IAEA
International Atomic Energy Agency
Atoms for Peace and Development

International RAMP Users' Group Meeting - Symposium on Emergency/Accident Assessment -

IAEA's assessment and prognosis in an emergency: response role, process and publications

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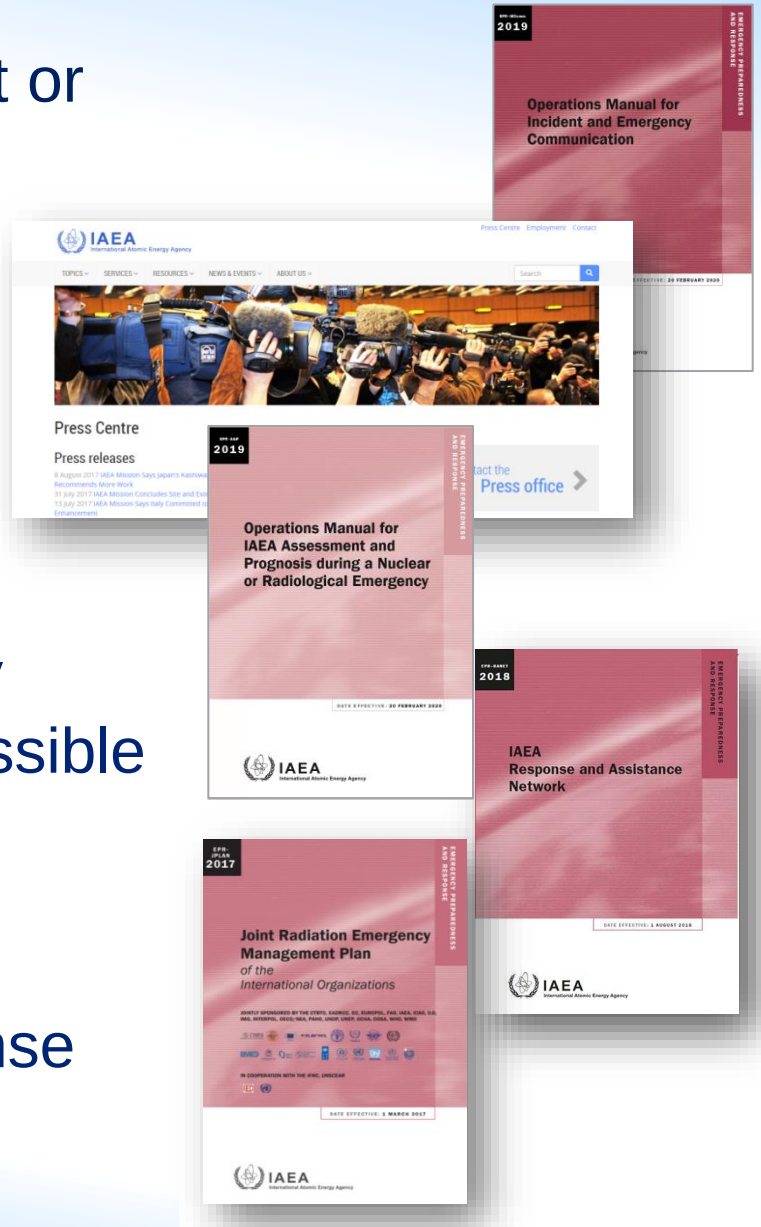
IAEA' response roles, including assessment and prognosis

IAEA roles in Response

During a nuclear or radiological incident or emergency, **irrespective of its cause**, the IAEA has 5 response roles

1. Notification and official information exchange
2. Provision of public information
3. Assessment of potential emergency consequences and prognosis of possible emergency progression (A&P)
4. Provision of assistance on request
5. Coordination of inter-agency response

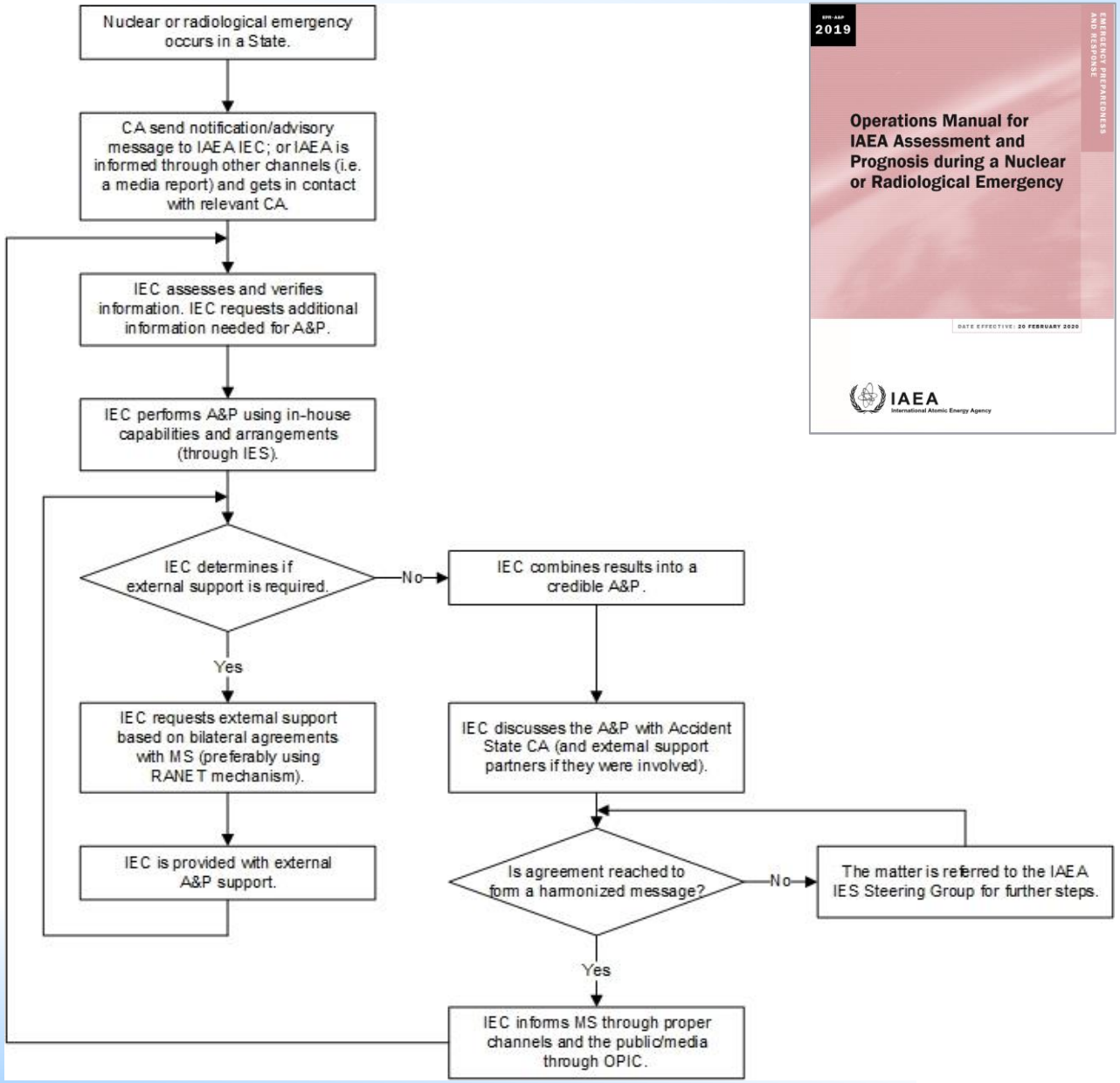


Assessment and Prognosis

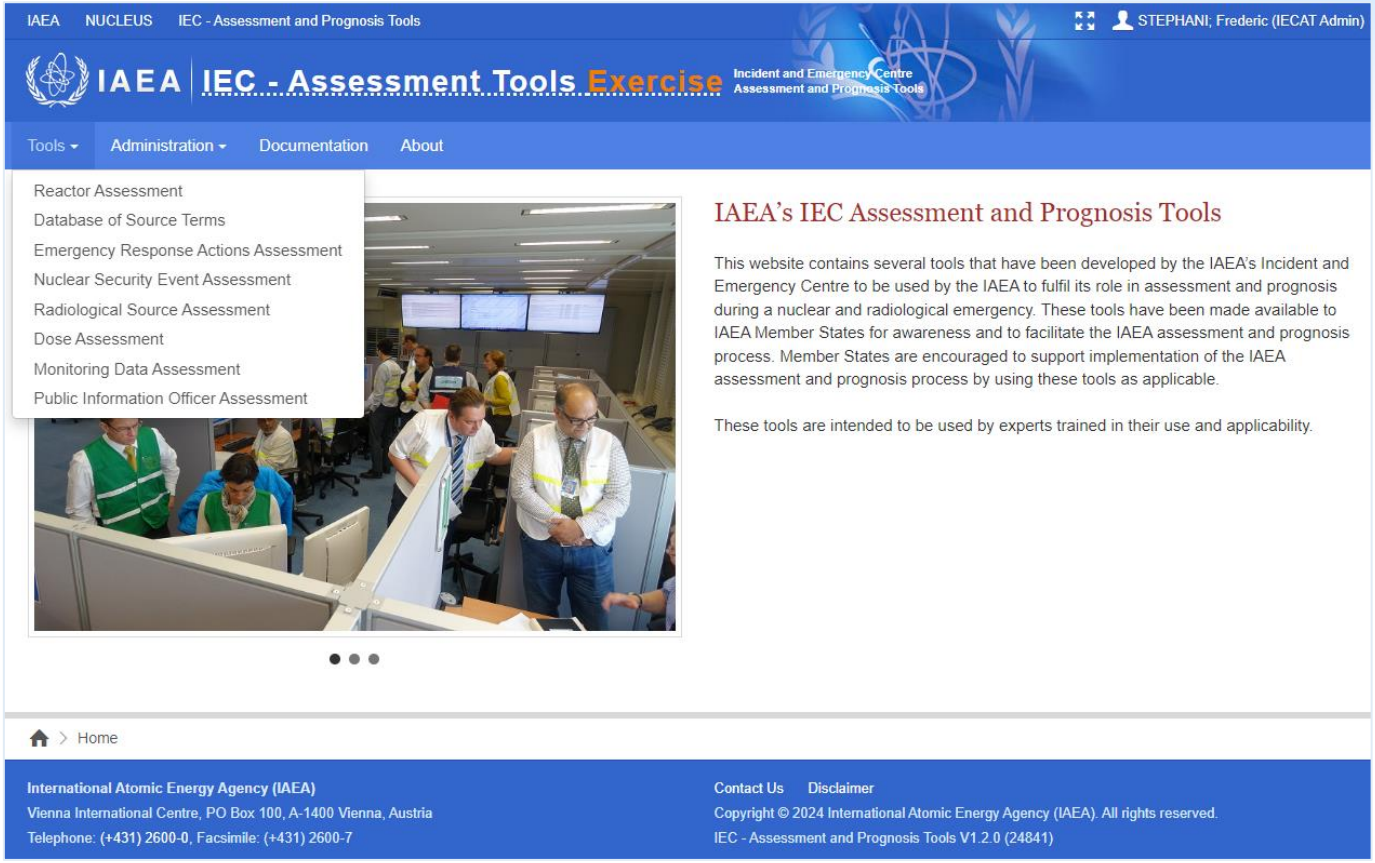
In 2013, GC(57)/RES/9 para 103 stated that:

"Requests the Secretariat, in close cooperation with Member States, to continue to develop an effective public communication strategy and to maintain and further develop arrangements to provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear or radiological emergency, including the analysis of available information and the prognosis of potential consequences;"

IAEA's A&P process



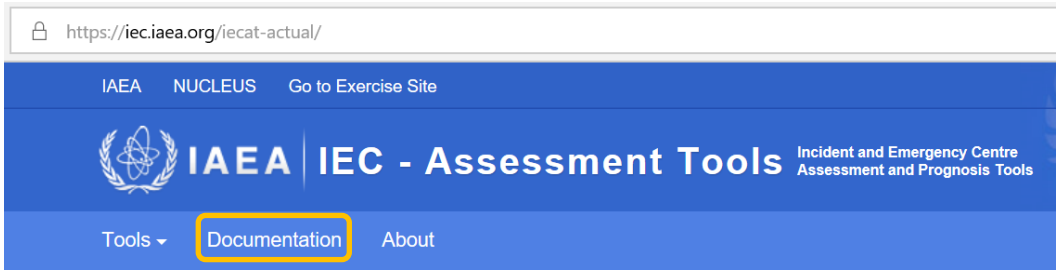
IAEA's assessment tools website

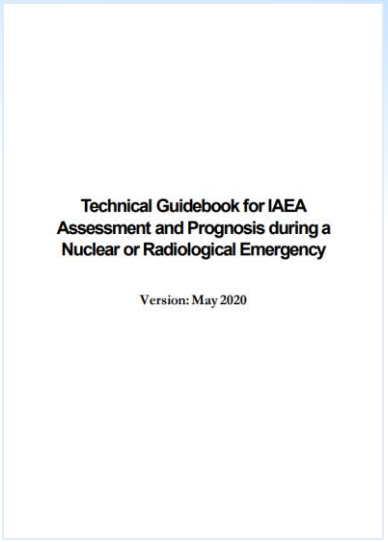


More detailed presentation on the IAEA assessment and prognosis tools on Day 2 of the Symposium

IAEA' Safety Standards and technical guidance
that support the assessment and prognosis response role

Technical Guidebook on A&P



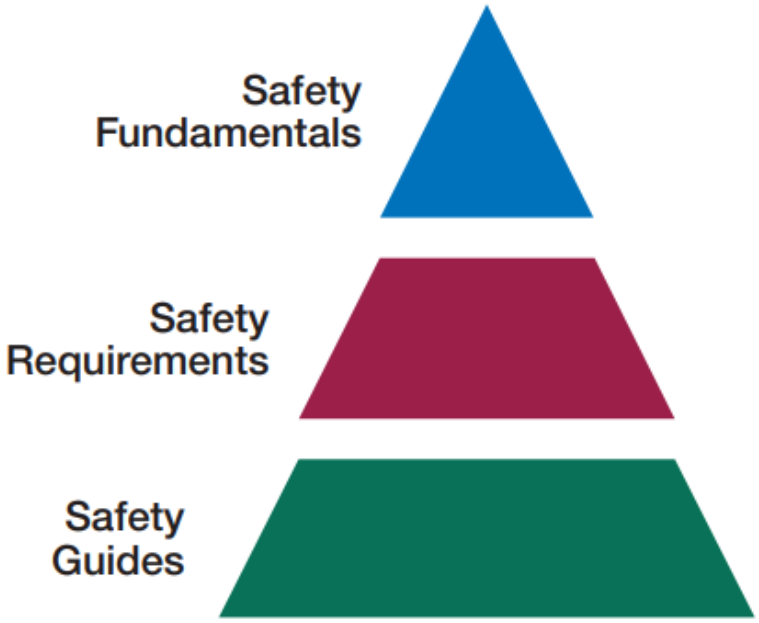

Technical Guidebook for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency

Version: May 2020

- Provides the detailed technical basis for the IAEA's A&P process during a nuclear or radiological emergency, irrespective of the cause
- Is intended to serve as an initial reference for users examining the technical basis behind the IAEA's assessment and prognosis process
- As new IAEA Safety Standards and technical guidance documents are published, this Technical Guidebook will be updated to reflect any potential changes

Overview of EPR Safety Standards

IAEA Safety Standards structure



EPR Safety Standards

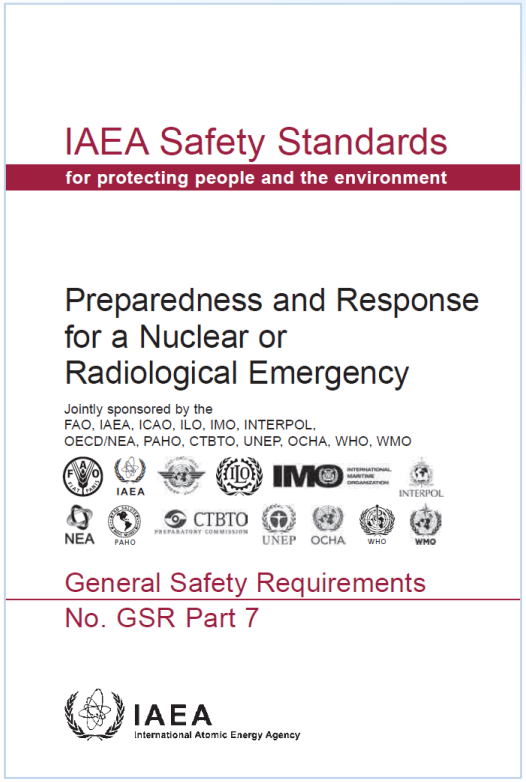
[SF-1, Principle 9: EPR]

GSR Part 7

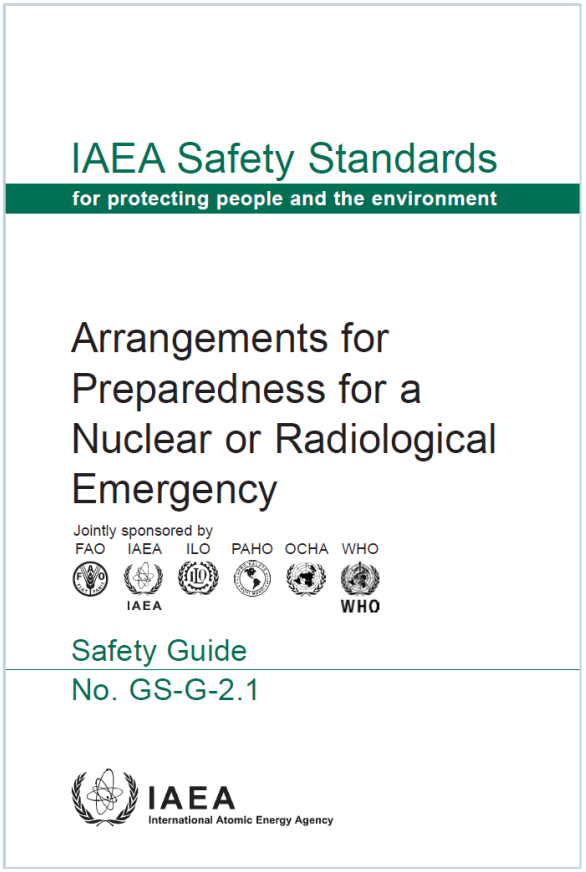
GS-G-2.1
GSG-2
GSG-11
GSG-14
SSG-65

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 and CTBTO
- Supersedes No. GS-R-2 issued in 2002



GS-G-2.1

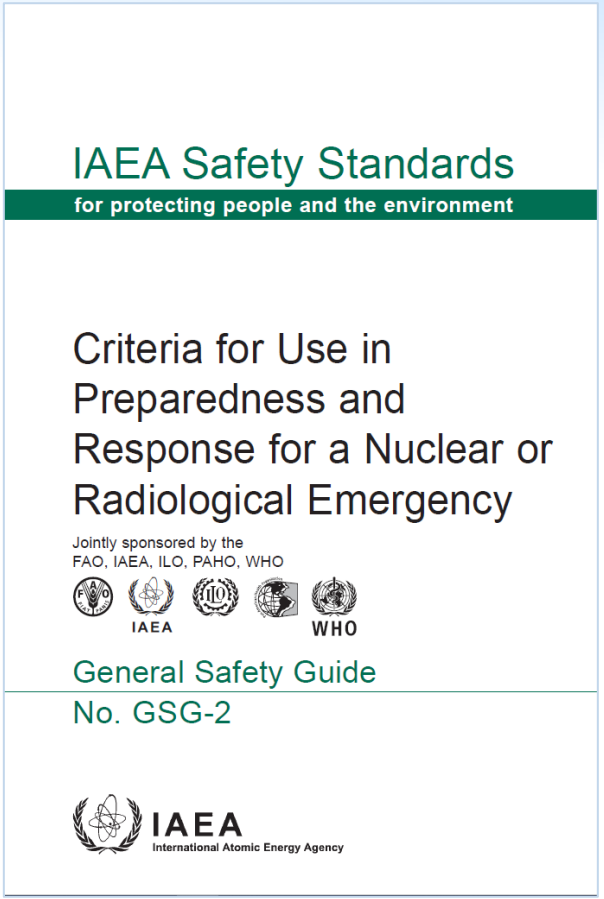


Currently under revision

- Provides recommendations on implementation of specific safety requirements established in GS-R-2
- Criteria for determining the EPC for facilities and activities derive from past experience and are given in terms of power levels, inventory of dispersible radioactive material and potential for uncontrolled criticality
- Recommendations level: ‘Should’ or ‘How’ to be done
- Recommendations are not formulated in a technology oriented manner, but on the basis of a given EPC

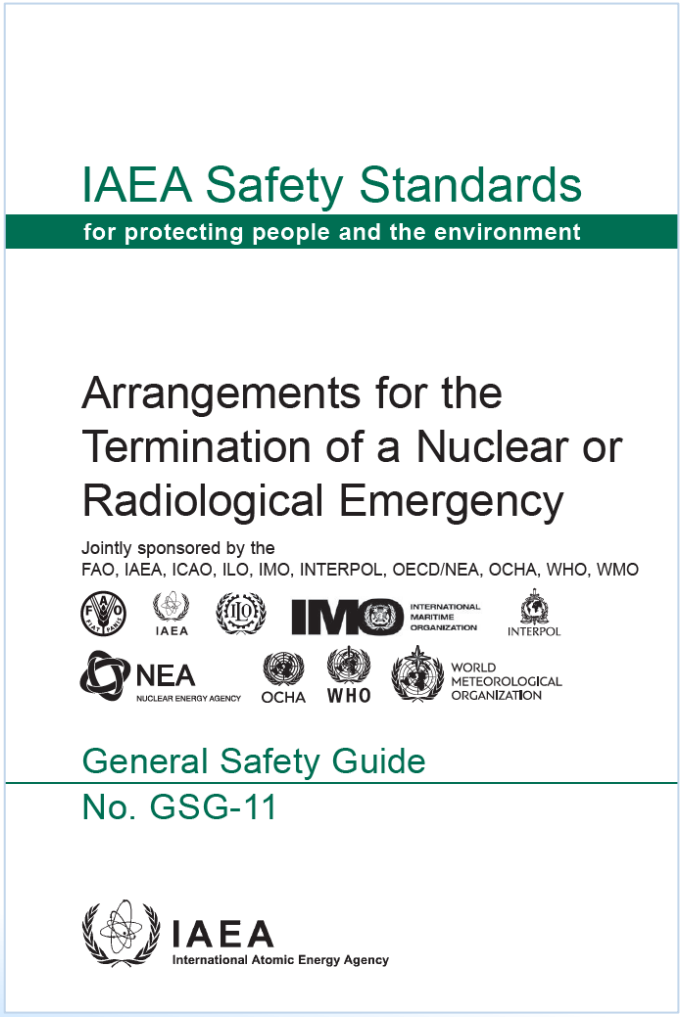
GSG-2

- 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
- Describes operational criteria to be used to initiate the implementation of specific actions in the course of the emergency response
  - Operational Intervention Levels (OILs)
  - Emergency Action Levels (EALs)
  - Observables



Currently under revision

GSG-11

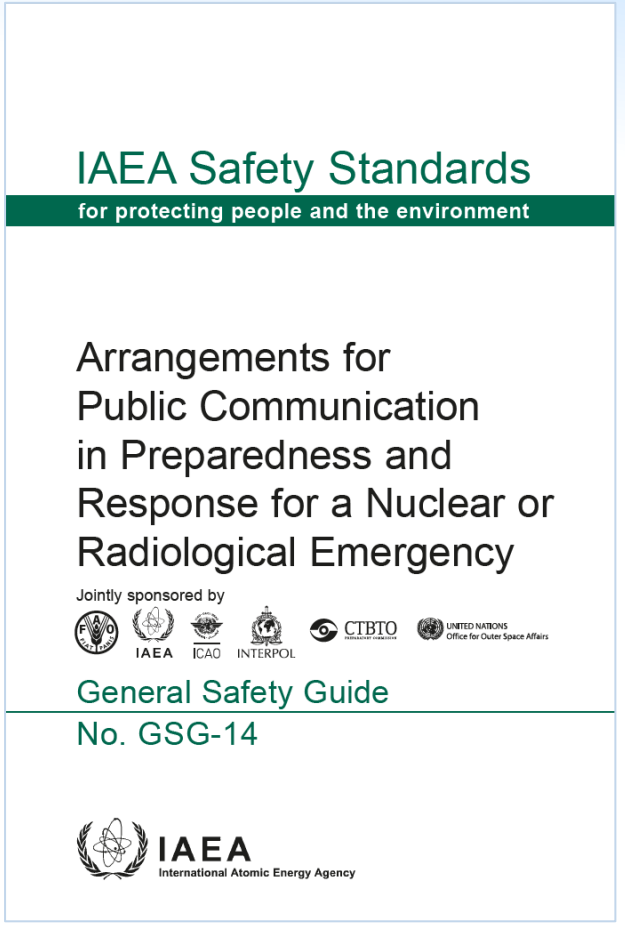


Provides guidance and recommendations on developing arrangements at the preparedness stage for:

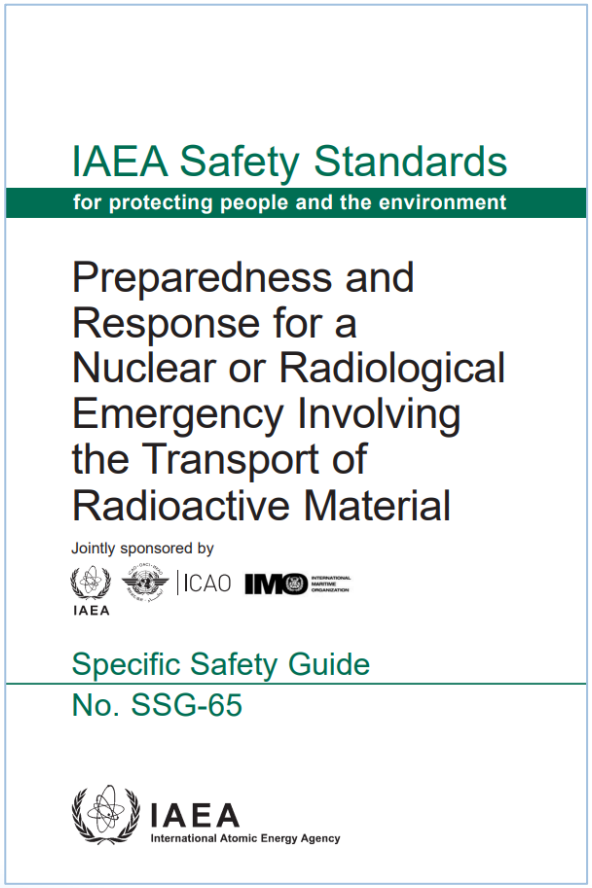
- Response to a nuclear or radiological emergency during the transition to either an existing exposure situation or a planned exposure situation
- The termination of the emergency. General and specific prerequisites to meet in order to enable the termination of an emergency

GSG-14

- Supports Member States in developing arrangements for communicating with the public and media and coordinating official information in the response to a nuclear or radiological emergency

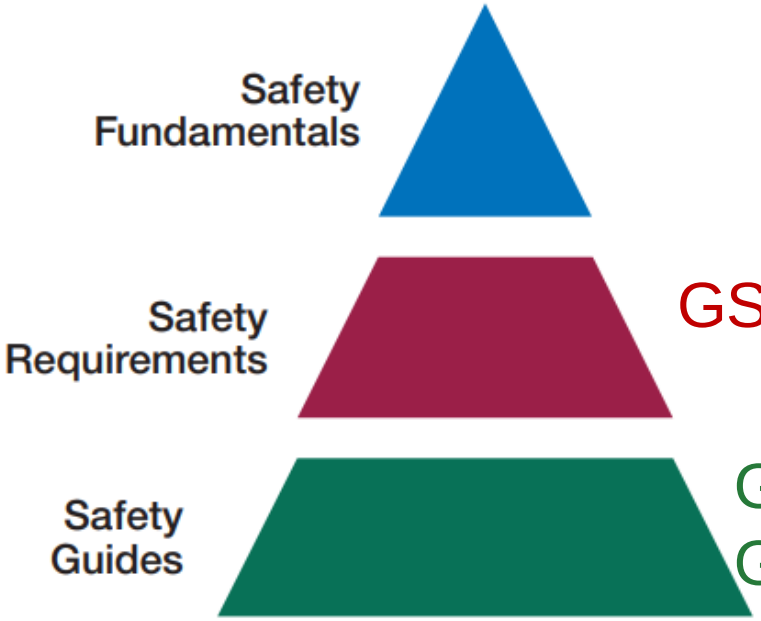


SSG-65



- Provides guidance and recommendations on arrangements to be made at the preparedness stage for emergencies involving the transport of radioactive material
- Supports the implementation of the requirements established in GSR Part 7 for such emergencies, irrespective of their cause, and the IAEA Transport Regulations, IAEA Safety Standards Series No. SSR-6 (Rev. 1)
- Published in 2022

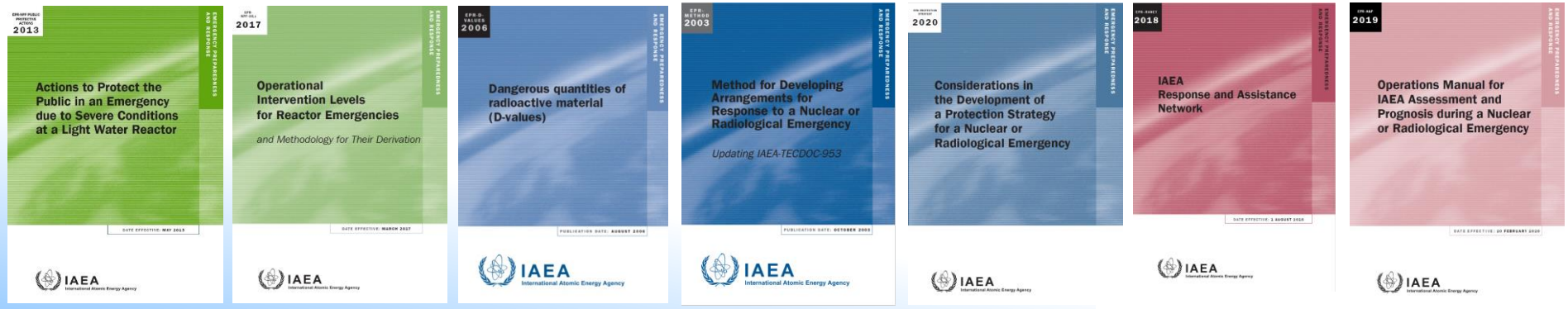
EPR Technical Guidance



GSR Part 7

GS-G-2.1 GSG-11 SSG-65
GSG-2 GSG-14

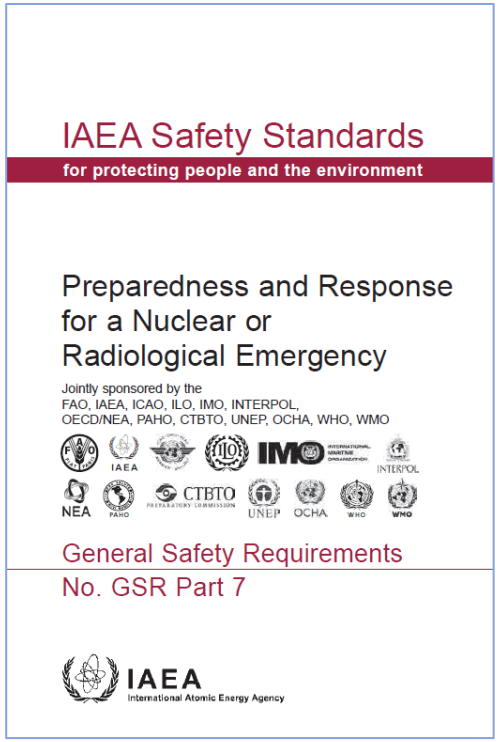
EPR Series publications, e.g.:



Recent development:

New EPR Series publication on Classification, Assessment and Prognosis for NPP emergencies

Identification and notification



Requirement 7: Identifying and notifying a nuclear or radiological emergency and activating an emergency response

"The government shall ensure that arrangements are in place for the prompt identification and notification of a nuclear or radiological emergency and for the activation of an emergency response."

Emergency Classification (1/2)

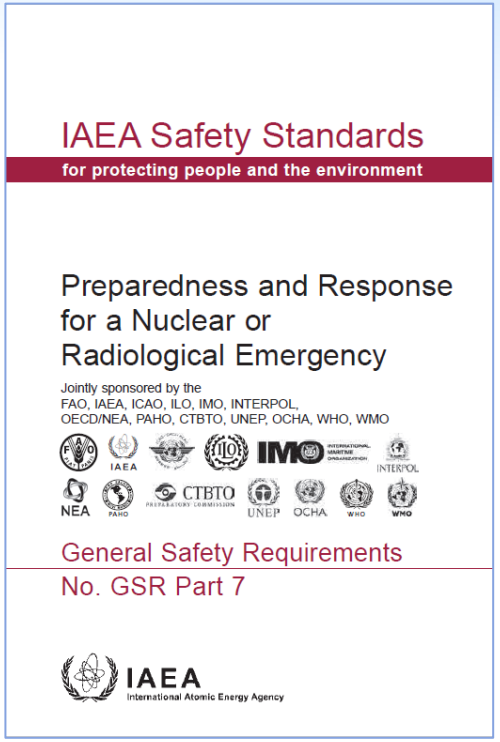
GSR Part 7 defines 4 emergency classes:

Emergency class	Applies to [Emergency Preparedness Category]	Triggers [On-site/off-site protective actions]
General emergency	EPC I and EPC II	On-site and off-site
Site Area emergency	EPC I and EPC II	On-site "and in the vicinity of the site"
Facility emergency	EPC I, EPC II, EPC III	On-site
Alert	EPC I, EPC II, EPC III	No protective action but "actions to assess and mitigate"

EPC I refers mostly to existing "large" Nuclear Power Plants
EPC II refers to most research reactors

General emergency (1/2)

"General emergency at facilities in category I or II for an emergency that warrants taking precautionary urgent protective actions, urgent protective actions, and early protective actions and other response actions on the site and off the site. Upon declaration of this emergency class, appropriate actions shall promptly be taken, on the basis of the available information relating to the emergency, to mitigate the consequences of the emergency on the site and to protect people on the site and off the site."



General Emergency (2/2)

This is of primary importance that a General Emergency, or escalation to a General Emergency, is promptly identified and notified so that:

- The local public decision maker is aware that protective actions need to be decided and implemented
- The State decision maker(s) are aware and can anticipate sending technical support and additional resources
- The international community (incl. neighboring States) is aware
  - Potential for a transboundary release?
  - Foreigners present in the area foreseen to be impacted?

Emergency Action Levels

EAL: “A specific, predetermined criterion for observable conditions used to detect, recognize and determine the emergency class.

An emergency action level could represent an instrument reading, the status of a piece of equipment or any observable event, such as a fire.”

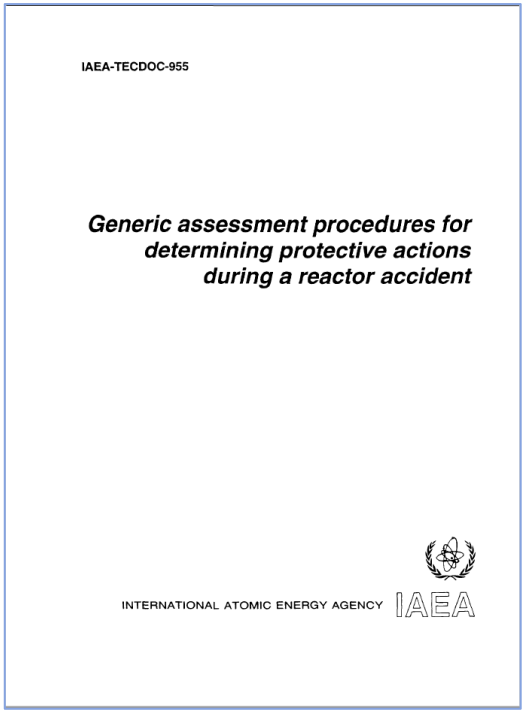
Symptom based
EAL that reflects a consequence from a higher-level event

e.g., dramatic increase in the core exit temperature or core exit temperature higher than, or equal to, … ˚C

Event based
EAL that reflects a main event, potential triggering event

e.g., site flooding

Existing technical guidance



TECDOC 955

- Deals with 3 emergency classes (the notion of Facility emergency is absent)
- Applies to PWR, BWR and VVER
- Contains EALs in the from of tables

TABLE A1 ACCIDENT CLASSIFICATION THE OPERATING, STAND-BY OR HOT SHUTDOWN MODE

For the following accident entry conditions:	Declare a General Emergency if:	Declare a Site Area Emergency if:	Declare an Alert if:
CRITICAL SAFETY FUNCTION IMPAIRMENT			
Failure to scram (stop nuclear reaction)	Failure to scram when above 5% power **and** any of the following: ▸ PWR negative cooling margin by Figure A1 **or** ▸ vessel water level below top of active fuel, **or** ▸ major (100 - 1000x) increase in multiple radiation monitors **or** ▸ other indication of actual or imminent core damage	Failure to scram when above 5% power and abnormal conditions indicate automatic or manual scram is necessary	Failure to fully shutdown as part of normal shutdown and there is sufficient heat removal available (ultimate heat sink available and sufficient)
Inadequate primary system decay heat removal	? ←	Actual or protected long term failure of the ability to remove decay heat to the environment potentially affecting the ability to protect the core	? ←

Technical guidance under development

Draft EPR-NPP-Assessment, *Classification, Assessment and Prognosis during Nuclear Power Plant Emergencies*

- Will replace TECDOC-955
- Will deal with the 4 emergency classes
- Will apply to PWR, BWR, VVER and PHWR-CANDU
- Will contain EALs in the form of flowcharts

Flowcharts will allow to:

- Bring more clarity
- Allow navigation between flowcharts
- Reflect the progressivity of emergency development / escalation from an emergency class to a more severe emergency class

Draft EPR-NPP-CAP (1/4)

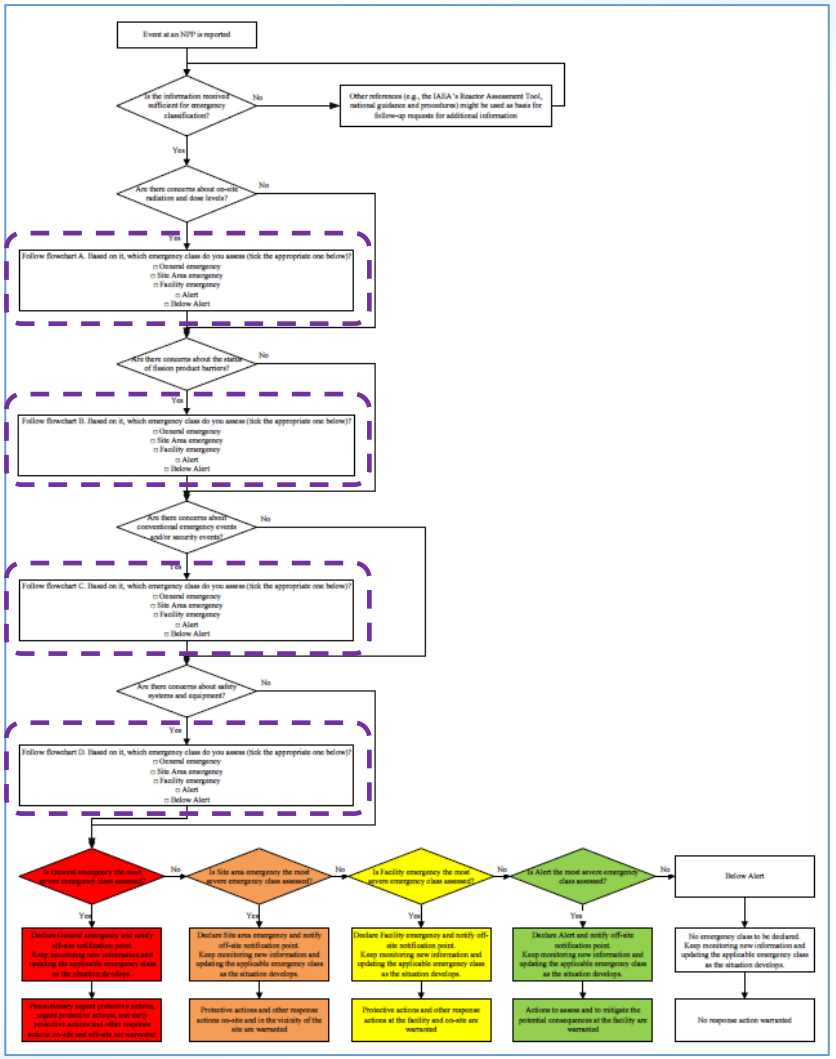
Overarching flowchart:

1. Flowchart “Radiation and Dose Levels”

2. Flowchart “Fission Product Barriers”

3. Flowchart “Conventional Emergencies, Natural Events, Security Events”

4. Flowchart “Safety Systems and Equipment”



Draft EPR-NPP-CAP (2/4)

Overarching flowchart:

1. Flowchart “Radiation and Dose Levels” includes:
   - Fuel damage in Spent Fuel Pool or during transfer
   - Actual or projected dose

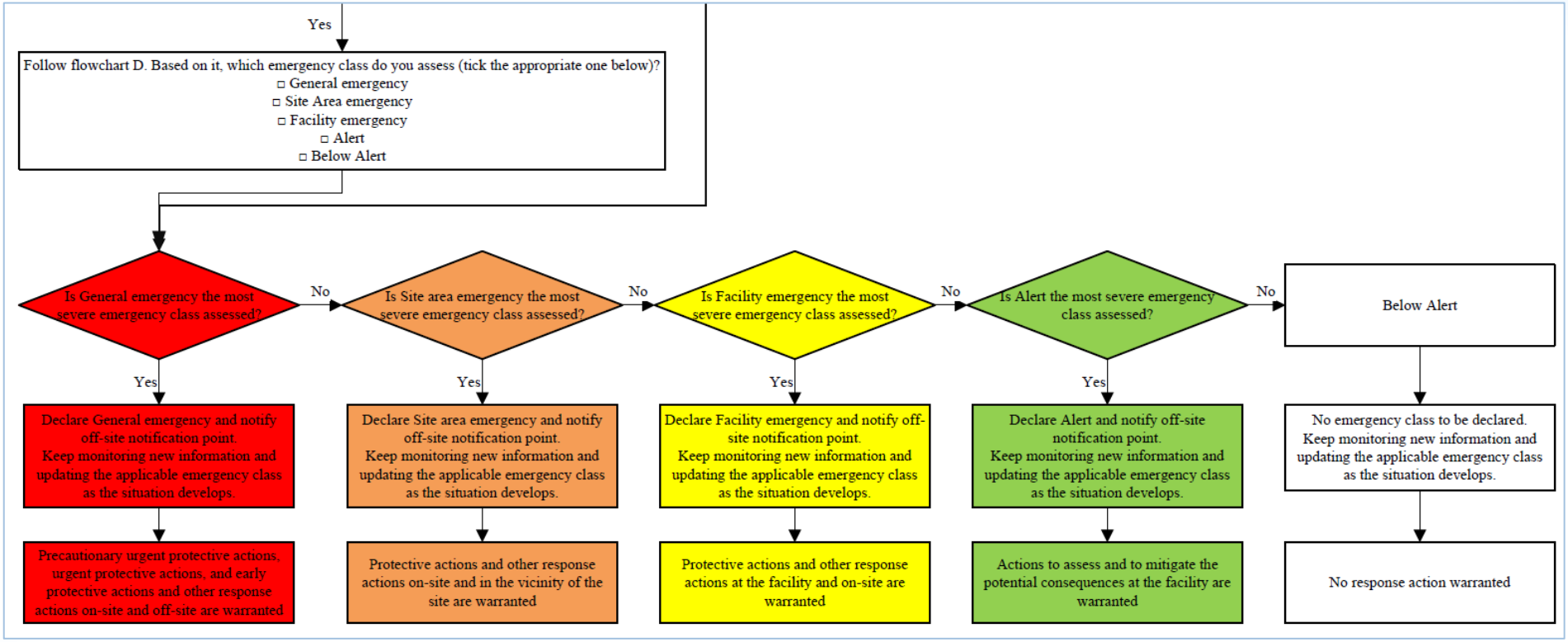
2. Flowchart “Fission Product Barriers” deals with:
   - Loss(es) of FP barriers

3. Flowchart “Conventional Emergencies, Natural Events, Security Events” includes:
   - Natural events
   - Conventional fire, explosion, toxic release
   - Security event

4. Flowchart “Safety Systems and Equipment” includes:
   - Reactor trips
   - Loss of power
   - Loss of capability to remove primary heat
   - Station blackout
   - Loss of Ultimate Heat Sink

Draft EPR-NPP-CAP (3/4)

Overarching flowchart



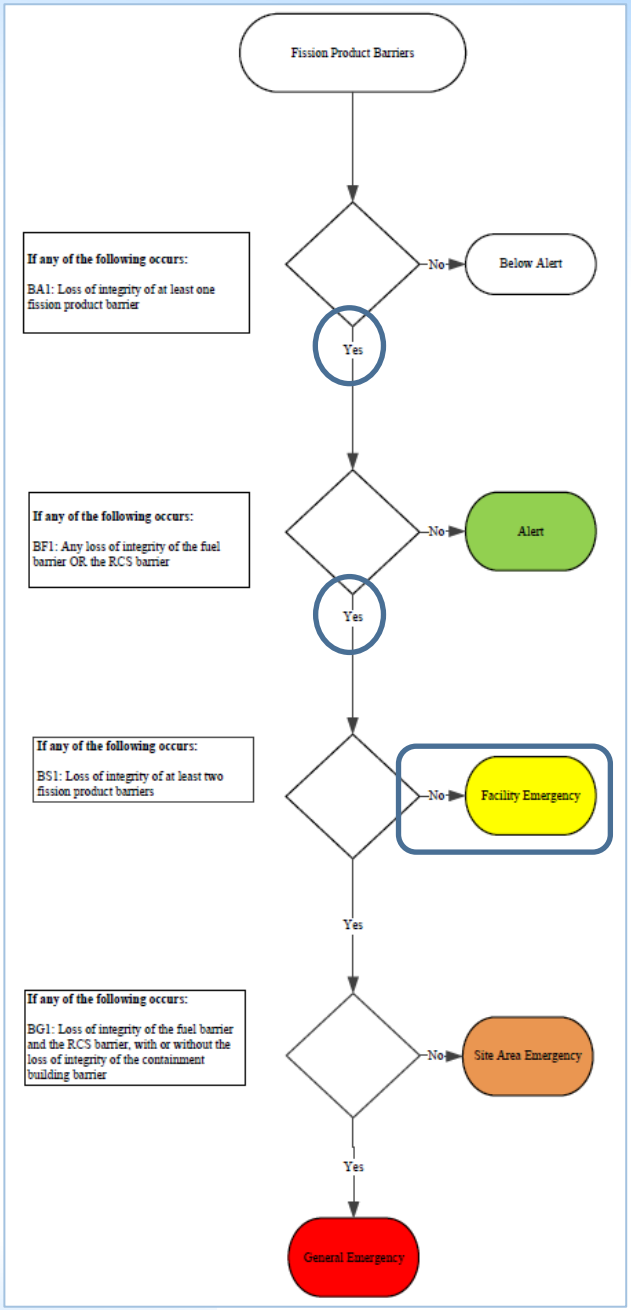
Draft EPR-NPP-CAP (4/4)

Example: Primary break (LOCA), focus on the use of the "Fission Product Barriers" flowchart

Note: the body text of EPR-NPP-Assessment will elaborate on the EALs used in the flowcharts and suggest specific/technical criteria

E.g., loss of the fuel FP barrier:

Core exit temperature ≥ 700˚C

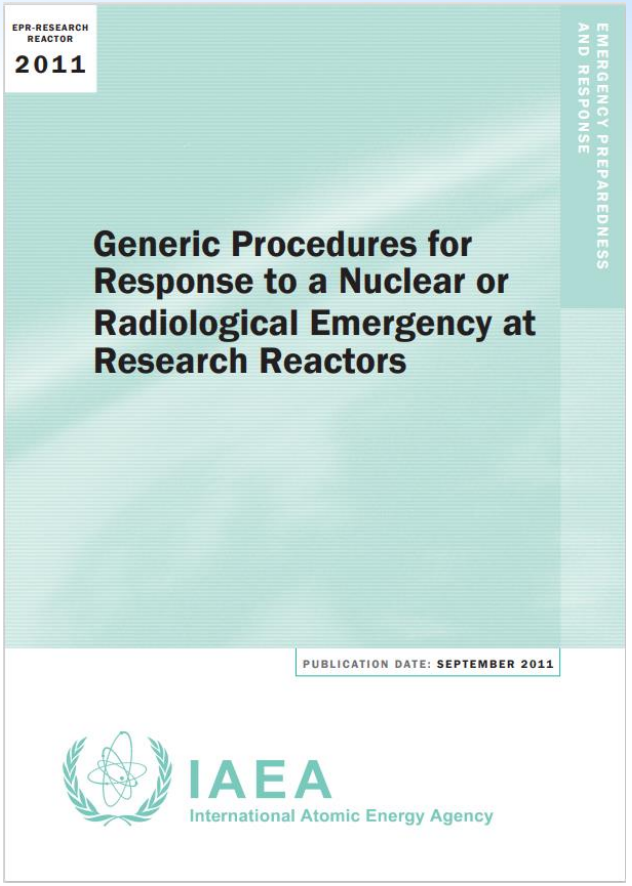


Draft EPR-NPP-CAP

- In addition to detailing EALs and their technical basis for emergency classification, EPR-NPP-CAP will elaborate on:
  - The process for the assessment of potential NPP emergency consequences and prognosis of possible NPP emergency progression
  - How emergency classification articulates with A&P during the response to an NPP emergency
- Current status of draft EPR-NPP-CAP:
  - Was reviewed and approved internally (IEC)
  - Went through Advance Publishing Advice by the IAEA Publishing section
  - Was submitted to the Publication Committee in February 2024

Draft EPR-Research Reactor (revision)

- EPR-Research Reactor 2011 under revision
- 2011 version includes EAL tables
- The same flowchart approach will be applied to the revision



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Thank you!