



60 Years

IAEA

Atoms for Peace and Development

System of Protective Actions and Other Response Actions in a Nuclear or Radiological Emergency

Webinar on Medical Preparedness and Response for a Nuclear or
Radiological Emergency

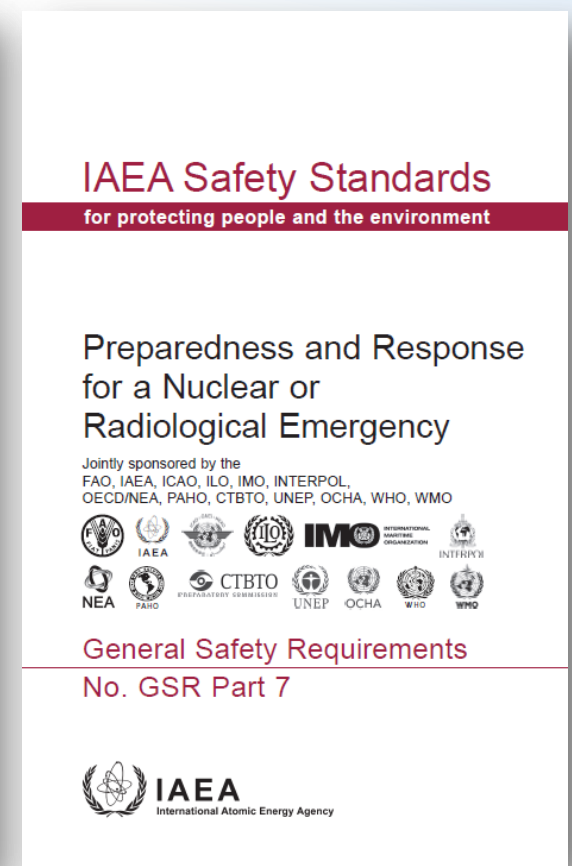
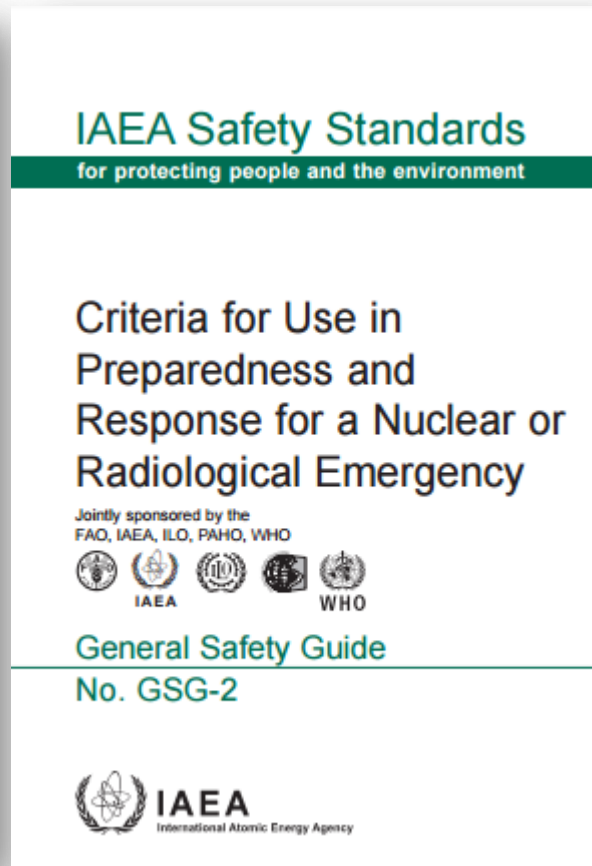
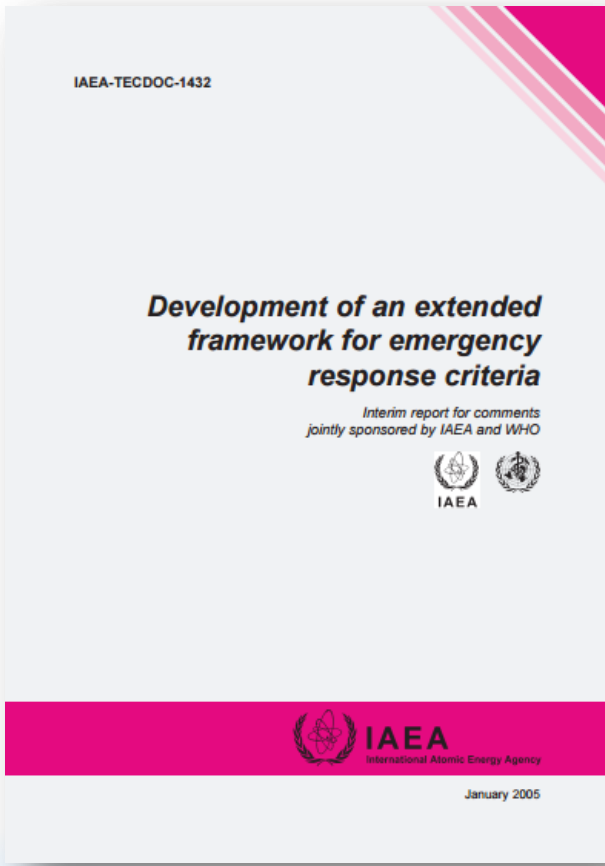
IAEA's IEC - WHO

24 February 2017

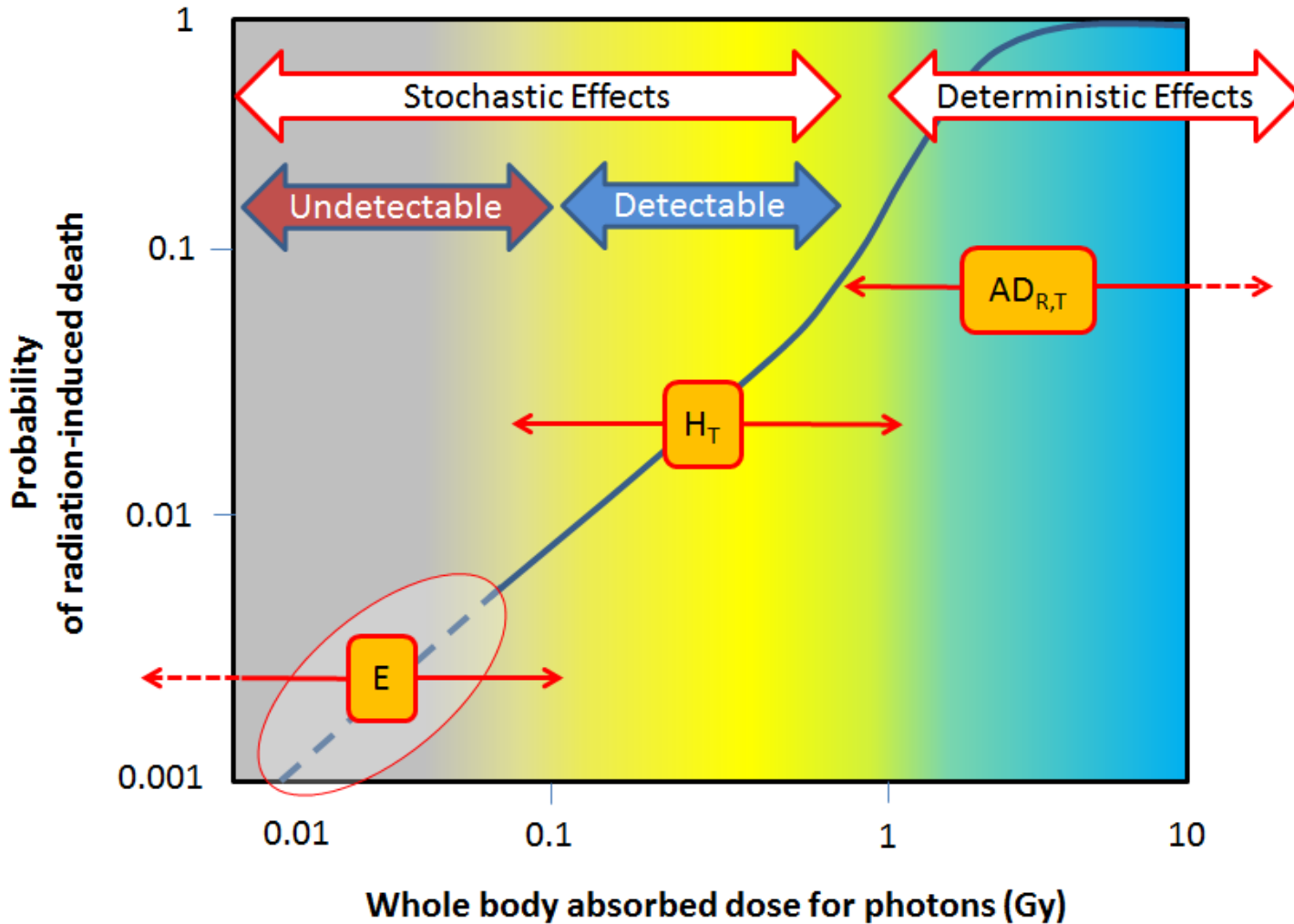
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Emergency Preparedness Officer, IEC, IAEA

History

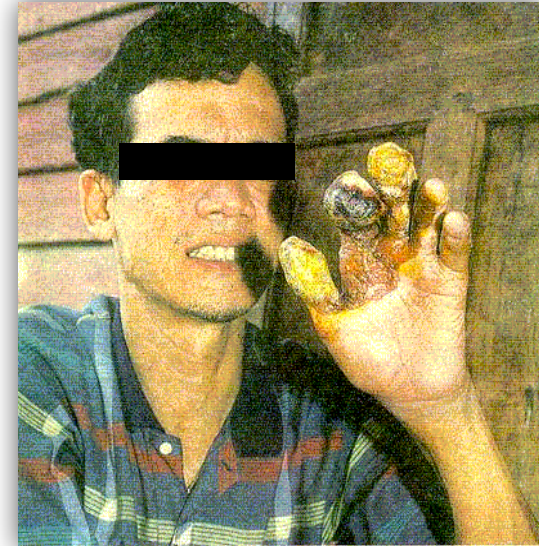
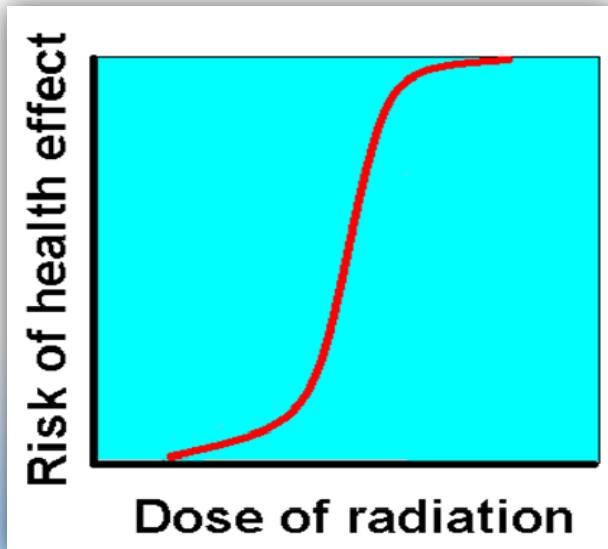


Radiation Induced Health Effects



Dosimetric Quantities

- Quantity: *RBE-weighted absorbed dose, AD_T*
Purpose: To evaluate a risk of **developing** severe deterministic effects due to exposure of a particular organ or tissue (T)
Unit: *gray (Gy)*

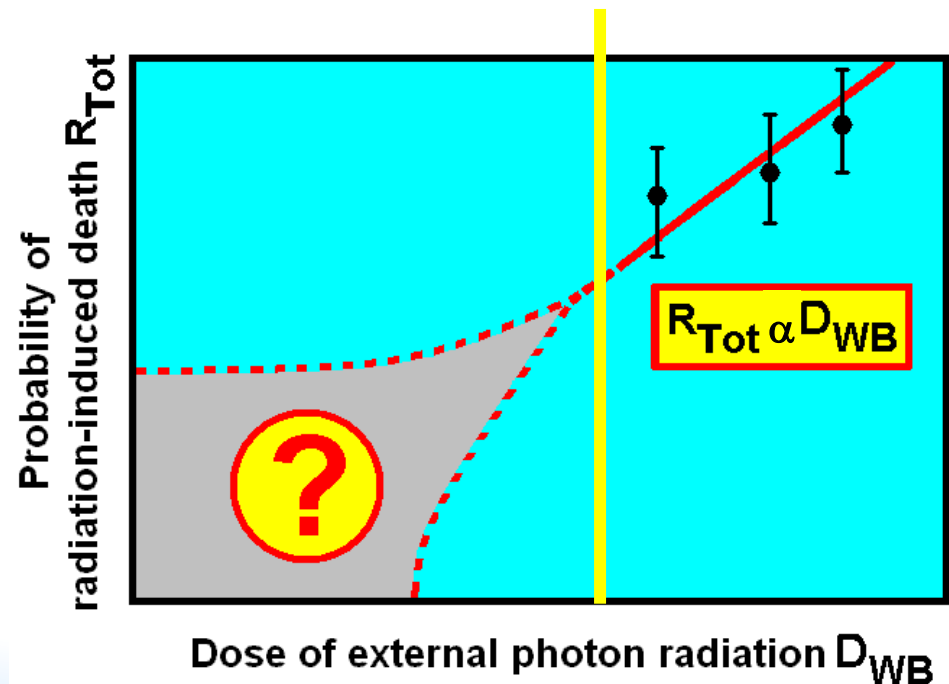
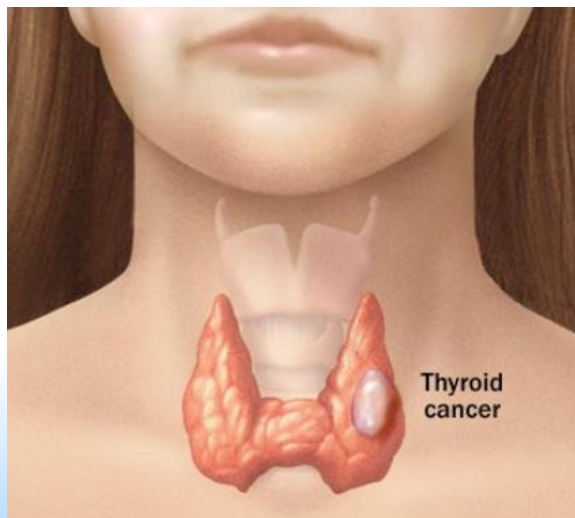


Dosimetric Quantities (cont)

Quantity: *Equivalent dose in organ or tissue, H_T*

Purpose: To evaluate risk of stochastic effects developing due to exposure of an organ or a tissue T

SI unit: *sievert (Sv)*



Dosimetric Quantities (cont)

Quantity: *Effective dose, E*

Purpose: To evaluate the radiation detriment
(radiation protection)

NOT TO ASSESS HEALTH EFFECTS!

SI unit: *sievert (Sv)*

Generic Criteria

- Generically justified and optimized levels (on radiological protection grounds) at which emergency response actions need to be taken (individually or in combination)
 - Supersedes the concept of intervention levels

Projected dose

Basis to **implement emergency response actions** (e.g. evacuation)

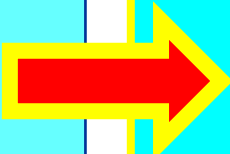
Received dose

Basis to **implement medical actions** (e.g. medical follow up)

Generic criteria to avoid or minimize severe deterministic effects

GS-R-2 (2002)

Action level of 2 day absorbed organ dose at which intervention is expected to be undertaken under any circumstances



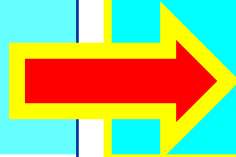
GSR Part 7 (2015)

Generic criteria of RBE weighted absorbed dose in organ or tissue due to external exposure (< 10h) or internal exposure (acute intake delivering dose over 30 days period) for undertaking precautionary urgent protective actions and other response actions to avoid severe deterministic health effects

Generic criteria to reduce the risk of stochastic effects and to mitigate non-rad. consequences

GS-R-2 (2002)

Intervention level of 2 day/7 day/month avertable dose at which specific protective action is to be taken



GSR Part 7 (2015)

Generic criteria for effective dose and equivalent dose in an organ of tissue in a week/month/year (via all exposure pathways or via a specific pathway) at which protective actions and other response actions are to be taken to reduce the risk of stochastic effects and to mitigate non-radiological consequences

System of protective actions and other response actions

Types of possible consequences	Basis for implementation of protective actions and other response actions	
	Projected dose	Dose received
Severe deterministic health effects	Precautionary urgent protective actions , even under adverse conditions, to prevent severe deterministic effects	Other response actions for treatment and management of severe deterministic effects
Increase in the risk of stochastic health effects	Urgent and early protective actions to reduce the risk of stochastic effects as far as reasonably possible	Other response actions for early detection and effective management of stochastic effects

Appendix II of GSR Part 7

- Generic criteria for doses:
 - For which protective actions and other response actions are expected to be taken:
 - Under any circumstances to avoid or to minimize severe deterministic effects
 - If they can be taken safely, to reasonably reduce the risk of stochastic effects
 - For which restriction of international trade is warranted with due consideration of non-radiological consequences
 - For use as a target dose for the transition to an existing exposure situation

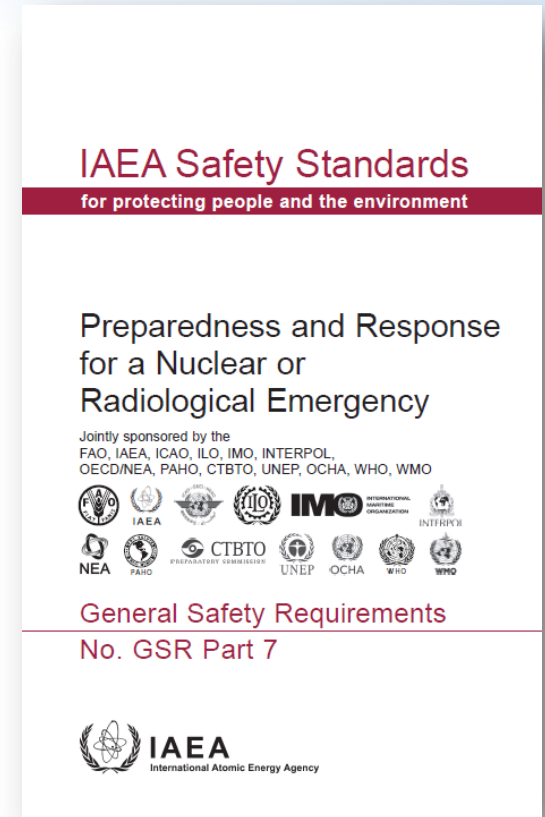
Appendix II of GSR Part 7 (cont.)

- To be taken into account when developing:
 - National protection strategy
 - National generic and operational criteria
- Emphasis on justification and optimization

Justified and optimized protection strategy

- 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.”*



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 implementing a justified and optimized system of protective actions and other response actions

Protection strategy (cont.)

General

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 system 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**

Justification

- *“...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.”*
 - Justification applies for:
 - Individual protective actions in the context of the protection strategy
 - For the protection strategy as a whole

Justification (cont.)

- **At high doses**

- Radiological considerations prevail 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 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.)

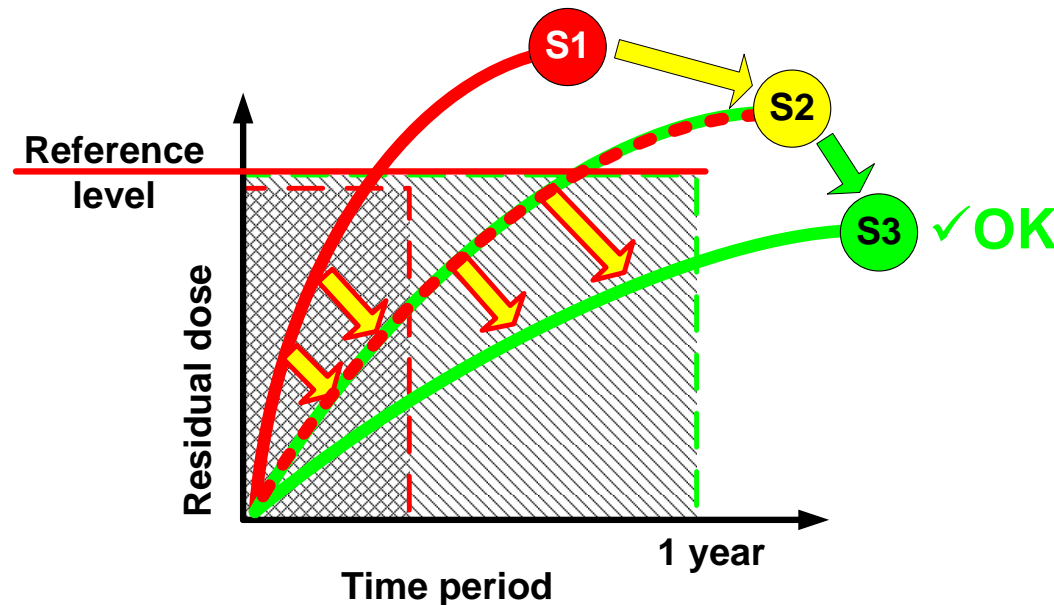
- Reasons for an option being considered unjustified may include:
 - Disruption of normal activities
 - Unreasonable economic burden
 - Greater risk by their implementation than the protect against
 - E.g. evacuation of hospitals without provision of adequate medical care to patients
 - Another protective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

Optimization

- *“Process of determining what level of protection and safety would result in the magnitude of individual doses, the number of individuals 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, and will thus not necessarily be the option with the lowest dose!
 - Optimization applies to protective actions and the protection strategy that have been demonstrated to be justified!

Optimization (cont.)

- “Constraint” optimization by using the **reference level**:
 - Priority is given to 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

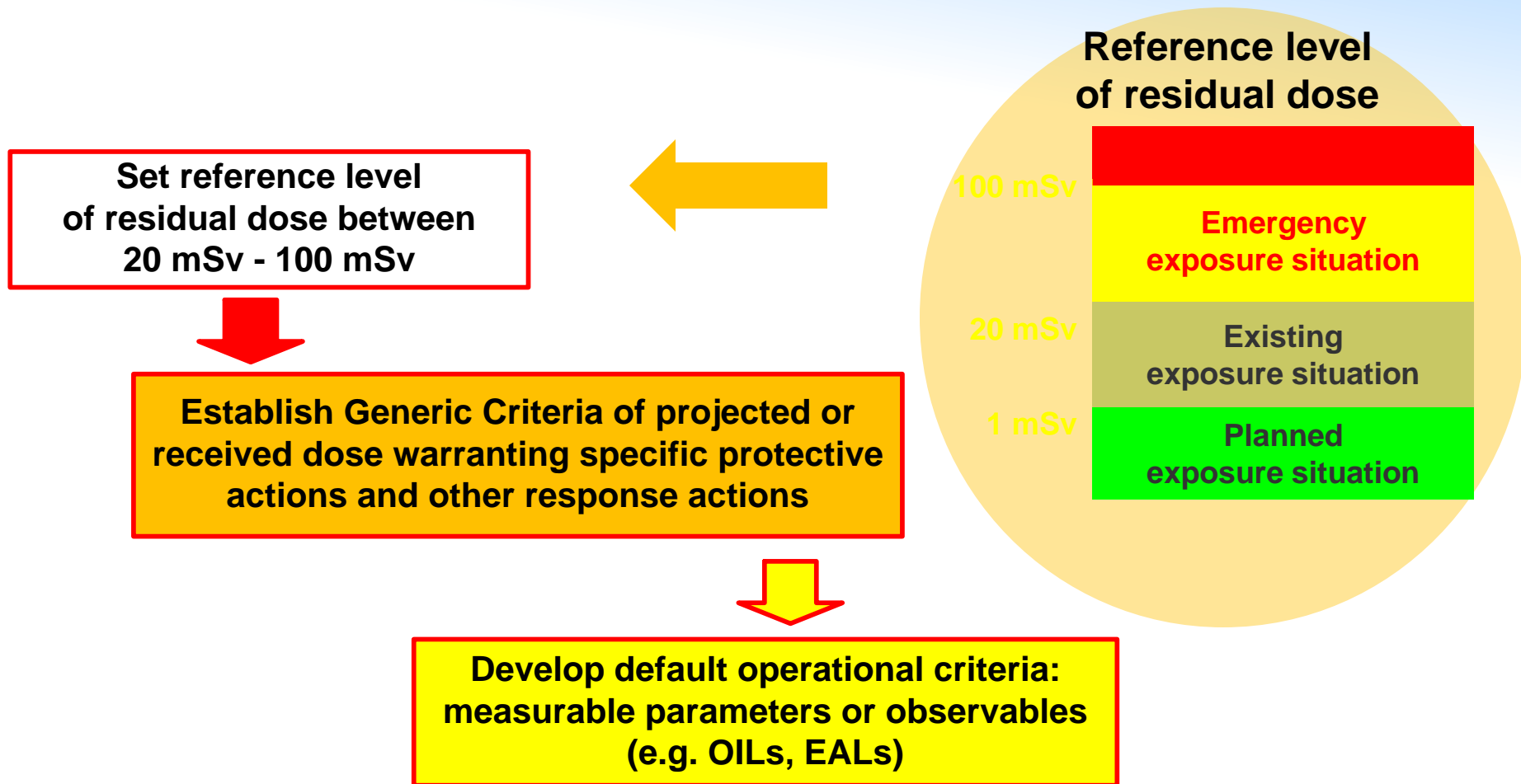


Optimization (cont.)

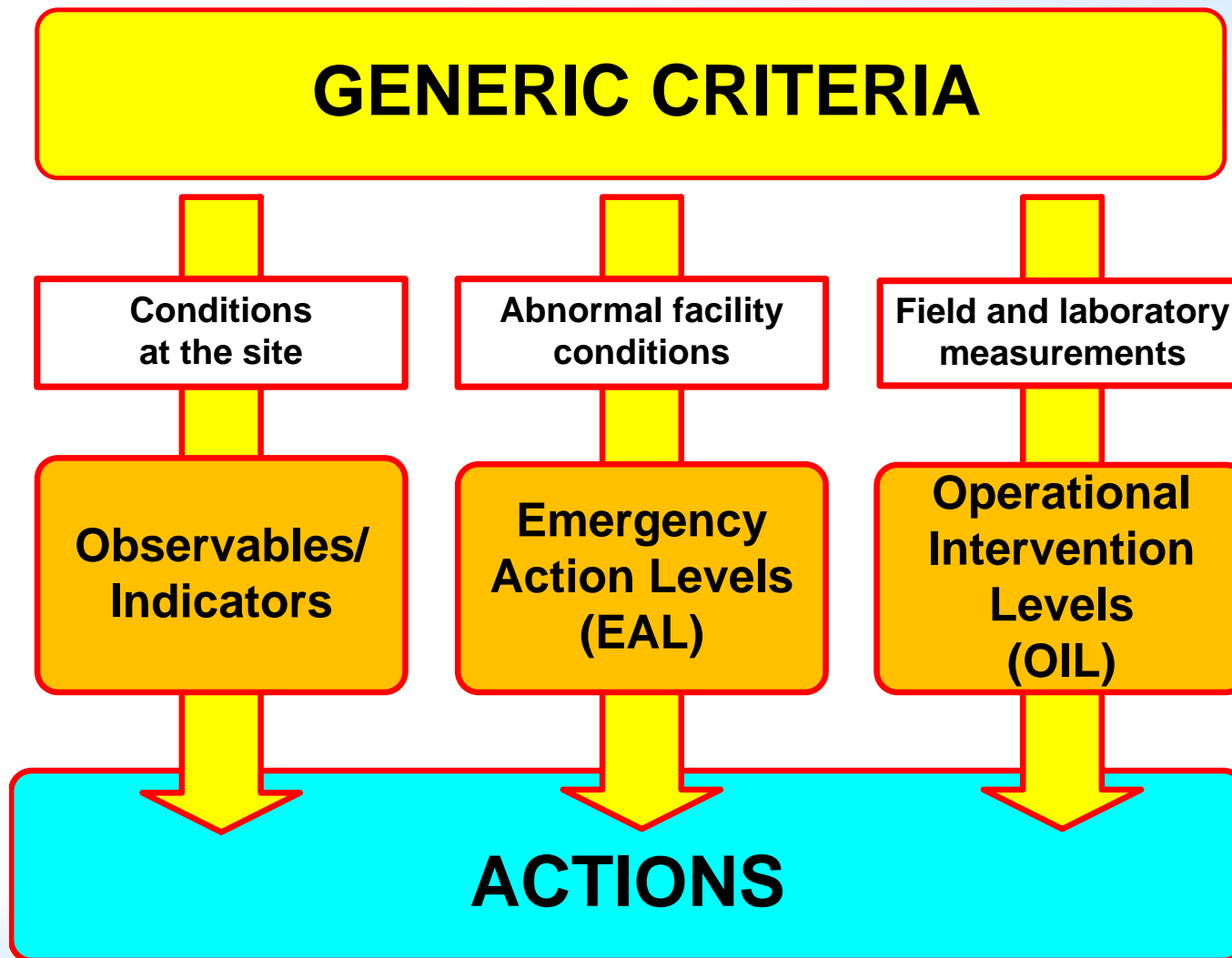
- **Reference level during an emergency response:** a benchmark for a retrospective assessment of effectiveness of actions and strategy taken in an emergency response
 - To also identify a need for its adaptation to address prevailing conditions as they evolve
 - Further protective actions are determined and implemented so that they are, in priority, focussed on those groups/individuals whose residual doses are higher or exceeding the reference level and the available resources are allocated accordingly

Protection Strategy (cont.)

Dosimetric concepts



Operational Criteria (cont.)



Further references

- IAEA Safety Standards Series No. GSR Part 7

http://www-pub.iaea.org/MTCD/Publications/PDF/P_1708_web.pdf

- IAEA Safety Standards Series No. GSG-2

http://www-pub.iaea.org/MTCD/publications/PDF/Pub1467_web.pdf

- IAEA TECDOC-1432

http://www-pub.iaea.org/MTCD/publications/PDF/TE_1432_web.pdf



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Thank you!