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Atoms for Peace and Development

Considerations for the development of a protection strategy for a nuclear or radiological emergency

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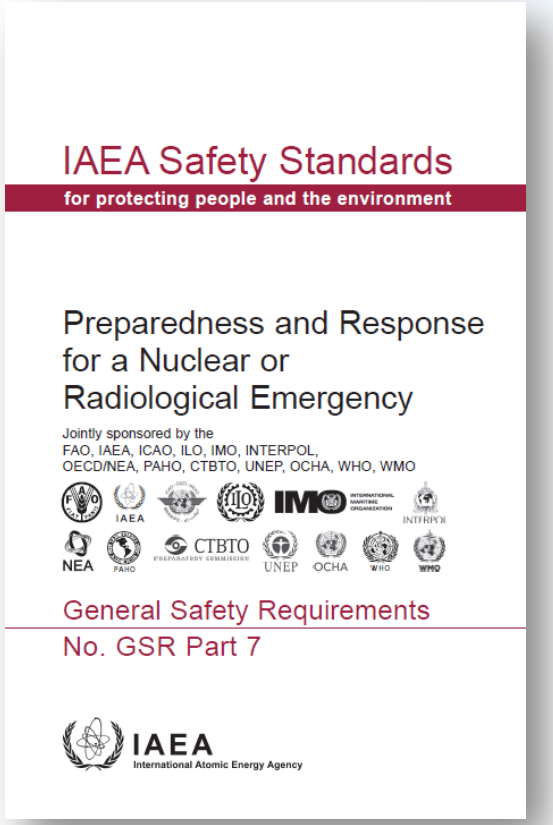
  - Relevant requirements
  - Evolution of the concept
- Development of guidance
  - Nature of the protection strategy
  - Step-wise process
- Key considerations
  - Justification and optimization
  - Stakeholder engagement

Protection strategy
Introduction

- Requirement 5 of GSR Part 7:

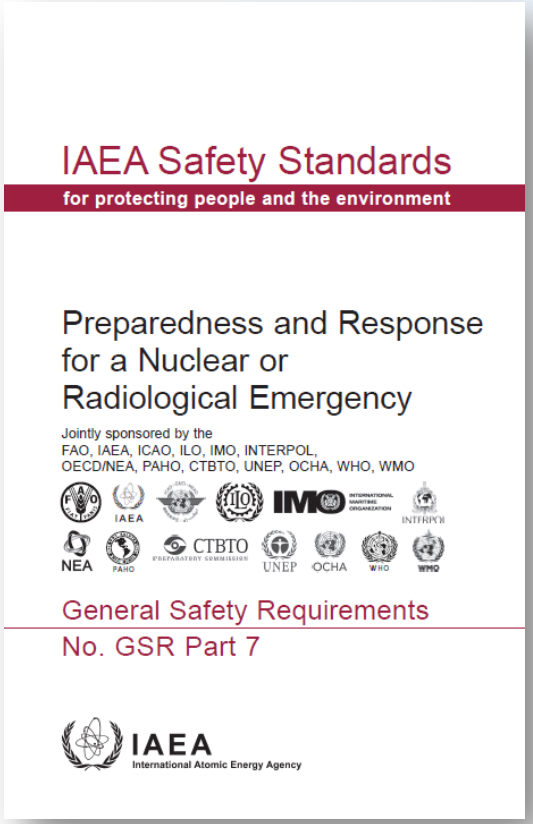
The government shall ensure that protection strategies are developed, justified and optimized at the preparedness stage for taking protective actions and other response actions effectively in a nuclear or radiological emergency.

➢ **Aim**: To achieve the goals of emergency response



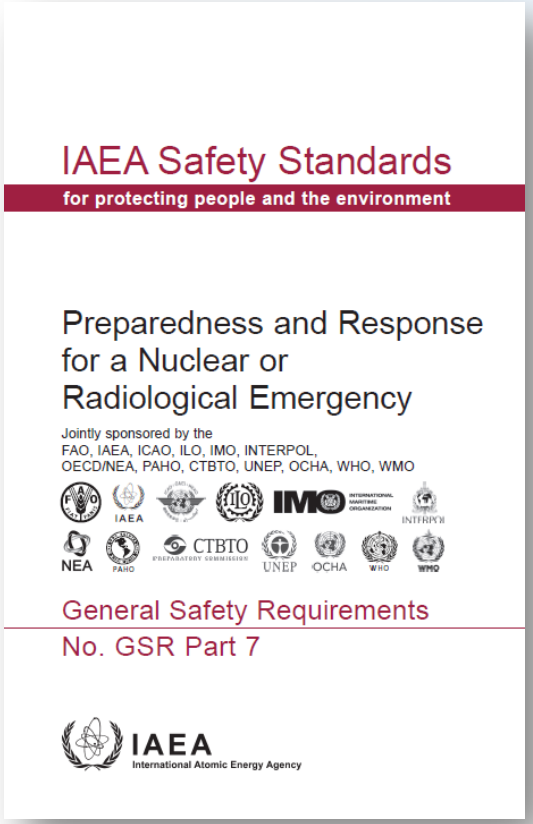
Protection strategy
Introduction (cont.)

- Development of a protection strategy to include (but not to be limited to):
  - Consideration of actions to **avoid or to minimize severe deterministic effects** and to **reduce the risk of stochastic effects** while taking into account what dosimetric quantities are appropriate for evaluating specific health effects due to radiation exposure
  - Setting **a reference level** in terms of **residual dose** in the range of **100-20 mSv acute or annual effective dose**



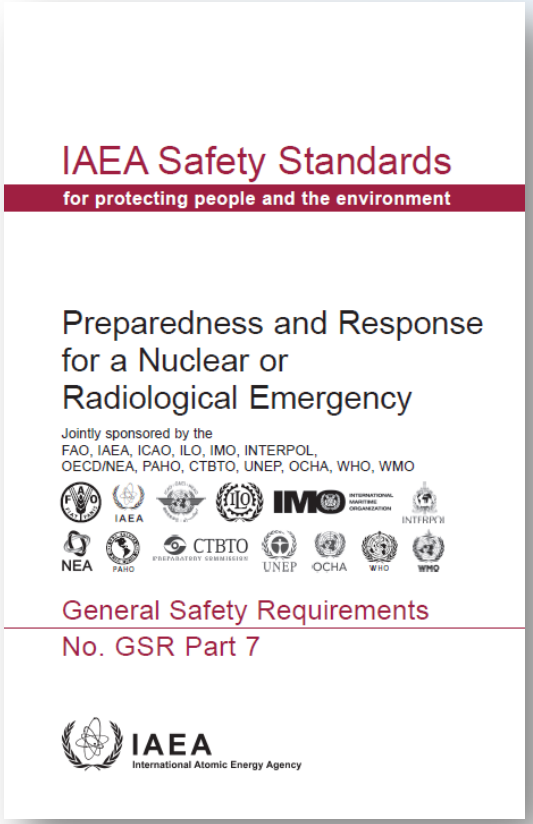
Protection strategy Introduction (cont.)

- Development of a protection strategy to include (but not to be limited to):
  - Developing **national generic criteria** in terms of **projected dose** or of **received dose** for taking protective actions and other response actions (either individually or in combination)
  - Developing pre-established **operational criteria** (i.e. observable conditions on the site, emergency action levels (EALs) and operational intervention levels (OILs)) on the basis of national generic criteria for initiating the different parts of an emergency plan and for initiating protective actions and other response actions



Protection strategy
Introduction (cont.)

- Emphasis given on:
  - **Justification and optimization**
  - **Consultation with interested parties**



Protection Strategy
General

- Describes in a comprehensive manner:
  - What needs to be achieved in response to a nuclear or radiological emergency
    - *From the time the emergency is declared until the emergency is terminated*
    - *For large scale emergency, the strategy may extend in the longer term within the framework of an existing exposure situation*
  - How this will be achieved by implementing a justified and optimized set of protective actions and other response actions

Protection Strategy (cont.)
General

- Developed at the preparedness stage with involvement of all relevant response organizations and other interested parties
  - Basis for emergency arrangements of all response organizations
  - Enables acceptability, feasibility and recognition of any associated practicalities
- Implemented safely and effectively in response to an emergency
  - Through execution of pre-established emergency arrangements (such as plans and procedures)

How the concept evolved?

- This concept results from an evolution from the previous ICRP recommendations 60 and 63 and GS-R-2 approach
  - Which suggested that the independent justification and optimization of individual intervention was sufficient
  - Based primarily on the doses avertable by the intervention

How the concept evolved?

GS-R-2 (2002)

- Implementation of **single protective action** (i.e. intervention) on the basis of **generic intervention level of dose *actually avertable*** by taking that intervention

GSR Part 7, GSR Part 3, GSG-2

- Implementation of **protection strategy** (i.e. justified and optimized set of protective actions and other response actions) on the basis of **generic criteria (GC) for dose *projected*** and **dose *received*** with account taken of the **reference level for *residual* dose**

Implications

- Most Member States already have emergency plans and other arrangements in place
  - Generally consistent with GS-R-2 concepts and intervention levels in terms of avertable dose (update needed)
- Development of protection strategy
  - Provides opportunity to review and revise basis for emergency arrangements in place to account for new concepts (e.g. reference level and criteria) and also to ensure consistency
  - Takes account of information and data already available (e.g. from existing plans)

IAEA EPR-Protection Strategy

- EPR Series publication under development
  - Considerations for the Development of a Protection Strategy for a Nuclear or Radiological Emergency
    - To provide Member States with p**ractical guidance and a stepwise approach** for the development, justification and optimization of a protection strategy including on:
      - Implementation of the concepts of reference levels and criteria in EPR
      - Various factors to be considered
    - To provide **example protection strategies** for postulated nuclear or radiological emergencies

IAEA EPR-Protection Strategy Activities taken

- Three consultancy meetings:
  - 29 June – 3 July 2015
  - 21 – 24 March 2016
  - 9 – 13 January 2017
  - Member States involved: Switzerland, Canada, Germany, Malaysia, France, UK, Australia, Belgium
- Workshop
  - 20 – 24 March 2017
  - Participants from 40 Member States

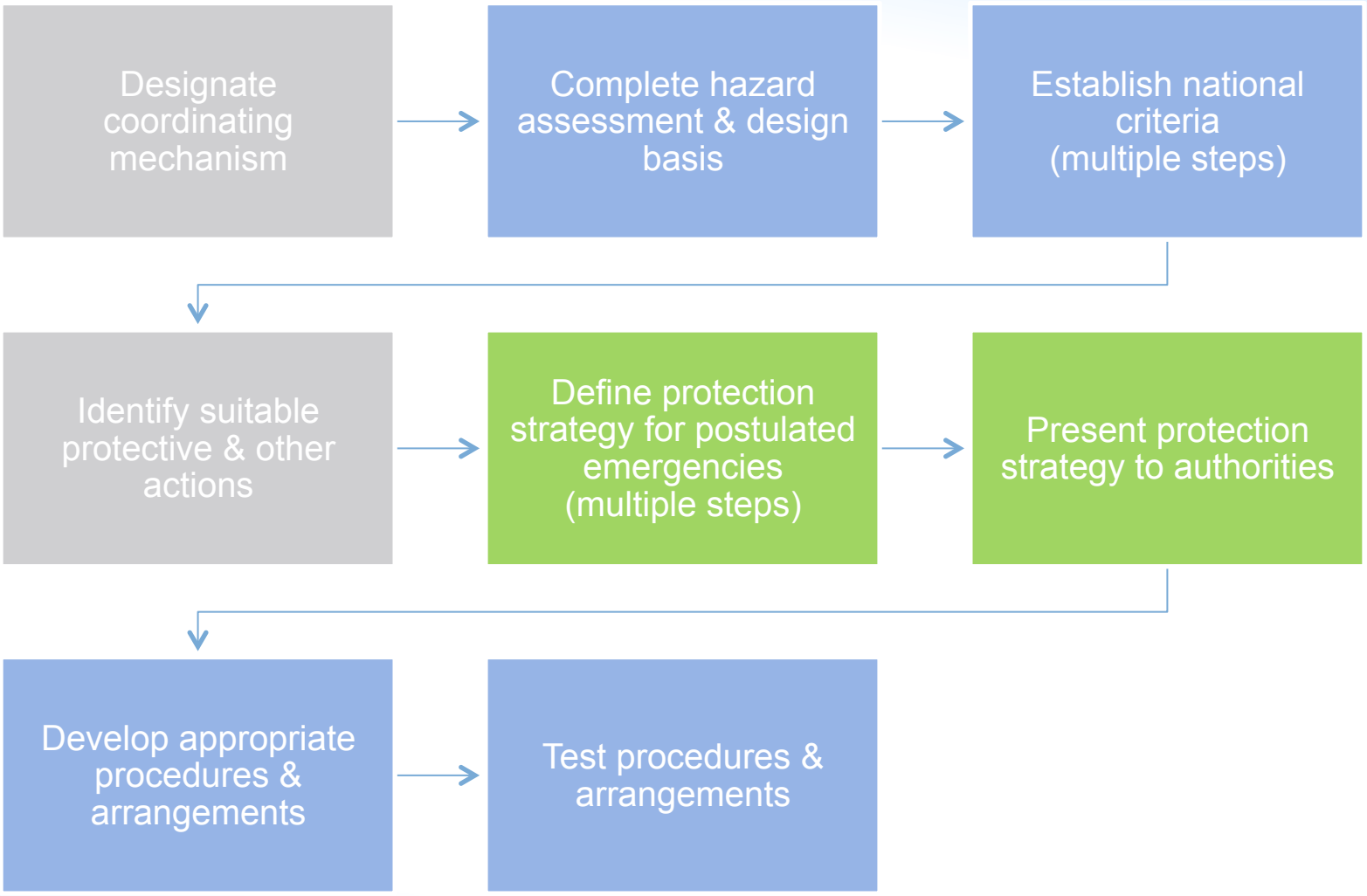
Protection strategy
The dual meaning

- Concept
  - Framework that provides the justified and optimized set of protective actions and other response actions in an emergency response
- Documentation (of the above)
  - A document outlining the concept in terms of goals, processes and a set of emergency response actions
  - A number of options regarding format

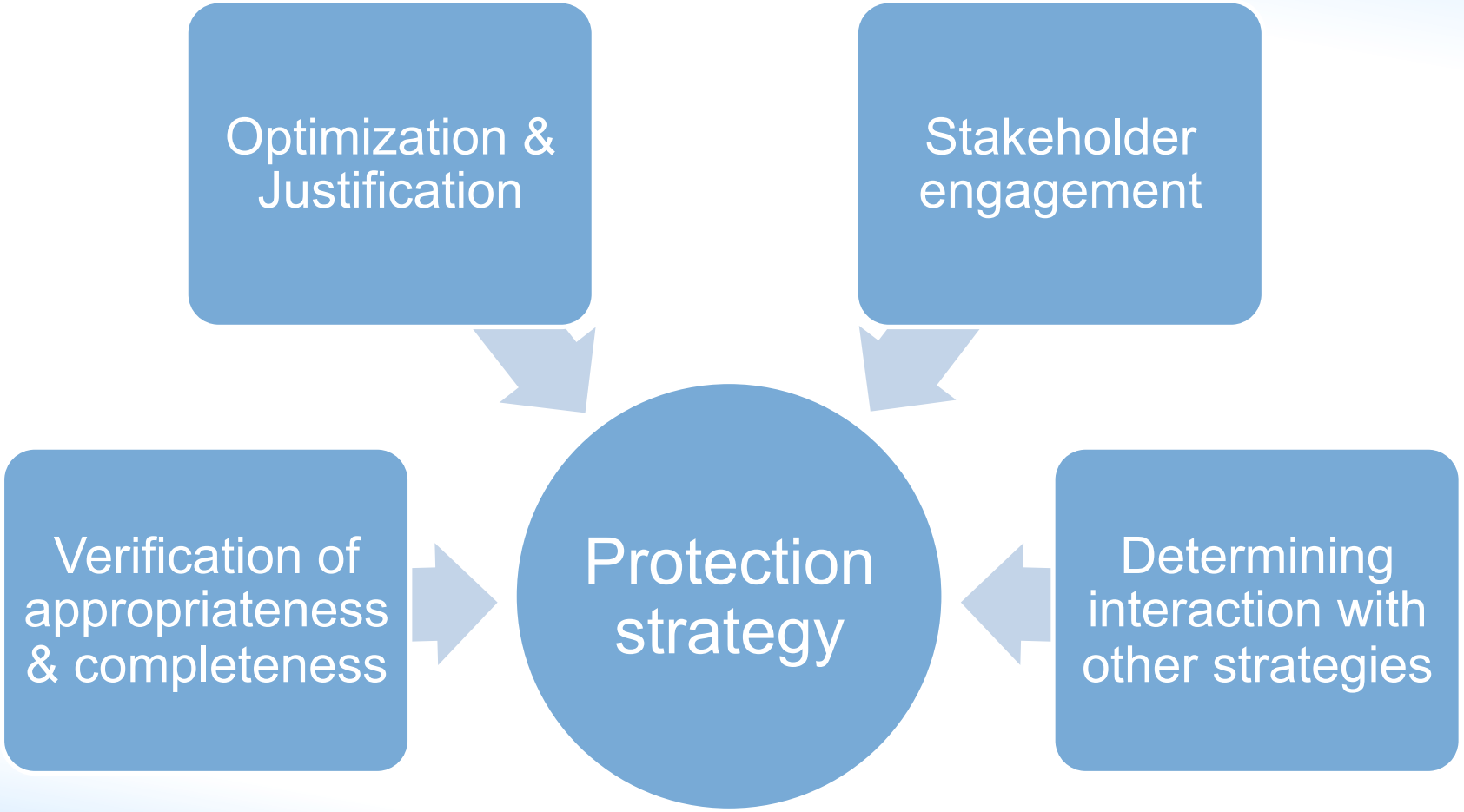
Options for documentation

- Standalone (national) document
  - Sets out high level statement of objectives and means in single place (promotes consistency).
- Part of the national emergency plan
  - Prevents possible duplication but
  - National emergency plan review cycle could lead to unnecessarily frequently revision of strategy
- Elements included in various documents (incl. policy documents, regulations and guidance)
  - Lacks transparency and consistency functions

Stages in developing the protection strategy



Factors in defining the protection strategy



Justification and optimization

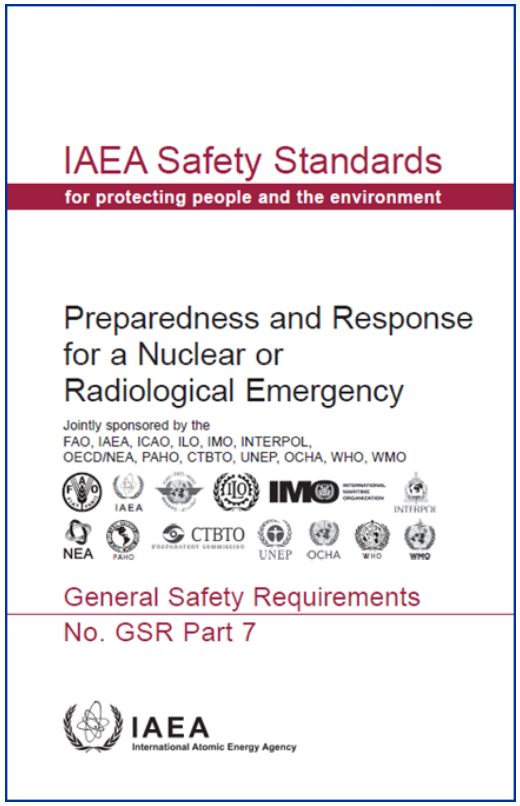
Considering radiological & non-radiological factors (incl. feasibility)

The justified and optimized set of actions for a range of emergency scenarios (or given situation in response)

Justification as the process

- *Determining … whether a proposed protective action or remedial action is likely, overall, to be beneficial; i.e. whether the expected benefits to individuals and to society (including the reduction in radiation detriment) from introducing or continuing the protective action or remedial action outweigh the cost of such action and any harm or damage caused by the action*

- The process applies to:
  - The protection strategy and individual protective actions



Justification (cont.)

- **At high doses**
  - Radiological considerations prevail over the non-radiological aspects in the decision-making process
  - Those situations in which the dose thresholds for severe deterministic injuries could be exceeded should always require action
  - Those situation in which the doses approach the level at which an increase in the incidence of cancers may be expected should also require action
- **At low doses**
  - Non-radiological considerations may prevail over the radiological consequences
  - Careful consideration is required with account taken of different radiological and non-radiological factors when making decisions to ensure actions taken do more good than harm

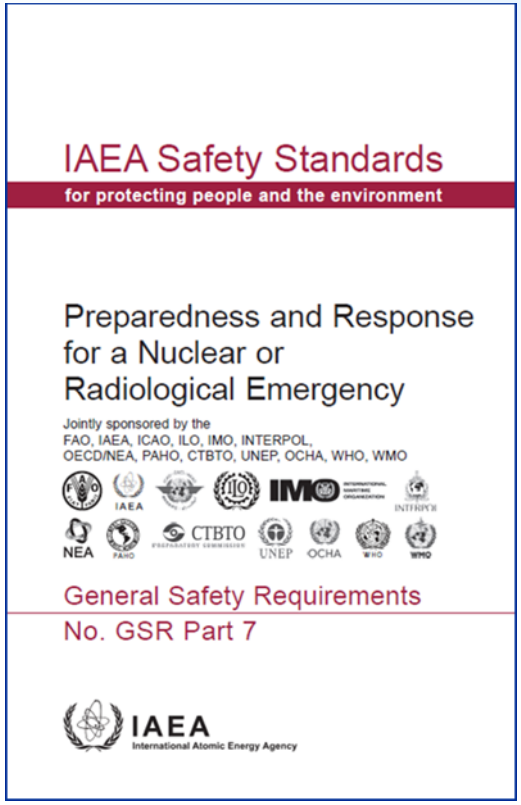
Justification (cont.)

- Reasons for an option being considered unjustified may include:
  - Disruption of normal activities
  - Unreasonable economic burden
  - Greater risk by their implementation than they protect against
    - e.g. evacuation of hospitals without provision of adequate medical care for patients
  - Another protective option associated with a lower risk which provides the same or better protection

Optimization as the process

- *Determining what level of protection and safety would result in the magnitude of individual doses, the number of individuals (workers and members of the public) subject to exposure and the likelihood of exposure being as low as reasonably achievable, economic and social factors being taken into account*

  - The level of protection would be the best possible under the prevailing circumstances, not necessarily that with the lowest dose
  - Optimization applies to protective actions and the protection strategy that have been demonstrated to be justified



Categories of factors considered

- General goals
- Legislation and regulations
- Nature of the emergency exposure situation
- Radiation protection
- Timing
- Efficiency
- Resources
- Environmental aspects
- Economic aspects
- Social and ethical aspects
- Waste

Radiation protection factors

- Exposure scenario and dominant exposure pathways
  - Dose to the public (projected doses, received doses, residual doses)
  - Dose to the emergency workers and helpers
  - Radiation induced health effects
  - Need for medical follow-up
- Contamination of
  - Living environment (dose rates, surface activity concentrations, activity concentrations in samples)
  - Food, milk and drinking water
  - Non-food commodities

Economic aspects

- Direct costs associated with the implementation of emergency response actions
- Indirect costs associated with impacts from consequences of the emergency
- Compensation issues
- Interruptions in international trade
- Expected market response and evolution in the future

Social and ethical factors

- Disrupted living conditions
- Reduction in life expectancy due to stress
  - (e.g. associated with resettlement)
- Psycho-social effects
- Socioeconomic aspects,
  - issues associated with public trust and credibility of authorities
- Feedback from interested parties on their concerns

Justification and optimization processes

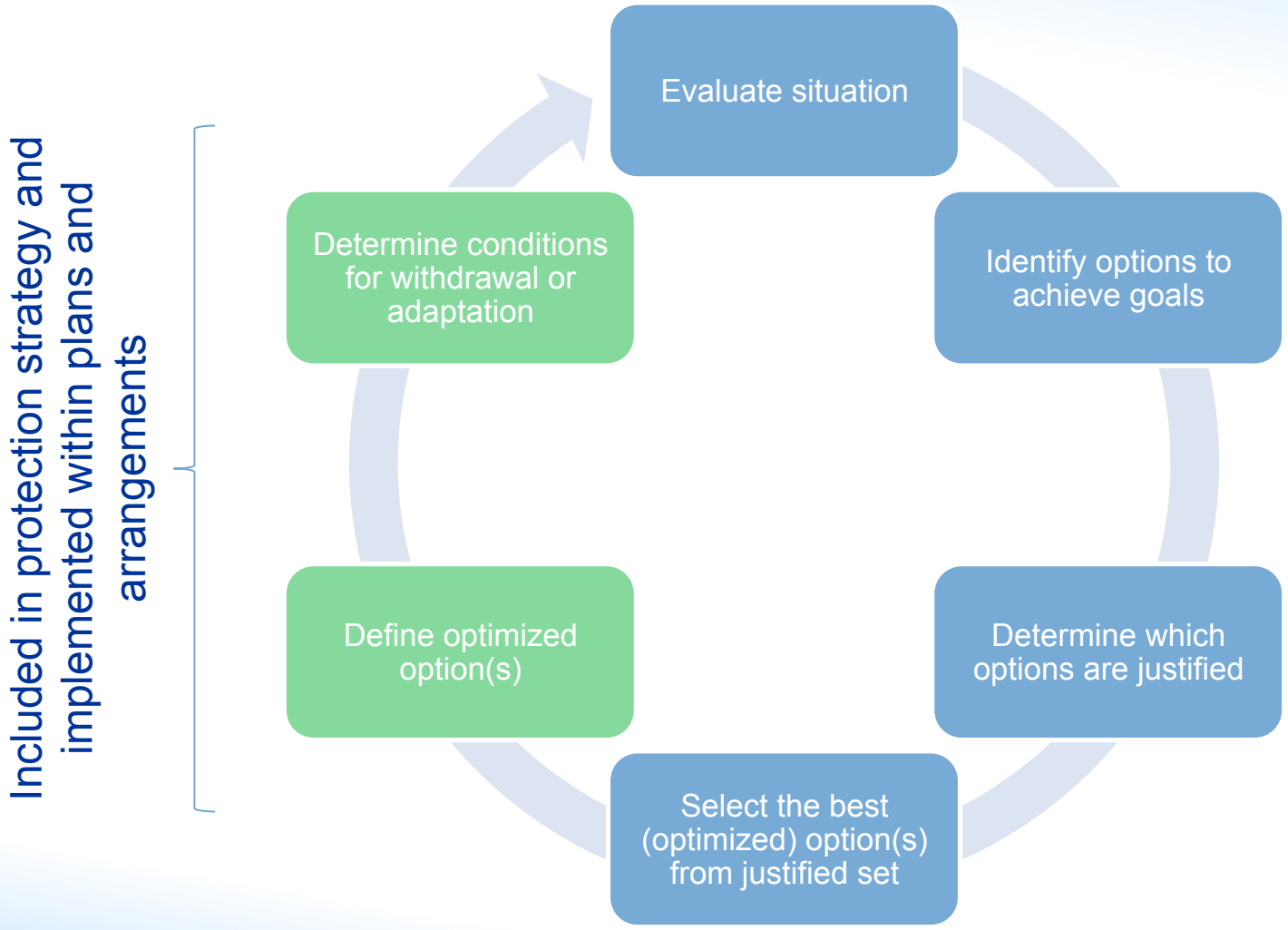
Preparedness

- Applied to develop strategies for a range of postulated emergencies (for range of sites)
- Generic process with significant uncertainties
- Involves coordination among relevant organizations and consultation with interested parties

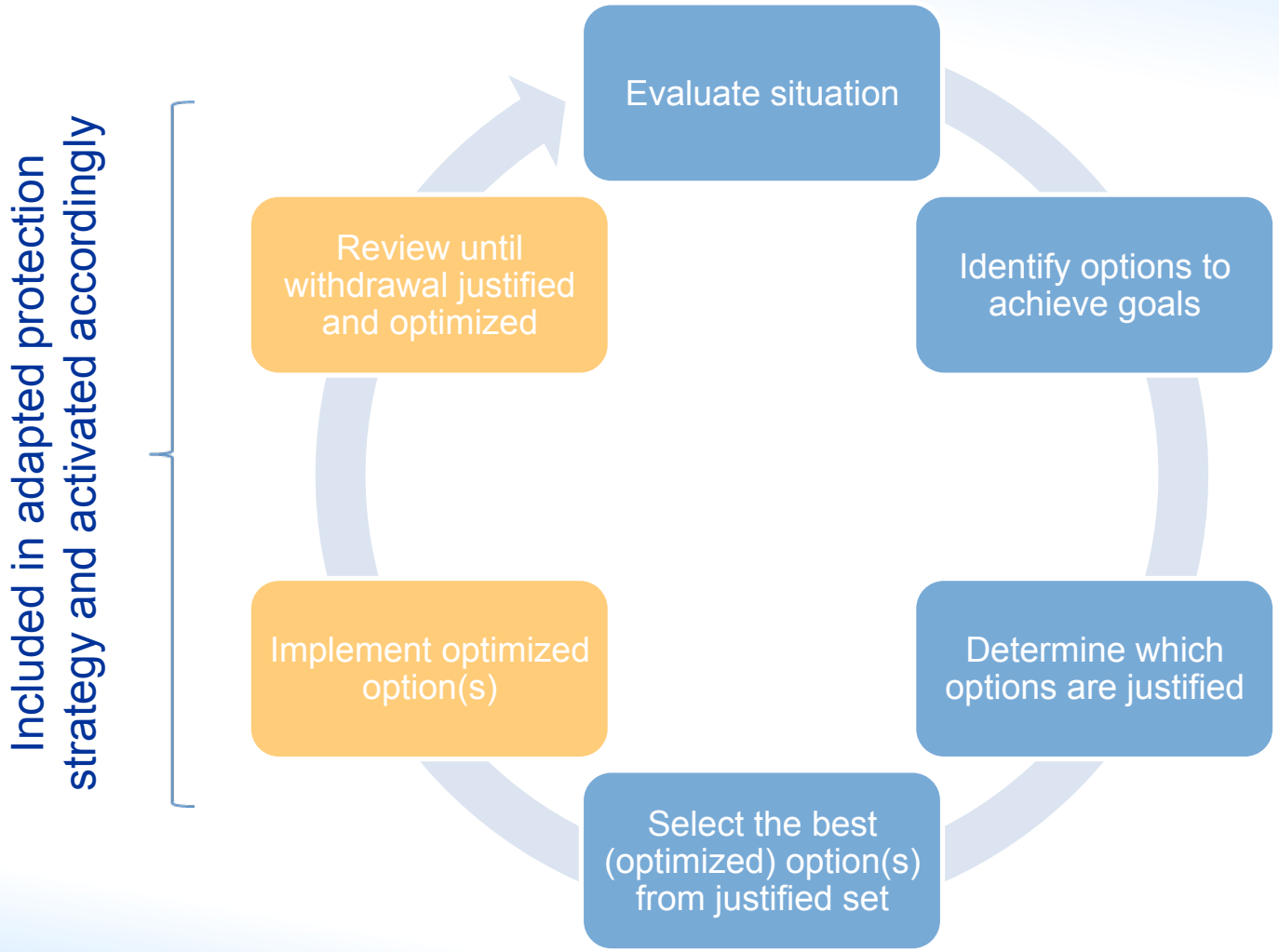
Response

- Applied to a given emergency situation
- Initial implementation of pre-planned (urgent) actions
- Increasingly greater time, amount of information and involvement of interested parties in decision-making
- Periodic review to ensure strategy still justified

Optimization process (preparedness)

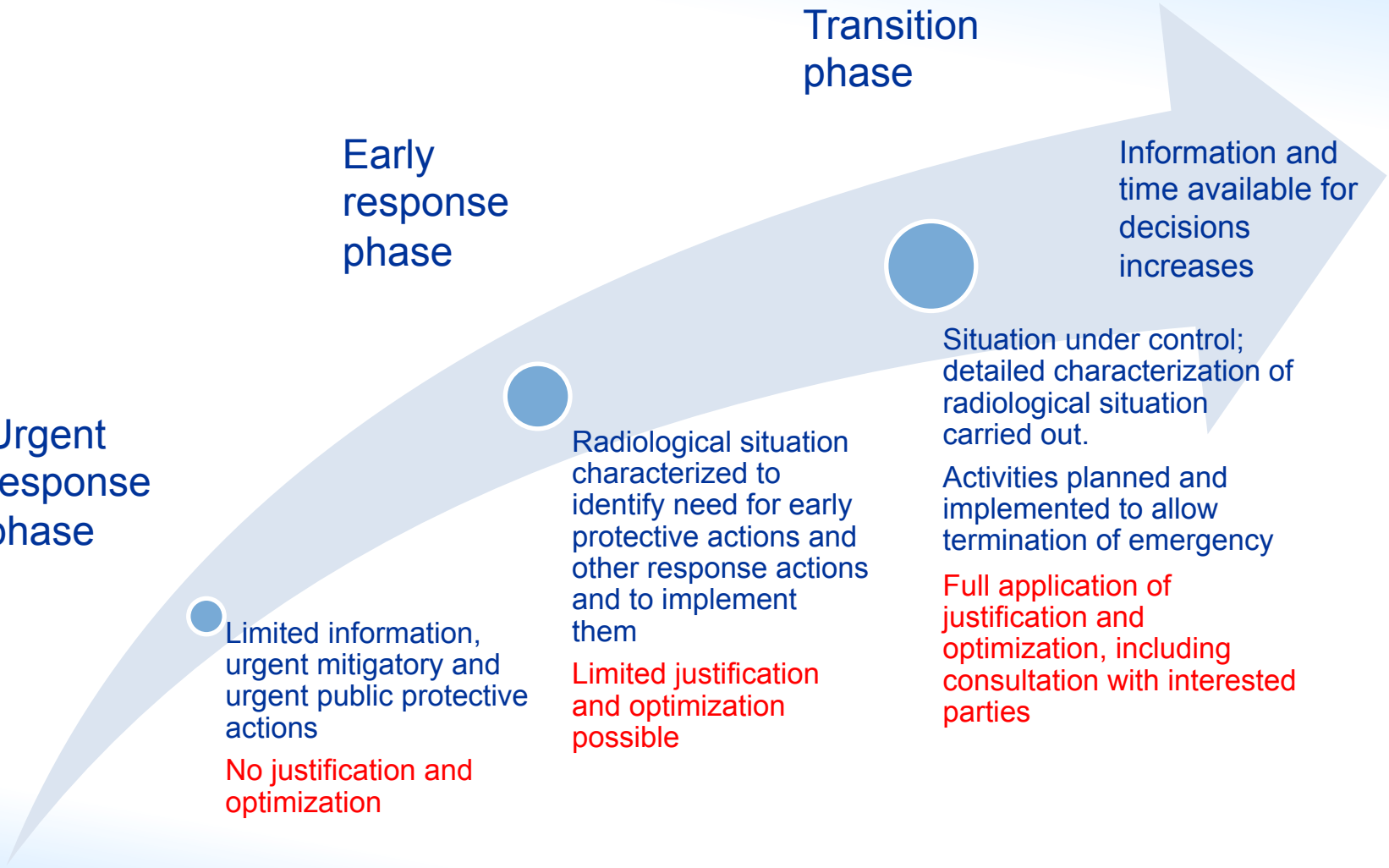


Optimization process (early response and transition phases)



Simplified version

Changing focus of justification and optimization



Practical considerations

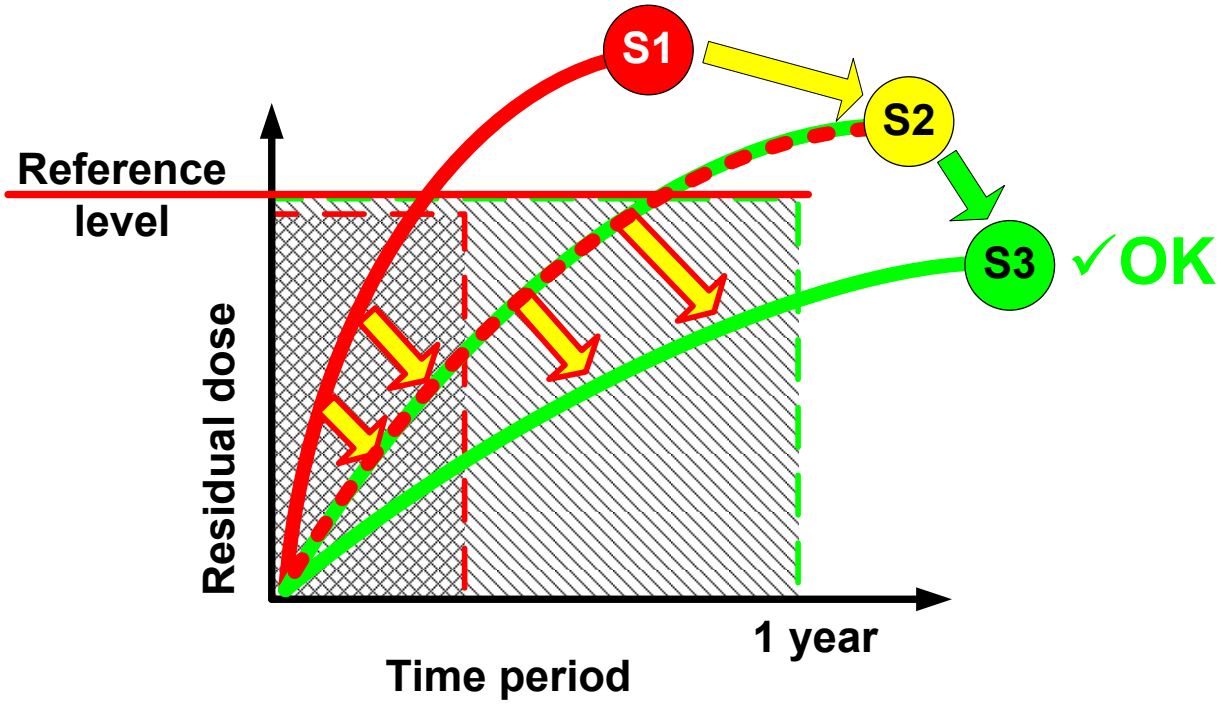
- The following considerations feed in to the justification and optimization processes, as the emergency situation evolves:
  - Current radiological and non-radiological situation
  - The type and quality of information available on the conditions of the emergency
  - The effectiveness of protective actions and other response actions already implemented
  - The possible effectiveness of other or additional protective actions and other response actions
  - The effectiveness of protective actions necessary in the longer term and activities necessary to resume normal social and economic conditions

Reference level

- The level of dose:
  - Above which it is not appropriate to allow exposures to occur
  - Below which optimization of protection and safety would continue to be implemented
- A residual effective dose in the range 20 – 100 mSv, acute or annual, via all exposure pathways
- Role: tool for optimization of protection and assessing effectiveness of strategy implemented

Reference level as a constraint to optimization

Priority is given to reducing exposures above the reference level with the possibility for the optimization of protection to continue to be implemented below the reference level as long as this is justified, i.e. does more good than harm



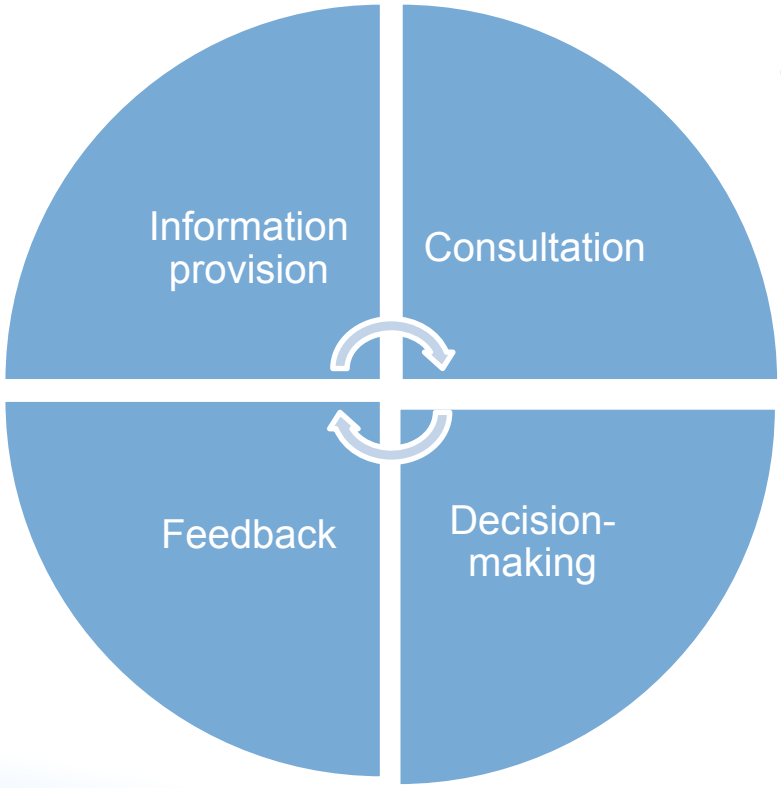
The role of the reference level in optimization

- In preparedness it is a constraint to optimization of the protection strategy and protective actions
- In response it is a benchmark for:
  - Retrospective assessment of effectiveness of actions and strategy to identify need for its adaptation to address prevailing conditions
  - Determining priorities for further protective actions
    - focus on those groups/individuals whose residual doses exceed the reference level

Stages of engagement

Scope depends upon situation (stage or phase of the emergency) and timescale available

General process & to support effective consultation

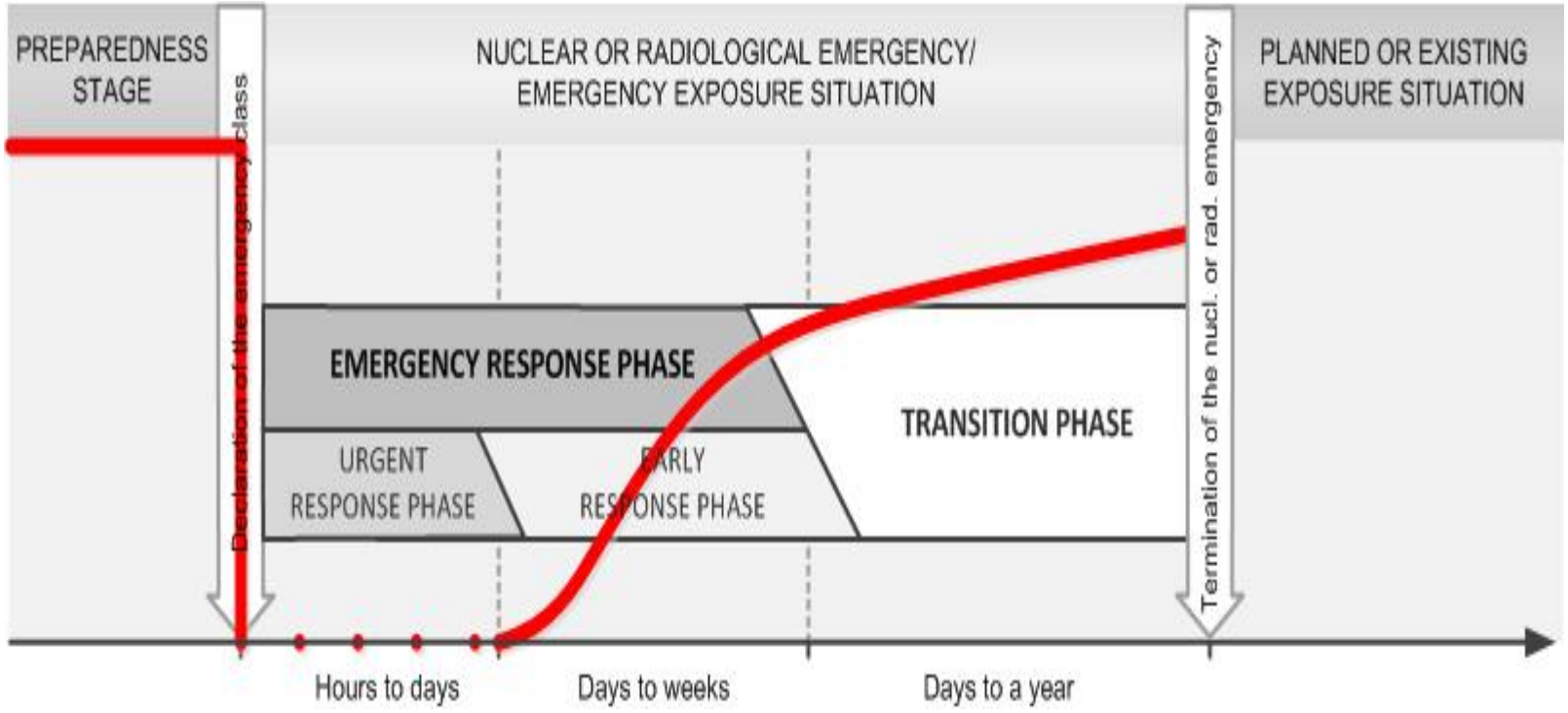


Different processes for those with, e.g.
(a) role in response
(b) general interest

Necessary process for transparency

Remains responsibility of authorities but scope of input should be clear

Involvement of interested parties during different stages & phases



Consulting interested parties on plans and arrangements

- Benefits
  - Increases trust, credibility and societal acceptance of the protection strategy
  - Fosters relationships with community leaders
  - Allows the community's capabilities and needs to be understood
  - Enhances the community resilience to nuclear or radiological emergencies

Objectives of stakeholder involvement during transition phase

- To set and agree the conditions and criteria to be met to terminate the emergency situation at the preparedness stage
- To facilitate the transition process to the new normality
- To improve coordination arrangements
- To facilitate communication process
- To ensure sustainability of new arrangements
- To support normal daily activities in the affected areas
- To improve acceptance of adjustment of protective actions and other arrangements imposed earlier in the emergency response

Conclusions

- The concept of the protection strategy continues to evolve
- Some aspects have already been addressed in existing emergency plans and arrangements but others have not
- Key factors include:
  - Justification & optimization
  - Stakeholder engagement
- These processes differ in **preparedness** and **response** due to
  - Postulated and real nature of the situations considered
  - Time, amount and type of information available

In conclusion of the recent Workshop Justification and optimization

- Importance of justification and optimization in decision-making process acknowledged
  - The processes adopted were generally not formalized processes (e.g. involving scoring and weighting factors using decision-aiding tools)
  - Emergency/crisis management organizations tend to be better at considering non-radiological factors and the practicalities for the purpose of optimization
  - It will be necessary to consider the way in which to develop the guidance on justification and optimization within the document to provide more practical guidance on these processes

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Thank you!