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Notice of Availability of NUREG-0654/FEMA-REP-1, Revision 1, Supplement 3, Guidance for Protective Action Recommendations for General Emergencies

**Comment On:** NRC-2010-0080-0009

NUREG-0654/FEMA-REP-1, Rev. 1, Supplement 3, Guidance for Protective Action Recommendations for General Emergencies; Draft for Comment

**Document:** NRC-2010-0080-DRAFT-0026

Comment on FR Doc # 2010-11842

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## General Comment

See attached files (total of three).

## Attachments

**NRC-2010-0080-DRAFT-0026.1:** Comment on FR Doc # 2010-11842

**NRC-2010-0080-DRAFT-0026.2:** Comment on FR Doc # 2010-11842

**NRC-2010-0080-DRAFT-0026.3:** Comment on FR Doc # 2010-11842

**NRC-2010-0080-DRAFT-0026.4:** Comment on FR Doc # 2010-11842

*Source Review Complete  
Template = ADM-013*

*FRFDS = ADM-03  
Case = R. Sullivan  
(RX53)*



NUCLEAR ENERGY INSTITUTE

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June 8, 2010

Ms. Cynthia K. Bladey  
Acting Chief, Rulemaking and Directives Branch  
Office of Administration  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**Subject:** NEI Comments on NRC Proposed Draft NUREG-0654 FEMA-REP-1, Revision 1, Supplement 3, "Guidance for Protective Action Recommendations for General Emergencies; Draft for Comment," *Federal Register (FR Vol. 75, No. 44)*, Docket ID NRC-2010-0080

**Project Number: 689**

Dear Ms. Bladey:

This cover letter and the attached comments on NRC Docket ID NRC-2010-0080 are being submitted by the Nuclear Energy Institute (NEI)<sup>1</sup> on behalf of the nuclear power industry. NEI appreciates the opportunity to comment on the Draft NUREG-0654 FEMA-REP-1, Revision 1, Supplement 3, "Guidance for Protective Action Recommendations for General Emergencies." We also recognize and appreciate the NRC staff's efforts in the preparation and conduct of the public meetings necessary to accommodate both industry and offsite stakeholder inquiries and concerns regarding this document. We trust you will find these comments useful as you work to finalize the proposed guidance with FEMA.

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<sup>1</sup> NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all utilities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear material licensees, and other organizations and individuals involved in the nuclear energy industry.

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The detailed comments in the attachments to this letter represent a comprehensive and substantive review of the proposed draft Supplement 3 and were developed by NEI in collaboration with the nuclear industry and ORO stakeholders. In addition to a comprehensive review of the document, NEI conducted three test cases using the proposed guidance that further validated the need for more focused clarifying instruction on how to evaluate and implement the proposed guidance.

The following overview highlights the particular aspects of NEI's comments that we wish to emphasize:

Implementation: It is not clear to the reader or end user on how this document is to be implemented. The Protective Action Recommendation (PAR) Study is predicated on a hypothetical Emergency Planning Zone (EPZ) and subsequently presents Protective Action Strategy (PAS) guidance as if EPZs were homogenous. This is not the case for most EPZs in the country. How the various protective action strategies would be implemented for various population and evacuation time estimate (ETE) characteristics needs to be more clearly articulated.

NEI proposes a more refined methodology that could better serve the user in the implementation of the document. This proposal is contained in Attachment 1, NEI Comment #1.

Clarity of Terminology: Terminology used in the document is not clear. NEI commissioned three separate case studies. In each case study, a team of licensee and ORO partners used the guidance to develop a site-specific PAR logic diagram based on the example logic diagram and notes provided in the Supplement. Where implementation should have produced similar protective action results, three different protective action outcomes were developed.

NEI believes that the proposed refined methodology discussed in Attachment 1, NEI Comment #1 is an approach that provides the clarity and guidance necessary to achieve a more consistent, systematic approach for PAS development. To further illustrate the benefit of the proposed refined approach to a PAS methodology (NEI Comment#1), NEI has included two marked-up versions of NRC's proposed logic diagram and corresponding notes to improve the definition of the terminology and usability of the proposed logic. The first mark-up of the logic diagram begins on page 18A of Attachment 2. Detailed discussion and basis for the markups appear in Attachment 1 starting on page 8, "Comment Area: Logic Diagram".

Rapidly Progressing Severe Accident: NEI believes there is no basis for including the left hand side of the PAR Logic Diagram in the proposed Supplement entitled, "Rapidly Progressing Severe Accident". This adds superfluous detail not supported by ongoing NRC studies on severe accidents. NEI recommends that this branch of the PAR Logic Diagram be removed. The basis for the removal

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of the rapidly progressing severe accident instruction is discussed in more detail in Attachment 1, NEI Comment #2.

In the event that NRC does not agree to remove the rapidly progressing severe accident portion of the logic diagram, NEI is submitting a second mark-up of the proposed PAR Logic Diagram. The rapidly progressing severe accident portion of the PAR Logic Diagram is not usable as presented in the Supplement. A basis for this mark-up is provided in Attachment 1, NEI Comment #13.

Wind Shift PAR: Information associated with PARs for wind shifts is contained in Section 4 of the proposed Supplement. Detail contained in this section is insufficient to appropriately inform licensees and OROs on the implementing guidance regarding wind shifts. NEI recommends a public meeting be conducted to develop adequate guidance. A more detailed discussion on the insufficiency of the guidance is presented in Attachment 1, NEI Comment #17.

Emergency Alerting and Instructions: Section 4 of the proposed Supplement introduces subject matter related to public information and is not within the scope of guidance and criteria for public protective actions for the general public. Therefore, NEI suggests removal of this section from the Supplement and relocate to a document intended to provide similar guidance to OROs such as the FEMA REP Program Manual. Supporting information related to this comment is contained in Attachment 1, NEI Comment #18.

SOARCA: The findings associated with State of the Art Reactor Consequence Analysis (SOARCA) are materially important to the content of the proposed draft document. Because the issuance of the final SOARCA study is anticipated in the foreseeable future, the proposed Supplement should incorporate pertinent elements of the SOARCA. A detailed discussion on this topic is presented in Attachment 1, NEI Comment #28.

Further, NEI is concerned that with the lack of participation by FEMA at the April 13, 2010 public meetings and that the draft Supplement 3 proposes guidance for offsite protective actions and public messaging that is not in concert with the draft proposed FEMA Radiological Emergency Preparedness Program Manual," *74 Fed. Reg. 23,198* (May 18, 2009) (Docket ID FEMA-2008-0022) is indicative of a lack of collaboration with FEMA in the development of the proposed guidance that impacts ORO decision makers.

NEI's detailed comments are presented in 3 attachments:

Attachment 1 – NEI Comments on Draft NUREG 0654 Supplement 3

Attachment 2 – NEI Mark-up of NUREG 0654 Supplement 3

Attachment 3 – NEI Comments Incorporated - NUREG 0654 Supplement 3

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We would like to thank the NRC in advance for its careful consideration of the comments and concerns outlined in this letter and our detailed comments provided in the attachments.

If you have any questions, please contact Martin Hug at (202) 739-8129; [mth@nei.org](mailto:mth@nei.org).

Sincerely,

A handwritten signature in cursive script, appearing to read "Susan Perkins-Grew".

Susan Perkins-Grew

Attachments

c: Mr. Christopher G. Miller, NSIR/DPR/DDEP, NRC  
Mr. Robert E. Kahler, NSIR/DPR/DDEP/IR, NRC  
Mr. Randolph L. Sullivan, NSIR/DPR/DDEP/IR, NRC  
Mr. James R. Kish, FEMA  
NRC Document Control Desk

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
Executive Summary**

<b>NEI Comment Number</b>	<b>Comment Area and Summary</b>	<b>Attachment 1 Page</b>
1	Implementation Methodology	3 through 7
	<i>A comprehensive approach is recommended for evaluation and inclusion of protective action strategies into a site-specific PAR methodology.</i>	
2 through 12	Logic Diagram	8 through 13
	<i>The rapidly progressing severe accident scenario should not be included in the Supplement 3 logic diagram. A markup of Supplement 3 removing this scenario is provided in Attachment 2 starting on page 18A. PAR logic gates and notes were marked-up in Attachment 2 to improve readability. A basis is provided for the more substantial mark-up in this Attachment.</i>	
13 and 14	Logic Diagram	13 through 14
	<i>Comments are provided on the use of the rapidly progressing severe accident scenario in the event that NRC does not accept the position on its removal from the logic diagram. PAR logic gates and notes associated with this scenario were marked-up in Attachment 2 to improve readability starting on page 18B. A basis is provided for the more substantial mark-up and in this Attachment.</i>	
15	Logic Diagram	14 through 15
	<i>The term "lateral evacuation" should be removed from the document.</i>	
16	Logic Diagram	15
	<i>SIP is a preferred protective action even when PAGs are exceeded for an area being sheltered.</i>	
17	Wind Shift PAR	16
	<i>Improvement is needed in the section 4 discussion on wind shift PARs. NEI recommends a public meeting on this specific issue.</i>	
18	Emergency Alerting and Instruction	17
	<i>The appendix should be removed from the document.</i>	
19 through 24	Implementation	18 through 19
	<i>Various Supplement 3 mark-up provided in Attachment 2 improve the understanding of how Supplement 3 is implemented. A basis is provided for the mark-up in this Attachment.</i>	
25	Outreach	20
	<i>Supplement 3 guidance changes the philosophy of the logic for protective action recommendations. Suggestions are provided for NRC outreach opportunities.</i>	

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
Executive Summary**

<b>NEI Comment Number</b>	<b>Comment Area and Summary</b>	<b>Attachment 1 Page</b>
26	Consistency in the Development of Guidance	21
	<i>Recent changes in federal requirements need implementation holistically.</i>	
27	Document Availability	22
	<i>Reviewers of Supplement 3 require access to documents cited.</i>	
28	SOARCA	23 through 24
	<i>SOARCA should inform Supplement 3.</i>	
29	Inspection and Enforcement	25
	<i>Policies and directives should be developed.</i>	
30	Implementation Schedule	26
	<i>Final implementation of Supplement 3 should be completed after Evacuation Time Estimates are updated.</i>	
31	Definition of Terms	27
	<i>Additional terms need definition.</i>	

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Implementation Methodology**

NEI COMMENT #1 – Implementation Methodology

NEI views the PAR Logic Diagram provided in the draft Supplement 3 as one generic example of developing a site-specific protective action logic based on evacuation time estimates and surrounding population densities. However, the diagram and corresponding notes are silent on site and EPZ specific characteristics that are key elements in developing a protective action strategy (PAS). As such, the PAR logic diagram requires modification to accommodate these specific characteristics.

The implied intent of the guidance to modify the logic diagram for site-specific EPZ characteristics (including population distributions and real-time conditions) is not understood by the end users (licensees and OROs). A review of recent letters<sup>1</sup> pertaining to this draft supplement submitted to the NRC by OROs supports NEI's assertion that the methodology to implement the guidance is ambiguous and warrants additional clarification for a more comprehensive approach to developing PAR strategies..

In addition, NEI conducted three test cases using the draft guidance. NEI set up three teams comprised of three different sites and their respective ORO decision making representative(s). Each team attempted to use the Supplement 3 Logic Diagram to develop site-specific protective action methodologies. It was expected that the teams would have developed 3 different PAR diagrams for the 3 different sites; however, it also expected that certain elements of the PAR guidance should have been interpreted and implemented consistently (e.g. interpretation of "when safer to do so"). From these case studies and feedback from the users, NEI concluded that the implementation guidance needs to be more specific and the notes that support the Logic Diagram need to be presented as a cogent list of considerations that could be systematically and consistently evaluated for inclusion as the basis for a protective action methodology.

The discussion in this section of the NEI comments recommends a more refined implementation approach.

**A Refined Approach to Developing a PAR Methodology is Required**

The guidance for the consideration of the various elements and criteria of the PAR Logic Diagram presented in the Draft Supplement 3 is ambiguous and would be enhanced by a more comprehensive approach for evaluation and inclusion into a site-specific PAR methodology. The Protective Action Recommendation (PAR) Study is predicated on a hypothetical EPZ and subsequently presents PAS guidance as if EPZs were homogenous.

Page 2, paragraph 1 states:

*The PAR Study modeled a hypothetical EPZ 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).*

As NRC states this is a hypothetical EPZ with a large population with uniform distribution. This type of population distribution is not the norm. Industry EPZs have varying population configurations. For example:

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<sup>1</sup> Reviewed the following comments: Military Department Emergency Management Division, dated May 21, 2010; Minnesota Department of Public Safety, Dated May 10, 2010; Pennsylvania Department of Environmental Protection, dated May 12, 2010

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Implementation Methodology**

- Very low ETE (very low population) for the 2 mile radius around the plant with a high ETE in the 2 to 5 mile radius. In this case staged evacuation may have no value.
- A large variation in population distribution within the 2 to 5 mile radius with low population elsewhere in the 10-mile EPZ. While staged evacuation may be of benefit for one sector, staged evacuation may not be of value in other sectors.

In addition to varying population distributions, varying and unique EPZ characteristics such as road networks, topography, and coastal locations exist as well, creating individual considerations for many sites. Therefore, a description of how the Supplement would apply to the various population distributions, EPZ characteristics, and evacuation time estimates (ETEs) needs to be more deliberate and specific.

**Implementation Instructions Not Clear and Deliberate**

As indicated by a review of comments submitted to the NRC it is not clear to stakeholders that the PAR logic diagram requires modification to fit each specific nuclear power plant EPZ or, more importantly, not clear to them how they would go about making the required modifications. In addition, the document blurs the distinction between onsite and offsite responsibilities.

Supplement 3 provides some general implementing instructions. These instructions are excerpted from the document and provided below. Key text is underlined:

Page iii, paragraph 1 states:

*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.*

Page 2, paragraph 5 states:

*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.*

Page 5, paragraph 1

*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.*

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Implementation Methodology**

Page 5, Paragraph 3 states:

*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.*

Review of the underlined key text in the above paragraphs infer that there are 14 Protective Action Strategies (PAS) elements presented in the Supplement and in the Logic Diagram. Each should be:

- Discussed between the licensee and ORO and result in agreement to various inputs and decision points for the PAS,
- Influenced by site-specific and EPZ-specific considerations.

In other words, actual EPZ characteristics and real-time conditions need to drive the decision for which protective action elements and criteria presented in Supplement 3 will be selected for incorporation into the site-specific PAS and those elements that are to be excluded or do not apply. The guidance should be clear that it is appropriate to employ a limited number of PAS elements and/or to modify certain PAS elements that best suit the population configuration, EPZ characteristics and real-time EPZ conditions. Based on the selection of PAS between the licensee and its OROs that are deemed appropriate for a specific EPZ, then the specific range of protective action recommendations required by 10 CFR 50.49(b)10 would be determined.

**Alternate Approach in Implementation of Protective Action Strategies**

NEI recommends that the guidance include a more systematic approach for licensees and their ORO decision makers to develop site specific PAR methodologies. This approach should result in the development of similar PARs for EPZs with similar characteristics and eliminate the implementation challenges demonstrated in the three test cases.

The following template example has three functions. First, it would guide the implementer to systematically consider each of the suggested elements for incorporation into a PAR. Secondly, it would include clarifying instruction for evaluation of whether to implement the element/criteria as is or to modify it for inclusion in the strategy. Lastly, the template will enable the user to document the basis for each selection and pertinent decision. The intent here is to facilitate a systematic approach for the licensee and its OROs to collaboratively evaluate each strategy, make a determination of effectiveness for the EPZ and population, and in most cases, agree on decision points and critical inputs. This would lead to a more consistent implementation of the guidance.

A partial example of this approach is provided below for three PAS elements. Guidance would consist of a two column format. The PAS element and detailed instructions are provided in the first column. The second column in the template would be intended for the implementers to document their evaluation and decisions for each element.

For the example below, NEI provided an example of how an implementer would complete the Evaluation and Implementation Basis. For the template, column two would be left blank. Each station using the template would complete the Evaluation and Implementation Basis.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Implementation Methodology**

Partial Template example for 3 Protective Action Strategy Elements:

Protective Action Strategy that should be considered from Supp 3	Evaluation and Implementation Basis
<p><b>PAS ELEMENT (1)</b> : Conduct a staged evacuation - At a General Emergency that is not a rapidly progressing severe accident, evacuate 2 mile radius, then 5 miles downwind when 90% ETE for the 2 mile radius is reached and conditions continue to warrant evacuation (EPA PAGs exceeded or plant conditions are present that would require a GE declaration).</p> <p>QUESTION: Does a staged evacuation strategy work for your EPZ – Evacuate 2 miles and SIP 2 to 5 miles until 90% of the 2 mile sector is evacuated?</p> <p><i>Note: If there is a basis for not utilizing staged evacuation, provide that basis. Final PAR determination would not use staged evacuation in this case.</i></p>	<p>We have reviewed ETE studies for the [NPP] plant in [State] specifically looking at the evacuation time for 2-mile and 5-mile sub areas. We have found that the difference in evacuation time from just evacuating the 2-mile area and evacuating the 2-mile area and any combination of sub areas 5-miles downwind only results in a 10 minute overall evacuation time difference. Therefore modifying existing evacuation strategies has limited value and may only add confusion to existing public information. Staged evacuation will not be used as an evacuation strategy for the [NPP].</p>
<p><b>PAS ELEMENT (2)</b>: Determine the impact of wind variability/persistence on the site specific PAR process.</p> <p>QUESTION: How wide an area should be considered for initial protective action decision due to wind variability/persistence?</p> <p><i>Note: It is the intention of this question to use available information related to wind persistence. It is not intended for a site to perform a wind persistence study.</i></p>	<p>A review of available information in the FSAR indicated that wind for this site over an 8 hour period of time may vary over a range of 180 degrees. Eight hours is the minimum ETE for a 5-mile downwind area. Therefore, it is appropriate for the downwind PAR to encompass this wind swath area.</p> <p><i>[The wind persistence information above is fictitious and used for illustrative purposes only]</i></p>
<p><b>PAS ELEMENT (3)</b>: There are three potential impediment areas that may require an alternative action (SIP) to immediate evacuation. These are: evacuation support not yet in place, hostile action event, weather or other impediments (e.g., earthquake, wildfire). If SIP is recommended, then an evaluation is completed when the impediment is removed to determine whether or not evacuation is still required.</p> <p>QUESTION (for HAB event): If a HAB event is in progress should the area around the NPP SIP or carry out evacuation at the GE?</p>	<p>The terrorist response plan recommends that for any terrorist threat that the population in the impacted area should SIP.</p> <p><i>[The terrorist response plan used above is a fictional document and is stated for illustrative purposes only.]</i></p>

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Implementation Methodology**

Final PARs determined from the analysis performed above:

PAS Elements (1) and (2): General Emergency:

Evacuate 2 miles 360 degrees and evacuate 2 – 5 miles downwind 180 degrees.

PAS Element (3): General Emergency HAB event:

SIP 2 miles 360 degrees and 2 – 5 miles downwind 180 degrees. An evaluation is made when the hostile threat has been removed to determine whether or not GE conditions are still present and/or offsite doses in the affected areas exceed or could exceed EPA PAGs.

It is recommended that each PAS in the Supplement be listed in the suggested format and that supporting instructions be formulated for each PAS element. The notes currently attached to the PAR Logic Diagram in the Supplement would inform the instructions.

Completion of the proposed template would result in a thorough analysis of each of the 14 proposed PAS elements contained in Supplement 3 by the implementers. The analysis would also include a basis for the decisions on the use and exclusion or modification of each element. As demonstrated above, a final PAR methodology would be informed by this analysis and a final logic diagram (or other decision making tool) would be developed using a more standardized approach.

The evaluation and analysis performed during discussions by the licensee and OROs and completed in this matrix can be used to provide documentation for subsequent NRC/FEMA review and inspection.

NEI believes that this refined approach in a template format is an effective systematic approach that will lead to more consistent application of the guidance contained in the Supplement. The sample template provided above represents a portion of NEI's proposed alternative approach for PAS element analysis and PAR methodology development. NEI intends to provide a complete evaluation matrix for NRC review prior to the close of the draft Supplement 3 comment period on August 9, 2010

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Logic Diagram**

NEI believes that the best method for implementing the guidance contained in Supplement 3 is to use the detailed PAS element analysis described in NEI comment #1 on page 1 of this attachment. However, NEI also provides detailed comments on the PAR Logic Diagram and corresponding notes for the NRC's consideration.

The logic diagram provided in the draft Supplement 3 does not provide consideration of all elements in described in the document (e.g., wind shifts) and does not provide for an alternate approach to staged evacuation in cases where staged evacuation may not be of measurable benefit to the affected population as determined by ORO decision makers. In Attachment 2 NEI provides two mark-ups of the Supplement 3 Logic Diagram and proposed revisions to the associated notes.

The first mark-up version of the Logic Diagram excludes the rapidly progressing severe accident. NEI does not believe that the rapidly progressing severe accident scenario should be included in the Supplement 3 Logic Diagram. Current reactor accident analysis studies indicate that this accident is not credible (refer to NEI comment # 2 below and NEI comment #28 on page 21 of this attachment). Should the NRC accept this comment, a proposed logic diagram (and notes) is provided with this element removed beginning on page 18A of Attachment 2.

Although NEI strongly recommends the omission of the rapidly progressing severe accident scenario discussed in this guidance, a second mark-up version of the Logic Diagram and associated notes is provided for NRC consideration beginning on page 18B of Attachment 2 should the omission of that event not be considered.

NEI Comment #2 - Use of Rapidly Progressing Severe Accident

NEI provides an extensive discussion on the State of the Art Reactor Consequence Analysis (SOARCA) study in these comments in NEI comment #28 on page 23 of this attachment. This comment on the inclusion of the rapidly progressing severe accident in the protective action logic diagram is not intended to conflict with or supersede the SOARCA comment, but is provided for consideration on its own merit.

If the  $1e-7$  per year frequency cutoff is acceptable for use in the significance determination process and accidents with a lower frequency are not considered meaningful for regulatory decision making (NUREG-1420), then such a frequency cutoff is appropriate for use in developing protective action strategies. Specifically, the rapidly progressing severe accident has a frequency less than  $1e-7$  and should be removed from consideration in protective action logic schemes, eliminating the left hand side of the Supplement 3 logic diagram.

NEI provides a proposed logic diagram and notes with the left hand side (rapidly progressing severe accident) of the logic diagram removed beginning on page 18A of the Supplement 3 mark-up contained in Attachment 2. Although not shown in the mark-up for simplification purposes, section 3 of the document is deleted in its entirety if the rapidly progressing severe accident is eliminated from the logic diagram.

NEI Comment #3 – Labeling of Logic Diagram Elements

Each logic diagram gate or action element (rectangle, diamond, and square) should be given its own unique label for ease of reference in the notes. NEI uses bracketed capital letters for this function in the Supplement 3 mark-up contained in Attachment 2.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Logic Diagram**

NEI Comment #4 – Logic Diagram as a Generic Example

As previously addressed in NEI comment #1 on page 1 of this attachment under the heading “Differing PAR Approaches Required”, the Logic Diagram in draft Supplement 3 is not representative of any actual nuclear power plant site and in fact treats the (example) surrounding population distribution as a homogenous EPZ distribution. Page 5 of the draft Supplement 3 provides information in bold and underlined font that the PAR Logic Diagram is not intended to be used without site-specific modification. In addition, NRC personnel have stated in the April 13, 2010 public meetings that no one site’s logic methodology will look like what is presented in the Supplement. NEI agrees with this position and further suggests that the Supplement 3 Logic Diagram be clearly labeled as a generic example. Additionally, the Supplement guidance should also acknowledge that the format of the final implementation methodology may result in a format other than a logic flow diagram.

NEI provides proposed language in this area on pages iii, 5, 19A and 19B of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #5 – Discrimination Between Instructions for Constructing Site Specific Implementation Tool and Background Information

The draft Supplement 3 mixes different types of information in one category labeled “protective action recommendation logic diagram notes.” The information in this section of the document should be divided between instructions for development of a site specific PAR methodology and background information intended to inform the analysis of PAS elements in the development of a site specific methodology. NEI provides a proposed method for separation of this information using “information notes” and “background notes” beginning on page 19A of the Supplement 3 mark-up contained in Attachment 2. NEI also provides added information associated with this comment in the second paragraph on page 5 of the mark-up. Where a draft Supplement 3 logic diagram note or portion of a note is retained, but moved to a “background note” in the NEI mark-up font coloring and strikethroughs are not used.

NEI Comment #6 – Clarification of Logic Diagram Notes

NEI provides revised language beginning on page 19A in the Supplement 3 mark-up contained in Attachment 2 to improve the readability of the Logic Diagram notes. Significant mark-ups to the document have a corresponding basis in this attachment.

NEI Comment #7 – Impediments to Evacuation

- A. The evacuation support impediment in bullet one of the draft Supplement 3 logic diagram note 2 is not well defined and could be construed to include a number of elements other than traffic control. NRC personnel indicated at the April 13, 2010 Supplement 3 public meeting that the intent of this impediment is the establishment of traffic controls (if needed or required in order to begin the evacuation). NEI proposes that the term “traffic controls” be used to define this impediment.

NEI provides proposed language with the addition of the parenthetical term “traffic controls” in the first bullet of Note 1 on page 19A (Note 2 on page 19B) of the Supplement 3 mark-up contained in Attachment 2.

- B. NEI does not agree that a PAR based on technical information should be adjusted by the licensee for weather related or other impediments (e.g., earthquake, wildfire) if the ORO responsible for making final protective action decisions has indicated that they do not see this as within the licensee’s purview and want the best technically based PAR available (without adjustment). Many OROs view such licensee adjustment of a technically based PAR as blurring the responsibilities between the

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Logic Diagram**

licensee and the public safety decision makers. In addition, it is not possible for a licensee to know or be familiar with all of the available resources and the multitude of additional options available to an ORO at the time of the event to ensure the best protective action is implemented – even if it is evacuation. Although this requirement was in previous guidance, NEI believes that this comment is justified based on the statement in the abstract on page iii of the draft Supplement 3 that states “this ... supersedes previous guidance on the development of protective action recommendation (PAR) logic for nuclear power plant accidents.”

NEI provides proposed language on weather related and other impediments in the third bullet of Note 1 on pages 19A and 20A (Note 2 on pages 19B and 20B) of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #8 – Heightened Preparedness

All references to “heightened preparedness” as a protective action should be removed from the draft Supplement 3. NEI agrees that the group of actions referred to in the draft Supplement 3 as “heightened preparedness” is appropriate as a consideration for an ORO decision maker, but does not agree that these actions are protective actions implemented in the same way as shelter-in-place (SIP) and evacuation.

Information regarding “heightened preparedness” (or any other terminology that may be used by licensees and OROs for the same group of actions) is routinely provided to the public by OROs and licensees in educational materials and Emergency Alert System (EAS) messaging. In many locales, these EAS messages would be disseminated in an actual event at a Site Area Emergency, prior to a requirement to implement SIP or evacuation protective actions, should these protective actions be required for the event. In addition, “heightened preparedness” information would be disseminated as part of the evacuation or SIP protective action EAS messages and special news broadcasts. Including the actions encompassed by the term “heightened preparedness” as protective actions may introduce additional complications since these actions are not in fact intended as protective but are preliminary in preparation for the execution of a protective action, such as SIP or evacuation.

This information should be included in NRC and FEMA guidance for communications with the public before and during nuclear power plant emergencies.

In addition, NRC should insure the use of this term is consistent with other preparedness documents, such as the National Response Framework, NIMS/ICS, and the FEMA REP Program Manual.

NEI comment # 18 on page 17 of this attachment advocates removal of the Appendix from the draft Supplement 3. The inclusion of a mark-up version of the Appendix pages included with this comment (NEI comment # 8 – Heightened Preparedness), is not intended to imply that the Appendix should remain as part of the document. The mark-up is included to illustrate NEI’s position that this information is misplaced in this document and should be included in the FEMA REP Program Manual since its intended audience is largely the offsite response organizations. Appendix pages are only included should the NRC reject NEI comment # 18 and accept NEI comment # 8.

NEI provides proposed changes to implement NEI comment # 8 on pages 14, A-1, A-3 and A-7 of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #9 – Hostile Action Event One Hour Initial PAR Followup

A one hour time period should not be prescribed for discussions between the licensee and OROs on whether or not the sheltering PAR for a hostile action event should be changed (second bullet in logic

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diagram note 8). It is anticipated that such communications will be ongoing through the Incident Command Structure during a hostile action event. The hostile action related impediment may be removed in less than one hour or, conversely it may take more than one hour to remove the impediment. In either case, NEI does not believe that the one hour time period should be arbitrarily selected and applied in this Supplement 3 document.

NEI provides a proposed revised version of this note in the second bullet of note 5 on page 21A (note 6 on page 21B) of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #10 – GE Conditions Remain

- A. The draft Supplement 3 logic diagram uses the term “GE conditions remain?” in logic gates associated with note 6. This terminology is vague and can be confusing as it could be read as “are the initial conditions that caused the GE still present?” NEI does not believe this is the intended result of this logic gate. NEI proposes that the logic gate read “GE entry conditions exist?”
- B. The associated note for GE conditions need to accommodate the licensee’s use of a readily observable monitor reading that is an indicator in the NEI EAL scheme for potential containment barrier loss and corresponds to 20% fuel clad damage.
- C. The reference to areas where EPA PAGs could be exceeded should be removed from the draft Supplement 3 logic diagram note 6. Exceeding EPA PAGs at or beyond the site boundary is one of the EAL criteria for a General Emergency condition and therefore subsumed in the proposed NEI language in note 3 on page 20A (note 4 on page 20B) of the NEI mark-up in Attachment 2 that states “...if any initiating Condition for a General Emergency exists...”

NEI provides a proposed revised version of this information in logic gates [F] and [J] on pages 18A and 18B and note 3 on page 20A (note 4 on page 20B) in the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #11 – Logic Diagram Elements and Flow

The Logic Diagram provided in draft Supplement 3 does not provide an element of consideration for changes in PARs due to wind shifts as addressed in section 4 of the document. In addition, the Logic Diagram does not “flow” well to a single point of closure for all elements and does not provide a logic gate for the point when the 2-mile radius 90% ETE is reached for staged evacuation. The single point of closure should address EPA PAGs and direct the user to expand PARs if needed.

NEI provides logic diagram options on pages 18A and 18B in the Supplement 3 mark-up contained in Attachment 2 that address this comment (logic diagram blocks [I] and [L] and gate [H]).

NEI Comment #12 – Staged Evacuation

- A. NEI agrees that the concept of staged evacuation will have merit at some nuclear power plants for the population distribution that is specific to the site. In some cases, staged evacuation may be the appropriate action for some wind directions and not others at a particular site based on that site’s geography and demographics. For instance, if a site has a very low population in both the 2-mile radius and 5-mile radius or a site has a much larger population in the 2-mile radius than the 5-mile radius, it is possible that the most protective action for the entire affected population is to evacuate the 2-mile radius and 5 mile downwind areas at the same time, not applying staged evacuation. Licensees and OROs should have this option in Supplement 3 to select alternatives to staged evacuation, but should have a logical technical justification for doing so. This technical justification

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should be documented and available for NRC/FEMA review and inspection. Refer also to NEI comment #1 on page 1 of this attachment under the heading "Implementation Instructions not Clear and Deliberate."

NEI provides additional logic diagram information on staged evacuation and the use of other site specific options in the logic diagrams on pages 18A and 18B and in the first bullet of note 4 on page 20A and note 5 on page 20B of the Supplement 3 mark-up contained in Attachment 2.

- B. The consideration for expansion of the evacuation to the 2-5 mile downwind area should be based not only on an assessment of plant conditions, but on dose projections and field monitoring information as well to determine if EPA PAGs have been or could be exceeded.

NEI adds the consideration of EPA PAGs in the second bullet of note 4 on page 20A and note 5 on page 20B of the Supplement 3 mark-up contained in Attachment 2.

- C. It is expected that for staged evacuations, the Technical Support Center (TSC) and Emergency Operations Facility (EOF) licensee emergency response facilities would be staffed within the time frame of the initial 2-mile evacuation, even for low population sites. Therefore, the Supplement 3 guidance should make clear that subsequent assessments following the initial 2-mile radius evacuation are performed by these facilities and should not refer to shift staff implementation of the second phase of staged evacuation.

NEI clarifies that assessments are performed by TSC and EOF staff in the second bullet of note 4 on page 20A and note 5 on page 20B of the Supplement 3 mark-up contained in Attachment 2.

- D. Site-specific ETE information may also vary seasonally, particularly for sites near public beaches or other resort areas. This element may need to be considered as well as the day and night ETEs for some locations.

NEI adds the consideration of seasonal ETE variations in the second bullet of note 4 on page 21A and note 5 on page 21B of the Supplement 3 mark-up contained in Attachment 2.

- E. Much of the guidance throughout the draft Supplement 3 document requires collaboration between OROs and licensees. NEI has received input from ORO members of the NEI task force for Supplement 3 review and ORO personnel outside the task force that most if not all of this collaboration would be expected to take place in planning and preparation before an event occurs and can be pre-described with pre-determined outcomes. In particular, the last sentence in the draft Supplement 3 logic diagram note 7 refers to the licensee and ORO conferring on staged evacuation during the event. It is expected that this is a protective action strategy that can be fully explored and actions determined in planning conducted prior to the occurrence of an event.

NEI revises the information in the draft Supplement 3 logic diagram note 7 in the second bullet of note 4 on pages 20A and 21A (note 5 on pages 20B and 21B) of the Supplement 3 mark-up contained in Attachment 2.

- F. Licensees and OROs may agree that the recommendation to perform a 2-5 mile downwind evacuation that follows the (90% ETE) 2-mile radius evacuation may be contained within the initial notification to evacuate the 2-mile radius. This does not relieve the licensee of the responsibility to monitor plant, meteorological and offsite radiological conditions and to notify the OROs if a change occurs affecting the recommendation. NEI believes that the draft Supplement 3 should address this item and indicate its acceptability in order to prevent potential future regulatory issues for sites and OROs that may choose to use this practice.

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**COMMENT AREA: Logic Diagram**

NEI adds information regarding this notification practice in a background note on pages 23A and 23B of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #13 – Clarification of Rapidly Progressing Severe Accident in Logic Diagram Note 1

As addressed earlier in these comments, NEI does not believe that the rapidly progressing severe accident scenario should be included in the Supplement 3 Logic Diagram and provides technical justification for the removal of this logic diagram element in NEI comments # 2 (page 8 of this attachment) and #28 (page 21 of this attachment), or at a minimum, delay of final implementation of Supplement 3 until the SOARCA study is complete and upon Commission review.. Comments are provided on the use of the rapidly progressing severe accident scenario in the event that NRC does not accept NEI's position on its removal from the draft Supplement 3.

- A. Logic Diagram note 1 should be clarified to refer to the loss of ALL ability to cool the core. NEI asked at the April 13, 2010 NRC public meeting on the draft Supplement 3 as to whether note 1 refers to a degraded ability to cool the core or loss of *all* ability to cool the core. NRC personnel responded that note 1 refers to a loss of all core cooling capability. Consequently, the word "all" should be added to note 1 for clarification.
- B. Site EAL schemes address the term "rapid loss of containment integrity" as used in the draft Supplement 3 Logic Diagram note 1. For instance, both NEI 99-01 Revisions 4 and 5 provide a containment loss EAL of "Rapid unexplained loss of pressure, following an initial pressure increase..." Therefore, NEI submits that the containment integrity language in note 1 can be further clarified by a tie to the site's EALs for a containment barrier loss condition.
- C. NEI does not believe that the rapidly progressing severe accident described in note 1 of the Supplement 3 Logic Diagram should contain the condition of a radiological release expected in less than 1 hour. Although Control Room operators will know that many systems have failed in the event of the very low probability (if even plausible) rapidly progressing severe accident, it would be difficult to determine with certainty whether or not a release will begin in less than 1 hour. NEI does not believe that this condition is necessary to determine that a rapidly progressing severe accident exists because (as explained by NRC personnel in the April 13, 2010 public meeting) this time period accounts for transport of radioactivity from a failed or bypassed containment to the environment, meaning the conditions for the release exist, but transport time may take up to 1 hour. In addition, the draft Supplement 3 states in note 1 that "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..." This statement appears sufficient to define the rapidly progressing severe accident without the addition of "...and a radiological release expected in less than 1 hour."
- D. Section 2 of the draft Supplement 3 indicates that licensees are expected to use site-specific information constructed from the Supplement 3 Logic Diagram and determine protective action recommendations within 15 minutes. NEI agrees that these protective action recommendations must be made promptly and further notes that Control Room personnel should not spend an inordinate amount of time attempting to determine whether or not a rapidly progressing severe accident is occurring when this is a very low probability scenario. Further, NEI believes that were it possible for a rapidly progressing severe accident to occur as described in the draft Supplement 3, that it would be readily identifiable. Therefore the term "immediately" should be used in describing the time frame in which the rapidly progressing severe accident is identified.

NEI provides a proposed revised version of this note on page 19B of the Supplement 3 mark-up contained in Attachment 2.

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COMMENT AREA: Logic Diagram**

NEI Comment #14 – Rapidly Progressing Severe Accident PARs

- A. The first two sentences of Logic Diagram note 9 do not appear to provide any useful information for developing a logic methodology or implementing protective actions and in fact, could be confusing in appearing to classify a “super General Emergency.” These two sentences should be deleted. This information could alternatively be moved to background note information (refer to NEI comment # 5 on page 7 of this attachment) should NRC wish to retain it.
- B. The term “immediately and urgently” appears to be unnecessary in Logic Diagram note 9. Licensees are required to provide a PAR within 15 minutes. The sentence in the draft Supplement 3 reads “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 term “immediately and urgently” should be deleted from the note.
- C. Site-specific ETE information may also vary seasonally, particularly for sites near public beaches or other public use areas. This element may need to be considered as well as the day and night ETEs for some locations.
- D. The term “*when safer to do so*” for determining when to begin staged evacuation following a rapidly progressing severe accident is vague and is not defined in the draft Supplement 3. NEI proposes deletion of this term to be replaced with plant and radiological conditions that are observable and measurable; specifically restoration of any method of core cooling and any method to reduce containment pressure and/or source term has been restored or implemented.
- E. The draft Supplement 3 Logic Diagram does not reference heightened preparedness for staged evacuation following the rapidly progressing severe accident (logic diagram block [O] in the NEI mark-up in Attachment 2). The actions associated with heightened preparedness are still applicable for this Logic Diagram block for areas that are not in the 2-mile radius or 2-10 miles downwind.
- F. The term “all affected areas” in the draft Supplement 3 Logic Diagram block (logic diagram block [O] in the NEI mark-up in Attachment 2) for staged evacuation following a rapidly progressing severe accident is ambiguous. The draft Supplement 3 Logic Diagram note 10 indicates that this is the 2-mile radius and 2-10 miles downwind. The term “all affected areas” in the Logic Diagram should be replaced with the more descriptive terminology used in note 10.

NEI provides a proposed revised version of the information pertaining to rapidly progressing severe accident PARs in the logic diagram on page 18B and in notes 7 and 8 on pages 21B and 22B of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #15 – Lateral Evacuation

Remove the term “lateral evacuation” as a protective action from Supplement 3.

Evacuation of an area depends considerably on the availability of evacuation roadway infrastructure for evacuees to egress out of at-risk areas. The layout of these evacuation routes determines the direction of travel, which involves both radial and lateral movement of evacuees in the course of their egress out of the EPZ. ETE studies incorporate the available and applicable roadway network “as-is” within the 10-mile EPZ of a nuclear power plant site, and do not explicitly account for only “lateral” or “radial” direction of travel. The proposed ETE rulemaking does not require licensees to develop separate ETEs for “lateral” and/or “radial” evacuation scenarios. In addition, there are no practical and/or economic means of

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Logic Diagram**

notifying the public to travel “laterally to the plume” since any such instruction to the public does not consider a “directional” component (in terms of E-W-N-S or its derivatives) that is critical to accurate public communication.

Other observations supporting removal of lateral evacuation from the document as a protective action are:

1. NRC representatives stated in the April 13, 2010 public meeting that lateral evacuation is considered to be an “ad hoc” response that is not required to be addressed in ORO plans or procedures.
2. The first bullet on page 2 of the draft Supplement 3 clearly states that radial evacuation should remain the major element of protective action strategies.

NEI deletes reference to “lateral evacuation” in note 8 on page 22B of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #16 – SIP and EPA PAGs

The draft Supplement 3 Logic Diagram and notes do not clearly state that SIP is a preferred protective action (such as the initial protective action for the 2-5 mile downwind area in a staged evacuation) even when EPA PAGs are exceeded for the area being sheltered. This is somewhat apparent to the reader in a full reading of the document, but should be stated for clarity in the Logic Diagram notes.

NEI provides proposed language regarding SIP for areas where EPA PAGs are exceeded in the background note on SIP on pages 22A and 22B of the Supplement 3 mark-up contained in Attachment 2.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Wind Shift PAR**

NEI Comment #17 – Wind Shift PAR

In the second paragraph of section 4 page 12, the document addresses PARs for wind shifts with the statement “Where there is reason to believe containment may fail...” The portion of this section dealing with wind shifts lacks specificity and does not consider all elements that may be involved in a decision to make a lesser protective action recommendation than was initially made (before the wind shift), regardless of the dose assessment information available. In addition, the statement “where there is reason to believe containment may fail” doesn’t provide congruence with the definition of a General Emergency, which is a failure of two fission product barriers and the potential failure of the third barrier. If containment is one of the failed barriers, then a release to the environment is in progress. If containment is the barrier that meets the criteria for potential failure, then the issue of “where there is reason to believe containment MAY fail,” has been addressed through the Emergency Action Levels in reaching a General Emergency and this determination is “yes,” containment MAY fail. In the case where the incident has been mitigated, NEI does not disagree with the NRC’s position.

In addition, section 4 goes on to state that “...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.”

NEI submits that the General Emergency is the worst case of the four emergency nuclear power plant emergency classifications. Multiple equipment failures would have to occur to reach this condition. NEI does not believe that the protection of public health and safety is best served by a strict and narrow reading of source term in determining subsequent protective action recommendations. Plant conditions may continue to deteriorate, meteorological conditions may change or the ongoing (or potential) radiological release isotopic composition, release rate and release points may be variable or even unknown at the time the wind shift occurs.

While NEI agrees with the NRC that severe nuclear power plant accidents will be mitigated by the power plant operators and that all available resources will be brought to bear to accomplish this as quickly as possible, it is also clear that the absolute determination of whether or not plant conditions support a lesser PAR when a wind shift occurs may not be possible for some time while these mitigating actions are in progress. This is borne out in EPA-400-R-92-001, section 1.1 where the early phase of a nuclear incident is described as a period that may last “from hours to days.”

The discussion above demonstrates that this issue has many complicated elements and these elements need to be explored systematically. The above discussion provides only limited examples. NEI proposes that a series of NRC public meetings be held to resolve this issue. The results of these public meetings should be incorporated in the final version of this Supplement 3.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Emergency Messaging**

NEI Comment #18 - Appendix

Supplement 3 is a technical document for determining protective actions. The appendix to Supplement 3 is a communications plan. NEI does not believe that this communications plan belongs in Supplement 3 and that there are other more appropriate regulatory venues for this information.

In addition, the appendix has different information from that which is contained in Section 1.E of FEMA Radiological Emergency Preparedness Program (REP) Manual (Draft), dated May 8, 2009. FEMA also utilizes Section III of the Draft FEMA REP Manual to evaluate ORO response in the area of public information. Both sections of the FEMA REP manual as it is currently written, fail to adequately address the new information contained in the appendix to Supplement 3.

Based on the above information, the appendix should be removed from Supplement 3. FEMA should, as appropriate, incorporate the appendix information into Section 1.E and Section III of the Draft FEMA REP Manual. This information should also be coordinated with the radiological risk and communications NUREG currently in development by NRC.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Implementation**

NEI Comment #19 – Superseded Regulatory Documents

- A. The last paragraph on page 2 in the Introduction section of the draft Supplement 3 refers to a limited number of regulatory documents that are superseded by the draft Supplement 3. This list should be expanded to include other documents in order to provide clarity and fully implement the statement in the first sentence of the paragraph.
- B. The information on page 3 of the draft Supplement 3 states that “NRC does not intend to affect the protective action guidelines developed and promulgated by the U.S. Environmental Protection Agency (EPA).” Supplement 3 does not refer to the specific EPA document in this section that embodies the EPA guidance. Reference to EPA-400-R-92-001 should be added.

NEI has revised the information regarding superseded (and non-superseded) regulatory documents on pages 2 and 3 of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #20 – Modification of Existing Emergency Response Planning Areas (ERPAs)

In response to a question asked at the public meetings on April 13, 2010, NRC personnel stated that OROs were not expected to modify existing ERPAs in order to implement the draft Supplement 3 guidance. This includes practices that may currently exist for implementing protective actions in areas over a 360-degree radius at greater than 2 miles (though NRC personnel discouraged these practices). This position is not stated in the draft Supplement 3.

NEI has added information on this subject in section 2 at the top of page 6 of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #21 – Site-Specific Modification

- A. The guidance in section 2 on page 6 of the draft Supplement 3 does not establish clear guidelines for taking information in Supplement 3 and using it to create a site-specific decision making tool. This includes the need for a technical basis for modification of the guidance.
- B. Section 2 of the draft Supplement 3 should also be clarified for its relationship to 10CFR50.47(b)10 and 44CFR350.5(10).
- C. A question was asked at the NRC public meetings on April 13, 2010 on the NRC’s expectation related to how the applicable ORO and licensee should work with in arriving at the appropriate site-specific modifications of Supplement 3 guidance. NEI agrees with the NRC response that this will vary from site to site in accordance with state and local governmental structure and must be determined by the licensee. However, if one licensee had a question in this area, there may be others and as such additional information should be provided in this guidance to ensure a consistent implementation approach is applied.
- D. The draft Supplement 3 does not address the documentation of decisions regarding modification of the guidance for site specificity.

NEI has added information on site-specific modification in section 2 on page 6 of the Supplement 3 mark-up contained in Attachment 2.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Implementation**

NEI Comment #22 - NRC Prior Approval

In the April 13, 2010 public meetings in response to questions regarding submittal to NRC for prior approval of site-specific changes as a result of future Supplement 3 implementation, NRC personnel stated that they did not believe such changes would require prior NRC approval to implement. NRC personnel also stated that the licensee is required to make this determination based on their individual situation. This position and further instruction regarding NRC prior approval must be addressed in the draft Supplement 3.

NEI has provided proposed language on NRC prior approval in Section 2 on page 6 of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #23 – Actions at a Site Area Emergency (Section 2.3)

NEI does not believe that offsite protective actions at a Site Area Emergency are required based on the description of this classification in industry EAL schemes. NEI further believes that any Site Area Emergency that would require that protective action recommendations be made because of plant status or dose assessment information should be classified as a General Emergency. This does not preclude OROs and licensees from agreeing (during planning and implementation of site-specific processes) on actions that are recommended or taken at a Site Area Emergency that are precautionary in nature. These actions should not be referred to as “protective actions” to prevent confusion with those actions that must be considered at a General Emergency.

In addition, NEI does not believe the draft Supplement 3 should attempt to provide guidance on Site Area Emergencies that may be “potential precursors to a more serious accident,” including a discussion on assessment of the condition and the conferring between licensee and ORO personnel (at the time of the event) regarding the nature of the event and the likelihood of core degradation. This does not mean that licensees and OROs will not communicate with one another during an event of this nature, but that the draft Supplement 3 guidance in this area is inappropriate given the way that emergency classification schemes are intended to be used. Site Area and General Emergencies are well defined in EAL schemes. If a licensee has plant indication that a failure of two fission product barriers has occurred and the potential failure or failure of the third is also present or that these conditions are imminent, then a General Emergency should be declared and protective action recommendations made within 15 minutes. The draft Supplement 3 language might be taken to imply that a condition that should be classified as a General Emergency is not classified that way.

NEI has provided a revised section 2.3 on pages 7 and 8 of the Supplement 3 mark-up contained in Attachment 2. Associated revisions are also provided on pages iii, v and 2 of the Supplement 3 mark-up contained in Attachment 2.

NEI Comment #24 – Wind Persistence (Section 2.4)

A wind persistence analysis may be included in the licensee's Updated Final Safety Analysis Report (UFSAR). If this is the case, then this information may be used in lieu of performing an additional wind persistence analysis. The wind persistence analysis or UFSAR information should be used to determine if the site specific PAR logic diagram should include more than three downwind compass sectors. The expanded PAR should then be developed not only for evacuation but also for SIP.

NEI has provided a revised section 2.4 on page 8 of the Supplement 3 mark-up contained in Attachment 2.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Outreach**

NEI Comment #25 - Outreach

The proposed NRC guidance changes the philosophy of the logic used for making protective action recommendations. The current version does not provide the option for shelter-in-place in the development of protective actions except where impediments to evacuation exist or in the case of a release of a known short duration. Since the implementation of Supplement 3 in 1996, the public has been advised that evacuation is the preferred method for protecting the public for all plant accident scenarios. The proposed guidance indicates that shelter-in-place is preferable (i.e., more protective under certain conditions) and should be considered.

Regardless of the validity of the technical basis and the site specific considerations, this represents a significant paradigm shift in the development of protective actions. State and local offsite agencies will have the daunting task of re-educating decision makers and the public on protective actions for nuclear power plants. In order to accomplish this task, it is critical that the NRC be involved in the implementation of the guidance along with state, local and onsite staff.

The following are suggestions for the implementation process and outreach:

- A. The NRC and FEMA should participate in the development discussions with state and local planners for site specific PAR logic diagrams so that they can provide input and guidance on consistent application of the logic. Further, for sites that will need to take exceptions to the guidance, the NRC should provide feedback on whether the exceptions are acceptable and appropriate for the site before the site specific guidance is implemented. FEMA should be involved in the discussions as well because of their role as the agency responsible for the evaluation of protective action decisions for state and local jurisdictions.
- B. Following the development of protective action logic diagrams for each site, the NRC and FEMA should be present for meetings and briefings for state and local decision makers. Some state and local agencies will need assistance from NRC in presenting the technical basis for the changes in the development of protective actions.
- C. There are likely to be many questions from the public and other interest groups regarding the change in philosophy in the development of protective actions. The NRC should be involved in developing a public outreach program with state, local and site staff in order to educate the public on the basis for the changes in protective action decision making.
- D. The NRC should develop a generic FAQ sheet highlighting the major shifts in philosophy for the revised guidance and post it to the agency's web page.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Consistency in the Development of Guidance**

NEI Comment #26 – Consistency in the Development of Guidance

NUREG-0654 is the basis document for emergency response planning for onsite and offsite organizations. It has been widely recognized by both NRC and FEMA that a comprehensive revision to NUREG-0654 is long overdue. Despite the need to revise the basis document, both NRC and FEMA have made decisions to make significant changes to supplemental guidance documents that are based on NUREG-0654. Going forward with the revision to NUREG-0654, both NRC and FEMA should be mindful of the changes already made to FEMA and NRC guidance documents so that they remain consistent.

Significant changes to federal guidance documents require tremendous efforts at the state and local level to identify portions of plans and procedures that require revision. Once revisions to plans and procedures are completed and reviewed for accuracy and completeness, there is another significant effort to train emergency response personnel and implement the revisions. NRC and FEMA must recognize the resources required to make and implement guidance changes at the state and local level and make every effort to limit the frequency of guidance updates. The future revisions made to NUREG-0654 should not impact actions already implemented based on updates to the FEMA REP Program Manual and NUREG-0654, Supplement 3.

In addition, the impact on state and local government agencies would be substantially lessened if the new guidance documents currently in development (FEMA REP Program Manual, NUREG-0654 and Supplement 3) were implemented together rather than in a piecemeal fashion so that change management could be performed at one time. This would also provide for consistency among the guidance documents.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Document Availability**

NEI Comment #27 – Document Availability

NUREG-0654, Supplement 3 (Draft) references two documents: the NRC State-of-the-Art Reactor Consequence Analysis (SOARCA) and NUREG/CR-6953, Vol. III, "Review of NUREG-0654, Supplement 3, 'Criteria for Protective Action Recommendations for Severe Accidents. Technical Basis for Protective Action Strategies.' At the time of the publication of the Federal Register announcing the initial comment period for the draft Supplement 3, neither of these documents was publicly available. In light of the comments and feedback NRC is seeking through the publication of the draft Supplement 3 document, it is imperative that reviewers have access to the pertinent documents to support their reviews.

At the time of writing of this NEI comment, a draft of NUREG/CR-6953, Vol. III is available (as of June 1, 2010). This document is not final. The SOARCA document is still not available for review. NEI provides a more comprehensive discussion of the SOARCA study in NEI comment #28.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: SOARCA**

NEI Comment #28 – SOARCA

The NRC established a study of severe accident phenomenology and consequences by the Sandia National Laboratory known as the State-of-the-Art Reactor Consequence Analysis (SOARCA). This multi-year study is nearing the point at which it will undergo independent peer technical review and then a separate technical review by the Advisory Committee on Reactor Safeguards (ACRS). Early findings from the SOARCA have been presented in various forums, including the NRC's Regulatory Information Conference (RIC) in March 2009 and the Workshop on Implementation of Severe Accident Management (SAM) Measures convened in October 2009 by the Organization for Economic Cooperation and Development (OECD).

The preliminary results reported on at the March 2009 RIC and the OECD Workshop provided valuable insights into the findings of the SOARCA. It appears that the findings are materially important to the content of the proposed Supplement 3 to NUREG-0654. The SOARCA findings are of such significance that it is particularly prudent for NRC to take them into consideration in the development of any revisions to NUREG-0654 and its supplements. Clearly the SOARCA findings are preliminary and subject to change. However, the SOARCA findings are of particular relevance to Supplement 3 because they have the potential for substantially modifying the nature of emergency planning for nuclear power reactors and because those findings are likely to be issued in the relatively near term. NEI strongly recommends that any revisions to NUREG-0654 Supplement 3 be deferred until the implications of the final SOARCA are released and incorporated into the bases for radiological emergency planning in the United States. Some examples of the preliminary findings and their implications are provided as follows:

From the March 2009 RIC presentation *Phenomenological Advance of Severe Accident Progression* by R.O. Gauntt, Sandia National Laboratory:

- Severe accidents progress significantly more slowly than in current models
- There is significantly more fission product retention in the reactor coolant system and in containment than predicted in current models
- Slower accident progression allows for more time to accomplish accident mitigation
- Overall source terms are significantly reduced from those predicted in current models

From the March 2009 RIC presentation *Updated Accident Progression Analyses* by Jason Schaperow, NRC Office of Nuclear Regulatory Research:

- All events can reasonably be mitigated
- For unmitigated cases there is no large early release fraction (LERF)
- Releases are dramatically smaller and delayed from the 1982 Siting Study

From the October 2009 OECD workshop presentation *Best-Estimate Calculations of Unmitigated Severe Accidents in State-of-the-Art Reactor Consequence Analyses* by Jason H. Schaperow, et al:

- Even without operator mitigating actions, accident progressions are slower and source terms are smaller than current models predict
- Operator actions to accomplish accident mitigation are likely and are likely to be effective
- There is no Large Early Release Fraction (LERF) of radionuclides into the environment
- Overall accidents have lower frequencies (probabilities) and lower consequences

One of the more significant implications of the findings to date is that there is no large early release event commonly referred to as the Large Early Release Fraction (LERF). This is important because the proposed changes to protective action strategies in the draft Supplement 3 do assume a large early release (left hand side of the logic diagram). Additional implications for the proposed changes to

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: SOARCA**

Supplement 3 include the SOARCA findings that accident progressions generally are far slower than found in the accident models currently in use. This finding has implications for the extent to which protective actions are appropriate. In this case it appears that SOARCA findings would support proposals in the draft revision to Supplement 3 for sheltering outer portions of the emergency planning zone and evacuating those portions closer to the accident source. The SOARCA findings may lead to conclusions that protective actions beyond 4-5 miles are unnecessary in almost all cases. Similar implications may arise from the SOARCA findings that source terms are far smaller than current models predict.

While the final outcome of the SOARCA is not known, it is reasonable to conclude based on what is already known that the study will have significant implications for radiological emergency planning. It would be imprudent to make changes to Supplement 3 that would be contradicted or at least substantially modified if the NRC adopts the SOARCA. Because the issuance of a final SOARCA report is anticipated in the foreseeable future, the interests of public health and safety are better served by delaying the issuance of the changes in this draft Supplement 3 until the Commission has the opportunity to study and act on the SOARCA.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Inspection and Enforcement**

NEI Comment #29 – Inspection and Enforcement

In response to a question on demonstration requirements at the April 13, 2010 public meetings, NRC personnel stated that there is nothing in the new rule, the draft Supplement 3 or FEMA's draft REP Program Manual that would require specific periodic demonstration of various logic diagram elements. Though NEI agrees with this statement, NEI recognizes that the combination of the new emergency preparedness rulemaking, the Supplement 3 revision and the FEMA REP Program Manual revision represents the most significant change to emergency preparedness programs since their inception. NRC and FEMA should develop policies and guidance on inspection and enforcement in these areas as soon as practicable. NEI believes that inspection and enforcement questions will continue to be raised by stakeholders until such information is made available.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3  
COMMENT AREA: Implementation Schedule**

NEI Comment #30 – Implementation Schedule

Final implementation of the draft Supplement 3 is informed by the evacuation time estimate. Specifically, the 90% evacuation information required to implement the supplement may not be available for all nuclear power plant sites in their current ETEs. Emergency preparedness regulation changes related to ETEs will require that this value be calculated. It is therefore important that a holistic implementation, which includes implementation of the ETE rulemaking, implementation of this Supplement 3 and data availability from the 2010 census, be considered.

Suggested implementation schedule sequence:

1. Final site-specific census data necessary for ETE studies compliant to ETE rulemaking,
2. Final ETE rulemaking approved and issued,
3. Site-specific ETE studies completed and submitted to NRC by licensees,
4. Approval of site-specific ETEs by NRC,
5. Implementation of the approved ETEs in site-specific Supplement 3 PAR logic

Items 1 and 2 above can occur in parallel, but 3, 4 and 5 are sequential only after 2 is complete. This sequence puts the logical time frame for final implementation of Supplement 3 in sequence with the ETE rulemaking or later.

If the final implementation of Supplement 3 does not follow the above-mentioned schedule and licensees are mandated to use the Supplement 3 PAR logic earlier, NEI believes the majority of licensees will be unable to use the PAR logic as described in the supplement because:

- A. Current ETE data is insufficient to meet all of the requirements of the draft Supplement 3 PAR logic decision points:
  - a. 90% evacuation information not available in all licensee ETEs
  - b. The majority of sites do not have specific ETEs for 2-5 mile downwind sectors
  - c. Some licensees don't have specific day and night ETEs

In addition, if the new PAR strategies will be based on current ETEs, NEI believes that in most cases, they will need to be significantly revised once new ETEs are completed that are in compliance with the ETE rulemaking.

NEI does not believe that the schedule published in the original Federal Register associated with the draft Supplement 3 (Vol. 75 No. 44 dated March 8, 2010) supports the recommended implementation sequence described above. The Federal Register schedule indicated that licensees would be required to implement the guidance by mid-2012. It is likely that revised site-specific ETEs based on the 2010 census and using the rulemaking requirements will not be available at that time. Even if revised ETEs are available, NEI does not believe the 2012 schedule supports the level of document revision and training (for both licensee and ORO organizations) that will be required to implement the Supplement 3 guidance.

**NEI COMMENTS ON Draft NUREG 0654 Supplement 3**  
**COMMENT AREA: Definition of Terms**

NEI Comment #31 – Definition of Terms

The glossary contained in the draft Supplement 3 is limited and does not define all terms used in the document that may be subject to misinterpretation. Though not considered an all-inclusive list, some terms that NEI suggests NRC consider for addition to the glossary are: “probabilistic perspective in a qualitative manner” (page 6), “low population density” (page 18), “high-population site” (page 19), “safer to do so” (page 17). NEI recommends replacement of the term “safer to do so” in NEI comment #14D on page 12 of this attachment.

In addition, NEI recommends that terms that are defined in the document’s glossary be shown in all caps elsewhere in the document to indicate that they are defined terms. This is a format that has worked well in the EAL guidance provided in NEI 99-01 Revisions 4 and 5 and one that is familiar to licensee and ORO personnel.

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# 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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Date Published:

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**FEMA**

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

## 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 using the example generic of the PAR logic diagram contained in the attachment to this supplement. This diagram should be used to develop a site-specific PAR decision making tool 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 decision making tool 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.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

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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-in-place 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 off-site 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-6954, 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). Other regulatory documents that are superseded by this revision of Supplement 3 are NRC Information Notice 83-28 and RIS 2003-12. The NRC Response

Technical Manual (RTM) information pertaining to protective action recommendations is also superseded by the information in this document.

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) and published in EPA-400-R-92-001. The EPA protective action guides remain the appropriate Federal guidance on radiological criteria for consideration of protective actions.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

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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 decision making tool 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 decision making tool 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 decision making tool logic diagram used by the licensee-augmented 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 decision making tools 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. Some information provided in the notes is of an informative or background nature and may not be required in the generation of a site-specific PAR decision making tool. This background information may be required to fully implement a protective action decision, but is not required in the construction of the logic tool for making a recommendation. The diagram is simplified when the site-specific elements are developed and the information 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 decision making tool 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 decision making tool logic diagram. This criteria and the approved PAR decision making tool 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 methodology 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.

This guidance is not intended to require modification of existing ERPAs or areas used by OROs for implementing public protective actions, including practices that may currently exist for taking action over 360 degree areas at a greater distance than 2 miles, though such practices may not be supported by the studies referenced in this guidance.

Licenseses and OROs should use this guidance to develop a range of protective actions in accordance with 10CFR50.47(b)10 and 44CFR350.5(10) and modify the information in this document for site specificity and identified ORO input points (described in the guidance). Any other modifications that do not have a technical basis as described in the guidance do not meet its intent. If OROs do not agree with implementation of this guidance (such as use of staged evacuation based on ETEs), the licensee should determine sufficient technical basis before modifying the information in the guidance for its site specific application or use the information in the guidance with a recognized difference in site protective action recommendations and ORO decisions. Any deviations from this guidance that are adopted by the licensee for site specific application should be documented with a technical justification and retained for future inspection.

Licenseses should determine the ORO organization(s) to provide the input to be used in implementation of this guidance. Generally, this will be the organization(s) responsible for making protective action decisions. It is not the intent of this guidance for licenseses to coordinate the development of a site specific protective action document based on discussions with all ORO organizations identified in the site specific emergency plan.

Licenseses may choose to document their discussions with and input provided by OROs for use in the site specific implementation of this guidance and retain it to support future inspection activities. Submittal of this documentation is not suggested or required.

It is not expected that prior NRC approval would be required to implement site-specific changes to existing protective action strategies based on the use of the guidance in this document. Each licensee is required to perform an evaluation and make this determination in accordance with 10CFR50.54q.

## **2.1 Implementation of the Protective Action Recommendation Logic Diagram at a General Emergency**

Licenseses 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 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) 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 Precautionary Protective Actions at Site Area Emergency**

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. A licensee may choose to include the option for precautionary actions at the Site Area Emergency Level if their respective OROs have provided input requesting that it be included in the licensee's procedure. The more likely situation is that OROs will do their own independent evaluation of the need for precautionary actions at the Site Area Emergency level taking into account offsite environmental conditions that may be unknown to the licensee and are the jurisdiction of the OROs.

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 countermanning 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 or determine this information from the Updated Final Safety Analysis Report, to determine if the site specific PAR decision making tool logic diagram should include more than three downwind 22.5 degree compass sectors when a downwind SIP or 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 the credibility and increase shadow evacuations, thereby potentially increasing evacuation times. However, this wind persistence information 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.

Attachment 2 - NEI Markup of NUREG 0657 Supplement 3

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

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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.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

#### **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.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

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## 5. GLOSSARY

- **Emergency Response Planning Area (ERPA)** - A local area within the EPZ that is a subset of 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. Some of these areas are rather large while others may be very small. As an example a 0-2 mile evacuation could result in evacuation out to 5 miles in some directions depending on how the EPRA is defined.
- **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** - An advisory type of protective action intended to mean to ensure 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. Licensees and OROs may use terminology other than "heightened preparedness" to describe these public communication and preparation actions.
- **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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Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

## 6. REFERENCES

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Nuclear Regulatory Commission (U.S.) (NRC). 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: Washington, D.C. 1980.

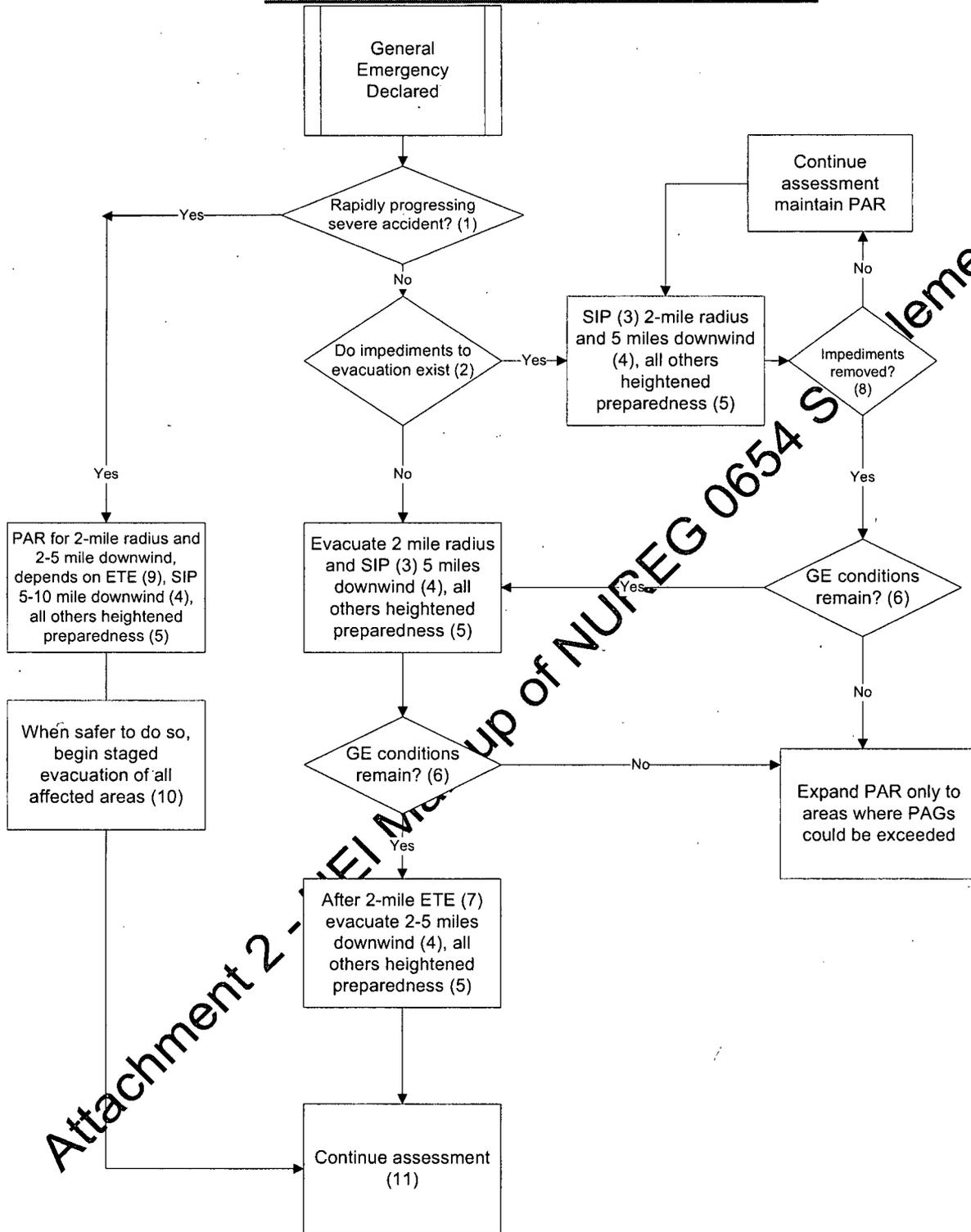
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ATTACHMENT

PROTECTIVE ACTION RECOMMENDATION LOGIC DIAGRAM

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

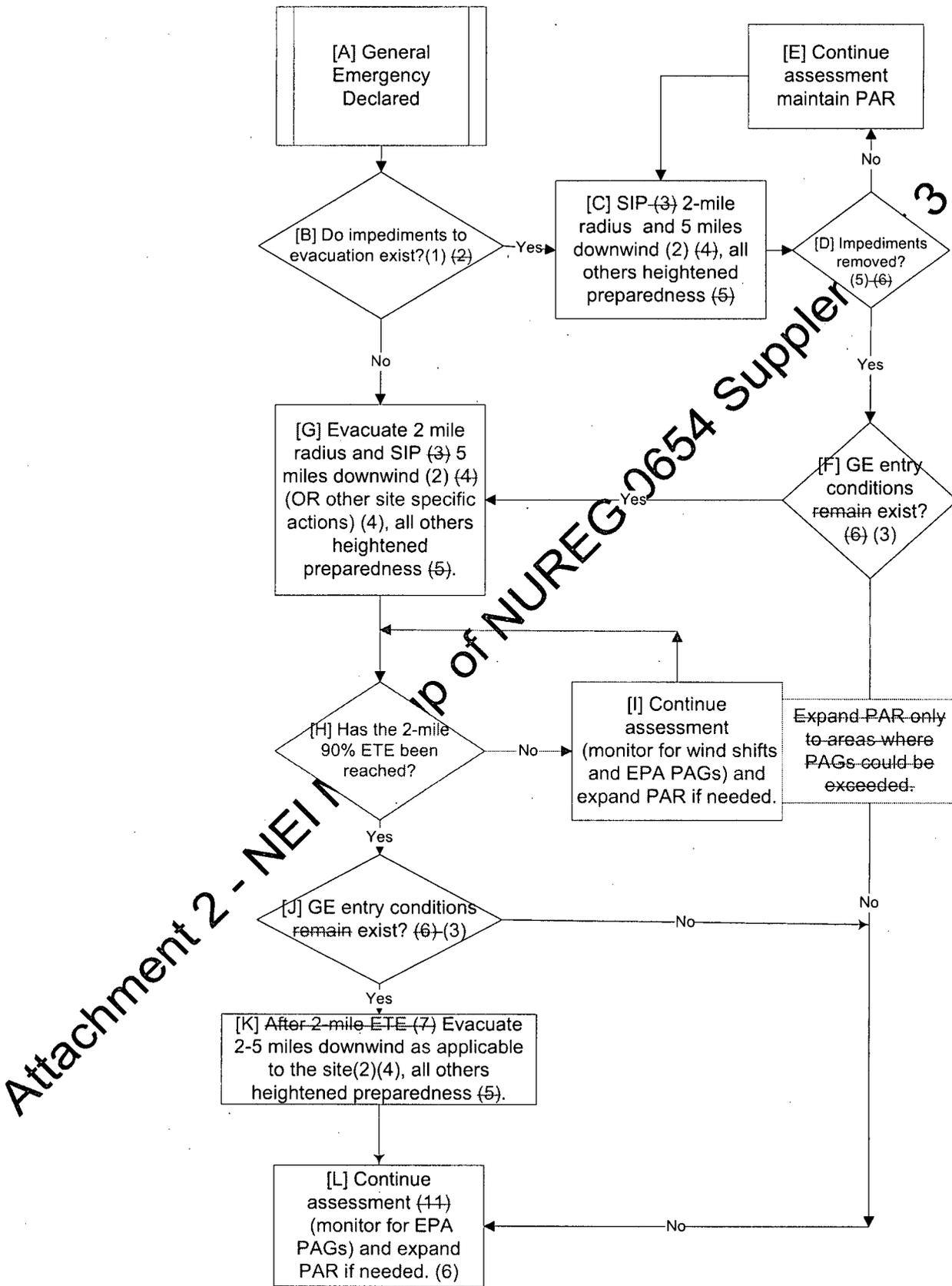
**REPLACE WITH EITHER OPTION A (RAPIDLY PROGRESSING SEVERE ACCIDENT REMOVED) OR B**



Attachment 2 - NEI Main Menu of NUPEG 0654 Supplement 3

**Protective Action Recommendation Logic Diagram**

OPTION A – RAPIDLY PROGRESSING SEVERE ACCIDENT REMOVED



Protective Action Recommendation Logic Diagram

## Protective Action Recommendation Logic Diagram Notes

It is not intended that any one site will have a logic diagram that looks exactly like the one provided in this supplement. Each site develops its own specific logic diagram (or other tool) for PAR decision making using the example generic logic diagram in this supplement and the associated notes in collaboration with applicable OROs.

Information in these notes that is required by the user to develop a site specific decision making tool is labeled as an "Instruction Note." Information that is strictly provided as background and/or is not required to be used in development of a site specific PAR decision making methodology is labeled as a "Background Note." Background Notes are not numbered and are listed at the end of the Instruction Notes. Background Note information may be needed to fully implement a protective action decision, but is not required in the construction of the logic tool for making a recommendation.

### 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.~~

Gate [B] Instruction Note 12 Impediments include the following:

- Evacuation support (traffic controls) 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) as part of the planning process. 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) decision making tool 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 during the development process for their PAR methodology and reach agreement. The licensee would then base its recommendation on their site specific PAR methodology 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. ORO decisions on evacuations consider impediments when determining which areas to evacuate. (e.g., roadways are closed because of deep snow, flooding, construction, etc.). If, in the planning process,

OROs indicate that they will make such determinations and do not want the licensee to adjust a PAR that is based on plant or dose assessment technical information for weather or other related impediments, then the licensee is not required to consider these impediments in PAR development.

Blocks [C], [G] and [K] Instruction Note 24

- This includes downwind 22.5 degree compass sector(s) and adjacent compass sectors. In practice, the downwind sectors have historically included the downwind compass sector and the two adjacent sectors. Based on historic wind variability/persistence (section 2.4) there may be a need to add additional compass sectors
- Site-specific wind persistence analysis or existing FSAR information may indicate the need to include additional compass sectors with the initial recommendation. The licensee must discuss this element with OROs and reach agreement. The licensee and OROs should discuss how protective action recommendations are implemented to determine in advance if it would be more prudent to include additional compass sectors. As indicated above, for some EPZs providing additional sectors may not be a factor.

Gates [F] and [J] Instruction Note 36

- 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, or if any Initiating Condition for a General Emergency exists then expansion of the PAR in areas where protective action guidelines (PAGs) could be exceeded is appropriate excluding dose assessment and/or field monitoring information, as GE conditions remain. This determination may be made using the pre-determined calculated containment high range radiation monitor reading based on 20% clad damage provided for EAL application.

Blocks [G] and [K] Instruction Note 4

- The example generic logic diagram assumes a homogenous population distribution throughout the 10-mile EPZ. When developing site-specific PAR logic elements, licensees should confer with OROs and review their site specific ETEs in the planning process to determine the best initial protective action at a General Emergency. Staged evacuation of the 2-mile radius and 5 miles downwind (following 90% ETE of the 2-mile radius) should be the primary consideration in most cases. This action may not be the best action for all sites in all cases. If staged evacuation is not selected, documentation of the technical basis should be retained for future review and inspection.

Note 7

After  $T=X$  hours, where X equals the time for 90% of the 2-mile radius to evacuate (from the ETE), 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, consider the need to expand evacuations based on plant conditions or EPA PAGs being exceeded beyond 2 miles or dose projections indicate the potential to exceed EPA PAGs beyond 2 miles. This assessment is expected to be performed by TSC or EOF staff and not shift staff as even in low population EPZs these facilities should be staffed at this time. 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 as well as seasonal considerations where applicable. 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.

Gate [D] Instruction Note 58

- 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 if General Emergency conditions are present or EPA PAGs are or could be exceeded in the affected areas. Refer to logic diagram gate [F] and Instruction Note # 3 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. For those sites where the licensee and OROs had agreed in planning activities that a hostile action event represents an evacuation impediment, it is expected that licensees and ORO personnel would be in contact with one another through Incident Command and discussing whether the sheltering PAR should be changed. Licensees should communicate any changes in their recommendations during this period and communicate the appropriate action in a timely manner when the impediment is removed. 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  $T_D$  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 (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 is 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 may 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.

Block [L] Instruction Note 644

- 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.

Background Note

- "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. Where SIP is indicated as the preferred protective action for an area of interest until it can be evacuated in a staged evacuation process (or evacuation impediments exist), this is the preferred action whether or not EPA PAGs are

exceeded in that area (e.g., 2-5 miles downwind SIP until 2-mile radius evacuation nears completion).

#### Background Note

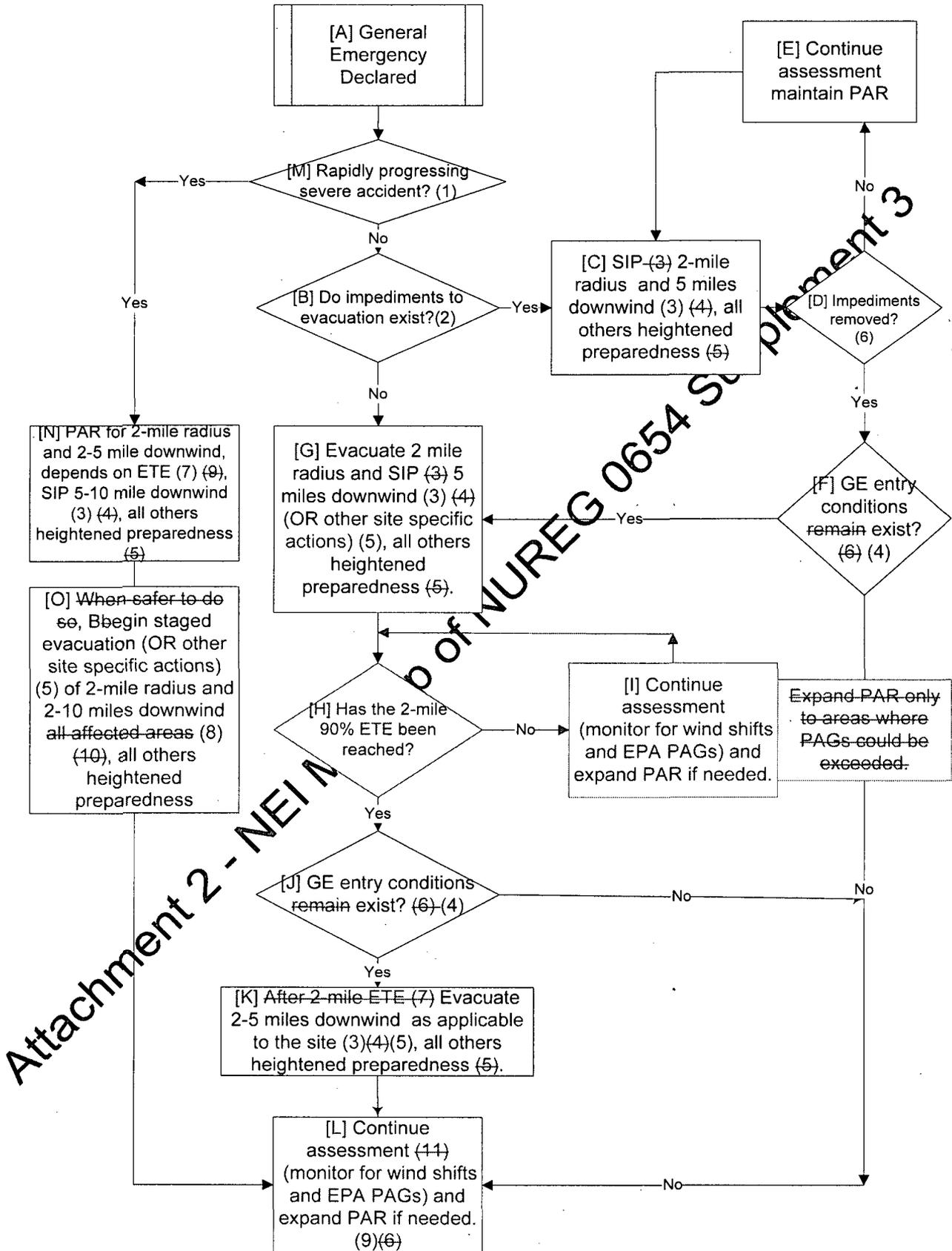
- "Heightened Preparedness" is intended to mean that the population within the plume exposure pathway emergency planning zone (EPZ) is informed of the emergency at the nuclear power plant and that they should monitor the situation and prepare for the possibility of evacuation, shelter-in-place or other 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. [Other terminology that meets the intent of "Heightened Preparedness" as used here is acceptable in a final protective action strategy.]

#### Background Note

- Licensees and OROs may develop site-specific notification practices for a staged evacuation in the planning process. For instance, the licensee and OROs may agree that an initial notification from the licensee recommends evacuation of the 2-mile radius followed by evacuation of the 5-mile downwind areas when the 2-mile radius evacuation is nearing completion (90% ETE time) unless conditions change and the ORO is notified otherwise by the licensee.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

OPTION B – INCLUDES RAPIDLY PROGRESSING SEVERE ACCIDENT



Protective Action Recommendation Logic Diagram

## Protective Action Recommendation Logic Diagram Notes

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Information in these notes that is required by the user to develop a site specific decision making tool is labeled as an "Instruction Note." Information that is strictly provided as background and/or is not required to be used in development of a site specific PAR decision making methodology is labeled as a "Background Note." Background Notes are not numbered and are listed at the end of the Instruction Notes. Background Note information may be needed to fully implement a protective action decision, but is not required in the construction of the logic tool for making a recommendation.

### [Gate M] Instruction Note 1

Rapidly progressing severe accident: This is a General Emergency (GE) with rapid loss of containment integrity (EALs indicate containment barrier loss) and loss of all 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 immediately identified, assume it is not taking place and answer "no" to this decision block.

Gate [B] Instruction Note 2 Impediments include the following:

- Evacuation support (traffic controls) 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) as part of the planning process. 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) decision making tool 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 during the development process for their PAR methodology and reach agreement. The licensee would then base its recommendation on their site specific PAR methodology 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. ORO decisions on evacuations consider impediments when determining which areas to evacuate. (e.g., roadways are closed because of deep snow, flooding, construction, etc.). If, in the planning process,

OROs indicate that they will make such determinations and do not want the licensee to adjust a PAR that is based on plant or dose assessment technical information for weather or other related impediments, then the licensee is not required to consider these impediments in PAR development.

Blocks [C], [G], [K] and [N] Instruction Note 34

- This includes downwind 22.5 degree compass sector(s) and adjacent compass sectors. In practice, the downwind sectors have historically included the downwind compass sector and the two adjacent sectors. Based on historic wind variability/persistence (section 2.4) there may be a need to add additional compass sectors
- Site-specific wind persistence analysis or existing FSAR information may indicate the need to include additional compass sectors with the initial recommendation. ~~The licensee must discuss this element with OROs and reach agreement.~~ The licensee and OROs should discuss how protective action recommendations are implemented to determine in advance if it would be more prudent to include additional compass sectors. As indicated above, for some EPZs providing additional sectors may not be a factor.

Gates [F] and [J] Instruction Note 46

- 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, or if any Initiating Condition for a General Emergency exists then expansion of the PAR in ~~areas where protective action guidelines (PAGs) could be exceeded~~ is appropriate excluding dose assessment and/or field monitoring information, as GE conditions remain. This determination may be made using the pre-determined calculated containment high range radiation monitor reading based on 20% clad damage provided for EAL application.

Blocks [G], [K] and [O] Instruction Note 5

- The example generic logic diagram assumes a homogenous population distribution throughout the 10-mile EPZ. When developing site-specific PAR logic elements, licensees should confer with OROs and review their site specific ETEs in the planning process to determine the best initial protective action at a General Emergency. Staged evacuation of the 2-mile radius and 5 miles downwind (following 90% ETE of the 2-mile radius) should be the primary consideration in most cases. This action may not be the best action for all sites in all cases. If staged evacuation is not selected, documentation of the technical basis should be retained for future review and inspection.

Note 7

- After  $T=X$  hours, where X equals the time for 90% of the 2-mile radius to evacuate (from the ETE), 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. consider the need to expand evacuations based on plant conditions or EPA PAGS being exceeded beyond 2 miles or dose projections indicate the potential to exceed EPA PAGs beyond 2 miles. This assessment is expected to be performed by TSC or EOF staff and not shift staff as even in low population EPZs these facilities should be staffed at this time. 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 as well as seasonal considerations where applicable. 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.

Gate [D] Instruction Note 68

- 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 if General Emergency conditions are present or EPA PAGs are or could be exceeded in the affected areas. Refer to logic diagram gate [F] and Instruction Note # 3 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. For those sites where the licensee and OROs had agreed in planning activities that a hostile action event represents an evacuation impediment, it is expected that licensees and ORO personnel would be in contact with one another through Incident Command and discussing whether the sheltering PAR should be changed. Licensees should communicate any changes in their recommendations during this period and communicate the appropriate action in a timely manner when the impediment is removed. 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.

Block [N] Instruction Note 79

- 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  $T_D$  for a daytime ETE and  $T_N$  for a nighttime ETE as well as seasonal considerations where applicable. 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.

#### Instruction Note 840

- However, Evacuation of the 2-mile radius and downwind areas (at least out to 5 miles) should take place following a rapidly progressing severe accident. The decision as to when to begin staged evacuation following the initial sheltering recommendation should ~~the determination~~ be based on current information from effluent monitors, operational status, and field monitoring efforts. Staged evacuation should begin when any method of core cooling has been restored and any method to reduce containment pressure and/or source term has been restored or implemented.

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.

#### Instruction Note 944

- 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.

#### Background Note

- "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. Where SIP is indicated as the preferred protective action for an area of interest until it can be evacuated in a staged evacuation process (or evacuation impediments exist), this is the preferred action whether or not EPA PAGs are exceeded in that area (e.g., 2-5 miles downwind SIP until 2-mile radius evacuation nears completion).

#### Background Note

- "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. [Other terminology that meets the intent of "Heightened Preparedness" as used here is acceptable in a final protective action strategy.]

#### Background Note

- For rapidly progressing severe accidents, 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 be based on current information from effluent monitors, operational status, and field monitoring efforts.

#### Background Note

- Licensees and OROs may develop site-specific notification practices for a staged evacuation in the planning process. For instance, the licensee and OROs may agree that an initial notification from the licensee recommends evacuation of the 2-mile radius followed by evacuation of the 5-mile downwind areas when the 2-mile radius evacuation is nearing completion (90% ETE time) unless conditions change and the ORO is notified otherwise by the licensee.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

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 heightened preparedness actions and 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 directions from OROs. This communications appendix is intended to be fully consistent with and complementary to, the Federal Emergency Management Agency (FEMA) guidance.

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## 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 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):

- 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 Staged Evacuation and Heightened Preparedness Protective Actions**

Two alternative protective actions that are introduced include staged evacuation and heightened preparedness. A staged evacuation is a protective action 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 may 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 (PEPZ) 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](http://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.

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### 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 informational materials 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 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 transit-dependent 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 Heightened Preparedness**

Heightened preparedness should be included formally established as an emergency message 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 ERPZ. Public information materials should describe the concept of heightened preparedness, introduced in this update to Supplement 3.

### **3.2 General Guidance for Evacuation**

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 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, 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 Transit Dependent Public Evacuation**

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 ( $\pm$  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.

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## **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. Likewise, the public information material 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-in-place 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 pickup
- 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.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

## 5. ADDITIONAL GUIDANCE FOR MORE EFFECTIVE MESSAGING

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®-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 to 10 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.

Attachment 2 - NEI Markup of NUREG 0654 Supplement 3

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# 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 using the example generic PAR logic diagram contained in the attachment to this supplement. This diagram should be used to develop a site-specific PAR decision making tool 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 decision making tool. This supplement also provides guidance regarding consideration of precautionary 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-in-place 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 off-site response organization resources as well as disruption to the public.
- Precautionary 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). Other regulatory documents that are superseded by this revision of Supplement 3 are NRC Information Notice 83-28 and RIS 2003-12. The NRC Response

Technical Manual (RTM) information pertaining to protective action recommendations is also superseded by the information in this document.

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) and published in EPA-400-R-92-001. 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 decision making tool 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 decision making tool 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 decision making tool used by the licensee-augmented 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 decision making tools 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. Some information provided in the notes is of an informative or background nature and may not be required in the generation of a site-specific PAR decision making tool. This background information may be required to fully implement a protective action decision, but is not required in the construction of the logic tool for making a recommendation. The diagram is simplified when the site-specific elements are developed and the information 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 decision making tool(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 decision making tool. This criteria and the approved PAR decision making tool 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 methodology 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.

This guidance is not intended to require modification of existing ERPAs or areas used by OROs for implementing public protective actions, including practices that may currently exist for taking action over 360 degree areas at a greater distance than 2 miles, though such practices may not be supported by the studies referenced in this guidance.

Licensees and OROs should use this guidance to develop a range of protective actions in accordance with 10CFR50.47(b)(10) and 44CFR350.5(10) and modify the information in this document for site specificity and identified ORO input points (described in the guidance). Any other modifications that do not have a technical basis as described in the guidance do not meet its intent. If OROs do not agree with implementation of this guidance (such as use of staged evacuation based on ETEs), the licensee should determine sufficient technical basis before modifying the information in the guidance for its site specific application or use the information in the guidance with a recognized difference in site protective action recommendations and ORO decisions. Any deviations from this guidance that are adopted by the licensee for site specific application should be documented with a technical justification and retained for future inspection.

Licensees should determine the ORO organization(s) to provide the input to be used in implementation of this guidance. Generally, this will be the organization(s) responsible for making protective action decisions. It is not the intent of this guidance for licensees to coordinate the development of a site specific protective action document based on discussions with all ORO organizations identified in the site specific emergency plan.

Licensees may choose to document their discussions with and input provided by OROs for use in the site specific implementation of this guidance and retain it to support future inspection activities. Submittal of this documentation is not suggested or required.

It is not expected that prior NRC approval would be required to implement site-specific changes to existing protective action strategies based on the use of the guidance in this document. Each licensee is required to perform an evaluation and make this determination in accordance with 10CFR50.54q.

## **2.1 Implementation of the Protective Action Recommendation Logic Diagram at a General Emergency**

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 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) 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 Precautionary Actions at Site Area Emergency**

The NRC does not require precautionary 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.

The NRC does not recommend that precautionary actions be automatic at the Site Area Emergency level. A licensee may choose to include the option for precautionary actions at the Site Area Emergency Level if their respective OROs have provided input requesting that it be included in the licensee's procedure. The more likely situation is that OROs will do their own independent evaluation of the need for precautionary actions at the Site Area Emergency level taking into account offsite environmental conditions that may be unknown to the licensee and are in the jurisdiction of the OROs.

In some cases, a licensee or ORO may have committed to site-specific precautionary 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 or determine this information from the Updated Final Safety Analysis Report, to determine if the site specific PAR decision making tool should include more than three downwind 22.5 degree compass sectors when a downwind SIP or 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 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 wind persistence information 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.

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#### **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 that is a subset of 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. Some of these areas are rather large while others may be very small. As an example a 0-2 mile evacuation could result in evacuation out to 5 miles in some directions depending on how the EPRA is defined.
- **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** - An advisory to ensure 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. Licensees and OROs may use terminology other than "heightened preparedness" to describe these public communication and preparation actions.
- **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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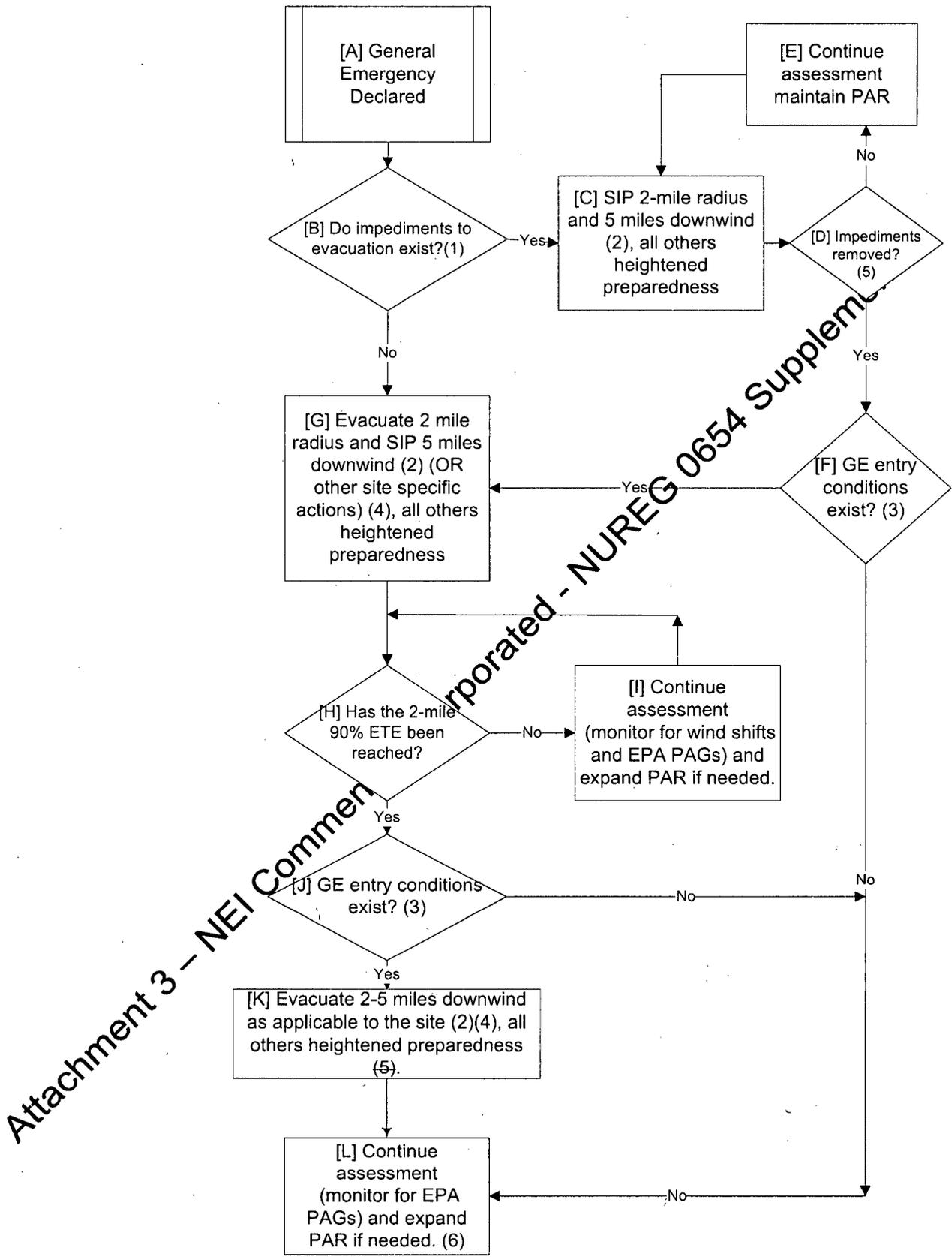
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ATTACHMENT

PROTECTIVE ACTION RECOMMENDATION LOGIC DIAGRAM

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## Protective Action Recommendation Logic Diagram Notes

It is not intended that any one site will have a logic diagram that looks exactly like the one provided in this supplement. Each site develops its own specific logic diagram (or other tool) for PAR decision making using the example generic logic diagram in this supplement and the associated notes in collaboration with applicable OROs.

Information in these notes that is required by the user to develop a site specific decision making tool is labeled as an "Instruction Note." Information that is strictly provided as background and/or is not required to be used in development of a site specific PAR decision making methodology is labeled as a "Background Note." Background Notes are not numbered and are listed at the end of the Instruction Notes. Background Note information may be needed to fully implement a protective action decision, but is not required in the construction of the logic tool for making a recommendation.

Gate [B] Instruction Note 1 Impediments include the following:

- Evacuation support (traffic controls) 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) as part of the planning process. 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) decision making tool 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 during the development process for their PAR methodology and reach agreement. The licensee would then base its recommendation on their site specific PAR methodology.
- 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. ORO decisions on evacuations consider impediments when determining which areas to evacuate. (e.g., roadways are closed because of deep snow, flooding, construction, etc.). If, in the planning process, OROs indicate that they will make such determinations and do not want the licensee to adjust a PAR that is based on plant or dose assessment technical information for weather or other related impediments, then the licensee is not required to consider these impediments in PAR development.

Blocks [C], [G] and [K] Instruction Note 2

- This includes downwind 22.5 degree compass sector(s) and adjacent compass sectors. In practice, the downwind sectors have historically included the downwind compass sector and the two adjacent sectors. Based on historic wind variability/persistence (section 2.4) there may be a need to add additional compass sectors
- Site-specific wind persistence analysis or existing FSAR information may indicate the need to include additional compass sectors with the initial recommendation. The licensee and OROs should discuss how protective action recommendations are implemented to determine in advance if it would be more prudent to include additional compass sectors. As indicated above, for some EPZs providing additional sectors may not be a factor.

Gates [F] and [J] Instruction Note 3

- 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, or if any Initiating Condition for a General Emergency exists then expansion of the PAR is appropriate excluding dose assessment and/or field monitoring information. This determination may be made using the pre-determined calculated containment high range radiation monitor reading based on 20% clad damage provided for EAL application.

Blocks [G] and [K] Instruction Note 4

- The example generic logic diagram assumes a homogenous population distribution throughout the 10-mile EPZ. When developing site-specific PAR logic elements, licensees should confer with OROs and review their site specific ETEs in the planning process to determine the best initial protective action at a General Emergency. Staged evacuation of the 2-mile radius and 5 miles downwind (following 90% ETE of the 2-mile radius) should be the primary consideration in most cases. This action may not be the best action for all sites in all cases. If staged evacuation is not selected, documentation of the technical basis should be retained for future review and inspection.
- After  $T=X$  hours, where X equals the time for 90% of the 2-mile radius to evacuate (from the ETE), consider the need to expand evacuations based on plant conditions or EPA PAGS being exceeded beyond 2 miles or dose projections indicate the potential to exceed EPA PAGs beyond 2 miles. This assessment is expected to be performed by TSO or EOF staff and not shift staff as even in low population EPZs these facilities should be staffed at this time. 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 as well as seasonal considerations where applicable. These values should be representative for the site and should not include special events.

#### Gate [D] Instruction Note 5

- 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 if General Emergency conditions are present or EPA PAGs are or could be exceeded in the affected areas. Refer to logic diagram gate [F] and Instruction Note # 3 Licensee shift staff is not expected to confer with OROs before changing the PAR although, if the ERO is activated, they may confer.
- For those sites where the licensee and OROs had agreed in planning activities that a hostile action event represents an evacuation impediment, it is expected that licensee and ORO personnel would be in contact with one another through Incident Command and discussing whether the sheltering PAR should be changed. Licensees should communicate any changes in their recommendations during this period and communicate the appropriate action in a timely manner when the impediment is removed. 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.

#### Block [L] Instruction Note 6

- 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.

#### Background Notes

- "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. Where SIP is indicated as the preferred protective action for an area of interest until it can be evacuated in a staged evacuation process (or evacuation impediments exist), this is the preferred action whether or not EPA PAGs are exceeded in that area (e.g., 2-5 miles downwind SIP until 2-mile radius evacuation nears completion).

- “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. [Other terminology that meets the intent of “Heightened Preparedness” as used here is acceptable in a final protective action strategy.]
- Licensees and OROs may develop site-specific notification practices for a staged evacuation in the planning process. For instance, the licensee and OROs may agree that an initial notification from the licensee recommends evacuation of the 2-mile radius followed by evacuation of the 5-mile downwind areas when the 2-mile radius evacuation is nearing completion (90% ETE time) unless conditions change and the ORO is notified otherwise by the licensee.

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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 and staged evacuation, as well as heightened preparedness actions and 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.

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## 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 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):

- 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 Staged Evacuation and Heightened Preparedness**

A staged evacuation is a protective action 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 may 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 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](http://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.

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### 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 RFD-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 informational materials 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 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 transit-dependent 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 school children, 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 Heightened Preparedness**

Heightened preparedness should be included as an emergency message. 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.

### **3.2 General Guidance for Evacuation**

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 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, 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 at 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 Transit Dependent Public Evacuation**

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 ( $\pm$  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 effort in planning should help identify a majority of those requiring assistance.

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## **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. Likewise, the public information material 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 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-in-place diminish quickly after 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 ride

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 require 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.

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## 5. ADDITIONAL GUIDANCE FOR MORE EFFECTIVE MESSAGING

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 to 10 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 the 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.

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