

## Lesson 7: EPA PAGs – Emergency Worker Dose Limits

### Lesson Overview

In this lesson you will learn about recommendations for protecting emergency workers in the event of a nuclear incident or accident.

Upon completion of this lesson, you will be able to:

- List categories of emergency workers and define special circumstances where higher dose limits for emergency workers may be appropriate.
- Differentiate between emergency worker limits, occupational worker limits, and protective action guides (PAGs).
- Summarize recommendations for emergency worker protection described in the EPA PAG Manual.
- Identify methods of managing and monitoring internal exposure during the early phase.

Remember you can access the glossary in one of two ways throughout this course. You can select the glossary button in the top right hand corner of each main content screen. In addition, on content screens you can select underlined words to access their definitions in the online glossary. Selecting an underlined word will take you directly to its definition in the glossary.

This lesson should take approximately **20 minutes** to complete.

### Emergency Worker Categories

State and local authorities designate what categories of workers are classified as emergency workers. The PAG Manual is careful to delegate the decision on what constitutes an emergency worker to state and local authorities. Examples of categories that may be designated as emergency workers include:

- Law Enforcement
- Firefighters
- Radiation Protection
- Civil Defense
- Emergency Management Traffic Control
- Health Services
- Transportation Services
- Animal Care

In addition, select workers at institutions, utilities, industrial facilities, farms as well as other agriculture-based businesses may be designated as emergency workers.

## **Dose Limits**

Emergency worker dose limits and protective action guides (PAGs) are not the same. PAGs are not limits; they are projected doses that warrant taking a protective action. PAGs consider the risks to individuals from exposure to radiation, and the risks and costs associated with a specific protective action. The risk involved in taking a protective action should not exceed the radiation risk incurred if the protective action is not taken.

Emergency worker dose limits are based on a federally acceptable level of risk of health effects and may be adjusted based on the collective dose to the population being protected.

Any resulting exposures will be considered justified if the maximum risks permitted to workers are acceptably low by Federal standards and the risks or costs to others that are avoided by the workers' actions outweigh the risks to which the workers are subjected.

### **Emergency Worker Dose Limits in the Early Phase (1 of 3)**

Emergency worker dose limits include all doses received during the early phase. PAGs consider a future dose that may be avoided. Emergency workers may also use protective equipment, protective clothing, and dosimetry to monitor their dose. You will learn more about these methods later in this lesson.

Occupational guidance specifies that:

- Doses to workers should be maintained as low as reasonably achievable (ALARA).
- Doses should be monitored.
- Workers should be informed of the risks involved and of the basic principles for radiation protection.

Higher dose limits for workers are allowed when required to:

- Prevent substantial risks to populations.
- Protect valuable property.
- Save lives.

### **Emergency Worker Dose Limits in the Early Phase (2 of 3)**

When accessing this table, keep in mind the following key points:

- The dose limit in this table is the TEDE.
- Dose to the eye lens should be limited to three times the listed value.
- Dose to any other organ (including skin and body extremities) should be limited to 10 times the listed value.
- There was a separate CDE thyroid dose limit of 25 rem. FDA previously recommended thyroid blocking to those who were likely to receive a projected dose of 25 rem to the thyroid. The current recommendation is 130 mg for non-pregnant adults between 18 and 40 at 10 rem, and 130 mg for those over 40 at 500 rem.

- Emergency worker limits apply during the duration of the emergency. No specific guidance is given on when the emergency ends, but it is usually considered to be when the release has terminated, the public has been evacuated, and valuable property has been protected from fires, etc.

### **Emergency Worker Dose Limits in the Early Phase (3 of 3)**

Doses received as emergency workers or from living in a slightly contaminated area are considered "once in a lifetime" doses and are not additive for the purpose of occupational exposure records. It is logical for occupational workers to add doses received as emergency workers to records as "planned special exposures."

Minors and pregnant women should not be designated as emergency workers. Their dose should not exceed 0.5 rem.

The Federal Radiological Protection Coordinating Committee (FRPCC) PAG subcommittee has decided to issue no additional guidance to the states on how to implement emergency worker dose limits. States are expected to:

- Work out the details in their plans.
- Include procedures in their plans for managing dose to emergency workers.

### **Emergency Worker Dose Limits in the Intermediate Phase**

Individuals who are permitted to reenter the restricted zone (RZ) to work or for other justified reasons will require protection from radiation. Such individuals should enter the RZ under controlled conditions in accordance with dose limitations and other procedures for control of occupationally exposed workers.

Ongoing doses received by these individuals from living in a contaminated area outside the RZ need not be included as part of this dose limitation. In addition, dose received previously during the emergency phase need not be considered as part of the intermediate-phase limits.

Occupational dose limits per year are as follows:

- TEDE: 5 rem
- CDE (eye): 15 rem
- DE (shallow, skin and extremity): 50 rem
- DDE + CDE (other than eye): 50 rem

Dose to minors must be limited to 10% of the above limits. Dose to pregnant females is limited to 500 mrem TEDE per entire nine-month period and no substantial variation above a uniform monthly rate.

### **Managing and Monitoring Internal Exposure During the Early Phase**

Now that you have learned about emergency worker dose limits, you will learn about methods of managing and monitoring internal exposure during the early phase. There are two methods to do so:

- Monitoring with Time and Turn-Back Limits
- Administering Potassium Iodide

During the next section of this lesson you will learn about each of these methods.

### **Monitoring Internal Exposure: Time and Turn-Back Limits (1 of 2)**

The PAG subcommittee provides three options for monitoring internal exposure using dose limits. Select the links below to learn more about these options.

1. Use minimal control of inhalation dose from particulate materials during evacuation; that is, calculate CEDE after the fact once a spectrum of the radionuclides is available.
  - Definition: Option 1 is to control only the whole-body gamma and thyroid dose during evacuation.
  - Rationale: It is not practical to rotate workers. Also, the inhalation dose is controlled for tasks after evacuation and evacuation may be completed before plume arrives (ideal situation).
  - Disadvantages: The risk of overexposure is higher than for other options.
2. Use previously established administrative dose limits; that is, use an emergency worker factor of five or some other dose correction factor (DCF).
  - Definition: Option 2 involves using pre-established administrative limits. This is also called the "mission limit."
  - Rationale: It is easy to implement. Once the limit is reached, pull out workers or authorize additional dose. Also it will meet limits for most probable accidents.
  - Disadvantages: It may not provide adequate control for the most severe accidents.
3. Use contextually calculated dose limits based on analysis of isotopes in the plume. Select this link to access a summary of the information presented on this screen.
  - Definition: Option 3 recommends calculating contextual mission limits applicable to the accident in progress. This requires analysis of the isotopes and their concentrations in the plume.
  - Rationale: This option is the most accurate means of measuring dose correction factor. The same can be said of data for dose projection. Mission limits would be more defensible.
  - Disadvantages: Necessary data may not/will not be available particularly early in an event.

### **Monitoring Internal Exposure: Time and Turn-Back Limits (2 of 2)**

The table accessible below lists the dosimeter adjustment factors for different accident categories. It shows the difference between the TEDE dose and an EDE dose based on the external dosimeter reading.

The individual's TEDE dose could be up to 37 times higher than what the dosimeter indicates. If a pocket chamber dosimeter reads 1 R, the TEDE would be approximately 37 rem.

### **Managing Internal Exposure: Administering Potassium Iodide (KI)**

You will learn more about the use of KI in Lesson 8. State and county health officers determine KI availability and proper use for their jurisdictions.

## Lesson Summary

Let's summarize what you have learned in this lesson:

- Examples of categories that may be designated as emergency workers include law enforcement, firefighting, radiation protection, civil defense, emergency management traffic control, health services, transportation services, and animal care.
- Emergency worker dose limits and protective action guides (PAGs) are not the same. PAGs are not limits; they are projected doses that warrant taking a protective action
- Emergency worker dose limits are based on a federally acceptable level of risk of health effects and may be adjusted based on the collective dose to the population being protected.
- Intermediate-phase dose limits are the same as occupational worker dose limits.
- During the early phase, internal exposure can be managed by administration of KI and monitored using direct-reading dosimeters.

The next lesson will cover considerations that must go into the use of potassium iodide (KI) as a supplemental public protective action.