

**IAEA**

International Atomic Energy Agency

# IAEA Safety Standards and Requirements for Emergency Response

**KINS-IAEA Workshop on Radiation Safety and  
Emergency Response in the Medical and Industrial Use  
of Radiation**

10 - 14 June 2019, Korea Institute of Nuclear Safety (KINS)  
Daejeon, Republic of Korea

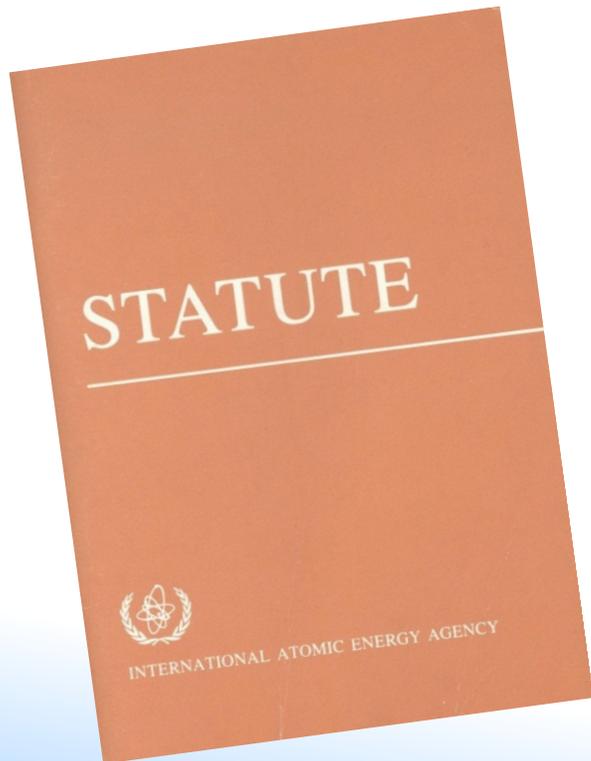
# Introduction

## IAEA Statute



Under **Article III.A.6** of its **Statute**, the IAEA is authorized:

*“To **establish or adopt**, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, **standards of safety** for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards...”*

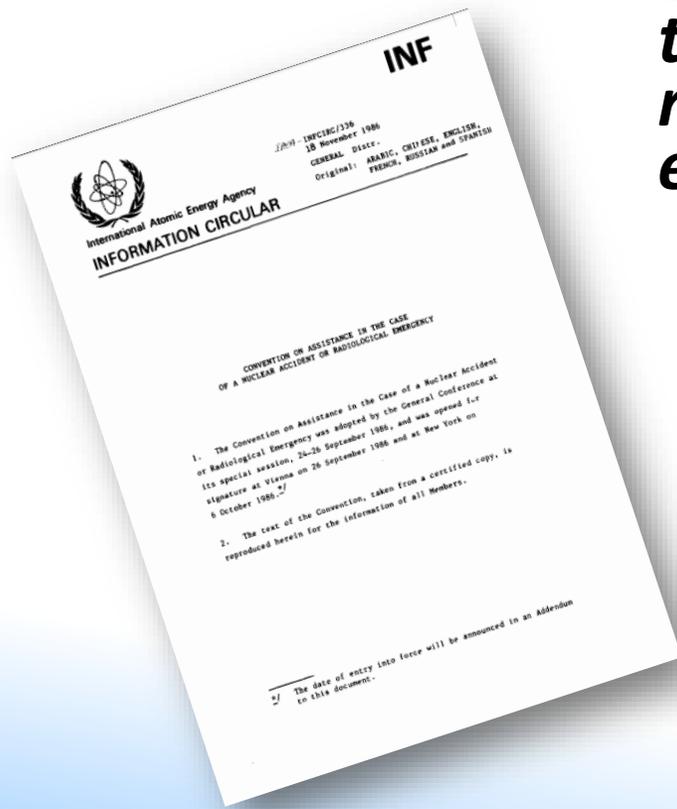


# Introduction

## Assistance Convention

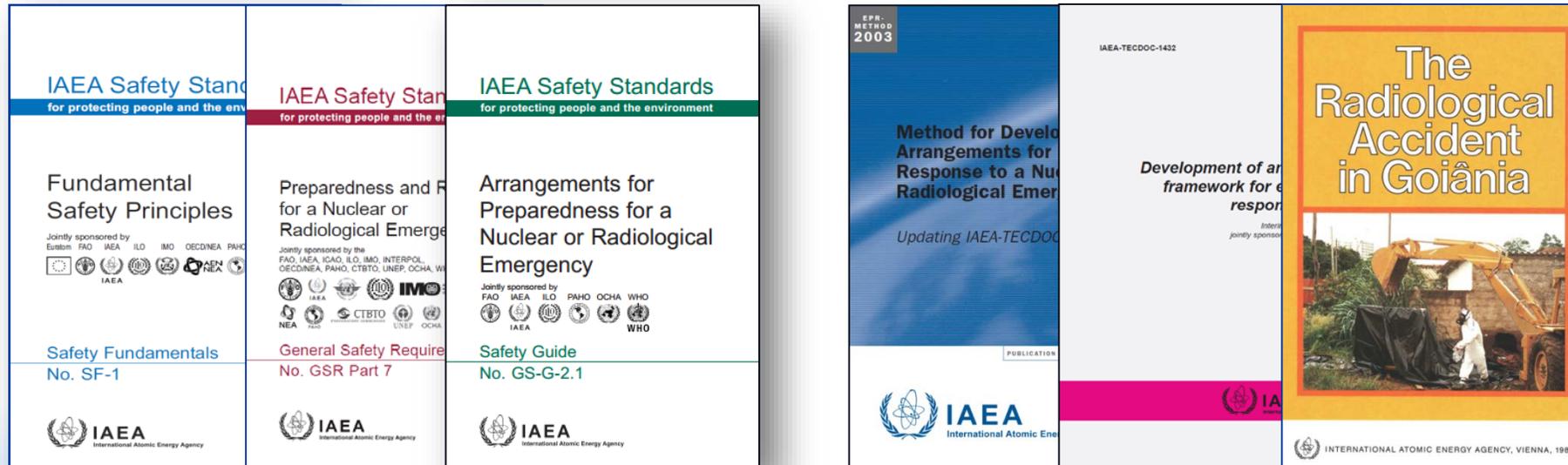
Under **Article 5**, the IAEA is given the function:

*“To collect and disseminate to States Parties and Member States information concerning ... (ii) methodologies, techniques and available results of research relating to response to nuclear accidents or radiological emergencies; ...”*



# Introduction

- IAEA fulfils these functions, in part, through development and publication of IAEA Safety Standards, EPR Series and other related publications



# Objective

- Introduce existing:
  - ✓ IAEA Safety Standards in EPR
  - ✓ EPR Series publications
  - ✓ Other relevant publication
- Understand:
  - ✓ Their applicability and relation with EPR Safety Requirements

# Contents

- Safety Standards in EPR
  - Fundamentals
  - Safety Requirements
  - Safety Guides
- EPR Series and training materials

# Safety Standards

## General

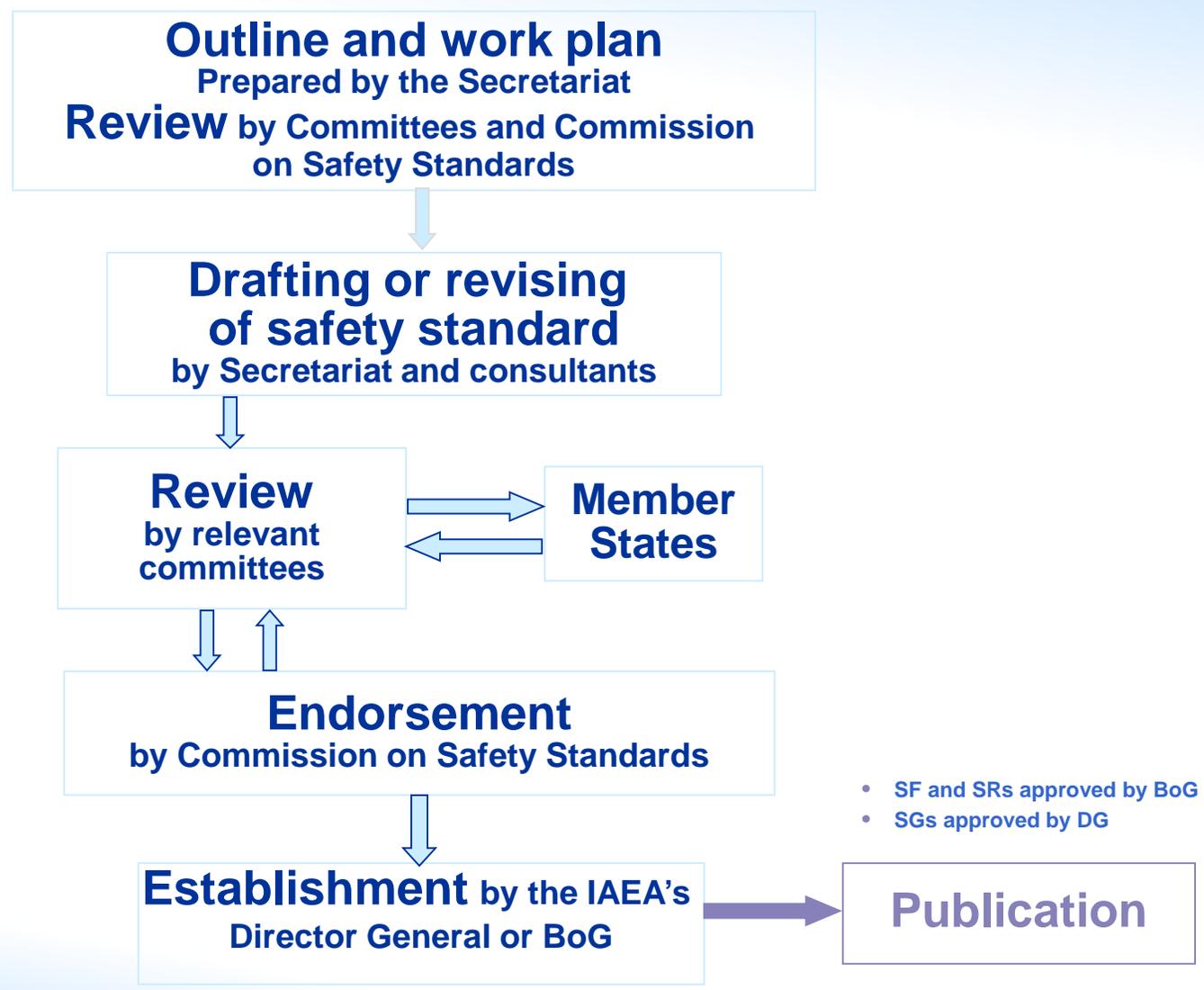


- ✓ An **international consensus** on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation...

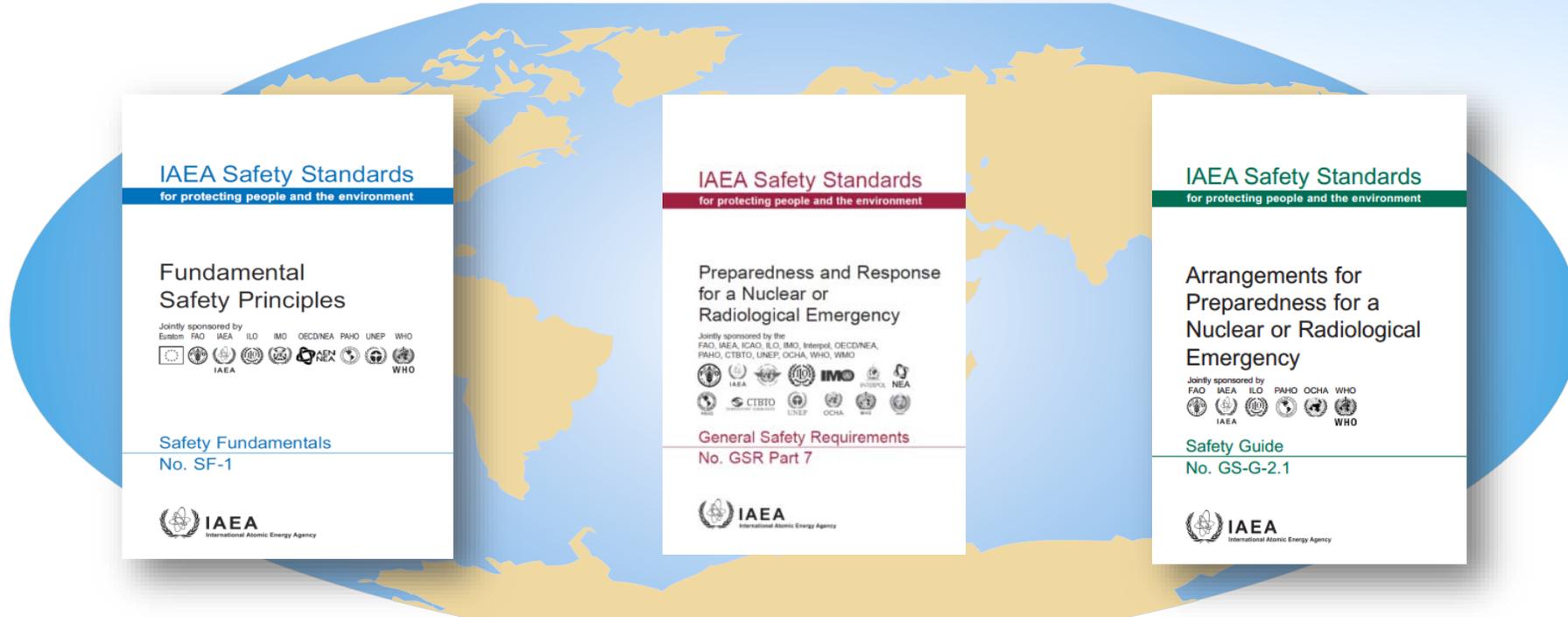


# Safety Standards

## Development process



# Safety Standards Categories



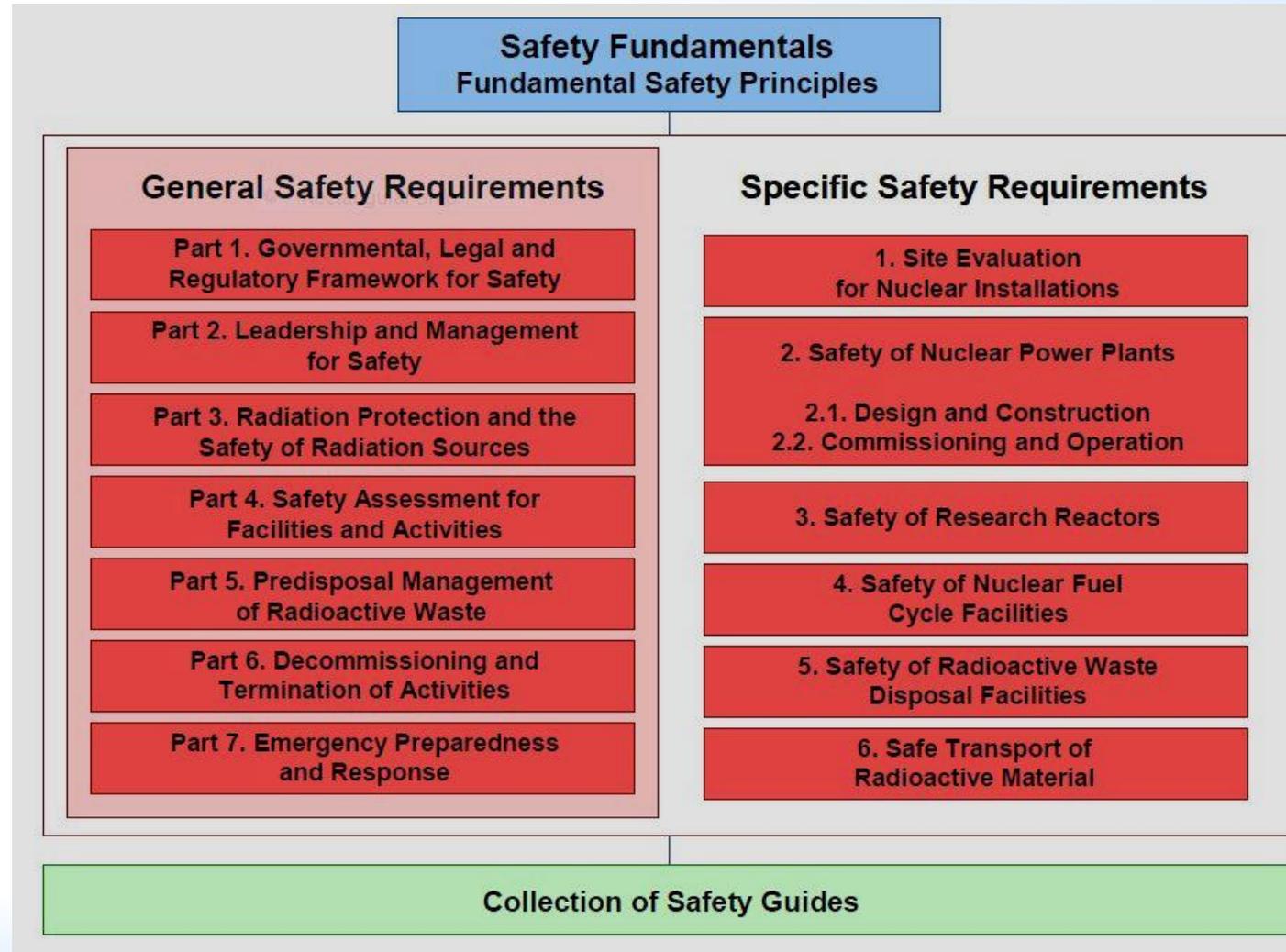
**Safety Fundamentals:**  
Fundamental safety objective and principles for protecting people and environment

**Safety Requirements:**  
Requirements that must be met to ensure protection of people and environment

**Safety Guides:**  
Recommended ways of meeting the requirements

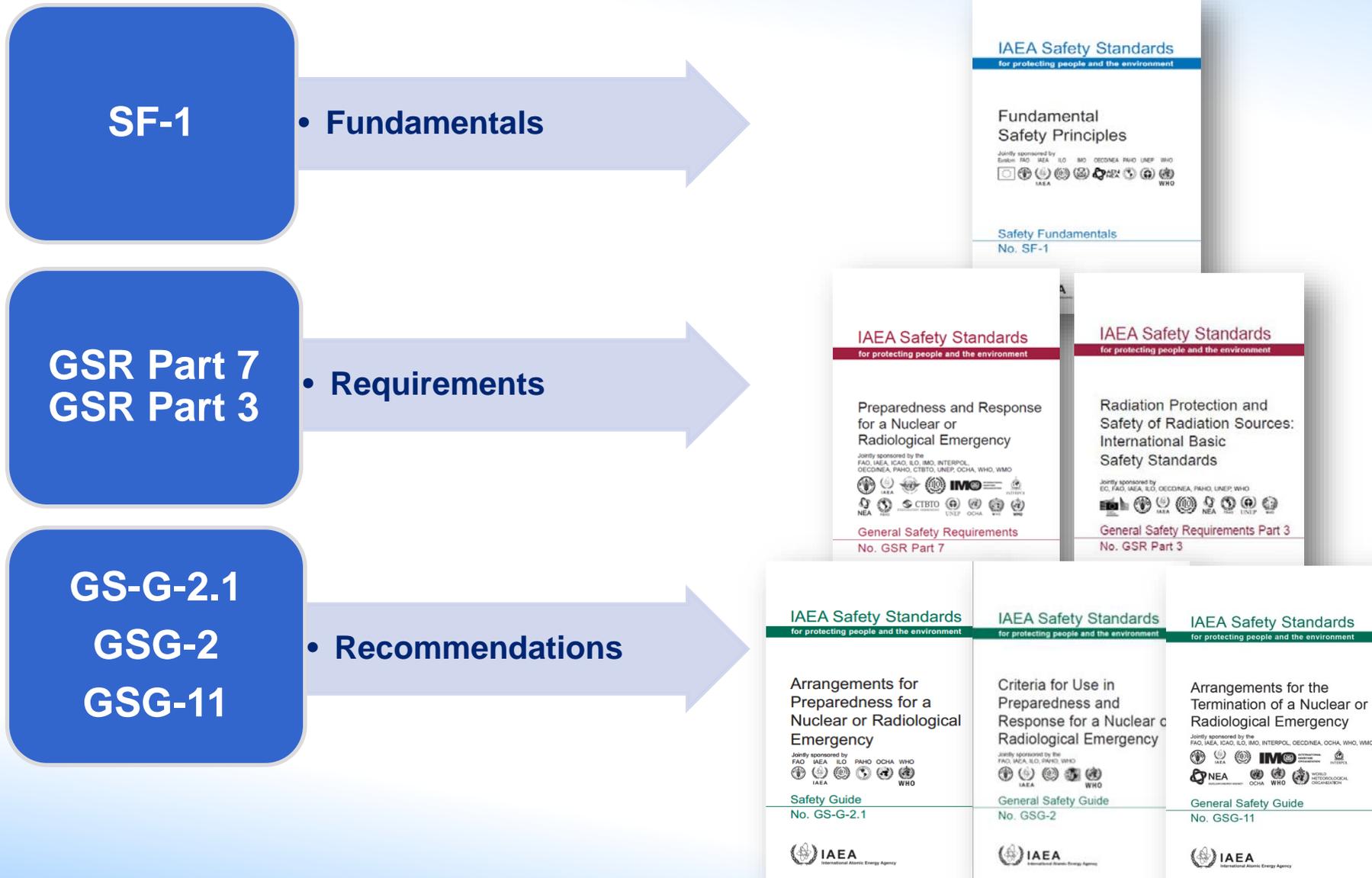
# Safety Standards

## Overall structure



# Safety Standards in EPR

## Overview



# Safety Fundamentals

## No. SF-1

➤ Establishes the fundamental safety objective, safety principles and concepts that provide the bases for the IAEA's safety standards and its safety related programme

- Published in 2006
- Cosponsored by Euratom, FAO, IAEA, ILO, IMO, OECD/NEA, PAHO, UNEP and WHO



# Safety Fundamentals

## Principle 9



### Principle 9:

Emergency preparedness and response

*“Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.”*

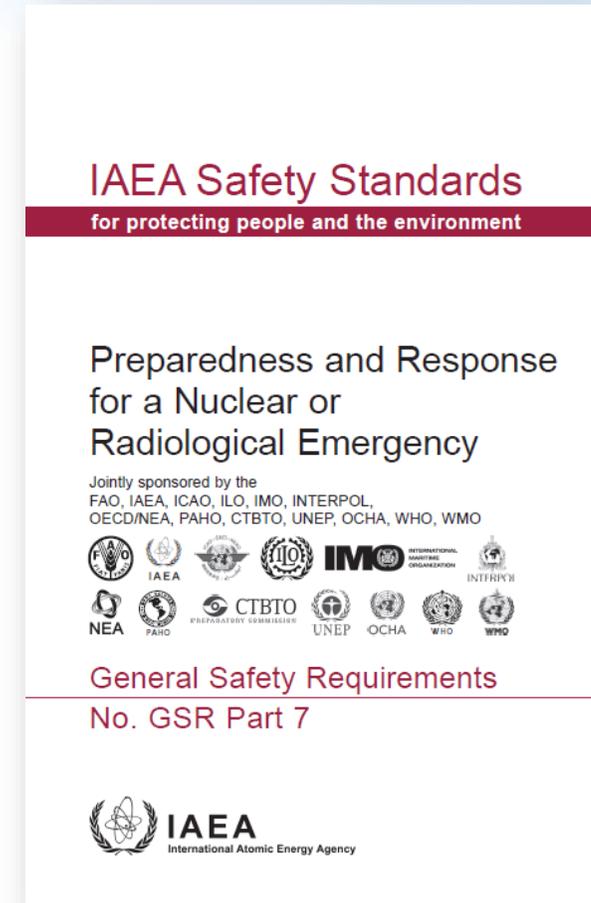


# Safety Requirements

## 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
- Approved in 2015
- Co-sponsored by FAO, IAEA, ICAO, ILO, IMO, Interpol, OECD/NEA, PAHO, UNEP, UNOCHA, WHO, WMO, CTBTO
- Supersedes No. GS-R-2 issued in 2002



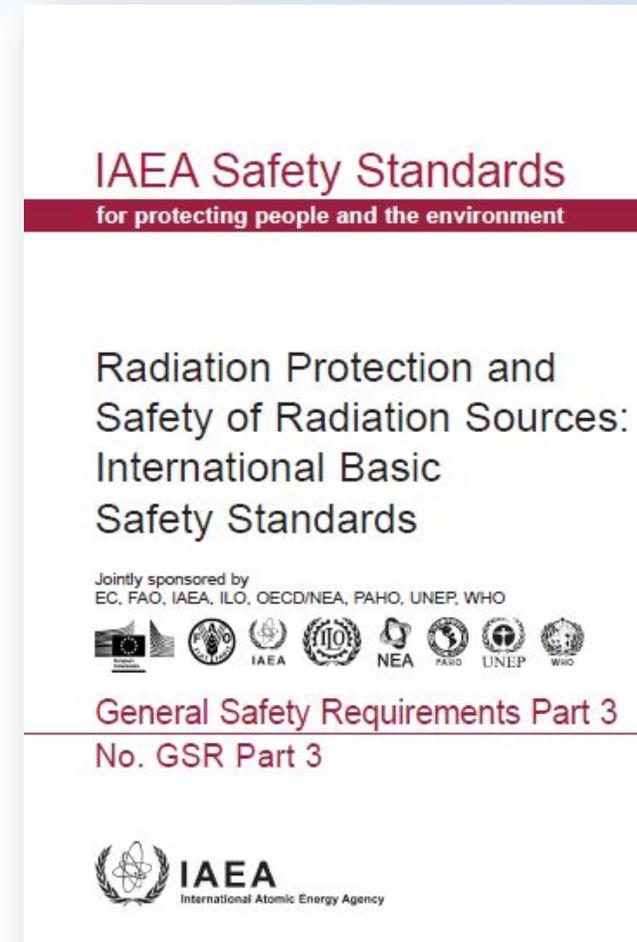
# Safety Requirements

## No. GSR Part 3: Section 4

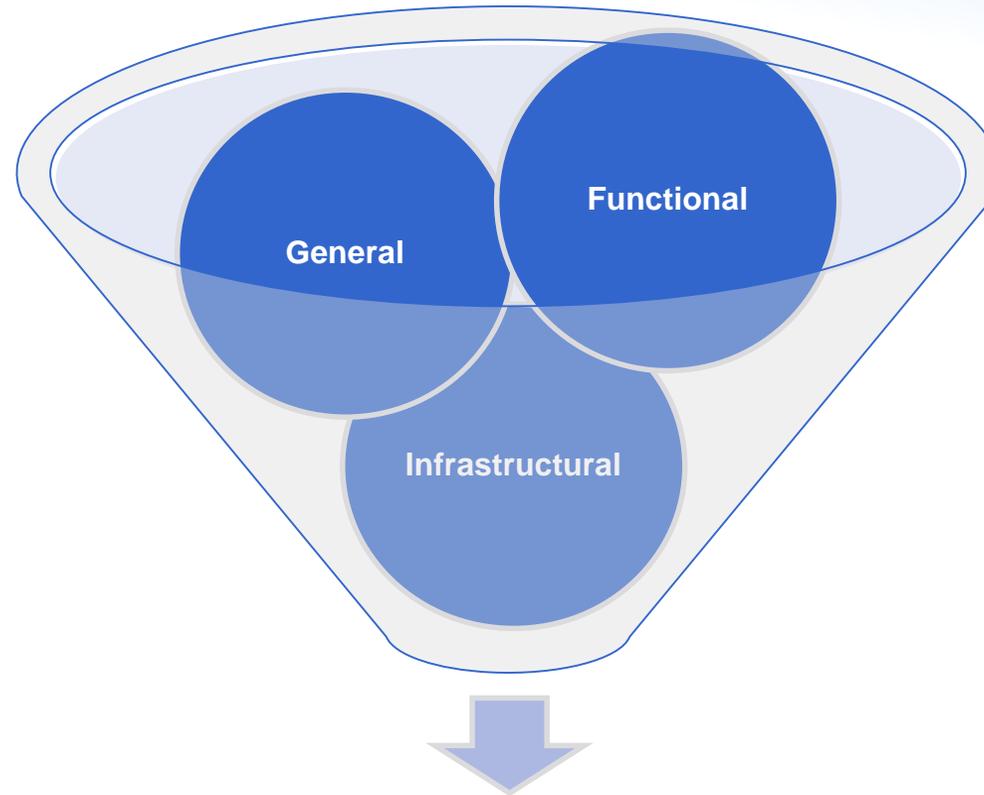


Relevant requirements in Section 4 on Emergency exposure situations

- Requirements level: **'Shall'** or 'What' to be done
- Approved on September 2011 by IAEA Board of Governors
- Published 2014
- Co-sponsored by EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO



# Safety Requirements in EPR Structure



**Goals of emergency  
preparedness and response**

# Goal of emergency preparedness

To have:

- An **adequate capability** in place at the operating organization and local, regional, national and international\* 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*

\* where appropriate

# 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

## General Requirements

- To be fulfilled before any emergency planning can start
  - **Emergency management system**
  - **Roles and responsibilities**
  - **Assessment of hazards**
  - **Protection strategy**

# Safety Requirements in EPR

## Functional Requirements

- Functions to be performed for response to be effective and goals of emergency response to be met
  - **Managing** emergency response operations
  - **Identifying, notifying** and **activating**
  - Taking **mitigatory** actions
  - Taking urgent protective and other response **actions**
  - Providing **instructions, warning** and relevant **information** to the public

# Safety Requirements in EPR

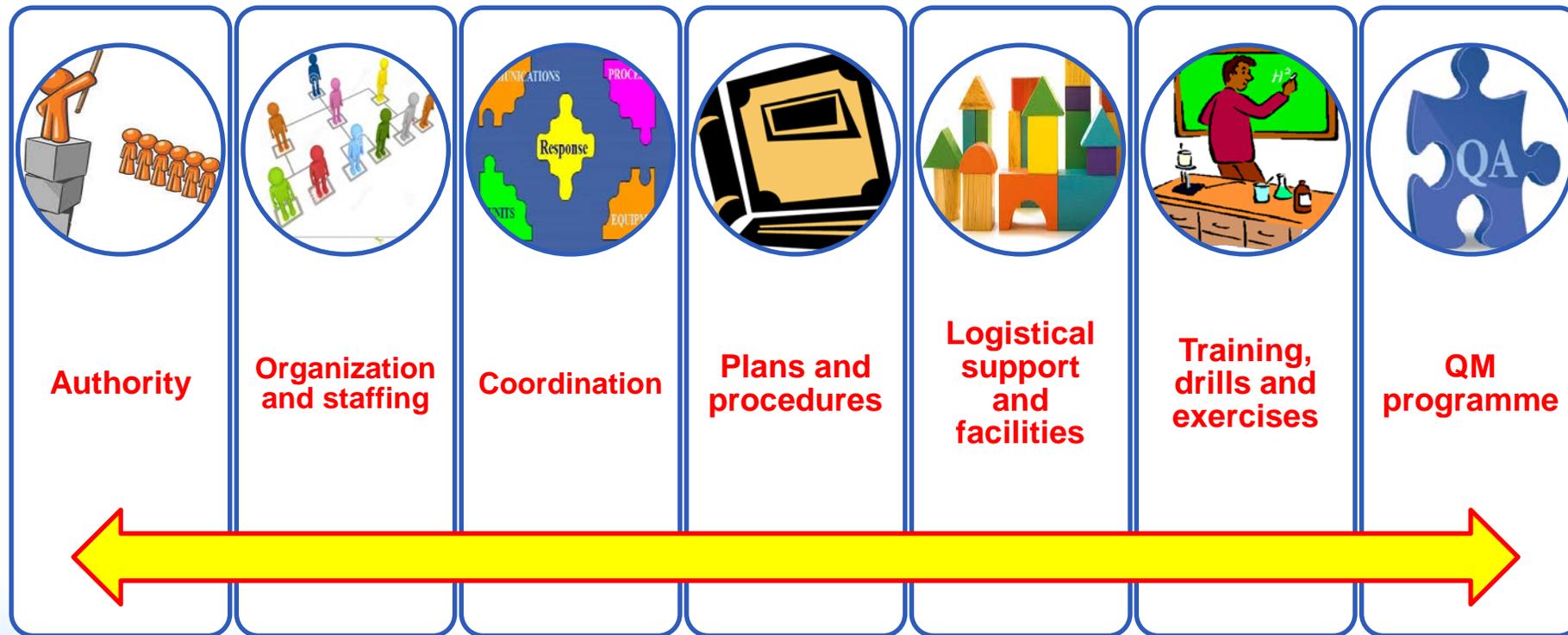
## Functional Requirements (cont'd)

- Protecting **emergency workers** and **helpers**
- Managing the **medical response**
- **Communicating** with the public
- Taking **early protective and other actions**
- Managing **radioactive waste**
- Mitigating the **non-radiological consequences**
- Requesting, providing and receiving **int. assistance**
- **Terminating** an emergency
- **Analysis** of emergency and the response

# Safety Requirements in EPR

## Requirements for Infrastructure

- Infrastructural elements essential for performing response functions

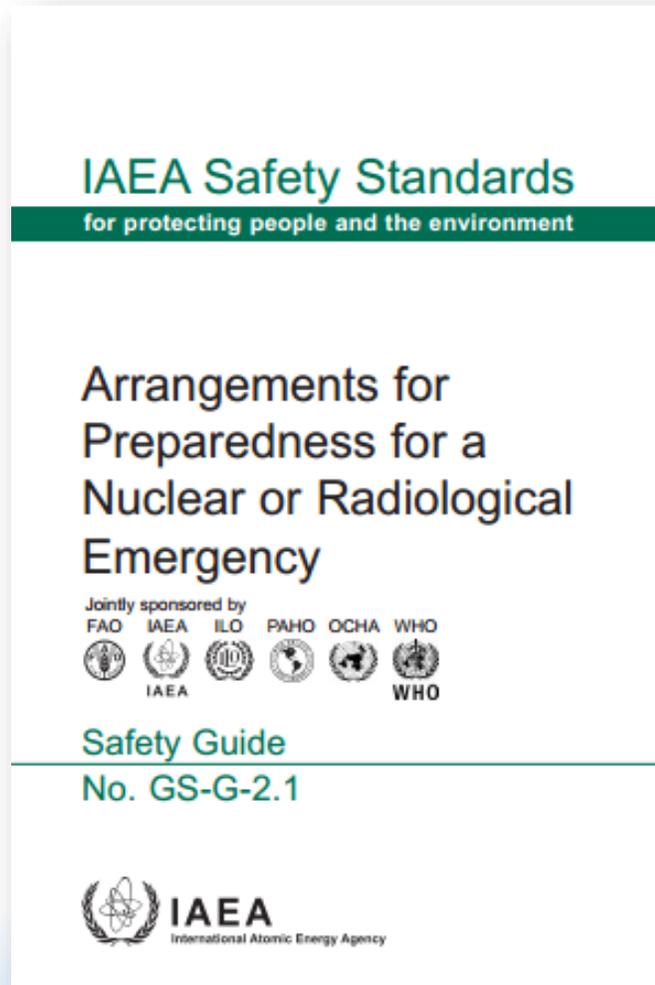


# Safety Requirements in EPR Graded Approach

- EPR to be commensurate with hazards and potential consequences of an emergency associated with facility, activity or source
  - Concept of hazard assessment
    - Emergency preparedness categories I – V
- Safety requirements apply this graded approach and they are addressed for facilities, activities and sources in specific category(ies)
  - If applicable for all categories, no category is specified in requirements

# Safety Guides

## No. GS-G-2.1



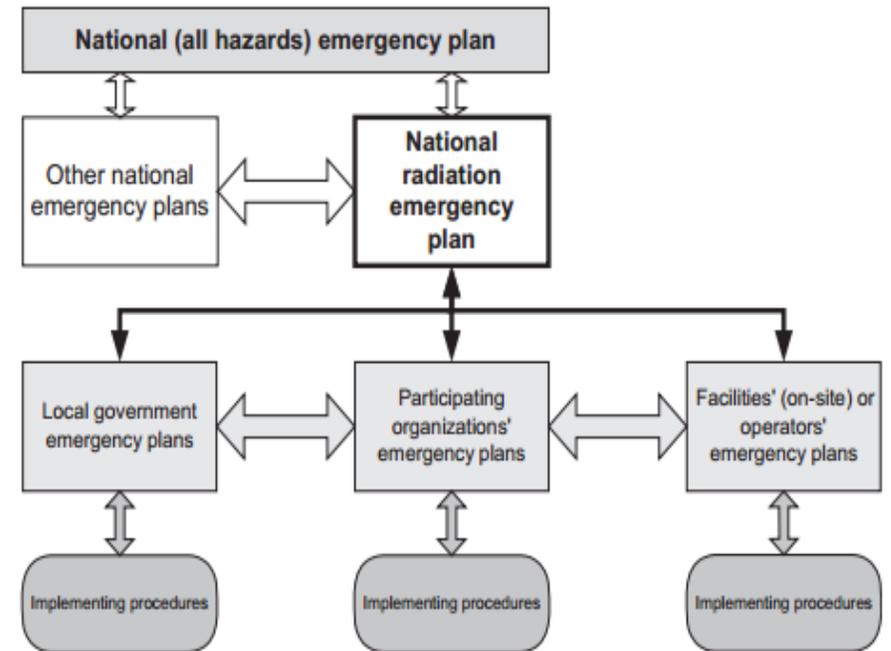
GS-G-2.1 provides recommendations on implementation of specific safety requirements established in GS-R-2

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

- **Basic concepts in EPR**
  - Types of potential nuclear or radiological emergencies
  - Overview of:
    - Radiation induced health effects
    - Exposure pathways
    - Protective actions and other response actions
- **Hazard (threat) assessment and categories**
  - Criteria for determining categories
  - Defines concept of dangerous source and provides D-values
  - Lists typical facilities and activities per category
  - Defines area and zone sizes and discusses the basis

- **Roles and responsibilities**

- Defined at operator, off-site and international levels
  - All categories covered
- Guidance for a coordinating mechanism
  - National Authority Coordinating
- Guidance on integrated planning
  - All hazards approach



- **Further guidance provided on infrastructural requirements**
  - Including detailed description of recommended *emergency response facilities and locations*, their functions and characteristics
- **Elaborated concept of operations for a range of postulated nuclear or radiological emergency**
  - For categories I-V

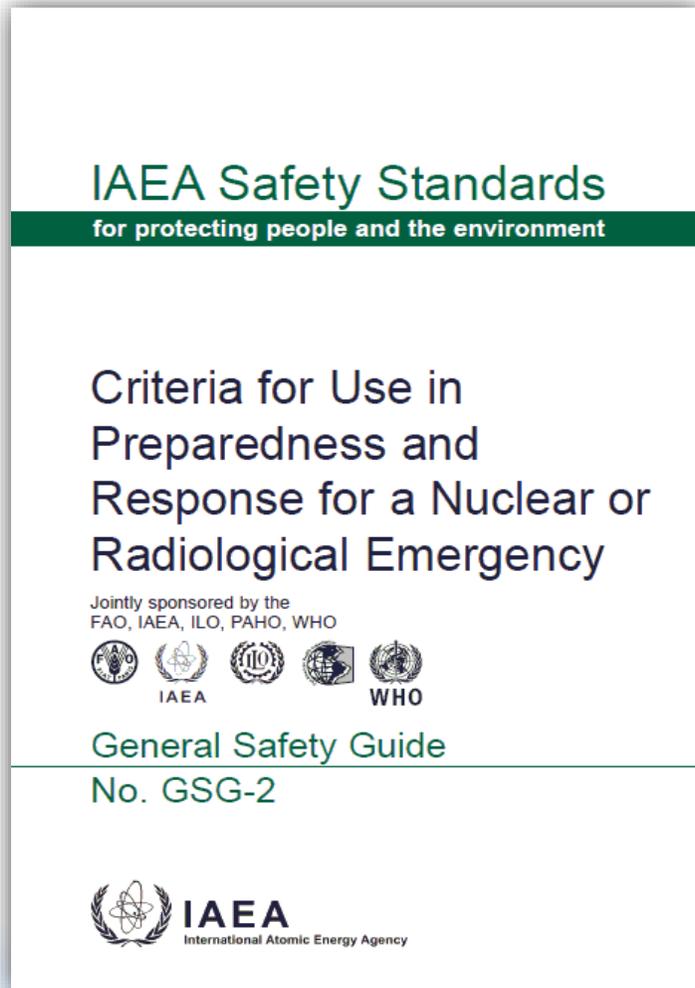
# Safety Guides

## GS-G-2.1 contents (4)

- Further guidance on how to implement following functional requirements:
  - ✓ Identifying, notifying and activating
  - ✓ Taking urgent protective actions
  - ✓ Keeping the public informed
  - ✓ Managing the medical response
  - ✓ Taking early protective and other actions
  - ✓ Mitigating the non-radiological consequences

# Safety Guides

## No. GSG-2



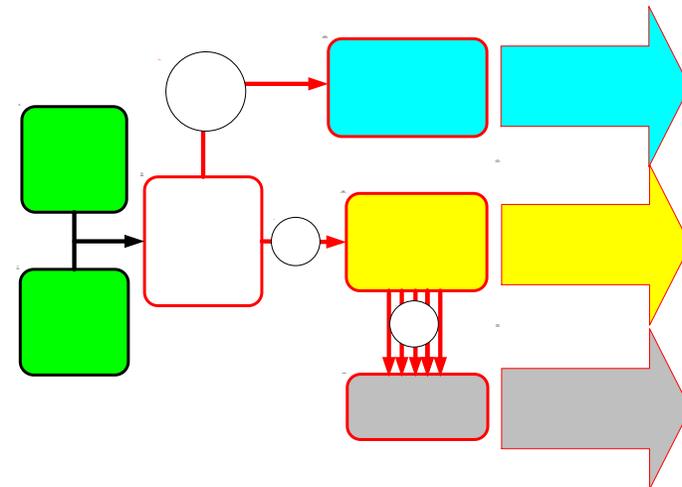
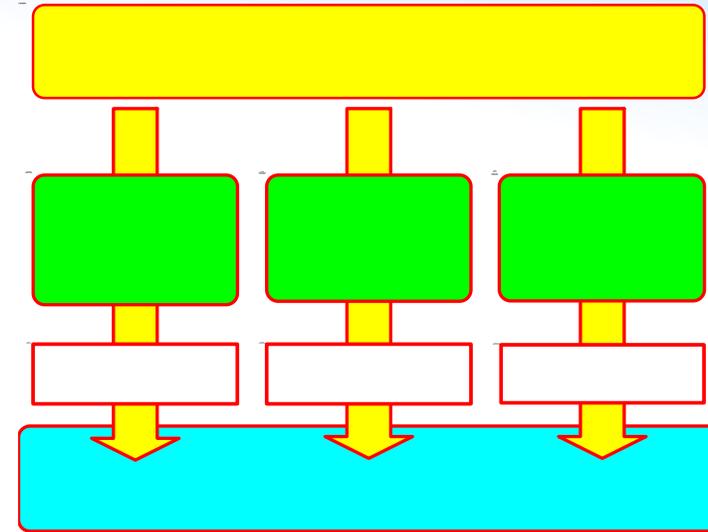
GSG-2 provides guidance on criteria for taking protective actions and other response actions in a nuclear or radiological emergency

- Recommendations level: **‘Should’** or ‘How’ to be done
- Published in **2011**
- Co-sponsored by FAO, IAEA, WHO, PAHO, ILO
- Supersede intervention levels and generic action levels contained in GS-R-2

# Safety Guides

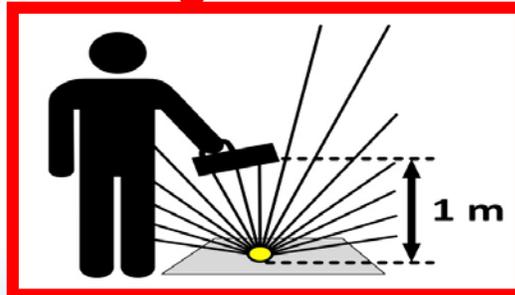
## GSG-2 contents (1)

- Elaborates framework for **emergency response criteria** at which specific emergency response actions need to be taken
  - Defines system of:
    - *Generic criteria*
    - *Operational criteria*
      - OILs, EALs, Observables
    - *Guidance values applicable for emergency workers*

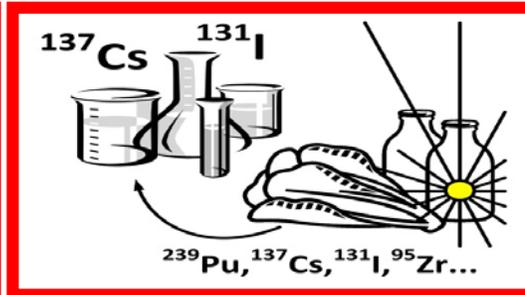


- Example of **default OILs** for:
  - Deposition
  - Individual contamination
  - Contamination of food, milk and drinking water
- **Plain language explanations** in support of the criteria

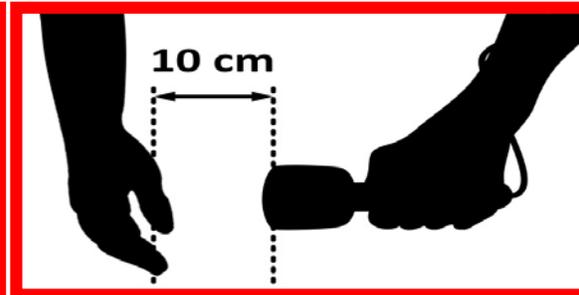
**Dose rate above ground**



**Food, milk and water concentrations**



**Dose rate from skin contamination**



# Safety Guides

## GSG-2 contents (3)

- Guidance on **EALs development** including example EALs for LWRs
- **Suggested radii for inner cordoned area** for radiological emergency

TABLE 12. EMERGENCY CLASSIFICATION FOR LIGHT WATER REACTORS IN OPERATING, STANDBY OR HOT SHUTDOWN MODE

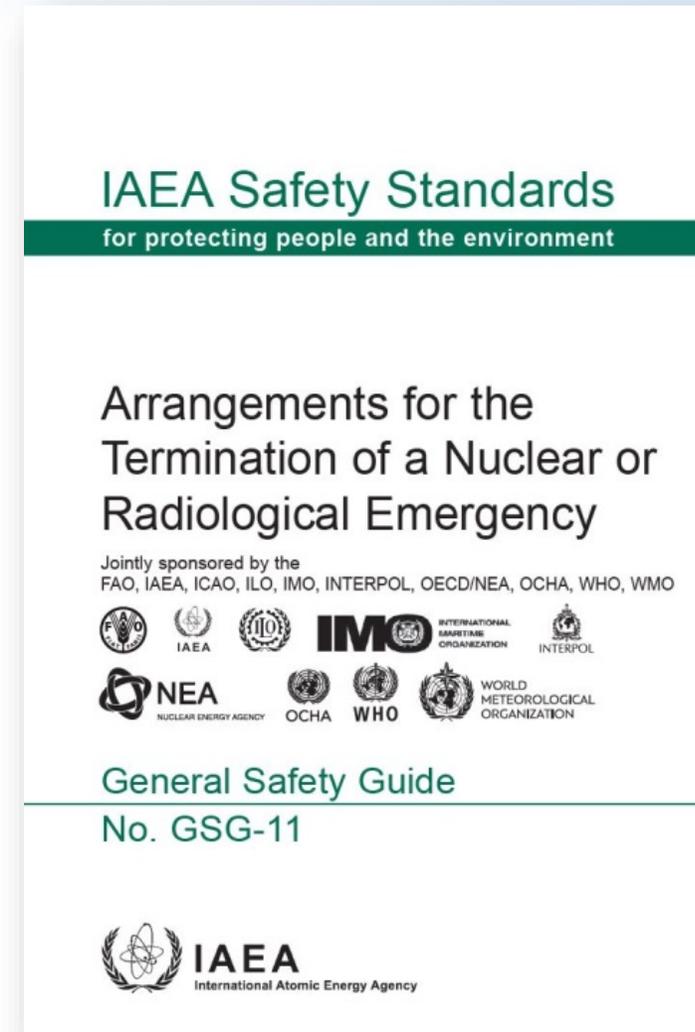
For the following entry conditions:	Declare a general emergency if:	Declare a site area emergency if:	Declare an alert if:
<b>Critical safety function impairment</b>			
Failure to stop nuclear reaction <sup>1</sup>	Failure to scram when above 5% power [or insert site specific power level] <sup>2</sup> and any of the following: — Pressurized water reactor negative cooling margin on the basis of Fig. 7 or — Vessel water level below top of active fuel or — Major (100–1000 times) increases in multiple radiation monitors or — Other indication of actual or imminent core damage	Failure to scram when above 5% power [or insert site specific power level] and abnormal conditions indicate that an automatic or manual scram is necessary	Failure to fully shut down (increasing neutron flux) <sup>3</sup> as part of normal shutdown with sufficient heat removal available (ultimate heat sink available and sufficient)

# Safety Guide

## GSG-11

Provides guidance and recommendations on:

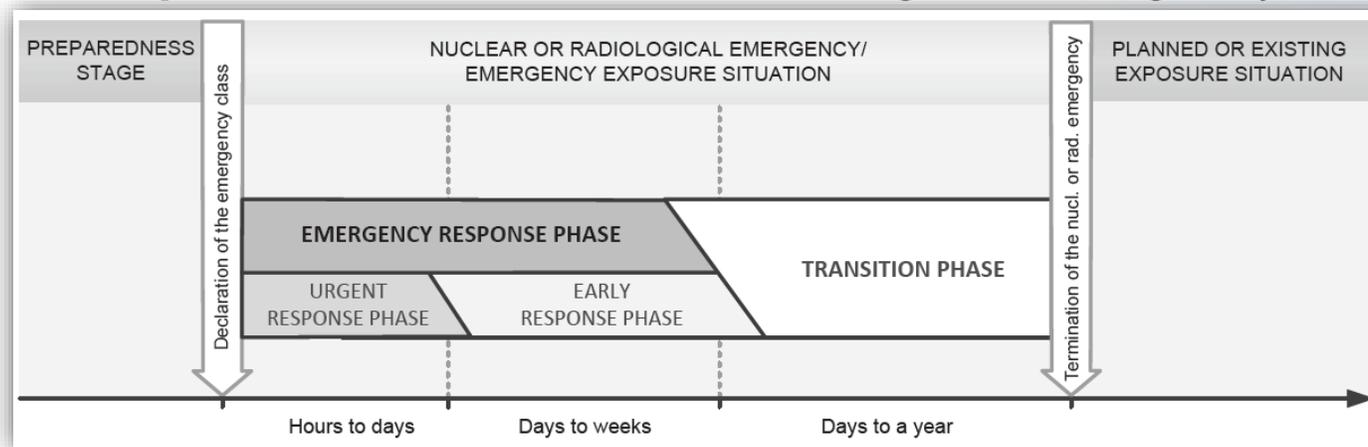
- Developing arrangements, as part of overall emergency preparedness efforts, for transition to either an existing exposure situation or a planned exposure situation, as appropriate, and for the termination of the emergency
- The primary objective and prerequisites for enabling the emergency to be terminated
- Applies to any nuclear or radiological emergency irrespective of its cause
- Recommendations level: **'Should'** or 'How' to be done
- Published in **March 2018**
- Co-sponsored by FAO, IAEA, ICAO, IMO, ILO, INTERPOL, OECD/NEA, UN OCHA, WHO, WMO



# Safety Guide

## GSG-11 content (1)

- Describes **phases** of a nuclear or radiological emergency



- States the **primary objective** of terminating a nuclear or radiological emergency and elaborates on the **prerequisites** that need to be met to terminate an emergency
  - Primary objective:
    - to facilitate the timely resumption of social and economic activity.
  - General prerequisites
  - Specific prerequisites
  - Timeframes for the termination



# Safety Guide

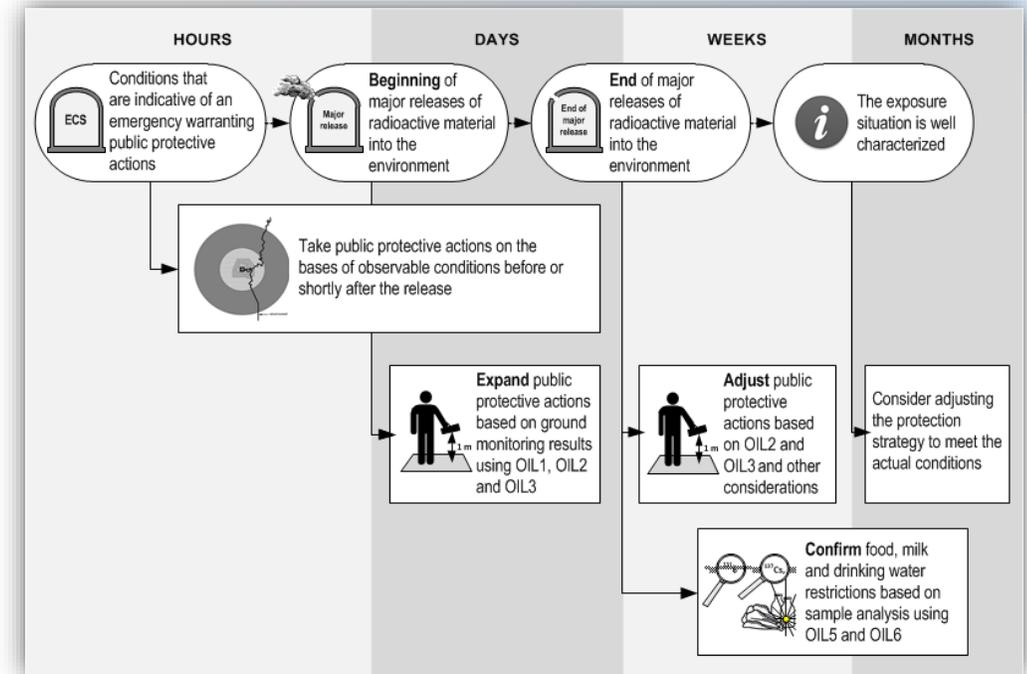
## GSG-11 content (2)

- Elaborates on the **arrangements for the transition phase**
  - Authority, responsibilities and management
  - Hazard assessment
  - Protection of the public
    - Protection strategy
    - Adapting and lifting the protective actions
  - Characterization of the exposure situation
  - Medical follow-up and counselling
  - Protection of emergency workers and helpers
  - Radioactive waste management
  - Consultation with the public and other interested parties
  - Compensation for victims of damage
  - Infrastructure

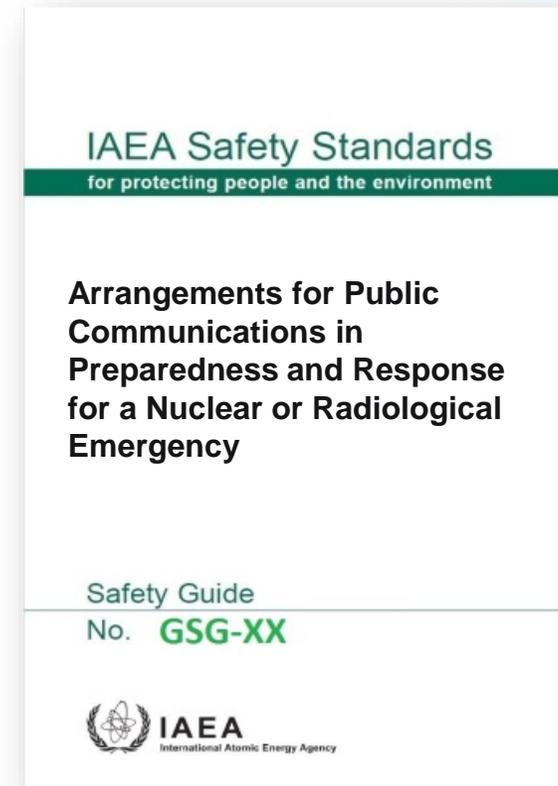
# Safety Guide

## GSG-11 content (3)

- Provides considerations for adapting or lifting protective actions and other response actions
- Provides case studies of several past nuclear or radiological emergencies
  - Fukushima Daiichi Accident, Japan
  - Radiological accident, Goiânia, Brazil
  - Severe nuclear incident at Paks NPP, Hungary
  - Radiological incident, Mexico
- Presents factors that need to be considered when justifying and optimizing the protection strategy at the national level



- **Arrangements for Communications with the Public in Preparedness and Response for a Nuclear or Radiological Emergency (DS475)**
  - ✓ Recommendations and guidance on communicating with the public in emergency preparedness and response taking into account some particular circumstances (e.g. coincident emergencies, emergencies triggered by a nuclear security event, transition phase)



# Draft Safety Guide DS475

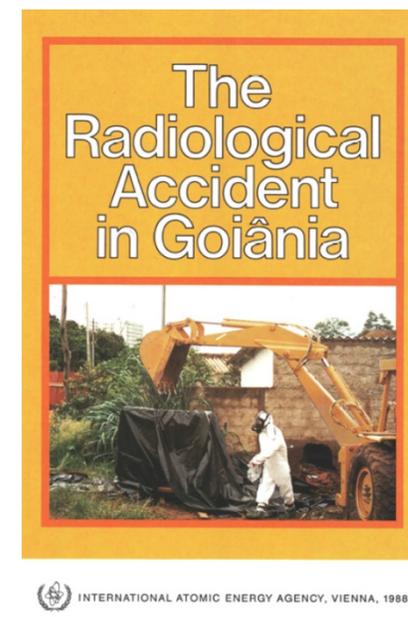
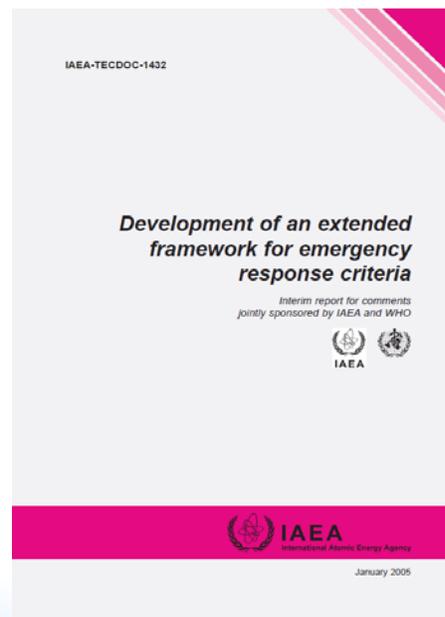
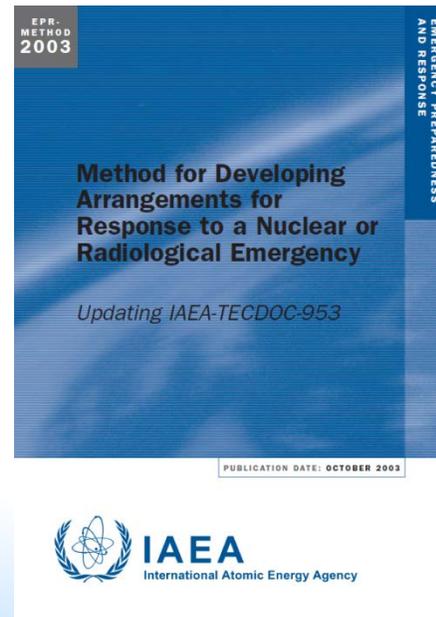
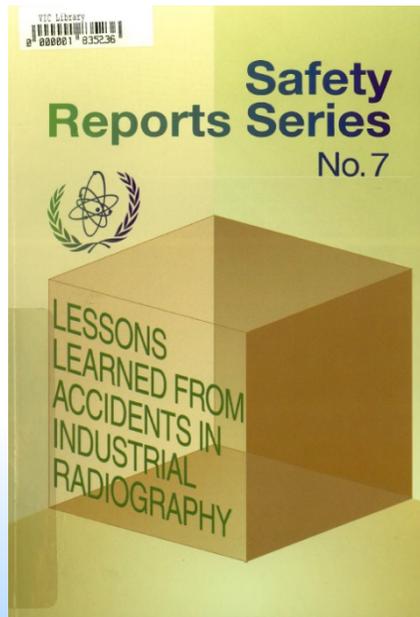
- Safety Guide DS475 is intended to provide guidance for meeting the relevant Requirements of GSR Part 7 (primarily Requirements 10, 13 and 16) and of GSR Part 3
- Due for Member States' consultation
  - 120 days commenting period started in July 2017
- Expected endorsement by the Commission on Safety Standards in November 2018
  - To be published in 2019

- **Preparedness and Response for an Emergency during the Transport of Radioactive Material** (Revision of TS-G-1.2 issued in 2002)
  - 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
- Expected completion: end of 2019, to be published 2020

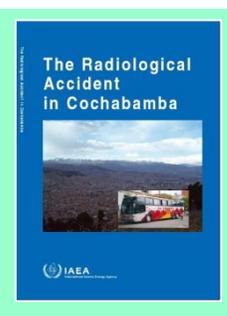
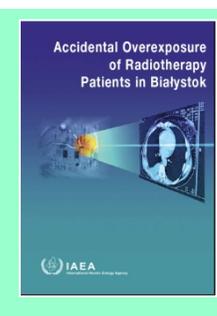
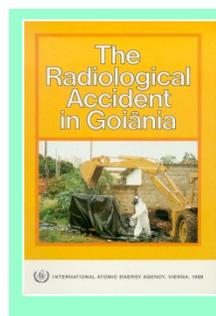
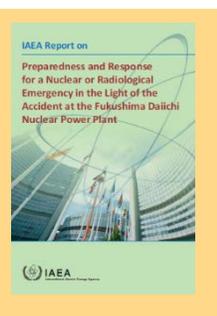
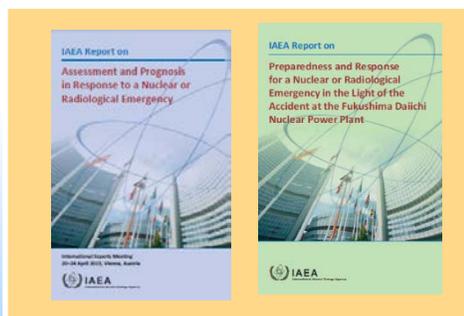
- Revision of GS-G-2.1 with the aim to:
  - Ensure consistency in terminology and concepts with GSR Part 7
  - Remove outdated guidance or guidance which has been addressed in more recent EPR related safety standards, either in place or under development
  - Ensure appropriate cross-references are given to various EPR related safety standards
  - Provide more detailed guidance on a number of requirements in GSR Part 7, such as those for infrastructure
  - Address equally all the five emergency preparedness categories with common guidance
- Expected completion in 2021, to be published in 2022

# What is not a Safety Standard?

- Other Agency's publications than Safety Fundamentals, Safety Requirements and Safety Guides, for example:
  - *Safety Reports*
  - *Accident Reports*
  - *EPR Series*
  - *TECDOC Series etc.*

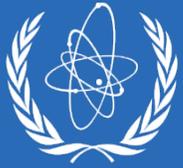


# EPR Series and training materials



# EPR Series and training materials

- To support the application of the IAEA Safety Standards in EPR:
  - EPR Series give further technical guidance and tools to support the establishment of effective and efficient emergency arrangements by Member States
  - EPR Training Materials provide material to be used for training purposes at the international and regional levels or as a basis for development of training materials at national level in various areas of EPR



**IAEA**

International Atomic Energy Agency

*Thank you for your attention!*