The National Academies of
SCIENCES·ENGINEERING·MEDICINE

Workshop on Challenges in Initiating and Conducting Long-term Health Monitoring of Populations Following Nuclear and Radiological Emergencies in the US

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Medical Follow-up of Individuals involved in a Nuclear or Radiological Emergency: IAEA Safety Standards and guidelines

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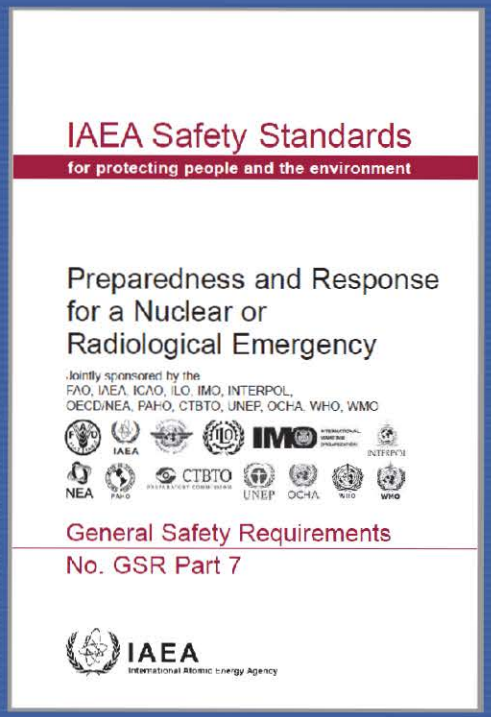
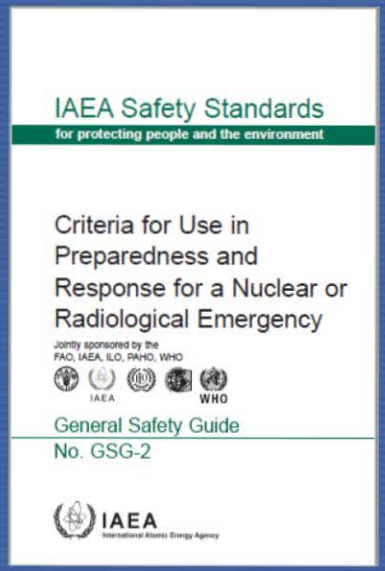
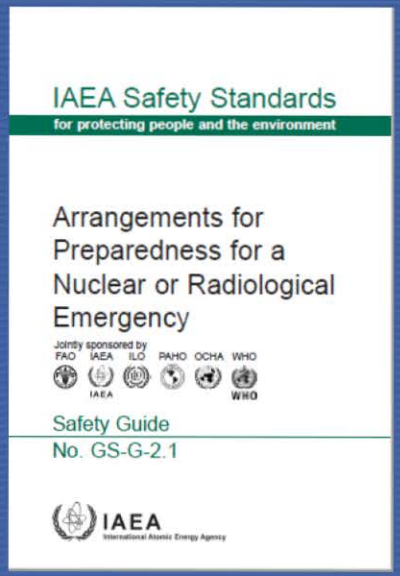
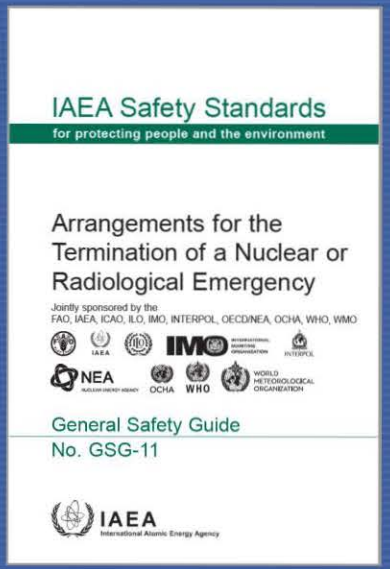
International Atomic Energy Agency

IAEA Relevant Safety Standards









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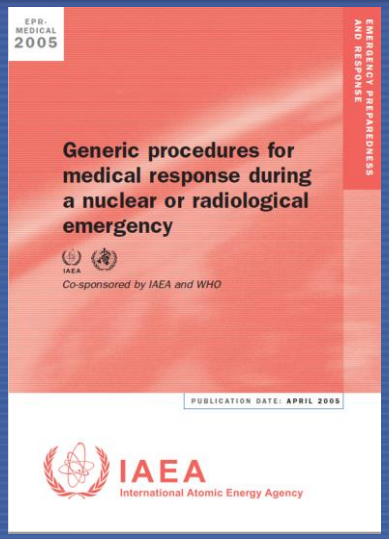
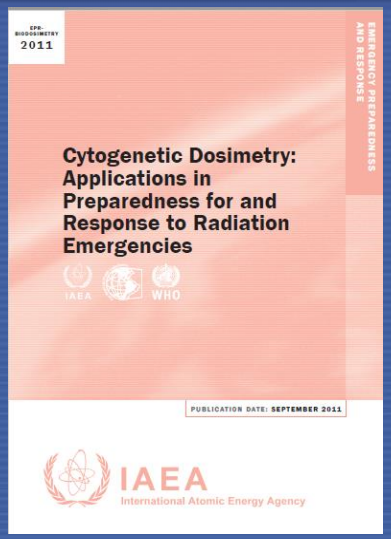
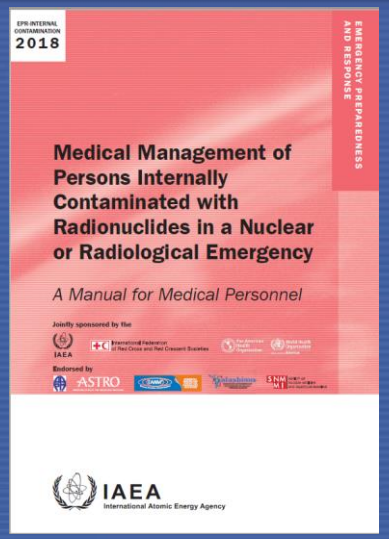
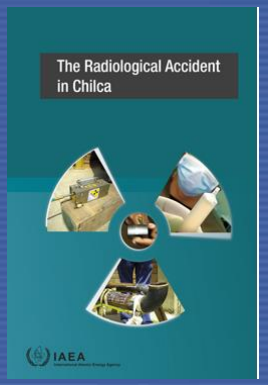
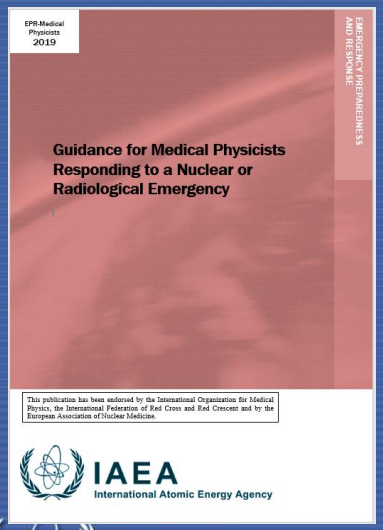
IAEA Relevant Guidelines

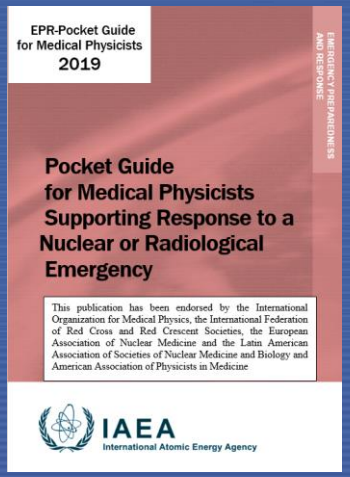












Safety Report Series: Medical Management of Radiation Injuries 2019 (Approved by the IAEA PC)

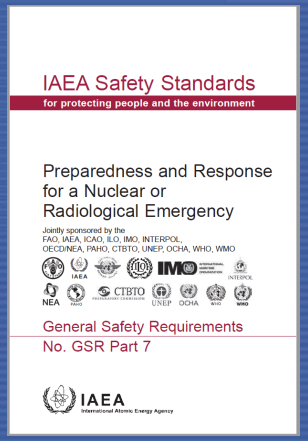
The Radiological accident in Ventanilla 2019 (Approved by the IAEA PC)

EPR-Medical follow-up. (in draft)

GSR Part-7

- *4.31. The government shall ensure that the protection strategy is implemented safely and effectively in an emergency response through the implementation of emergency arrangements, including but not limited to:*

- *(c) Providing for registration, health screening and longer term medical follow-up…*



Generic Criteria

TABLE II.1. GENERIC CRITERIA FOR DOSES RECEIVED WITHIN A SHORT PERIOD OF TIME FOR WHICH PROTECTIVE ACTIONS AND OTHER RESPONSE ACTIONS ARE EXPECTED TO BE TAKEN UNDER ANY CIRCUMSTANCES IN AN EMERGENCY TO AVOID OR TO MINIMIZE SEVERE DETERMINISTIC EFFECTS

Acute external exposure (<10 h)		
$AD_{\text{red marrow}}$ [a]	1 Gy	If the dose is projected: — Take precautionary urgent protective actions immediately (even under difficult conditions) to keep doses below the generic criteria; — Provide public information and warnings; — Carry out urgent decontamination.
AD_{fetus}	0.1[b] Gy	
AD_{tissue} [c]	25 Gy at 0.5 cm	
AD_{skin} [d]	10 Gy to 100 cm^2	
Acute internal exposure due to an acute intake (Δ = 30 d[e])		
$AD(\Delta)_{\text{red marrow}}$	0.2 Gy for radionuclides with atomic number $Z \geq 90$[f] 2 Gy for radionuclides with atomic number $Z \leq 89$[f]	If the dose has been received: — Perform immediate medical examination, medical consultation and indicated medical treatment; — Carry out contamination control; — Carry out immediate decorporation[g] (if applicable); — Conduct registration for longer term medical follow-up — Provide comprehensive psychological counselling.
$AD(\Delta)_{\text{thyroid}}$	2 Gy	
$AD(\Delta)_{\text{lung}}$ [h]	30 Gy	
$AD(\Delta)_{\text{colon}}$	20 Gy	
$AD(\Delta)_{\text{fetus}}$ [i]	0.1[b] Gy	

[a] $AD_{\text{red marrow}}$ represents the average RBE weighted absorbed dose to internal tissues or organs (e.g. red marrow, lung, small intestine, gonads, thyroid) and to the lens of the eye from exposure in a uniform field of strongly penetrating radiation.

TABLE II.2. GENERIC CRITERIA FOR PROTECTIVE ACTIONS AND OTHER RESPONSE ACTIONS IN AN EMERGENCY TO REDUCE THE RISK OF STOCHASTIC EFFECTS (cont.)

Generic criteria		Examples of protective actions and other response actions[a]
Dose that has been received and that exceeds the following generic criteria: Take longer term medical actions to detect and to effectively treat radiation induced health effects		
E[d]	100 mSv in a month	Health screening based on equivalent doses to organs (as a basis for longer term medical follow-up)[h], registration, counselling
H_{fetus} [f]	100 mSv for the full period of in utero development	Counselling to allow informed decisions to be made in individual circumstances

[a] These examples are neither exhaustive nor grouped in a mutually exclusive way.
[b] The equivalent dose to the thyroid (H_{thyroid}) only due to exposure to radioiodine.
[c] This generic criterion applies only for administration of iodine thyroid blocking. For the thyroid, iodine thyroid blocking is an urgent protective action that is prescribed: (a) if exposure due to radioactive iodine is involved, (b) before or shortly after a release of radioactive iodine, and (c) within only a short period before or after the intake of radioactive iodine.
[d] Effective dose.
[e] As a less disruptive protective action, sheltering may be ordered at lower doses as long as justified and optimized in accordance with Requirement 5 with due consideration of the reference level in para. 4.28(2).
[f] H_{fetus} is the equivalent dose to the fetus, derived as the sum of the dose from external exposure and the maximum committed equivalent dose to any organ of the embryo or fetus from intake to the embryo or fetus for different chemical compounds and different times relative to conception.
[g] Restrictions on food, milk and drinking water using these generic criteria are to be applied before sampling and analysis of food, milk and drinking water are carried out. Such restrictions apply as long as replacements of food, milk and drinking water or other alternatives are available to ensure they would not result in severe malnutrition, dehydration or other severe health impacts.
[h] When results of the health screening indicate that the criteria in Table II.1 are exceeded, then appropriate medical attention on the basis of Appendix II (see Table II.1) is necessary.

Objectives of the medical follow-up

- To provide for the long-term medical care of individuals who have suffered deterministic effects and of individuals incurring doses that exceed the threshold dose for deterministic effects;

- To provide for the early detection and diagnosis of stochastic effects (e.g. thyroid cancer) among the exposed population in order to allow for effective treatment

IAEA Safety Standards Series No. GSG-11 (2018)

Justification

- Long-term medical follow-up is justified to detect and treat late deterministic effects, their complications, and radiation induced cancers.

- Long-term medical follow-up is justified on the basis of one of the following levels of exposure*:

  (a) "Long-term health monitoring is always justified at levels of dose above the thresholds for deterministic effects".

  (b) Justification of long-term health monitoring at levels of dose below the thresholds for deterministic effects requires proper identification of populations at higher risk of developing radiation induced cancers.

*IAEA Safety Standards Series No. GSG-2 (2011)

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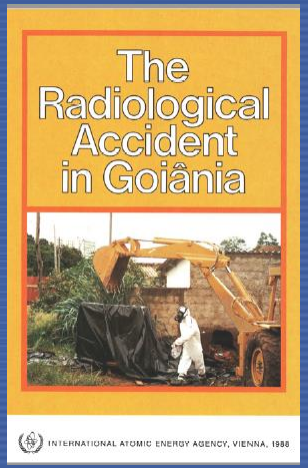
Example: Goiania 1987

EF – February 2015

WMP – February 2015

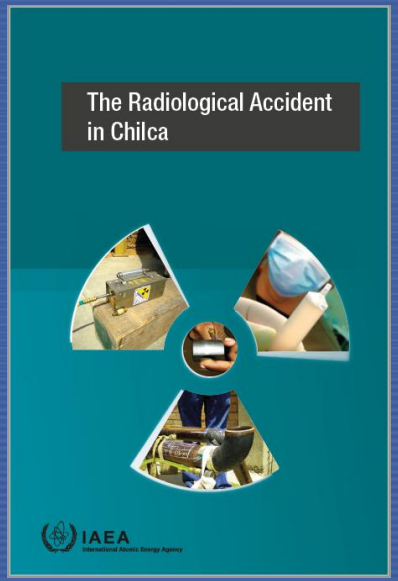


Credits: Dr. N. Valverde

Example: Chilca 2012

January 2012

May 2012



February 2013

August 2013

September 2013

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The Registry

- A registry of individuals who have been identified as requiring longer term medical follow-up has to be established before the termination of the emergency*.

- An initial registration should be carried out by employers or first responders that would allow for completion of the registry later on. Arrangements should be made for transferring information to the organization designated for the maintenance of the registry*.

- Persons listed in the registry should be provided with information on their individual risks and should be considered for long-term medical follow-up aimed at early detection and prompt treatment of any radiation-related late effects.

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IAEA Safety Standards Series No. GS-G-2.1 (2007) and GSG-11 (2018)

Initial data set for persons suspected to have been significantly exposed to radiation

a) Basic demographic details (ensure that the correct identity of persons in the registry can be confirmed over time);

b) The exact place/location at the moment of the emergency;

c) Results of survey for contamination (internal and external);

d) Personal dosimetry results, if available;

e) History of any injury – conventional/radiation induced/combined;

f) Detail of treatment given.

IAEA, EPR-MEDICAL 2005, IAEA, Vienna (2005).

Mental Health and Psychological Counselling

- The mental health and psychosocial support will reduce the adverse psychological and societal consequences for the wider affected population, such as evacuees, people relocated after a decision has been made to lift evacuation and/or relocation and also for those under medical follow-up.
- Emergency arrangements have to be such that both psychological counselling and continuous medical care can be provided.
- Organisations and facilities responsible for these services need to be identified at the preparedness stage.

IAEA Safety Standards Series No. GSG-11 (2018)

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Information and results

- An adequate medical follow-up study will produce relevant data and information that will:
  - contribute to optimize the medical management of the patients included in the study,
  - provide valuable information for future medical management of emergencies, and
  - provide scientific evidence for the development and justification of Protective Actions and their criteria.

Safety Report Series No. 2, Diagnosis and Treatment of Radiation Injuries. IAEA and WHO, Vienna (1998).
Safety Report Series, Medical Management of Radiation Injuries, IAEA , PAHO and IFRC. Vienna (2019) "in publication process.

Conclusion

- The criteria for the medical follow-up of overexposed persons is essential and it should be established at the preparedness stage (on a life-long basis).
- Medical record needs to be as complete as possible.
- The criteria should be tied to potential health effects and be consistent with other national criteria.
- It will require the expertise of a multidisciplinary team (medical, dosimetry, etc). This also includes the provision of mental health and psychosocial support.

Safety Report Series No. 2, Diagnosis and Treatment of Radiation Injuries. IAEA and WHO, Vienna (1998).
Safety Report Series, Medical Management of Radiation Injuries, IAEA (2019) "in publication process.

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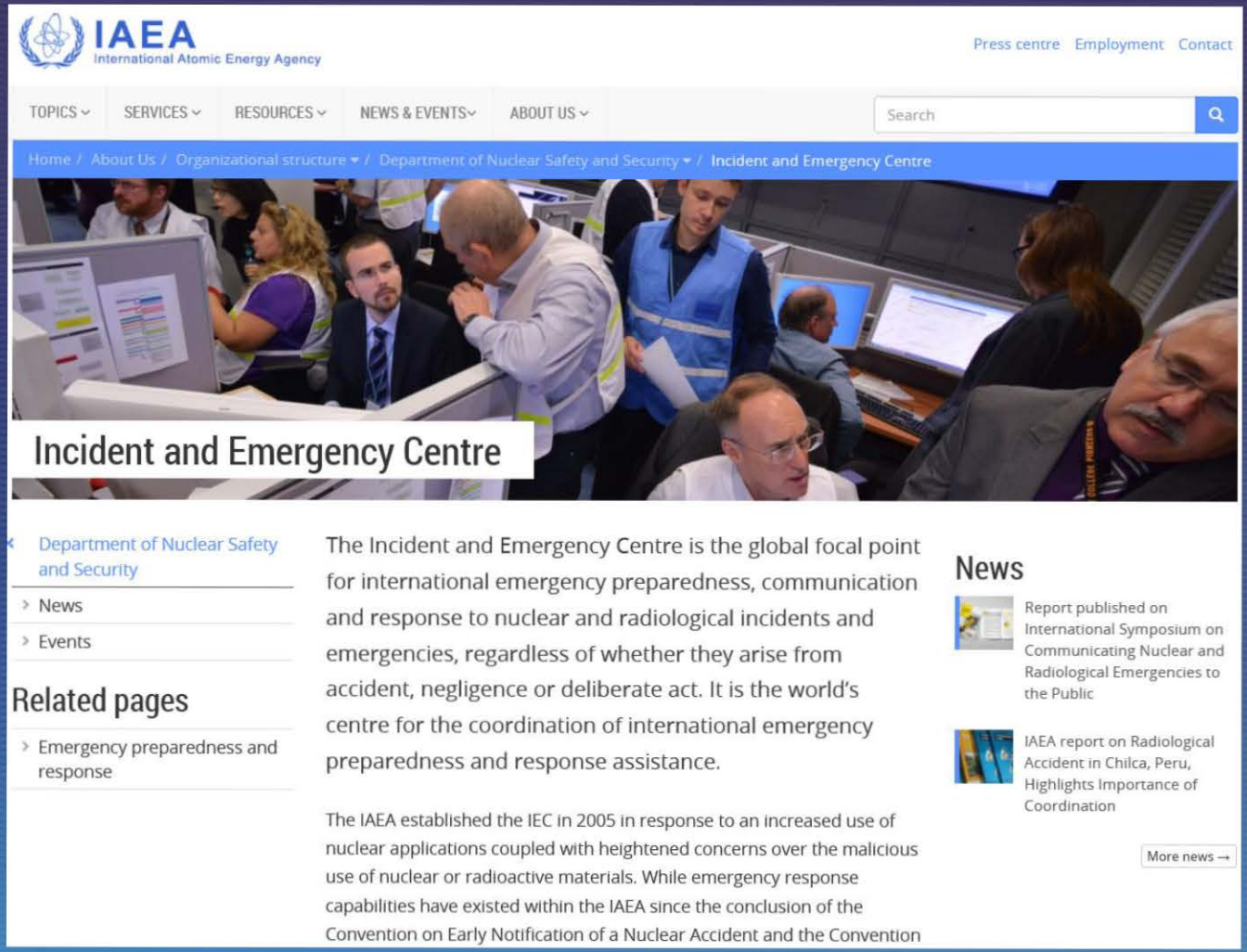

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Thank you!