

## LESSON OVERVIEW

This lesson provides information on Evaluation Area 2, Protective Action Decisionmaking.

### Lesson Objectives

At the completion of this lesson, you will be able to:

- Identify the five elements to be evaluated under protective action decisionmaking.
- Summarize the criteria used to evaluate protective action decisionmaking.

## OVERVIEW OF EVALUATION AREA 2

EA-2, Protective Action Decisionmaking, includes 5 sub-elements:

- 2.a Emergency Worker Exposure Control
- 2.b Radiological Assessment and Protective Action Recommendations and Decisions for the Plume Phase of the Emergency
- 2.c Protective Action Decisions for the Protection of Special Populations
- 2.d Radiological Assessment and Decisionmaking for the Ingestion Exposure Pathway
- 2.e Radiological Assessment and Decisionmaking Concerning Relocation, Reentry, and Return

All activities must be based on the ORO's plans and procedures and completed as they would be in an actual emergency unless otherwise indicated in the Extent of Play.

### Evaluation Frequency

The minimum frequency for evaluating criteria under these sub-elements is as follows:

Sub-Elements	Minimum Frequency
2.a Emergency Worker Exposure Control 2.b Plume Phase 2.c Protection of Special Populations	Every Exercise
2.d Ingestion Exposure Pathway 2.e Relocation, Reentry, and Return	Once in 6 years. The plume phase and the post-plume phase can be demonstrated separately.

## 2.a EMERGENCY WORKER EXPOSURE CONTROL

Sub-element 2.a, Emergency Worker Exposure Control, assesses the ORO's ability to render decisions about what protective actions emergency workers need to take in the wake of an incident. This sub-element includes one criterion:

**2.a.1:** OROs use a decisionmaking process, considering relevant factors and appropriate coordination, to ensure that an exposure control system, including the use of KI, is in place for emergency workers including provisions to authorize radiation exposure in excess of administrative limits or protective action guides.

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### Radiation Exposure Limits

Radiation exposure limits for emergency workers are the recommended accumulated dose limits or exposure rates that emergency workers may be permitted to incur during an emergency.

These limits include any pre-established administrative reporting limits (taking into consideration Total Effective Dose Equivalent or organ-specific limits) identified in the ORO's plans and procedures.

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### Required Decisionmaking

This criterion applies to any ORO authorized to send emergency workers into the plume exposure pathway EPZ. The ORO must demonstrate the ability to make decisions regarding:

- Authorization of exposure levels above the pre-authorized levels.
  - Number of emergency workers who can receive those higher levels.
  - Distribution and administration of potassium iodide (KI) as a protective measure, based on:
    - The ORO's plan and/or procedures, **or**
    - Projected thyroid dose compared with the established Protective Action Guides (PAGs) for KI administration.
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## 2.b PLUME PHASE

Sub-Element 2.b is Radiological Assessment and Protective Action Recommendations and Decisions for the Plume Phase of the Emergency. It provides that OROs have the capability to use all available data to independently project integrated dose and compare the estimated dose savings with the protective action guides.

OROs can choose, from among a range of protective actions, those that are most appropriate for the situation. They base these choices on PAGs from their plan/procedures. Or, they can base them on the EPA Manual of PAGs and Protective Actions for Nuclear Incidents (EPA 400-R-92-001) and other criteria, such as:

- Plant conditions
- Licensee protective action recommendations (PARs)
- Coordination of protective action decisions (PADs) with other political jurisdictions (for example, other affected OROs)
- Availability of appropriate in-place shelter, weather conditions, and situations that create higher than normal risk from evacuation.

This sub-element is broken into two criteria related to PARs and PADs:

- **Criterion 2.b.1:** Appropriate PARs are based on available information on plant conditions, field monitoring data, and licensee and ORO dose projections, as well as knowledge of onsite and offsite environmental conditions.
  - **Criterion 2.b.2:** A decisionmaking process involving consideration of appropriate factors and necessary coordination is used to make PADs for the general public (including the recommendation for the use of KI, if ORO policy).
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### Criterion 2.b.1: PARs

Requirements for Criterion 2.b.1 relate to:

- Appropriate means of PAR development
  - Validation of dose projections
  - Prompt transmittal of PARs
  - Handling of differences in dose projections
  - Revision of dose projections
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### Development of PARs

During the initial stage of the emergency response, following notification of plant conditions that may warrant offsite protective actions, the ORO should demonstrate its ability to use appropriate means to develop PARs for decisionmakers. The means for developing PARs are described in the plan and/or procedures. The ORO should also consider:

- Available information and recommendations from the licensee.
- Field monitoring data, if available.

When the licensee provides release and meteorological data, the ORO also considers these data.

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### Dose Projections

**Validation.** The ORO should demonstrate a reliable capability to independently validate dose projections. The types of calculations to be demonstrated depend on the data available and the need for assessments to support the PARs appropriate to the scenario. In all cases, calculation of projected dose should be demonstrated. Projected doses should be related to quantities and units of the PAG to which they will be compared.

**Prompt transmittal.** PARs should be promptly transmitted to decisionmakers in a prearranged format.

**Handling of projection differences.** The ORO should discuss with the licensee any differences greater than a factor of 10 between projected doses by the licensee. Discussions should address the input data and assumptions used, the use of different models, or other possible reasons for the differences. Resolution of differences should be incorporated into the PAR if timely and appropriate.

**Refinement of projections.** The ORO should demonstrate the capability to use any additional data to refine projected doses and exposure rates and revise the associated PARs.

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**Criterion 2.b.2: PADs**

Criterion 2.b.2 requires that a decisionmaking process involving consideration of appropriate factors and necessary coordination be used to make PADs for the general public (including the recommendation for the use of KI, if ORO policy).

Requirements relate primarily to initial and subsequent PADs, decisions on KI, and coordination. Evaluators need to be aware of planned coordination, both within States and among multiple States. Check the plan carefully to see what is required.

**Initial PADs.** Initial PADs need to be made in a timely manner appropriate to the situation, and they PADs should be based on:

- Notification from the licensee
- Assessment of plant status and releases
- PARs from the utility and ORO staff

**Subsequent PADs.** The decisionmakers should be able to change protective actions as appropriate based on subsequent projections. For example, subsequent PADs would be generated when dose assessment personnel provide additional PARs based on such input as:

- Later dose projections
  - Field monitoring data
  - Information on plant conditions
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**KI Decisions**

If (and **only** if) it is in the ORO's plan to use potassium iodide (KI) as a protective measure for the general public, the ORO should demonstrate its ability to make decisions on the distribution and administration of KI to supplement sheltering and evacuation. Those decisions should be based on:

- The ORO's plan and/or procedures, or
- Projected thyroid dose compared with the established PAG for KI administration.

The KI decisionmaking process should involve close coordination with appropriate assessment and decisionmaking staff.

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**Coordination**

Finally, criterion 2.b.2 addresses coordination with regard to plume phase protective action decisions. If more than one ORO is involved in decisionmaking, OROs should:

- Communicate and coordinate PADs with affected OROs.
  - Demonstrate the capability to communicate the contents of decisions to the affected jurisdictions.
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## 2.c SPECIAL POPULATIONS

Sub-element 2.c, Protective Action Decisions for the Protection of Special Populations, includes one criterion:

**2.c.1:** Protective action decisions are made, as appropriate, for special population groups.

Examples of special populations include:

- Correctional facilities
  - Hospitals and nursing homes
  - Schools and day care centers
  - Mobility-impaired or transportation-dependent individuals
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### Protective Actions

Protective actions for special populations who could be affected by a radiological release usually include:

- Evacuation
- Sheltering-in-place
- Use of KI if applicable

Evacuation is usually implemented in areas where doses are projected to exceed the lower end of the range of PAGs. The exception would be for situations where high risk is involved. In cases involving a high-risk environment or high-risk groups (e.g., the immobile or infirm), various factors should be considered in protective action decisionmaking. Examples include:

- Weather conditions
- Shelter availability
- Availability of transportation assets
- Risk of evacuation versus risk from the avoided dose
- Precautionary school evacuations

In situations where an institutionalized population cannot be evacuated, the administration of KI should be considered.

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## Schools

Schools receive special emphasis under this criterion.

**Alert and notification.** OROs should demonstrate the ability to alert and notify all school systems/districts of emergency conditions that could necessitate protective actions for students. Contacts with school systems/districts must be actual.

**Prompt decisions.** OROs and/or officials of school systems/districts should demonstrate the capability to make prompt decisions on protective actions for students.

**Decisionmaking process.** Officials should demonstrate that the decisionmaking process for protective actions considers (i.e., automatically accepts them or to gives them heavy weight):

- PARs made by ORO personnel.
- The ECL at which these recommendations are received.
- Preplanned strategies for protective actions for that ECL.
- The location of students at the time (for example, whether the students are still at home, en route to the school, or at the school).

The decisionmaking process also needs to take into account the availability of resources.

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## 2.d INGESTION EXPOSURE PATHWAY

Sub-element 2.d is Radiological Assessment and Decisionmaking for the Ingestion Exposure Pathway. During a nuclear power plant incident, a radioactive release may contaminate water supplies and agricultural products in the surrounding areas. This would likely occur during the plume phase and could impact the ingestion pathway for weeks or years. 2.d addresses the ability to assess radiological consequences for the ingestion exposure pathway, relate them to PAGs, and make PADs to mitigate exposure. This sub-element includes one criterion:

**2.d.1:** Radiological consequences for the ingestion pathway is assessed and appropriate protective action decisions are made based on the ORO's planning criteria.

This criterion is evaluated once every 6 years. The plume phase and the post-plume phase (ingestion, relocation, re-entry, and return) can be demonstrated separately.

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### **Precautionary Actions**

OROs are expected to take precautionary actions to protect food and water supplies, or to minimize exposure to potentially contaminated water and food, in accordance with their plans/procedures. Precautionary actions (e.g., placing milk animals on stored feed or using protected water supplies) are often initiated based on the facility's ECLs.

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### **Consequence Assessment**

The ORO should use its procedures (for example, development of a sampling plan) to assess the radiological consequences of a release on the food and water supplies. The assessment should include:

- Evaluation of the radiological analyses of representative samples of water, food, and other locally relevant food products from potentially impacted areas.
- Characterization of the releases from the facility.
- The extent of areas potentially impacted by the release.

Agricultural and watershed data within the 50-mile EPZ should be considered in the assessment.

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### **Providing Recommendations**

**Comparison to PAGs.** The radiological impacts should be compared to the ingestion PAGs in the ORO's plan/procedures, which may be based on specific dose commitment criteria or on FDA guidance.

**Timely and appropriate.** Recommendations provided to ORO decisionmakers should be timely and appropriate. As time permits, the ORO may also include a comparison of taking or not taking a given action on the resultant ingestion pathway dose commitments.

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### **Protective Action Decisions**

The ORO then makes decisions to minimize radiological impacts from the ingestion pathway. Those decisions should be:

- Timely
- Based on the assessments and other available information
- Communicated to (and, if possible, coordinated with) neighboring and local OROs.

OROs are expected to use Federal resources and other resources (e.g., compacts, nuclear insurers) if they are available. Evaluation of this criterion will take into consideration the level of Federal and other resources participating.

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## **2.e RELOCATION, REENTRY, AND RETURN**

Sub-element 2.e is Radiological Assessment and Decisionmaking Concerning Relocation, Reentry, and Return. Decisions about relocation, reentry, and return are essential for the protection of the public from the direct long-term exposure to deposited radioactive materials from a severe incident at a nuclear power plant. Sub-element 2.e contains one criterion:

**2.e.1:** Timely relocation, re-entry, and return decisions are made and coordinated as appropriate, based on assessments of the radiological conditions and criteria in the ORO's plan and/or procedures.

This criterion is demonstrated once in 6 years. The plume phase and the post-plume phase can be demonstrated separately.

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### **Relocation**

Relocation is the removal or continued exclusion of people from contaminated areas to avoid chronic radiation exposure. OROs should demonstrate their ability to:

- Estimate integrated dose in contaminated areas.
- Compare these estimates with PAGs.
- Apply decision criteria for relocation of members of the public who have not been evacuated but where projected doses exceed relocation PAGs.
- Control access to evacuated and restricted areas.

Decisions should also be made for relocating evacuees who lived in areas that now have residual radiation levels in excess of the PAGs. The areas to be restricted should be determined based on factors such as:

- The mix of radionuclides in deposited materials
  - Calculated exposure rates versus the PAGs
  - Field samples of vegetation and soil analyses
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### **Re-Entry**

Re-entry refers to provisions for the return of the public after evacuation, when the radiation risk has been reduced to acceptable levels. Decisions should be made regarding:

- Location of control points.
  - Policies regarding access.
  - Exposure control for emergency workers and members of the public who need to re-enter temporarily to perform specific tasks or missions.
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### **Re-Entry Control Procedures**

Examples of control procedures include:

- Use of dosimetry by emergency workers.
  - Questioning people about why, where, and how long they need to be in the area.
  - Having radiation exposure rate maps available.
  - Providing advice on areas to avoid.
  - Implementing controlled exit procedures, such as:
    - Monitoring of individuals, vehicles, and equipment.
    - Decision criteria regarding decontamination.
    - Proper disposition of emergency worker dosimetry.
    - Maintenance of emergency worker radiation exposure records.
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### **Individual Re-entry**

Responsible OROs should have a strategy for authorizing re-entry of individuals into the restricted zone, based on established decision criteria. Their strategy should allow for modifying those policies for specific purposes, such as:

- Security (e.g., police patrols)
- Essential services (e.g., fire protection and utilities)
- Other critical functions
- Property maintenance or retrieval of important possessions by members of the public.

Policies should be in place for providing dosimetry to anyone allowed to re-enter the restricted zone.

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### **Coordination**

Coordinated policies for access and exposure control should be developed among all agencies with roles to perform in the restricted zone.

The extent to which OROs need to develop policies on re-entry will be determined by scenario events.

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**Return**

Decisions about return are to be based on:

- Environmental data.
- Identifiable political boundaries or geophysical features which demarcate areas to which the public may return.

Other factors that should be considered in return decisions include:

- Cancellation of the ECL and the relaxation of associated restrictive measures.
  - Measurements of radiation from ground deposition.
  - Services and facilities requiring restoration within a few days (e.g., medical and social services, utilities, roads, schools, and intermediate term housing for relocated persons).
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