



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

Arrangements for the Termination of a Nuclear or Radiological Emergency

Protection of Emergency Workers and Helpers in the Transition Phase

Lecture 07

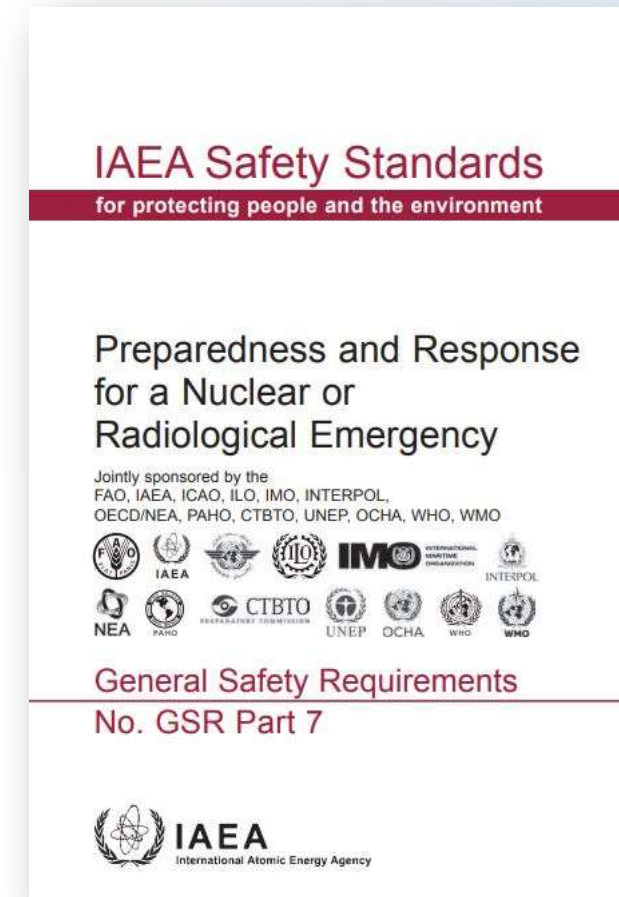
Introduction.

GSR Part 7, Requirements 11 and 18



*“The government shall ensure that
arrangements are in place to
protect emergency workers and to
protect helpers in an emergency.”*

*“Once the emergency is terminated,
all workers undertaking relevant work
shall be subject to the relevant
requirements for occupational
exposure in planned exposure
situations ...”*



Introduction.

GSG-11, Section 3, General prerequisites



*“Before the termination of the emergency, **it should be confirmed** that the **requirements for occupational exposure in planned exposure situations established in Section 3 of GSR Part 3 can be applied for all workers who will be engaged in recovery operations ...**”*

IAEA Safety Standards

for protecting people and the environment

Arrangements for the Termination of a Nuclear or Radiological Emergency

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General Safety Guide

No. GSG-11



Introduction.

Challenges in the transition phase



- Severe radiological conditions at the site;
- Large variations in the radiological conditions off-site;
- Existence of different exposure situations simultaneously in different geographical areas;
- Large number of emergency workers with diverse backgrounds and knowledge;
- Numerous members of the public offering their help.

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

Emergency workers and helpers?

Emergency worker: *“A person having specified duties as a worker in response to an emergency.”*

Helpers: *“Members of the public who willingly and voluntarily help in response to a nuclear or radiological emergency.”*

GSR Part 7



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)

Who are helpers in an emergency?

“Members of the public who willingly and voluntarily help in response to a nuclear or radiological emergency.”

GSR Part 7

- Helpers **are aware** that they may be exposed to radiation while helping in response to nuclear or radiological emergency.



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.



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.



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.



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.

Discussion



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

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.

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.

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.

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.

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.

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.

Helpers (cont'd)

- Arrangements should include:
 - **Mechanism** to be used for involvement of helpers:
 - Where and how their interest can be expressed;
 - How their willingness to do so will be documented;
 - How it will be determined to which organization or for what tasks they will be assigned;
 - What information and instructions will be given; when and how they are given;
 - Process for informing them of their rights, duties and responsibilities.
 - What **type of work** helpers will be permitted to be engaged in during the transition phase.

Discussion



In the transition phase, what tasks might emergency workers and helpers be undertaking?

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.

Dose restrictions for emergency workers

Guidance values, Appendix I, GSR Part 7



Expected to be completed in the
emergency response phase

| TASKS | GUIDANCE VALUES | | |
|--|--|-----------|------------------------------|
| | $H_p(10)$ | E | AD_T |
| Life saving actions | < 500 mSv | < 500 mSv | $< \frac{1}{2}AD_{T, SDE}^a$ |
| Actions to prevent severe deterministic effects and actions to prevent development of catastrophic conditions that could significantly affect people and the environment | This value may be exceeded — with due consideration to the generic criteria used for taking actions to prevent the occurrence of severe deterministic effects — under circumstances in which the expected benefits to others clearly outweigh the emergency worker's own health risks, and the emergency worker volunteers to take the action and understands and accepts these health risks | | |
| | < 500 mSv | < 500 mSv | $< \frac{1}{2}AD_{T, SDE}$ |
| Actions to avert a large collective dose | < 100 mSv | < 100 mSv | $< \frac{1}{10}AD_{T, SDE}$ |

Likely to extend during the
transition phase

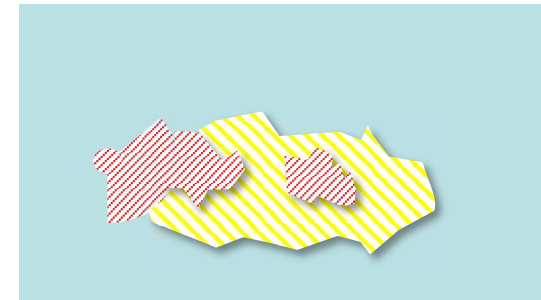
^a RBE weighted absorbed dose to an organ or tissue at which precautionary actions are to be taken to prevent severe deterministic effects

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.



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 | $<\frac{1}{10}AD_{T, Table II.1}^{++}$ |

Image reproduced from 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.

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.

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: <ul style="list-style-type: none">- Restoring essential infrastructure (e.g. roads, public transportation networks)- Management of conventional waste | $\leq 50 \text{ mSv}$ |

Image reproduced from 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.

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.

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.

Discussion



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

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.

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.

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.

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.



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.



After emergency is terminated

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



Discussion



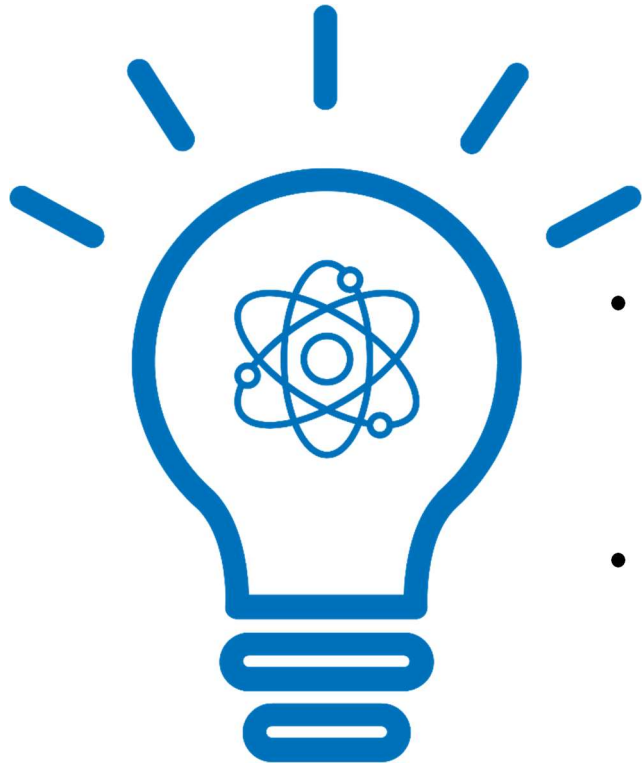
How would you classify and protect employees (teachers in schools and medical staff of hospitals) in an affected area preparing to reopen their facilities or services, so people can return after being evacuated/relocated?



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).

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.



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Thank you!