

OBJECTIVE 6: FIELD RADIOLOGICAL MONITORING - AMBIENT RADIATION MONITORING

OBJECTIVE

Demonstrate the appropriate use of equipment and procedures for determining field radiation measurements.

INTENT

This objective is derived from NUREG-0654 which provides that OROs should have the capability to deploy field teams with the equipment, methods, and expertise necessary to determine the location of airborne radiation and particulate deposition on the ground from an airborne plume. (See evaluation criteria in Planning Standards I. and N.)

In the event of an accident at a nuclear power plant, the possible release of radioactive material may pose a risk to the nearby population and environment. Although accident assessment methods are available to project the extent and magnitude of a release, these methods are subject to uncertainties. During an accident, it is important to collect accurate field radiological data on any radioactive release. These data are used to assist in developing ORO dose and exposure rate projections and confirming licensee dose and exposure rate projections that have been made. Field radiation monitoring teams are necessary to provide this information. Adequate equipment and procedures are essential to such field measurement efforts.

This objective covers basic radiation monitoring equipment and procedures, organization and deployment of field teams, and general operating procedures. This objective and Objective 8, Field Radiological Monitoring-Airborne Radioiodine and Particulate Activity Monitoring, may be demonstrated simultaneously and by the same teams.

DEMONSTRATION CRITERIA

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- 1. Each team has the equipment to perform field radiation measurements.**

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Explanation

Field teams of responsible OROs should demonstrate the availability and use of the following minimal equipment:

- o low-range gamma survey instruments [range: approximately 0.1 to 20 or more milliroentgens per hour (mR/h)] such as the CD V-700 or other Geiger-Mueller survey instruments with a moveable beta shield or equivalent and
- o high-range gamma survey instruments that cover the range from the maximum reading capacity of the low-range survey meters up to approximately 100 Roentgens per hour (R/h)] such as the CD V-715 or other sealed-ion-chamber instruments or equivalent

Extent of Play

Under this criterion all field monitoring equipment available to field teams and the inventory list of equipment should be presented for evaluation. The availability of personal dosimetry should be evaluated in accordance with Objective 5, Emergency Worker Exposure Control.

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- 2. Each team performs all appropriate operational response checks of their equipment and instruments before deployment. The survey instruments are calibrated within 12 months of the exercise date.**

Explanation

Responsible ORO field teams should demonstrate the operative procedures that they will use to: inventory equipment, replace missing items with spare equipment, perform battery and source checks, and show evidence that the instruments' calibration dates are within required time frames. Documentation or exterior labels should show the following information:

- o date of most recent calibration or date that next calibration is due

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- o the appropriate reading or range of readings for an identified check source for instruments with check sources
- o calibration curve or exposure rate correction factors to be used, if needed

If the calibration data is contained on other than the item itself, the item, serial number of the item, and date of calibration should be clearly listed.

Most portable instruments have a battery check circuit. These checks should be performed to confirm proper operation before the teams are deployed. In addition, CD V-700 instruments, and most other low range instruments with Geiger-Mueller detectors, are accompanied by a small radioactive sealed source (check source) for use in confirming the instruments response to beta-gamma radiation.

Radio communication equipment, as required by the plan, should be checked for proper operation including the ability to contact appropriate OROs.

When available, appropriate radioactive check sources (e.g., Cs-137) should be used for checking the proper operational response of the survey instruments. When the reading on the label is expressed as a single value, the instrument response (as adjusted by any correction factors identified on the label) should be within 25 percent of this value. When the reading is expressed as a range of values, the adjusted reading should be within the range. The ability to detect natural background radiation should be demonstrated using low range instruments. Any survey instrument that is not properly operating should be replaced with backup equipment.

Extent of Play

Under this criterion, all procedures should be completed as in an actual emergency.

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- 3. Each team demonstrates proper deployment capability and procedures and promptly arrives at assigned monitoring locations.**

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Explanation

Each field team should have a map(s) of the plume emergency planning zone (EPZ) that delineates roads, natural or political boundaries of areas that have been pre-selected for protective actions, and the location of any pre-selected reference points for monitoring.

Responsible OROs should demonstrate the capability to brief field teams on predicted plume location and direction, travel speed and exposure control procedures before deployment from the staging area or office. At the time of notification of OROs of plant conditions that could lead to an offsite release, or that a release is in progress, onsite officials should provide information on wind speed and direction as well as any available information regarding the timing and magnitude of the release. Briefing of the field teams on this information prior to their deployment by the ORO responsible for directing the monitoring operation should be demonstrated.

Field teams should also be briefed on procedures for controlling their exposure including exposure rate and accumulated exposure turn back values as stated in the plan, the benefit of taking KI to reduce dose to the thyroid from inhalation of radioiodines, and the use of personal monitoring devices as discussed in Objective 5, Emergency Worker Exposure Control.

ORO should demonstrate the capability to provide sufficient directions to field teams that ensure they will drive through or into the projected path of the airborne plume, along appropriate routes, and to take measurements at locations that can be identified from pre-selected reference points. In cases where adequate roads exist, they should also be directed to record peak readings near the boundary of the evacuated (or evacuating) area in the downwind direction, and to relate locations where these readings were taken with reference to preselected reference points or other easily recognized landmarks such as buildings, cross-roads, street intersections, and bridges.

If the responsibility has been accepted by licensee teams for field monitoring to obtain peak measurements in the plume, there is no requirement for these measurements to be repeated by State and local monitoring teams. These measurements may provide the basis for:

- confirmation of monitored or unmonitored release

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- determination of plume direction
- confirmatory dose projections based on field measurements.

In this case, State and local teams should demonstrate their ability to perform field measurements:

- to determine the location of the plume edge (side)
- at points near boundaries of evacuated/evacuating areas
- to evaluate potential dose to emergency workers assigned to lifesaving missions or other activities in high exposure rate areas.

Since measurements of maximum exposure rates in the plume are important to confirm the presence or absence of unmonitored releases and to provide data on the magnitude of the release for decisions further downwind, States are encouraged to maintain monitoring procedures in their emergency plan to locate peak exposure rates in the plume and to practice them during exercises. However, if these responsibilities have been accepted by the licensee, State and local monitoring teams will not be evaluated on these procedures during exercises.

Unless the responsibility has been transferred to licensee teams, field-teams should be briefed on procedures for traversing the plume to determine peak readings in evacuated (or evacuating) areas downwind of the release (roadways and turn-back values permitting). In each case, the gamma exposure rate at waist level, the time and location of the reading, and the individual taking the reading should be recorded.

OROs should also include in the briefing, procedures that are in the plan for identifying plume edges and for open and closed beta shield exposure rate measurements. If the same field team(s) will be collecting air samples, these procedures should also be included.

In cases where the plan does not specify the reading that confirms the location of a plume, a gamma exposure rate of one mR/h is satisfactory. If simultaneous readings of plume edges are demonstrated, these procedures should be described. Procedures for collecting the air sample are included in Objective 8, Field Radiological Monitoring - Airborne Radioiodine and Particulate Activity Monitoring.

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OROs should demonstrate the capability to promptly field a sufficient number of teams, with at least two members per team, to assure that measurements are taken and reported to appropriate OROs in time to provide input essential to protective action decision making.

All field teams specified in the plan are encouraged to participate in the exercise, unless a fewer number of teams is determined by mutual agreement between the FEMA Regional Assistance Committee (RAC) Chair and the ORO as acceptable for the exercise. Two teams, at a minimum, should be used for field monitoring. A combination of State and licensee field teams are sufficient for obtaining field measurements, provided that: appropriate coordination of functions between the two teams is effected. This arrangement is documented in the ORO plans and a written agreement supporting this coordination is made. The OROs plan should provide, except in the case of a fast-breaking emergency, that these field teams be deployed and stationed near the boundary before a release occurs. If the plume is predicted to already exist, the initial approach should be from the sides of the plume, sufficiently downwind for the plume to have reached ground level. (Usually three miles is sufficient.) Field teams should demonstrate the capability and availability of vehicles appropriate for local terrain and inclement weather conditions for the area during field monitoring demonstration.

Extent of Play

Under this criterion all activities should be completed as in an actual emergency. In areas covered by a simulated plume, field teams should be accompanied by a controller who provides the simulated monitoring data to be communicated to the dose projection staff. For areas not affected by the plume, actual (background) readings can be communicated to the dose projection staff.

Field teams may be dispatched from normal work-stations (e.g., the State radiation program office or its regional or district office) or from a location near the nuclear power plant where they are pre-positioned. Any pre-positioning necessary to meet exercise time constraints should be agreed to by responsible OROs, including the RAC Chair before the exercise. Regardless of location, all deployment procedures should be performed as they would be in an actual emergency.

The extent of demonstrated deployment will depend upon such variables as: accessibility of the areas; availability of motor vehicles, equipment, or personnel; weather conditions;

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location of stationary monitors that should be visited by survey teams; and projected high exposure to field teams. A minimum of two teams, with at least two individuals per team, should be deployed for defining and verification of the plume position.

The number of pre-selected reference points demonstrated during the exercise in a given area should be a function of wind speed and direction, the distance from the nuclear power plant, topography of the area, density of population, and presence of roads. Each team should take radiation measurements at a minimum of six pre-selected reference points.

At the discretion of responsible OROs and if incorporated in the plan, field teams may demonstrate the capability to utilize other transportation means, such as boats, when the plume extends into large bodies of water (e.g., Lake Michigan). While significant numbers of individuals may not reside on open water areas, collection of data on radioactive plumes in such areas may be important if wind shifts cause such plumes to move over populated areas.

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4. Each team demonstrates proper field radiological monitoring procedures.

Explanation

Responsible OROs field teams should demonstrate the capability to proceed to sampling areas as directed by the Field Team Coordinator (FTC) and take appropriate measurements and samples.

Upon notification that an offsite release has occurred, field teams should demonstrate the capability to move toward the plume and define the outer edges by taking near simultaneous readings or by other methods if provided for in the plan. Pre-selected monitoring points should be used as reference points where practical.

To the extent that roads permit, field teams should demonstrate procedures for traversing the plume using survey instrumentation to determine peak readings in areas near the boundary of the area evacuated, or being evacuated, downwind. Unless the responsibility has been transferred to licensee field teams, State and local field teams should also

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demonstrate this procedure for obtaining peak downwind measurements in the plume, to the extent permitted by turn-back exposure rates.

Field teams should demonstrate the capability to determine the location of the plume, based on field measurements. They should demonstrate procedures for field monitoring efforts concentrated at the edges of the evacuated areas to provide data for determining if the evacuated area is large enough. Monitoring data will also be needed to verify the absence of the plume in geographical sectors near the plume and in all non-downwind directions near the source of the release.

Responsible ORO field teams should demonstrate proper ambient radiation measurement procedures. These procedures should include contamination control measures such as: the use of spare probes, replacement of contaminated probes, enclosing probes in thin, plastic, and open and closed probe readings at both one meter (waist-level) and near ground level. Transparent probe covers are recommended but not required so that open and closed beta shield positions may be observed. The plastic must be thin to avoid shielding against beta radiation. A thickness of two mils or less (e.g. sandwich bag) is sufficient. Gamma exposure measurements should be taken at waist-level to determine whether radioactive material from the accident is present. If it is found, readings should be taken at waist-level and near the ground (2 to 3 inches). In each case, readings should be taken with the probe shield opened and closed. For the open probe reading at ground-level, the open window should point downward. These readings will assist in evaluating whether the plume was present when the readings were taken, and whether it contains iodine or particulate materials. Readings taken, en route or at pre-selected reference points, should be logged along with location, time, date, and name of monitor.

Extent of Play

Under this criterion, all activities should be conducted as in an actual emergency. Except for exercises in which there is no simulated release. In these cases, evaluators may use the interview method in which they ask the field team questions about how they would respond to hypothetical situations or exposure rates. The evaluator may also request the field team to demonstrate their response where appropriate.

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- N.1.a. 5. Each team demonstrates the capability to promptly report the radiological data collected to the Field Team Coordinator.**

Explanation

Field teams should demonstrate the capability to report measurements to the FTC or accident assessment group. The reports should indicate the location of measurement points. The time of measurement, the type of instrument used, the instrument reading(s), whether the beta shield was open or closed and the person taking the reading.

Extent of Play

Same as extent of play for Demonstration Criterion 4, except add the following: In cases where release of radioactive material to the atmosphere is simulated, transmission of simulated environmental measurements to the FTC or to the dose assessment group should be simulated. For other cases where no release is simulated, the hypothetical environmental measurement data should be sent only to the FTC, but not to the dose assessment group. This will avoid confusion regarding whether a release was simulated.

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- N.1.a. 6. All activities described in the demonstration criteria for this objective are carried out in accordance with the plan, unless deviations are provided for in the extent-of-play agreement.**

Explanation

Responsible OROs should demonstrate the capability to follow policies, implement procedures, and utilize equipment and facilities contained in the plans and procedures. OROs should demonstrate that they can follow sequences outlined in the various procedures and perform specified activities, as necessary.

Extent of Play

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Under this criterion, all activities should be carried out as specified in the plan, unless deviation from the plan is provided for in the extent-of-play agreement.

CLARIFICATION OF TERMS

The following definitions describe the limited meanings of terms in the context of the Exercise Evaluation Methodology and may vary from the technical definition for all circumstances.

Check source refers to a radioisotope with a relatively fixed activity level used to determine the responsiveness of survey instruments.

Emergency worker refers to an individual who has an essential mission within or outside the plume exposure pathway emergency planning zone to protect the health and safety of the public who could be exposed to ionizing radiation from the plume or from its deposition.

Some examples of emergency workers are: radiation monitoring personnel; traffic control personnel; evacuation vehicle drivers; fire and rescue personnel, including ambulance crews; medical facilities personnel; emergency operations center personnel; personnel carrying out backup alerting procedures; and essential services or utility personnel.

Exposure rate refers to the amount of gamma radiation that a individual would receive in one hour as measured in air (typically expressed in units of milliroentgens per hour or Roentgens per hour).

Field Team Coordinator refers to the individual who manages the functions of field teams and coordinates data with the dose assessment group located in emergency operation centers and facilities.

Hypothetical data refers to the data inserted to drive field play or to support an interview in situations where the data differs from the overall scenario.

Monitoring refers to checking radiation levels, usually by counting ambient radiation.

Sampling refers to collecting specimens of materials at field locations.

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Turn-back values are total accumulated external exposure limits or exposure rates, established by the offsite health authority, at which the emergency worker should leave the area without further consultation or direction.