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

Guidance for Protective Action Strategies

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ABSTRACT

Supplement 3, "Guidance for Protective Action Strategies" 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, updates the previous version of Supplement 3, "Criteria for Protective Action Recommendations for Severe Accidents" published in 1996 as a draft report for interim use and comment. Supplement 3 provides a protective action logic development tool based upon recent technical information for use by nuclear power reactor licensees to develop site specific protective action recommendation procedures. Supplement 3 is recommended for use by offsite response organizations to develop protective action strategy guidance for decision makers. The guidance of Supplement 3 provides an acceptable method to comply with Title 10 of the Code of Federal Regulations (10 CFR), Part 50, Section 50.47(b)(10) in development of a range of protective actions for the plume exposure emergency planning zone. However, in accordance with 10 CFR 50.54(q) licensees may identify alternative methods of compliance.

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1. INTRODUCTION

1.1 Purpose

This guidance is provided for use in developing site specific protective action strategies for implementation during an incident that escalates to a General Emergency at a commercial nuclear power reactor site.¹

1.2 Regulatory Basis

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. However, licensees may use alternate methods to develop protective action recommendation logic, strategies and/or implementing procedures in accordance with 10 CFR 50.54(q).

44 CFR 350.5 (10) similarly states, in part, “Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place....” This guidance is recommended for use by offsite response organizations (OROs) to develop appropriate protective action strategies. Nothing in this guide should be interpreted as interfering with State, Tribal and local ORO authority to determine the appropriate protective action strategies and decision making protocols for the protection of public health and safety during a radiological emergency.

1.3 Protective Action Guides

This guidance is not intended to affect use of the protective action guidelines developed and promulgated by the U.S. Environmental Protection Agency (EPA). The EPA protective action guides (EPA, 1992) remain the appropriate Federal guidance on radiological criteria for consideration of protective actions.

1.4 Background

The Federal Emergency Management Agency (FEMA) and the Nuclear Regulatory Commission (NRC) issued Supplement 3 to NUREG-0654/FEMA-REP-1 in 1996 as a draft report for interim use and comment. At that time, the guidance reflected the most current accident analysis information: NUREG-1150, “Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants” (NRC, 1990). The 1996 version of Supplement 3 noted that the guidance was to be used to develop protective action recommendations (PARs) in response to severe accidents. In practice, this was translated into the expectation that protective actions would be recommended and implemented during any General Emergency. Although a General Emergency is a serious event and warrants protective action, it is not necessarily synonymous with a “severe accident” as that term is used in nuclear power plant accident analyses. The current guidance recognizes the disparity between a severe accident with early release and

¹ Considering the possibility that an intentional hostile action directed at a nuclear reactor site could become the direct cause of a radiological emergency, the term ‘incident’ is more prudent than ‘accident’ when generally discussing radiological planning and preparedness. With the exception of referencing previous sources, this guidance uses the term ‘incident’, irrespective of initiating events for emergency scenarios.

other General Emergency conditions and has provided scenario specific protective action decision guidance. Additionally, it provides guidance for immediate evacuation of those closest to the nuclear plant and criteria for expansion of initial protective actions. This is intended to simplify initial protective action decision making and implementation and allow additional time for evacuation management if the evacuated areas must be expanded.

In late 2004, NRC initiated a project to analyze the relative efficacy of alternative protective action strategies in reducing consequences to the public from a spectrum of nuclear power plant core melt accidents. The study is documented in NUREG/CR-6953, "Review of NUREG-0654, Supplement 3, 'Criteria for Protective Action Recommendations for Severe Accidents,'" Volumes 1, 2 and 3 (NRC, 2007a, NRC, 2008 and NRC 2010), hereafter referred to as the PAR Study. The PAR Study provides a technical basis for enhancing protective action guidance.

The NRC Advisory Committee on Reactor Safeguards (ACRS) reviewed the PAR Study and documented its review in a July 27, 2007, letter to the NRC (NRC, 2007b), recommending a revision of NUREG-0654/FEMA-REP-1, Supplement 3. In 2008, the Commission directed the NRC staff to revise Supplement 3 in coordination with FEMA after receiving public input.

PAR Study results for enhancing protective action strategies follow:

- Radial evacuation should remain the major element of protective action strategies.

Evacuations are effective in protecting public health and safety and the public is seldom injured during evacuation. Most evacuations are preformed ad hoc by local authorities.

- Sheltering-in-place (SIP) should receive more emphasis in protective action strategies.

SIP is more protective than radial evacuation under rapidly progressing severe accidents at sites with long evacuation times. Direction for SIP should include instructions for those at work or in transit. It is important to understand how and when to end SIP (ORNL, 2003). Effective SIP can reduce shadow evacuation.

- Staged evacuation is the preferred initial protective action in response to a General Emergency and should be considered.

Staged evacuation is more protective than immediate radial evacuation in many scenarios due to limiting the exposure of those closest to the plant. In some scenarios, the improved benefit is not large but in most every case, staged evacuation speeds decision making, decreases demand on ORO traffic control and reception center resources, simplifies initial protective actions and reduces public disruption.

- Precautionary actions, such as evacuating schools and parks during a Site Area Emergency, can be prudent.

Review of Site Area Emergencies since 1980 shows that none required precautionary actions. However, in the more significant scenarios considered in the emergency preparedness planning basis such actions are prudent to protect public health and safety.

- Strategies that reduce evacuation time reduce public health consequences.

Staged evacuation can reduce evacuation times by allowing early movement of some people while setting up traffic and access control points to further direct road use. Staged evacuation is most beneficial if shadow evacuation is minimized.

- Evacuation time estimates are important in planning protective action strategies.

Evacuation time estimates can be used as timing criteria to expand staged evacuation and for SIP versus evacuation decision making for large early release scenarios. Recognition of the evacuation “tail” has improved planning. The evacuation tail is about the last 10 percent of evacuees who have longer preparation time (e.g., farms, businesses, etc.) (Wolshon, 2010). While evacuation plans account for all members of the public, a decision based on the evacuation time of 90 percent of the population reduces total public exposure.

- Advance planning for the evacuation of persons with disabilities and access/functional needs that do not reside in special facilities may not be consistently addressed within all nuclear power plant EPZs.

The PAR Study survey identified a significant population that may be underserved in planning for evacuation (NRC, 2008). Reasonable enhancements, including the integration of more modern technologies in the registration process, can be made to improve planning for this population.

- Emergency messaging and public information should be improved to reduce shadow evacuation and improve compliance with protective action direction.

In order to reduce shadow evacuation, the public must be given frequent information and specific instruction. Under standard offsite conditions (e.g., no severe weather, hostile activities, etc.), SIP for all areas not evacuated may not be necessary as it could limit people from reuniting their families (e.g., retrieving children).

These results contributed to revision of NUREG-0654/FEMA-REP-1, Supplement 3. Input from State and local government emergency response professionals, stakeholders, and industry was also incorporated.

The guidance in this revision to Supplement 3 to NUREG-0654/FEMA-REP-1 is based upon recent technical analyses and updates the following previous guidance on the development of PAR logic for nuclear power plant accidents:

- 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/FEMA, 1980). Note: The revised Supplement 3 updates the protective action guidance in Appendix 1 of NUREG-0654/FEMA-REP-1, Revision 1, e.g., for the General Emergency on pages 1-16 through 1-19 but does not address other guidance in this appendix,
- 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),

- NRC Information Notice 83-28, "Criteria for Protective Action Recommendations for General Emergencies." (NRC, 1983),
- RIS 2003-12, "NRC Regulatory Issue Summary 2003-12: Clarification of NRC Guidance for Modifying Protective Actions." (NRC, 2003) and
- NRC Response Technical Manual (RTM-96) (NRC, 2002).

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2. PROTECTIVE ACTION STRATEGY GUIDANCE

2.1 Development of Site Specific Protective Action Recommendation and Decision Logic

The Attachment to this supplement contains a protective action strategy development tool, which is recommended for OROs to develop site-specific protective action decision logic and should be used by licensees to develop protective action recommendation procedures. **The Protective Action Strategy Development Tool, (Attachment 1) is not intended to be used without site-specific modification.**

A site-specific PAR development tool is expected to be contained in emergency plan implementing procedures used by the nuclear power plant emergency response organization (ERO). The Attachment is intended to guide the development of such a tool for operational shift personnel and is designed to be implemented rapidly without the initial need to confer with ORO personnel. The PAR 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.

As demonstrated in biennial evaluated exercises, licensees include a PAR with the General Emergency notification. The 15 minute notification requirement remains in effect regardless of differences in licensee PAR tools used by shift and augmented ERO personnel. The PAR must be made rapidly, in accordance with approved procedures, and those procedures should be developed in partnership with the ORO(s) responsible for protective action decision making.

The background information and notes included with the protective action strategy development tool provide direction for developing site-specific elements and criteria. The tool diagram is simplified when the site-specific elements are developed and deployed in an emergency plan implementing procedure. The tool notes some decision criteria that should be discussed and agreed to by licensees and responsible OROs. 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 regulations, Federal guidance and plant conditions, and for providing the PARs to OROs to allow them to make timely and well informed protective action decisions (PADs). OROs are responsible for deciding which protective actions to implement.

FEMA and the NRC expect nuclear power plant licensees will develop PAR procedures that include ORO input at various decision points. The approved PAR emergency plan implementing procedure constitutes the licensee's commitment to OROs to provide PARs immediately upon the declaration of a General Emergency in a manner mutually agreed upon. In case a responsible ORO chooses not to participate in the development of a site-specific PAR development tool consistent with this guidance, the licensee may use FEMA approved ORO emergency plans and implementing procedures as a basis to develop the necessary decision points. Efforts to achieve licensee and ORO agreement on protective action strategy decision criteria should be documented in a manner available for review by NRC and FEMA.

It is incumbent upon licensees to make the determination that onsite emergency plan changes meet the requirements of 10 CFR 50.54(q).

2.2 Notification of Protective Action Recommendation 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 a General Emergency. The General Emergency notification is expected to include a PAR. The PAR must be developed in accordance with the approved onsite emergency plan, and should be coordinated with OROs.

2.3 Termination of Protective Actions

Licensees are responsible for declaring a General Emergency and issuing a PAR. The licensee is also responsible for downgrading or terminating the General Emergency but should not 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. OROs are responsible for terminating offsite protective actions. The licensee provides input regarding plant status to ORO decision makers.

2.4 Precautionary Protective Actions at Site Area Emergency

ORO at many sites plan precautionary actions upon declaration of a Site Area Emergency. These actions may include sounding sirens, informing the population that an event has taken place, closing schools, closing parks, and preparing special-needs facilities for potential evacuation.

In some cases, a licensee or ORO may have committed to site-specific precautionary actions at the Site Area Emergency such as evacuation of beaches or other recreational areas. This guidance must not be interpreted as countermanding any such commitments in licensing-basis documents or State, Tribal and local offsite emergency plans and implementing procedures.

2.5 Wind Persistence Issues

It may be appropriate for licensees to perform a wind persistence analysis (the Updated Final Safety Analysis may be used) to determine appropriate modifications to protective action strategy. The modification may be appropriate where typical site meteorology includes wind direction shifts on a time scale that is shorter than the evacuation time estimate for downwind 2 to 5 mile sectors. This could result in OROs expanding protective actions while an evacuation is proceeding due to changes in wind direction. Multiple changes in protective action direction may undermine credibility and increase shadow evacuations and thereby increase evacuation times. In such cases it may be appropriate to include more than 3 downwind sectors in an expanded evacuation.

2.6 Expansion of Initial Protective Action Recommendation

The Emergency Action Level scheme used at nuclear power plants is designed to be anticipatory. A General Emergency is expected to be declared, based on plant conditions before a radiological release could potentially begin. Licensees will perform radiological assessments throughout the emergency and recommend to OROs 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 an initial PAR is expected. As subsequent PARs are implemented, the issue of expansion of protective actions beyond the 5-mile downwind sectors can arise. When expansion of a PAR is considered under this scenario, the condition of containment must be assessed.

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. 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.

2.7 Strategy of Rapidly Progressing Scenarios

The emergency preparedness planning basis includes rapidly progressing scenarios that have a significant radioactive release in about 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/FEMA, 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). The objective was to identify the relative efficacy of protective action options at sites with differing population densities. The analysis included SIP and evacuation at different distances, 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 zones.

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 estimates for evacuating 90 percent of the general public under normal weekday conditions (NRC, 2010). 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 zone – If the 90 percent ETE for this area is 2 hours or less, immediately evacuate.

2 to 5 mile zone – If the 90 percent ETE for this area is 3 hours or less, immediately evacuate.

5 to 10 mile zone – SIP, then evacuate when safe to do so.

Licensees may perform a site-specific analysis to determine if other criteria are more appropriate.

Extreme weather conditions such as inversion, significant precipitation, or no wind, can change the efficacy of SIP and make evacuation the preferred protective action.

3. PUBLIC INFORMATION MATERIALS

The public information program required by 10 CFR 50.47(b)(7) is intended to provide the permanent and transient population within the EPZ the opportunity to become aware of preparedness information (NRC, 1980). In a 2008 telephone survey of residents of EPZs published in NUREG/CR-6953, Volume II (NRC, 2008), most respondents stated they are familiar with these emergency information materials, and many keep this information readily accessible. NUREG-0654/FEMA REP-1, Rev. 1, contains guidance on public information materials and notification of the public. An informed EPZ population contributes to reducing evacuation times through:

- Reducing preparation time,
- Reducing the time to accept and implement the protective action direction (sometimes called the “milling” time),
- Reducing shadow evacuation and
- Reducing travel times through knowledge of evacuation routes.

An informed population also enhances the implementation of SIP strategies.

The guidance in this section is meant to enhance public information for EPZ populations and improve messaging during emergencies to enhance public compliance with protective action direction.

3.1 Public Information

Protective actions strategies, including staged evacuation, should be described in the public information materials. The need for the public to monitor information channels for updated direction must also be stressed.

Where this strategy is employed by OROs, public information materials should explain that the purpose of staged evacuation is to allow those closest to the plant to evacuate unimpeded. Materials should clearly state that those who are not within the declared evacuation area should not evacuate. The definition of a shadow evacuation should be included and note that it has the potential to impede the outbound traffic flow slowing the evacuation from the affected area.

ORO expectations for those under a monitor and prepare advisory should be stated, e.g., reunite family, prepare for evacuation, monitor information channels, keep off the road, etc.

Public information materials tend to be directed to individuals who are at home when an emergency occurs. Materials should clarify expectations for those who are not at home when a protective action is ordered.

Instructions should include how to SIP and provide details such as closing doors and windows, turning off air conditioning or heating (as appropriate), and monitoring communications channels for further instructions. Information should also be included for people in vehicles when SIP order is issued (e.g., leave the EPZ or enter a nearby building) and for people who are away from home, for example, working, shopping, or dining (e.g., remain in the building where they are currently located and monitor for additional information).

Where potassium iodide (KI) is included in the ORO program, instruction should include what to do if KI is not available (e.g., can't find it or not with them). It is important for residents to understand KI is an additional precaution, and that they still should be safe even if KI has been recommended, but they do not have access to it.

Through cell phone use among school age children, parents will likely become aware of an impending school evacuation before buses are mobilized. This early awareness may result in some parents picking up their children. Materials should discuss the benefit of allowing schools to implement school evacuation plans without interference.

A significant lesson learned following the Hurricane Katrina disaster, is that planning and preparedness for special needs populations was lacking and needed to be made more robust and enhanced. The National Response Framework (NRF) defines Special Needs as "populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision and medical care. Individuals in need of additional response assistance may include; those who have disabilities; who live in institutionalized settings; who are elderly; who are children; who are from diverse cultures; who have limited English proficiency or are non-English speaking; or who are transportation disadvantaged."

Following the guidance provided by the FEMA Office of Disability Integration and Coordination (ODIC) and other responsible departments, agencies and organizations, REP OROs (working in a partnering and closely coordinated manner with FEMA) should emphasize major functional needs as vital to protecting life and safety. This can be accomplished by providing Special Needs populations with Functional Needs Support Services (FNSS). FNSS are defined as 'services that are provided to individuals during an emergency in general population shelters or other integrated community facilities to enable them to maintain their independence in such settings.' Historically, REP program public information materials have focused on urging Special Needs residents to register for assistance by filling out and mailing in registration cards. Results of a national telephone survey of EPZ residents show that 6 percent of the EPZ population may be special needs residents who do not reside in institutionalized settings (NRC, 2008). Of that 6 percent, less than one-third have registered with local authorities, although most residents stated they were willing to inform authorities of their need. The spectrum of preparedness efforts should be expanded and not be limited to any single method such as filling out registration cards. The use of community driven integrated process teams to brainstorm, prioritize, design, and implement FNSS for their special needs citizens should be considered since they have proven to be quite effective.

3.2 Emergency Messaging

The following guidance addresses communication elements that can enhance public compliance with ORO direction to monitor and prepare, SIP or evacuate.

The alert and notification system is used to warn the public of an emergency and of the need to take protective actions. Information is communicated to the public through EAS messages and radio and television broadcasts. Information can also be transmitted through local real-time internet postings, text-messaging, and other methods consistent with State/local/Tribal emergency plans.

After the initial alert and notification, the public will maintain an awareness of the event through media broadcasts and subsequent EAS messages. OROs are encouraged to use supplemental information bulletins to inform the public of status and direction periodically.

Information should cover topics such as:

- the length of time the public will be expected to SIP and that they will be told to evacuate should it be necessary,
- the appropriate actions for SIP in a residence and when in transit,
- the projected length of time the public will monitor and prepare,
- request that people stay off the road to reduce shadow evacuation,
- what to do if ordered to evacuate,
- who is to evacuate,
- where evacuees are to go,
- when they need to leave,
- transportation alternatives,
- instructions for persons with disabilities and access/functional needs not in special facilities.

Messaging directed 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 regarding bus routes, how residents are expected to get to the bus route, and what to do if they cannot get to a bus route. Additionally, information should explain why it is safe outdoors while waiting for pick up, what they should bring, and how long they may expect to wait for a bus. Recognize that this population group may include thousands of individuals.

Messaging to persons with disabilities and access/functional needs who do not reside in special facilities should request that these residents obtain a ride from a relative, friend or neighbor, if at all possible. Instructions should be clear for residents who have previously registered with authorities explaining how long they should expect to wait for prearranged assistance, what to do while they are waiting, 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. Instructions are also needed for residents who have not preregistered but require transportation assistance.

Special facilities have specific evacuation plans and typically would receive early warning through direct notification from OROs. This preplanned activity helps ensure that the special facilities are notified promptly to allow response activities to begin.

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4. GLOSSARY

- **Emergency Response Planning Area (ERPA)** - A local area within the EPZ for which emergency response information is provided (NRC, 2005b). These areas are typically defined by geographic or political boundaries to support emergency response planning and may not conform to an exact 10-mile (16-kilometer) radius from the nuclear power plant.
- **Evacuation Tail** - A small portion of the population that takes a disproportionately longer amount of time to evacuate than the remaining public and is the last to leave the evacuation area. The tail generally consists of approximately the last 10 percent of the population.
- **Evacuation Time Estimate (ETE)** - The estimated time needed to evacuate the public from affected areas of the plume exposure pathway EPZ.
- **Monitor and Prepare** - A type of precautionary action intended to advise the public within the EPZ of a serious emergency at the nuclear power plant, that they should monitor the situation and prepare for the possibility of evacuation, SIP or other protective actions. Further, if an evacuation is taking place, the public not involved in the evacuation should be asked to remain off the roadways to allow those instructed to evacuate to do so.
- **Shelter-in-place (SIP)** - 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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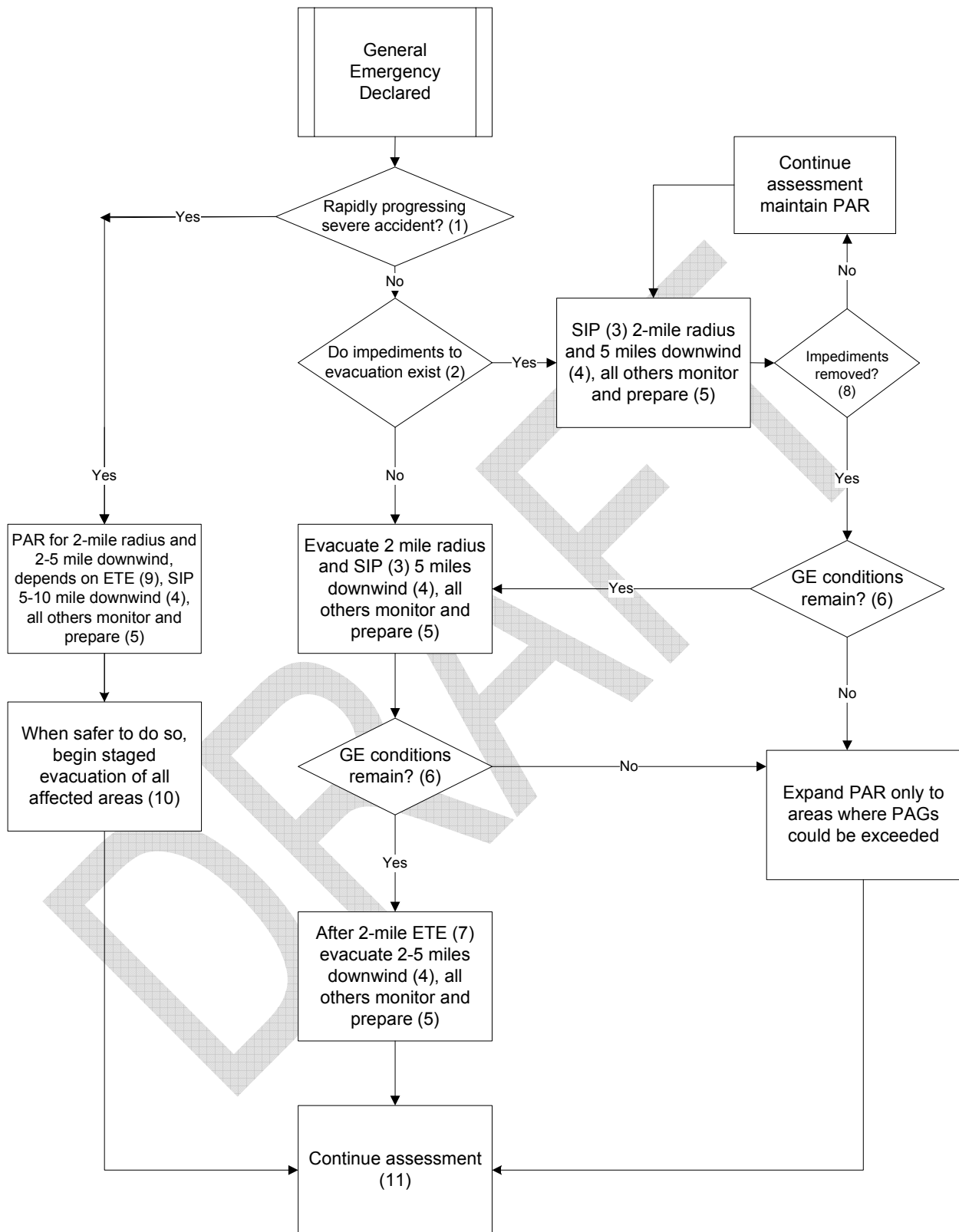
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**ATTACHMENT: PROTECTIVE ACTION STRATEGY DEVELOPMENT
TOOL**

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Protective Action Strategy Development Tool

Protective Action Strategy Development Tool Notes

It is not intended that any licensee or ORO have protective action implementing procedures that are exactly the same as provided here. Site-specific strategies and decision tools/procedures should be developed for each nuclear power plant site using the guidance provided below in collaboration with OROs responsible for protective action decision making.

Information in these notes that should be considered in developing the strategy is labeled as a “Note”. Information that is provided as background is labeled as a “Background Note” and is meant to be helpful in development efforts.

Note 1: Rapidly progressing severe incident

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 used for scenarios where containment integrity can be determined as bypassed or immediately lost during a GE with core damage. If this scenario cannot be immediately confirmed, assume it is not taking place and answer “no” to this decision block.

Note 2: Impediments to evacuation

- Evacuation support (e.g., traffic control) is not yet in place – A situation where the GE is the initial notification or if there was a previous notification, the GE notification occurs before preparations to support an evacuation are complete. Many sites have a low population density within 2 miles and lack of traffic control may not be considered an impediment. This element should be discussed and agreed to with OROs. The expected time for evacuation support to be put in place after notification of an emergency classification should be agreed to with OROs in advance and embodied in the site-specific PAR procedure for those sites where delay of an initial staged evacuation is necessary, pending support setup. The licensee would base procedures on the agreement and would not confer with OROs before making the initial PAR notification.
- Hostile action event - OROs may determine that initial SIP rather than evacuation is preferred in a hostile action (armed attack) based GE. The licensee would discuss this element with OROs and reach agreement during the development process. The licensee would base procedures on the agreement and would not confer with OROs before making the initial PAR notification.
- Adverse weather - Licensees are not responsible for soliciting information or making a determination that weather or other impediments (e.g., earthquake, wildfire) for safe public evacuation exist at the time of the emergency. However, the licensee will consider an impediment to exist, if OROs have previously notified the licensee of such an impediment (e.g., roadways are closed because of deep snow). OROs may determine during the planning process that the licensee need not consider adverse weather in plant PAR procedures.

Note 3: Shelter-in-Place

SIP 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 SIP is safer than evacuation at this time, or alternatively, SIP is being implemented in order to keep roadways clear to allow others to evacuate rapidly. 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 when more immediate options for sheltering are at hand.

Note 4: Downwind Sectors

This includes downwind 22.5 degree compass sector(s) and adjacent sectors. Generally this is 3 or 4 sectors and includes all the ERPA's impacted in that area.

Background Note: Wind persistence

Site-specific wind persistence information may indicate the need to include additional sectors with the initial recommendation. However, this element should be discussed with responsible OROs to determine if expanded initial protective actions are appropriate or desirable. The size of ERPA's may determine whether there is a site-specific need for this contingency.

Note 5: Monitor and Prepare

Monitor and Prepare is intended to engage the population within the plume exposure pathway emergency planning zone (EPZ) and inform them of the emergency, that they should monitor the situation and prepare for the possibility of evacuation, shelter-in-place or other protective actions. If an evacuation is taking place, the public not directed to evacuate should be asked to remain off the roadways to allow the evacuation to proceed.

Background Note: Emergency messaging

Communications with the public must be clear and frequent to be effective. If the public is not engaged, i.e., given instructions of some kind, the potential result is a larger shadow evacuation. A large shadow evacuation could impede those closest to the plant and increase public exposure. Frequent communication may also reduce public inquiries to OROs for status and instructions.

Note 6: Consideration of plant conditions before evacuating downwind sectors

If the conditions that caused the GE declaration have been mitigated (i.e., core cooling is restored), it may not be necessary to expand the PAR to evacuate downwind sectors upon completion of the initial staged evacuation. However, if GE emergency action levels are still met expansion of the PAR to the downwind sectors may be appropriate. In the case where core cooling is restored, it is still necessary to perform radiological assessment to identify the extent of contamination, if any. If surveys or dose projections reveal areas under no protective action direction, where PAGs could be exceeded, the public in those areas should be evacuated or sheltered as appropriate.

Note 7: Timing for evacuation of downwind sectors

This element should simply be implemented at the time of the site-specific 2-mile ETE for 90 percent evacuation, e.g., T hours (use site specific time) hours after OROs were notified of the initial PAR, recommend evacuation of downwind sectors.

Background Note: The licensee identifies the value of T using the site-specific ETE and should consider T_D for a daytime ETE and T_N for a nighttime ETE. These values should be representative for the site and should not include special events.² However, OROs should consider the effects of special events. If the shift staff is responsible for making this PAR it should be done without conferring with OROs and in accordance with procedures, based on the ETE value alone. Verification of evacuation progress is not expected. However, if the augmenting ERO has been activated there may be sufficient resources available for the licensee to confer with OROs more fully before expanding the PAR to downwind sectors.

Note 8: Removal of evacuation impediments

- Evacuation support: If this contingency was identified as necessary by OROs during the planning effort, then when the agreed-to time (e.g., 1 hour from the GE notification) has elapsed, the licensee should notify OROs with an evacuation PAR. Licensee shift staff is not expected to confer with OROs before changing the PAR although, if the augmenting ERO is activated, they may confer.
- Hostile action (armed attack): OROs may identify this contingency as necessary during the planning effort. It may be appropriate to set up a time frame for the licensee to notify OROs with an evacuation PAR. Licensee shift staff is not expected to confer with OROs, before changing the PAR although, if the augmenting ERO is activated, they may confer.
- Adverse weather: If the impediment was caused by weather or other roadway disruption, OROs will determine when it is appropriate to change the protective action. Licensees 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: SIP versus evacuation PAR for rapidly progressing scenarios

Where the time to evacuate 90 percent of the population within a 2-mile radius is 2 hours or less the PAR should be evacuation. If the ETE is longer, SIP should be recommended. The licensee should consider T_D for a daytime ETE and T_N for a nighttime ETE.

If the 2 to 5 mile downwind sector evacuation time for 90 percent completion is 3 hours or less then the PAR should be evacuation. If the ETE is longer, SIP should be recommended.

For all cases SIP should be recommended for the 5 to 10 mile downwind sectors.

² Temporary offsite activities that draw transient, non-resident populations into the EPZ, who may be present during an emergency.

To the extent practical recognizing the urgency of the incident, impediments may be considered. It is possible that existence of impediments could change the most effective PAR from evacuation to SIP, in any case.

Background Note: Rapidly progressing scenario

The ETE values should be representative for the site and should not include special events.

The rapidly progressing incident is more severe than other GEs and different protective actions are appropriate for all sites.

Extreme weather conditions such as inversion, significant precipitation, or no wind, can change the efficacy of SIP and make evacuation the preferred protective action.

Licensees may perform an analysis to determine site-specific ETE criteria rather than use this generic guidance.

Note 10: Evacuation timing for rapidly progressing scenarios

Evacuation after the SIP period is critical to reducing public exposure. Licensees should discuss evacuation of the sheltered population with OROs.

Background Note: Evacuation timing for rapidly progressing scenarios

The evacuation should proceed from the areas most at risk. This may be a 2-mile radius unless field monitoring data shows otherwise, e.g. at a site with an elevated release point where contamination may begin beyond 2 miles. Lateral evacuation may be considered where the roadway network is conducive, as it may reduce public exposure. Preplanning for lateral evacuation is not expected however. In any case, the determination of evacuation routes and timing should be based on release information, field monitoring data and ORO resources.

Note 11: Continue assessment

Continue radiological and meteorological assessments and consider evacuation of any areas where dose projections or field measurements indicate that protective action guidelines may be exceeded.

Background Note: Continue assessment

Maintain communications with the public while protective actions are in effect.