The Abdus Salam
International Centre
for Theoretical Physics

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International Atomic Energy Agency

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Emergency Preparedness and Response

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Emergency Preparedness and Response

Prepared for Emergencies

R. Martincic
Incident and Emergency Centre

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International Atomic Energy Agency

What we are going to discuss

- EPR Goals
- EPR Requirements
- EPR framework
- EPR Operational tools

EPR – Emergency Preparedness and Response

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The Radiological Accident in Lilo
The Radiological Accident in Goiânia
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1988
AN ELECTRON ACCELERATOR ACCIDENT IN HANOI, VIET NAM
THE CRITICALITY ACCIDENT IN SAROU
The Radiological Accident in Soreq
The Radiological Accident in Yanango
THE RADIOLOGICAL ACCIDENT IN SAN SALVADOR
A REPORT PREPARED BY IAEA IN CO-OPERATION WITH PAHO/WHO
The Radiological Accident in Tammiku
Accidental Overexposure of Radiotherapy Patients in San José, Costa Rica
The Radiological Accident in Samut Prakarn
INVESTIGATION OF AN ACCIDENTAL EXPOSURE OF RADIOTHERAPY PATIENTS IN PANAMA
INTERNATIONAL ATOMIC ENERGY AGENCY
THE RADIOLOGICAL ACCIDENT IN THE REPROCESSING PLANT AT TOMSK
Vapour–gas phase
Nitric acid, 1.3 m³
Organics
Product 401e
4 m³ beta active solution of Nb, Pu, Zr
Pu and U
Product 166
19.5 m³ Pu and U
INTERNATIONAL ATOMIC ENERGY AGENCY
Health consequences of the Chernobyl accident
Results of the IPHECA pilot projects and related national programmes
Scientific Report
World Health Organization
Geneva 1996
The Radiological Accident in Nueva Aldea
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International Atomic Energy Agency
The Radiological Accident in Istanbul
THE RADIOLOGICAL ACCIDENT AT THE IRRADIATION FACILITY IN NESVIZH
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Report on the preliminary fact finding mission following the accident at nuclear fuel processing facility in Tokaimura, Japan
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1999

Nuclear/Radiological Emergencies

They DO occur!

We have to be PREPARED to respond!

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Goals of Emergency Response

- To regain control of situation
- To prevent or mitigate consequences at the scene
- To prevent occurrence of deterministic effects in workers, patients and public
- To render first aid and to manage treatment of radiation injuries

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Goals of Emergency Response

- To the extent practicable
  - Prevent occurrence of stochastic effects in population
  - Prevent occurrence of non-radiological effects on individuals and in population
  - Protect property and environment
  - Prepare for resumption of normal social and economic activity

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Goals of Emergency Preparedness

- Emergency preparedness ensures that adequate infrastructure elements and practical arrangements are in place for effectively achieving goals of emergency response
- Sound emergency preparedness helps to build confidence that an emergency response will be effective in achieving its goals

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Key EPR Elements

- Emergency management system
  - Basic responsibilities are defined
  - Hazard assessment is performed (graded approach to EPR)
  - Adequate EPR infrastructure exists
  - EPR arrangements are in place

EMS for radiation emergency needs to be integrated into an all hazards national EMS

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Integrated Emergency Planning

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Graded Approach to EPR

- Basic question (at facility, local, national level): for what we need to be prepared?
- Identified hazards/threats and potential consequences of emergency provide an answer

Hazard assessment provides framework for graded approach to EPR

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Hazard Assessment

- Events (full range) that could occur at facility or activity including those with a low probability and criminal acts
- Events involving combination of nuclear or radiological emergency and conventional emergency: earthquake, tropical cyclone or tsunami that affect wide areas and/or impair capabilities to provide support to response efforts

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Hazard Assessment

- Events affecting several facilities simultaneously
- Events at nuclear facilities or activities in other States
- Non radiation hazards (e.g. hazardous chemicals) that are associated with facility or activity

Hazard Categories

Category	Radiological Hazard
I	Facilities for which on-site events could give rise to severe deterministic effects off the site
II	Facilities for which on-site events could warrant urgent/early protective or other response actions off the site – no severe deterministic effects off the site
III	Facilities for which on-site events could warrant protective or other actions on the site – no off-site actions needed
IV	Activities that could give rise to emergency that could warrant protective and other response actions in unforeseeable location
V	Across border hazards – areas that could be impacted by emergency in category I or II facilities in another State

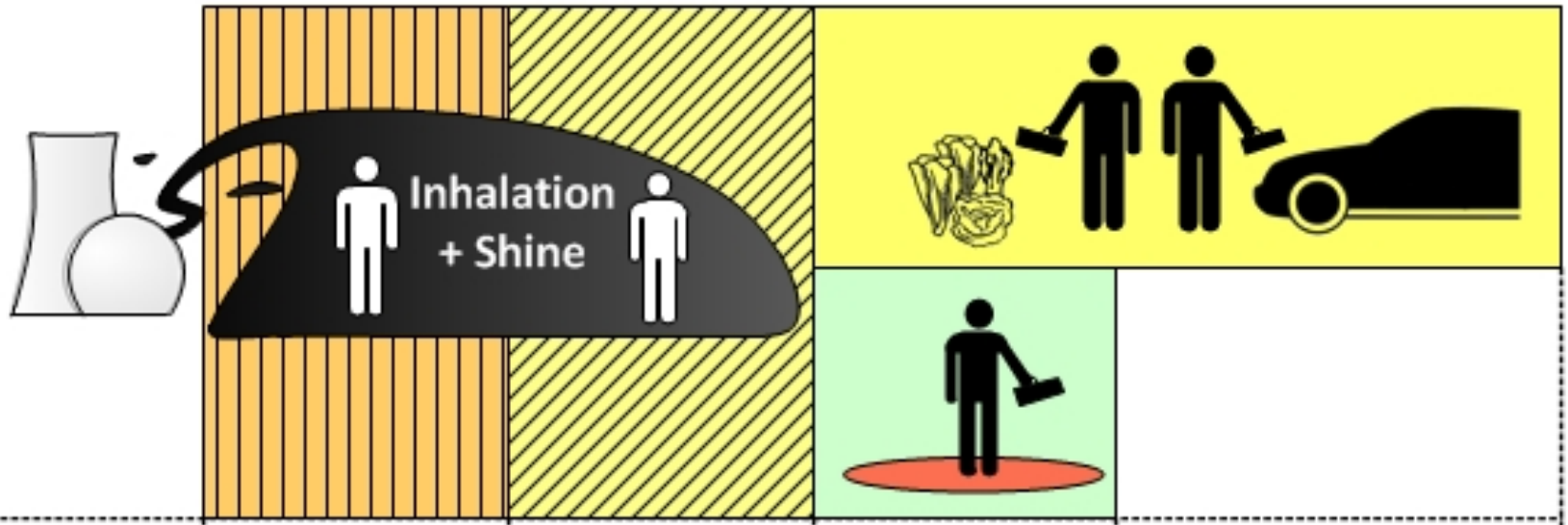
Emergency Zones and Distances

- Areas needs to be identified for which emergency could warrant
  - Precautionary urgent protective actions to avoid/ minimize severe deterministic effects – precautionary action zone (PAZ)
  - Urgent protective and other response actions to avoid/minimize severe deterministic effects and reduce risk of stochastic effects – urgent protective action planning zone (UPZ)

Emergency Zones and Distances

- Early protective and other response actions – extended planning distance (EPD)
- Ingestion and commodities planning distance (ICPD)
- Other response actions (e.g. longer term medical actions)
- Protection for emergency workers

Emergency Zones and Distances



Name	PAZ	UPZ	EPD	ICPD
Basis	SDHE	Stochastic	GC_{Early}	GC_{Early}
Response actions	Urgent	Urgent	Early	Early

Emergency Zones and Distances

Suggested Sizes

	Distance (km)	
	≥ 1000 MW (th)	100 to 1000 MW(th)
Precautionary action zone (PAZ)	3 to 5	
Urgent protective action planning zone (UPZ)	15 to 30	
Extended planning distance (EPD)	100	50
Ingestion and commodities planning distance (ICPD)	300	100

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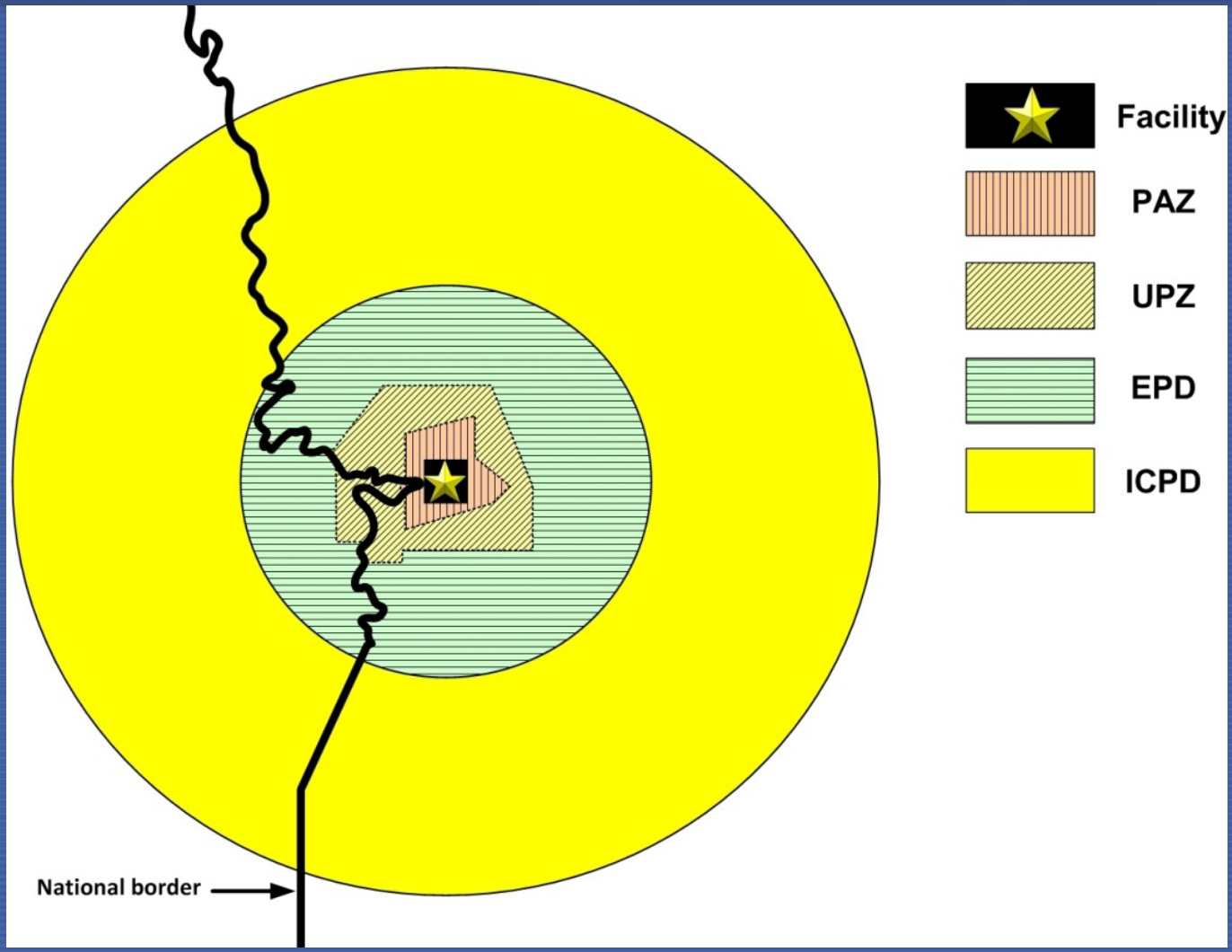
Emergency Zones and Distances



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Emergency Classification

- System is needed for classifying all potential radiation emergencies irrespective of cause
- Following emergency types needs to be addressed
  - General emergencies
  - Site area emergencies
  - Facility emergencies
  - Alerts at facilities
  - Radiological emergencies

General Emergencies
Category I and II

- Actual, or substantial risk of release of radioactive material or radiation exposure that warrants taking urgent protective actions and other response actions on the site and off site
- Actions have to be promptly taken to
  - Mitigate consequences
  - Protect people on site and within emergency planning zones and distances

Site Area Emergencies
Category I and II

- Major decrease in level of protection for those on site and near facility
- Actions have to be promptly taken to
  - Mitigate consequences
  - Protect people on site
  - Make preparations to take protective actions and other response actions off site if this becomes necessary

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Facility Emergencies
Category I, II and III

- Major decrease in level of protection for people on site
- Actions have to be promptly taken to
  - Mitigate consequences
  - Protect people on site
- Emergencies in this class can never give rise to an off-site hazard

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Alerts at Facilities
Category I, II and III

- Uncertain or significant decrease in level of protection for public or people on site
- Response actions have to be promptly taken to
  - Assess and mitigate consequences
  - Increase readiness of on-site and off-site response organizations, as appropriate

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Radiological Emergencies
Category IV

- Radiological events in hazard category IV that warrant taking protective and other response actions
- Actions have to be promptly taken to
  - Mitigate consequences of emergency
  - Protect those in vicinity (e.g. public, workers and first responders) and determine where and for whom other protective actions and other response actions are warranted

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Key EPR Infrastructure

- Authority
- Organization and staff
- Coordination of EPR
- Plans and procedures
- Logistic support and facilities
- Training, drills and exercises
- Quality assurance programme

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Keeping Public Informed

- Provide consistent information - spokesperson(s) trained
- Account for loss of usual communication
- Address inappropriate actions
- Explain differences/changes within the State and by other States
- Monitor media, social networks and internet to identify and address inappropriate actions
- Place information into perspective in terms of **health hazard**

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Problems in Communicating

Bq

Sv

Dose

I-131 Bq/kg

µSv/h

cps

R/h

High doses

Not answering "Is it safe ?" resulted in:

- Dangerous evacuation of patients
- Not treating patients
- Stigma
- Voluntary abortions
- Economic – psychological

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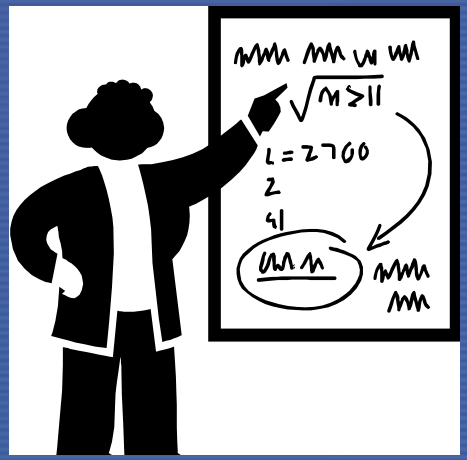
Need to protect her from



Radiation

“Experts”

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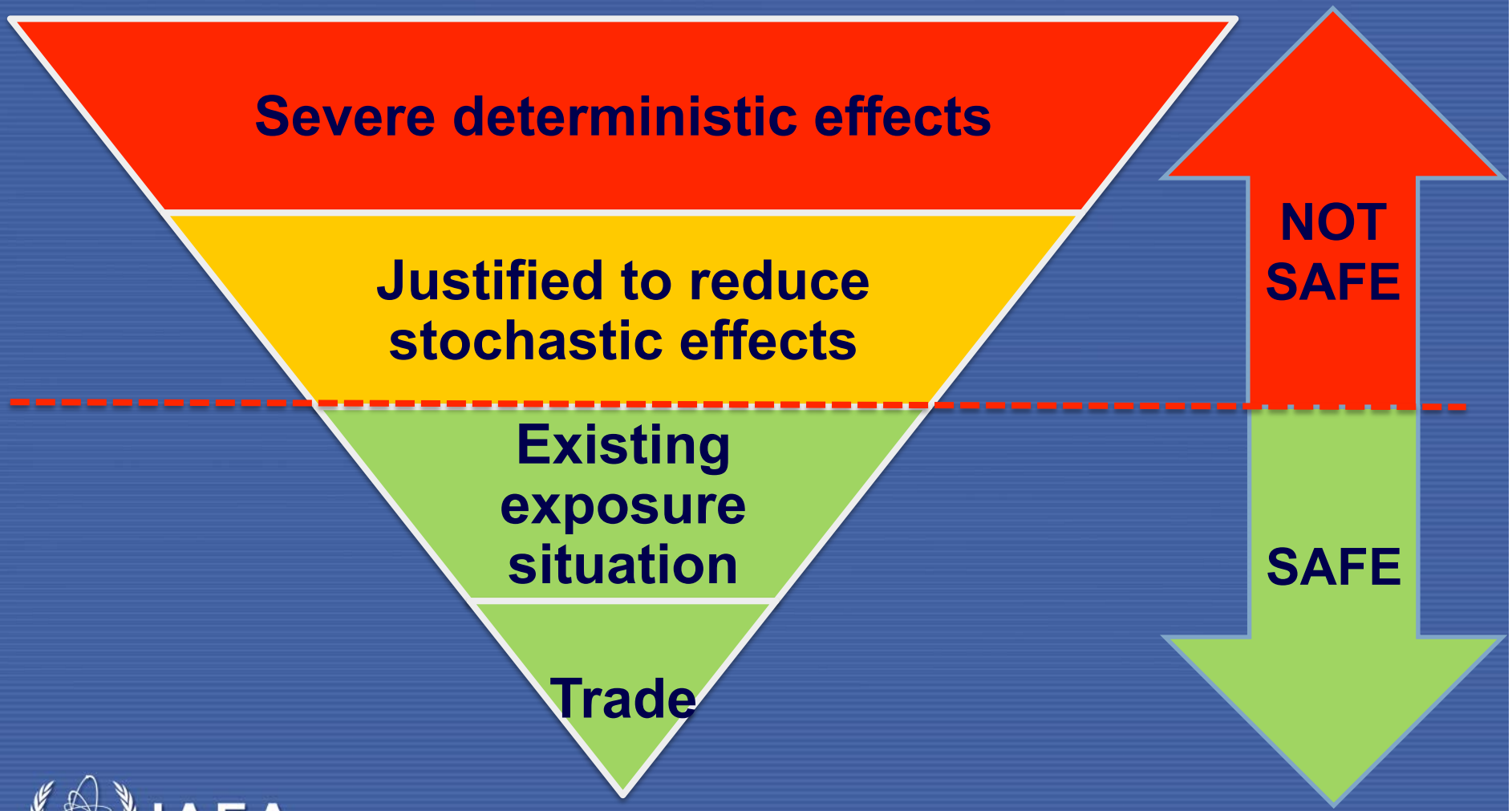
Safe – Not Safe



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Generic Criteria

- International guidance (IAEA 2011) has established generic criteria (GC) of levels for:
  - Acute doses for which protective actions and other response actions are expected to be taken under any circumstances to avoid or minimize severe deterministic effects
  - Protective actions and other response actions in emergency exposure situations to reasonably reduce risk of stochastic effects

Generic Criteria

- Below these generic criteria there will not be any severe deterministic effects or an observable increase in incidence of cancer, even in a very large exposed group
- Furthermore, risk of cancers and other health effects is too low to justify taking any protective or other response actions

Definition of ‘Safe’

- It is ‘safe’:
  - *if living will result in doses below established GC at which protective and other response actions are justified to avoid or to minimize severe deterministic effects and to reasonably reduce risk of stochastic effects*

Color-coded Presentation

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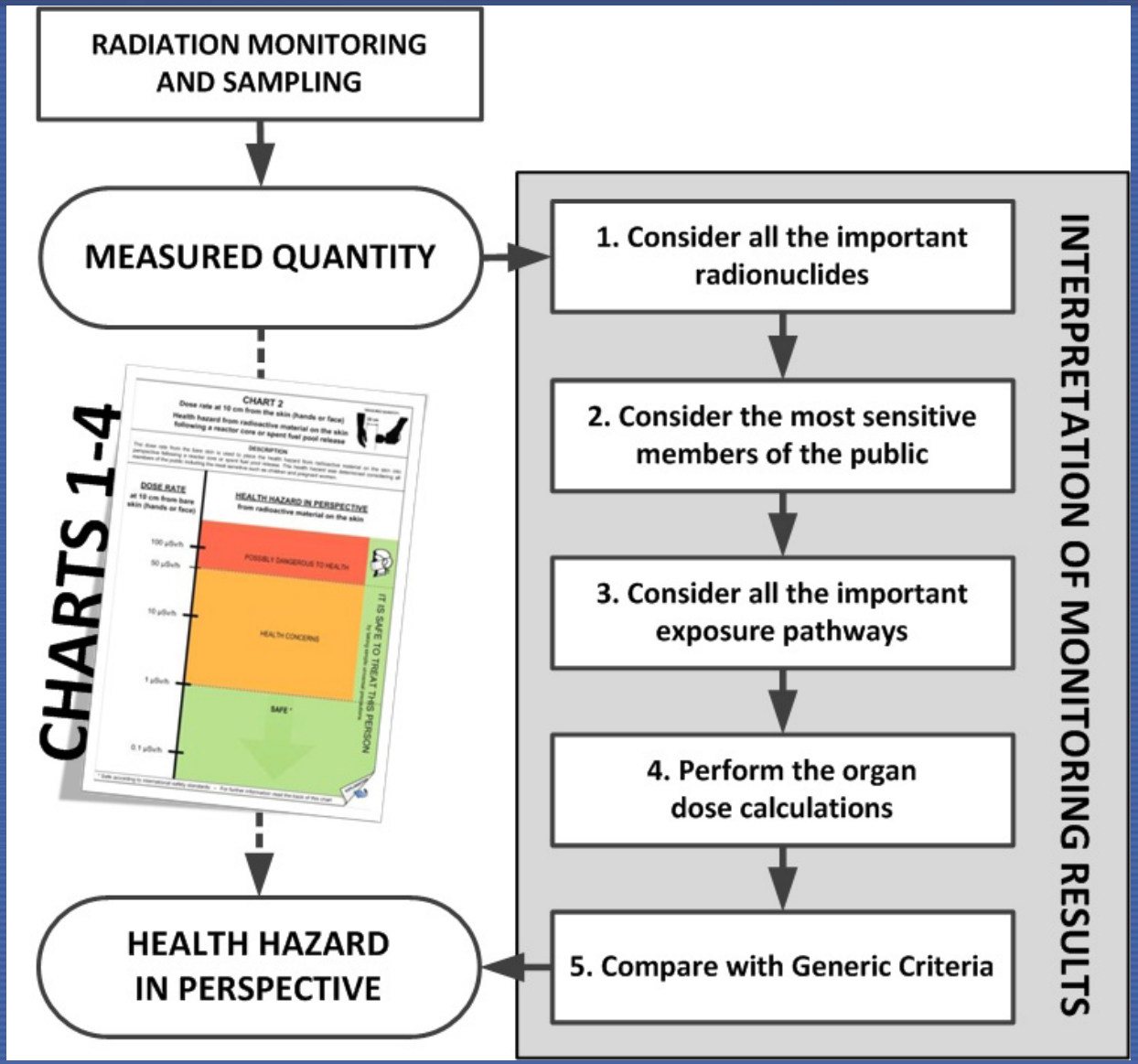
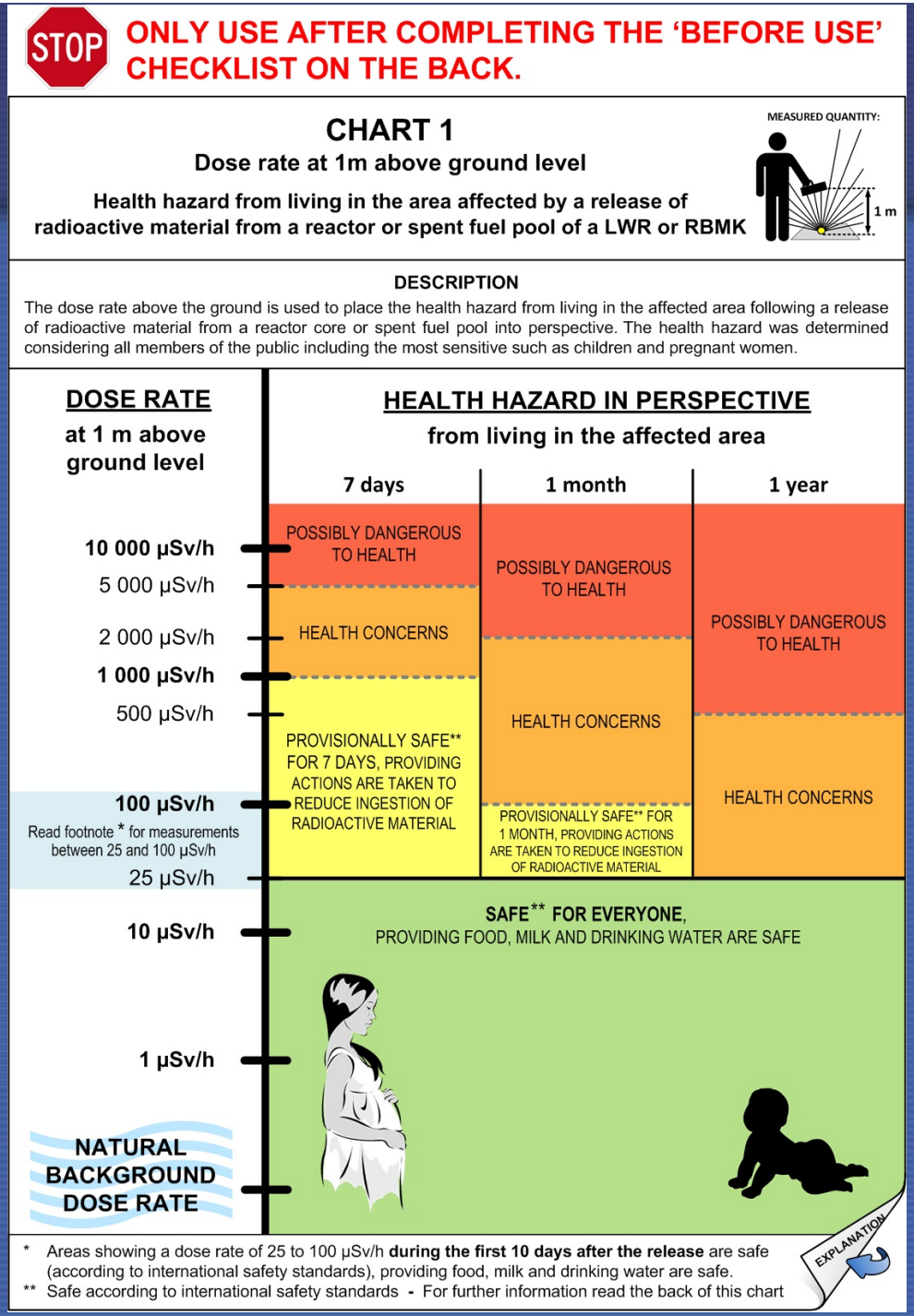
Relating Monitoring Results to Health Hazards



Example



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Key EPR Arrangements

- Establishing emergency management and operations
- Identifying, notifying and activating
- Performing migratory actions
- Taking protective/response actions
- Providing information/instructions/warnings to public
- Protecting emergency workers

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Key EPR Arrangements

- Assessing initial phase
- Managing medical response
- Keeping public informed
- Mitigating non-radiological consequences
- Requesting, providing and receiving international assistance
- Transiting from emergency
- Identifying lessons and corrective actions

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Planning Methodology - Ten Tasks

Tasks	Implementation Time
Designate National EP Coordinator	
1. Review national policy	
2. Perform hazard assessment	
3. Develop planning basis	
4. Allocate responsibilities	
5. Develop interim capability	
6. Write NREP	
7. Present NREP	
8. Implement detailed plans	
9. Test capability	
10. Establish ongoing QA programme	

Common Planning Problems

- Who is responsible?
- “No teeth”
- No legal framework
- Lack of knowledge of risks
- Lack of resources
- Lack of organization
- Lack of co-ordination
- Training “for exercises”
- “Paper plans”
- Public education
- Public information

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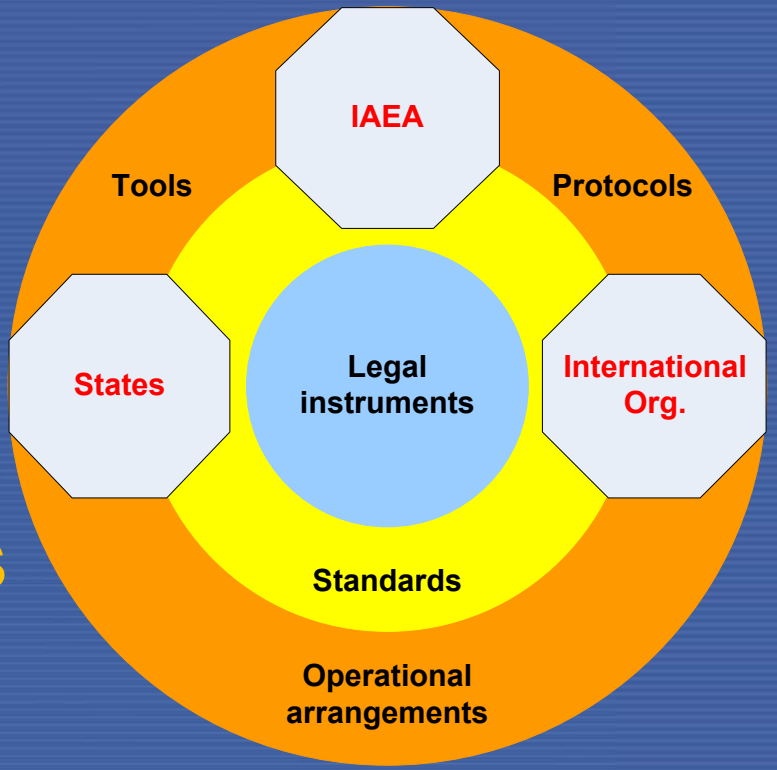
Involve all parties in planning process who have responsibilities or an interest in development and implementation of emergency plan(s) at early stage

EPR Framework

- Legal instruments
- Safety Standards
- Tools, protocols and operational arrangements



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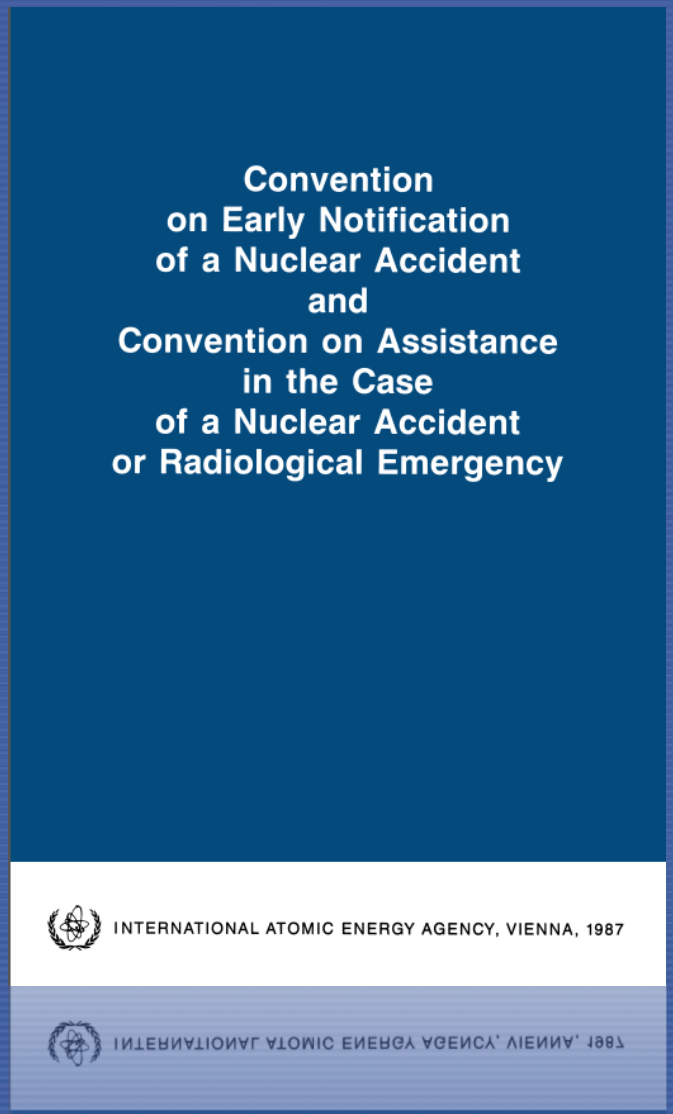
Legal Instruments

- International instruments – conventions
- Member State laws and regulations

Conventions



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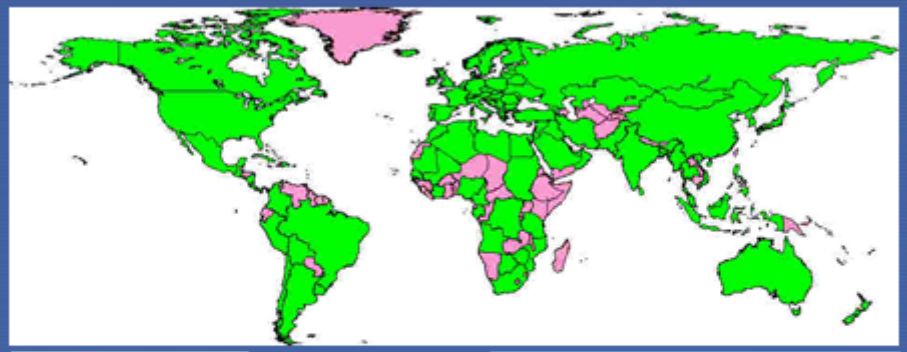
Notification and Assistance Conventions

- Date of adoption: 26 September 1986
- Depositary: IAEA
- Place obligations on Parties and IAEA Secretariat

Early Notification Convention



Parties
Non-Parties

114 Parties including
FAO, WMO, WHO & EURATOM
157 IAEA Member States
(November 2012)

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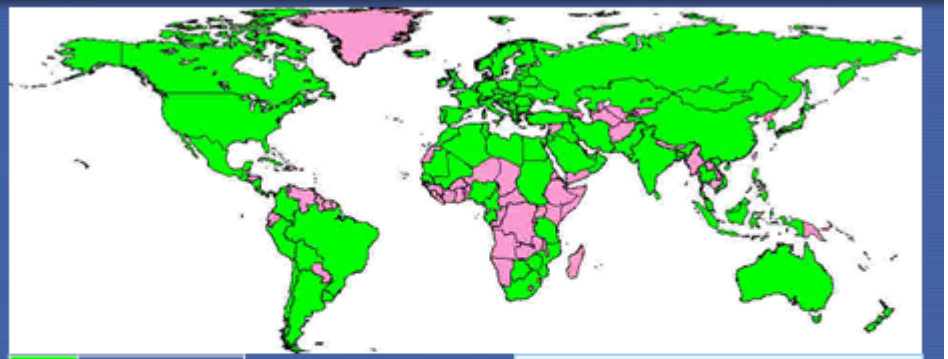
Assistance Convention



Parties
Non-Parties

108 Parties including
FAO, WMO, WHO & EURATOM
157 IAEA Member States
(November 2012)

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Notification Convention
Application

- Applies in ANY accident involving facilities or activities of State Party or of persons or legal entities under its jurisdiction or control:
  - from which release of radioactive material occurs OR is likely to occur; and
  - which has resulted, OR may result in international transboundary release

Notification Convention
Facilities and Activities

- Any nuclear reactor wherever located
- An nuclear fuel cycle facility
- Any radioactive waste management facility
- Transport and storage of nuclear fuels or radioactive wastes
- Manufacture, use, storage, disposal and transport of radioisotopes for agriculture, industrial, medical and related scientific and research purposes; and
- Use of radioisotopes for power generation in space objects

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Notification Convention
Parties' Obligations

- Forthwith notify, directly or through IAEA, those States *which are or may be* physically affected and IAEA of nuclear accident, its nature, time of its occurrence, its exact location, assumed or established cause, general characteristics of release, meteorological conditions, monitoring data, protective actions, and predicted behavior, where applicable

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Notification Convention
Obligations

- Promptly provide States, directly or through IAEA, and IAEA with such available information relevant to minimizing radiological consequences in those States
- Relevant information on development of emergency situation, including its foreseeable or actual termination, shall be supplemented at appropriate intervals

Assistance Convention

State Parties

- Shall cooperate between themselves and with IAEA to facilitate prompt assistance in the event of nuclear accident or radiological emergency
- Request IAEA, acting within framework of its Statute, to promote, facilitate and support cooperation between States Parties

Assistance Convention
Provisions of Assistance

- State Party (SP) needing assistance, *whether or not such accident or emergency originates within its territory, jurisdiction or control,* may call for such assistance from:
  - any other SP, directly or through IAEA
  - IAEA
  - other international/intergovernmental organizations where appropriate

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Assistance Convention
Objectives

Goals of assistance are to:

- minimize consequences
- protect life, property and environment from effects of radioactive releases

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Assistance Convention
IAEA Obligations

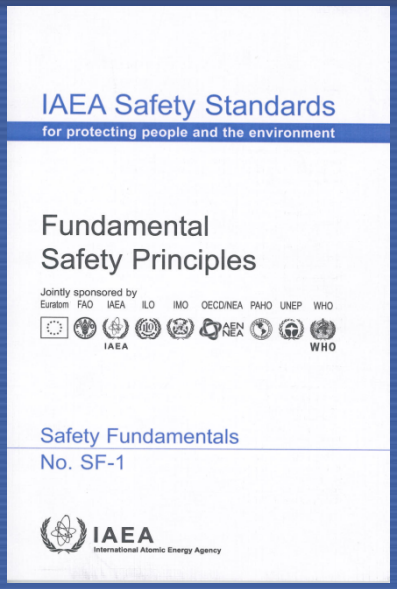
- Tasks IAEA *(inter alia)* to:
  - make available appropriate resources allocated for assistance
  - transmit promptly requests for assistance to other States and international organizations
  - coordinate assistance at international level, if requested by requesting State

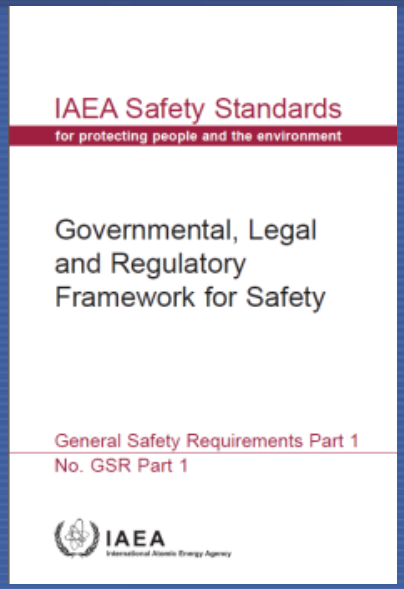
Assistance Convention
IAEA Obligations - continuation

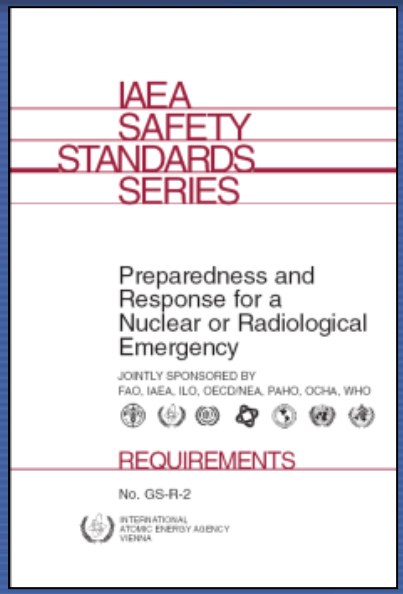
- Collect from and disseminate to SP and MS information concerning:
  - experts, equipment and materials which could be made available in nuclear accidents or radiological emergencies
  - methodologies, techniques and available results of research relating to response to nuclear accidents or radiological emergencies

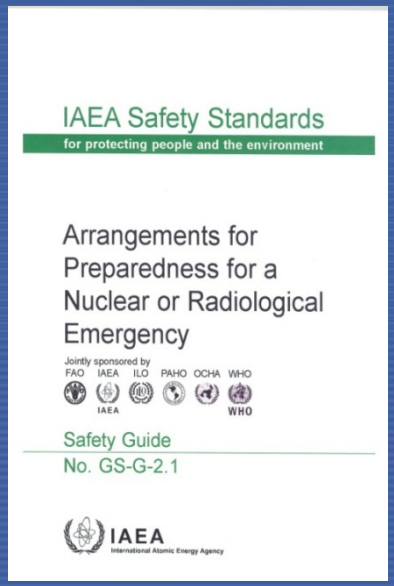
Safety Standards

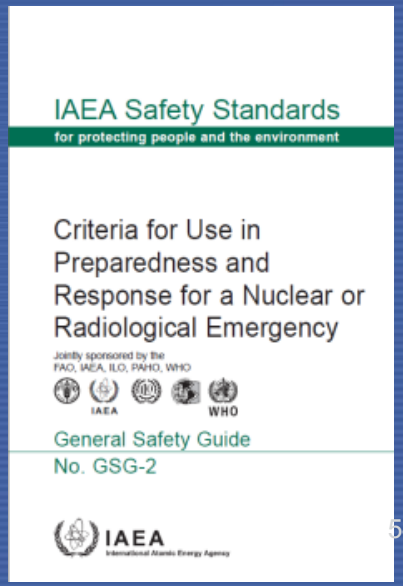
Requirements and Guides











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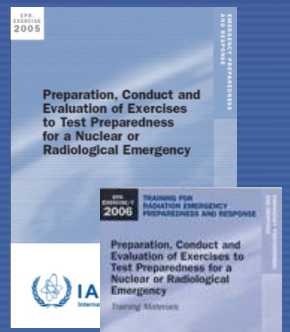
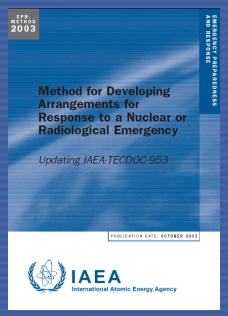
Tools


2005
Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency

2006
Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency
IAEA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Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency
Updating IAEA-TECDOC-953
IAEA
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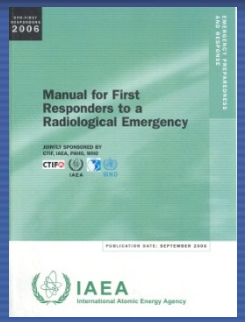
2006
Manual for First Responders to a Radiological Emergency
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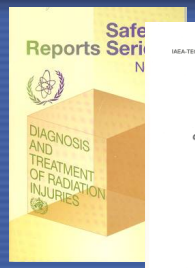
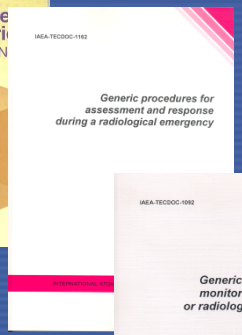
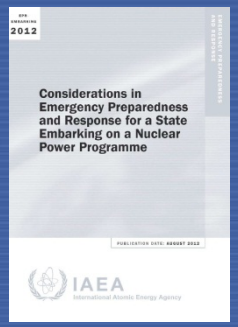
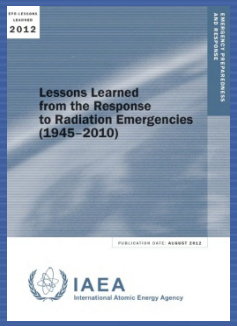

DIAGNOSIS AND TREATMENT OF RADIATION INJURIES


Generic procedures for assessment and response during a radiological emergency


Generic procedures for monitoring in a nuclear or radiological emergency
IAEA


2012
Considerations in Emergency Preparedness and Response for a State Embarking on a Nuclear Power Programme
IAEA
International Atomic Energy Agency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Lessons Learned from the Response to Radiation Emergencies (1945–2010)
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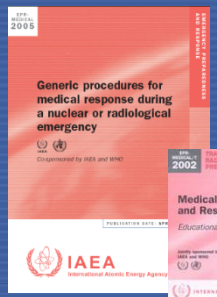
2005
Generic procedures for medical response during a nuclear or radiological emergency
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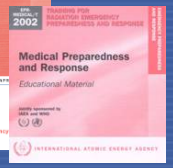
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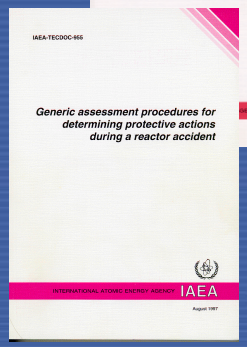
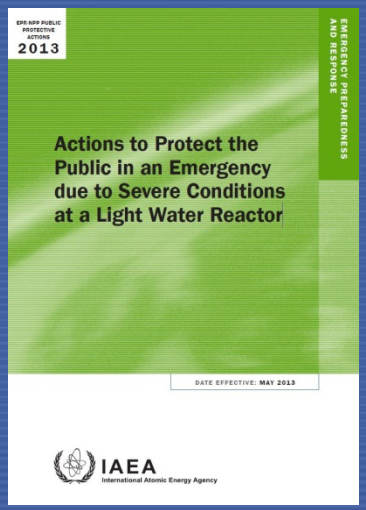
Medical Preparedness and Response
Educational Material


IAEA-TECDOC-966
Generic assessment procedures for determining protective actions during a reactor accident
IAEA


2013
Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor
DATE EFFECTIVE: MAY 2013
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First Responders Toolkit
English Edition
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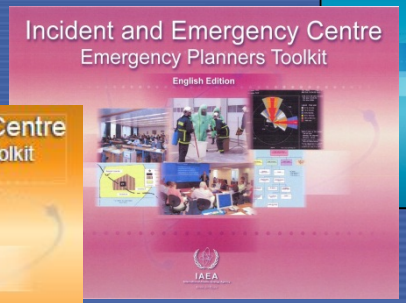
Incident and Emergency Centre
Emergency Planners Toolkit
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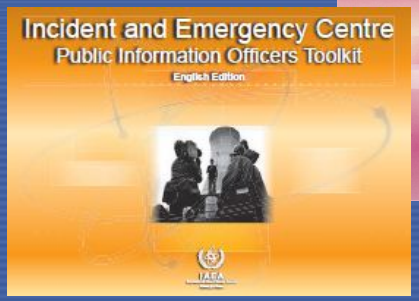
Incident and Emergency Centre
Public Information Officers Toolkit
English Edition
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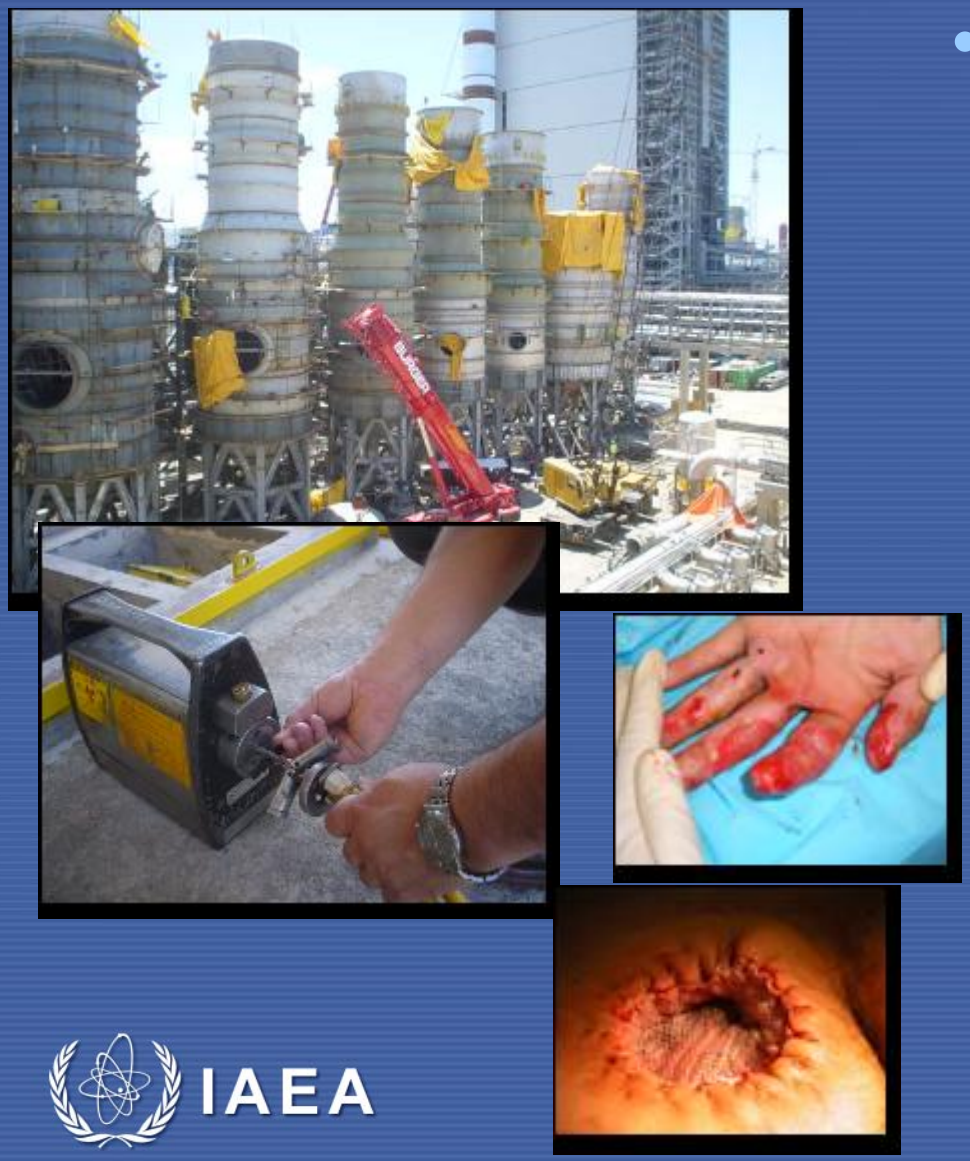
Operational Arrangements
Key Document

- National Radiation Emergency Plan (NREP)
  - Provides basis for emergency preparations by both local and national response organizations
  - Contains information other organizations need to know about national level response
  - Summarises more detailed plans and assures all other planning is integrated and compatible

International Assistance

- Adequate arrangements need to be in place to benefit from, and contribute to, international assistance in EPR
  - Arrangements for requesting, providing and receiving international assistance

What is RANET



- RANET is network of States capable and willing to provide, upon request, specialized assistance by appropriately trained, equipped and qualified personnel with ability to respond quickly and effectively to radiation emergencies

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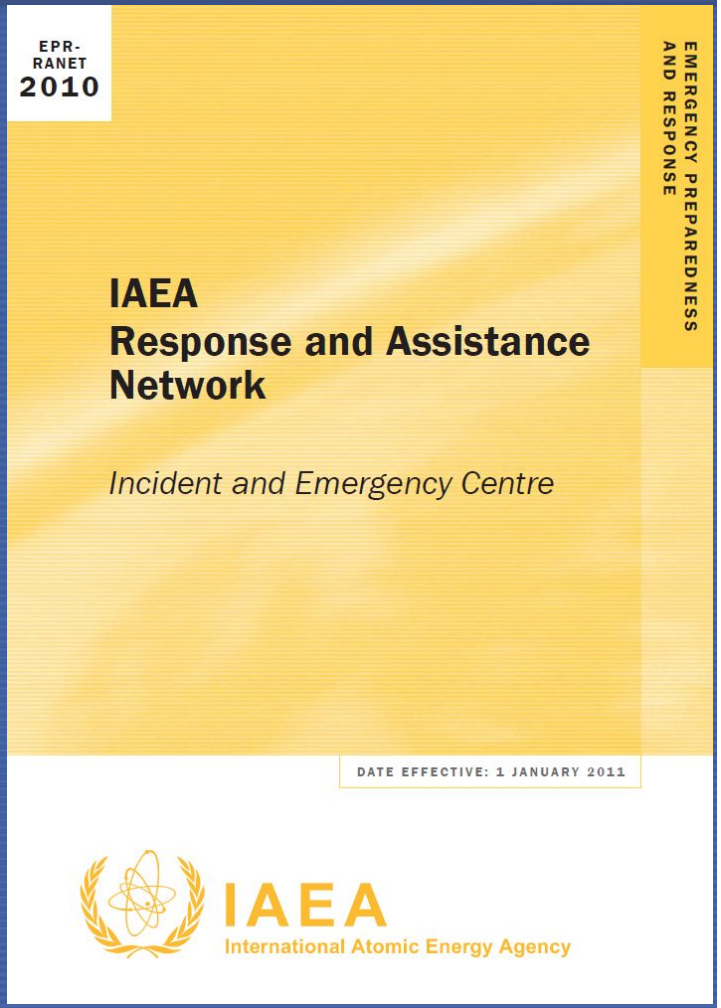
Aim of RANET

- To facilitate
  - Provision of requested international assistance (preferably on regional basis)
  - Enhancement and harmonization of response capabilities
  - Exchange of relevant information and feedback of experience



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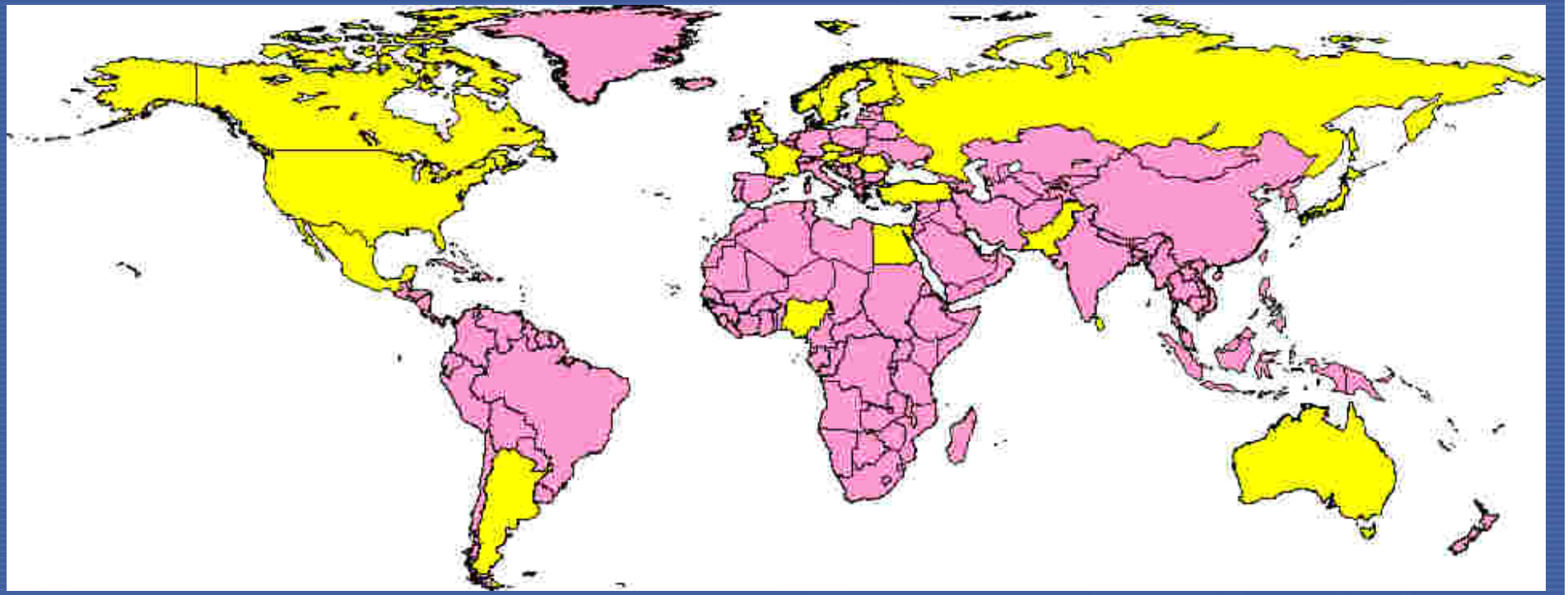
States Registered in RANET



22 States registered their capabilities – Nov 2012

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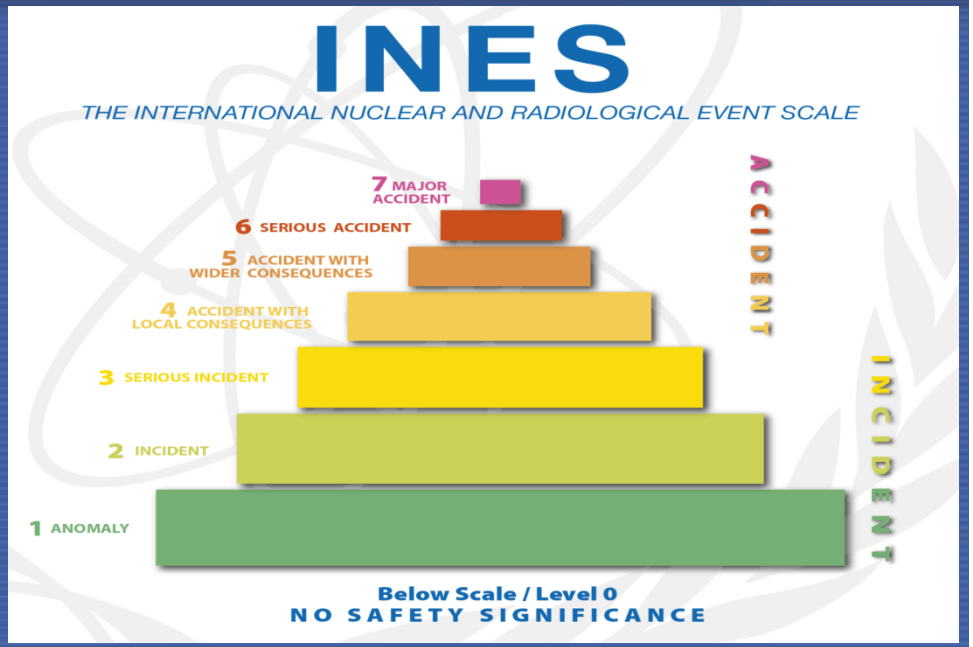
International Nuclear Event Scale

- Worldwide tool for communicating to public in a consistent way safety significance of nuclear and radiological events



- Scale should not be confused with emergency classification systems, and should not be used as a basis for determining emergency

IAEA

Additional Information

If you need any additional information or you have any question

Email us

iec3@iaea.org

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Luck Favours Prepared

Let's be prepared!

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Thank you