IAEA
International Atomic Energy Agency
Atoms for Peace and Development

International Training Course
on the IAEA Safety Standards
at Tokai University, 11-14 March 2024

GSR Part 7
Preparedness and Response for a Nuclear or Radiological Emergency

Frederic Stephani
Emergency Preparedness Officer
Incident and Emergency Centre
Department of Nuclear Safety and Security
IAEA

Incident and Emergency Centre (IEC)

Global focal point

for international emergency preparedness, communication and response to nuclear and radiological incidents and emergencies, regardless of whether they arise from accident, negligence or deliberate act

and

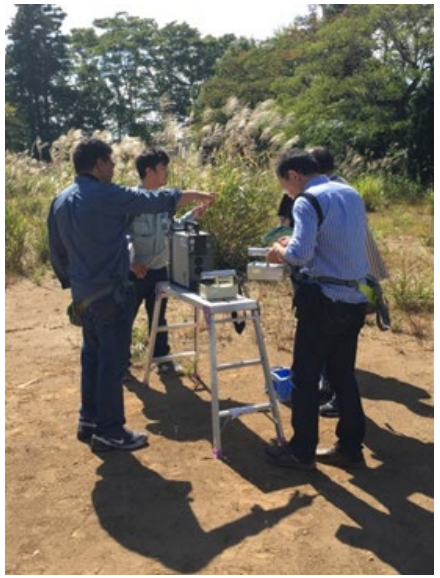
world's centre for coordination of international emergency preparedness and response assistance

Roles in Emergency Response

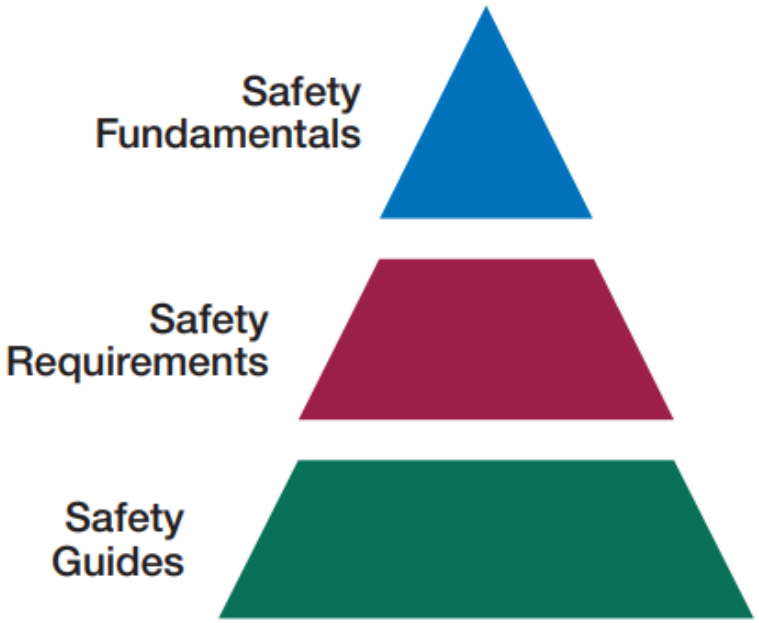
- Notification and official information exchange
  - Through officially designated Contact Points
- Provision of public information
  - Timely, clear, factually correct and easily understandable
- Assessment and prognosis
  - Technical understanding of the situation and its possible developments
- Provision of assistance on request
  - Provide/facilitate and coordinate
- Coordination of inter-agency response
  - 'Many voices – one message'

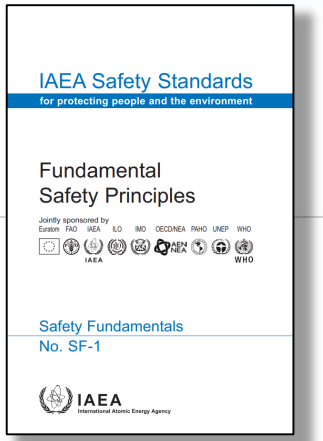
Roles in Emergency Preparedness

- Development/revision of EPR Safety Standards, guidance and tools
- EPR Capacity Building
- Emergency Preparedness Review (EPREV)
- IAEA's in-house and inter-agency preparedness

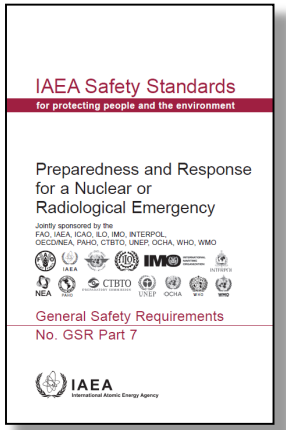


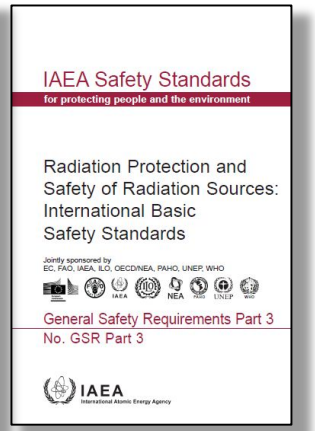
Safety Standards in EPR Overview

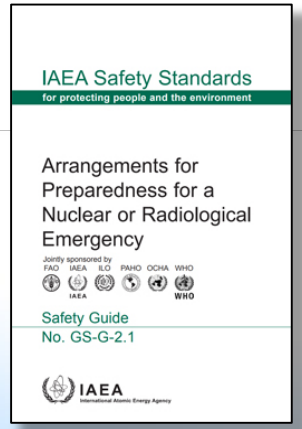


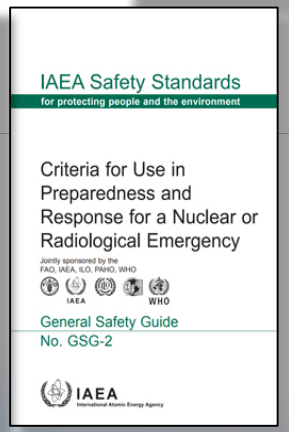


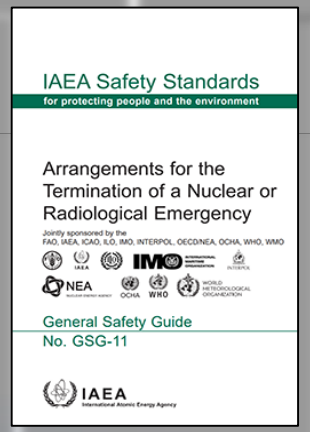
Principle 9: *"Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents."*

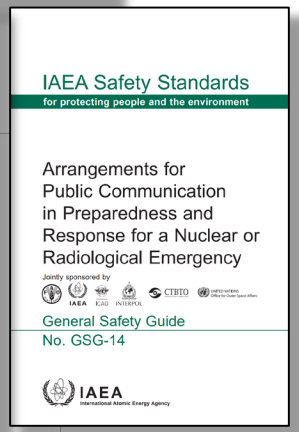


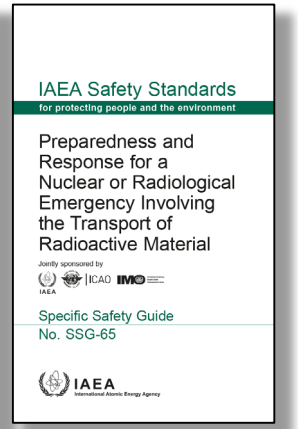








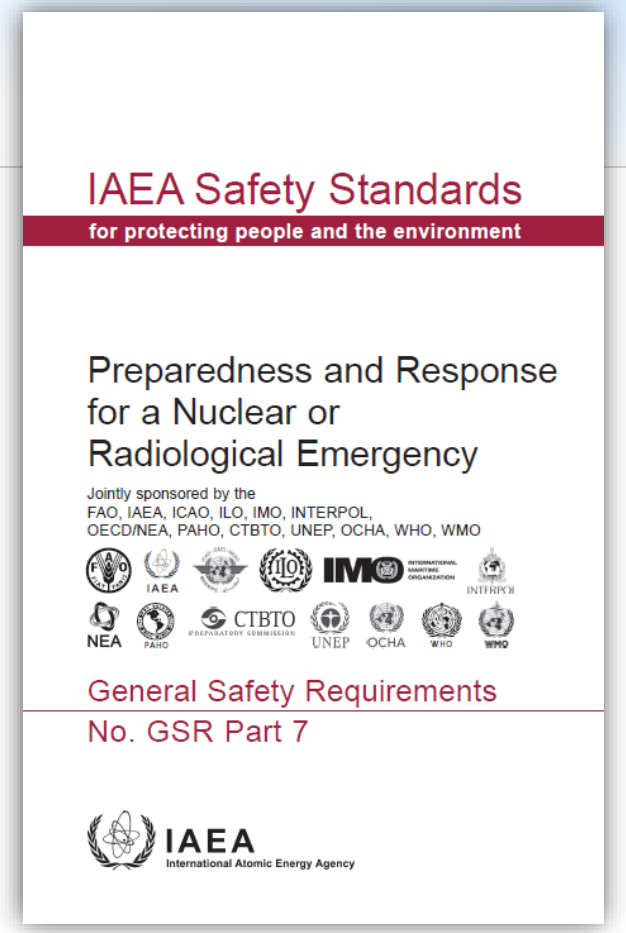




Safety Requirements No. GSR Part 7

Establishes requirements for an adequate level of preparedness and response for a nuclear or radiological emergency, irrespective of its cause

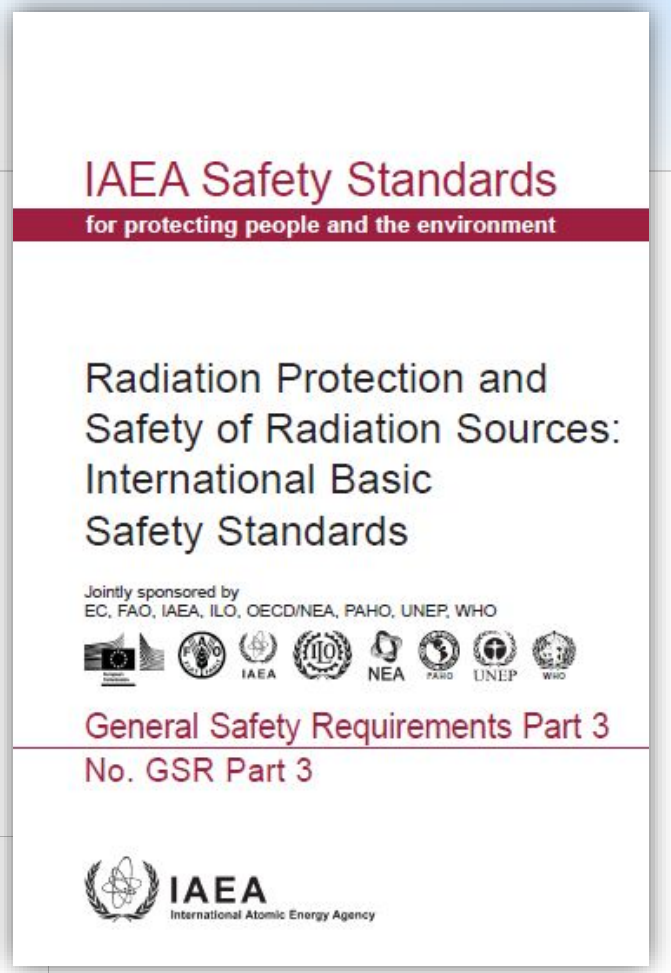
- Requirements level: **'Shall'** or 'What' to be done
- Published in 2015
- Co-sponsored by CTBTO, FAO, IAEA, ICAO, ILO, IMO, Interpol, OECD/NEA, PAHO, UNEP, UNOCHA, WHO, WMO
- Supersedes No. GS-R-2 issued in 2002



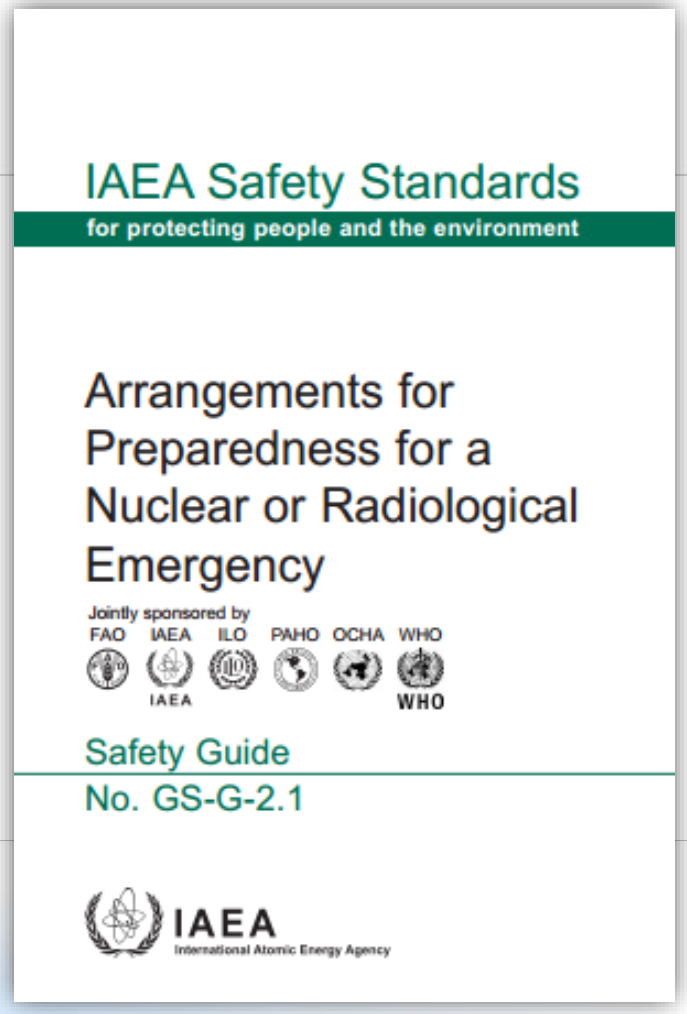
Safety Requirements No. GSR Part 3: Section 4

Relevant requirements in Section 4 on Emergency exposure situations

- Requirements level: **'Shall'** or 'What' to be done
- Published 2014
- Co-sponsored by EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO



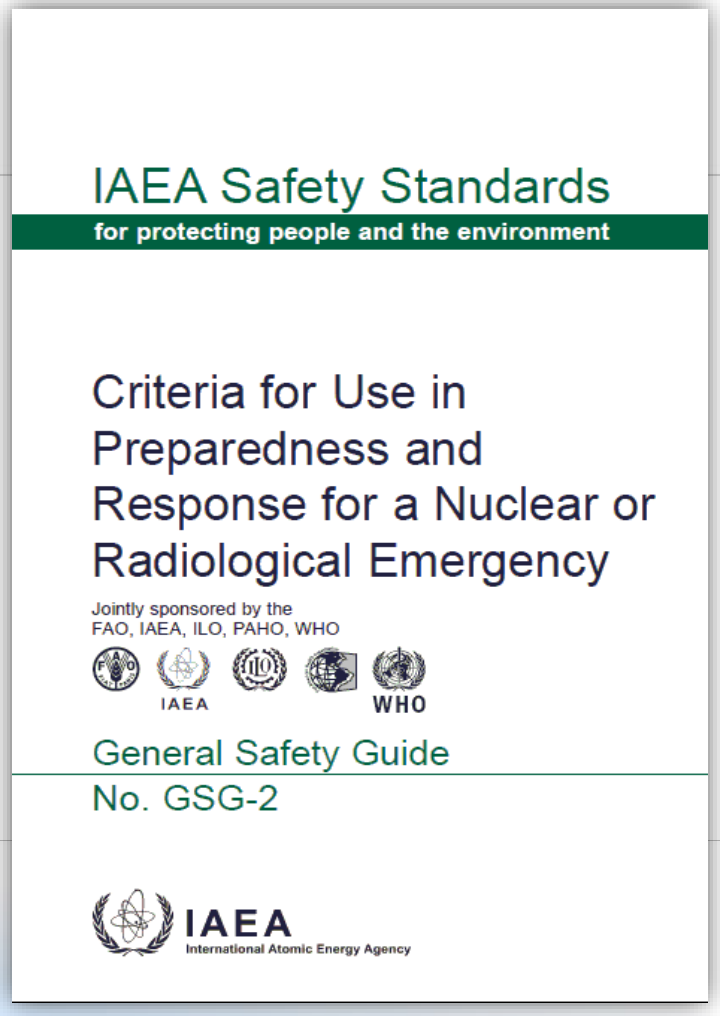
Safety Guides No. GS-G-2.1



Provides recommendations on implementation of specific safety requirements that were established in GS-R-2

- Recommendations level: **'Should'** or 'How' to be done
- Published in 2007
- Co-sponsored by FAO, IAEA, ILO, OCHA, WHO, PAHO
- Currently under revision

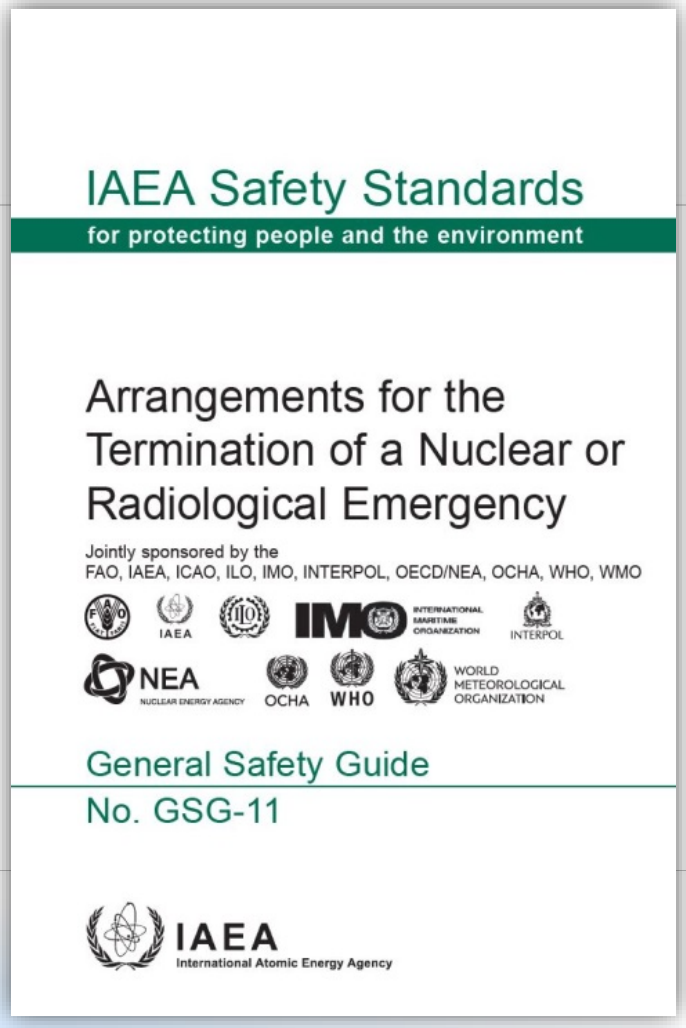
Safety Guides No. GSG-2



Provides guidance on criteria for taking protective actions and other response actions in a nuclear or radiological emergency

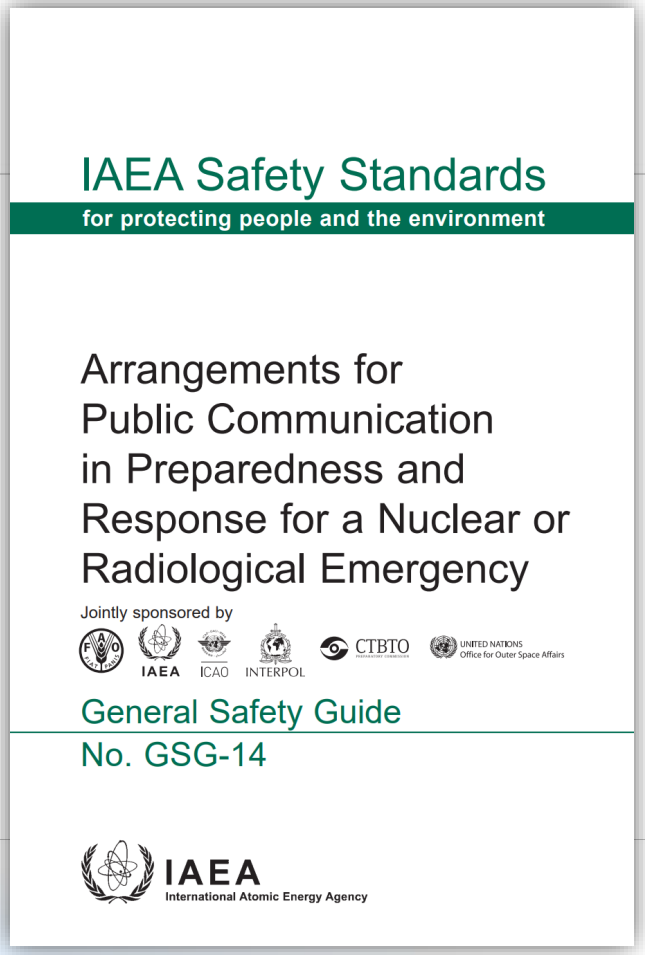
- Recommendations level: **'Should'** or 'How' to be done
- Published in **2011**
- Co-sponsored by FAO, IAEA, WHO, PAHO, ILO
- Currently under revision

Safety Guides No. GSG-11



- Provides guidance and recommendations on:
  - Developing arrangements, as part of overall emergency preparedness efforts, for transition to either an existing exposure situation or a planned exposure situation, as appropriate, and for the termination of the emergency
  - The primary objective and prerequisites for enabling the emergency to be terminated
- Applies for any nuclear or radiological emergency irrespective of the cause
- Published in March 2018
- Joint sponsorship: FAO, IAEA, ICAO, IMO, ILO, INTERPOL, OECD/NEA, UNOCHA, WHO, WMO

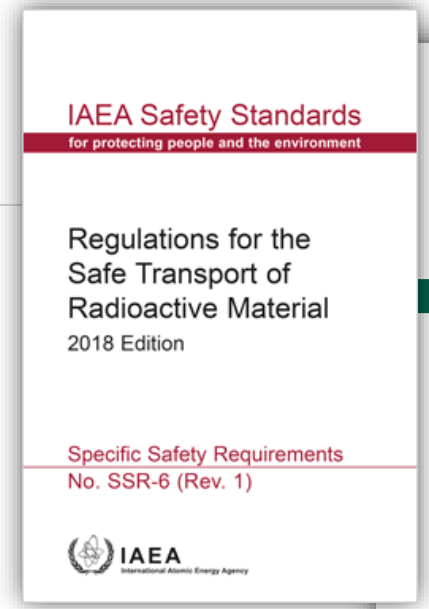
Safety Guides No. GSG-14

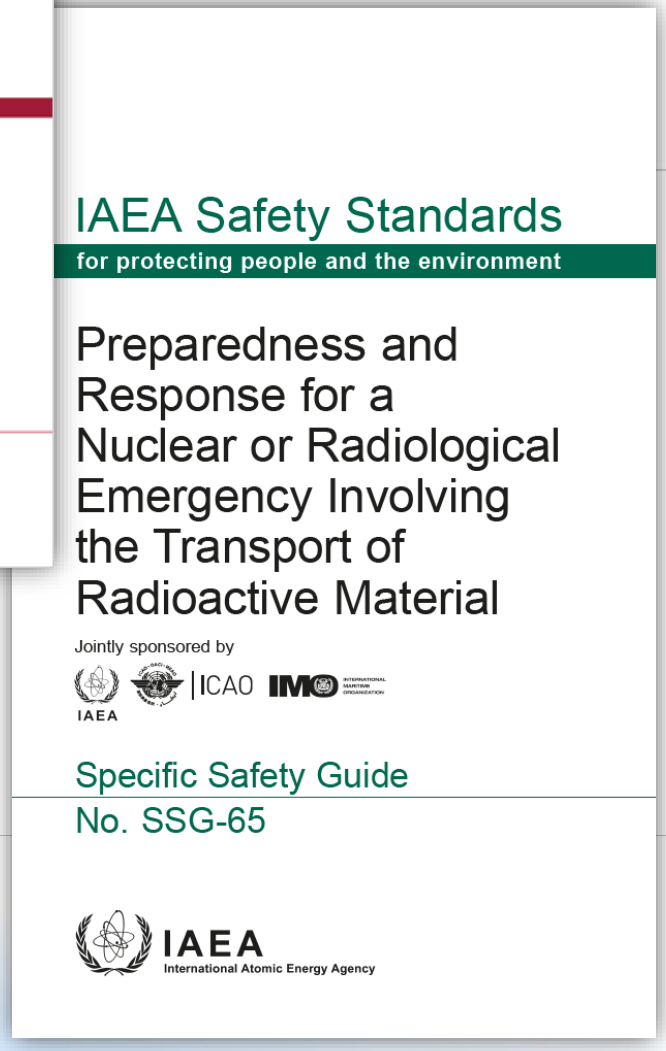


Provides guidance on applying requirements 10 and 13 in GSR Part 7, and developing and implementing effective communication plans to communicate with the public in preparedness and response to a nuclear or radiological emergency

- Recommendations level: **'Should'** or 'How' to be done
- Published in **2020**
- Co-sponsored by FAO, IAEA, ICAO, INTERPOL, CTBTO, UNOOSA

Safety Guides No. SSG-65



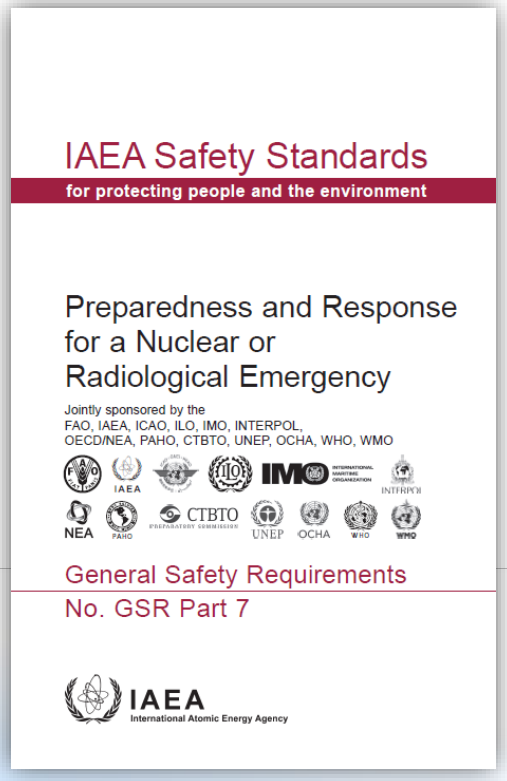


Guidance and recommendations on the implementation of the requirements established primarily in GSR Part 7 and SSR 6 in order to prepare for, and respond to, emergencies during the transport of radioactive material

- Recommendations level: **'Should'** or 'How' to be done
- Published in **2022**
- Co-sponsored by IAEA, ICAO, IMO

Safety Requirements in EPR:

Overview of the IAEA Safety Standards No. GSR Part 7



- 26 requirements
- 3 main sections:
  - General requirements
  - Functional requirements
  - Requirements for infrastructure

Goals of Emergency Preparedness

To have:

- An adequate capability in place at the operating organization and local, regional, national and international (where appropriate) levels, for the effective response to a nuclear or radiological emergency

- Integrated set of infrastructural elements that include, but are not limited to:
  - *authority and responsibilities*
  - *organization and staffing*
  - *coordination*
  - *plans and procedures*
  - *tools, equipment and facilities*
  - *training, drills and exercises*
  - *management system*

Goals of Emergency Response

- To regain control of the situation and to mitigate consequences
- To save lives
- To avoid or minimize severe deterministic effects
- To render first aid, to provide critical medical treatment and to manage the treatment of radiation injuries
- To reduce the risk of stochastic effects
- To keep the public informed and to maintain public trust
- To mitigate, to the extent practicable, the non-radiological consequences
- To protect, to the extent practicable, property and the environment
- To prepare, to the extent practicable, for the resumption of normal social and economic activity

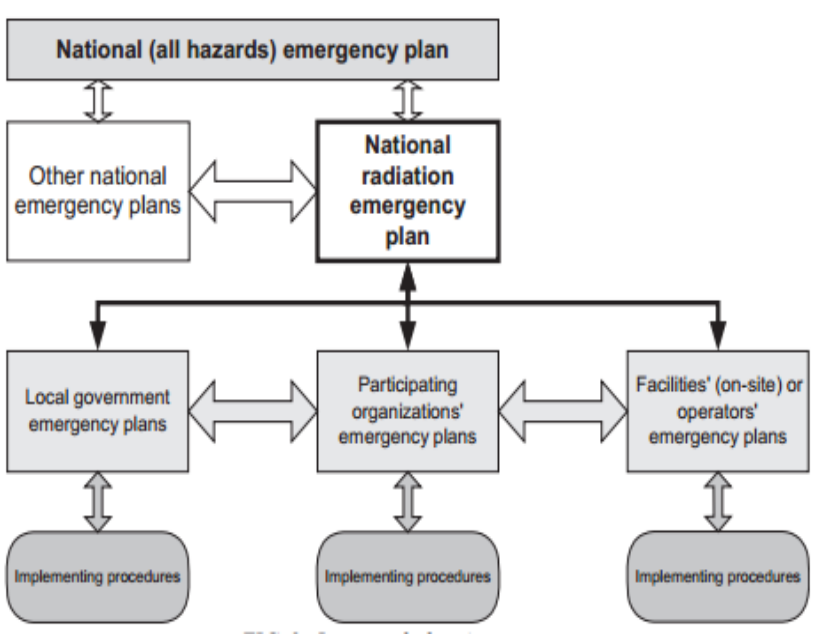
Safety Requirements in EPR Structure

- **General requirements:** *to be fulfilled before any emergency planning can start*
- **Functional requirements:** *functions to be performed for response to be effective and goals of emergency response to be met*
- **Requirements for infrastructure**: *for infrastructural elements essential for performing response functions*

General Requirements

#1. Emergency Management System

- Emergency management system
  - *Response organizations*
- Management system
  - *Operating organization*



✓To enable an effective response at all levels

✓To be integrated under an all-hazards approach

General Requirements

#2. Roles and Responsibilities

- Clear allocation of roles and responsibilities in EPR:
  - Government
  - Regulatory body
  - Operating organizations
  - Response organizations

- National Coordinating Mechanism to ensure, at all levels:
  - Roles and responsibilities are well understood
  - Coordination and consistency among emergency arrangements
  - Enforcement and compliance

General Requirements

#4. Hazard Assessment (1/2)

- *"Assessment of hazards associated with facilities, activities or sources within or beyond the borders of a State in order to identify:*
  - *Those events and the associated areas for which protective actions and other response actions may be required within the State;*
  - *The actions that would be effective in mitigating the consequences of such events."*

- Five emergency preparedness categories (EPCs) are established according to the level and characteristics of hazard, and corresponding stringency of requirements for preparedness and response arrangements (Table I in GSR Part 7)
  - EPCs provide for hazard categorization
  - EPC provides basis for graded approach
  - For facilities and activities belonging to an EPC: similar planning, concept of operations, on-site and off-site response actions

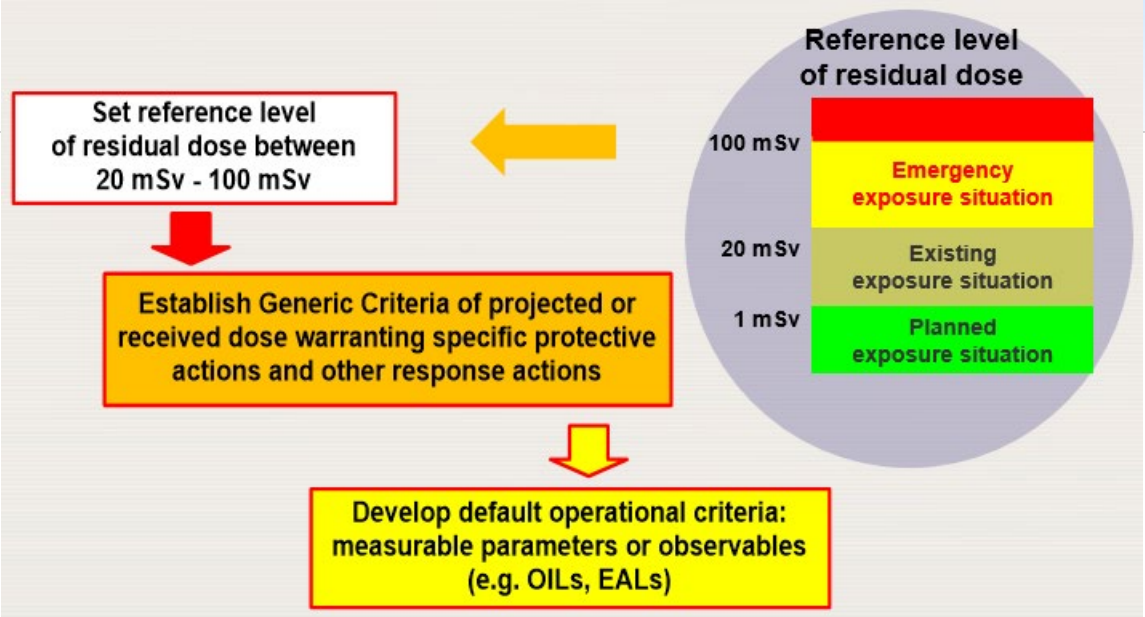
General Requirements - #4. Hazard Assessment (2/2)

EPC	Description
I	Facilities, for which postulated on site events could give rise to **severe deterministic effects off the site** that would warrant **precautionary urgent protective actions, urgent protective actions or early protective actions, and other response actions** to achieve the goals of emergency response
II	Facilities, for which postulated on site events could give rise to **doses to people off the site** that would warrant **urgent protective actions or early protective actions and other response actions** to achieve the goals of emergency response *** No consideration given to events giving rise to severe deterministic effects off the site**
III	Facilities, for which postulated on-site events could warrant **protective actions and other response actions on the site** to achieve the goals of emergency response *** No consideration given to events warranting urgent protective actions or early protective actions off the site**
IV	**Activities and acts** that could give rise to a nuclear or radiological emergency that could warrant **protective actions and other response actions** to achieve the goals of emergency response in an unforeseen location
V	**Areas within emergency planning zones and emergency planning distances** in a State for a facility in category I or II located in another State

General Requirements

#5. Protection Strategy

- Justified and optimized set of protective actions and other response actions to be taken in a nuclear or radiological emergency to meet the goals of emergency response
- To be developed:
  - At the preparedness stage
  - Based on the results of hazard assessment and the potential consequences of an emergency if it is to occur
  - Involving all interested parties, as appropriate
- To be implemented:
  - Safely in response to an emergency
  - Through the implementation of emergency arrangements



Functional requirements (1)

#6. Managing emergency response operations

- Smooth transition from normal to emergency operations
- Clearly specified and unified command and control system
  - including decision-making
- Coordination at any level
  - including across border where appropriate

#7. Identifying, notifying and activating

- Identification (Emergency Action Levels)
- Emergency classification for facilities
  - General emergency, Site area emergency, Facility emergency, Alert
- Notification and activation of pre-planned response
  - On-site and off-site (including across border) as appropriate

Functional Requirements (2)

#8. Performing mitigatory actions

- Actions to be taken to reduce the potential for conditions to develop that would result in exposure or a release of radioactive material requiring response actions on-site or off-site
- Provision of off-site emergency services to support on-site response

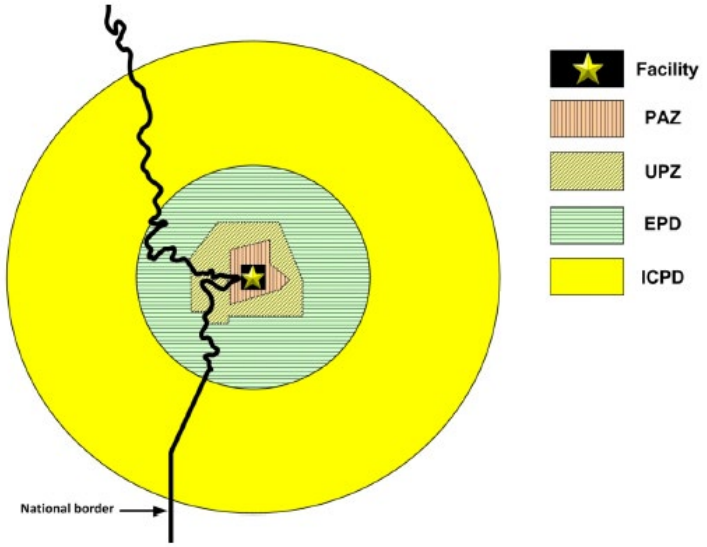
#9. Taking urgent protective actions and other response actions

- To avoid severe deterministic effects and to reduce the risk for stochastic effects (e.g. through sheltering, evacuation, ITB, restrictions on food and comodities, preventing inadvertent ingestion)
- Within the first few hours that follow a release to be effective; effectiveness is significantly reduced by delay
  - NPP – Severe fuel damage: act before a release, if possible ("precautionary" urgent protective actions)
    - Failure to do so could result in deaths and other severe deterministic effects off-site

Functional Requirements (3)

#9. Taking urgent protective actions and other response actions

- Off-site emergency planning zones and distances for facilities in Category I&II:
  - Precautionary action zone (PAZ)
  - Urgent protective action planning zone (UPZ)
  - Extended planning distance (EPD)
  - Ingestion and commodities planning distance (ICPD)



Arrangements to be ensured at the preparedness stage

Functional Requirements (3)

#9. Taking urgent protective actions and other response actions

Precautionary Action Zone (PAZ)

for **EPC I**, for which arrangements shall be made **for taking urgent protective actions** and other response actions, **before any significant release** of radioactive material occurs, **based on conditions at the facility** (i.e., conditions leading to the declaration of a general emergency), **to avoid or to minimize severe deterministic effects**

Suggested EPZ sizes for EPC I & II facilities

Power	PAZ	UPZ
EPC I Reactors		
≥1000 MW_{th}	3-5 km	15-30 km
100-1000 MW_{th}		
EPC II Reactors		
10-100 MW_{th}	None	0.5-5 km
2-10 MW_{th}		0.5 km

Functional Requirements (3)

#9. Taking urgent protective actions and other response actions

Urgent protective action Planning Zone

for **EPCs I and II**, for which arrangements shall be made **to initiate urgent protective actions** and other response actions, **if possible before any significant release** of radioactive material occurs, **on the basis of conditions at the facility**, and after a release occurs, on the basis of monitoring and assessment of the radiological situation off the site, **in order to reduce the risk of stochastic effects**

Suggested EPZ sizes for EPC I & II facilities

Power	PAZ	UPZ
EPC I Reactors		
≥1000 MW_{th}	3-5 km	15-30 km
100-1000 MW_{th}		
EPC II Reactors		
10-100 MW_{th}	None	0.5-5 km
2-10 MW_{th}		0.5 km

Functional Requirements (3)

#9. Taking urgent protective actions and other response actions

Extended Planning Distance

for EPC I and II (beyond the UPZ), for which arrangements shall be made **to conduct monitoring and assessment of the radiological situation off the site** to identify areas, within a period of time that would allow the risk of stochastic effects in the areas to be effectively reduced by taking protective actions and other response actions **within a day to a week or to a few weeks following a significant radioactive release**

Suggested EPD sizes for EPC I & II facilities

Power	EPD	ICPD
EPC I Reactors		
≥1000 MW_{th}	100 km	300 km
100-1000 MW_{th}	50 km	100 km
EPC II Reactors		
Under development		

Functional Requirements (3)

#9. Taking urgent protective actions and other response actions

Ingestion and Commodities Planning Distance (ICPD)

for EPC I or II (beyond the EPD), for which arrangements shall be made to take response actions for **protecting the food chain and water supply** as well as for **protecting commodities other than food** from contamination following a significant radioactive release and for **protecting the public from the ingestion of food, milk and drinking water and from the use of commodities other than food** with possible contamination following a significant radioactive release

Suggested EPD sizes for EPC I & II facilities

Power	EPD	ICPD
EPC I Reactors		
≥1000 MW_{th}	100 km	300 km
100-1000 MW_{th}	50 km	100 km
EPC II Reactors		
Under development		

Functional requirements (4)

#10. Providing instructions, warnings and associated information

✓ To potentially or actually affected public

EPC I, II & V

- In normal operations & at preparedness stage:
  - Identify target population groups
  - Communicate to them in understandable language:
    - Potential for an emergency and hazards associated
    - Arrangements in place to protect them (warning, actions to take)
- In an emergency
  - Warn them and instruct them what to do

EPC III & IV

✓ To provide invoration and instructions to identify people who may have been affected by a nucl. or rad. Emergency and may need response actions

Functional requirements (5)

#11. Protecting emergency workers and helpers

- Emergency worker
  - Worker with a duty in emergency response, e.g.:
    - operating personnel, directly or indirectly employed
    - first responders, drivers & crews of evacuation vehicles
  - Designation prior to the emergency & fitness for duty
    - Integration of those not designated in advance
- Helper in an emergency
  - Volunteers from the public
    - Integration and protection as for emergency workers not designated in advance

Provisions for protection:

- Trained in advance (if designated) / 'just in time' training (if not designated)
- Dose received is managed, controlled and recorded
- Necessary protective and monitoring equipment is provided;
- ITB is provided, if it is needed
- Informed consent (when appropriate)
- Arrangements for medical examination, longer term medical actions, psychological counselling

Requirement for Restricting Exposure of Emergency Workers (GSR Part 7, para. 5.55)

"The operating organization and response organizations shall ensure that no emergency worker is subject to an exposure in an emergency that could give rise to an effective dose in excess of 50 mSv other than:

(1) For the purposes of saving human life or preventing serious injury; [< 500 mSv]

(2) When taking actions to prevent severe deterministic effects or actions to prevent the development of catastrophic conditions that could significantly affect people and the environment; [< 500 mSv]

(3) When taking actions to avert a large collective dose." [< 100 mSv]

Functional requirements (6)

#12. Managing the medical response

- ✓ **Medical screening and triage, medical treatment and longer term medical actions for those affected in the emergency**
  - Provision of first aid, triage, transportation
  - Specialized treatment of overexposed resulting in severe deterministic effects
  - Dose estimation
  - Early detection and treatment of stochastic effects among the exposed population

- ✓ **Medical practitioners make appropriate notifications and implement the response actions**
  - Presentation of medical symptoms of radiation exposure
  - Other effects indicating possible radiological emergency

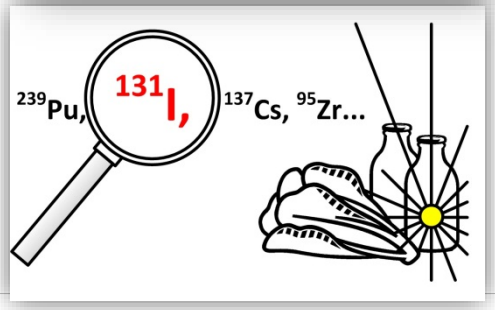
Functional requirements (7)

#13. Communicate with the public throughout the emergency

- ✓ Provide timely, clear, factually correct information
  - Account for loss of usual communication
  - Account for any sensitive information
- ✓ Develop a system to place health hazards in perspective:
  - To support informed decisions concerning emergency response actions to be taken
  - To help assure that actions taken do more good than harm
  - To address public concerns regarding health consequences (e.g., “Am I safe?”)
- ✓ Monitor and address misleading information and actions taken beyond actions that are warranted
- ✓ Respond to enquiries from the public and news media

Functional requirements (8)

#14. Taking early protective actions and other response actions



- To reduce the risk of stochastic effects (e.g., through restrictions on food and commodities, relocation, prevention of inadvertent ingestion)
- Within days to weeks and still be effective on the basis of monitoring and assessment
- Develop monitoring strategy and use Operational Intervention Levels (OILs)
- Specific to emergency planning distances (EPD, ICPD)
  - Provisions to extend areas within EPD & ICPD if needed
- **Access control** and **restriction control** for areas in which evacuations and relocations are carried out

Functional requirements (9)

#15. Managing radioactive waste during an emergency

- ✓ Ensure safe and effective management of radioactive waste
  - Do not compromise protection strategy
  - Consider, at preparedness stage, its impact on waste production
- ✓ Minimize the amount of material declared as radioactive waste
- ✓ Ensure method of identifying appropriate storage options and sites
- ✓ Respect national policy and strategy for rad. waste management
- ✓ Consider management of contaminated human and animal remains

Image reproduced from 'The Radiological Accident in Goiânia', IAEA , Vienna (1988)

Functional requirements (10)

#16. Mitigating the non-radiological consequences

- Adverse psychological, social and economic consequences
- May arise from emergency itself or from actions taken

✓ Consider them in development of protection strategy

✓ Provide the public with:

  - Information and place the health hazard in perspective
  - Medical and psychological support
  - Social support

✓ Protect international trade

✓ Identify and address inappropriate actions

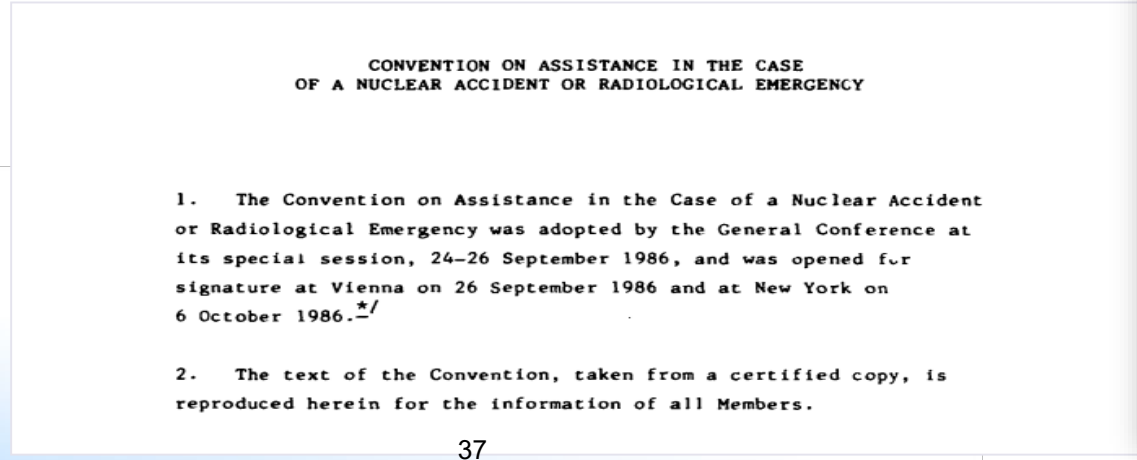
Functional requirements (11)

#17. Requesting, providing and receiving international assistance

- On the basis of multilateral instruments (e.g., Assistance Convention) or bilateral arrangements

To:

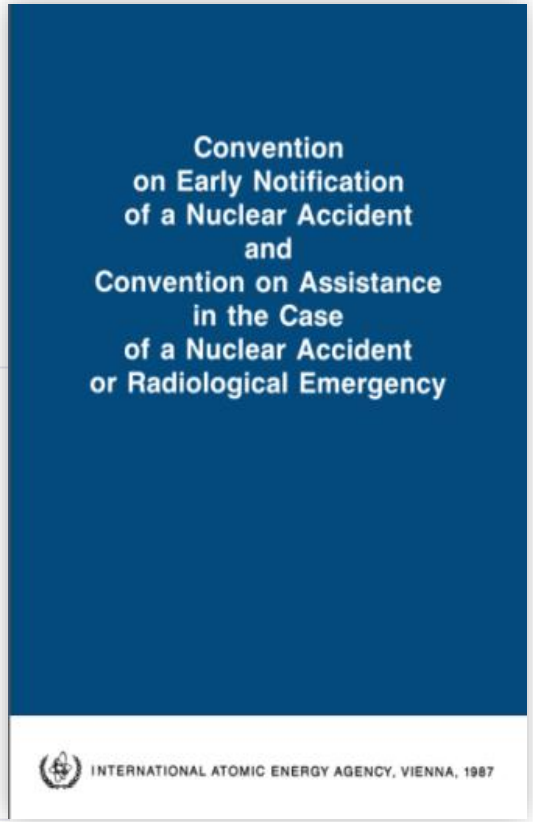
- request international assistance when needed
- receive assistance requested
- timely respond to request for assistance



CONVENTION ON ASSISTANCE IN THE CASE
OF A NUCLEAR ACCIDENT OR RADIOLOGICAL EMERGENCY

1. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency was adopted by the General Conference at its special session, 24-26 September 1986, and was opened for signature at Vienna on 26 September 1986 and at New York on 6 October 1986.*/

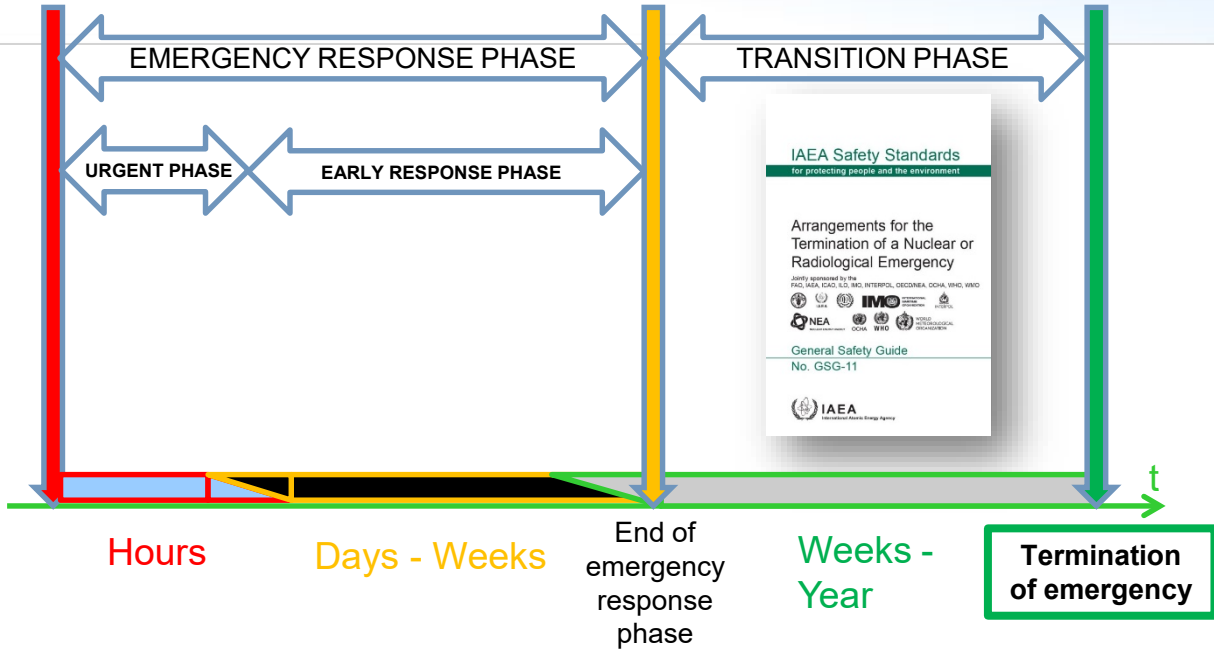
2. The text of the Convention, taken from a certified copy, is reproduced herein for the information of all Members.



Functional requirements (12)

#18. Terminating a nuclear or radiological emergency

- ✓Prepare to **terminate** the emergency
  - Recovery
  - Transition to existing or planned exposure situation
- ✓ Ensure **consultation with interested parties**
- ✓ **Adjust protective actions and other actions**
- ✓**Inform the public**
- ✓Ensure clear roles, responsibilities, organization and guidance



Functional requirements (13)

#19. Analysis of emergency and emergency response

- Identify root causes to prevent similar emergencies to occur
- Identify improvements needed in emergency arrangements

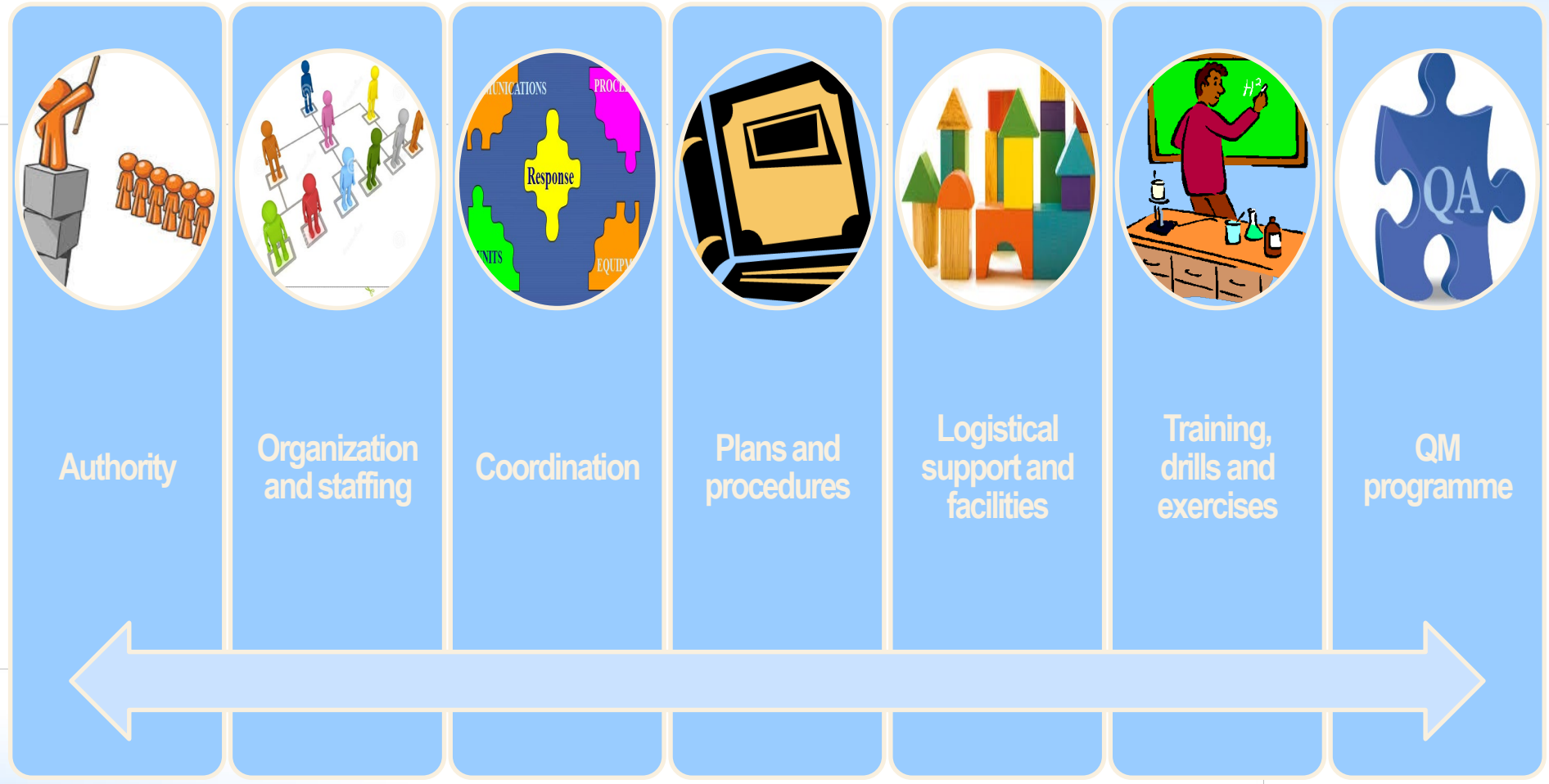
✓ Preserve data and information during response to the extent practicable

✓ Identify general implications to safety

✓ Be able acquire the expertise needed

Members of the IAEA fact-finding team in Japan in the technical support center of the Fukushima Daini Nuclear Power Plant on 26 May 2011.

Requirements for infrastructure



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How to contact us

Safety.Standards@iaea.org

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Thank you!