PILGRIM NUCLEAR POWER STATION

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50-293

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PILGRIM NUCLEAR POWER STATION

Procedure No. EP-IP-400

PROTECTIVE ACTION RECOMMENDATIONS

Stop
Think
Act
Review

SAFETY RELATED

REVISION LOG

REVISION 9 **Date Originated 9/01**

Pages Affected	Description
4-9,12	Change "release" to "emergency release" for consistency.

REVISION 8 **Date Originated 9/00**

Pages Affected	Description
All	Reformat all pages IAW PNPS 1.3.4-1. Revison bars are not shown for reformat changes.
4	Add EOP-01 to References.
7,8,12	Incorporate revised EAL 1.4.1.4 General Emergency threshold values and include design basis core cooling requirements (2/3 core height with Core Spray) specified in EOP-01 for indication of substantial core damage.

TABLE OF CONTENTS

1.0 PURPOSE

This Procedure provides instruction and guidance in determining offsite Protective Action Recommendations (PARs) in the event of a radiological emergency at the Pilgrim Nuclear Power Station (PNPS).

2.0 REFERENCES

[1] EOP-01, "*RPV Control*"

[2] EP-PP-01, "*PNPS Emergency Plan*"

[3] EPA 400-R-92-001, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents", October, 1991

[4] IE Information Notice No. 83-28, "Criteria for Protective Action Recommendations for General Emergencies", dated May 4, 1983

[5] NUREG-0654 FEMA REP-1, Rev. 1, Supplement 3; "Criteria for Protective Action Recommendations for Severe Accidents"

3.0 DEFINITIONS

[1] Core Melt Sequence - A situation in which the core is uncovered and there is no means for restoring coolant to the core. Without coolant, overheating and melting of the fuel will occur.

[2] Dose Assessment - The dose calculated to occur at a downwind receptor based on actual emergency release rates and meteorological data. Dose assessments are primarily used to ensure plant-based Protective Action Recommendations are adequate.

[3] Dose Commitment - The dose that will be accumulated by a specific organ over a specified period following uptake.

[4] Dose Projection - The dose calculated to occur at a downwind receptor based on projected emergency release rates or meteorological data. Dose projections are primarily used to conduct bounding calculations prior to an emergency release occurring.

[5] Emergency Planning Zones (EPZs) - Areas established around a nuclear power station in which predetermined protective action plans are needed.

The first EPZ has an approximate radius of 10 miles for the plume exposure pathway.

The second EPZ has an approximate radius of 50 miles for the food and water ingestion exposure pathway.

[6] Evacuation Exposure Period - The period during which those being evacuated are exposed to the radioactive plume.

[7] Gap Release Sequence - A situation in which the core is overheated and/or uncovered and there is no rapid means for restoring coolant to the core. Without cooling, overheating and failure of the fuel cladding will occur.

[8] MEMA/OEP - Massachusetts Emergency Management Agency/Office of Emergency Preparedness.

[9] MDPH - Massachusetts Department of Public Health.

[10] Offsite - The area outside the owner controlled area.

[11] Projected Exposure Time - That period of time in which the offsite population will be exposed to radiation as a result of an airborne radioactive emergency release.

4.0 DISCUSSION

None

5.0 RESPONSIBILITIES

[1] The Emergency Director is responsible for recommending protective actions to offsite agencies (MEMA/OEP, State Police, EPZ and host communities) to protect the health and safety of the general public.

[2] The Emergency Offsite Manager is responsible for recommending offsite protective actions to the Emergency Director following discussions with the Offsite Radiological Supervisor and the Operations Advisor.

[3] The Offsite Radiological Supervisor is responsible for determining the need for offsite protective actions, based on radiological considerations, and for providing these recommendations to the Emergency Offsite Manager.

[4] The Operations Advisor is responsible for determining the need for offsite protective actions, based on plant conditions, and for providing these recommendations to the Emergency Offsite Manager.

6.0 PROCEDURE

6.1 BACKGROUND

[1] Protective Action Recommendations (PARs) are made by PNPS personnel whenever a General Emergency is declared. Additionally, if in the opinion of the Emergency Director conditions warrant the issuance of PARs, a General Emergency will be declared (PNPS will not issue PARs for any accident classified below a General Emergency).

[2] PARs provided in response to a significant radioactive emergency release include evacuation and taking shelter.

(a) Dose assessment results which indicate exposure > 1 rem whole body (EPA TEDE) or > 5 rem thyroid (EPA CDE thyroid) should be used as the threshold for dose-based evacuation PARs.

(b) Evacuation is the preferred action unless external conditions impose a greater risk from the evacuation than from the dose received.

(c) PNPS personnel do not have the necessary information to determine whether offsite conditions would require sheltering instead of an evacuation. Therefore, an effort to base PARs on external factors (such as road conditions, traffic/traffic control, weather, or offsite emergency worker response) should not be attempted.

[3] At a minimum, a plant condition-driven PAR to evacuate the 2 mile ring and 5 miles downwind, and shelter all other subareas, is given at the declaration of a General Emergency. Depending on the plant conditions, evacuation of a 5 mile radius and 10 miles downwind, and shelter all other subareas, may be issued instead of the minimum PAR.

(a) PARs are included with the initial and follow-up notifications issued at a General Emergency.

(b) The PAR must be provided to the Commonwealth within 15 minutes, and to the NRC within 60 minutes of:

(1) The General Emergency classification.

(2) Any change in recommended actions.

[4] The Emergency Director may elect to specify the PARs for any combination of subareas or the entire EPZ (or beyond) regardless of plant and dose-based guidance. However, dose-based PARs should not normally be extended based on the results of hypothetical dose projections. Plant-based PARs are inherently conservative such that expanding the evacuation zone as an added precaution could result in a greater risk from the evacuation than from the radiological consequences of an emergency release. It also would dilute the effectiveness of the offsite resources used to accommodate the evacuation. Plant-based PARs should only be extended as provided for in Steps 6.2[5] and 6.2[6] and Section 6.3.

[5] Protective actions taken in areas affected by plume deposition following the emergency release are determined and controlled by offsite governmental agencies.

(a) PNPS is not expected to develop offsite recommendations involving ingestion or relocation issues following plume passage.

(b) PNPS may be requested to provide resources to support the determination of postplume protective actions.

[6] Throughout the duration of a General Emergency, assess plant conditions and effluent release status to ensure the established PARs are adequate.

[7] Additional protective action guidance is provided in Attachment 2 (Accident Phases and Exposure Pathways).

6.2 PLANT-BASED PROTECTIVE ACTION RECOMMENDATIONS

[1] Use Attachment 1 (Protective Action Recommendation Process) as an aid in determining the proper PAR.

[2] At a minimum, evacuation of the 2 mile ring and 5 miles downwind (with sheltering of all other subareas) will be recommended for a declaration of General Emergency.

[3] For plant conditions in which substantial core damage is imminent or has occurred **AND** a significant emergency release of Reactor coolant into the containment is imminent or has occurred **AND** containment failure is imminent or has occurred, evacuation of the 5 mile ring and 10 miles downwind (with sheltering of all other subareas) will be recommended.

(a) Indications that substantial core damage is imminent or has occurred include:

(1) Core damage > 1% melt.

(2) CHRMs reading > General Emergency EAL 1.4.1.4 threshold values.

(3) Containment hydrogen reading > 18%.

(4) Core temperatures > 2400°F.

(5) RPV water level cannot be restored and maintained above -150 inches (Minimum Steam Cooling RPV Water Level) for an extended period of time **AND** no Core Spray subsystem flow can be restored and maintained above 3,600 GPM (design Core Spray flow).

(6) RPV water level cannot be restored and maintained above -175 inches (elevation of jet pump suction) for an extended period of time.

(b) Indications that a significant release of Reactor coolant is imminent or has occurred include:

(1) A large break (> approximately 6") loss of coolant accident.

(2) The presence of hydrogen gas in containment not attributable to chemistry processes.

(3) Excessive leakage or makeup not attributable to operating conditions or transients.

(4) Rapid vessel depressurization.

(c) Indications that containment failure is imminent or has occurred include:

(1) An emergency release of radioactivity that cannot be maintained below the General Emergency criteria of EAL 5.0 classifications.

(2) Primary Containment pressure cannot be maintained below the PCPL curve (EOP Figure 7).

(3) Primary Containment H_2 and O_2 gas concentrations cannot be maintained below combustible limits ($\geq 6\%$ hydrogen and $\geq 5\%$ oxygen).

(4) EOPs are entered and actions have begun which will lead to the emergency venting of containment.

[4] Containment monitors can provide indication of both core damage and RCS leakage. Monitor values used to determine a specific amount of core damage are dependent on plant conditions, power history, and time after shutdown. Monitor readings used to quantify an amount of damage or coolant leakage should be complimented by other indications and engineering judgment.

[5] If no emergency release is in progress, then:

(a) Perform dose projections on possible conditions as time permits to determine whether Protective Action Guides (PAGs) could be exceeded.

(b) Consider adding any subareas requiring evacuation as determined by dose projection to the plant-based PARs.

6.3 DOSE ASSESSMENT-BASED PROTECTIVE ACTION RECOMMENDATIONS

> NOTE
>
> Dose projections are not required to support the decision process in Attachment 1 (Protective Action Recommendation Process).

[1] In the event dose assessment results indicate the need to recommend actions beyond the outer EPZ boundaries, that is past 10 miles:

(a) Dispatch Radiation Monitoring Teams to downwind areas to verify the calculated exposure rates prior to issuing PARs outside the EPZ.

(b) Many assumptions exist in dose assessment calculations, involving both source term and meteorological factors, which make predictions over long distances highly questionable.

[2] From the Control Room: If an emergency release is in progress and time permits, direct the SCRE or other qualified SRO to perform offsite dose assessment in accordance with EP-IP-300 to determine whether the plant-based PARs of Attachment 1 are adequate.

[3] From the Emergency Operations Facility: Conduct offsite dose assessment in accordance with EP-IP-300 to determine whether the plant-based PARs of Attachment 1 are adequate using the following methods as applicable:

(a) Monitored Release:

(1) If an emergency release is in progress, assess the calculated impact to determine whether the plant-based PARs of Attachment 1 are adequate.

(2) If an emergency release is not in progress, use current meteorological and core damage data to project effluent monitor threshold values which would require 2, 5, and 10 mile evacuations (Attachment 3). Reestablish threshold values whenever meteorological conditions or core damage assessment values change.

(b) Containment Leakage/Failure:

(1) If a release is in progress, assess the calculated impact to determine whether the plant-based PARs of Attachment 1 are adequate.

(2) If a release is not in progress, use current meteorological and core damage data on various scenarios (design leakage, failure to isolate, catastrophic failure) to project the dose consequences to determine whether the plant-based PARs of Attachment 1 are adequate. Reestablish scenario values whenever meteorological conditions or core damage assessment values change.

(c) Field Team Analysis: Actual field readings from Radiation Monitoring Teams should be compared to dose assessment results and used as a dose projection method to validate calculated PARs and to determine whether the plant or release-based protective actions of Attachment 1 are adequate.

(d) Release Point Analysis: Actual sample data from monitored or unmonitored release points should be utilized in conjunction with other dose assessment and projection methods to validate calculated PARs and to determine whether the plant-based protective actions of Attachment 1 are adequate.

[4] The Emergency Director, the Emergency Offsite Manager, and the Offsite Radiological Supervisor shall discuss dose assessment and projection analysis results and evaluate their applicability prior to issuing PARs to the Commonwealth.

7.0 RECORDS

All forms and other documentation shall be reviewed for completeness and forwarded to the Emergency Preparedness Manager.

8.0 ATTACHMENTS

ATTACHMENT 1 - PROTECTIVE ACTION RECOMMENDATION PROCESS

ATTACHMENT 2 - ACCIDENT PHASE AND EXPOSURE PATHWAYS

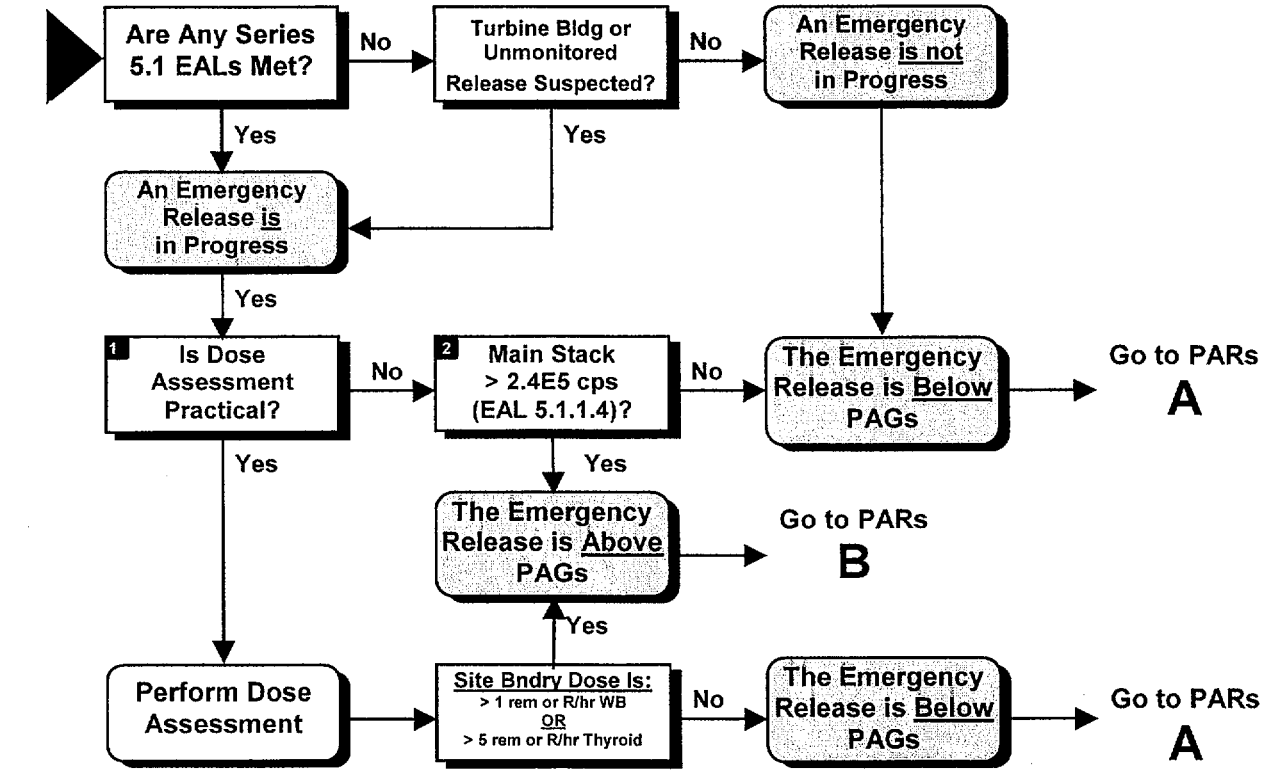
ATTACHMENT 3 - PROTECTIVE ACTION RECOMMENDATION BOUNDING CALCULATIONS

ATTACHMENT 4 - DOCUMENT CROSS-REFERENCES

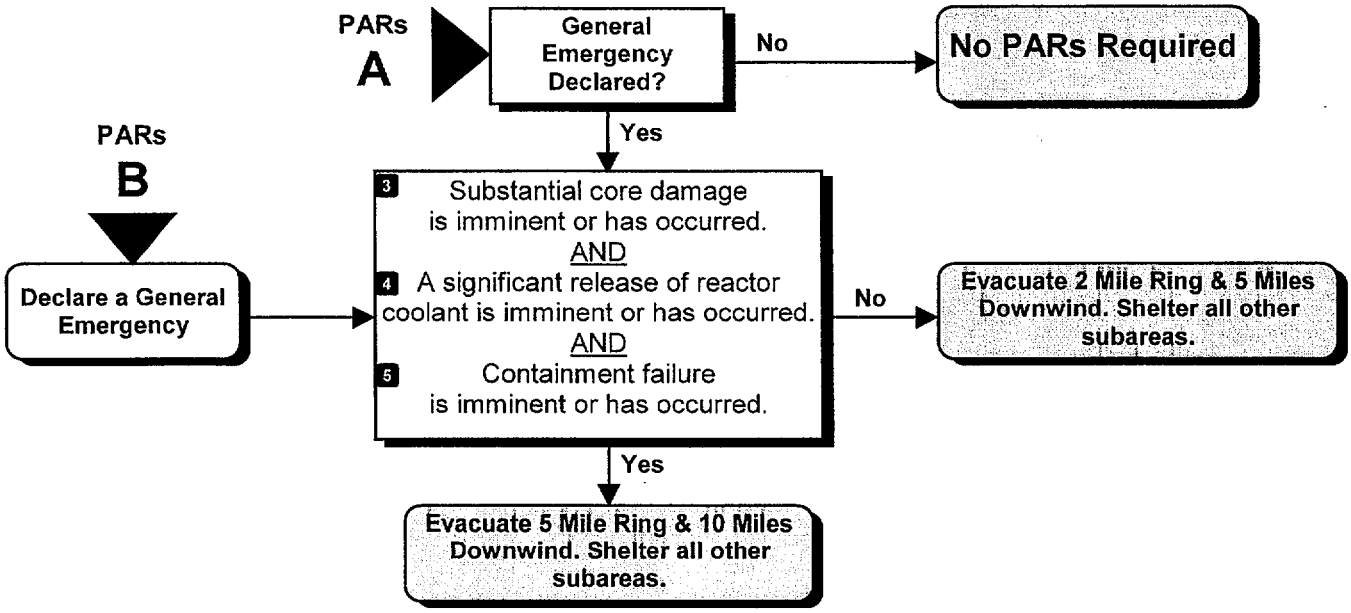
ATTACHMENT 5 - IDENTIFICATION OF COMMITMENTS

PROTECTIVE ACTION RECOMMENDATION PROCESS

Step 1: Determine Emergency Release Status



Step 2: Determine the Appropriate PARs



PROTECTIVE ACTION RECOMMENDATION PROCESS (CONT.)

Notes

1) CONTROL ROOM ONLY: Qualified individual is immediately available to perform dose assessment.
2) Perform dose assessment as soon as possible to verify that the emergency release is below/above PAGs and to determine whether additional subareas require evacuation.
3) Indications that substantial core damage is imminent or has occurred include:
   - Core damage > 1% melt.
   - CHRMs reading > General Emergency EAL 1.4.1.4 threshold values.
   - Containment hydrogen reading > 18%.
   - Core temperatures > 2400°F.
   - RPV water level cannot be restored and maintained above -150 inches (Minimum Steam Cooling RPV Water Level) for an extended period of time AND no Core Spray subsystem flow can be restored and maintained above 3,600 GPM (design Core Spray flow).
   - RPV water level cannot be restored and maintained above -175 inches (elevation of jet pump suction) for an extended period of time.
4) Indications that a significant release of Reactor coolant is imminent or has occurred include:
   - A large break (> 6") loss of coolant accident.
   - Presence of hydrogen gas in containment not attributable to chemistry processes.
   - Excessive leakage or makeup not attributable to operating conditions or transients.
   - Rapid vessel depressurization.
5) Indications that containment failure is imminent or has occurred include:
   - An emergency release of radioactivity that cannot be maintained below the General Emergency criteria of EAL 5.0 classifications.
   - Primary Containment pressure cannot be maintained below the PCPL curve (EOP Figure 7).
   - Primary Containment H_2 and O_2 gas concentrations cannot be maintained below combustible limits (≥ 6% hydrogen and ≥ 5% oxygen).
   - EOPs are entered and actions have begun which will lead to the emergency venting of containment.

2 Mile Ring, 5 Miles Downwind

Wind Direction (° From)	Affected Subareas
020° - 069°	1, 12, 2, 3
070° - 122°	1, 12, 3
123° - 140°	1, 12, 3, 4
141° - 183°	1, 12, 4
184° - 305°	1, 12
306° - 019°	1, 12, 2
Any Subareas requiring evacuation as determined by Dose Assessment are added to the plant-based PARs.	
Shelter All Other Subareas	

5 Mile Ring, 10 Miles Downwind

Wind Direction (° From)	Affected Subareas
020° - 021°	1, 12, 2, 3, 4, 5, 6
022° - 056°	1, 12, 2, 3, 4, 5, 6, 11
057° - 066°	1, 12, 2, 3, 4, 6, 11
067° - 069°	1, 12, 2, 3, 4, 6, 7, 11
070° - 103°	1, 12, 2, 3, 4, 6, 7, 8, 11
104° - 109°	1, 12, 2, 3, 4, 6, 7, 8, 9, 11
110° - 115°	1, 12, 2, 3, 4, 6, 7, 8, 9
116° - 129°	1, 12, 2, 3, 4, 7, 8, 9
130° - 132°	1, 12, 2, 3, 4, 7, 8, 9, 10
133° - 140°	1, 12, 2, 3, 4, 8, 9, 10
141° - 175°	1, 12, 2, 3, 4, 9, 10
176° - 179°	1, 12, 2, 3, 4, 10
180° - 318°	1, 12, 2, 3, 4
319° - 019°	1, 12, 2, 3, 4, 5
Shelter All Other Subareas	

ACCIDENT PHASE AND EXPOSURE PATHWAYS

Potential Exposure Pathways And Incident Phases		Protective Actions
1. External radiation from the facility.	Early	Shelter Evacuation Access Control
2. External radiation from the plume.		Shelter Evacuation Access Control
3. Inhalation of activity in the plume.		Shelter Administration of KI Evacuation Access Control
4. Contamination of skin and clothes.		Shelter Evacuation Decontamination of Persons
5. External radiation from ground deposition.	Intermediate	Evacuation Relocation Decontamination of Land Decontamination of Property
6. Ingestion of contaminated food and water.	Late	Food and Water Controls
7. Inhalation of resuspended activity.		Relocation Decontamination of Land Decontamination of Property

Note: The use of stored animal feed and uncontaminated water to limit the uptake of radionuclides by domestic animals in the food chain can be applicable in any of the phases.

PROTECTIVE ACTION RECOMMENDATION BOUNDING CALCULATIONS

Name: _____ Date: _____ Time: _____

Basis

Wind Speed: _____

Wind Direction: _____

Stability Class: _____

Release Duration: _____

	Monitor Reading		
Monitor	SB-2 Mile Evacuation	2-5 Mile Evacuation	5-10 Mile Evacuation
Main Stack			
Reactor Building			
Turbine Building			

Notes:

1. Insert "N/A" in monitor reading boxes where threshold values will not provide a dose necessary to drive the evacuation.

2. Site Boundary to 2 mile evacuations require an indicated dose:
   ≥ 1 rem Whole Body ≥ 5 rem Thyroid at the Site Boundary
   and
   < 1 rem Whole Body and < 5 rem Thyroid at 2 miles.

3. 2 to 5 mile evacuations require an indicated dose:
   ≥ 1 rem Whole Body or ≥ 5 rem Thyroid at 2 miles
   and
   < 1 rem Whole Body and < 5 rem Thyroid at 5 miles.

4. 5 to 10 mile evacuations require an indicated dose ≥ to 1 rem Whole Body or ≥ 5 rem Thyroid at 5 miles.

DOCUMENT CROSS-REFERENCES

This Attachment lists those documents, other than source documents, which may be affected by changes to this Procedure.

Document Number	Document Title
EP-IP-100	Emergency Classifications
EP-IP-300	Offsite Dose Assessment
EP-IP-330	Core Damage

IDENTIFICATION OF COMMITMENTS

This Attachment lists those external commitments (i.e., NRC commitments, QA audit findings, and INPO inspection items) implemented in this Procedure.

Reference Document	Commitment	Affected Section(s)/Step(s)
NRC Inspections Finding 81-15-38	Provide recommended protective actions based on actual and projected core/containment conditions and offsite factors which may impact on the effectiveness of the recommendations and consider the near-site population.	6.2, 5.3, Att. 1
NRC Inspection Finding 84-35-06	Include discussion of radiological data analysis and evaluation by key EOF staff members prior to making protective action recommendations to the state.	6.3.5
QA Audit Report 86-74 Recommendation 86-74-08	As part of the protective actions recommendation procedure, include offsite protective action decision making based on plant conditions as suggested in NUREG 0654, Appendix 1, and NRC IE Information Notice 83-28.	6.2, Att. 1