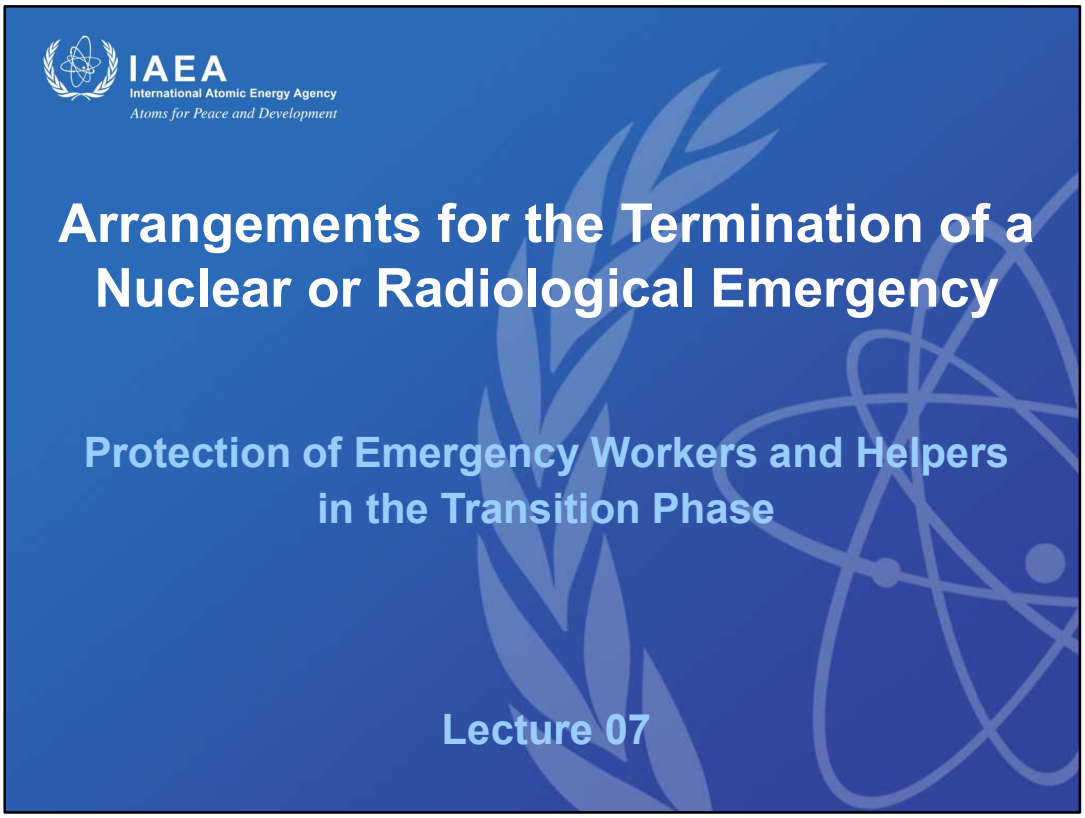
Arrangements for the Termination of a Nuclear or Radiological Emergency



Lecture: 07. Protection of Emergency Workers and Helpers in the Transition Phase

Purpose of the Presentation:

- Present and discuss arrangements for the protection of emergency workers and helpers during the transition phase

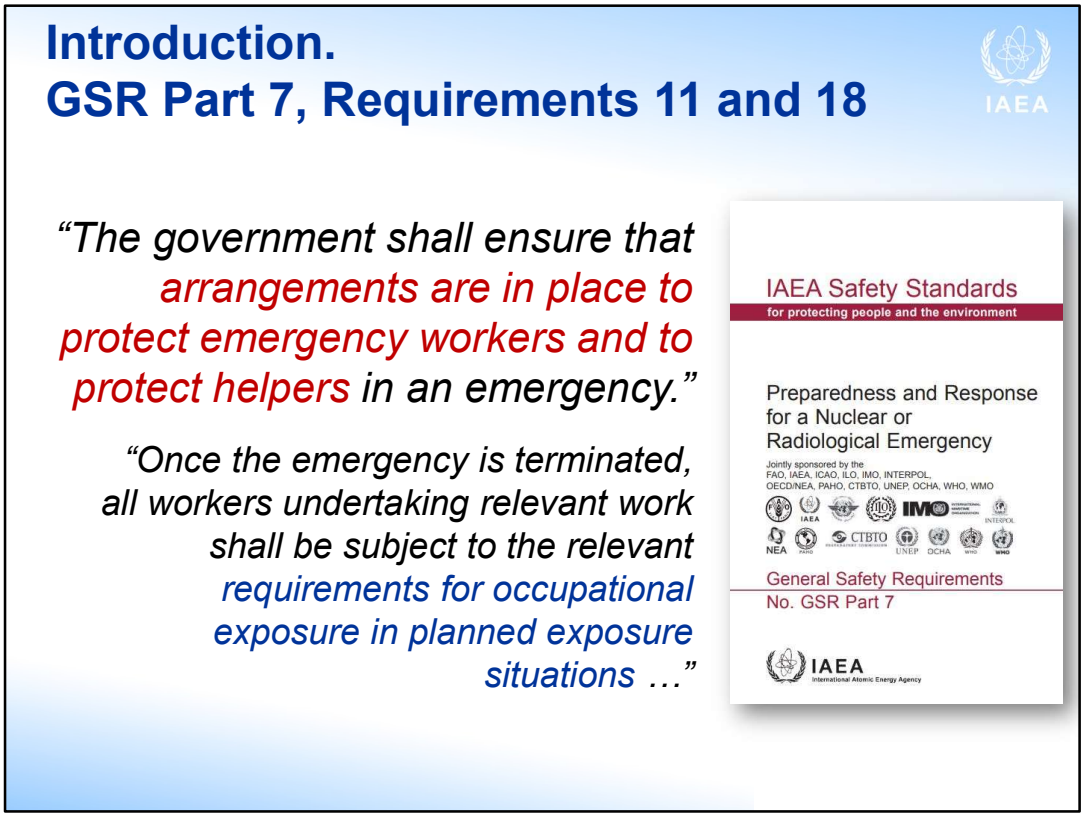
Learning objectives:

- Recognize the differences between emergency workers and helpers and applicable dose restrictions
- Identify arrangements to be made regarding protection of emergency workers and helpers during the transition phase

Duration: 60 minutes

References:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).
2. International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018).
3. International Atomic Energy Agency, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-2, IAEA, Vienna (2011).

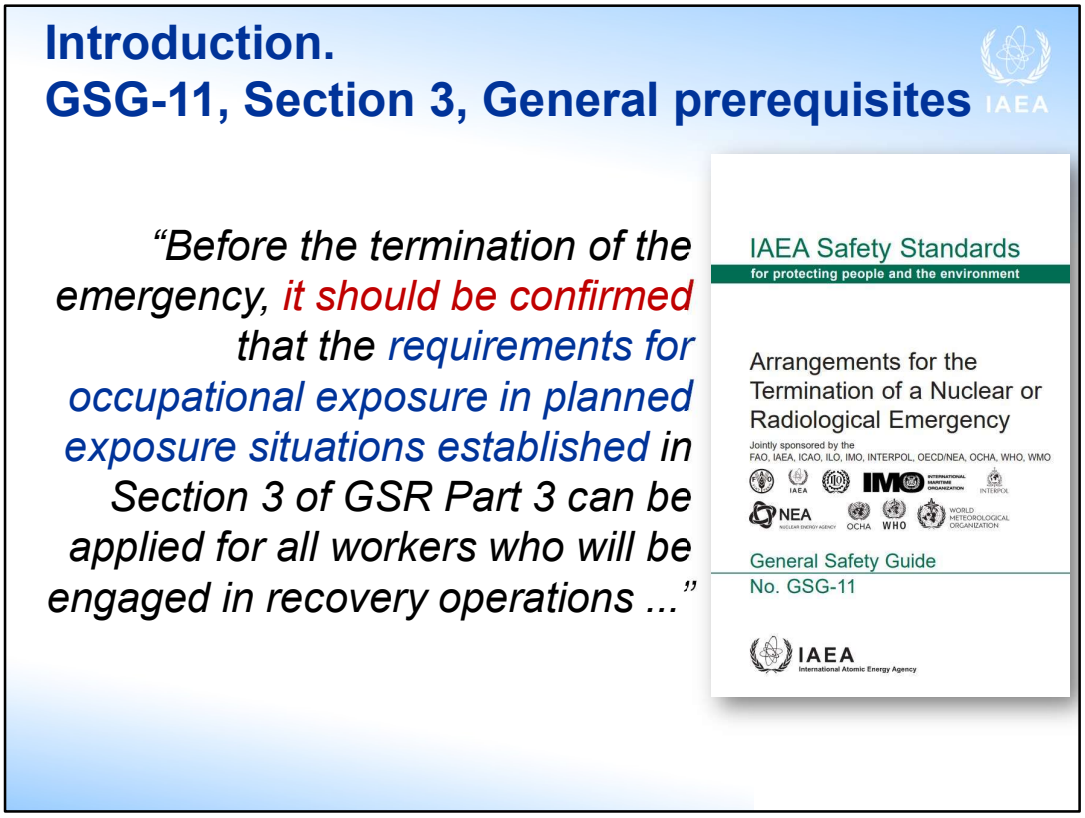


Lecture notes:

The key point is that, while we always need to ensure the protection of emergency workers irrespective of the phase, in order to be able to terminate the emergency (whether transitioning to a planned or existing exposure situation), we need to be able to ensure that all workers involved in recovery work can meet the requirements for planned exposure; this includes use of occupational dose limits.

Reference:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

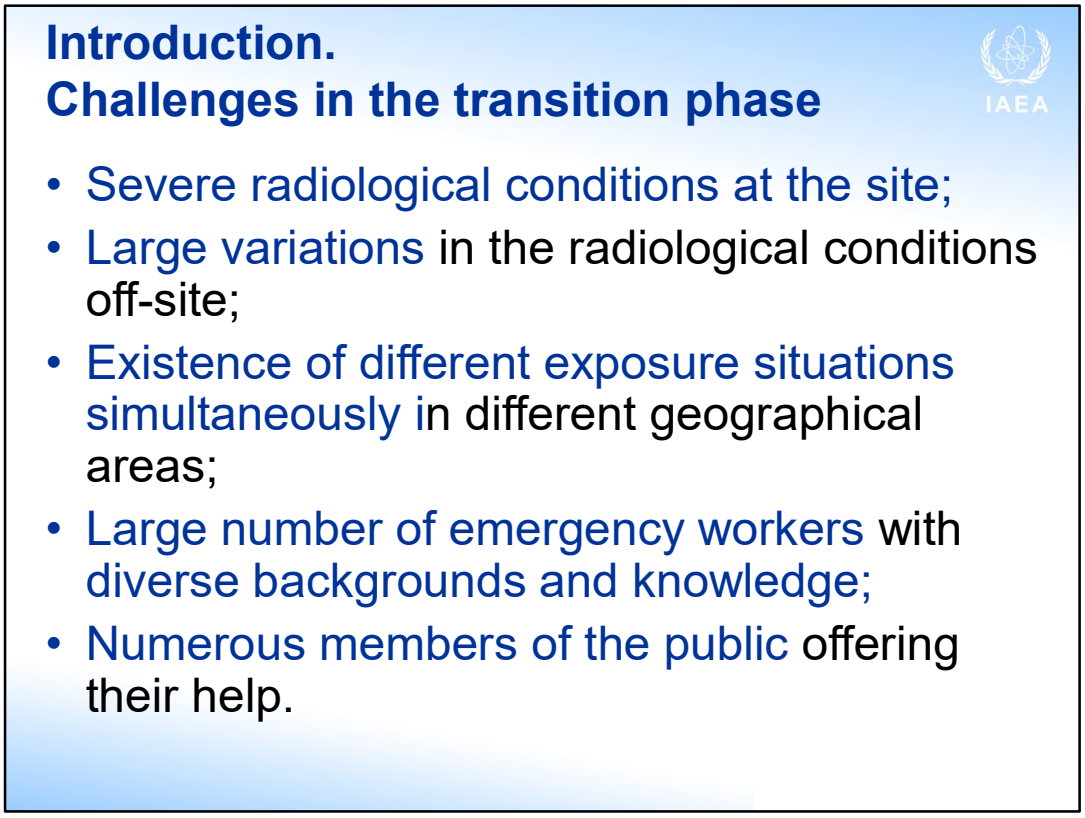


Lecture notes:

This general prerequisite for termination of the emergency stated in GSG-11, which is applicable for any emergency, derives from the safety requirement mentioned before.

Reference:

1. International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018).



Lecture notes:

While many of the challenges of the urgent and early response phases no longer exist as we move to the transition phase (e.g., requirement of rapid actions, as yet uncharacterized situation which may be quickly evolving, little time to plan work, etc.), for an emergency involving significant long-lasting contamination of the environment that would require transition to an existing exposure situation, the protection of emergency workers and helpers in the transition phase will be still challenged by:

- Large variations in the radiological conditions expected within the affected area in an emergency exposure situation, warranting the simultaneous application of different measures for the protection of emergency workers and helpers;
- Severe radiological conditions having been present at the site for a longer period and, thus, challenging the on-site response efforts;
- Different exposure situations existing simultaneously in different areas, warranting workers undertaking the same work to be subject to different dose restrictions;

Lecture notes:

- Involvement of large numbers of emergency workers from different organizations and services with diverse backgrounds, knowledge and expertise, some of whom might not have been identified and designated as emergency workers in advance of the emergency;
- Numerous members of the public volunteering to help.

These new challenges associated with the transition phase may be associated with new activities being started, such as clean up of the site and surrounding areas – this will warrant new skills and new workers (many of whom are not familiar with radiation and working safely in such an environment). In addition, the local community may wish to support response efforts, and when doing so, they should be appropriately protected from any radiation hazards.

Purpose

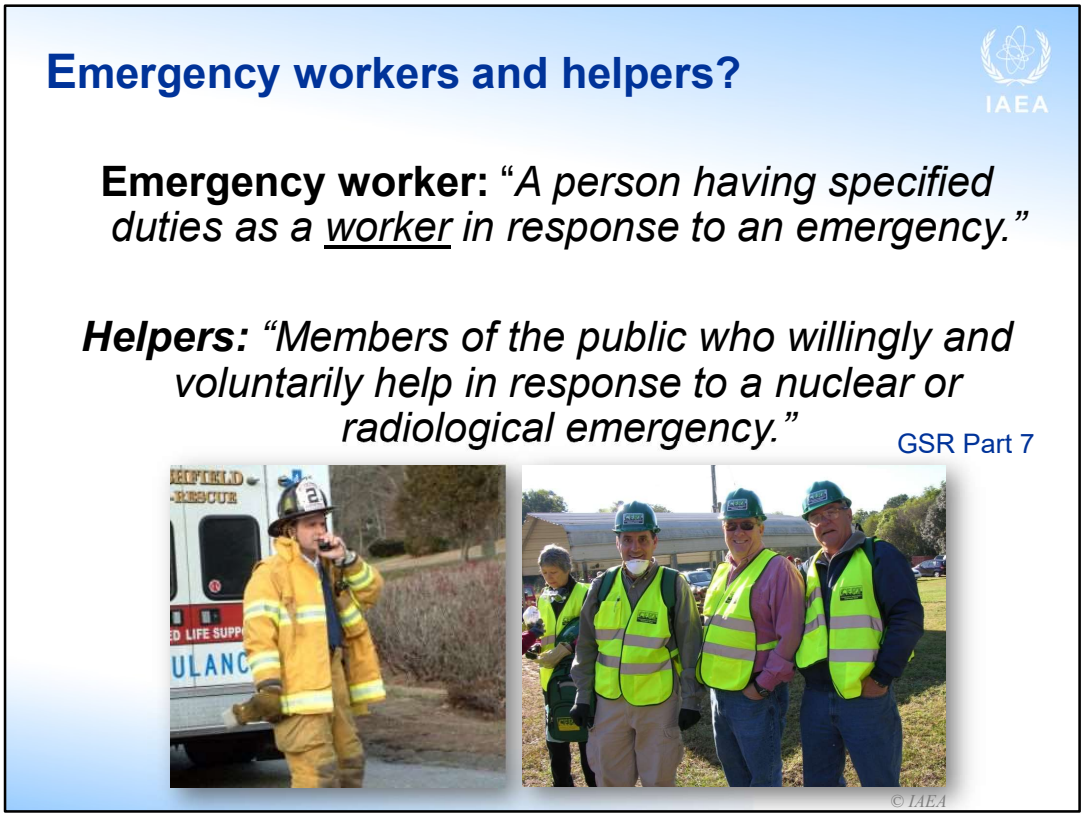
- Present and discuss arrangements for the protection of emergency workers and helpers during the transition phase.

Learning Objectives

- Recognize the differences between emergency workers and helpers and the applicable dose restrictions.
- Identify arrangements to be made regarding the protection of emergency workers and helpers during the transition phase.

Contents

- Identification of emergency workers and helpers
- Designation of emergency workers
- Dose restrictions during the transition phase
- Training
- Justification and optimization
- Medical support
- Protection of other workers



Lecture notes:

To understand the difference between emergency workers and helpers – both of whom may be involved in response efforts – we start with the definitions from GSR Part 7. The aim is to look in more detail at what these designations mean, with an opportunity to look at some example cases to identify which classification people fall under.

The key word is 'worker' –people who are undertaking a response task as part of their job and for an employer; they are considered emergency workers. People who act in a private/personal capacity are helpers.

FIG.: Courtesy of International Atomic Energy Agency

Reference:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

Who is an emergency worker?

"A person having specified duties as a worker in response to an emergency" GSR Part 7

- Designated operating personnel:
  - Directly and indirectly employed.
- Designated personnel of response organizations;
- Designated personnel providing care and support to affected population;
- Other emergency workers who may not necessarily have been designated prior to emergency;

Image reproduced from 'The Fukushima Daiichi Accident', IAEA, Vienna (2015)

Lecture notes:

GSR Part 7 describes an emergency worker as a person having specified duties in response to an emergency. Emergency workers may include workers who are employed, both directly and indirectly, by registrants and licensees, as well as personnel of responding organizations, such as police officers, fire fighters, medical personnel and drivers and crews of evacuation vehicles.

Emergency workers may or may not have been designated as such in advance of an emergency. Emergency workers not designated as such in advance of an emergency are not necessarily radiation workers prior to the emergency but can still be emergency workers during the response.

Example in the picture: Workers handling the heavy machinery may not be designated emergency workers at the preparedness stage (this task may not have been anticipated in the planning), but they are responding as emergency workers during the emergency.

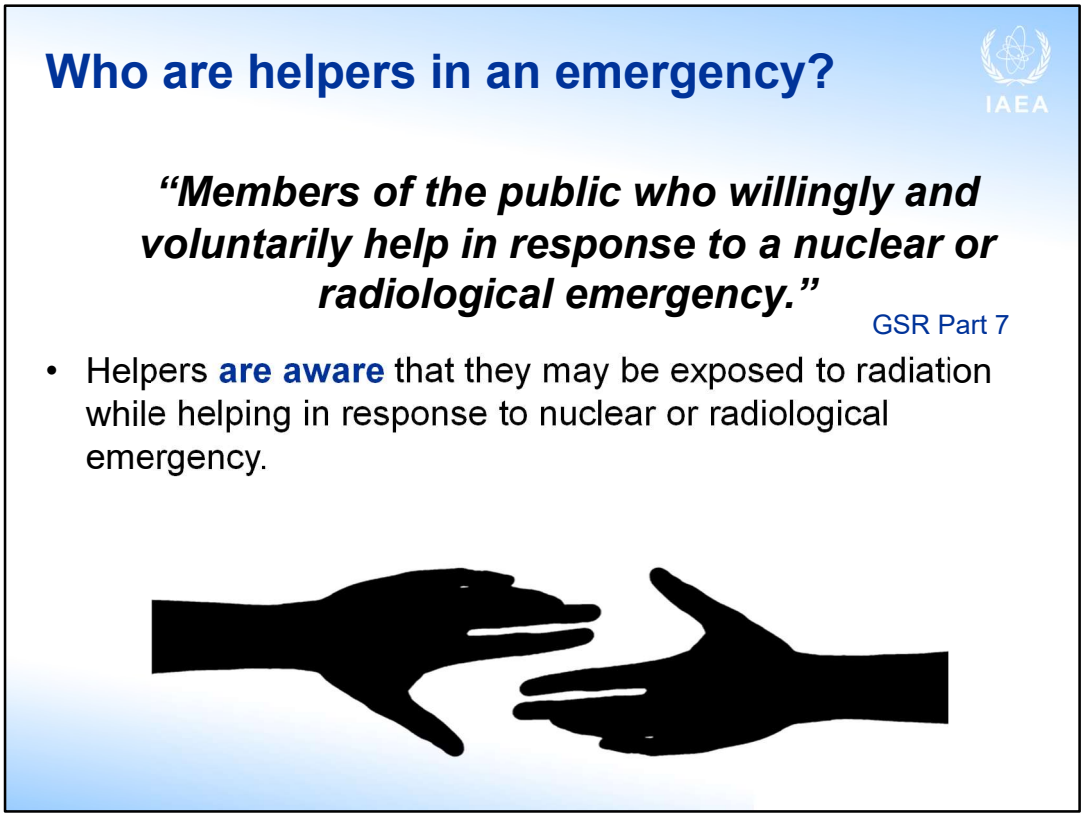
Lecture notes:

These emergency workers (not designated in advance) should be provided with the same level of protection as those who were designated in advance.

FIG.: Example of debris removal from Unit 3 reactor building, International Atomic Energy Agency, The Fukushima Daiichi Accident, Technical Volume 5/5, Post-accident Recovery, IAEA, Vienna (2015)

Reference:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).



Lecture notes:

People undertaking response tasks in a private/personal capacity – not as part of their job (no employer/employee relationship) - are referred to as helpers. Helpers may be increasingly engaged in the response as the emergency evolves, particularly during the transition phase.

Reference:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

Emergency worker or helper?

- Shift supervisor at a facility: is a radiation worker. In an emergency, leads facility-level response to control the source.
- Fire warden at the facility: day to day work does not involve radiation exposure; in an emergency, has the job of overseeing building evacuation.
- Receptionist at facility: day to day work does not involve radiation exposure; no designated role in emergency; Evacuated with other non-essential staff.

Lecture notes:

Before elaborating the arrangements for protection of emergency workers and helpers, ask participants to discuss whether they think the person is a worker or a helper – and if it is likely that the person will be pre-designated (if a worker).

Check that participants are happy/aware with why certain personnel is worker/helper/neither:

- Shift supervisor: Worker (should be pre-designated as has assigned role in plan)
- Fire warden: Worker (should be pre-designated as has assigned role in plan)
- Receptionist: Neither (is member of public as far as emergency exposure situation)

Emergency worker or helper? (cont'd)

- As there are a lot of people to evacuate, a local teacher offers to drive a mini-bus to evacuate people.
- Local construction worker – brought in to operate heavy machinery (crane) to clear debris from the accident site to allow rescue of trapped people.
- Paramedic who attends accident site to provide medical support for injured people.

Lecture notes:

- Local teacher: Helper as not undertaking this task as part of his/her job for his/her employer
- Construction worker: Worker (may not be pre-designated, as this task may not have been anticipated in the plan; arose due to particular circumstances of the emergency)
- Paramedic: Worker (probably pre-designated as a local emergency service worker if the emergency occurred on a radiation/nuclear facility; but may not be pre-designated if the emergency occurred, for example, as a result of a transport accident or involved a mobile source)

Emergency worker or helper? (cont'd)

- The person who is designated to check the roster of people being evacuated is on sick leave. The receptionist is asked to cover this role.
- The accident site has a damaged bridge due to a storm that coincided with the nuclear accident. The damage is hampering access for the response crews, so a specialist scaffolding crew is contracted to help repair the bridge.
- The local playground is not accessible due to debris from the storm. Local residents assist in clearing the paths.

Lecture notes:

- Receptionist: In this case the receptionist is an emergency worker, as he/she has a response role performed by virtue of his/her employment. As the receptionist was not the pre-assigned person for this task, it is likely he/she will be a 'not pre-designated worker'
- Scaffolding crew: Workers (probably not pre-designated, as this task will probably not have been anticipated in plan; it arose due to the particular circumstances of the emergency)
- Local residents: Helpers (members of the public volunteering with clean-up tasks)

Who is an emergency worker? (cont'd)

"A person having specified duties as a worker* in response to an emergency." GSR Part 7

The definitions recognize rights, duties and responsibilities of both emergency workers and their employers:

- **Worker** is any person who works -- full time, part time or temporarily -- for an employer and who has recognized rights and duties in relation to occupational radiation protection;
- **Employer** is a person or organization with recognized responsibilities, commitments and duties towards a worker in the employment of the person or organization by virtue of a mutually agreed relationship.

Lecture notes:

It is important to highlight the use of 'worker' in the definition. With this, the different responsibilities and commitments (including the rights) are defined for emergency workers and their employers in relation to occupational radiation protection.

Workers may be permanent employees or temporary contractors – the important point is the fact that they are undertaking work on behalf of the employer.

Reference:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

Discussion

- Are you designated as an emergency worker?
- Why might some workers not be pre-designated?

Lecture notes:

Allow for about 3 mins. of discussion.

Designation of emergency workers

- Designation of emergency workers as such at the preparedness stage provides the basis for adequate and prompt discharge of assigned rights, duties, responsibilities and commitments when needed, e.g.:
  - All relevant organizations need to identify emergency workers to the extent practicable;
  - Assess emergency workers regularly for fitness for intended duties.
- Acknowledges that some emergency workers who are not designated as such prior to emergency may not necessarily be workers with recognized rights and duties in occupational radiation protection prior to the emergency:
  - Limit to the extent possible the use of non-designated workers.

Lecture notes:

- The relevant organizations, in this context, include response organizations, as well as other organizations at the national, regional and local levels
- These organizations may not necessarily be recognized as emergency response organizations, but may gradually take over a role and assume responsibilities during the transition phase for long term recovery (e.g., critical infrastructure restoration, decontamination)
- The assessment of fitness for duty is not solely about radiation exposure but generally fitness to undertake the assigned roles (e.g., may need a certain level of physical/medical fitness to carry out manual tasks, wear breathing apparatus, work quickly in a hazardous environment, use certain instruments/machinery, etc.). Many jobs require a medical or fitness assessment at the recruitment stage – or on a regular basis for certain physically challenging roles.

Lecture notes:

- In preparing its plans, each responding organization, should identify who will carry out the response tasks – and determine if there are any particular fitness-for-duty requirements to allow someone to carry out these tasks safely and effectively.
- There is no requirement to have a central list of all designated emergency workers at the state/national level, but each organization with a response role should, at a minimum, maintain its own list.

Designation of emergency workers (cont'd)

- Emergency Response Phase:
  - Implementation of well defined and pre-planned mitigatory actions, protective actions and other response actions;
  - Those assigned with duties to undertake such actions (including operating personnel, fire fighters, evacuation vehicle drivers, medical staff, etc.) can be identified at the preparedness stage and designated accordingly.

Lecture notes:

For the emergency response phase, it is expected that most, if not all, of the necessary actions to be undertaken have been identified in advance in the plans and procedures. This means that the responding personnel ('emergency workers') can be designated in advance and provided with the necessary training for the tasks to be undertaken and given information about the risks from radiation.

Designation of emergency workers (cont'd)

- Transition Phase:
  - Implementation of various activities to facilitate the resumption of normal social and economic activity;
  - Planning at the preparedness stage may not be as detailed as for the emergency response phase;
  - Organizations to be involved go beyond the usual emergency response organizations;
  - Although adequate preparedness for this phase will ensure that those who are assigned to carry out these activities are identified, this may not necessarily always be possible.

Lecture notes:

Workers in the transition phase may not be pre-designated, as the planning may not have been as detailed for this phase. There will also be additional tasks required above and beyond protective actions/mitigatory actions in order to clean up the site/surrounding area or facilitate resumption of normal social and economic activity (the need for or detail of tasks may not have been identified in preparedness). This calls for special provisions to be implemented at the time of the emergency, such as just-in-time training and the provision of emergency equipment in sufficient quantity and quality to ensure that those workers are protected to the same degree as pre-designated emergency workers.

Designation of emergency workers (cont'd)

- How to approach the designation of emergency workers for the transition phase:
  - Plan adequately to allow for identifying necessary activities during the transition phase;
  - Identify duties to be assigned to relevant organizations, and assign their responsibilities, commitments and duties in occupational radiation protection (ORP):
    - Response organizations, but also organizations taking over a role and assuming responsibility as of the transition phase.
  - Designate emergency workers and inform them of their rights, duties and responsibilities in ORP.

Lecture notes:

Relevant organizations should use the process of designating emergency workers who will be engaged in the transition phase to:

- Inform emergency workers of their rights, duties and responsibilities with regard to occupational radiation protection;
- Recognize the organizations' responsibilities, commitments and duties as employers in occupational radiation protection, so that those responsibilities, commitments and duties can be effectively discharged at the preparedness stage and in the transition phase.

Designation of emergency workers (cont'd)

- How to approach the designation of emergency workers for the transition phase:
  - Identify organizations that might not have the necessary expertise and capabilities to provide for the protection of their emergency workers:
    - For example, organizations involved in the restoration of essential infrastructure during the transition phase.
  - Agree on arrangements to be used in such cases:
    - For example, contracting services of another relevant institution, provided that the responsibility remains with the organization providing the emergency workers.

Lecture notes:

In the transition phase, there will likely be some organizations undertaking certain roles connected to resumption of normal social and economic activity that might not have the necessary expertise and capabilities to provide for radiation protection of their employees (i.e. emergency workers). Examples of such organizations include those carrying out the restoration of infrastructure or dealing with conventional waste within an affected area. Thus, such organizations may need to call on a relevant institution with the necessary expertise to provide such services. The necessary arrangements for this expert support should be identified in preparedness. Such support arrangements do not relieve the employers of their responsibilities, commitments and duties in occupational radiation protection - these remain with the relevant organization and cannot be transferred to the institution providing the services.

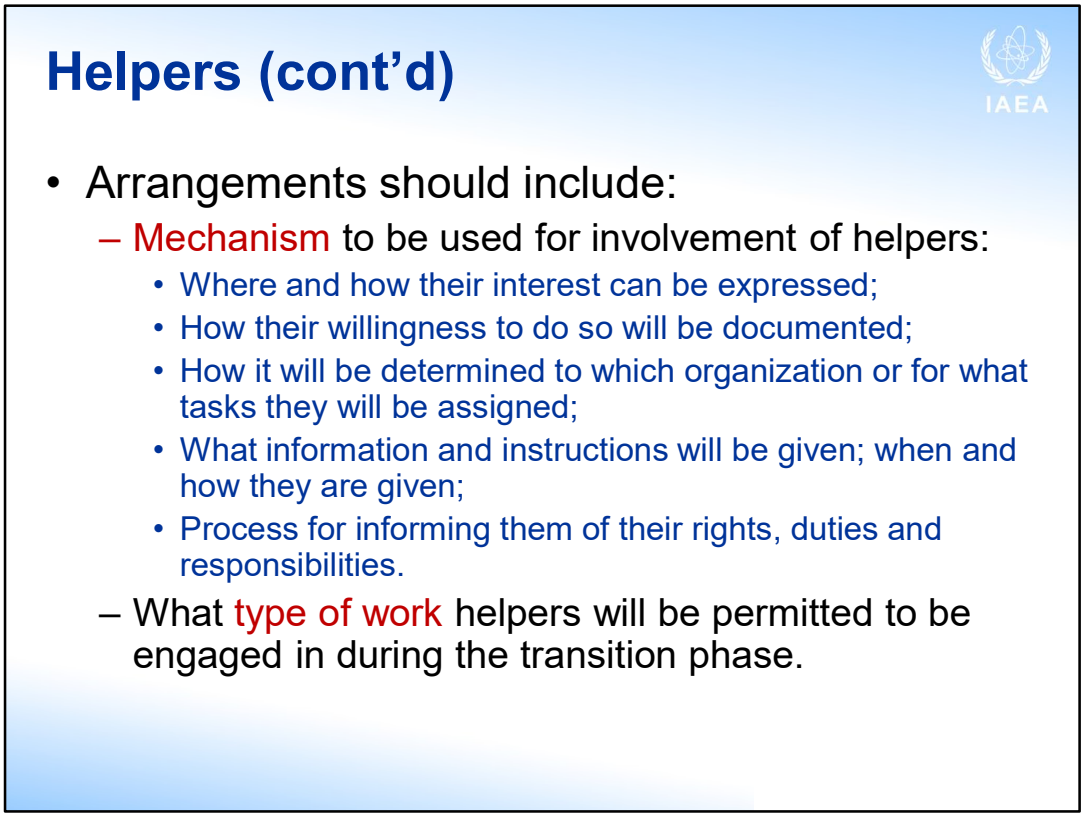
Helpers

- Interest to help in the emergency response expressed at the time of the emergency out of solidarity;
- Cannot be identified and designated in advance;
- Response organization(s) should be designated and assigned responsibility to prepare arrangements for helpers' involvement and protection.

Lecture notes:

While the engagement of helpers in the urgent response phase of an emergency is less expected, helpers can be increasingly engaged as the emergency evolves, particularly in the transition phase. Once registered and integrated into the emergency response operations, helpers need to be protected in the same manner as emergency workers who are not designated in advance. GSR Part 7 stipulates the relevant requirements for protection of emergency workers.

An organization needs to be designated at preparedness to provide the necessary arrangements to oversee the involvement and protection of helpers in the response (as they have no employer responsible for their protection, in terms of their involvement in the response).

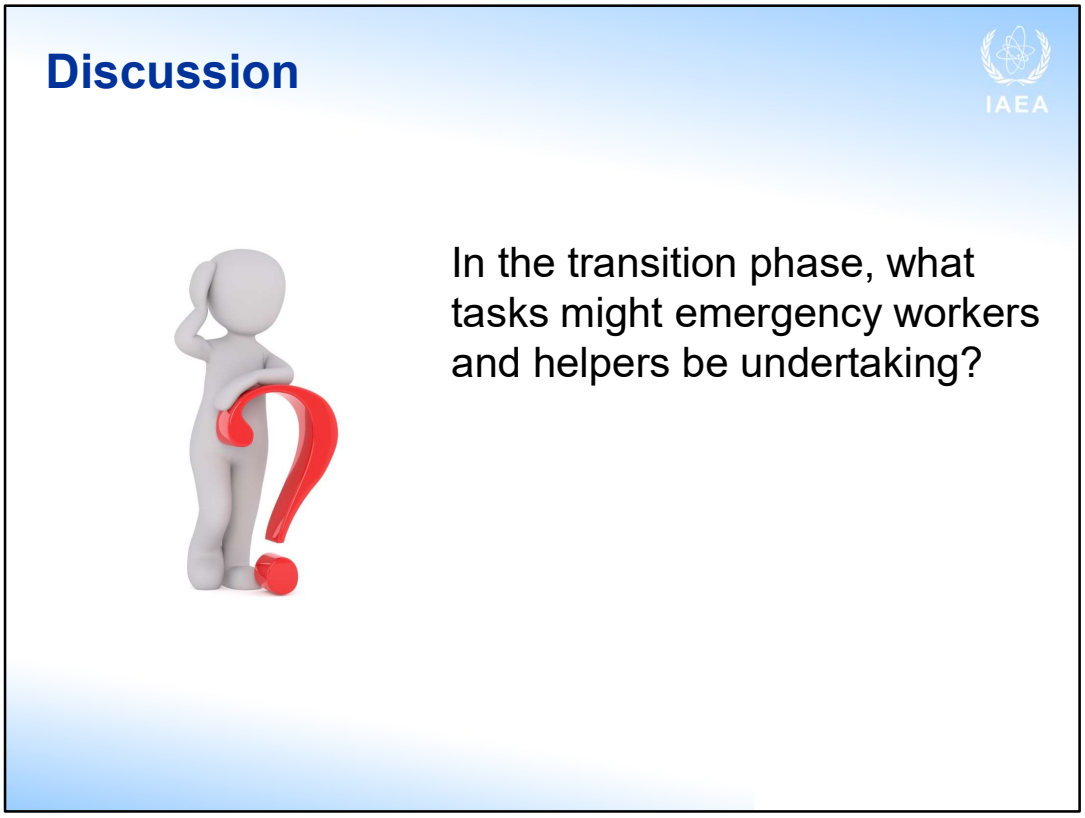


Lecture notes:

As part of the emergency arrangements, the designated response organization(s) should determine:

- What type of work helpers are permitted to be engaged in during the transition phase and what kind of training helpers will need to safely and effectively carry out this work;
- A mechanism for the helpers' engagement (e.g. where and how volunteers from the public may express their interest and willingness to help, how the willingness to help will be documented, what information and instructions the helpers will be provided with, and which organization(s) or tasks they will be assigned to);
- The process for informing helpers about, and training them in, their rights, duties and responsibilities.

Possible questions to help in the planning: Are there certain tasks that helpers should not be allowed to carry out due to hazards or the necessary skills to perform a task quickly (and so to minimize the dose incurred)? Or are there certain areas that should be closed to helpers?



Lecture notes:

Allow for about 3 mins. of discussion.

Emergency workers:

- Employees of the site or contractors implementing actions on site to enable termination of emergency;
- Response managers, fire fighters, drivers/crew of evacuation vehicles, medical personnel; teams responsible for monitoring, decontamination, critical infrastructure restoration, waste management, support (medical, welfare, psycho-social) to the population.

Helpers:

- Restoration of essential infrastructure;
- Handling of conventional waste.

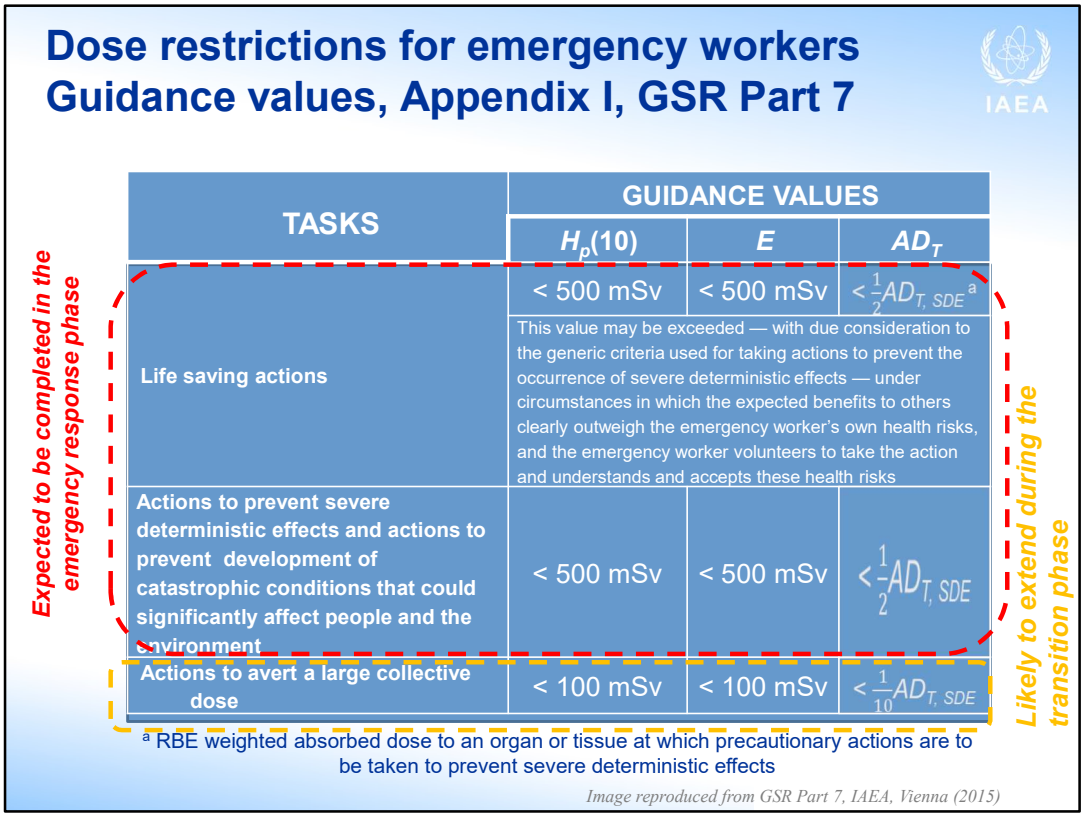
Dose restrictions for emergency workers
GSR Part 7, Requirement 11

- Emergency workers subject to requirements for occupational exposure in planned exposure situation to the extent practicable, except when taking:
  - Life-saving actions;
  - Actions to prevent development of catastrophic conditions and to prevent severe deterministic effects;
  - Actions to avert large collective doses.

Lecture notes:

- As far as possible, emergency workers should be subject to the usual requirements for occupational exposure in planned exposure situation (i.e. maximum 50 mSv effective dose in a single year), except if their tasks involve actions to:
  - Save lives and serious injury;
  - Prevent catastrophic conditions/severe deterministic effects;
  - Avert large collective doses (i.e. to reduce the risk of stochastic effects below levels at which an incidence of radiation induced cancers can be observed).

In such exceptional circumstances, doses above occupational dose limits may be permitted. For the exceptional circumstances outlined, national guidance values shall be established restricting the exposures of emergency workers.



Lecture notes:

This slide reproduces the suggested guidance values provided in GSR Part 7 for the different types of actions:

- Actions to save lives, prevent severe deterministic effects or avert the development of catastrophic conditions that could significantly affect people and the environment are typical during the urgent response phase of a nuclear or radiological emergency. Although the implementation of these actions should be pre-planned, it is expected that the actions would be driven by the prevailing conditions as the emergency evolves. Such actions would likely be carried out early in the emergency response when there is a scarcity of information about the radiological situation where the action is to be performed. Because of the urgency associated with implementing these actions and their importance, detailed planning of the work of emergency workers might not be possible; thus, exposures exceeding the dose limits for occupational radiation protection in planned exposure situations are justified to ensure the net benefit of the overall response efforts.

Lecture notes:

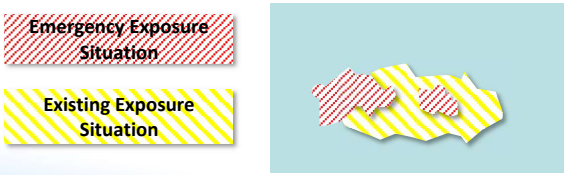
- Actions to avert a large collective dose may extend through the early response phase and into the transition phase of an emergency because of the range of activities that are warranted to allow the timely resumption of social and economic activity.

  The guidance values for restricting the exposure of emergency workers in an emergency response in terms of personal dose equivalent $H_p(10)$ are given for external exposure to strongly penetrating radiation. The values for $H_p(10)$ assume that every effort has been made for protection against external exposure to weakly penetrating radiation and against exposure due to intakes or skin contamination. But as these efforts are never 100 % effective, the total effective dose and the relative biological effectiveness (RBE) weighted absorbed dose to a tissue or organ via all exposure pathways (i.e. both dose from external exposure and committed dose from intakes) need to be estimated as early as possible in a nuclear or radiological emergency. The guidance values for the effective dose and the RBE weighted absorbed dose to a tissue or organ are given for consideration in restricting further exposure in the response to a nuclear or radiological emergency once these doses have been estimated.

FIG*: Guidance values for restricting exposure of emergency workers*, International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015)

Dose restrictions for emergency workers
Transition phase

- Compliance with stringent requirements for emergency workers' protection feasible during the transition phase:
  - Increased knowledge and understanding of the situation;
  - No urgency in decision making;
  - Detailed planning of emergency work possible.
- Simultaneous implementation of different dose restrictions among emergency workers possible:
  - Consistency to be ensured based on the type of tasks, exposure situation where the work is carried out, etc.



Lecture notes:

During the transition phase, knowledge and understanding of the situation where the work needs to be carried out increases, and there is no need to take urgent decisions on the deployment of workers. Thus, any work in the transition phase should be undertaken only after detailed planning.

In 'routine' situations, all those working as emergency services or directly with radiation will likely work in an emergency response under the same regime for their protection for the corresponding tasks. But in the transition phase, we may find some workers still under the emergency exposure situation (especially on the site or in more contaminated areas off-site), while others are in a situation for which the requirements for occupational radiation protection in a planned exposure situation apply. These differences in perceived protection (where different regimes now apply) will need to be carefully managed, as they may give rise to confusion.

Dose restrictions for emergency workers Transition phase (cont'd)

- Example actions to avert large collective dose in the transition phase:
  - Actions to keep the affected facility or source stable;
  - Monitoring (environmental, source, individual).
- Dose restrictions to be applied:

Guidance value *		
$H_p(10)$ **	E ***	AD_T +
<100 mSv	<100 mSv	$\leq \frac{1}{10} AD_{T,\ \text{Table II.1}}$ ++

Image reproduced from GSR Part 7, IAEA, Vienna (2015)

Lecture notes:

Example actions to avert large collective dose that may be taken during the transition phase for which corresponding guidance values apply.

FIG*: Guidance values for restricting exposure of emergency workers*, International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015)

Dose restrictions for emergency workers Transition phase (cont'd)

- Examples of other activities:
  - Remedial actions, including decontamination;
  - Repair of the affected facility and restoration of the essential infrastructure;
  - Management of waste (radioactive, conventional);
  - Monitoring (environmental, source and individual);
  - Medical management of contaminated patients;
  - Implementation of corrective actions.

- **Dose limits** for occupational exposure in planned exposure situation to be applied together with all applicable requirements for such exposure situation.

Lecture notes:

For any other activity, as a result of the time available for detailed planning of work in the transition phase, the protection of emergency workers in the transition phase should be applied stringently. This should be in accordance with the requirements for occupational radiation protection for planned exposure situations (i.e., applying occupational dose limits – a maximum of 50 mSv/year). This should be feasible to achieve through rotation of staff, practice of tasks prior to undertaking them under high dose conditions, etc.

Dose restrictions for emergency workers
Transition phase (cont'd)

- Req. 11 of GSR Part 7 requires that emergency workers who take specific actions in which occupational dose limits are exceeded are:
  - Volunteers (informed consent);
  - Informed on associated health risks and protective measures to apply;
  - Trained.

Lecture notes:

The employers need to ensure that emergency workers who undertake emergency response actions in which the doses received might exceed an effective dose of 50 mSv do so voluntarily; that they have been clearly and comprehensively informed in advance of associated health risks as well as of available protective measures; and that they are, to the extent possible, trained in the actions that they might be required to take.

Dose restrictions for helpers

- Helpers in an emergency are not to be allowed to take actions that could result in their receiving doses in excess of an effective dose of **50 mSv** (Req. 11, GSR Part 7):
  - For the full duration of the emergency work.

Helpers

	E^{***}
Specified activities in the national arrangements, such as: - Restoring essential infrastructure (e.g. roads, public transportation networks) - Management of conventional waste	≤50 mSv

Image reproduced from GSR Part 7, IAEA, Vienna (2015)

Lecture notes:

Paragraph 5.57 of GSR Part 7 limits the exposure of helpers in an emergency to an effective dose of 50 mSv for the full duration of the emergency work.

FIG*: Guidance values for restricting exposure of emergency workers*, International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015)

Female emergency workers who are or who might be pregnant

- IAEA Safety Standards do not limit the involvement of female emergency workers in an emergency response but provide for protection of the fetus in case of actual or possible pregnancy:
  - Informing female emergency worker on the health risks;
  - Applying appropriate dose restrictions in accordance with assigned tasks:
    - Exclude female emergency workers who are or might be pregnant from actions that can result in doses greater than 50 mSv equivalent dose to the fetus;
    - Provide the same protection for the fetus as for members of the public in planned exposure situation.

Lecture notes:

Female emergency workers who are aware that they are pregnant should, in order to provide for an adequate protection for the embryo or fetus, notify the employer. After being notified, the employer has the responsibility to inform the emergency worker of the associated health risks to the fetus and to provide adequate working conditions and protective measures to ensure compliance with the dose restrictions.

Female emergency workers who are or who might be pregnant (cont'd)

- To do so, establish arrangements for:
  - Notification (of pregnancy) by female worker to employer;
  - Providing information by employer on health risk to fetus;
  - Assessing and monitoring conditions in which the female emergency worker might perform assigned emergency tasks;
  - Provision of adequate protective and monitoring equipment;
  - Assessment of equivalent dose to fetus as basis for further work restrictions and identifying need for medical consultation.

Lecture notes:

In order to protect the embryo or fetus, all relevant organizations should make adequate arrangements to:

- Encourage female workers to notify their employer of an actual or suspected pregnancy;
- Inform female workers who are or who might be pregnant of the associated health risks before they undertake the assigned work;
- Assess and monitor the conditions in which female emergency workers who are or who might be pregnant may need to work;
- Ensure that adequate protective equipment is provided to female emergency workers who are or who might be pregnant, and ensure that they are trained in its use;
- Assess the equivalent dose to the embryo or fetus after the emergency work as a basis for determining whether the further involvement of the female emergency worker needs to be restricted and whether medical consultation is warranted.

Dose management during transition phase

- Adequate dose management during the transition phase will call for arrangements to:
  - Register emergency workers and helpers;
  - Continuously monitor the hazardous conditions in which emergency work is performed;
  - Comprehensively plan the expected work while accounting for the prevailing hazardous conditions and the time needed to complete the work;
  - Assess doses via all exposure pathways, as appropriate, as a basis, for example, to apply applicable dose restrictions;
  - Record the doses received.
- Communicate to emergency workers and helpers the doses they received and the associated health hazards.

Lecture notes:

The adequate management of doses to emergency workers and helpers warrants the establishment of a comprehensive system for monitoring and controlling doses, including the use of individual dosimeters or other appropriate methods. IAEA Safety Standards Series No. GSG-7, on Occupational Radiation Protection, provides guidance on monitoring for the assessment of internal and external exposures relevant to occupational radiation protection. To ensure that doses to emergency workers and helpers are adequately managed in the transition phase, all relevant organizations should make arrangements as outlined on the slide.

Discussion

Would radiation monitoring established for occupational radiation protection purposes during a normal operation be sufficient for an emergency exposure situation?

Lecture notes:

Try to elicit reasons of why it is not sufficient and how routine monitoring measures can support the emergency response as well.

Allow for about 3 mins. of discussion.

Just-in-time training for emergency workers and helpers

- Description of the work:
  - How to carry it out under assessed conditions.
- Work area radiological conditions;
- Dosimetry;
- Stay time;
- Protective clothing and respiratory protection;
- Maximum permissible level of radiation and associated health risks;
- Other exposure reduction considerations.

Lecture notes:

The dedicated response organizations should also be responsible for the provision of 'just in time' training to emergency workers not designated in advance and to helpers before they carry out their specified duties. Such briefing/training should include the elements on this slide as a minimum. The briefing/training should be used as an opportunity to obtain informed consent from workers who may exceed usual dose limits in performing exceptional actions (as described on previous slides).

Justification and Optimization

- Justification: Doses to emergency workers and helpers should be considered in the justification of the protection strategy:
  - At the preparedness stage;
  - In adapting the protection strategy during the transition phase.
- Optimization: Applied to the protection of emergency workers and helpers at all times:
  - Driven by pre-set dose restrictions (guidance values);
  - Take into account characteristics and necessity of work to be carried out.

Lecture notes:

- The detriment associated with doses received during the implementation of the protection strategy by emergency workers and helpers should be taken into account when justifying the protection strategy and the specific protective actions within the strategy.
- This consideration should be undertaken at the preparedness stage, as well as in the transition phase, when justifying and optimizing the protection strategy to meet the actual circumstances
- The question of optimization is a challenging one here. Its goal is to ensure that the process of recruiting, designating, briefing and training all emergency workers does not unduly affect the effectiveness and timeliness of their actions.
- This can be best achieved by using pre-designated (and trained) staff as far as possible. However, it will not always be possible, so arrangements are needed for providing adequate briefing and training (just-in-time training) to allow additional emergency workers to be safely and quickly integrated into the response.

Lecture notes:

- At the preparedness stage, the process of optimization should be applied to the protection of emergency workers and helpers and should be driven by pre-set dose restrictions for different types of actions.
- When implementing the protection strategy in the transition phase, the optimization process should be applied for the protection of emergency workers and helpers in the same way as for workers in planned exposure situations.

Optimization Means…

- Respecting limits;
- Not exposing unless it is necessary;
- Reducing internal dose contribution;
- Providing the right equipment;
- Keeping the dose well under the guidance values;
- Rotating personnel.

Lecture notes:

- These are basic principles for the optimization of emergency worker protection. Limits should not be exceeded, except in very special situations. No exposing unless required is basic ALARA (as low as reasonably achievable).
- Reducing internal dose is also a basic principle, but it requires the provision of appropriate equipment, such as respiratory protection. Here, optimization is important; there may not be full respirators available for all emergency workers. Authorities will need to adapt and adjust the level of respiratory protection based on the level and type of hazard, and based on the importance of the tasks to be performed.
- Keeping the dose well below the guidance values is also important. Allowing emergency workers to reach those values means that they will no longer be available to perform other emergency tasks. Rotating emergency workers will help prevent guidance values from being reached by individual workers.

Optimization. Responsibility…

- Applied by relevant organizations (i.e. employers for designated emergency workers) or designated organization(s) (for undesignated emergency workers and helpers);
- Provides input into identifying:
  - Training and information needs;
  - Necessity for ITB, personal protective equipment as well as monitoring equipment, taking into account cases of prolonged exposure;
  - Dose restrictions to be applicable for respective tasks;
  - Necessity for fitness of emergency workers for their intended duties.

Lecture notes:

- Response organizations and other relevant organizations should optimize the protection and safety of emergency workers and helpers in recognition of the limited information available at the preparedness stage, taking into account the anticipated hazardous conditions and expected duties in an emergency response.
- In this context, these organizations should identify the elements listed on the slide to inform the arrangements required to optimize the protection of workers/helpers.

Medical support

- Provision of medical support to all emergency workers and helpers includes:
  - Longer term medical follow up or medical examination and treatment adequate for the doses received in response;
  - Medical care and psychological counseling.
- Based on doses received (>100 mSv) or when requested by worker/helper (should be a right of worker/helper):
  - Would not expect doses in the transition phase to exceed 100 mSv – investigate circumstances if this does occur.

Lecture notes:

- GSR Part 7 provides a basis for a common approach in providing medical support to emergency workers and helpers.
- This approach includes a generic criterion, in terms of received dose, consistent with the criterion for members of the public (an effective dose of 100 mSv in a month), at which longer term medical actions need to be taken. In the transition phase, it is not expected that emergency workers and helpers will receive doses exceeding 100 mSv effective dose in a month.
- If doses of this magnitude are received accidentally, the circumstances that led to this should be investigated, and the emergency worker or helper should be provided with adequate medical treatment.

Lecture notes:

- Such medical actions may include, as necessary, health screening, longer term medical follow-up and counselling aimed at detecting radiation induced health effects early and treating them effectively:
  - Longer term medical follow up: serves to detect early and treat effectively radiation induced health effects, primarily for late stochastic effects;
  - Medical examination and treatment are aimed at diagnosing and treating deterministic effects;
  - Medical care in general to deal with other health effects due, for example, to working in a very stressful environment;
  - Psychological counselling can be support to all of above.
- Irrespective of the doses received, emergency workers and helpers need to have the right to psychological counselling and continuous medical care during the emergency response, including in the transition phase.
- Thus, the emergency arrangements should be such that both psychological counselling and continuous medical care can be provided, and the organizations and facilities responsible for providing these services should be identified in preparedness.

After emergency is terminated

- Relevant requirements for occupational exposure in a planned exposure situation are applicable.

Lecture notes:

- A planned exposure situation is a situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure from a source. Since provisions for protection and safety can be made before embarking on the activity concerned, associated exposures and their probabilities of occurrence can be restricted from the outset.
- The primary means of controlling exposure in planned exposure situations is by good design of installations, equipment and operating procedures. In planned exposure situations, a certain level of exposure is expected to occur.
- After the transition from an emergency exposure situation to an existing or planned exposure situation has been decided, dose limits for occupational exposure in line with GSR Part 3 (i.e., a maximum dose limit of 50 mSv/year) should be applied for workers undertaking relevant work.

Discussion

How would you classify and protect employees (teachers in schools and medical staff of hospitals) in an affected area preparing to reopen their facilities or services, so people can return after being evacuated/relocated?

Lecture notes:

As emergency workers (designated or not) and helpers have been discussed, ask participants where this other group of workers belong?

Allow for about 3 mins. of discussion.

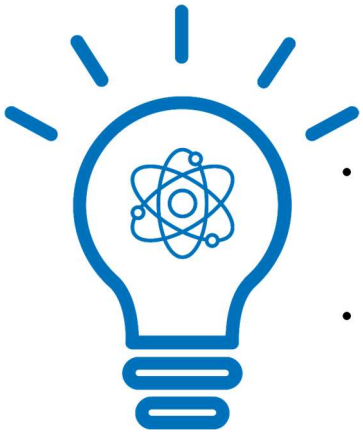
Other workers in the transition phase

- Those carrying out some work within an affected area and working for an employer to prepare the area for the return of the population and/or for reopening of special facilities, public services etc.
  - Teachers in schools and medical staff of hospitals in an affected area;
  - Other employees of special facilities or public services preparing for reopening in the affected area.
- Responsibility for their protection as members of the public remains with their employer:
  - Subject to applicable reference level for public exposure, with account taken of the fact that some of these workers may also reside in the affected area (and thus spend their entire time within the affected area, as workers and as members of the public).

Lecture notes:

- In the transition phase, other categories of workers may carry out work within an affected area. Examples include teachers and the medical staff of hospitals working in an affected area to prepare that area for the return of the population.
- Such workers should be protected by their employers at the same level as members of the public within the area: this means they should be subject to the reference levels agreed to be applied for members of the public to allow for the transition to take place (e.g., reference level of 20 mSv/year – or a value adopted nationally).
- The application of the reference level for the residual dose for such workers should take into account that some of these workers may also reside in the affected area (and thus spend their entire time within the affected area as workers and as members of the public).

Summary



- Difference between emergency workers and helpers relates to employment status, rights and responsibilities as regards the response tasks performed.
- Arrangements need to be in place for protection of workers and helpers (whether pre-designated or not).
- During the transition, it should be ensured that once the emergency is terminated, workers' protection complies with requirements for occupational exposure in a planned exposure situation.

Lecture notes:

Thank you!