offices, recreational areas, and government and military installations);
- Use of aircraft for alerting (equipped with either loudspeakers or leaflets);
- Use of automatic telephone dialers/switching equipment;
- Use of modulated power lines; or
- Use of police, fire, and rescue (emergency) vehicles or personnel (e.g., in an extremely sparsely populated area, it may be more cost effective to have law enforcement, fire protection, rescue, or other personnel alert households by a vehicle's public address or siren system, or by personal contact).

E.6.2.4.1 General Acceptance Criteria For Special Alerting Methods

The design report should include a detailed description of each special alerting method and the rationale for employing this method as a proposed part (or all) of an alert and notification system. In addition, the map(s) submitted with the design

report (see Appendix 2: A Summary of Design Report Map Requirements) must indicate the areas alerted by the special method(s). The design report should also contain a description, including any assumptions made, of any analyses or calculations necessary to verify that individuals within a special alerting area can be provided an alert signal and informational message within 15 minutes of the initial decision to activate (or within 45 minutes of such decision when the design objective is to ensure coverage of a population who may not have received the initial alert and notification). Such calculations should include conservative estimates of the time required to execute any necessary procedures and to obtain or position any necessary equipment and should conservatively estimate equipment capabilities. When the individual responsible for activating the alert and notification system does not directly control the necessary equipment or personnel responsible for activation, the design report should contain or reference applicable written agreements. These written agreements should ensure that the individual responsible for activation can place such equipment or personnel under his or her control within the times estimated in the design report.

The design report should also discuss the testing and maintenance of any equipment necessary to employ a special alerting method. In general, full-scale equipment testing should be conducted at least annually. Routine use of this equipment or these procedures (independent of their utilization as a part of an alert an notification system) demonstrating alert and notification system capabilities may be considered to be an acceptable test.

For those special alerting methods involving the distribution of equipment (other than tone alert radios as covered in this guide's section E.6.2.3, "Tone Alert Radios") to the public, a special alerting program should make a "best-effort" attempt to place this equipment or information. This effort should include:

- A record system (register) containing an accurate list of addresses (names are optional) in the geographical area(s) where the equipment or information is needed;
- A record of addresses where such equipment or information is offered to and refused by the residents; and
- An ongoing maintenance program, available to all residences within the affected areas, offering equipment operating checks.

Necessary written guidance should accompany the equipment. This guidance should address, if applicable:

- General usage;
- Suggested placement to facilitate efficient use;
- Details of the maintenance program, including self tests, if appropriate; and
- Telephone numbers for equipment repair or replacement.

This information should be provided annually as a reminder to each equipment holder. Any other necessary special information should also be redistributed annually. Register update and maintenance and public information programs can be integrated with this written guidance.

E.6.2.4.2 Use of Institutional Alerting Systems

In addition to meeting the general acceptance criteria for special alerting systems, institutional alerting methods used as a part of an alert and notification system should have an effective and continual program that, at a minimum, encompasses the following:

- Specification of those organizations and the individuals within those organizations, by title, responsible for the institutional alerting system;

- Description of the procedures employed to notify those individuals that the alert and notification system is to be activated; and

- Distribution of special information to notify those individuals of their responsibility to activate the existing institutional alerting system, including, where appropriate (e.g., for hotels, motels, and shopping centers), guidance on the most effective method of alerting system activation or other supporting information (e.g., public information stickers or posters).

E.6.2.4.3 Use of Aircraft for Alerting

In some geographical areas (e.g., hiking trails and hunting and fishing areas), prompt alert and notification may not be feasible except by employing aircraft equipped with powerful sound systems or by dropping prepared leaflets.

In addition to meeting special alerting system general acceptance criteria, the design report should describe the use of aircraft for alerting as follows:

- The sound system, if any, to be employed in alerting the public via aircraft should be described. The design report should include an analysis demonstrating that the sound system can provide an intelligible alerting signal at ground level throughout the geographical area requiring coverage.

- The system and procedures established for dropping leaflets should be discussed. The design report should indicate the manner and location in which the leaflets are stored, the individual responsible for ensuring that they are loaded onto the aircraft, and the time required to load the leaflets onto the aircraft. The design report should also include an analysis or calculation demonstrating that the employed procedures are likely to provide adequate coverage of the geographical area to be alerted by aircraft.

- The airfield and storage location for the aircraft and its distance from the area to be covered should be specified. Specifically, the design report analysis of the time required to alert individuals should include, among other pertinent factors, the amount of time required:

- To notify the pilot or alternate, who is available 24 hours a day, 7 days a week;
- For the pilot to reach the aircraft;
- To prepare the aircraft for flight;
- For the aircraft to take off; and
- For the aircraft to reach the area to be alerted.

E.6.2.4.4 Use of Automatic Telephone Dialers/Switching Equipment

Another available alert and notification method is a system that automatically dials pre-selected telephone numbers and plays a recorded emergency announcement when the telephone is answered. After a fixed number of rings, the next number is dialed automatically, with the unanswered numbers redialed at the end of the queue. Other telephone systems available connect directly to telephone exchange equipment, can call 100, 1,000, or more stations simultaneously, and may employ a special ring condition (e.g., a half-second ring followed by a two-second pause), a recorded voice, or a live voice message.

In addition to meeting special alerting system general acceptance criteria, the design report should describe automatic telephone dialers/switching equipment as follows:

- The type, manufacturer, and general operating concepts of the automatic telephone dialers or switching equipment employed should be specified. If a sequential automatic dialer is used, the design report should include a calculation of total time required to cycle once through the queue under both "worst-case" conditions (e.g., all respondents answer on the last ring before re-dial) and "expected" conditions. The design report should also present the rationale for sequencing the numbers in the queue. Measures to ensure that the telephone system does not fail due to traffic (subscriber) overloading prior to at least one complete cycle through the queue should also be discussed. If simultaneous alert calling is used, the design report should discuss provisions to ensure that "busy lines" at

the time the system is activated are alerted. Measures to ensure that the telephone system does not fail due to traffic (subscriber) overloading during this alert call should also be discussed in the design report.

E.6.2.4.5 Use of Modulated Power Lines

Electrical power lines can be used as another alert and notification method to transmit information by adding a modulated carrier frequency into the standard 60-cycle-per-second frequency used for power transmission. Transmitted information can perform a variety of functions (e.g., turn on a water heater, activate a device that reads the electric meter and transmits the reading back to the utility, ring a bell). Such a system can be modified to activate a variety of alerting devices, including an electrically driven horn, a warning light, or a buzzer. If used as a part of an alert and notification system, a modulated power line system should meet special alerting system general acceptance criteria.

E.6.2.4.6 Use of Police, Fire, or Rescue Vehicles and Personnel

In very isolated areas, the most cost-effective means of alert and notification may employ police, fire, or rescue vehicles and personnel to alert individual households, either via a vehicle's public address or siren system or by individually contacting members of a household. This use of police, fire, or rescue vehicles and personnel may also be a cost-effective method of alerting individuals in small populated areas, such as parks, where seasonal and diurnal variations in a population make a fixed siren system less cost effective.

In addition to meeting special alerting system acceptance criteria, the design report should describe the use of police, fire, or rescue vehicles and personnel as follows:

- The alerting procedures to be followed;
- The geographical areas to be covered; and
- The routes to be used.

These routes should be clearly delineated on the map(s) submitted with the design report (see Appendix 2: A Summary of Design Report Map Requirements). A proposed route and elapsed time (measured from the initial time of alert) should be shown for each vehicle on each route. The design report should also account for the transit time of each vehicle to the initiation of its route and the time required for a vehicle to slow or pause to alert an individual household. Total elapsed time for alert and notification using police, fire, or rescue vehicles and personnel should not exceed 15 minutes (or 45 minutes, when the design objective of route alerting is to ensure coverage of a population who may not have received the initial alert and notification).

CHAPTER 2

NUREG-0654/FEMA-REP-1, REVISION 1, PLANNING STANDARD F - EMERGENCY COMMUNICATIONS

Planning Standard F in NUREG-0654/FEMA-REP-1, Revision 1, requires that:

> "Provisions exist for prompt communications among principal response organizations to emergency personnel and to the public."

Evaluation Criterion F.1 in Planning Standard F requires that:

> "The communication plans for emergencies shall include organizational titles and alternates for both ends of the communication links. Each organization shall establish reliable primary and backup means of communication for licensees, local, and State response organizations. Such systems should be selected to be compatible with one another. Each plan shall include:
>
> a. provision for 24-hour per day notification to and activation of the State/local emergency response network; and at a minimum, a telephone link and alternate, including 24-hour per day manning of communications links that initiate emergency response actions.
>
> b. provision for communications with [contiguous] State/local governments within the Emergency Planning Zones;
>
> c. provision for communications as needed with Federal emergency response organizations;
>
> d. provision for communications between the nuclear facility and the licensee's near-site Emergency Operations Facility, State and local emergency operations centers, and radiological monitoring teams;
>
> e. provision for alerting or activating emergency personnel in each response organization; and
>
> f. provision for communication by the licensee with NRC headquarters and NRC Regional Office Emergency Operations Centers and the licensee's near-site Emergency Operations Facility and radiological monitoring team assembly area."

F.1.1 Areas of Review

Review under Evaluation Criterion F.1 addresses whether a primary and a secondary means of communication exist from the Emergency Response Facilities through the alert and notification system's implementing chain to an officials responsible for activating the alert system.

F.1.2 Acceptance Criteria

An acceptable emergency plan under Evaluation Criterion F.1 should provide a clear description of the primary and secondary means of communication, from the licensee's Emergency Response Facilities through an alert and notification system's implementing chain to the officials responsible for activating the alert system, that meets the following criteria:

- Coverage: The primary and secondary means of communication must provide the capability for a 24-hour-per-day notification from the licensee's Emergency Response Facilities to the officials responsible for making the decision to activate the alert and notification system. The primary and secondary means of communication must also provide the capability for a 24-hour-per-day notification from these officials to those individuals responsible for the actual activation of the alert and notification system.

- Communications Net Control: To ensure effective use, communications net discipline, and communications availability, one location on each communications net should be assigned responsibility for net control and an alternate should be assigned.

- Communications System Availability and Reliability: All stations and points on the network and communication linkage must provide a capability for immediate dissemination, receipt, and acknowledgment of alert and warning messages on a 24-hour-per-day basis. Oral message communications should be supported by written (e.g., tele... or telefax) verification. A primary or secondary means of communication should be able to function notwithstanding adverse environmental conditions, such as floods and power outages. At least one of those means of communication should not be subject to pre-emption for lower priority purposes or

for failure due to traffic (subscriber) overloading. A primary and secondary means of communication should be selected so that they do not have common failure modes under adverse environmental conditions.

- Information Sensitivity: Design of communications systems and procedures should take into consideration that alert and notification information is highly sensitive and, if monitored or intercepted by unauthorized personnel, is subject to misinterpretation that can lead to undesirable and counterproductive reactions.

CHAPTER 3

NUREG-0654/FEMA-REP-1, REVISION 1, PLANNING STANDARD N - EXERCISES AND DRILLS

Planning Standard N in NUREG-0654/FEMA-REP-1, Revision 1, requires that:

> "Periodic exercises are (will be) conducted to evaluate major portions of emergency response capabilities, periodic drills are (will be) conducted to develop and maintain key skills, and deficiencies identified as a result of exercises or drills are (will be) corrected."

Evaluation Criterion N.1.a in Planning Standard N requires that:

> "An exercise is an event that tests the integrated capability and a major portion of the basic elements existing within emergency preparedness plans and organizations. The emergency preparedness exercise shall simulate an emergency that results in offsite radiological releases which would require response by offsite authorities. Exercises shall be conducted as set forth in NRC and FEMA rules."

Evaluation Criterion N.1.b in Planning Standard N requires that:

> "An exercise shall include mobilization of State and local personnel and resources adequate to verify the capability to respond to an accident scenario requiring response. The organization shall provide for a critique of the annual exercise by Federal and State observers/evaluators. The scenario should be varied from year to year such that all major elements of the plans and preparedness organizations are tested within a five-year period. Each organization should make provisions to start an exercise between 6:00 p.m. and midnight, and another between midnight and 6:00 a.m. once every six years. Exercises should be conducted under various weather conditions. Some exercises should be unannounced."

N.1.(a,b).1 Areas of Review

Review under Evaluation Criterion N.1.(a,b) addresses demonstration of the integrated capability of an alert and notification system chain of command to function effectively from the time a decision to activate the system is necessary until the system is activated. Before recommending an alert and notification system demonstration for the purposes of conducting a public survey, the requirements of Planning Standards E and F must be satisfied.

N.1.(a,b).2 Acceptance Criteria

To demonstrate proper functioning of an alert and notification system, the total chain of events required to implement an activation decision should be exercised completely. An exercise should be structured to demonstrate that:

- A legitimate, informative, and clearly understood message summarizing the emergency is sent from the utility to any state and local officials responsible for the decision to activate an alert and notification system;
- Individual(s) responsible for activating an alert and notification system are notified and mobilized in time to be in position to discharge, when required, their responsibilities;
- A decision to activate an alert and notification system is made by the appropriate official;
- A legitimate, informative, and clearly understood command to activate an alert system is sent from state and local officials to the person(s) responsible for physically activating the alert system;
- An alert system is appropriately activated or activation is simulated;
- A legitimate, informative, and clearly understood command to disseminate specified instructions emanates from state and local officials to the person(s) responsible for physically activating a notification system;
- A notification system is appropriately activated or simulated; and
- The specified public messages are relayed.

For the above actions to be meaningful, an exercise scenario should result from undisclosed situations and not from previously determined or specified times (e.g., the time of an alert system's activation). A satisfactory exercise of an alert decision implementing chain can occur up to the point of actually activating the alert and notification system (although activation should be simulated as realistically as possible).

For the purposes of a public survey, an alert and notification system demonstration may or may not occur during an annual exercise. Actual activation can occur at any mutually agreed upon time between appropriate state and local officials. State and local officials are responsible for determining the time of day an alert and notification system is activated.

A final determination of an alert and notification system's effectiveness must consider the system design, implementation, routine siren testing procedures and operability maintenance (see Appendix 4: A Summary of Design Report Routine Siren Testing Procedures and Operability Requirements), and the results of a public survey conducted immediately following a demonstration of the system. In order to satisfy the alert and notification aspects of 44 CFR 350.9 (a), a telephone survey is conducted of residents within a nuclear power plant's EPZ as soon as possible following completion of an alert and notification system activation. The objective of this telephone survey is to estimate the proportion of households within the EPZ alerted by an alert and notification system (see Appendix 3: A Summary of the Alert and Notification Survey Methodology). For the purposes of a telephone survey, all reasonable means (i.e., a manual backup activation) should be employed during activation to ensure that all system components operate.

The telephone survey provides prompt assessment of an alert and notification system's effectiveness following an activation and permits monitoring of responses during the sampling process in order to obtain enough responses to achieve statistically valid survey results. Special sampling provisions are considered in unique situations where large portions of the population within a nuclear power plant's EPZ may not have home telephones (e.g., where religious beliefs prevent telephones). Other means of efficiently obtaining public survey information are considered on a case-by-case basis.

The statistical focus of the survey is public (residential households) alerting versus nonalerting, which is a binary event with some probability, p, for a nuclear power plant's EPZ population. The statistical model representing the number of successful events in such a process is the hypergeometric distribution. Well-known statistical methods are available to estimate a confidence interval for p, based upon a representative sample of the EPZ population. In order to achieve an appropriate number of responses, a sample of between 1,000 and 3,000 residences is developed for each survey. This sample is representative of a nuclear power plant's entire EPZ, and enough telephone calls are completed and responses received to achieve a statistically valid sample with a confidence level of 95% and a precision of 5%. Depending upon this ratio of affirmative-to-total answers, the number of completed telephone calls can vary from 250 residences to approximately 400 residences within a nuclear power plant's EPZ.

A telephone survey of a nuclear power plant's EPZ residential households consists of approximately six questions, approved by the Office of Management and Budget (OMB), designed to determine:

- The validity of the respondent's address and telephone number;
- If a respondent was aware of a nuclear power plant's emergency alerting signal;
- How a respondent was made aware of a nuclear power plant's emergency alerting signal;
- The location (at home, away from home) of the respondent at the time of a nuclear power plant's alert and notification system activation; and
- If a residence received emergency instructional material regarding what to do in the event of an actual emergency at the nuclear power plant.

The results of this survey are used to identify aspects of an alerting system that may need enhancement.

Evaluation Criterion N.2 in Planning Standard N requires that:

> "A drill is a supervised instruction period aimed at testing, developing and maintaining skills in a particular operation. A drill is often a component of an exercise. A drill shall be supervised and evaluated by a qualified drill instructor. Each organization shall conduct drills, in addition to the annual exercise at the frequencies indicated below:
>
> a. Communication Drills
>
> Communications with State and local governments within the plume exposure pathway Emergency Planning Zone shall be tested monthly. Communications with Federal emergency response organizations and States within the ingestion pathway shall be tested quarterly. Communications between the nuclear facility, State and local emergency operations centers, and field assessment teams shall be tested annually. Communication drills shall also include the aspect of understanding the content of messages."

N.2.1 Areas of Review

Review of alert and notification system effectiveness under Evaluation Criterion N.2 relates only to communication drills as specified in "a." above. Communication drills should be conducted in accordance with the intent and schedule of Evaluation Criterion N.2.

N.2.2 Acceptance Criteria

An acceptable emergency plan should require monthly alert and notification system communication drills among the officials specifically responsible for activating an alert and notification system. Drills need not include coordination or support Emergency Operations Center staff. Drills should emphasize developing and maintaining the capabilities of officials responsible for activating an alert and notification system.

Evaluation Criterion N.3 in Planning Standard N requires that:

"Each organization shall describe how exercises and drills are to be carried out to allow free play for decision making and to meet the following objectives. Pending the development of exercise scenarios and exercise evaluation guidance by NRC and FEMA the scenarios for use in exercises and drills shall include but not be limited to, the following:

a. The basic objective(s) of each drill and exercise and appropriate evaluation criteria;

b. The date(s), time period, place(s), and participating organizations;

c. The simulated events;

d. A time schedule of real and simulated initiating events;

e. A narrative summary describing the conduct of the exercises or drills to include such things as simulated casualties, offsite fire department assistance, rescue of personnel, use of protective clothing, deployment of radiological monitoring teams, and public information activities; and

f. A description of the arrangements for and advance materials to be provided to official observers."

N.3.1 Areas of Review

Review of the alert and notification system under Evaluation Criterion N.3 addresses only that aspect of the requirement for developing exercise scenarios applicable to the alert and notification system implementing chain.

N.3.2 Acceptance Criteria

An acceptable emergency plan should require that exercise scenarios provide for alert and notification system activation (or a simulated activation). Activation (or a simulated activation) should result from the decision-making process and should not result from previously determined, specified times for certain events to occur.

Evaluation Criterion N.5 in Planning Standard N requires that:

> "Each organization shall establish means for evaluating observer and participant comments on areas needing improvement, including emergency plan procedural changes, and for assigning responsibility for implementing corrective actions. Each organization shall establish management control used to ensure that corrective actions are implemented."

N.5.1 Areas of Review

This guide covers Evaluation Criterion N.5 as it applies to evaluating official federal, state, or local government observer and participant comments concerning the performance of an alert and notification system during exercises and for assigning responsibility for implementing any modifications to an alert and notification system.

N.5.2 Acceptance Criteria

An emergency plan is acceptable under Evaluation Criterion N.5 provided the method for evaluating and responding to observer and participant comments concerning alert and notification system performance during exercises meets the following minimum criteria:

- Observer and participant comments, recommendations, and responses (if appropriate) by individuals responsible for planning, maintenance, or operation of an alert and notification system should be documented.
- Evaluations of observer and participant comments and recommendations should be performed by qualified individuals. These evaluations and the bases for any conclusions or recommendations should be documented.
- The results of these evaluations, including disposition, should be maintained on file for review by appropriate federal, state, and local government officials and licensee personnel with the authority to take appropriate corrective actions.

- The individual within each organization responsible for ensuring timely implementation of corrective actions should be identified by title.

- Reports documenting observer and participant comments and the evaluations of these comments should be retained for a period of at least 5 years.

APPENDIX 1

PROCEDURES FOR PREPARATION AND SUBMISSION OF A DESIGN REPORT DESCRIBING ALERT AND NOTIFICATION SYSTEMS

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PROCEDURES FOR PREPARATION AND SUBMISSION OF A DESIGN REPORT DESCRIBING ALERT AND NOTIFICATION SYSTEMS

INTRODUCTION

FEMA's 44 CFR 350 final rule creates the regulatory framework by which FEMA evaluates and approves state and local emergency plans and preparedness to deal with a radiological emergency at a licensed commercial nuclear power plant. This appendix supplements the Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants by recommending a process for submitting the alert and notification aspects of a total state emergency plan.

Purpose and Applicability

This appendix has been prepared as an aid to uniformity and completeness in the preparation and review of the alert and notification system sections of state/local emergency plans applicable to commercial nuclear power plants. States that have previously submitted plans (or even prepared plans for submission) to FEMA do not have to restructure or resubmit those plans. In these cases, a design report may be prepared, addressing only the alert and notification system aspects. Cross-references to applicable documentation in existing plans are encouraged.

Submitted plans or design reports will be reviewed for completeness on the basis of site and system design considerations relevant to the contents of this guide. If the plans and design report do not contain the required information, FEMA's review will be delayed until such information is provided.

Number of Copies

One copy of the alert and notification system portion of (or attachment to) the state plan should be submitted to the appropriate state for review and should be coordinated with the appropriate FEMA Regional Director. If a state plan is undergoing approval, an NRC licensee may still submit a design report for review. To facilitate review and approval, one additional copy of the alert and notification system portion of (or attachment to) the plan should be submitted to the Chief, Field Operations Branch, Technological Hazards Division, Federal Emergency Management Agency, 500 C Street S.W., Washington, D.C. 20472.

Public Disclosures

FEMA has determined that the alert and notification system portion of an emergency plan will be subject to public disclosure. Alert and notification information is highly sensitive and, if monitored or intercepted by unauthorized personnel, becomes subject to misinterpretation that can lead to undesirable and counterproductive reactions. Therefore, information that facilitates such monitoring or interception should not be included in the design report. In particular, the specific radio frequencies and authentication codes employed should not be identified.

Compatibility

Efforts should be made to ensure that the alert and notification system portion of (or attachment to) the emergency plan is compatible with other portions of the emergency plan. However, other sections of the emergency plan need not be physically

incorporated. An NRC licensee can cross-reference other sections of an emergency plan in the design report. However, FEMA encourages actual duplication of any references in the design report to facilitate a timely review.

APPENDIX 2

A SUMMARY OF DESIGN REPORT MAP REQUIREMENTS

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The design report must include map(s) as required by this guide. When necessary, the map(s) provided should:

- Depict the EPZ boundary;
- Depict, when more than one alerting mechanism is utilized, the geographical areas covered by each mechanism; and
- Depict unpopulated geographical areas that are not covered by an alerting mechanism.

Unnecessary and duplicative information is not desired. For example, if only tone alert radios are utilized for alerting the public and the EPZ is defined by a 10-mile radius around the plant, no map would be required. Supplementary information, such as that needed to support route alerting, should be provided in text form in the design report. This information should:

- Depict, for those geographical areas where fixed sirens are utilized, areas where the population density exceeds 2,000 persons per square mile and areas virtually unpopulated;
- Depict, for those geographical areas where fixed sirens are utilized, siren locations and unique siren identifiers such that the siren locations and identifiers can be accurately transferred to U.S. Geological Survey topographic maps for analysis; and
- Depict, for those geographical areas where fixed sirens are utilized, sound pressure level contours of 60 dBC and 70 dBC (note that 70 dBC contours need only be shown when covering population densities greater than 2,000 persons per square mile). In cases where the design report shows the siren sound pressure level exceeding an average measured outdoor daytime ambient sound level(s) by 10 dB, depict appropriate siren sound pressure level contours for the sound pressure levels that are 10 dB above the average outdoor daytime ambient sound pressure level(s).

APPENDIX 3

A SUMMARY OF THE ALERT AND NOTIFICATION SURVEY METHODOLOGY

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A SUMMARY OF THE ALERT AND NOTIFICATION SURVEY METHODOLOGY

Survey Methodology

Immediately following activation of a nuclear power plant's alert and notification system as a part of a demonstration that the system meets the requirements of 44 CFR 350.9(a), FEMA will conduct a telephone survey of a sample of residents within that nuclear power plant's emergency planning zone (EPZ). The purpose of this survey is to estimate the proportion of households within the EPZ alerted by a nuclear power plant's alert and notification system. The generic survey questionnaire approved by the Office of Management and Budget is included in this appendix.

The universe for a nuclear power plant's alert and notification survey consists of all residential, non-institutional households within the EPZ. While this area is generally a 10-mile-radius circle, with the nuclear plant as the center point, it may sometimes include areas extending beyond 10 miles. The longitudinal and latitudinal coordinates of the nuclear power plant, along with a complete description of the size and shape of the EPZ, are used to identify the universe of households within the EPZ.

When drawing a sample for the telephone survey, the first task is to obtain a complete set of detailed street maps covering the survey area. These maps are usually obtained from county planning commissions or local governmental agencies. Next, a list of names and addresses (commonly referred to as the sample) is obtained for residents of households within the EPZ. Given the longitude and latitude of the plant, along with details of

the size and shape of the EPZ, computerized mapping techniques are used to obtain this information from a data base for households within the EPZ.

Depending on the characteristics of the area, households are selected via census tracts, block groups, enumeration districts, zip codes, or other geographic delimiters.

A base list of households, geographically ordered, is compiled, comprising all available addresses and telephone numbers identified within the EPZ. From this base list, a sample of households is selected in a systematic (nth name) fashion, ensuring that the sample proportionately represents the entire EPZ (i.e., EPZ areas are represented in proportion to the number of households contained therein).

Although the techniques used to collect the universal sample are highly accurate, sometimes households on the list are located just outside the EPZ. Households determined by this check to be outside the EPZ are removed from the sample. The first step in preparing the sample for interviewing is to check each address on the aforementioned street maps to verify that it is, in fact, located within the EPZ.

For households located within the EPZ, hard copy sample labels are printed and affixed to sample call report forms. These sample pieces are then systematically (nth name) divided into mini-samples. Each of these mini-samples (commonly referred to as replicate groups) is proportionate and representative of the entire (universal) sample. After the mini-samples have been selected, they are shuffled into random order to ensure that the specific calling sequence does not introduce any bias into the results. Immediately following the alert and notification system activation, these sample pieces are released to interviewers in replicate groups, and the interviewers begin telephoning households within the EPZ. Since the exact number

of sample pieces needed to complete interviewing cannot be precisely determined in advance, the release of the sample in randomly shuffled replicate groups ensures that the final set of completed interviews is representative of the entire surveyed EPZ.

As interviewing progresses, interviewers key all responses into computer terminals, and running totals are kept on completed interviews for those households that were alerted and those households that were not alerted.

The target number of completed interviews varies from survey to survey, depending on the alerted/not alerted ratio. This target number is established to ensure that a sufficient number of interviews are conducted to provide survey results with 5% precision at a 95% confidence level. The computer program monitors the alerted/not alerted ratio and performs a sample size calculation after each recorded interview. The number of interviews required is continuously updated and displayed to supervisory staff, allowing the sample to be released properly and the interviewing process to be terminated when the required number of interviews have been completed. The interviews are usually completed within one hour of the alert and notification system activation.

After the telephone survey has been terminated, all completed interviews are once again checked against maps to see if the surveyed households are located within the EPZ. During interviewing, respondents are asked to provide their address and the closest cross street or intersection to their house. Since respondents sometimes provide new addresses or a more exact location, these addresses are checked against street maps a second time. In addition, this second check identifies anyone who has moved or whose address has changed from the one obtained with the original sample. Before final tabulations are run, any households detected to be outside of the EPZ are removed from the universe of surveyed households.

SAMPLE SIZE DETERMINATION

The number of households that need to be surveyed is determined based upon the need to obtain a sample size sufficient to obtain a 95% confidence interval with precision (half-width) of 0.05 for the estimate of the proportion alerted. The exact number of households to be surveyed can be derived from the following statistical considerations. For relatively large sample sizes ($n \geq 30$), taken without replacement from a population (N), the sampling distribution for proportions (e.g., the proportion of the population alerted) is nearly a normal distribution, the mean of which is the proportion (p) of the population alerted and the variance of which is

$$p(1 - p)/n \left(\frac{N - n}{N - 1}\right)$$

If P is the observed sample proportion, then for a particular confidence level with confidence coefficient Z_c,

$$(P - p)^2 \leq Z_c^2 \, p(1 - p)/n \left(\frac{N - n}{N - 1}\right)$$

Thus, for this confidence level, the actual proportion of the population alerted satisfies the following inequalities:

$$\frac{P + \frac{Z_c^2}{2n}\left(\frac{N - n}{N - 1}\right) - Z_c\sqrt{\frac{P(1 - P)}{n}\left(\frac{N - n}{N - 1}\right) + \frac{Z_c^2}{4n^2}\left(\frac{N - n}{N - 1}\right)^2}}{1 + \frac{Z_c^2}{n}\left(\frac{N - n}{N - 1}\right)} \leq p \text{ and}$$

$$P \leq \frac{P + \frac{Z_c^2}{2n}\left(\frac{N-n}{N-1}\right) + Z_c\sqrt{\frac{P(1-P)}{n}\left(\frac{N-n}{N-1}\right) + \frac{Z_c^2}{4n^2}\left(\frac{N-n}{N-1}\right)^2}}{1 + \frac{Z_c^2}{n}\left(\frac{N-n}{N-1}\right)}$$

Thus, the precision (W) is simply given by

$$W = \frac{Z_c\sqrt{\frac{P(1-P)}{n}\left(\frac{N-n}{N-1}\right) + \frac{Z_c^2}{4n^2}\left(\frac{N-n}{N-1}\right)^2}}{1 + \frac{Z_c^2}{n}\left(\frac{N-n}{N-1}\right)}$$

This equation can be solved to determine the sample size (n) required to yield a given precision (W) with a given observed sample proportion (P) as follows:

$$n = \frac{\frac{Z_c^2}{2W^2}\left[P(1-P) - 2W^2 + \sqrt{W^2\left[1 - 4P(1-P)\right] + P^2(1-P)^2}\right]}{1 + \frac{Z_c^2}{2W^2N}\left[P(1-P) - 2W^2\left(1 + \frac{1}{Z_c^2}\right) + \sqrt{W^2\left[1 - 4P(1-P)\right] + P^2(1-P)^2}\right]}$$

Although this expression for n can be used directly, it is customary to make several approximations. First, since the term in N in the denominator (the finite population term) is positive definite for all reasonable values of W ($0 < W < 0.5$), omitting this term will result in an approximation to n that is slightly larger than its true value. This is an acceptable practice in sizing the sample since a larger sample gives greater precision.

A second approximation that can be made is to neglect the terms in W^2 within the bracket in the numerator. Analysis demonstrates that this underestimates n when $P < 1/2 - 1/4 \sqrt{2 + 8W^2}$ or $P > 1/2 + 1/4 \sqrt{2 + 8W^2}$ and overestimates n for P between those two values. For the case of interest (a 95% confidence interval with precision of 0.05), this approximation provides an overestimation of n when a sample size greater than 191 is required. Since the sampling plan calls for a minimum sample size of 250, regardless of the value of P, this approximation is acceptable because it also yields an estimate of n larger than the true value. Therefore, for the purposes of the pilot test and subsequent surveys, the following approximate equation can be used to determine whether a sample size larger than 250 is required:

$$n = \frac{Z_c^2}{W^2} P(1 - P)$$

or using 1.96 for Z_c and 0.05 for W,

$$n = 1536.64\ P(1 - P)$$

Data from the pilot test can be used to illustrate the effects of these approximations. In the pilot test, the population of tone alert households from which the sample was to be drawn (N) was approximately 4500 and the observed proportion alerted (P) was 0.675. This yields 311 as the exact result for n. Neglecting the finite population term yields an estimate of 334 for n, and the simplified final approximation estimates n as 338. Thus, the final simplified approximation overestimates the required sample size by 27 in this case.

#1683Q
Chilton Research Services
Radnor, Pennsylvania

OMB #3067-0103 (FEMA 9/85)
FEMA NUCLEAR POWER PLANT ALERTING AND NOTIFICATION SYSTEM: PUBLIC TELEPHONE SURVEY

Time Began _____AM _____PM

Time Ended _____AM _____PM

Interview # _____ (1-5)

Zip Code _____ (6-10)

Sample Type _____ (11)

RECORD BEFORE DIALING -Telephone # _____ (Area Code) (Exchange) (Number) (12-21)

RESPONDENT: Male or Female head of household.

(ASK, DEPENDING ON SEX: Are you the (man of the house/lady of the house)?

INTRODUCTION:

Hello, my name is _____. We're calling households long distance from Chilton Research Services as part of a survey. This survey is sponsored by The Federal Emergency Management Agency (FEMA) of the United States Government.
Your answers are voluntary and will be kept strictly confidential.

1. First of all, is this (REPEAT # DIALED)?

	Yes	1
TERMINATE AND DIAL AGAIN	No	2

2. As you may or may not know, there was a test of the emergency alert notification system for (NAME OF NUCLEAR POWER PLANT). Did you, or any other member of your household, hear or see any type of emergency signal from this test today?

22-

CONTINUE	Yes	1
SKIP TO Q. 4A	No	2
CONTINUE	Heard from another source	3
ASK IF ANY OTHER HOUSEHOLD MEMBER IS MORE KNOWLEDGEABLE	Don't Know	8

3 How were you made aware of this emergency test signal? (DO NOT READ. CIRCLE ALL THAT APPLY)

(23-29)

SKIP TO Q. 4	Siren (PROBE FOR TYPE)	
	Fixed siren	1
	Mobile siren	2
	Don't Know	3
	Tone Alert Radio	4
	Neighbor told me	5
	Other family member told me	6
	Other: (SPECIFY)_____	7
CONTINUE	Don't Know	Y

3A. Were you made aware by a . . . (READ LIST. CIRCLE ALL THAT APPLY)

(30-36)

	Fixed siren	1
	Mobile siren	2
	Tone alert	4
	Neighbor	5
	Another Family Member	6
	Or something else (SPECIFY) _____	7
DO NOT READ	Siren Don't know type	3
	Don't Know	Y

4. (IF "HEARD OR SAW EMERGENCY SIGNAL" ASK Q. 4 BELOW OTHERWISE SKIP TO Q. 4A)

Were you at home or away from home when you were made aware of this emergency test signal?

37

SKIP TO Q. 5 UNLESS THIS IS A TONE ALERT AREA AND RESPONDENT DID NOT ANSWER SIREN OR TONE ALERT IN Q.3 OR Q.3A. OTHERWISE SKIP TO Q.4B	Home	1
	Away From Home	2

4A. (IF "DID NOT HEAR OR SEE EMERGENCY SIGNAL")

Were you inside your house at (TIME OF ALERT) today?

38

IF TONE ALERT AREA, ASK Q. 4B, OTHERWISE, SKIP TO Q. 5.		Yes	1
	SKIP TO Q. 5	No	2
		Don't Know	Y

4B. Has your household ever been issued a (TONE ALERT RADIO/APPROPRIATE TERMINOLOGY)?

39-

	Yes	1
SKIP TO Q. 5	No	2
	Don't Know	Y

4C. Was it turned on and in the (ALERT MODE/APPROPRIATE TERMINOLOGY) at (TIME OF TEST) today?

40-

Yes	1
No	2
Don't Know	Y

5. Has your household ever received (DESCRIPTION OF INSTRUCTIONS) which tell you what to do in a real emergency at (NAME OF REACTOR)?

41-

Yes	1
No	2
Don't Know	Y

6. Because we need to determine whether or not you live in the Emergency Planning Zone (EPZ) of (NAME OF REACTOR), would you please give me your address? (PAUSE FOR ANSWER)

ADDRESS:

_____

_____

and the nearest cross street or main road to your home.

_____

On behalf of Chilton Research Services and the Federal Emergency Management Agency, I would like to thank you for giving us some very valuable information.

APPENDIX 4

A SUMMARY OF DESIGN REPORT
ROUTINE SIREN TESTING PROCEDURES AND OPERABILITY REQUIREMENTS

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A SUMMARY OF DESIGN REPORT
ROUTINE SIREN TESTING PROCEDURES AND OPERABILITY REQUIREMENTS

Before a siren system is installed and operational, the licensee should develop a routine siren testing and operability program to provide for regularly scheduled testing of a siren system. A suggested testing frequency is outlined in NUREG-0654/FEMA-REP-1, Revision 1, Appendix 3.

As part of the alert and notification system approval process, FEMA will:

- Review and accept a nuclear power plant's routine siren testing program; and

- Verify the siren operability average estimated from the results of the siren testing program as it was implemented for the 12 months preceding submission of the design report.

The operability of a siren system is considered acceptable when an average of 90% of the sirens (as determined by a simple average of all regularly conducted tests) can be demonstrated functional over the 12-month period immediately preceding the submittal of the design report. Special consideration will be given for siren systems that have not been operational for 12 months. Acceptability of the routine siren testing procedures is an important part of the overall alert and notification system review since the operability percentage will be derived from implementation of these procedures. Further information on testing procedures and operability is contained in the FEMA Guidance Memorandum series, an added interpretation and application of NUREG-0654/FEMA-REP-1, Revision 1.

Use of the following generic checklist is recommended when submitting a nuclear power plant's routine siren testing program and computation of operability percentage:

I. Items to be Included in a Qualitative Description of Routine Siren Testing Procedures and Operability

1. A description of the alert and notification system:

   - Number of sirens (for fixed or mobile sirens); and

   - Other system components (for tone alert radios, route alerting, etc.).

2. A description of the standard operating procedures for routinely testing the system:

   - Type of testing (silent, growl, complete cycle); and

   - Frequency of testing for each type (weekly, bi-weekly, twice monthly, monthly, quarterly, annually, other).

3. A description of the method used for verifying activation:

   - Procedures for verifying activation (by electronic or mechanical means, paid personnel or volunteers located at each siren, other);

   - Method of reporting results of verification (by telephone, mail-in response card, checklist, etc.); and

   - Verification of whether 100% of the sirens were activated and, if not, why.

4. A description and location of testing and verification records.

II. Items to be Included in a Quantitative Computation of Siren Operability Percentage

1. Detailed records of all tests conducted for the immediately preceeding 12-month period.

   - A chart or table summary listing the dates of the tests, type of tests, number of sirens tested, number of sirens verified, number of sirens operable, and percentage of sirens operable; and

   - Relevant documentation to support the summarized data.

2. A description of the method used to calculate the siren operability percentage.

3. The computation of the siren operability percentage for the immediately preceding 12-month period.