# Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants

Guidance for Protective Action Recommendations for General Emergencies

# Draft Report for Comment

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### ABSTRACT

The guidance in this updated Supplement 3 to NUREG-0654/FEMA-REP-1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Revision 1, (NRC, 1996), supersedes previous guidance on the development of protective action recommendation (PAR) logic for nuclear power plant accidents. The guidance suggests that nuclear power plant licensees and the offsite response organizations (OROs) responsible for implementing protective actions discuss and agree to various elements and criteria of the PAR logic diagram contained in the attachment to this supplement. This diagram should be used to develop a site-specific PAR logic diagram for use by the licensee's emergency response organization. The NRC expects that nuclear power plant licensees will develop PAR procedures that embody ORO input at the various decision points as identified in the guidance, and that such input will guide criteria used in the PAR logic diagram. This supplement also provides guidance regarding consideration of precautionary protective actions, assessment of wind persistence, determination of PARs for rapidly progressing release scenarios, and termination of protective actions. The appendix to this supplement provides information and guidance regarding effective communication with the public to support emergency preparedness and response.

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### 1. INTRODUCTION

In late 2004, the U.S. Nuclear Regulatory Commission (NRC) initiated a project with Sandia National Laboratories to analyze the relative efficacy of alternative protective action recommendation (PAR) strategies in reducing consequences to the public from a spectrum of nuclear power plant core melt accidents. The study results, documented in NUREG/CR-6953, "Review of NUREG-0654, Supplement 3, 'Criteria for Protective Action Recommendations for Severe Accidents,'" Volumes 1 and 2, (NRC, 2007a and NRC, 2008), (hereafter referred to as the PAR Study), show that shelter-in-place and staged evacuation can be more protective to public health and safety than radial evacuation, providing a technical basis for improving NRC PAR guidance. The NRC provided a draft of NUREG/CR-6953 to the Advisory Committee on Reactor Safeguards (ACRS) for review. The Committee documented its review in a July 27, 2007, letter to the NRC (NRC, 2007b), recommending a revision of NUREG-0654, Supplement 3, which was published in July 1996 as a draft report for interim use and comment. The ACRS also recommended against making PAR strategies overly complicated, such that they slow down decision making during emergencies. The NRC staff agreed with the ACRS recommendations.

In the PAR Study, the NRC staff selected a series of radiological source terms representative of severe core melt accidents that result in containment failure and evaluated the potential consequences to the public under various PAR strategies. The study analyzed the following three General Emergency accident conditions:

- (1) rapidly progressing severe accident
- (2) progressive severe accident
- (3) severe accident without loss of containment

Although rapidly progressing severe accidents are very unlikely, nuclear power plant emergency preparedness programs are designed to respond to a wide spectrum of accidents including these scenarios. The NRC staff examined various PAR strategies for each of the three General Emergency accident conditions, including the following:

- immediate radial evacuation, which is the current strategy of evacuation away from the plant
- lateral evacuation, which is evacuation perpendicular to the plume
- staged evacuation, where the close-in population leaves first while others shelter-inplace and then leave
- shelter-in-place, where residents shelter at home or in their current location followed by radial evacuation
- shelter-in-place, followed by lateral evacuation
- preferential sheltering, which includes use of large public structures followed by radial evacuation
- preferential sheltering, followed by lateral evacuation

The PAR Study modeled a hypothetical site with generic weather and a population of about 80,000 people based on 100 residents per square kilometer in the 10-mile (16-kilometer) plume exposure pathway emergency planning zone (EPZ). The relative benefit of alternative PAR strategies was compared to the current strategy and reported qualitatively. The PAR Study also discussed heightened preparedness, which is the act of informing and making the public aware that actions may soon be needed, and shadow evacuations, which are spontaneous evacuations of members of the public who do not reside in areas under an evacuation order.

PAR Study results suggest that the NRC should consider improving its PAR guidance, and a synopsis of the results includes:

- Radial evacuation should remain the major element of protective action strategies.
- Sheltering-in-place should receive more emphasis in protective action strategies because it is more protective than radial evacuation under rapidly progressing severe accidents at sites with longer evacuation times.
- Staged evacuation should be considered because it is more protective than immediate radial evacuation. Although in some scenarios, the improved benefit of staged evacuation is not large, the strategy decreases demand on offsite response organization resources as well as disruption to the public.
- Precautionary protective actions, such as evacuating schools and parks during a Site Area Emergency, are prudent and should be considered.
- Strategies that reduce evacuation time reduce public health consequences.
- Evacuation time estimates are important in planning PAR strategies.
- Advance planning for the evacuation of special-needs populations that do not reside in special facilities may not be consistently addressed within all nuclear power plant EPZs.

These results guided this revision of NUREG-0654, Supplement 3. This revised guidance considered additional insights from the PAR Study, as well as input from State and local government emergency response professionals, stakeholders, and industry. In addition to the technical analyses documented in NUREG/CR-6953, Volume 1, the NRC staff conducted a public telephone survey of EPZ populations. The public survey provided information on the tendencies of EPZ populations with respect to emergency response. These insights assisted the NRC staff in improving the PAR guidance; the NRC published the survey results in NUREG/CR-6953, Volume 2 (NRC, 2008).

This Supplement 3 to NUREG-0654 supersedes previous guidance on the development of PAR logic for nuclear power plant accidents, including the guidance contained in Appendix 1, "Emergency Action Level Guidelines for Nuclear Power Plants," of NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," (NRC, 1980), and NUREG-0654/FEMA-REP-1, Revision 1, Supplement 3, "Criteria for Protective Action Recommendations for Severe Accidents," published in 1996 as a draft report for interim use and comment (NRC, 1996).

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.47(b)(10) states, in part, "Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place...." This supplement is considered "Federal guidance" as referred to in the regulation, and it will be used to aid in determining compliance with 10 CFR 50.47(b)(10). By issuing this guidance, the NRC does not intend to affect the protective action guidelines developed and promulgated by the U.S. Environmental Protection Agency (EPA). The EPA protective action guides remain the appropriate Federal guidance on radiological criteria for consideration of protective actions.

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# 2. IMPLEMENTATION OF GUIDANCE

The Attachment to this supplement contains a PAR logic diagram, which should be used to develop a site-specific PAR logic diagram for use by the licensee's emergency response organization (ERO). The PAR Logic Diagram (Attachment 1) is not intended to be used without site-specific modification. The site-specific PAR logic diagram is expected to be contained in emergency plan implementing procedures used by the nuclear power plant ERO. The Attachment is intended to guide the development of a PAR procedure for operational shift personnel and is designed to be implemented rapidly without the initial need to confer with offsite response organization (ORO) personnel. The PAR logic diagram used by the licenseeaugmented ERO may differ reflecting the expectation that the augmented ERO has more resources than the shift organization. Section IV.D.3 of Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires licensees to have the capability to notify OROs within 15 minutes of the declaration of a General Emergency. The NRC expectation, as demonstrated by licensees in biennial evaluated exercises, is that licensees will include a PAR with the General Emergency notification. The 15 minute time requirement remains in effect regardless of differences in licensee PAR logic diagrams used by shift and by augmented ERO personnel. The PAR must be made rapidly, in accordance with approved procedures, and those procedures should be developed in partnership with the responsible OROs.

The notes included with the PAR logic diagram provide direction for developing site-specific elements and criteria. The diagram is simplified when the site-specific elements are developed and the diagram is deployed in an emergency plan implementing procedure. The NRC suggests that nuclear power plant licensees and the OROs responsible for implementing protective actions discuss and agree to various elements and criteria of the licensee and ERO PAR logic diagram(s). However, in no case does the NRC intend that nuclear power plant licensees delay the recommendation of protective actions to confer with OROs at the time of a General Emergency. Licensees are responsible for making timely PARs, in accordance with Federal guidance and plant conditions, and for providing the PARs to OROs to allow them to make timely and well-informed protective action decisions. OROs are responsible for deciding which protective actions to implement.

The NRC expects that nuclear power plant licensees will develop PAR procedures that include ORO input at various decision points, identified in the guidance, and that this input will guide the criteria used in the PAR logic diagram. This criteria and the approved PAR logic diagram in emergency plan implementing procedures constitute the licensee's commitment to OROs to provide PARs immediately upon the declaration of a General Emergency. In the rare case where a responsible ORO chooses not to participate in the development of a site-specific PAR logic diagram in accordance with this guidance, the licensee may use ORO emergency plans, implementing procedures, or both, as a basis to develop the necessary decision points.

### 2.1 <u>Implementation of the Protective Action Recommendation Logic Diagram at</u> <u>a General Emergency</u>

Licensees are required to be able to provide immediate notification (i.e., within 15 minutes) to OROs upon the declaration of an emergency, and in the case of a General Emergency declaration, the notification is expected to include a PAR. The PAR must be developed in accordance with approved site emergency plan implementing procedures.

The previous version of NUREG-0654, Supplement 3, noted that the guidance was to be used to develop PARs in response to severe accidents (NRC, 1996). In practice, this was translated into the expectation that the PAR development guidance would be implemented during any General Emergency. However, although a General Emergency is a serious event and warrants a protective action offsite, it is not necessarily synonymous with a "severe accident" as that term is used in nuclear power plant accident consequence analyses. The PAR Study found that General Emergencies are unlikely events. A General Emergency followed by severe core melt is even more unlikely, and a General Emergency where the containment would rapidly fail is still more unlikely (NRC, 2007a). This guidance recognizes the disparity between a severe accident and a General Emergency and requires evacuation (or shelter-in-place as appropriate) of the closest population; it provides a decision point for increasing protective actions after that initial protective action. The PAR logic diagram in this guidance reflects this probabilistic perspective in a qualitative manner, while requiring escalated protective actions, when appropriate.

Select decision points within the PAR logic diagram are dependent upon the site specific evacuation time estimate (ETE). When the ETE is used in the decision process, the 90 percent ETE is the value expected to be used in making the decision. The last 10 percent of the evacuating public is referred to as the evacuation tail and can take a disproportionate amount of time to leave the area. It is fully expected that planning and resources support evacuation of the EPZ population; however, it is not appropriate to base the selected decision points on the time to fully clear the area. Therefore, the ETE values in the PAR logic diagram are based on the time required to evacuate 90 percent of the defined area.

### 2.2 <u>Termination of Protective Actions</u>

Licensee emergency plans are designed to support mitigative actions to ameliorate plant accidents, and an ongoing NRC study, (the State-of-the-Art Reactor Consequence Analysis, yet unpublished) concludes that mitigative actions will likely be successful. A licensee is responsible for declaring a General Emergency and issuing a PAR; however, a licensee is not responsible for making a recommendation for terminating a protective action direction already given to the public. The licensee is responsible for downgrading the General Emergency but is not expected to do so without wide consultation. Downgrading an emergency may take time to ensure that the plant condition will remain safe and to confer with authorities. Corresponding protective actions should not be terminated by OROs until fully discussed among responsible State and local officials, with the licensee supplying input regarding plant status. The PAR logic diagram recognizes this path and provides decision points for protective actions, based on the current plant status.

### 2.3 <u>Precautionary Protective Actions at Site Area Emergency</u>

The NRC does not require precautionary protective actions in response to Site Area Emergency or lesser emergency classifications. However, OROs at many sites already plan precautionary actions upon declaration of a Site Area Emergency, and some have plans for actions at the Alert level. These actions typically include sounding sirens, informing the population that an event has taken place at the site, evacuating schools, closing parks, and preparing special-needs facilities for potential evacuation.

Site Area Emergencies rarely occur. A review of actual Site Area Emergencies that have taken place since 1980 concluded that none required offsite protective actions. Some of these emergencies were declared because of an overly conservative emergency action level (EAL)

scheme that has largely been replaced at nuclear power plants. However, the PAR Study (NRC, 2007a) and the historical record illustrate that precautionary protective actions are prudent only for a Site Area Emergency that is a precursor to a more serious event.

The NRC does not recommend that precautionary protective actions be automatic at the Site Area Emergency level. The NRC expects that licensees will be able to discern whether a Site Area Emergency is a potential precursor to a more serious accident or, as in the historical cases, that core damage is not likely. The NRC recommends that OROs consider the implementation of precautionary protective actions appropriate for their locale following a Site Area Emergency declaration after conferring with licensee personnel regarding the nature of the event and the likelihood of core degradation. Should licensees be unable to provide this assessment, the prudent action would be to implement precautionary protective actions. Heightened preparedness is one appropriate precautionary protective action.

In some cases, a licensee or ORO may have committed to site-specific precautionary protective actions, such as early or preferential evacuation, or both, of beaches or other recreational areas at the Site Area Emergency. This guidance should in no way be interpreted as countermanding these commitments which may exist in licensing-basis documents or in State emergency plans.

### 2.4 Wind Persistence Issues

It may be appropriate for licensees to perform a wind persistence analysis to determine if the site specific PAR logic diagram should include more than three downwind sectors when a downwind evacuation of about 2 to 5 miles (3.2 to 8 kilometers) is recommended. The wind persistence analysis may be appropriate where licensees have noted that site meteorology includes shifting wind directions on a time scale that is shorter than the evacuation time estimate for the downwind sectors. This could result in OROs expanding protective actions while an evacuation is proceeding as a result of changes in wind direction. Multiple changes in protective action direction can undermine credibility and increase shadow evacuations, thereby potentially increasing evacuation times. However, this analysis may not be used to justify a default PAR to evacuate 360 degrees, as this would result in evacuating areas not impacted by the radioactive release.

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# 3. DETERMINATION OF PAR FOR RAPIDLY PROGRESSING SCENARIOS

As the PAR Study indicates, a nuclear power plant accident that leads to a rapidly progressing release is a very unlikely scenario; but, the emergency preparedness planning basis includes this event. A rapidly progressing event, in this context, is defined as a scenario in which a large radioactive release may occur in less than 1 hour. Historically, emergency preparedness regulations and guidance have been based on a spectrum of accidents, which is a concept embodied by NUREG-0396, "Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants," in the specification of the EPZ (NRC, 1978). Furthermore, NUREG-0654/FEMA-REP-1, Revision 1, notes that planning should not address a single accident sequence as each accident could have different consequences (NRC, 1980).

To provide a technical basis for the development of PARs for a rapidly progressing scenario, the NRC staff performed a series of calculations using a spectrum of source terms (NRC, 2010 DRAFT). The objective was to identify the relative efficacy of protective action options at sites with differing population densities. The analysis included shelter-in-place and evacuation at different distances from a plant, as well as varied shelter durations and evacuation speeds. The analysis evaluated the efficacy of protective actions for the 0 to 2 mile, 2 to 5 mile, and 5 to 10 mile (0 to 3.2 kilometer, 3.2 to 8 kilometer, and 8 to 16 kilometer) zones around a plant.

Factors that most influenced the efficacy of protective action strategies included the travel speed of the evacuating population and shelter duration. Travel speed is related to population density and is influenced by the roadway network and evacuation planning. The analysis derived the travel speeds from current time estimates for evacuating 90 percent of the general public under normal weekday conditions (NRC, 2010 DRAFT). The analysis tested multiple weather trials and assessed mean consequences. The calculations determined relative efficacy rather than absolute consequences.

For sites where the 90-percent ETE for the general public of the full EPZ is less than about 3 hours, results showed that, for the rapidly progressing scenario, evacuation is the most appropriate protective action. For sites where this is not the case, the protective actions given below are most beneficial, unless impediments exist to implementation. Where evacuation cannot be accomplished in the time specified, shelter-in-place until the plume has passed is more beneficial. The evacuation tail generally represents the last 10 percent of the population and describes the population that takes a disproportionately longer time to evacuate than the remaining public. Planning is in place to evacuate 100 percent of the public; however, protective action recommendations and decisions should be based on the 90 percent ETE values.

**0 to 2 mile (0 to 3.2 kilometer) zone** – If the 90 percent ETE for this area is 2 hours or less, immediately evacuate.

**2 to 5 mile (3.2 to 8 kilometer) zone** – If the 90 percent ETE for this area is 3 hours or less, immediately evacuate.

5 to 10 mile (8 to 16 kilometer) zone – Shelter-in-place, then evacuate when safe to do so.

Extreme weather conditions such as inversion, significant precipitation, or no wind, can change the efficacy of shelter-in-place and make evacuation the preferred protective action. The PAR logic diagram guidance reflects the consideration of weather. Licensees may perform a site-specific analysis to determine if other criteria are more appropriate.

# 4. RADIOLOGICAL ASSESSMENT BASED PAR

The Emergency Action Level (EAL) system used at nuclear power plants is designed to be anticipatory, in that a General Emergency is expected to be declared, based on plant conditions before a radiological release could potentially begin. The NRC expects that licensees will perform radiological assessments throughout the emergency and notify OROs of the need to take or expand protective actions where dose projections show that protective action criteria could be exceeded. Dose projections based on effluent monitor data and verified by field monitoring data would be the strongest basis for a PAR, but effluent monitor data alone can be sufficient where other data (e.g., plant conditions, area or process monitors) verify that a radiological release is occurring. Although verification of dose projection data is desirable, PARs should not be delayed unduly while awaiting field monitoring data or sample analysis.

A more difficult case for dose assessment is a scenario with a large radiological source term in containment and a leak rate at or near the design basis. This is clearly a General Emergency and initial PARs are expected. As subsequent PARs are implemented, the issue of expansion of protective actions beyond the 5-mile (8-kilometer) downwind sectors can arise. When expansion of a PAR is considered under this scenario, the condition of containment must be assessed, and the licensee should provide OROs with the best available information to inform decision-making. Additionally, changes in wind direction may indicate that if a release begins, it would affect different downwind sectors. Where there is reason to believe containment may fail, the expansion of PARs should be pursued. However, the more likely case is that containment will hold and the accident will be mitigated, as occurred during the 1979 Three Mile Island accident. Finally, when radiological assessment shows an ongoing release or containment source term is not sufficient to cause exposures in excess of EPA protective action guidelines, it would be inappropriate for licensees to expand PARs based only on changes in wind direction.

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# 5. GLOSSARY

- **Emergency Response Planning Area (ERPA)** A local area within the EPZ for which emergency response information is provided. These areas are typically defined by geographic or political boundaries to support emergency response planning and may not conform to an exact 10-mile (16-kilometer) radius from the nuclear power plant.
- **Evacuation Tail** A small portion of the population that takes a disproportionately longer amount of time to evacuate than the remaining public and is the last to leave the evacuation area. The tail generally consists of approximately the last 10 percent of the population.
- **Evacuation Time Estimate (ETE)** The estimated time needed to evacuate the public from the EPZ with a radius of about 10 miles (16 kilometers) around each nuclear power plant.
- **Heightened Preparedness-** A type of protective action intended to mean that the public within the EPZ is informed of a serious emergency at the nuclear power plant and are told that they should monitor the situation and prepare for the possibility of evacuation, shelter-in-place, or other protective actions. Further, if an evacuation is taking place, the public not involved in the evacuation should be asked to remain off the roadways to allow those instructed to evacuate to do so.
- Shelter-in-place A type of protective action intended to mean that instructions are given to remain indoors, turn off heating or air conditioning (as appropriate for the region and season), close windows, monitor communication channels and prepare to evacuate. Those not at home (e.g., shopping, dining, working) are instructed to stay in their current location. The instructions should specify that shelter-in-place is safer than evacuation at this time, or alternatively, shelter-in-place is being implemented in order that the public remain off roadways to allow other areas, under an evacuation order, to evacuate unimpeded. The intent is for members of the public to remain where they are, or seek shelter close by, but not to return home to shelter.

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# 6. <u>REFERENCES</u>

*Code of Federal Regulations*, Title 10, "Energy," Part 50, "Domestic Licensing of Production and Utilization Facilities."

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# **ATTACHMENT**

# PROTECTIVE ACTION RECOMMENDATION LOGIC DIAGRAM





Protective Action Recommendation Logic Diagram

### Protective Action Recommendation Logic Diagram Notes

#### Note 1

• Rapidly progressing severe accident: This is a General Emergency (GE) with rapid loss of containment integrity and loss of ability to cool the core. This path is only used for very unlikely scenarios where containment integrity can be determined as bypassed or immediately lost during a GE with core damage and a radiological release expected in less than 1 hour. If this scenario cannot be identified, assume it is not taking place and answer "no" to this decision block.

Note 2 Impediments include the following:

- Evacuation support not yet in place For example, the GE is the initial notification to offsite response organizations or if there is a previous emergency classification notification, the GE notification occurs before preparations to support evacuation. Many sites have a low population density within 2 miles (3.2 kilometers) and evacuation support readiness will not be considered an impediment. This element should be discussed and agreed to with offsite response organizations (OROs). The expected time for evacuation support to be put in place should be agreed to with OROs in advance and embodied in the site-specific protective action recommendation (PAR) logic diagram for those sites where delay of a 2-mile (3.2-kilometer) radius evacuation is necessary, pending support setup. The licensee would base the recommendation on the agreement and would not confer with OROs on this matter before making the initial PAR.
- Hostile action event Many OROs consider that initial shelter-in-place is preferred in this type of event. The licensee would discuss this element with OROs and reach agreement. The licensee would then base its recommendation on the agreement and would not confer with OROs before making the initial PAR.
- Licensees are not responsible for soliciting information or making a determination that weather or other impediments (e.g., earthquake, wildfire) to safe public evacuation exist at the time of the emergency. However, the licensee will consider an impediment to exist, if OROs notify the licensee of such an impediment (e.g., roadways are closed because of deep snow, flooding, construction, etc.).

### Note 3

• "Shelter-in-Place" (SIP in the diagram) is intended to mean that instructions are given to remain indoors, turn off heating or air conditioning (as appropriate for the region and season), close windows, monitor communications channels and prepare to evacuate. The instructions should specify that shelter-in-place is safer than evacuation at this time, or alternatively, shelter-in-place is being implemented in order that the public remain off roadways to allow other areas, under an evacuation order, to evacuate unimpeded. The intent is for members of the public to remain where they are, or seek shelter close by, but not to return home to shelter.

#### Note 4

• This includes downwind sector(s) and adjacent sectors.

• Site-specific wind persistence analysis may indicate the need to include additional sectors with the initial recommendation. The licensee must discuss this element with OROs and reach agreement.

#### Note 5

• "Heightened Preparedness" is intended to mean that the population within the plume exposure pathway emergency planning zone (EPZ) is informed of the emergency at the nuclear power plant and that they should monitor the situation and prepare for the possibility of evacuation, shelter-in-place or other protective actions. Further, if an evacuation is taking place, the public not residing in the evacuation areas should be asked to remain off the roadways to allow those instructed to evacuate to do so. Communications with this population must be clear and frequent to be effective.

#### Note 6

• Once a GE is declared, terminating the declaration will take time. If the conditions that caused the declaration have improved (i.e., core cooling is restored), it may not be necessary to expand the PAR to evacuate additional areas. However, if there is a source term in containment that exceeds the GE emergency action level, expansion of the PAR in areas where protective action guidelines (PAGs) could be exceeded is appropriate, as GE conditions remain.

### Note 7

• At T=X hours, where X equals the site-specific 2-mile (3.2-kilometer) ETE for 90 percent evacuation, (e.g., 3 hours after the public is notified of the initial PAR), the licensee should evaluate the need to expand the PAR, based on plant conditions. The licensee identifies the value of T using the site-specific ETE and shall consider T<sub>D</sub> for a daytime ETE and T<sub>N</sub> for a nighttime ETE. These values should be representative for the site and should not include special events. The shift staff is expected to make this PAR without conferring with OROs, and the PAR is based on the ETE time value alone, not on verification of evacuation progress. If the augmenting emergency response organization (ERO) has been activated, there should be sufficient resources available for the licensee to confer with OROs more fully.

### Note 8

- If the impediment was the time to set up evacuation support (e.g., at a high-population site) When the agreed-to time (e.g., 1 hour) for evacuation support to be in place has elapsed, the PAR should be changed. Licensee shift staff is not expected to confer with OROs before changing the PAR although, if the ERO is activated, they may confer.
- If the impediment was a hostile action event Within 1 hour of the initial PAR, the licensee should discuss with OROs whether the sheltering PAR should be changed. This will be dependent on plant status as well as local law enforcement support obtained by OROs.
- If the impediment was caused by weather or other roadway disruption OROs will determine when it is appropriate to change the protective action. Licensees may inquire as resources allow, but have no responsibility for PAR modification unless a PAR change is necessary because of plant conditions. OROs determine when it is safe for the public to evacuate.

#### Note 9

The rapidly progressing severe accident is more severe than other GEs, and different protective actions are appropriate for all sites. However, differences in ETE will dictate the most appropriate protective actions. Sites where the time to evacuate 90 percent of the population within a 2-mile (3.2-kilometer) radius is 2 hours or less should immediately and urgently recommend evacuation of the 2-mile (3.2-kilometer) radius, otherwise recommend shelter-in-place. The licensee uses the site specific ETE for this decision and shall consider T<sub>D</sub> for a daytime ETE and T<sub>N</sub> for a nighttime ETE. The ETE values should be representative for the site and should not include special events. If the 2 to 5 mile (3.2 to 8 kilometer) downwind evacuation time for 90 percent completion is 3 hours or less then that area should also be immediately evacuated (this time should include any traffic control preparations where necessary), otherwise, recommend shelter-in-place. For all cases shelter-in-place should be recommended for the 5 to 10 mile (8 to 16 kilometer) downwind areas.

#### Note 10

• Evacuation after the initial shelter-in-place period is critical to reducing public exposure. However, the rapidly progressing severe accident scenario cannot be precisely characterized in advance. In general, accident analyses show that this source term may be initially large, but it will be reduced within several hours because of the exhaustion of the available radionuclide inventory (NRC, 1990). Mitigative actions may also be implemented to reduce the source term. While the timing of this reduction can not be specified in advance, the licensee must use available radiological monitoring information to identify when it would be safe to begin public evacuation from affected areas. PAR Study results showed that shelter-in-place times in excess of 4 hours reduce public exposure for the hypothetical events analyzed; and conversely, shelter-in-place for less than 4 hours did not reduce public exposure. However, the determination must be based on current information from effluent monitors, operational status, and field monitoring efforts.

The NRC expects that licensees would discuss evacuation of the sheltered population with OROs and plan for rapid evacuation of the public through potentially contaminated areas. Lateral evacuation should be considered, as it may reduce public exposure where the roadway network and plume meander are conducive.

The evacuation should proceed from the areas most at risk. This is expected to be the 2-mile (3.2-kilometer) radius (if sheltered), unless field monitoring data shows otherwise. The 2 to 10 mile (3.2 to 16 kilometer) downwind sectors should be evacuated when the initial evacuation is nearing completion.

#### Note 11

- Continue radiological and meteorological assessments and evacuate any areas where dose projections or field measurements indicate that protective action guidelines are likely to be exceeded. Recommend shelter-in-place for additional areas, as appropriate. Maintain heightened preparedness. OROs should communicate frequently with the public while protective actions are in effect.
- Continue plant assessments to determine if accident conditions warrant changes to the PAR.



# **APPENDIX**

### EFFECTIVE COMMUNICATION WITH THE PUBLIC TO SUPPORT EMERGENCY PREPAREDNESS AND RESPONSE

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# 1. PURPOSE

This appendix provides guidance to licensees of the U.S. Nuclear Regulatory Commission (NRC) and offsite response organizations (OROs) to enhance communications with the public before and during nuclear power plant emergencies. This guidance includes the integration of protective action elements such as expanded use of shelter-in-place, heightened preparedness, and staged evacuation, as well as methods to reduce shadow evacuations. The appendix supplements the guidance contained in NUREG-0654/FEMA-REP-1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Revision 1, (NRC 1980), by providing methods and techniques to enhance the effectiveness of communications with the public during emergencies. Implementation of the methods presented can improve public understanding of, and compliance with, protective action direction from OROs. This communications appendix is intended to be fully consistent with, and complementary to, the Federal Emergency Management Agency (FEMA) guidance.

# 2. INTRODUCTION

Research on alternative protective actions showed that shelter-in-place and staged evacuation can enhance public health and safety during a nuclear power plant accident (NRC, 2007). Research on large-scale evacuations (NRC, 2005; NRC, 2008a) showed the importance of clear communication with the public during emergencies. To achieve the desired public response to shelter-in-place and staged evacuation protective actions, NUREG/CR-6953, "Review of NUREG-0654, Supplement 3, 'Criteria for Protective Action Recommendations for Severe Accidents," Volume II, (NRC, 2008b), included several recommendations regarding communications. This guidance addresses these recommendations, which are summarized below:

- Communicate the benefits and appropriateness of staged evacuation and shelter-in-place to the affected public.
- Develop guidance on communicating with the public during a shelter-in-place and directing an effective evacuation upon the termination of shelter-in-place.
- Develop communications that will support effective staged evacuation.
- Develop communications to minimize shadow evacuation.
- Develop communications that address the evacuation of schoolchildren.
- Enhance processes for identifying residents who may require assistance during an evacuation.
- Update emergency planning information regarding the management of pets at congregate care centers.

### 2.1 <u>Public Response</u>

There is much agreement among researchers that an individual's decision to implement protective actions is influenced by, among other things, the belief and understanding of the warning. More specifically, the following items are necessary for assembling effective public warning messages (Mileti, 2000):

- Hazard--Describe the event in enough detail for members of the general public to understand the hazard and why it may be a threat to safety.
- Location--Identify the areas that may be affected such that the general public will understand who is at risk as well as who is NOT at risk.
- Guidance--Provide clear instruction regarding what people need to do, how to do it, where to go, and how to get there.
- Time--Inform the public how long they have to implement protective actions and why the time is important. In most instances, immediate and urgent response would not be needed, and messages should convey that residents have time to prepare and evacuate.

• Source--Choose the source to convey protective action information carefully, as it affects the perception of risk. Information from a credible and reliable source encourages believability.

The frequency of messaging is also important, because the number of times a message is heard affects understanding and belief. This increases confidence that the message is understood and decreases the opportunity for misinterpretation. Communications with the public during emergencies should expeditiously address information needs to minimize the time individuals take to verify information and implement a protective action (Mileti, 2000).

### 2.2 <u>Staged Evacuation and Heightened Preparedness Protective Actions</u>

Two alternative protective actions that are introduced include staged evacuation and heightened preparedness. A staged evacuation is one in which one area is directed to evacuate first, while others are asked to shelter-in-place and await the order to evacuate later, if necessary. For nuclear power plants, a staged evacuation would be directed for the 2-mile (3.2-kilometer) area around the plant, while downwind areas out to 5 miles (8 kilometers), or farther as needed, would shelter-in-place. When implementing a staged evacuation, the public not within the affected area should be requested to stay off roadways to allow those directed to evacuate to do so. Heightened preparedness is intended to mean that the population within the plume exposure pathway emergency planning zone (EPZ) is informed of the serious emergency at the nuclear power plant and instructed to monitor the situation and prepare for the possibility of evacuation, shelter-in-place, or other protective actions. Communications with this population must be clear and frequent to be effective. These protective actions require additional communication in both the public information program and during an emergency, to ensure the public understands the expected response.

### 2.3 Department of Homeland Security Guidance

This communication appendix is intended to be consistent with U.S. Department of Homeland Security (DHS) guidance, which was established to prepare the public for events that might require protective actions. DHS guidance, developed in response to "Homeland Security Presidential Directive 8; National Preparedness," dated December 17, 2003 (HSPD-8), establishes policies to strengthen the preparedness of the United States, including encouraging active citizen participation and involvement in preparedness efforts. HSPD-8 also provides for a comprehensive plan to communicate accurate and timely preparedness information to public citizens, first responders, and other interested parties (DHS, 2003). DHS provides detailed information on the expectations for citizen preparedness, during an emergency, at its Web site, www.dhs.gov. The guidance encourages individuals to take responsibility for themselves and their families through planning and preparedness in the unlikely event of an emergency.

### 2.4 Federal Emergency Management Agency Guidance

Part I, Section E, "Public Information Materials Review Guidance," of the FEMA Interim REP Program Manual, contains "A Guide to Preparing and Reviewing Public Information

Materials and Emergency Alert System Instructions for Radiological Emergencies" (FEMA, 2002). This guide supports the FEMA review of offsite radiological emergency preparedness planning, response, and public information materials and addresses the potential audiences, content, and format of public information materials and emergency alert system (EAS) messaging. The information provided in this appendix is intended both to complement the FEMA guidance by adding detail in selected areas and to integrate heightened preparedness of the public and staged evacuation into the communications program.

# 3. PUBLIC INFORMATION MATERIALS

Public information materials are disseminated yearly to the public within the EPZ, as required in Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." Brochures, phone books, calendars, and utility bills are examples of methods used to inform residents on radiation, instructions for evacuating and sheltering, arrangements for special-needs individuals, contacts for additional information, and other topics related to emergency preparedness. In a comprehensive telephone survey conducted in 2008 of residents within EPZs, published in NUREG/CR-6953, Volume II, (NRC, 2008b), most respondents stated they are familiar with these emergency information materials, and many keep this information readily accessible. Most residents of EPZs prefer their information sources to be pamphlets and calendars, while some residents prefer emergency management Web site information (NRC, 2008b).

The public information program is intended to provide the permanent and transient population within the EPZ an annual opportunity to become aware of preparedness information (NRC, 1980). Section II.G of NUREG-0654/FEMA REP-1, Revision 1, contains guidance on the content of public information materials, which should include, but not be limited to, educational information on radiation; contacts for additional information; and protective measures, such as evacuation routes, sheltering, respiratory protection, radioprotective drugs, and information for special-needs individuals. While these information and instructions tend to be directed to individuals who are at home when an emergency occurs. Clarifying expectations for those who are not at home when a protective action is ordered will provide members of the public a greater understanding of what is expected in the unlikely event of an emergency. Public information materials should include the following information:

- Explanation of the individual's responsibility for emergency preparedness. Consistent with DHS guidance, encourage residents to be prepared and have an emergency response kit.
- A registration card so residents who may need assistance to evacuate can provide their telephone number and register their need.
- Instructions regarding what to do if sirens (or other alerting devices) sound. Sirens are intended to support an initial notification. The public should listen for an EAS message before taking any other action.
- Explanation of the types of protective actions that may be recommended.
- Instructions regarding what to do if ordered to evacuate, including who is to evacuate, where evacuees are to go, when they need to leave, and transportation alternatives for getting to their destination.
  - discussion of personal belongings that evacuees, including those who may use public transportation, should bring during an evacuation

- instructions for those who will need a means of transportation to evacuate (i.e., transit dependent)
- location of bus routes and pickup points along routes for the transitdependent population, and a discussion regarding how transit-dependent residents should plan to get to the pick-up points
- location of facilities where residents should go if ordered to evacuate, such as registration centers, congregate care centers, or shelters
- A map of the EPZ that shows evacuation routes and emergency response planning areas (ERPAs), which are also referred to as protective action zones or other local terminology.
- Specific instructions to parents regarding the evacuation of schoolchildren, including whether provisions are in place for parents to pick children up from school, if they wish. Information should be included regarding the reception centers for schools. These may not always correspond to the parent's assigned reception center, if the parent works elsewhere within the EPZ or is at home.
- Instructions on how to shelter-in-place. Residents should be instructed on the basics of closing doors and windows and shutting off air conditioning or heating (as appropriate for the region and season). Residents should also be instructed to prepare for a possible evacuation while they are sheltering-in-place.
- Information to limit shadow evacuations. The informational material should define a shadow evacuation and note that it has the potential to impede the traffic flow and slow the evacuation from the affected area. It should clearly state that those who are not within the declared evacuation area should not evacuate.
- Explanation regarding the use of potassium iodide (KI), including what to do if KI is not available to the individual (e.g., KI not distributed; KI is lost). It is important for residents to understand that they are still safe if use of KI has been recommended, and the individual does not have access to it. This information is only necessary in States where KI will be authorized for the general public.
- Information to residents regarding whether KI will be available at congregate care centers and why it is safe to wait until evacuees get to the centers to take KI. This information is only necessary in States where KI will be authorized for the general public.
- A list of television and radio stations that provide emergency information.
- Definitions of terminology used in the informational material or in EAS messages.
- Basic information regarding radiation and nuclear energy.
- Explanation regarding what to do with pets. Informational materials typically state that pets should be left at home or that pets are not allowed at congregate care centers. Research shows that residents are more likely to comply with an

evacuation order if they can bring their pet (NRC, 2005; NRC, 2008a), thus, public information materials should not suggest that pets be left at home. Statements such as "pets are not allowed at congregate care centers" do not tell residents what to do with their pets. A statement such as "Pets may be brought to congregate care centers, provided they remain in a pet carrier, in the vehicle, or outside at all times," informs the recipient that pets may evacuate with the family but restrictions may apply. The policy on pets must be discussed with the operator of the congregate care centers, as some operators do place restrictions on pets.

A review of existing public information materials has shown that basic information does not always include complete instructions. Providing additional detail in the materials can better inform the public of expectations during an emergency. Data shows that the public follows instruction more readily when better informed (NRC, 2008b). Detailed guidance that should be considered and included in public information materials is provided below.

### 3.1 <u>Heightened Preparedness</u>

Heightened preparedness should be formally established as a protective action. The alert and notification that occur by sounding sirens (or other alerting devices) and broadcasting EAS messages initiates the implementation of a heightened preparedness for those within the EPZ. Public information materials should describe the concept of heightened preparedness, introduced in this update to Supplement 3.

### 3.2 <u>General Guidance for Evacuation</u>

Evacuation is a key element of emergency preparedness, and public information materials should provide some detail regarding the expectations of the public. At the basic level, the public information materials should contain the following details (FEMA, 2002):

- Who is to go (i.e., affected ERPAs)
- Where they are to go (e.g., reception centers, congregate care centers, shelters)
- How they should get there (e.g., personal vehicle, bus)
- When they should go (e.g., whether there may be time to go home and pack, or if they may be requested to leave the area immediately, with specific directions provided through EAS messaging)
- What they should take with them

Public information materials should state that the evacuation will be directed by local authorities who will staff traffic control points throughout the evacuation area. To avoid confusion, the materials should include details such as the following regarding the expected actions of the public if they are not at home when an evacuation order is issued:

- Describe actions to take for those in vehicles when the order is issued. Some existing public information materials instruct drivers to roll up windows and turn off vents but do not provide instructions on whether drivers should exit the EPZ immediately or if they may drive home first.
- Describe actions for those whose family is not together at home. Public information materials should recommend that families create an emergency plan to address separation and reunion issues. Families should be encouraged to allow schools to evacuate children in accordance with established plans. When children are not at school but not at home, the guidance must recognize the need for families to gather children.
- Describe actions to take for those who are at other locations, such as working, shopping, and dining.

### 3.3 <u>Staged Evacuation</u>

Staged evacuation, introduced in this update to Supplement 3, is the preferred initial protective action in response to a General Emergency because it is more protective of public health and safety than other actions (NRC, 2007). In a staged evacuation, those closest to the plant (i.e., within 2 miles (3.2 kilometers)) are evacuated first, while others shelter. The evacuation is later expanded as necessary. Public information materials should explain that the purpose of staged evacuation is to allow those directed to evacuate to do so in an unimpeded manner. A key message in the material should inform residents not in the evacuation area to stay off roadways to allow the initial evacuation to proceed. Those asked to shelter-in-place or to implement heightened preparedness should prepare for the possibility of evacuation, should it be necessary.

### 3.4 School Evacuation

Research shows that people prefer to evacuate as a family unit, and some parents will attempt to pick children up from school (NRC, 2008b). Emergency preparedness professionals should recognize that, through the immediacy of cell phone communication among children, parents will likely become aware of an impending school evacuation before buses are mobilized. This early awareness may result in large numbers of parents picking up their children. It is suggested that this sensitive issue be addressed with a two-fold approach.

- The initial expectation of most OROs is that schoolchildren will be evacuated. Public informational materials and other communications with parents of children in public schools should discuss the benefits of allowing schools to implement these evacuation plans without interference. It may be appropriate to explain that parental interference may impede the evacuation process and thereby increase risk to all students during an emergency. The materials should clearly describe the evacuation process for schools and the locations where parents can find their children.
- Although the initial expectation of OROs may be to evacuate schoolchildren, parents will arrive and will remove their children from school. This is potentially difficult to manage in an emergency; however, school evacuation planning should

accommodate parents picking up children. This may include developing an expedient means to release children to parents, friends, or relatives, and may also include provisions to manage additional traffic.

### 3.5 <u>Transit Dependent Public Evacuation</u>

Transit-dependent residents, by definition, need transportation assistance to evacuate (NRC, 1980). It is important that planning documentation emphasize that transit-dependent residents should request a ride from a neighbor, relative, or friend, while also assuring residents that transportation will be available if they are unable to obtain a ride. Research suggests that most evacuees with vehicles would provide a ride to someone in need during an evacuation (NRC, 2008b). Residents requiring transportation assistance are asked to register with the ORO, and most public information materials include bus routes for pickup and instructions to go to the nearest major street where buses are traveling. The informational materials should include the following additional information:

- Describe how authorities expect transit-dependent residents to get to a bus route and what to do if they cannot get to the bus route on their own (e.g., register for assistance).
- State whether residents may bring their pets, and whether restrictions apply, such as the required use of a pet carrier.
- Discuss when the bus runs will start, taking into account that it may take an hour or longer to mobilize drivers and buses.
- Discuss how long residents may expect to wait for pickup.
- Explain why residents are safe outdoors while waiting for pickup.
- State whether multiple bus runs will be made within the EPZ.

### 3.6 Shelter-in-Place

Instructions are typically provided on how to shelter-in-place and include details such as closing doors and windows, turning off air conditioning or heating (as appropriate for the region and season) and monitoring communications channels for further instructions. In addition, details should be included on expected actions for the following situations:

- Those in vehicles when the order is issued (e.g., leave the EPZ or enter a nearby building)
- Those whose family members are not together at home (e.g., implement family emergency plan)
- Those who are, for example, working, shopping, or dining (e.g., remain in the building where they are currently located and monitor for additional information)

As provided in the Interim REP Program Manual (FEMA, 2002), emergency messages should agree with the information in the brochure and be repeated frequently to reassure the public that the instructions remain appropriate.

### 3.7 Special Needs Individuals

According to NRC research, 8 percent (± 3.5 percent at the 95-percent confidence level) of the EPZ population nationwide may require assistance from outside the home during an evacuation (NRC, 2008b). However, a quarter of these people believed that, if necessary, they might be able to evacuate on their own, leaving about 6 percent of the population that might require assistance from outside the home during an evacuation. The research indicated that only 29 percent of these people (less accurate figure due to smaller sample size) have registered with local authorities, while an equal number, 29 percent, did not know how to register. A typical means for registering special-needs individuals not residing in special facilities is to provide a post-card in the public information materials (FEMA, 2002). Research shows that this method is not used by a majority of those in need (NRC, 2008b).

The response rate from registration services currently available indicates that this is an area where enhanced communication in the planning phase may yield substantial improvement. Although most EPZ residents have reviewed the public information brochures (NRC, 2008b), of those who stated they may need evacuation assistance, 42 percent indicated they did not know they could register. About 30 percent have not "taken the time" to register. Fewer than 10 percent of those respondents who would need assistance to evacuate indicated that they were concerned about providing personal information to others. This population group is rather diverse and may include those with physical or mental handicaps, the aged, and those recently but temporarily incapacitated.

The survey results indicate residents with special needs are willing to inform authorities of their need; however, the current registration process should be improved. Public information materials should address the need to register for assistance, but efforts should not be limited to registration cards. The following techniques may result in increased registration:

- Provide a distinct section in the beginning of the public information material to attract the attention of those who might need assistance. A bold-print telephone number and a Web address, if available, should allow registration over the telephone or Internet.
- Change the title from "Special Needs" to "Evacuation Assistance," or another more general term to avoid a connotation to which an individual may be sensitive.
- Move the registration card to the first or second page of the informational material and modify the card to attract readers. The card itself could be a different color and might include questions designed to elicit a response; for instance, asking if the resident has a pet. This information may stimulate residents to complete the card.

- Inform residents that personal information will be kept confidential.
- Routinely include the need to register for evacuation assistance during outreach efforts within the community.
- Contact senior centers or advocacy groups in the EPZ for assistance in registration.

The responsibility for identifying these individuals does not rest solely with local authorities. Individuals must take responsibility for their own family's emergency planning and this includes requesting help before it is necessary. However, ultimately, the OROs will be called on to evacuate anyone remaining in the area, and extra efforts in planning should help identify a majority of those requiring assistance.

# 4. EMERGENCY ALERTING AND INSTRUCTIONS

Local authorities will use the alert and notification system to warn the public of an emergency and the need to take protective actions. This system normally consists of sirens, tone-alert radios, and the EAS to alert and inform the public. Detailed information can be communicated to the public through EAS messages and radio and television broadcasts. Additional tools are available and used by some OROs, including publishing information on emergency management Web sites, blast texting emergency notices using cell phone messaging systems, and establishing emergency management Internet blogs. Tools such as these should be considered, as their use is expanding rapidly and can be cost effective.

### 4.1 Initial Alert and Notification

The requirement for a prompt initial alert and notification message to the public is provided in 10 CFR 50.47, "Emergency Plans," with additional guidance included in NUREG-0654/FEMA-REP-1, Revision 1 (NRC, 1980). The intent of the initial notification is to use a scripted EAS message to bring awareness to the public that there is an incident at the nuclear power plant. It is important that emergency response instructions be consistent within the EAS message, and EAS messages should be reviewed for consistency with public information materials (FEMA, 2002). For instance, when a telephone number is included in an EAS message for residents to use to obtain additional information, the EAS message should not ask residents to refrain from using the telephone if a phone number is provided in the EAS message. Such contradictory information should be clarified or omitted.

### 4.2 Ongoing Communication during an Emergency

After the initial alert and notification, the public will maintain an awareness of the event through media broadcasts and subsequent EAS messages. The length of time during which the public will be expected to monitor the situation should be mentioned as early in the communication as practical. If the initial notification to the general public is at Site Area Emergency (SAE), it may be hours before there is new information available that is substantively different than the original messages. It is important to maintain a current status of the emergency with the public through frequent and scheduled updates, even when there is no measurable or definable change in the emergency status.

The national survey of residents of EPZs (NRC, 2008b) found that less than 30 percent of residents believe they would monitor an emergency event for more than 4 hours. Thus, for an emergency in which it may be necessary to ask the public to monitor the situation for many hours, it is important to convey the reason for such a lengthy monitoring period and to assure the public that, as events unfold, there will be time to implement protective actions. The objective of this lengthened period of communicating routinely to the public should be to create a state of heightened preparedness among those in the EPZ, which will require clear and frequent communication to be effective. The details of the message should instill confidence in the public that the emergency is being monitored and that the public will have time to comply with any protective action that may be needed.

### 4.2.1 Sheltering-in-Place Messaging

For shelter-in-place, residents should be instructed to go inside or remain indoors, turn off heating or air conditioning, seal windows, monitor communications channels, and prepare to evacuate. The instructions should specify that sheltering is more safe than evacuation at this time. An impediment to shelter-in-place may include loss of power or loss of communication systems. When these systems are not available to inform the public to take shelter and subsequently to inform the public when to exit the shelter and evacuate, then the effectiveness of shelter-in-place as a protective action may not be achieved. If a power outage is associated with a nuclear power plant emergency, and if power is not expected to return to normal in a short amount of time, shelter-in-place may not be the most appropriate protective action for emergencies in which a release is expected.

Messages should address the locations at which people might be sheltering such as at home, work or other location. Frequent updates should be provided on the need to shelter and the expected length of the shelter period. When shelter-in-place instructions are provided, recognize that for large commercial, industrial, and office buildings, it is often not a simple task to turn off heating and air conditioning units. Large facilities may require a building engineer to support such an activity. Communications should address the importance of shutting off outside air sources and inform those sheltering in such facilities as to why it may or may not be appropriate to stay in place if heating or air conditioning cannot be shut off.

Some EAS messages recommend that, during a shelter-in-place protective action, residents should take KI that has been provided to them. It is important to provide instructions to those who are not residents, such as tourists, and to residents who may not have KI or may not know where it is. Individuals who do not have KI available to them need to know if it is still appropriate to shelter-in-place. This detail is specific to each State because some States do not implement KI programs, while others distribute KI to residents or stockpile KI for distribution at reception centers.

Expectations at the end of the shelter-in-place period should be clearly communicated and may include evacuation, if a release has occurred. The benefits from shelter-inplace diminish quickly if the notification to leave and subsequent evacuation are not conducted optimally (NRC, 2007). Analyses show that shelter-in-place in residences and buildings can be highly effective at reducing dose, although reliance on large dose-reduction factors for shelter-in-place should be accompanied by cautious examination of the local housing conditions in order to understand the integrity of these structures with regard to shelter benefits (EPA, 1991).

### 4.2.2 Evacuation Messaging

It should be recognized that, even if an evacuation is ordered immediately, the mobilization of residents and their travel to exit the EPZ takes time. During this period, instructions and communication to the public should be continuous and informative regarding the status of the incident, as well as the status of the protective action. Communications should address the known population groups, including permanent residents, transit-dependent residents, transients (i.e., tourists, employees and other non-EPZ residents), special needs individuals not residing in special facilities, schools,

and special facilities. Messages should address the possible locations where people might be when an evacuation is ordered, such as at home, work, or other location, because their response decisions may be based on their location.

Instructions on evacuation should be specific, identify ERPAs or protective action zones that are under an evacuation order, and clearly state that people in areas not under an evacuation order should refrain from travel to allow evacuees to exit the area. Information directed to transients should express the immediacy of the need to comply. If the order is for immediate evacuation, then instructions should clearly indicate such. It should be recognized that members of the transient population may not be aware of their ERPA or protective action zone.

The following evacuation information should be provided in media broadcasts and on Web sites when available:

- Specify to whom the message applies (e.g., residents, tourists, employees, special-needs residents).
- Explain where to find information describing the evacuation zones, such as the public information brochure or the telephone book. Maps with very clear boundaries of the affected areas are recommended.
- Indicate where to go, such as a reception facility, and the reason to go to the facility. Clarity and consistency are important: for instance, if the EAS and media messages state that there has not been a release from the plant, the instructions to go to a reception center should not explain that the purpose is to screen residents for contamination.
- Specify when to leave, such as immediately or within an hour, to inform the residents of the level of urgency.
- Describe any special activities that should be performed before leaving home, such as turning off heating or air conditioning and locking and securing the home for a brief absence.
- Explain what to do if a person does not own a vehicle and cannot get a ride with a neighbor.
- If children are evacuated from school, indicate where parents can meet them.
- Specify the organization and the telephone number to request assistance.
- Indicate who should not be contacted simply for additional information, such as 911.
- Specify when additional information and updates will be provided through the media.

### 4.2.2.1 Staged Evacuation Messaging

The preferred protective action is a staged evacuation where the 2-mile (3.2-kilometer) area around the nuclear power plant is evacuated first, while others shelter-in-place. The purpose of staging an evacuation is to allow those nearest the plant to be evacuated first, with little effect from background traffic on roadways. Although most residents believe they would support a staged evacuation order (NRC, 2008b), the potential for a shadow evacuation of the surrounding areas exists, as it does with any evacuation. For a successful staged evacuation, clearly defining the limits of the evacuation area is important. Clear and direct communication should identify areas that should not evacuate and the reason for staying off roadways and explain that this is to allow those nearest to the plant to leave first. The public that is asked to shelter-in-place should be informed that they will be evacuated, should it be necessary, as soon as those directed to evacuated are moved. Communication combined with traffic control is necessary for the staged evacuation to be successful.

### 4.2.2.2 School Evacuation Messaging

Emergency planning for the evacuation of schoolchildren is often established to move children early such as at SAE, or, in some instances at Alert. It should be expected that parents will receive word of the evacuation through informal channels before the mobilization of buses to support an evacuation. Cell phones are widely available and used by children of all ages, and parents will likely be informed of preparations for evacuation. As a result of this "societal notification," parents, friends, and family should be expected to pick children up even if informed that children will be evacuated (NRC, 2008b).

Additional communications that emphasize the benefits and safety of organized evacuation of the schools can alleviate some parents' concerns and reduce potential added traffic congestion in these areas. However, school administrators should understand the strong desire to evacuate as a family and should plan to accommodate the pickup of children. This includes providing an expedient means to release children to parents, friends, or relatives. Local traffic control plans around schools should be prepared to manage vehicles and buses in the area.

### 4.2.2.3 Shadow Evacuation Messaging

A shadow evacuation is the evacuation of people from an area that is outside an officially designated evacuation area, usually consisting of areas adjacent to the affected area. A shadow evacuation should be anticipated (NRC, 2008b) and can be controlled or mitigated through communication, education of the public, and implementation of traffic control (NRC, 2005). Emergency response agencies are typically focused on sending an immediate message to the affected population, but for large-scale events, a clear message should also be provided to those that are in areas not affected by the incident. In particular, the success of staged evacuation depends on minimizing shadow evacuation, which can delay those directed to evacuate. NRC research indicates that about 70 percent of EPZ populations will comply with shelter-in-place while a staged evacuation takes place. However, the same population indicated that a majority may evacuate if simply told others are evacuating but they need not (NRC 2008b). The proper message is necessary to ensure an effective response.

### 4.2.2.4 Transit Dependent Evacuation Messaging

Communications to the transit dependent population should emphasize the need to request a ride from a neighbor, relative, or friend. For those who cannot obtain a ride, information should be provided, consistent with the public information material, such that transit-dependent residents know where bus routes are and how they are expected to get to the bus route. Instructions to this population group should include the following:

- A map of bus routes or a list of major roadways on which buses are running
- How often buses will be running
- How these residents are expected to get to the bus route
- What to do if they cannot get to a bus route
- Whether they are safe outdoors while waiting for pick up
- What provisions they should bring for a few days (e.g., clothing, medical supplies)
- Whether limits will be placed on allowable belongings (e.g., can they bring their pets and if so, must they be in a pet carrier)
- How long they may expect to wait for a bus

Recognize that in many EPZs this population group may include thousands of individuals. Once the individuals are at the bus stop, communication with them will be limited; thus, initial instructions must be thorough and accurate.

### 4.2.2.5 Messaging for Special-Needs Residents Not Residing in Special Facilities

Messages to this population group should request they obtain a ride from a relative, friend or neighbor, if at all possible. Instructions should clearly state what to do for residents who have registered with authorities as needing assistance. A key element of this messaging is how long residents should expect to wait for prearranged assistance to arrive, and what to do if assistance does not arrive during the specified timeframe. It can take many hours in some EPZs to mobilize and complete the evacuation. This information will need to be carefully coordinated with response agencies to include the specific areas where these agencies are focusing on assisted evacuation efforts. Residents should be informed what to do while waiting for assistance to arrive. Instructions are also needed for residents who have not preregistered for assistance. For those who still require transport, a means should be provided to contact response agencies for assistance.

#### 4.2.2.6 Special Facilities Evacuation Messaging

Special facilities have specific evacuation plans and may receive early warning through direct notification during an emergency. This preplanned activity helps ensure that the special facilities are notified promptly to allow reaction and response activities to begin. Although the warning may be direct and the facility response may be prompt, the nature of these facilities requires additional time to implement a protective action strategy. EPZ evacuation times for special facilities, such as hospitals and nursing homes, may be longer than the evacuation time for the general public. In the evacuation of special facilities for Hurricanes Katrina and Rita, most of the special facilities had independent evacuation plans (NRC, 2008a), but frequently the facilities identified the same ambulance or bus service to support an evacuation. When all of the facilities required evacuation at the same time, there were not enough resources available. Although emergency response planning should address adequate resources, it is important that emergency management agencies communicate directly with facilities to both determine if they need assistance evacuating the facility, and to follow up at a later time to verify whether expected resources arrived to evacuate the facility.

# 5. <u>ADDITIONAL GUIDANCE FOR MORE EFFECTIVE</u> <u>MESSAGING</u>

In addition to the existing guidance provided in NUREG-0654/FEMA-REP-1, Revision 1, and that provided above, the following should be considered in the development of communications messages:

- As new communications systems become more widely available, EROs are using them, in addition to the normal alert and notification system. Secondary systems using Reverse 911<sup>®</sup>-type telephone messaging are available in many areas and route alerting is commonly identified as a backup or alternative method of notification. In some EPZs, residents can register to receive emergency messages by cell phone text messaging, emails, and automated telephone calls.
- Emergency response agencies are typically focused on getting an immediate message to the affected population. A clear message should also be provided to residents in areas adjacent to and extending about 5 to10 miles (8 to 16 kilometers) beyond the evacuation area. This should be a site-specific determination and should be based on population density and availability of roadway infrastructure. Residents of areas not affected by the incident should be instructed to stay off roadways to allow those directed to evacuate from the EPZ to proceed unimpeded.
- Use of telephone numbers such as 211, 311, or others should only be encouraged in areas where it is confirmed that the phone service can handle the large number of calls anticipated.
- As provided in NUREG-0654/FEMA-REP-1, Revision 1, Section II G(4)(c), each organization is to establish coordinated arrangements for dealing with rumors (NRC, 1980). It should be recognized that rumor control may play a greater role in communications than anticipated in the past. During emergency events, the public widely uses cell phones and Internet access for immediate communications (NRC, 2008a). Text messages are "blasted" to large groups of recipients and Internet social networking utilities are widely used. Emergency response agencies should monitor social networks and address errant information expeditiously through rumor control. The use of blog sites by emergency management agencies is helpful in controlling rumors.
- Establishing an emergency management Internet blog has proven effective in providing current updates of incidents, as well as clarifying erroneous information. Response personnel can use cell phones to send text, photos, or video directly to their Web sites to provide first hand credible information on the incident. This approach was successfully implemented by St. Charles Parish in response to Hurricane Gustav in 2008, where the Internet blog was managed out of the emergency operations center (NRC, 2008a).
- Under the National Response Framework, DHS/FEMA assumes overall coordination of an incident if it progresses to a General Emergency. As Federal agencies, such as DHS/FEMA, become integrally involved in the incident the public should be informed that these are planned actions, to avoid unnecessary confusion.

- The public will generally want to confirm the need to take action, and it may be expected they will actively seek additional information (Mileti, 2000). With telephones, cell phones, and the Internet readily accessible to most Americans, it should be expected that attempts to confirm information will be immediate, and the propagation of information will occur quickly. Requests that the public refrain from using these services are not likely to be heeded. A better approach is to ensure adequacy of the available systems and for emergency response agencies to use these services as well, to provide additional information to the public.
- Cable overrides and cable scrolls used to provide emergency information should be carefully constructed to avoid messages so lengthy that residents cannot determine whether they are affected by the incident.

### 6. <u>REFERENCES</u>

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