



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

Arrangements for the Termination of a Nuclear or Radiological Emergency

Basic Concepts in
Emergency Preparedness and Response

Lecture 02

Introduction

- Various EPR concepts have been defined and used for many years, e.g.:
 - Nuclear or radiological emergency;
 - Emergency phase;
 - Emergency response.
- In addition, in 2011, the concept of exposure situations (planned, emergency, existing) was introduced.
- Consequently, the issue of the transition between different exposure situations has arisen.

Purpose



- Present the concepts addressed in IAEA Safety Standards Series No. GSG-11, particularly in relation to the transition phase;
- Describe how these concepts derive and build upon those provided in IAEA Safety Standards Series No. GSR Part 7 and other EPR related Safety Standards.

Learning objectives

- Differentiate between different exposure situations;
- Differentiate between various phases of a nuclear or radiological emergency, with an understanding of the underlying principles of, and the objectives for, the delineation of these phases;
- Recognize the implications of the termination of an emergency with regard to the management of the situation;
- Identify the scope of IAEA Safety Standards Series No. GSG-11.

Content



- Basic concepts and terminology:
 - Nuclear or radiological emergency
 - Situations of exposure (emergency, planned, existing)
 - Emergency response phase
 - Transition phase
- Transition to:
 - An existing exposure situation
 - A planned exposure situation
- Important considerations

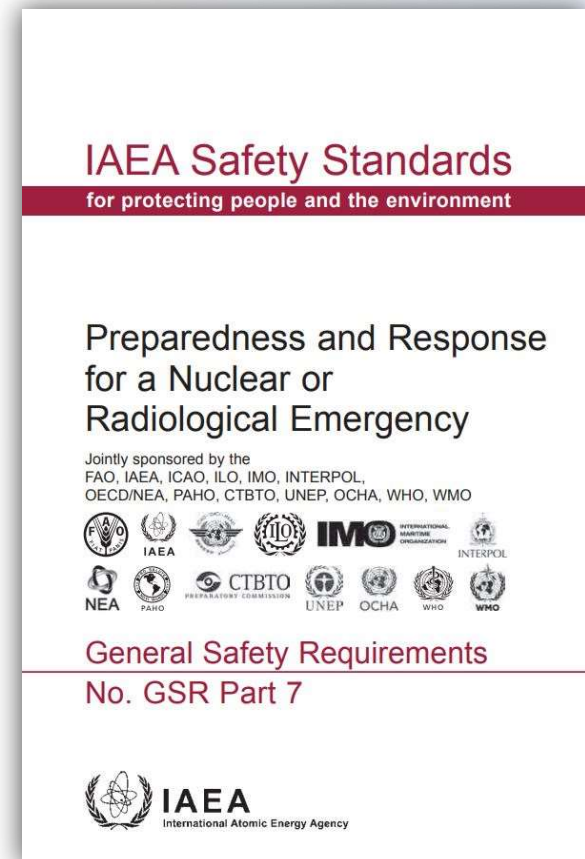
Definition of Emergency



- **Emergency:** A non-routine situation or event that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment.

Nuclear or radiological emergency: An emergency in which there is, or is perceived to be, a hazard due to:

- 1) The energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction; or
- 2) Radiation exposure.



Definition of Emergency (Response) Phase



- ***Emergency response phase***: The period of time from the detection of conditions warranting an *emergency response* until the completion of all the actions taken in anticipation of or in response to the radiological conditions expected in the first few months of the *emergency*:
 - This phase typically ends when the situation is under *control*, the *off-site* radiological conditions have been characterized sufficiently well to identify where food restrictions and *temporary relocation* are *required*, and all *required* food restrictions and *temporary relocations* have been implemented.

= early protective actions have been implemented.

Situations of exposure

- GSR Part 3, on the basis of ICRP 103 Recommendations, introduced three situations of exposure:
 - Planned exposure situation;
 - Emergency exposure situation;
 - Existing exposure situation.



IAEA Safety Standards

for protecting people and the environment

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

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General Safety Requirements Part 3
No. GSR Part 3



Definition of emergency exposure situation

- A **situation of exposure** that arises as a result of an accident, a malicious act or other unexpected event, and **requires prompt action** in order to avoid or reduce adverse consequences.



Emergency: A non-routine **situation** or event **that necessitates prompt action**, primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment.

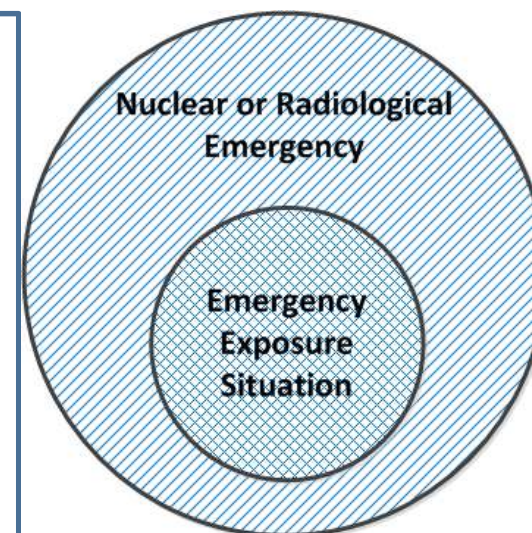
Definition of emergency exposure situation (cont'd.)



- A **situation of exposure** that arises as a result of an accident, a malicious act or other unexpected event, and **requires prompt action** in order to **avoid or reduce adverse consequences**.



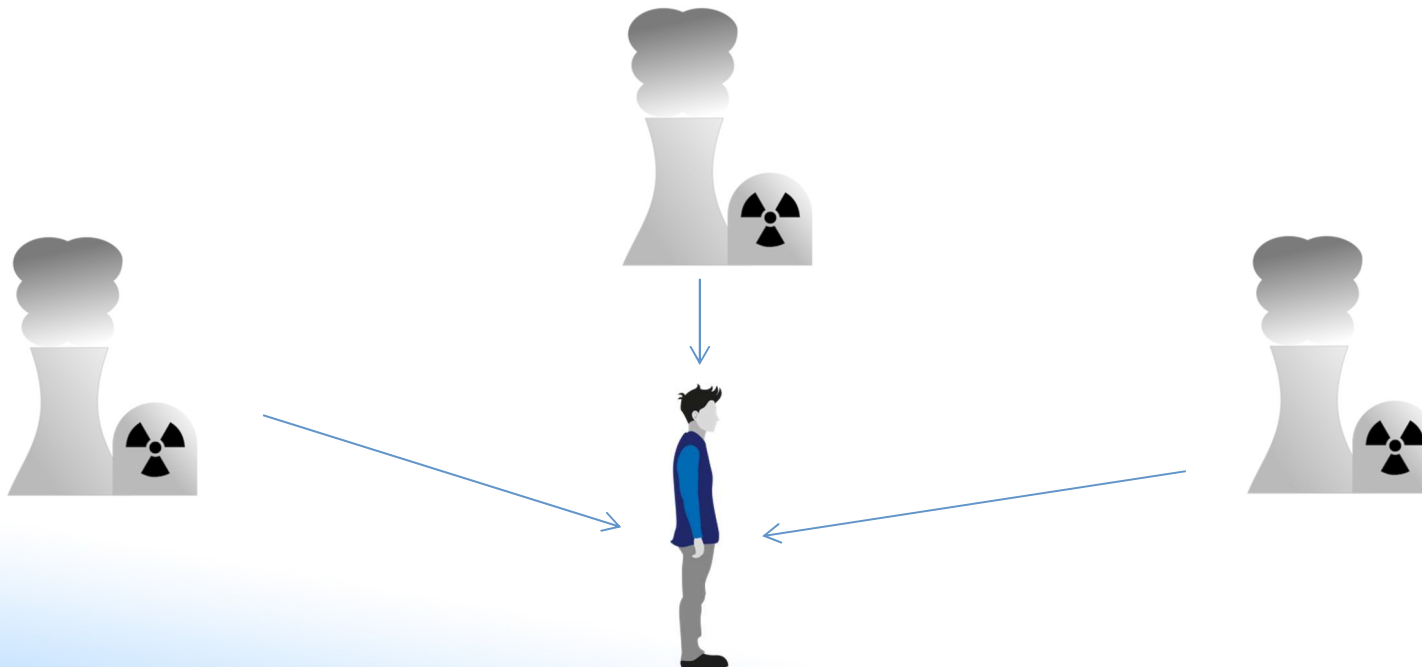
Nuclear or radiological emergency
≠
Emergency exposure situation



Definition of planned exposure situation



- The situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure due to a source.



Definition of existing exposure situation

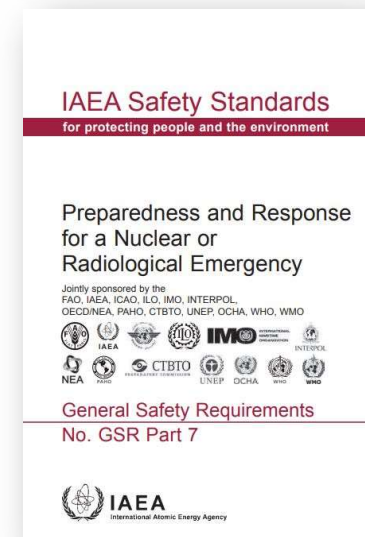
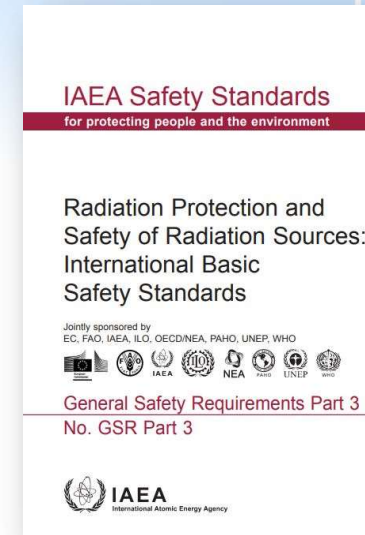


- A situation of exposure that already exists when a decision on the need for control needs to be taken.
 - (i) ...*"exposure due to residual radioactive material deriving from a nuclear or radiological emergency **after an emergency has been declared to be ended.**"*

Transition between situations of exposure



- **Req. 46 of GSR Part 3:** Transition from an emergency exposure situation to an existing exposure situation
- **Req. 18 of GSR Part 7:** Termination of the emergency and transition to either an existing exposure situation or a planned exposure situation



Discussion

- Have you defined and used the three exposure situations at your national level?



Existing exposure situation

Nuclear or radiological emergency

Emergency

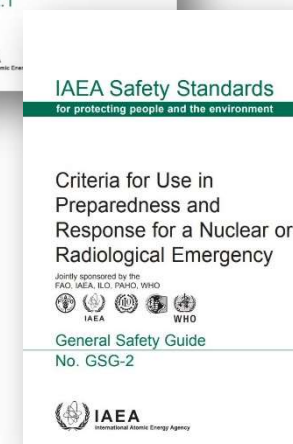
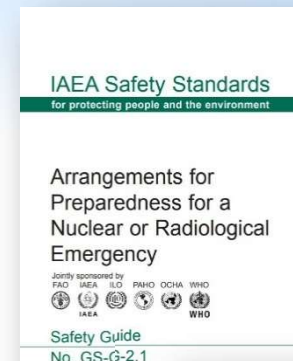
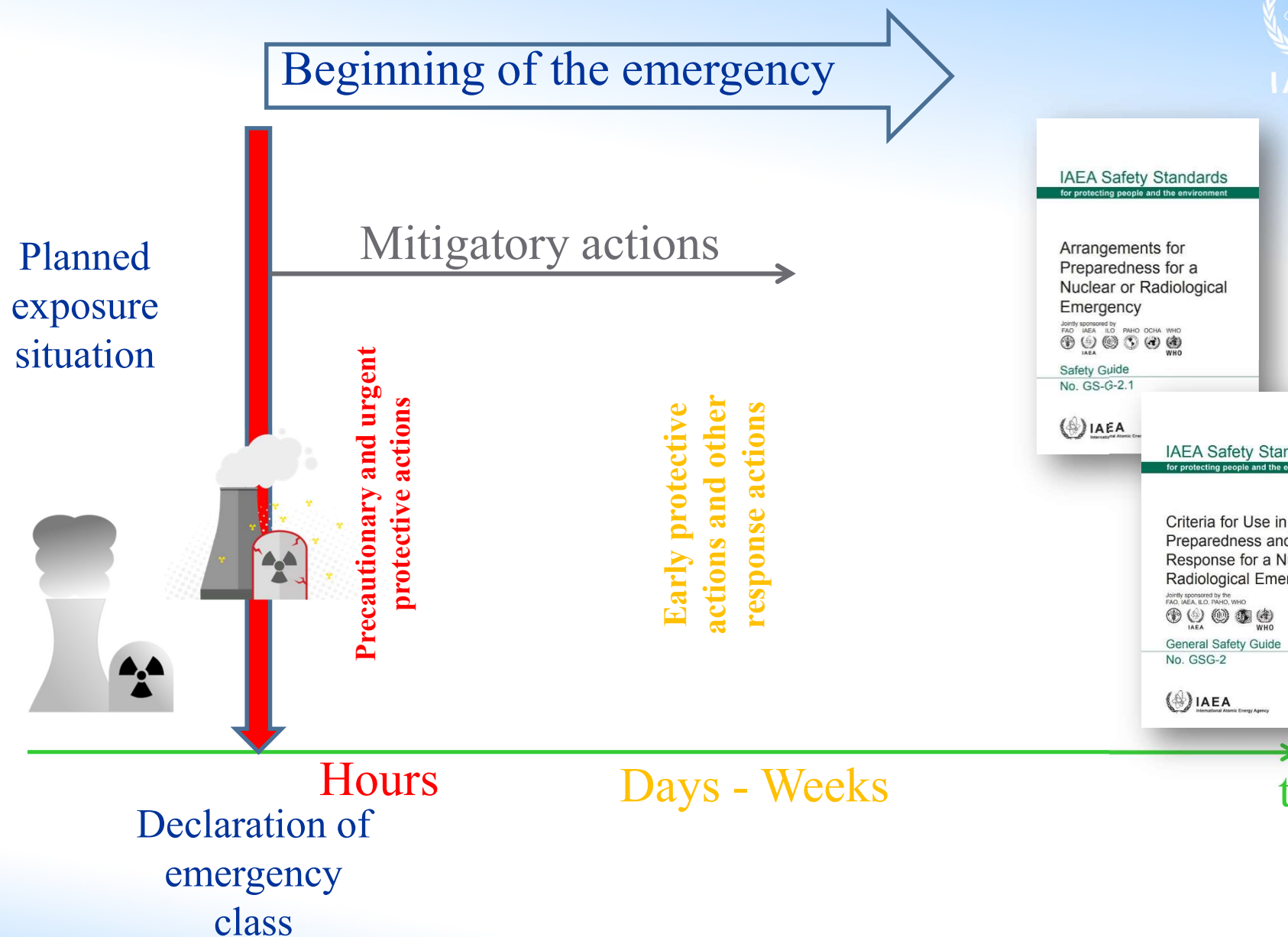
Declaration an emergency ended

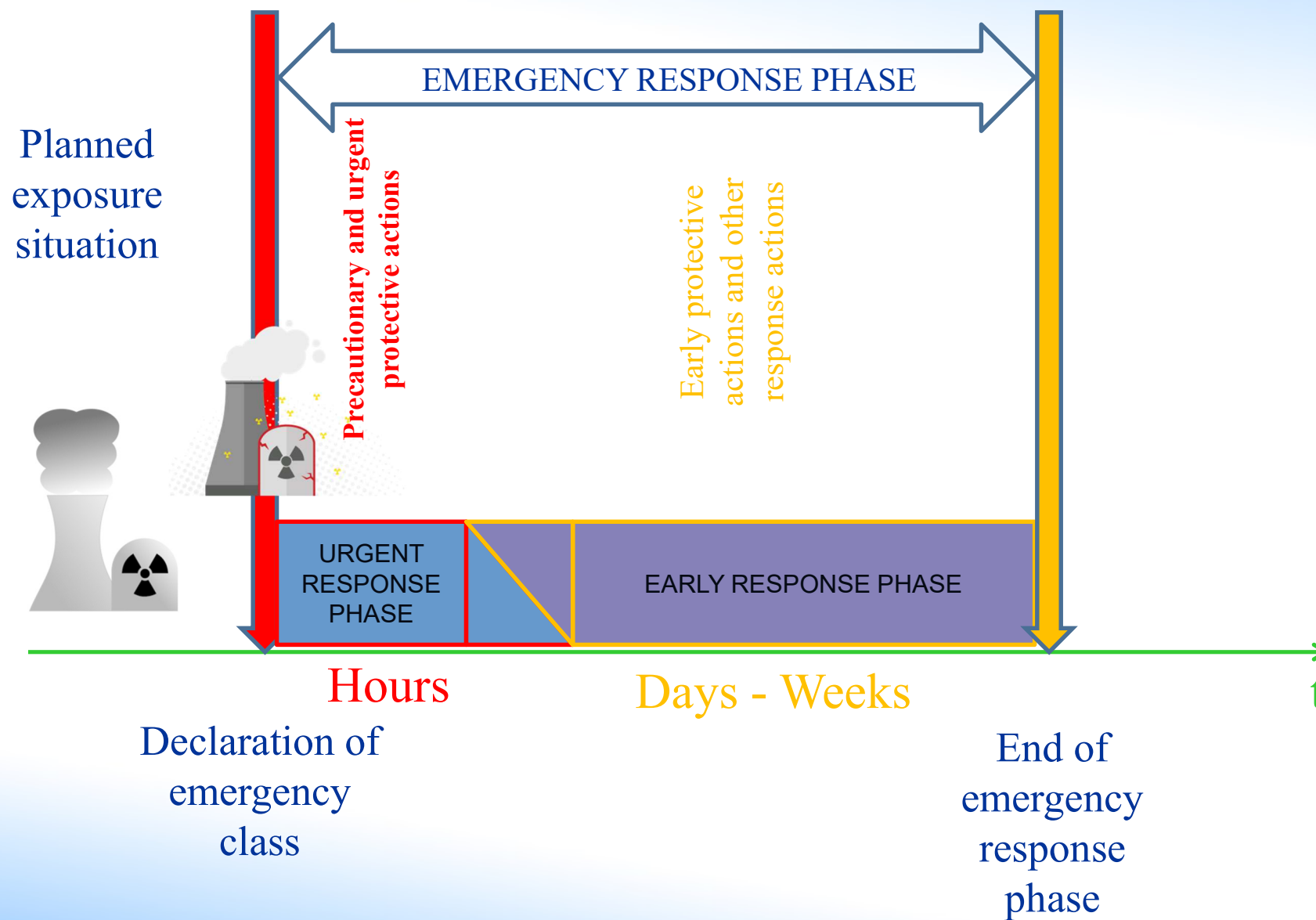
Emergency phase

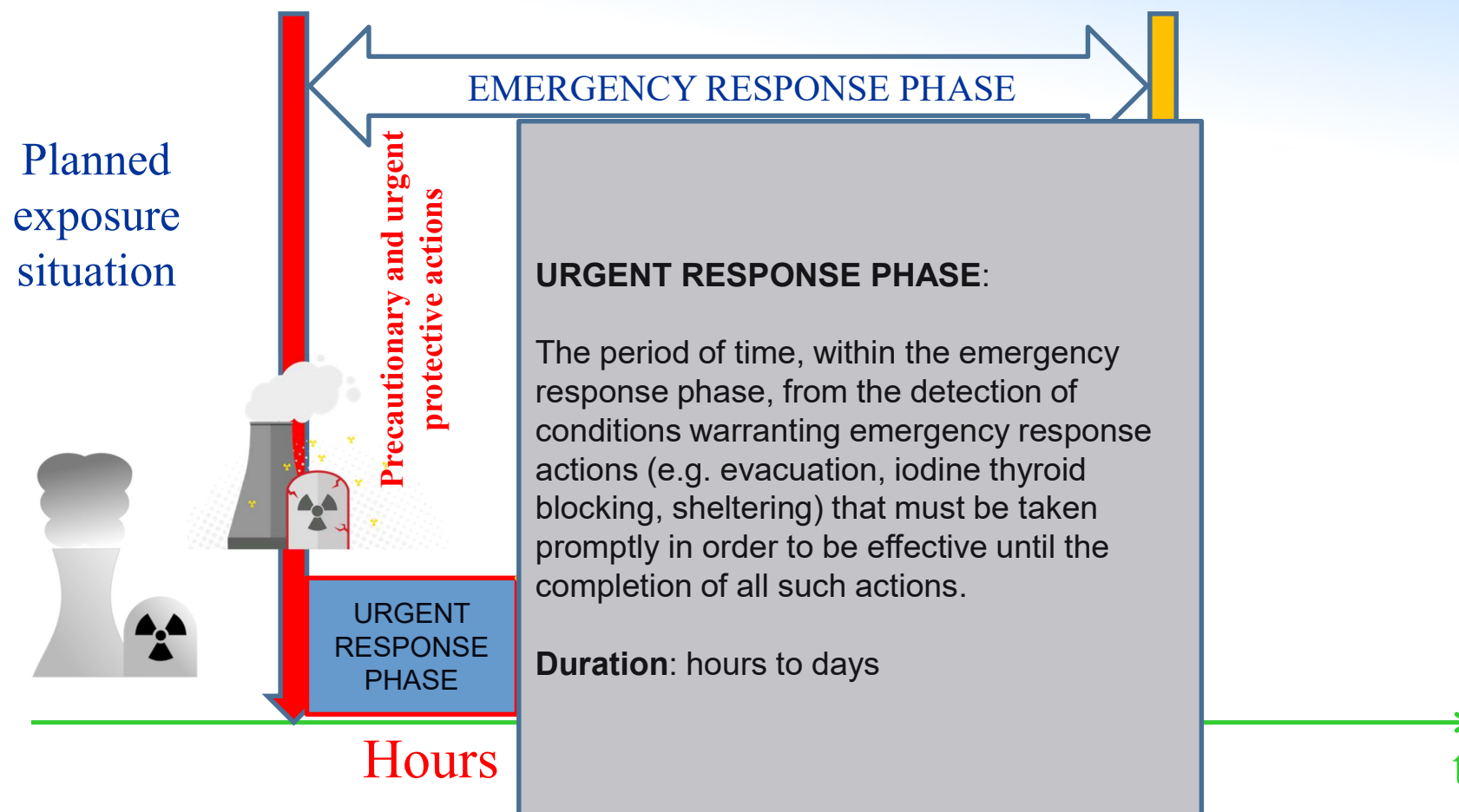
Transition to an existing exposure situation

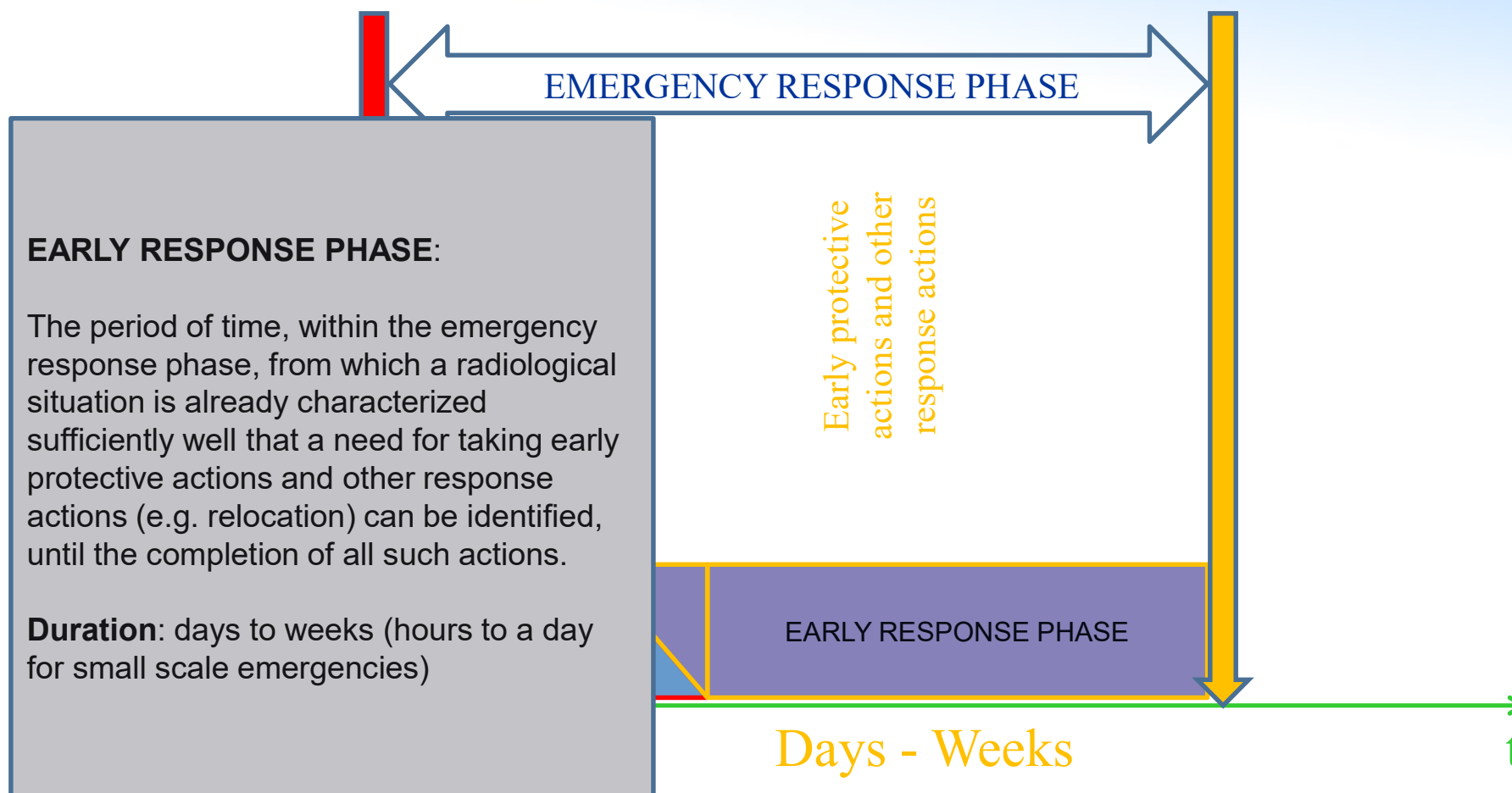
Emergency exposure situation

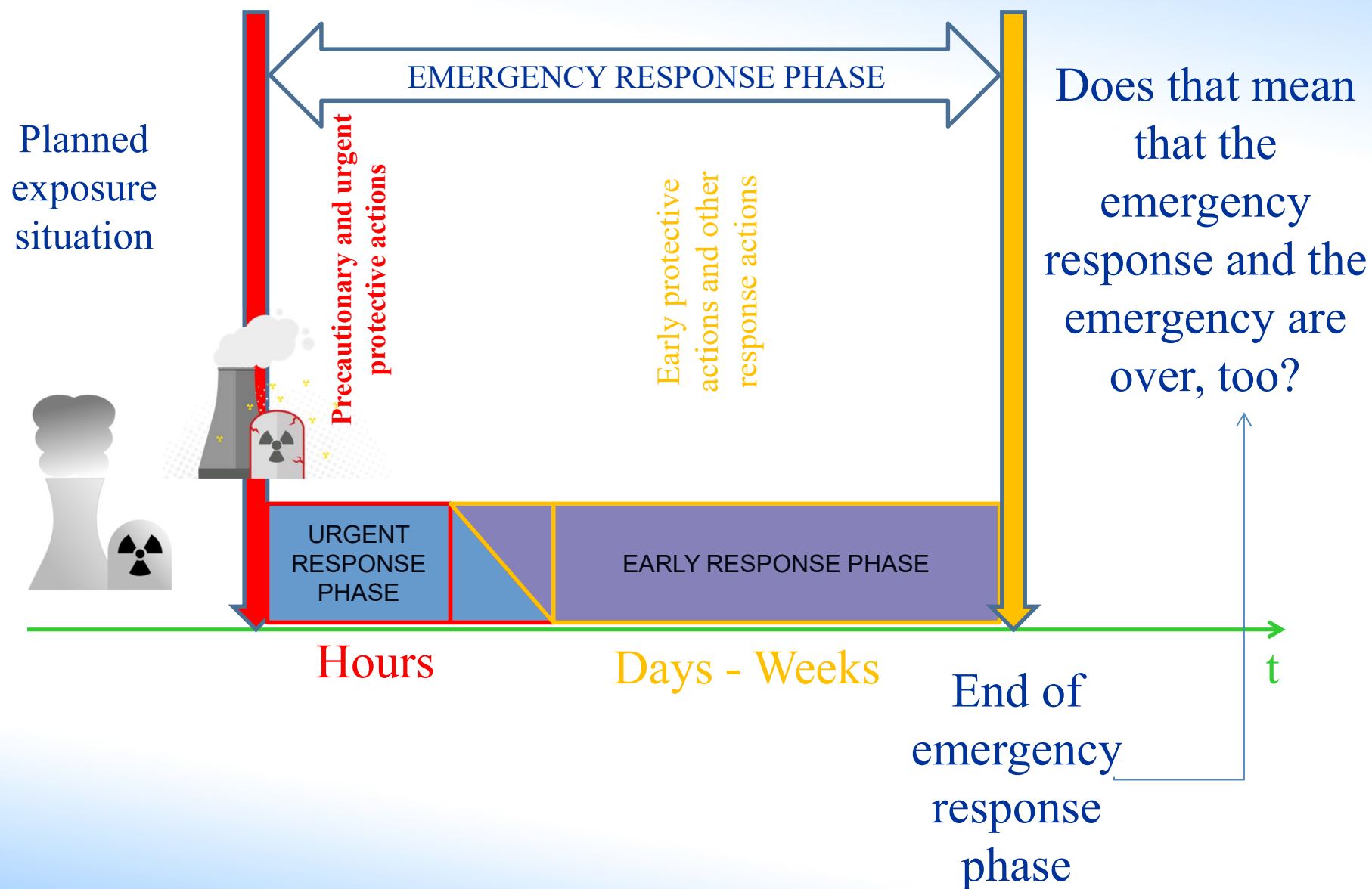
Planned exposure situation











Goals of emergency response



Para. 3.2 of IAEA Safety Standards
Series No. GSR Part 7:

“ [...]

(i) To prepare, to the extent practicable, for the resumption of normal social and economic activity.”

IAEA Safety Standards for protecting people and the environment

Preparedness and Response for a Nuclear or Radiological Emergency

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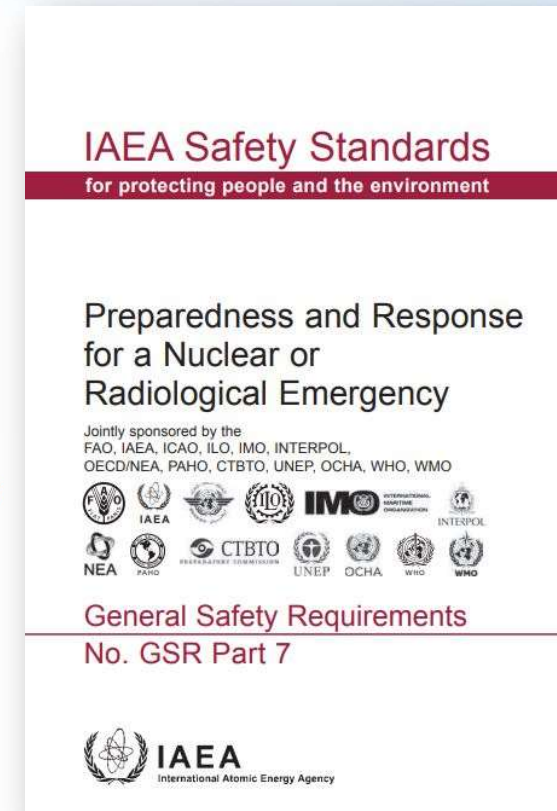
General Safety Requirements No. GSR Part 7

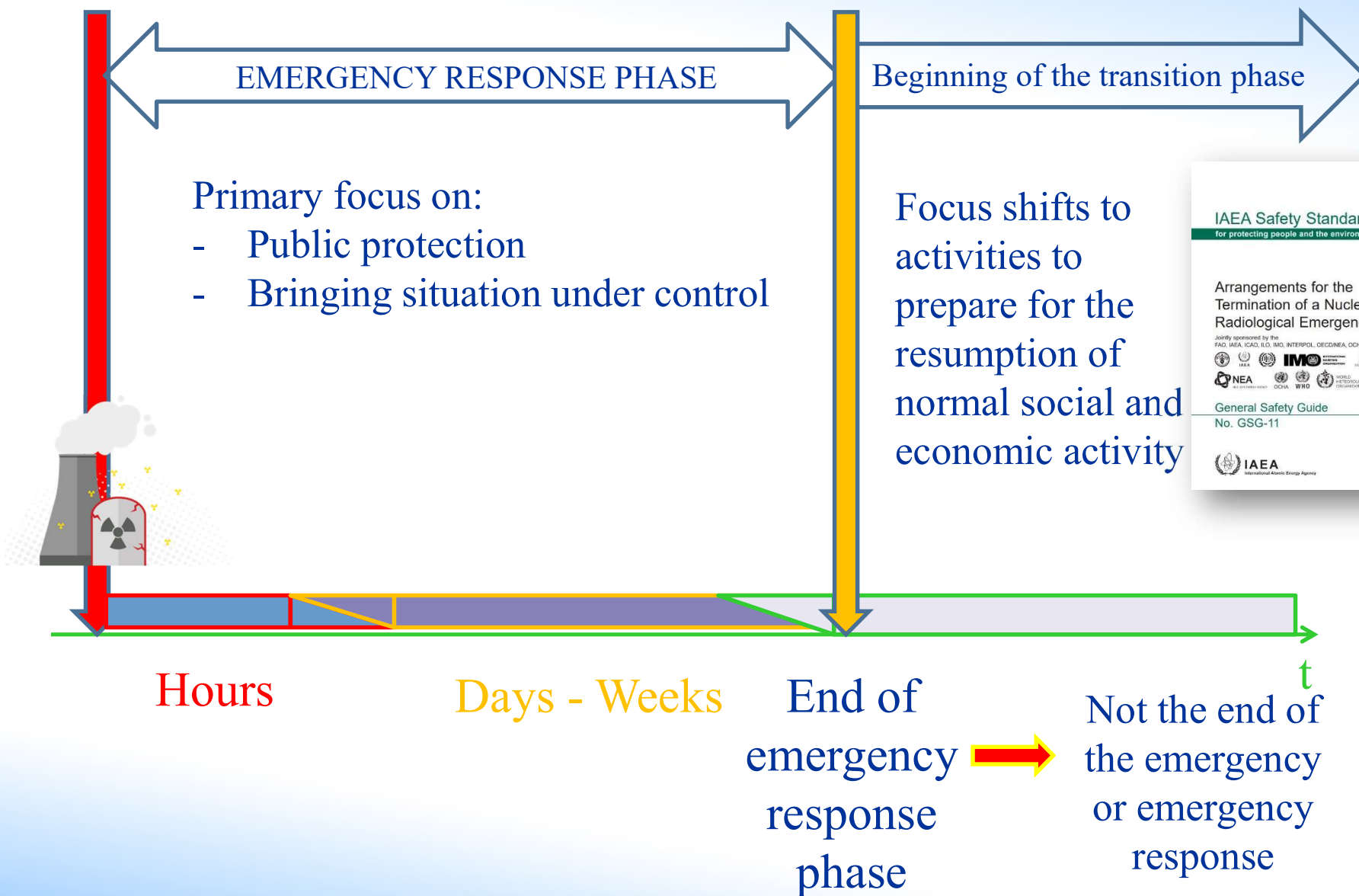


Definition of emergency response



- The performance of actions to mitigate the consequences of an emergency for human life, health, property and the environment:
 - The emergency response also provides a basis for the resumption of normal social and economic activity.





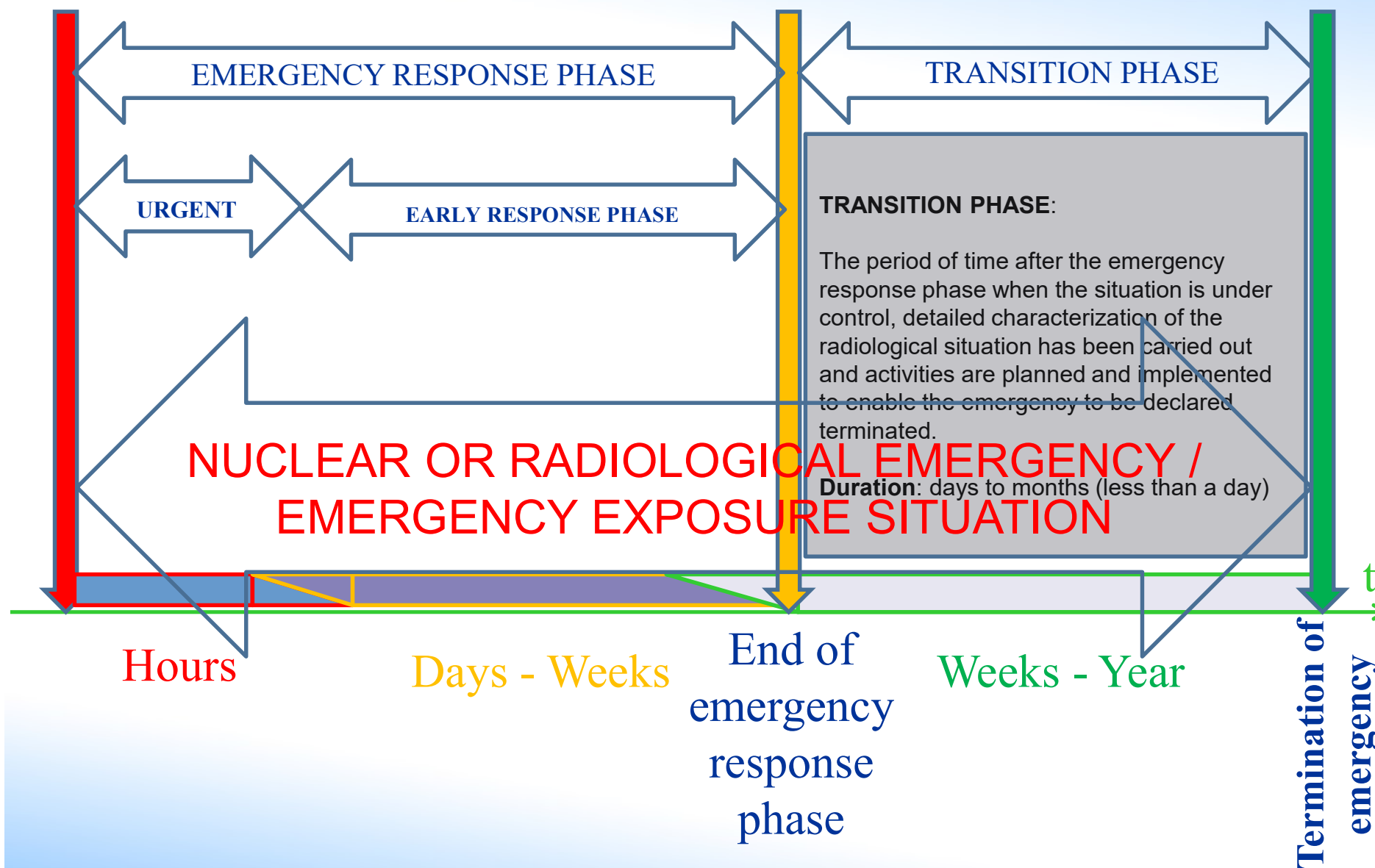


Transition phase

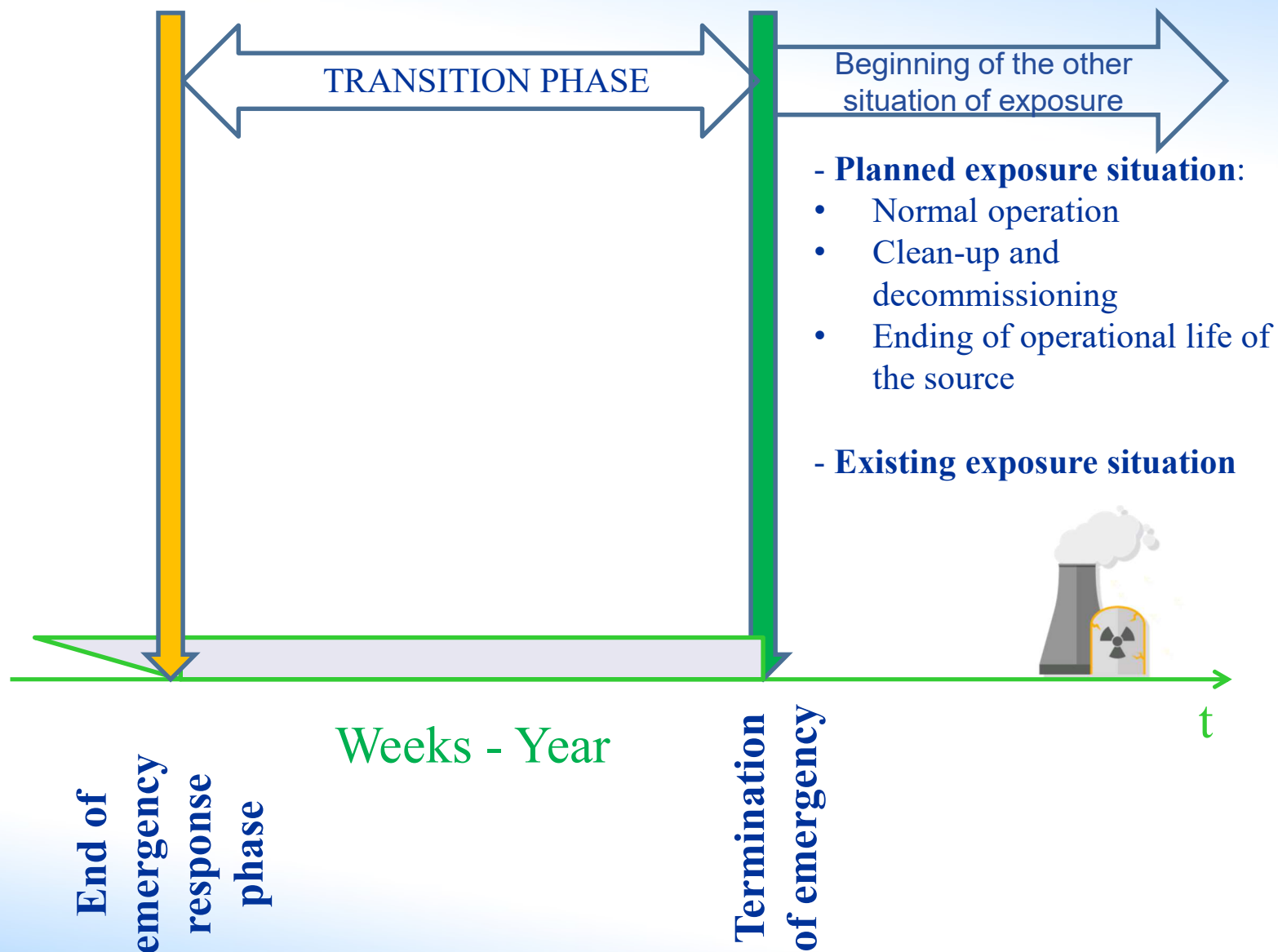
- **Beginning:**
 - The end of the emergency response phase
- **End:**
 - When preparations for the resumption of normal social and economic activity are completed
 - Marks the beginning of the planned or existing exposure situation

Examples:

- Active emergency response organization (24/7) that gradually integrates additional organizations that assume roles in the longer term
- Disrupted:
 - Practices involving nuclear or radioactive material and radiation technologies
 - Public services and possibly infrastructure
 - Businesses
- Protection strategy in place which might not be suitable as such to remain in the longer term
- Displaced populations
- Increased interest by affected populations in ongoing activities to provide for their protection, safety and well-being



Situation of exposure after the termination



Discussion

- Can you explain some differences between a transition to a planned exposure situation and a transition to an existing exposure situation?
- Can you provide examples of emergencies that may transition to a planned or to an existing exposure situation?



Transition to an existing exposure situation



- Emergencies involving significant releases of radioactive material into the environment:
 - Result in an emergency exposure situation;
 - Public exposures in the longer term due to residual radioactive material are eventually to be managed as an existing exposure situation;
 - Termination of the emergency will mark entering into the existing exposure situation with regard to public exposures;
 - The facility, the activity or the source involved in the emergency will undergo clean-up, decommissioning or ending of the operational life of the source (all subject to the requirements for a planned exposure situation).

Transition to a planned exposure situation

- Emergencies that do not involve significant releases of radioactive material into the environment:
 - Do not introduce a situation of exposure to the public that differs from the one that existed before the emergency;
 - May not necessarily result in an emergency exposure situation;
 - Termination of the emergency will mark the beginning of a planned exposure situation associated with normal operation, clean-up, decommissioning or ending of the operational life of the source (all subject to requirements for a planned exposure situation).

Important considerations

- The concept of ‘transition phase’ is introduced to provide **clarity about the scope of GSG-11** regarding the period after the emergency it addresses:
 - Depending on the type of emergency, this period may last from hours to months.
- Various phases of the emergency are distinguished on the basis of the **different timescales in which specific protective actions and other response actions are to be undertaken** in order to achieve the goals of emergency response.

Important considerations (cont'd.)

- Various phases are intended to support the planning efforts for each phase at the preparedness stage:
 - These efforts depend on the characteristics of each phase, including the information available and the specific activities to be carried out to achieve the relevant goals of the emergency response.
- Response to a nuclear or radiological emergency is a continuous effort:
 - During the response, it is not intended that a distinction be made between the various phases .

Important considerations (cont'd.)

- The complexity of the radiological situation may vary greatly within an affected area after a large scale emergency and may be transient in nature:
 - Different phases and different exposure situations will coexist geographically and temporally;
 - Transition will occur gradually in specific areas within the entire affected area:
 - In such case, the transition phase will end when the final area that was in an emergency exposure situation has transitioned to an existing exposure situation;
 - The transition of this final area to an existing exposure situation will also denote the overall termination of the emergency.

Illustration. Transition to existing exposure situation

T

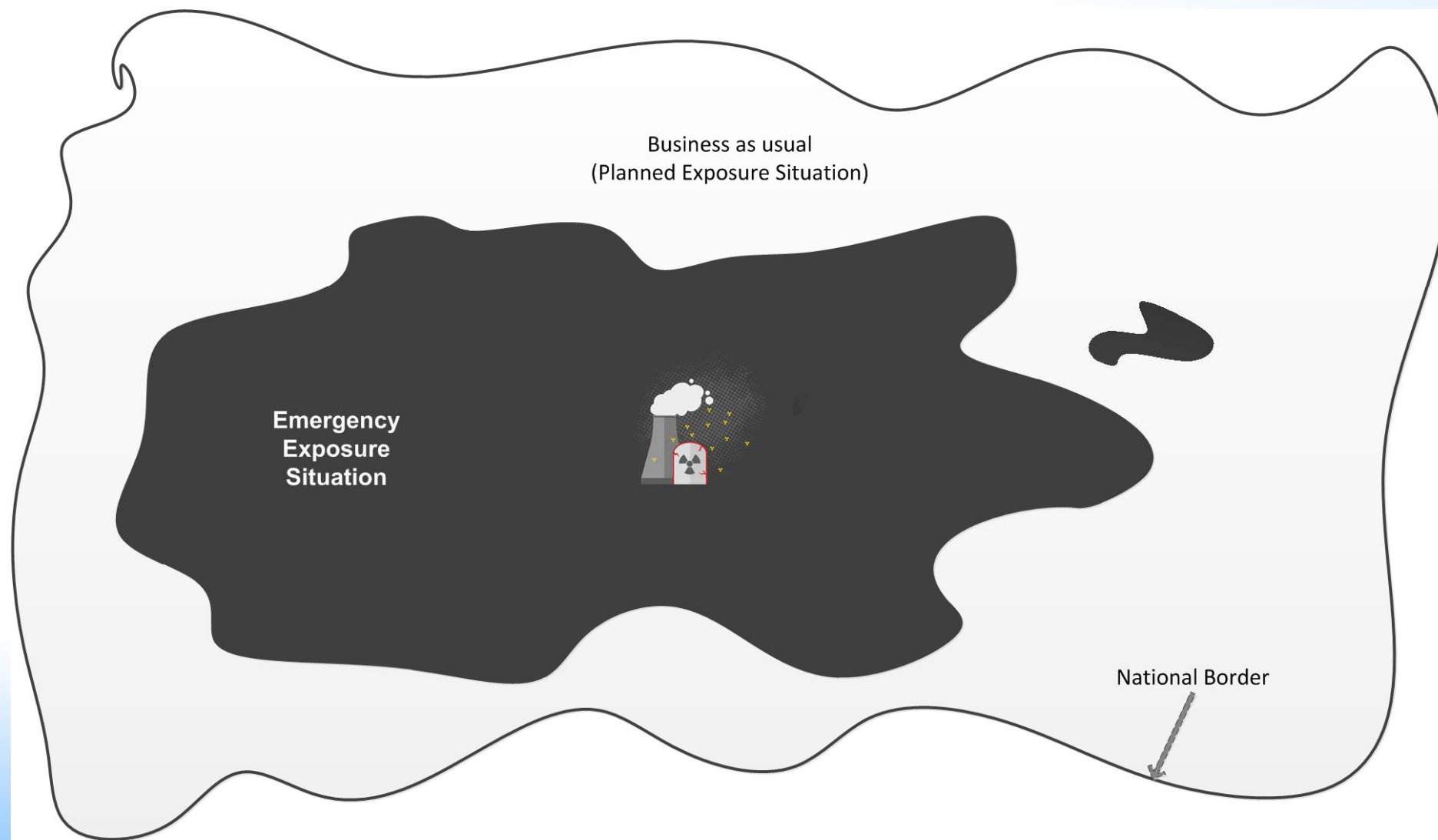


Illustration.

Transition to existing exposure situation (cont'd.)

$T + \Delta t_1$



Illustration.

Transition to existing exposure situation (cont'd.)



$T + \Delta t_2$

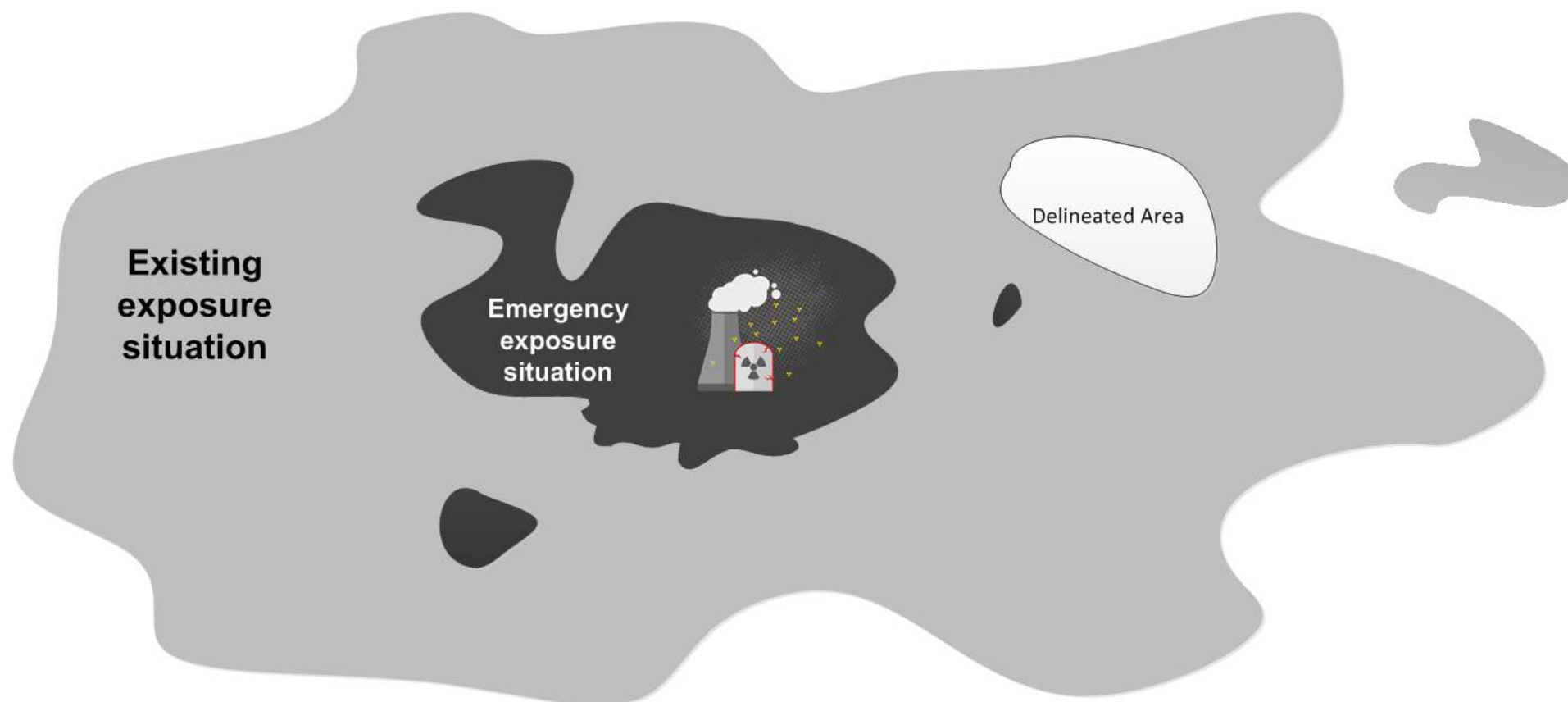


Illustration.

Transition to existing exposure situation (cont'd.)

$T + \Delta t_3$

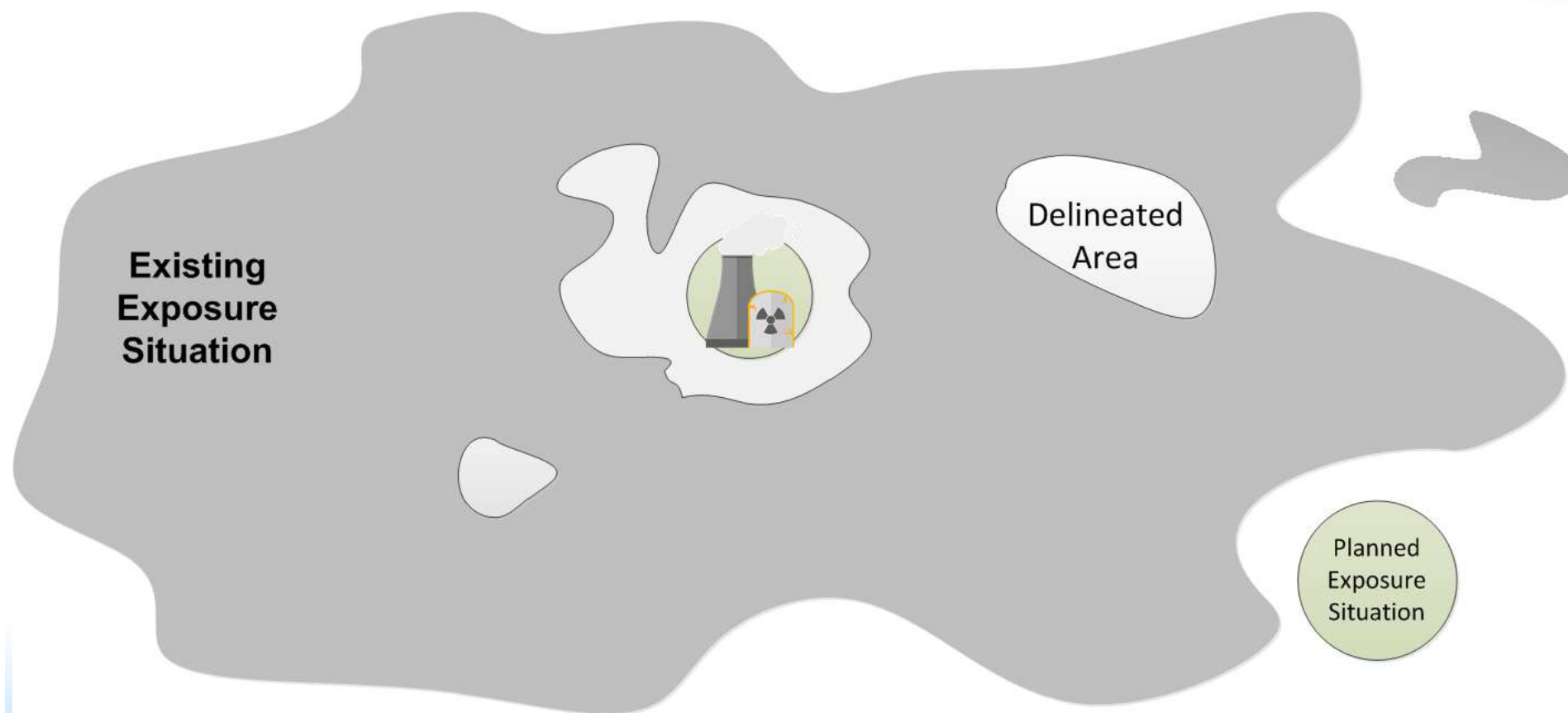


Illustration.

Transition to planned exposure situation (cont'd.)

T

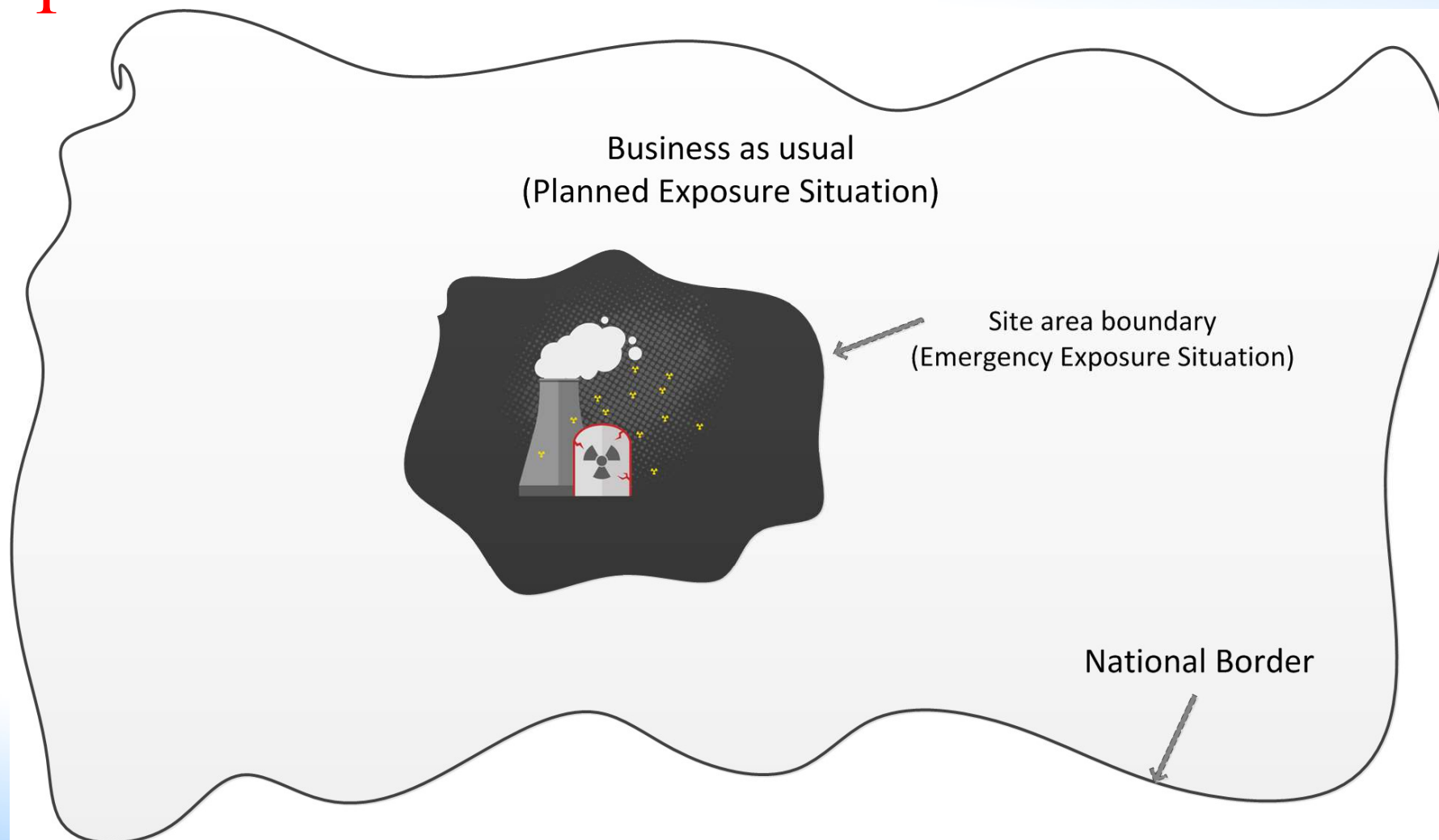
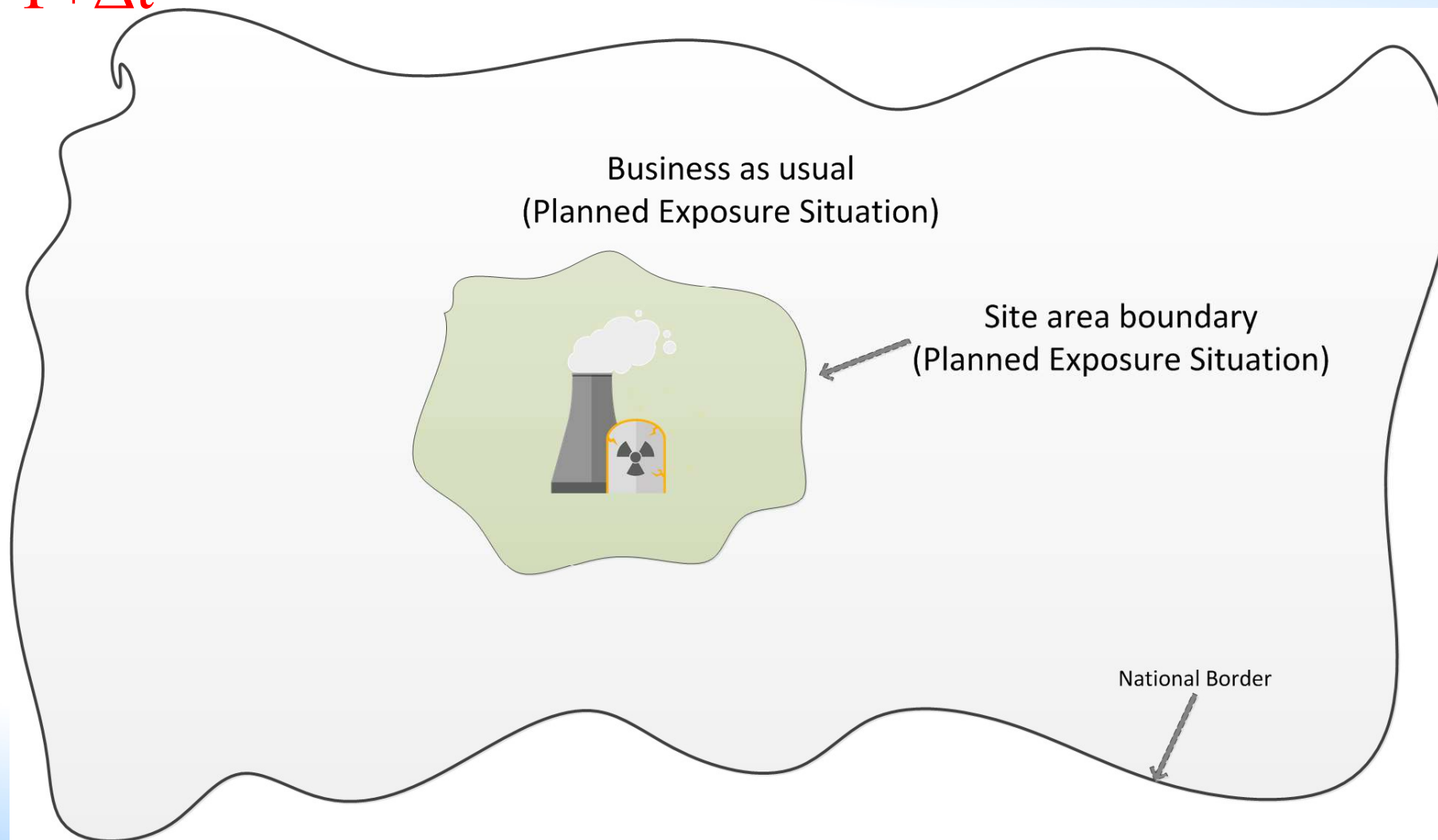


Illustration.

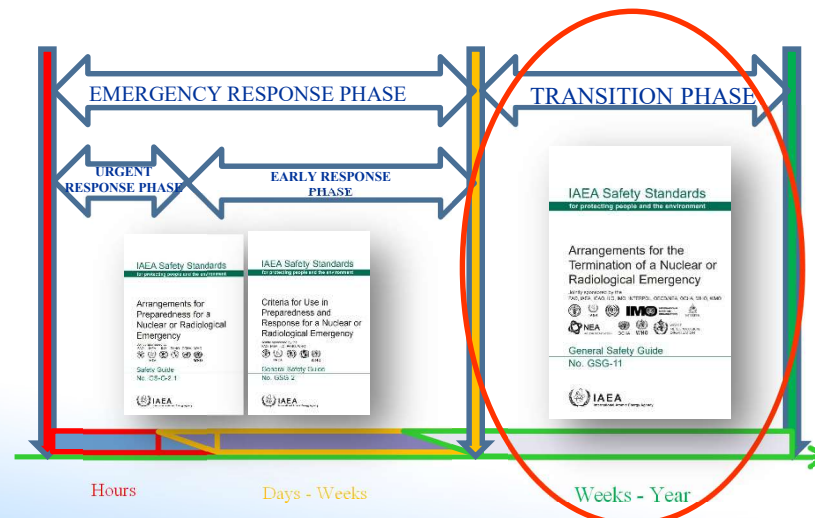
Transition to planned exposure situation (cont'd.)

$T+\Delta t$

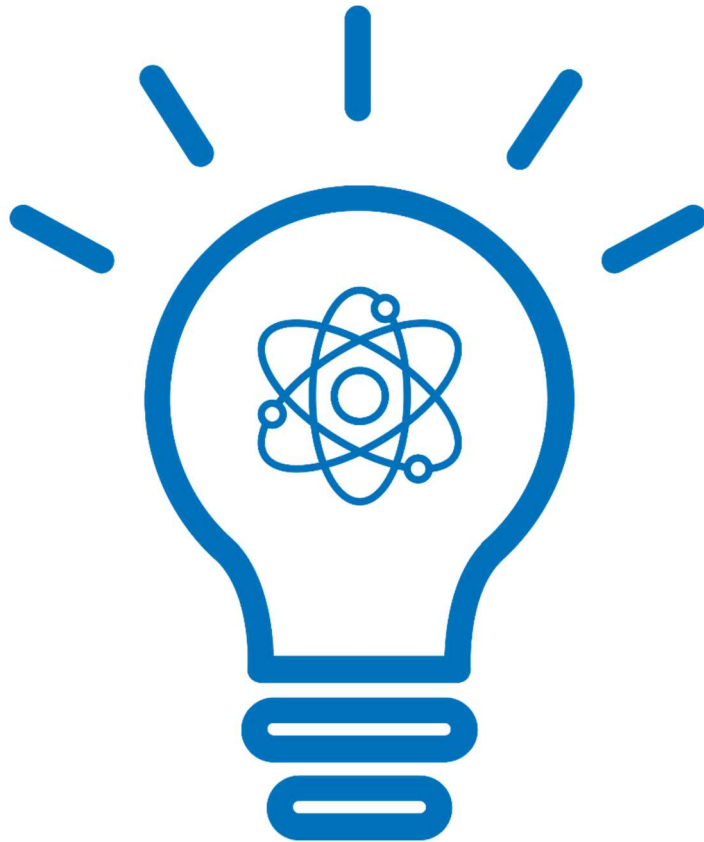


Finally...

- GSG-11, which is the basis of this workshop:
 - Addresses the transition phase in terms of how we can prepare for the timely resumption of normal social and economic activity after an emergency and what needs to be fulfilled to be able to end the emergency;
 - Complements GS-G-2.1 and GSG-2, providing for integrated and coordinated EPR from the emergency onset until its termination;
 - Facilitates planning for long term recovery.



Summary



- Various concepts and terms in emergency preparedness and response are in use. Some are inherited from earlier versions of the Safety Standards, and others, such as different situations of exposure, are newly introduced. They all relate to each other.
- Depending on the severity of the emergency and its consequences, an emergency may be terminated and transition to either a planned or an existing exposure situation.
- The transition will occur gradually at different times in different areas, posing challenges to both management and communication with the public.



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Thank you!