

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

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Prepared By:

Sandia National Laboratories
Albuquerque, NM 87185
Operated by
Sandia Corporation
for the U.S. Department of Energy

R. Sullivan, NRC Technical Lead

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U.S. Nuclear Regulatory Commission
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ABSTRACT

The guidance in this updated Supplement 3 to NUREG-0654, FEMA-REP-1, Rev. 1 supersedes previous guidance on the development of protective action recommendation (PAR) logic for nuclear plant accidents. The guidance suggests that nuclear plant operators 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 Attachment 1 of this supplement. The PAR Logic Diagram should be used to develop a site-specific PAR Logic Diagram for use by the licensee emergency response organization (ERO). The NRC expects that nuclear plant operators will develop PAR procedures that embody ORO input at the various decision points as identified in the guidance and such input will guide criteria used in the PAR Logic Diagram. Guidance is also provided within this Supplement regarding consideration of precautionary protective actions, assessment of wind persistence, determination of PAR 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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1.0 Introduction

In late 2004, 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 are documented in NUREG/CR-6953, Vols. 1 & 2, "Review of NUREG-0654, Supplement 3, Criteria for Protective Action Recommendations for Severe Accidents" (informally, the PAR Study) and show that shelter-in-place and staged evacuation can be more protective to the public health and safety providing a technical basis for improving NRC PAR guidance. A draft of NUREG/CR-6953 was provided to the Advisory Committee on Reactor Safeguards (ACRS) for review. The ACRS documented its review in a July 27, 2007, letter to the NRC (NRC, 2007a), concluding that NUREG-0654, Supplement 3, which was first published in July 1996 as a draft report for interim use and comment, should be revised. The ACRS also recommended that PAR strategies should not become 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. Three General Emergency accident conditions were analyzed:

- Rapidly progressing severe accident;
- Progressive severe accident; and
- Severe accident without loss of containment.

It should be noted that rapidly progressing severe accidents are very unlikely but nuclear power plant emergency preparedness programs are designed to respond to a wide spectrum of accidents including this scenario.

The NRC staff examined various PAR strategies for each of the three General Emergency accident conditions, including:

1. Immediate radial evacuation which is the current strategy of evacuation away from the plant;
2. Lateral evacuation which is evacuation perpendicular to the plume;
3. Staged evacuation where the close-in population leaves first while others shelter-in-place and then leave;
4. Shelter-in-place where residents shelter at home or in their current location followed by radial evacuation;
5. Shelter-in-place followed by lateral evacuation;
6. Preferential sheltering which includes use of large public structures followed by radial evacuation; and
7. 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 emergency planning zone (EPZ). The relative benefit of alternative PAR strategies was compared to the current strategy and reported qualitatively. 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 the public who do not reside in areas under an evacuation order, were also discussed in the PAR Study.

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

- 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 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 plant EPZs.

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

1.1 Previous Guidance

This Supplement 3 to NUREG-0654 supersedes previous guidance on the development of PAR logic for nuclear plant accidents including the guidance contained in Appendix 1 of NUREG-0654, FEMA-REP-1, Rev.1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," (NRC, 1980) and NUREG-0654, FEMA-REP-1, Rev. 1, Supplement 3, "Criteria for Protective Action Recommendations for Severe Accidents," as a "Draft Report for Interim Use and Comment," (NRC, 1996).

As stated in 10 CFR 50.47(b)(10), "Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place..." This supplement is considered the "Federal guidance" referred to in the regulation, and it will be used to determine compliance with § 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.

2.0 Implementation of Guidance

A PAR Logic Diagram is provided in Attachment 1 of this supplement and should be used to develop a site-specific PAR Logic Diagram for use by the licensee emergency response organization (ERO). **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 plant ERO. Attachment 1 is intended to guide 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 licensee augmented ERO may differ in this and perhaps other aspects, reflecting the expectation that the augmented ERO has more resources than the shift organization. The requirement in Section IV.D.3 Appendix E to 10 CFR 50 to provide OROs a PAR within 15 minutes of declaration of a General Emergency remains in effect regardless of differences in licensee PAR Logic Diagrams used by shift and augmented ERO personnel. The PAR must be made rapidly in accordance with approved procedures, and those procedures should be developed in partnership with responsible OROs.

Direction for the development of site-specific elements and criteria are provided in notes within the PAR Logic Diagram. The diagram is simplified when the site-specific elements are developed and the diagram is deployed in an emergency plan implementing procedure. It is suggested that nuclear plant operators and the OROs responsible for implementing protective actions discuss and agree to various elements and criteria of the licensee ERO PAR Logic Diagram(s). However, in no case does the NRC intend that nuclear plant operators delay the recommendation of protective actions to confer with OROs at the time of a General Emergency. Operators have the responsibility to make timely PARs in accordance with Federal guidance and plant conditions and provide the PARs to OROs to allow them to make timely and well informed protective action decisions. OROs have the responsibility to decide which protective actions to implement.

The NRC expects that nuclear plant operators will develop PAR procedures that embody ORO input at various decision points identified in the guidance and this input will guide criteria used in the PAR Logic Diagram. This criteria and the approved PAR logic diagram in plant emergency plan implementing procedures constitute the plant commitment to OROs regarding PARs that will be provided 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 and/or implementing procedures as a basis to develop the necessary decision points.

2.1 Implementation of the PAR Logic Diagram at a General Emergency

Licensees are required to have the capability 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 guidance of NUREG-0654, Supplement 3, noted that the guidance was to be used to develop PARs in response to severe accidents. 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 plant accident consequence analyses. The PAR Study documents that General

Emergencies are unlikely events. A General Emergency followed by severe core melting is even more unlikely, and a General Emergency where containment would rapidly fail is still more unlikely (NRC, 2007b).

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 and provides a decision point for the increase of 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 ETE. When the ETE is used in the decision process, the 90 percent ETE is the value expected to be used in the decision. The last 10 percent of the evacuating public is referred to as the evacuation tail and can take a disproportionate 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 established based on the time required to evacuate 90 percent of the defined area.

2.2 Termination of Protective Actions

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) assesses 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 protective action direction already given to the public. The licensee is responsible for downgrading the General Emergency, but is not expected to downgrade a General Emergency without wide consultation. Downgrading an emergency may take time to assure 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 given current plant status.

2.3 Precautionary Protective Actions at Site Area Emergency

The NRC does not require precautionary protective actions in response to a 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 Alert. These actions typically include sounding sirens, informing the population that an event has taken place at the site, evacuating schools, closing parks and / or preparing special needs facilities for potential evacuation.

Site Area Emergencies rarely occur. A review of four actual Site Area Emergencies that have taken place since 1980 identified that none required offsite protective actions. Some of these emergencies were declared due to an overly conservative emergency action level (EAL) scheme that has largely been replaced at nuclear plants. However, the PAR Study (NRC, 2007b) 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.

It is not recommended that precautionary protective actions be automatic at Site Area Emergency. The NRC expects that operators will be able to discern whether a Site Area Emergency is potentially a 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 at a Site Area Emergency declaration after conferring with licensee personnel regarding the nature of the event and likelihood of core degradation. Should operators be unable to provide this assessment, the prudent action would be to implement precautionary protective actions. Heightened Awareness is one appropriate precautionary protective action.

In some case, a licensee or ORO may have committed to site-specific precautionary protective actions, such as early and/or preferential evacuation of beach or other recreational areas at the Site Area Emergency. This guidance should in no way be interpreted as countermending these commitments which may exist in licensing basis documents or approved State emergency plans. Although this guidance may be cited as a basis for changing such commitments, no changes in practice or procedure should be implemented until the appropriate approval process is completed.

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 (3) downwind sectors when a 2 to 5 mile downwind evacuation 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 down wind 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 for the population actually at risk. However, this analysis may not be used to justify a default PAR of 360 degrees as this would result in evacuation of areas not threatened by the radioactive release.

3.0 Determination of PAR for Rapidly Progressing Scenarios

As the PAR Study indicates, a nuclear plant accident that leads to a rapidly progressing release is a very unlikely scenario, but the EP planning basis includes planning for this event. A rapidly progressing event, in this context, is defined as a scenario in which a large release may occur in less than one (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. Furthermore, NUREG-0654, FEMA-REP-1, Rev. 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 development of PARs for a rapidly progressing scenario, NRC staff performed a series of calculations using a spectrum of source terms (NRC, 2009 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 the plant and varied shelter durations and evacuation speeds. Efficacy of

protective actions was evaluated for the 0 to 2 mile zone, 2 to 5 mile zone, and 5 to 10 mile zone around the 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. Travel speeds used in the analysis were derived from current evacuation time estimates for evacuation of 90 percent of the general public under normal weekday conditions (NRC, 2009 DRAFT). Multiple weather trials were tested and mean consequences were assessed. The calculations determined relative efficacy rather than absolute consequences.

For sites where the 90 percent ETE for general public of the full EPZ is less than about 3 hours, data shows that for the rapidly progressing scenario, evacuation is the most appropriate protective action. For sites where this is not the case, the following protective actions 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.

0 to 2 mile zone – If the 90 percent ETE for this area is 1 hour or less, immediately evacuate.

2 to 5 mile zone – If the 90 percent ETE for this area is 1.5 hours or less, immediately evacuate.

5 to 10 mile zone – Shelter-in-place then evacuate when safe to do so.

Extreme weather conditions such as inversion, significant precipitation, or no wind conditions 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. However, a review in accordance with 10 CFR 50.54(q) must document the deviation from Federal guidance.

4.0 Radiological Assessment Based PAR

The EAL system used at nuclear plants is designed be anticipatory, in that a General Emergency is expected to be declared based on plant conditions before a serious radiological release could potentially begin. The NRC expects that licensees will perform radiological assessment 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 projection 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 serious release is occurring. While verification of dose projection data is desirable, PARs should not be delayed unduly while awaiting field monitoring data or analysis of samples.

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 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 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 guides (PAGs), it would be inappropriate for licensees to expand PARs based only on changes in wind direction.

5.0 Glossary

- **Emergency Response Planning Area (ERPA)** is defined as local areas 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 radius from the NPP.
- **Evacuation Tail** – A small portion of the population that takes a disproportionate time to evacuate than the remaining public and is the last to leave the evacuation area. The tail generally conforms to about the last 10 percent of the population.
- **Evacuation Time Estimate (ETE)** – Licensees are required to estimate the time needed to evacuate the public from the plume exposure pathway EPZ extending about a 16-km (about 10-miles) radius around each nuclear power plant. ETE results provide emergency planners information to support protective action decisions, including whether evacuation or shelter-in-place is the better response to the emergency.
- **“Heightened Preparedness”** is intended to mean that the population within the plume exposure emergency planning zone is informed of the serious emergency at the nuclear plant and is told that they should monitor the situation and prepare for the possibility of evacuation, shelter-in-place and/or other protective actions. Further, if an evacuation is taking place, the public not involved in the evacuation should be asked to stay off the roadways to allow those immediately threatened to evacuate.
- **“Shelter-in-place”** is intended to mean that instructions are given to remain indoors, turn off ventilation (as appropriate for the region and season), close windows, monitor communications channels and prepare to evacuate. Those not at home (e.g., shopping, dining, working, etc.) are asked to stay in their current location. The instructions should also specify that shelter-in-place is safer than evacuation at this time or, alternately, that others more immediately threatened are evacuating and the roadways should remain open for them. The intent is that the public remain where they are or seek shelter close by but not return home to shelter.

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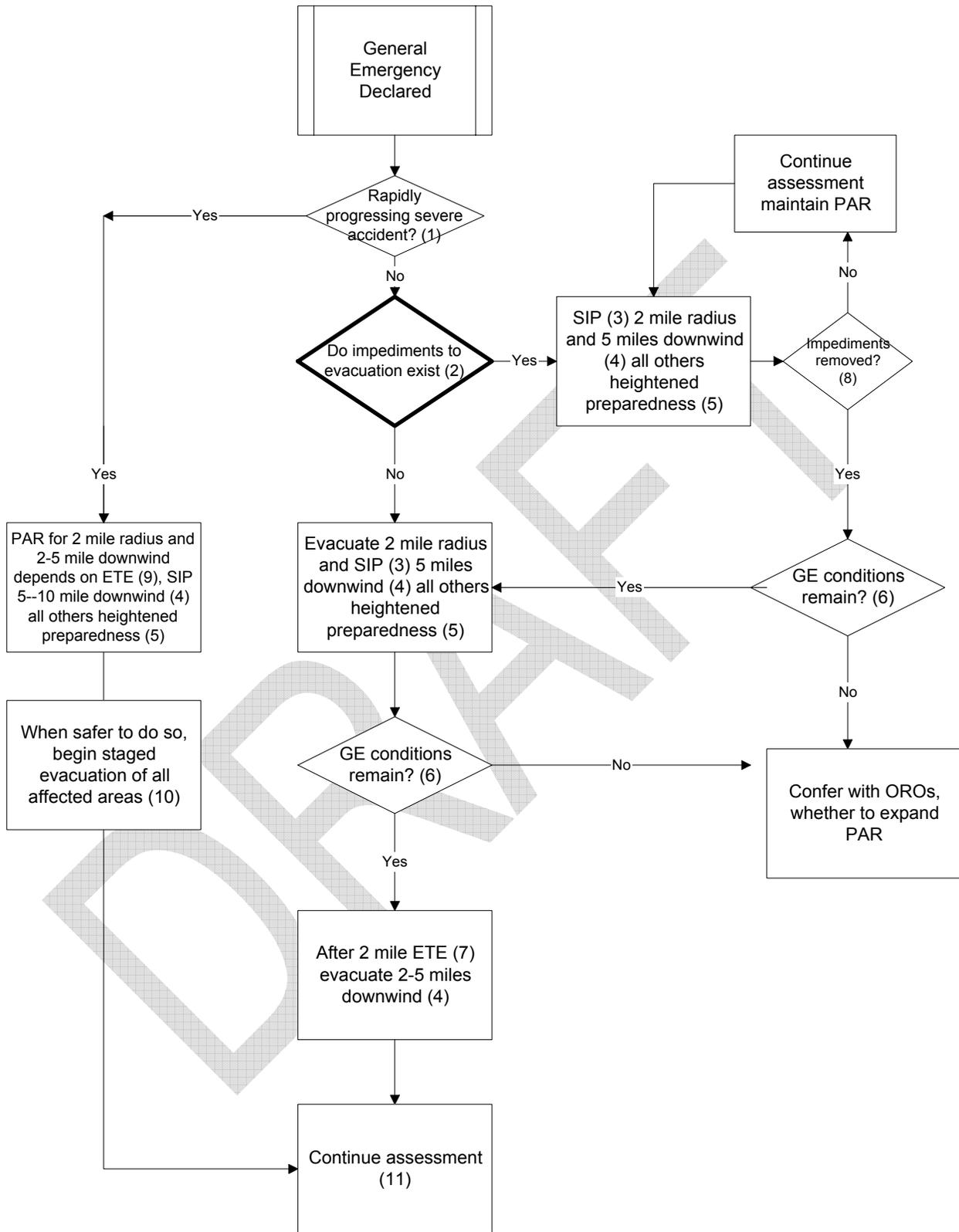
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Attachment 1
Protective Action Logic Diagram

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Protective Action Logic Diagram

Protective Action 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 one (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:

- Evacuation support not yet in place: e.g., the GE is the initial notification to offsite response organizations or if there is a previous emergency classification notification, the GE notification occurs prior to preparations to support evacuation. Many sites have a low population density within 2 miles and evacuation support readiness will not be considered an impediment. This element should be discussed and agreed to with 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 PAR Logic Diagram for those sites where delay of a 2 mile radius evacuation is necessary pending support set up. 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. This element would be discussed and agreed to with OROs. The licensee would base the recommendation on the agreement and would not confer with OROs before making the initial PAR.
- Licensees are not responsible to solicit information or make a determination if 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 notified the licensee that an impediment exists, e.g., roadways are closed due to deep snow.

Note 3

- **“Shelter-in-Place” (SIP)** is intended to mean that instructions are given to remain indoors, turn off ventilation (as appropriate for the region and season), close windows, monitor communications channels and prepare to evacuate. The instructions should also specify that shelter-in-place is safer than evacuation at this time or, alternately, that others more immediately threatened are evacuating and the roadways should remain open for them. Communications with the shelter-in-place population must be clear and frequent to be effective.

Note 4

- Downwind sector(s) and adjacent sectors
- Site specific wind persistence analysis may indicate the need to include additional sectors with initial recommendation. This element must be discussed and agreed to by OROs.

Note 5

- **“Heightened Preparedness”** is intended to mean that the population within the plume exposure EPZ is informed of the serious emergency at the nuclear plant and they should monitor the situation and prepare for the possibility of evacuation, shelter-in-place and/or other protective actions. Further, if an evacuation is taking place, the public not residing in the evacuation areas should be asked to stay off the roadways to allow those more at risk to evacuate. Communications with this population must be clear and frequent to be effective.

Note 6

- Once a General Emergency is declared termination will take time. If the conditions that caused the declaration are ameliorated, (i.e., core cooling is restored) it may not be necessary to expand the PAR to evacuate additional areas.

Note 7

- At $T=X$ hours, where X = the site-specific 2 mile ETE for 90 percent evacuation, (e.g., 90 minutes after the public is notified of the initial PAR) evaluate 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_D for a daytime ETE and T_N for a nighttime ETE. These values should be representative for the site and should not include special events. The shift staff are expected to make this PAR without conferring with OROs, and it is based on the time value alone, not on verification of evacuation progress. If the augmenting ERO has activated, there should be sufficient resources available for the licensee to confer with OROs more fully.

Note 8

- In the case where 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 are not expected to confer with OROs prior to changing the PAR although if the ERO is activated, they may confer.
- In the case where 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.
- In the case where the impediment was due to 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 due to 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 General Emergencies and different protective actions are appropriate for all sites. However, differences in ETE will dictate the most appropriate protective actions. Sites with 2 mile radius evacuation times for 90 percent completion that are 60 minutes or less should immediately and urgently recommend evacuation of the 2 mile radius, otherwise recommend shelter-in-place. The licensee uses the site specific ETE for this decision and shall consider T_D for a daytime ETE and T_N 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 downwind evacuation time for 90 percent completion is 90 minutes or less than that area should be immediately evacuated also (this time should include any traffic control preparations necessary), otherwise recommend shelter-in-place. For all cases a recommendation of shelter-in-place for the 5-10 mile downwind areas should be given.

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 due to 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 safer 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 evacuation of the sheltered population would be discussed with OROs and plans made 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 is conducive.

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

Note 11

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

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APPENDIX A

Effective Communication with the Public to Support Emergency Preparedness and Response

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Appendix to Supplement 3 'Effective Communication with the Public to Support Emergency Preparedness and Response'

1.0 Purpose

This Appendix provides guidance to licensees and offsite response organizations (OROs) to enhance communications with the public before and during nuclear power plant emergencies. Guidance is provided for 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 guidance supplements the guidance contained in NUREG-0654/FEMA-REP-1, Rev. 1, 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 offsite response organizations (OROs). This communications appendix is intended to be fully consistent and complimentary to Federal Emergency Management Agency (FEMA) guidance in the Interim Radiological Emergency Preparedness (REP) Program Manual (FEMA, 2002) and the proposed revision to the Interim REP Program Manual.

2.0 Introduction

Research on alternative protective actions showed that shelter-in-place and staged evacuation can enhance public health and safety during a nuclear plant accident (NRC, 2007b). Research on large scale evacuations (NRC, 2005a; 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 1 (NRC, 2008b) identified several recommendations regarding communications. This guidance serves to address these recommendations which are summarized as follows:

- 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 that may require assistance during an evacuation; and
- Update emergency planning information regarding management of pets at congregate care centers.

2.1 Public Response

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):

1. 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.
2. 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.
3. Guidance - Provide clear instruction regarding what people need to do, how to do it, where to go, and how to get there.
4. 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 likely needed, and messaging should convey that residents have time to prepare and evacuate.
5. Source - The source of the protective action recommendation 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 of 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 Staged Evacuation and Heightened Preparedness Protective Actions

Two protective actions that may be new to some OROs 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 if necessary. For nuclear plants, staged evacuation would be directed for the 2 mile area around the plant while downwind areas out to 5 miles, or farther as needed, shelter-in-place. When implementing a staged evacuation, the public not within the affected area should be informed to stay off of roadways to allow those in higher risk areas to evacuate. Heightened preparedness is intended to mean that the population within the plume exposure EPZ is informed of the serious emergency at the nuclear plant and instructed to monitor the situation and prepare for the possibility of evacuation, shelter-in-place and/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 (HSPD-8) sets forth 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 provide accurate and timely preparedness information to public citizens, first responders and other interested parties (DHS, 2003). The DHS provides detailed information on the expectations for citizen preparedness during an emergency at their website www.dhs.gov. The guidance encourages individuals to take responsibility for themselves and their families in the unlikely event of an emergency through planning and preparedness.

2.3.1 Federal Emergency Management Agency Guidance

“A Guide to Preparing and Reviewing Public Information Materials and Emergency Alert System Instructions for Radiological Emergencies” is provided in Section E, ‘Public Information Materials Review Guidance’ of the Interim REP Program Manual (FEMA, 2002). This guide is used to support the FEMA review of offsite radiological emergency preparedness planning, response, and public information materials and addresses potential audiences, content, and format of public information materials and EAS messaging. The information provided in this Appendix A is intended to compliment the FEMA guidance by adding detail in selected areas and integrates heightened preparedness of the public and staged evacuation into the communication program.

3.0 Public Information Materials

Public information materials are disseminated yearly to the public within the EPZ, as required in Appendix E of 10 CFR 50. Information is provided in the form of brochures, phone books, calendars, utility bills, etc., to inform residents on radiation, instructions for evacuating and sheltering, arrangements for special needs individuals, contacts for additional information, and other emergency preparedness related topics. 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 be pamphlets and calendars while some residents prefer Emergency Management website information (NRC, 2008b).

3.1 Public Information Brochures

The public information program is intended to provide the permanent and transient population within the EPZ the opportunity to become aware of preparedness information annually (NRC, 1980). Guidance on the content of public information brochures is found in NUREG-0654 / FEMA-REP-1, Rev. 1 Section II, G which identifies information to the public include, but not be limited to, educational information on radiation, contacts for additional information, protective measures such as evacuation routes, sheltering, respiratory protection, radioprotective drugs, and information for special needs individuals. While these brochures are largely retained by residents of EPZs (NRC, 2008b), the information and instructions tend to be directed to individuals who are at home when an emergency might occur. 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. The following information should be included in public information brochures.

1. Emphasis on the individual's responsibility for emergency preparedness. Consistent with DHS guidance, discussion should be provided to encourage residents to be prepared and have an emergency response kit.
2. A registration card so residents who may need assistance evacuating can provide their phone number and register their need.
3. Instructions regarding what to do if sirens sound. Sirens are intended to support an initial notification. The public should listen for an EAS message prior to taking any other action.
4. Explanation of types of protective actions that may be recommended.
5. Instructions regarding what to do if ordered to evacuate should address who is to go, where they are to go, when they need to go, and how they are expected to get there.
 - a. Discussion of personal belongings that evacuees, including those who may use public transportation, should bring in an evacuation.
 - b. Instructions for those who will need a ride to evacuate (i.e., transit dependent).
 - c. Location of bus routes and pick-up points along routes for the transit-dependent population and a discussion regarding how transit dependent residents are expected to get to the pick-up points.
 - d. Location of where people should go if ordered to evacuate, such as registration centers, congregate care centers, or shelters.
6. 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.
7. Specific instructions to parents regarding evacuation of schoolchildren including whether provisions are in place for parents to pick up children from school, if parents desire. Information should be included regarding the reception centers for schools. These may not always correspond to the reception center a parent may be evacuated to, if the parent works elsewhere within the EPZ or is at home. Section 3.1.4 of this Appendix provides additional discussion regarding schoolchildren.
8. Instructions on how to shelter-in-place. Residents should be instructed on the basics of closing doors and windows and shutting off air conditioning, as applicable for the region. Residents should also be instructed to prepare for a possible evacuation while they are sheltering-in-place.
9. Information to limit Shadow Evacuation. The brochure 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. The brochure should clearly state that those who are not within the declared evacuation area should not evacuate.

10. Information regarding potassium iodide (KI) including what to do if KI is not available to the individual (e.g., KI not distributed; individual lost their KI; etc.). It is important residents understand whether they are still safe if use of KI has been recommended, and the individual does not have access to KI. This information is only necessary in States where KI will be authorized for the general public.
11. Information 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.
12. A list of television and radio stations that provide emergency information.
13. Definitions of terminology used in the brochure or in EAS messages.
14. Basic information regarding radiation and nuclear energy.
15. Information regarding what to do with pets - Brochures 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 brochures should not suggest that pets be left at home. Statements such as “pets are not allowed at congregate care centers” do not instruct residents what to do. 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 be applied. The policy on pets must be discussed with the operator of the congregate care centers as some operators do place restrictions on pets.

In review of existing public information brochures has shown that basic information does not always provide complete instructions. Providing additional detail in the brochures 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 brochures is provided in the following subsections.

3.1.1 Heightened Preparedness

It is intended that heightened preparedness be formally established as a protective action. Implementation of a ‘heightened preparedness’ among those within the EPZ is initiated with the alert and notification which occurs via sounding of the sirens and broadcast of EAS messaging. Heightened preparedness, introduced in this update to Supplement 3, should be described in the public information brochures.

3.1.2 Evacuation General Guidance

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

- Who is to go (i.e., affected ERPAs);
- Where they are to go, such as reception centers, congregate care centers, etc.;

- How they should get there (i.e., personal vehicle, bus, etc.);
- When they should go. Under some situations individuals may have time to go home, pack and evacuate or they may be requested to leave the area immediately. Specific directions would be provided through EAS messaging.

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

- Actions to take for those in vehicles when the order is issued – some existing public information brochures 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 can drive home first.
- Actions to take for those whose family is not together at home – brochures should recommend 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.
- Actions to take for those who are at other locations, such as working, shopping, dining, etc.

3.1.3 Staged Evacuation

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, 2007b). In a staged evacuation those closest to the plant (i.e., within 2 miles) are evacuated first while others shelter. The evacuation is later expanded as necessary. Public information brochures should explain that the purpose of staged evacuation is to protect those most at risk. A key message in the brochure should identify that residents not in the evacuation area should stay off roadways to allow the initial evacuation to proceed. Those asked to shelter-in-place or to implement heightened awareness should prepare for the possibility of evacuation, should it be necessary.

3.1.4 School Evacuation

Research shows that people prefer to evacuate as a family unit, and some parents will attempt to pick up children 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 this sensitive issue be addressed with a two fold approach.

1. The initial expectation of most OROs is schoolchildren will be evacuated. Brochures and other communications with parents of children in public schools should discuss the benefits of allowing schools to implement these evacuation plans without interference. Information explaining that parental interference may impede the evacuation process and thereby increase risk to all students during an emergency

may be appropriate. The evacuation process for schools and locations where parents may meet up with their children should be clearly described.

2. Although the initial expectation of OROs may be to evacuate schoolchildren, parents will arrive and will remove their children from school to self evacuate. 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.

3.1.5 Transit Dependent Public Evacuation

Transit dependent residents, by definition, need transportation assistance in order 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). In some EPZs people requiring transportation assistance are asked to register with the ORO. Most public information brochures include bus routes for pick up and instructions to go to the nearest major street where buses are traveling. The following additional information should be included:

- Describe how transit dependent residents are expected to get to the bus route and what to do if they cannot get to the bus route on their own (e.g., register for assistance);
- Identify whether residents may bring their pets, and if 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 a couple of hours to mobilize drivers and buses;
- Discuss how long residents may expect to wait for pick up;
- Explain why residents are safe outdoors while waiting for pick up; and
- Identify whether multiple bus runs will be made within the EPZ.

3.1.6 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:

- Actions to take for those in vehicles when the order is issued, e.g., leave the EPZ or enter a nearby building,
- Actions to take for those whose family is not together at home, e.g., implement family emergency plan,
- Actions to take for those who are working, shopping, dining, etc., 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 messaging should synchronize with the information in the brochure and be repeated frequently to reassure the public that the direction remains appropriate.

3.1.7 Special Needs Individuals

NRC research identified that eight 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 believed that if necessary they may be able to evacuate on their own. A conclusion can then be made that 6 percent of households may require assistance from outside the home during an evacuation. The research indicated that only 29 percent of these people have registered with local authorities (this figure is less accurate due to a smaller sample size) while an equal amount of 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 brochures (FEMA, 2002). Research clearly shows that this method is not utilized 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. Less 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 brochures should address the need to register for assistance, but efforts should not be limited to registration cards. Some techniques that may result in increased registration using the public information brochure include:

- Providing a distinct section in the beginning of the brochure to attract the attention of those who might need assistance. A bold phone number and a web address, if available, should be provided to allow registration over the phone or internet.
- Changing the title from Special Needs to "Evacuation Assistance" or other more general term may remove any connotation that may be sensitive to the individual;
- It may help to move the registration card to the first or second page of the brochure and to 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, does the resident have a pet. This information may stimulate residents to complete the card.
- Brochures should inform residents that information will be kept confidential.
- Outreach efforts within the community should routinely include the need to register for evacuation assistance.

- Elder centers or advocacy groups may exist in the EPZ and could be contacted 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 to evacuate anyone remaining in the area, and extra efforts in planning should help identify a majority of those requiring assistance.

4.0 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 (and perhaps tone alert radios) and the Emergency Alert System (EAS) to alert and inform the public. Detailed information can be communicated to the public via EAS messages and radio and television media broadcasts. Additional tools are available and utilized by some OROs including publication of information on emergency management websites, blast texting of emergency notices via cell phone messaging systems, and establishment of emergency management internet blogs. Tools such as these should be considered and utilized as use of these systems is expanding rapidly and they can be cost effectively implemented within EPZs.

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 with additional guidance included in NUREG-0654 / FEMA-REP-1, Rev. 1. 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 NPP. It is important that emergency response instructions be consistent within the EAS message and also consistent with public information brochures (FEMA, 2002). EAS messages should be reviewed for consistency with public information brochures. For instance, when a phone number is included in an EAS message for residents to use to obtain additional information, the EAS message should not state that residents refrain from using the phone. Likewise, the public information brochure should not state that residents refrain from using the phone 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 via media broadcasts and subsequent EAS messaging. 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 SAE, it may be hours before there is new information available that is substantively different than the original messaging. 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 four 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 instill a 'heightened preparedness' among those in the EPZ. Communications during this time period must be clear and frequent to effectively instill a heightened preparedness among the public. 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, if one is deemed necessary during the course of the event.

4.2.1 Sheltering-in-Place Messaging

For shelter-in-place, residents should be instructed to go inside or remain indoors, turn off ventilation, seal windows, monitor communications channels *and* prepare to evacuate. The instructions should specify that sheltering is safer than evacuation at this time. An impediment to shelter-in-place may include loss of power or communication systems. When these systems are not available to inform the public to shelter-in-place 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 be returned 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.

Messaging 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 expected length of the shelter period. When shelter-in-place instructions are provided, recognize that for large commercial, industrial, and government 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 ventilation cannot be shut off.

Some EAS messages identify 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 or may not know the location of their KI. 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-in-place diminish quickly if the notification to leave and subsequent evacuation are not conducted optimally (NRC, 2007b). 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 (EPA, 1991).

4.2.2 Evacuation Messaging

It should be recognized that even if an evacuation is ordered immediately, the mobilization of residents and travel to exit the EPZ takes time. During this time, 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 or other non-EPZ residents), special needs individuals not residing in special facilities, schools, and special facilities. Messaging should address the locations at which 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 and identify ERPAs (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 the transient population may not be aware of the ERPA or protective action zone they are in.

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

- To whom the message applies (e.g., residents, tourists, employees, special needs residents, etc.);
- Where to find information to determine if you are in the evacuation zone, such as the public information brochure, phone book, etc. Maps are recommended with very clear boundaries of the affected areas;
- 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 messaging are stating that there has not been a release from the plant, the instructions to go to a reception center should not state that the purpose is to screen residents for contamination;
- When to leave, such as immediately, within an hour, etc., informing the residents of the level of urgency.
- Any special activities which should be performed prior to leaving home such as turning off ventilation, locking and securing the home for a brief absence;
- What to do if you do not own a vehicle and cannot get a ride with a neighbor;
- If children are evacuated from school, indicate where parents can meet them;
- Who to call if assistance is needed;
- Who not to contact simply for additional information, such as 911; and
- When additional information and updates will be provided via the media.

4.2.2.1 Staged Evacuation Messaging

The preferred protective action is a staged evacuation directing that the 0 to 2 mile area around the nuclear plant be 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 staged evacuation, clearly defining the limits of the evacuation area is important for success. 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 more at risk to leave. 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 at risk 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 an Alert. It should be expected that parents will receive word of the evacuation through informal channels prior to 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. A result of this “societal notification,” parents, friends, and family should be expected to pick up children even if informed children will be evacuated (NRC, 2008b). Emergency response plans for early evacuation of schoolchildren were developed long before cell phones were available and do not consider the potential effect of these advanced communications. While the Interim REP Program Manual suggests that ‘no exceptions’ will be made in providing emergency alerting and notification of the public, this may not reflect reality and OROs may not plan for what should be an expected action by parents.

Additional communication that emphasizes 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 pick up 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 better communication, education of the public, and implementation of traffic control (NRC, 2005a, 1992a). 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 the evacuation of those most at risk. 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 effective response.

4.2.2.4 Transit Dependent Evacuation Messaging

Communications to the transit dependent population group 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 brochure, such that transit dependent residents know where bus routes are and how they are expected to get to the bus route. This information should also include how long they should expect to wait along a bus route and why they are safe waiting outside. Instructions to this population group should include:

- 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;
- Bringing provisions for a few days, which may include clothing, medical supplies, and other accessories;
- Any limits on allowable belongings, such as whether they can bring their pets and if they must be in a pet carrier; and
- How long they may expect to wait for a bus.

Recognize that this population group may include thousands of individuals in many EPZs. 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 Special Needs Residents not Residing in Special Facilities Messaging

Messaging to this population group should request they obtain a ride from a 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 pre-arranged 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 instructed what to do while waiting for assistance to arrive. Instructions also need to be provided to 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 assure 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, nursing homes, etc., 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 expected resources arrived for the evacuation of the facility.

5.0 Additional Guidance for More Effective Messaging

In addition to the existing guidance provided in NUREG-0654/FEMA-REP-1, Rev. 1 and that provided above, the following should be considered in the development of communication messaging:

- As new communications systems become more widely available, emergency response organizations are utilizing them in addition to the normal alert and notification system. Secondary systems utilizing Reverse 911[®] 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 messaging via cell phone text messaging 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 to 10 miles 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 of roadways to allow those evacuating from the EPZ to proceed.
- Use of phone 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, Rev. 1, G (4) (c), each organization is to establish coordinated arrangements for dealing with rumors. It should be recognized that rumor control may play a greater role in communications than anticipated in the past. With the mass use of cell phones and Internet access, communication among the public has become immediate in emergency events. 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 through rumor control expeditiously. The use of blog sites by emergency management agencies is helpful in addressing rumor control.
- 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 websites 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.

- Under the National Response Framework, the DHS assumes overall coordination of an incident if it progresses to a General Emergency. As Federal agencies, such as DHS, become integrally involved in the incident the public should be informed that these are planned actions in order 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 out additional information (Mileti, 2000). With telephones, cell phones, and Internet access at the fingertips of 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 assure adequacy of the available systems and for emergency response agencies to also utilize these services to provide additional information to the public.
- Cable overrides and cable scrolls used to provide emergency information should be carefully constructed such that messages are not so lengthy that residents cannot determine whether they are affected by the incident.