Comissão Nacional de Energia Nuclear

INAC 2019 - ENIN

General Overview of Tendency of the Emergency Plan

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CNEN/CODRE/DIANG – 21-10-2019

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  - Why we need it ???
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INTRODUCTION

- What is the Emergency Plan ???
- Why we need it ???
- Existing Emergency Nuclear Power Plans (PEE, PEL, PESRPot, PECs, ...)
- Organizations envolved in a Nuclear Emergergency

Organizations envolved in a Nuclear Emergency

- Gabinete de Segurança Institucional – GSI (SIPRON)
- Governo do estado
  - Defesa Civil do estado
  - 10º GBM
- CNEN
- ETN
- ABIN
- IBAMA
- INEA
- Defesa Civil Municipal
- Defesa Civil Federal
- Ministério da Defesa – MD
- Ministério do Desenvolvimento Regional – MDR
- Ministério da Saúde - MS

Emergency Centers

- CCCEN - Municipal
- CIEN - Comunicação
- CESTGEN - Estadual
- CENAGEN - Federal

NRC & NEI

- **NSIR - DPS - ISG - 01 - Emergency Plan for NPP - Interim Staff Guidance - 2011**
- **NUREG-0396 - Planning basis for the Development of State and Local Gov Rad ERPs in Support of PWR NPP – 1978**
- **NUREG-654 Rev 1 - Criteria for Prep & Evaluation of Rad Emergency Response Plan – 2002**
- **NUREG-0728 - NRC Incident Response Plan - IRP - rev 4 – 2005**
- **NRC Regulatory Guide 1.101 -Emergency response Planing and Preparedness for NPP – re 5 – 2004**
- **NEI-95-01 – Develop of Emergency Action Levels for Non Passive Rx – rev 6 – 2012**
- **NUREG-0396 – Planning Basis for the Development of State and Local Government Radiological Emergency. Response Plans … - 1978**
- **NSAC/100 – Emergency Planning - The Effect of New Source Term Data – 1986**
- **NUREG-75 ou WASH-1400 - Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants - 1977**

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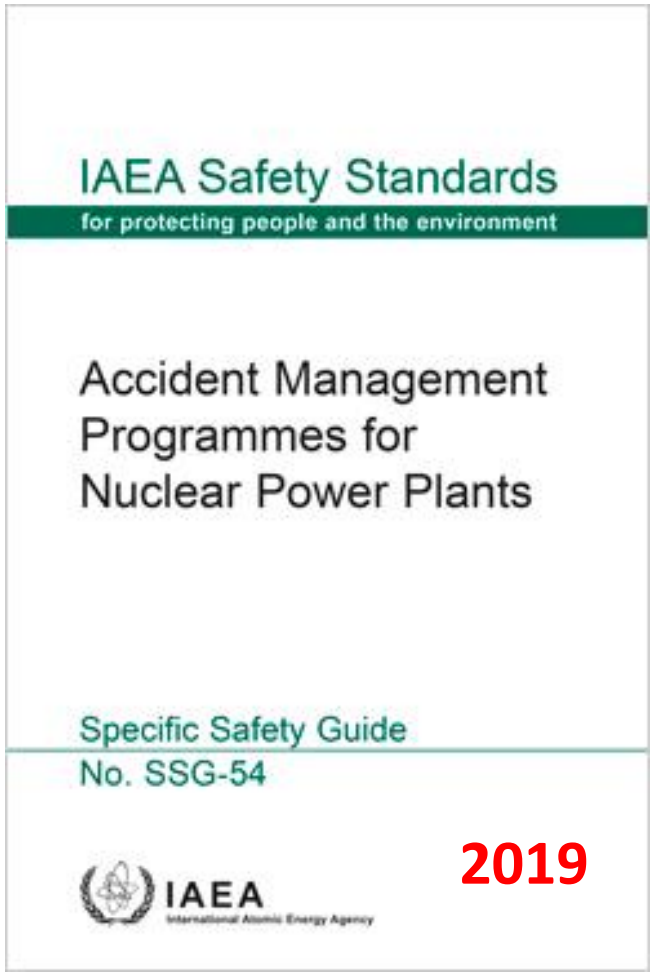
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for protecting people and the environment
Accident Management Programmes for Nuclear Power Plants
Specific Safety Guide
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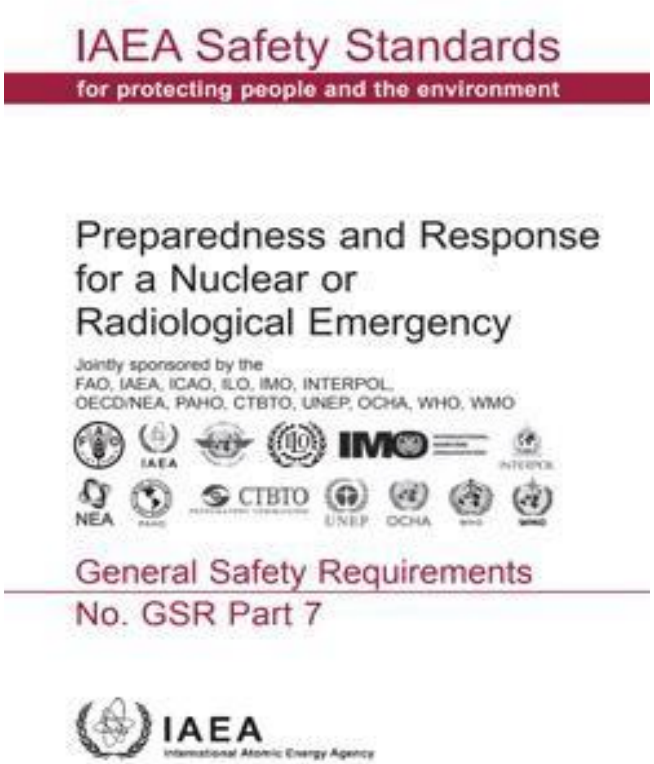
2019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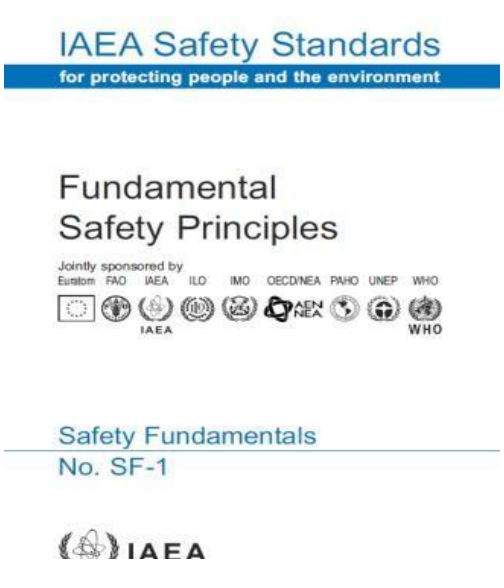
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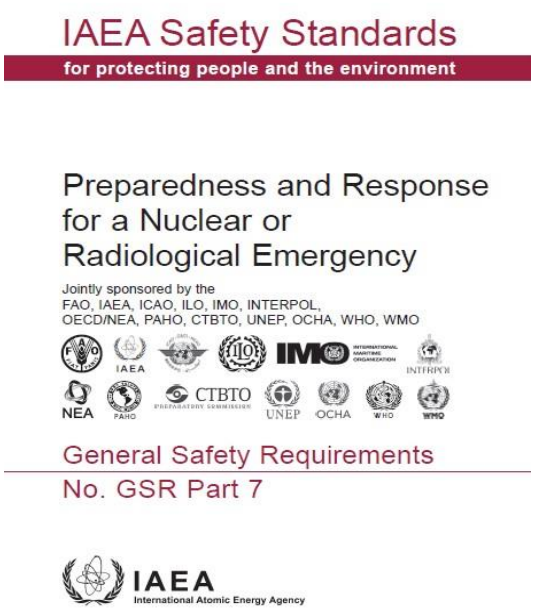
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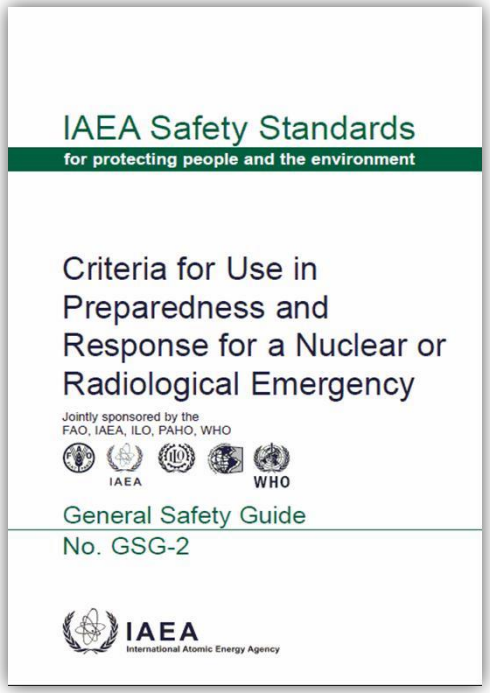
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Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency
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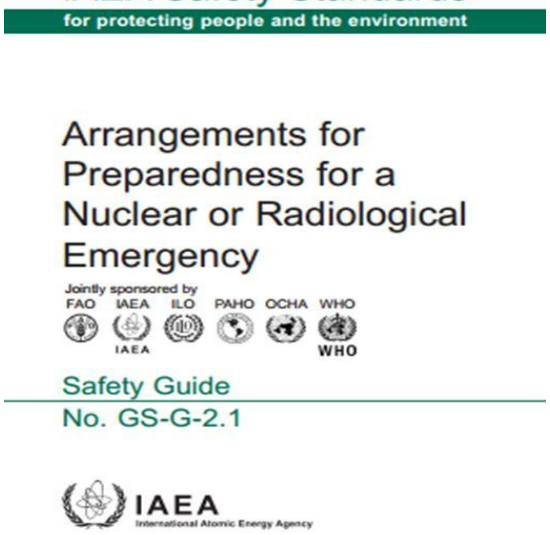
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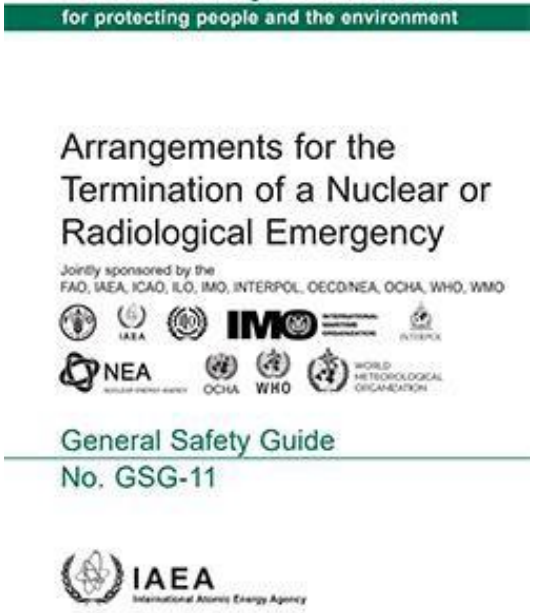
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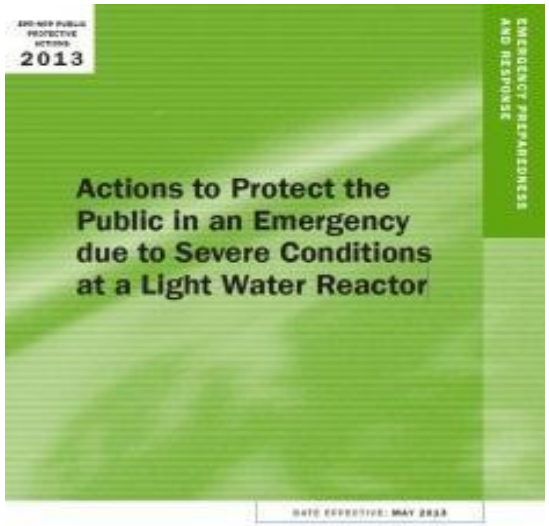
2013
EMERGENCY PREPAREDNESS AND RESPONSE
Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor
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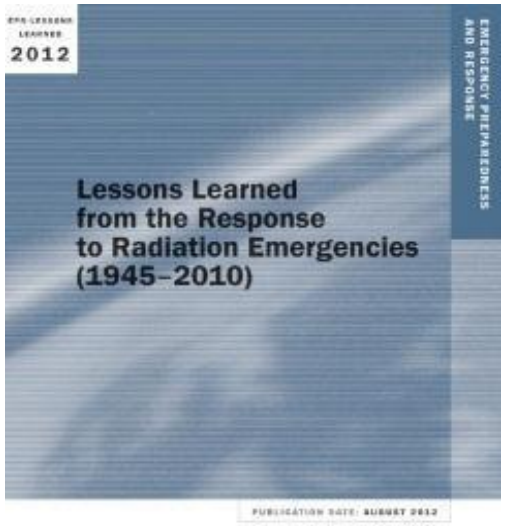
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EMERGENCY PREPAREDNESS AND RESPONSE
Lessons Learned from the Response to Radiation Emergencies (1945–2010)
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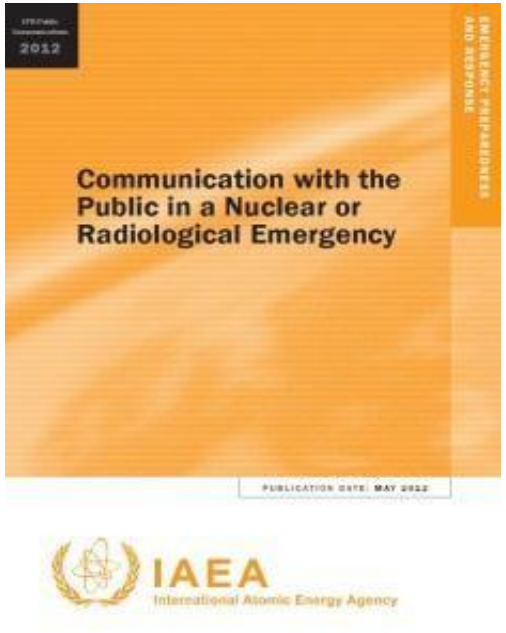
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EMERGENCY PREPAREDNESS AND RESPONSE
Communication with the Public in a Nuclear or Radiological Emergency
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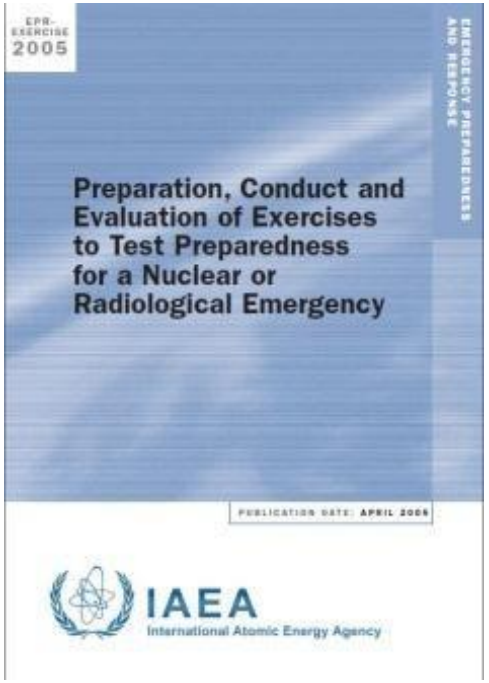
EPR-EXERCISE 2005
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Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency
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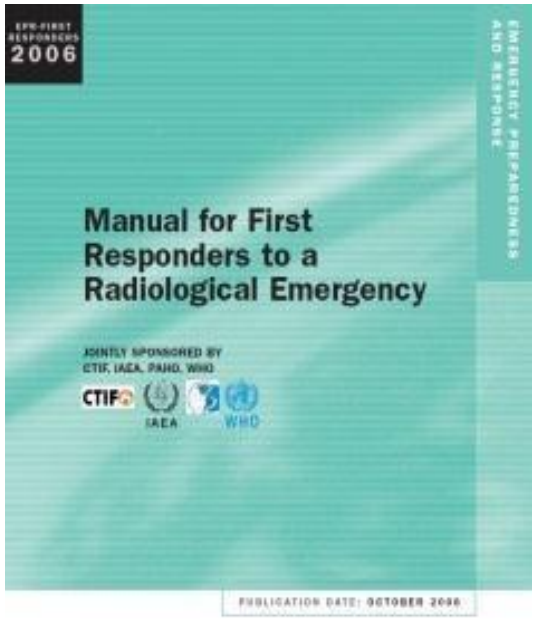

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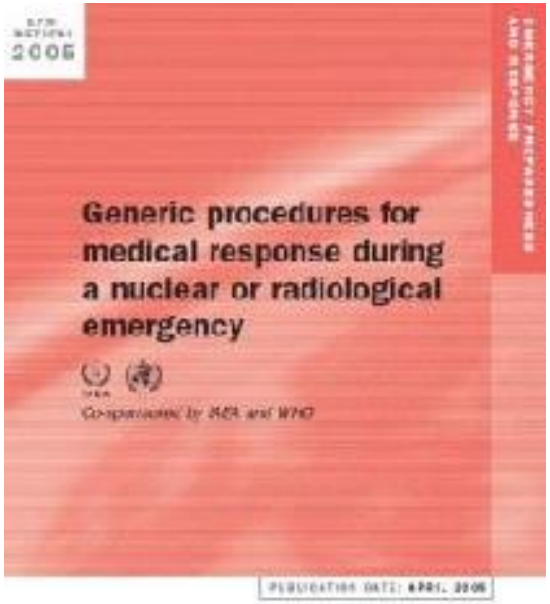

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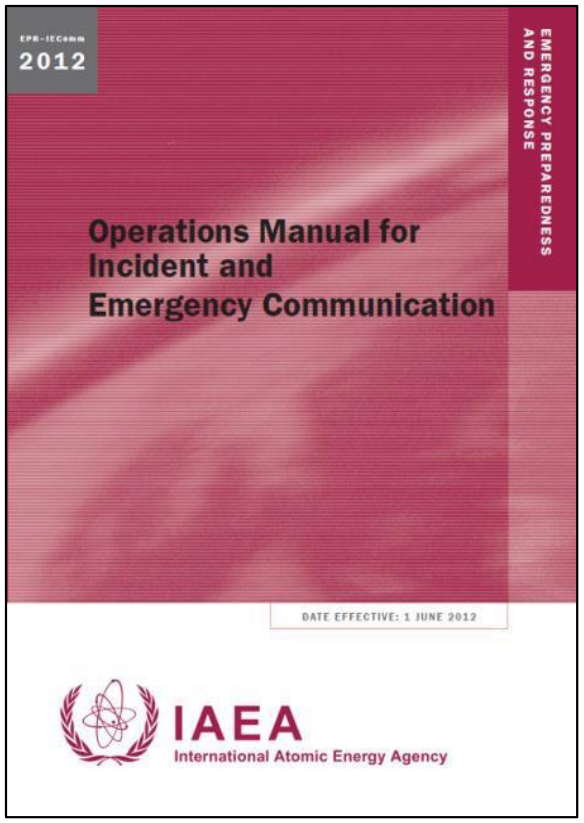
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EMERGENCY PREPAREDNESS AND RESPONSE
Operations Manual for Incident and Emergency Communication
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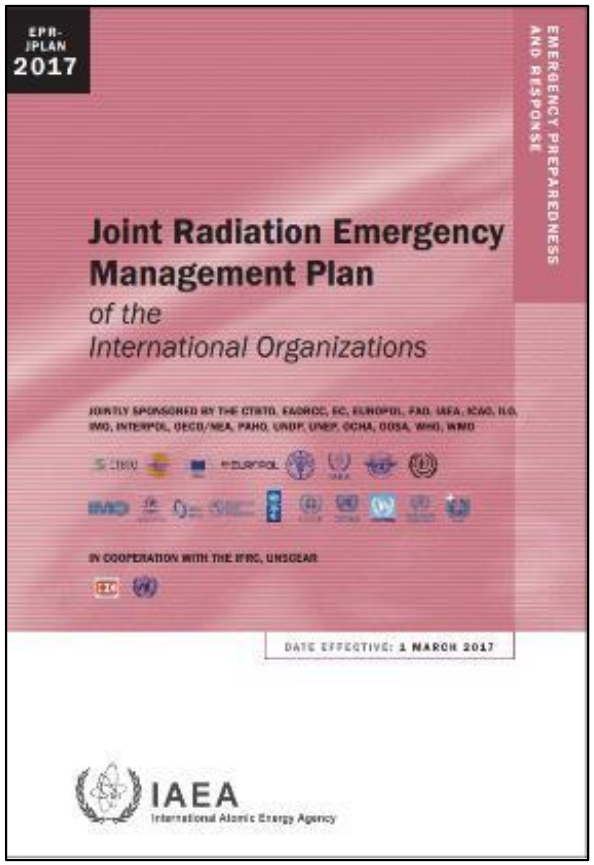
International Atomic Energy Agency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EMERGENCY PREPAREDNESS AND RESPONSE
Joint Radiation Emergency Management Plan
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IN COOPERATION WITH THE IFRC, UNSCEAR
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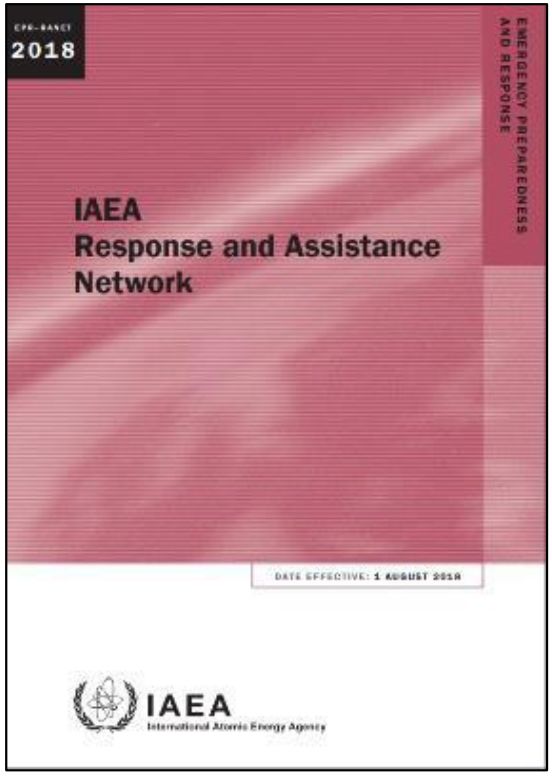
EPR-RANET
2018
EMERGENCY PREPAREDNESS AND RESPONSE
IAEA
Response and Assistance Network
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IAEA
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ETN

- **PEL**
- **Emergency Procedures of Operating Manual**
  - **CST**
  - **POEs**
  - **POECAs**
  - **RFs**
  - **POAs**
  - **SAMGs**

Aspects to consider to ensure operational safety

- **Safety Culture**
- **Plant Design**
- **Technical specification**
- **Training & Re-Training & Simulators**
- **Emergency Plan Exercises**
- **Resident CNEN inspectors**
- **Licensing Board**
- **Team work**
- **Configuration Control**
- **Operational Experience**
- **Periodic Tests**
- **MOU - Procedures**
- **Autonomy for decision making**
- **HR qualification**
- **PSR**
- **INTER MISSIONS - OSART, WANO**
- **Commissioning**
- **SGP**
- **Safety Indicator Monitoring**

Phses of a Emergency

- **Initial Phase - Includes the period from the possibility of radio nuclide release into the environment until the source is again under control, including the release period.**

- **Intermediate Phase - This phase begins after the of radio nuclide release and may stay for days or weeks. At this stage most of the release has already taken place, and unless it is predominantly noble gases, it is likely that significant amounts of radio nuclides are deposited in the soil.**

- **Final or recovery phase - decisions are made regarding the return to normality of the areas affected by the accident. It is planned at this stage the gradual suspension of corrective actions implemented in the initial and intermediate phases. The main avenues of radiation exposure of the population, as well as the recommended protective measures, in this phase are similar to those of the intermediate phase.**

Emergencies Classes proposed by IAEA

- **The IAEA suggests the following emergency classes:**

- **ALERT - Declared once some uncertainty or reduction in protection level has been identified. No action outside site protection is required;**

- **Area Emergency - Declared when people outside the site need to prepare to take protective actions and other necessary response and monitoring actions in the vicinity of the site.**

- **General Emergency - Declared when protective measures and other response actions need to be taken immediately to protect the public.**

Emergency Planning Zones

- **EAL – Emergency Action Level**
- **OIL – Operational Intervention Level**
- **PAZ – Precautionary Action Zone**
- **UPZ – Urgent protective action planning zone**
- **EPD – Extended planning distance**
- **ICPD - Ingestion and commodities planning distance**

- **Operational Events:**
- **Transients**
- **Failures**
- **Incidents**
- **Design Basis Accident**
- **Accidents beyond project bases - Severe Accident - Damage to the Core**

Emergency zones and distances	**Suggested maximum radius (km)**	
	>1000 MW (th)	**100 to 1000 MW (th)**
Precautionary action zone (PAZ) – **ZPE 3 e ZPE 5**	**3 TO 5**	
Urgent protective action planning zone (UPZ) **Zona de Controle Ambiental: de 10 a 25 km;**	**15 TO 30**	
Extended planning distance (EPD) **Zona de Acompanhamento Ambiental: de 50 a 100 km.**	**100**	**50**
Ingestion and commodities planning distance (ICPD)	**300**	**100**

Actual Planning Zones

- Preventive Action Zones: 3 - 5 km;
- Environmental Control Zone: 10 - 25 km;
- Environmental Monitoring Zone: 50 - 100 km.

OILs ou Níveis de Intervenção utilizados atualmente

Ação de Proteção	Nível Genérico de Intervenção (dose evitada pela ação de proteção)
"Abrigagem"	10 mSv (1)
Evacuação	50 mSv (2)
Profilaxia por Iodo Estável	100 mGy(3)

(1) A "abrigagem" não é recomendada por um período superior a 2 dias.
(2) A evacuação não é recomendada por um período superior a 1 semana.
(3) Dose absorvida comprometida evitada na tiróide.

Tabela 2: Limiares de efeitos determinísticos para doses agudas (SS-109).

Órgão ou Tecido	Dose em menos de 2 dias (Gy)	Efeito Determinístico	
		Tipo de Efeito	Tempo de Ocorrência
Corpo inteiro[(1)] (medula óssea)	1	Morte	1-2 meses
Pulmão	6	Morte	2-12 meses
Pele	3	Eritema	1-3 semanas
Tireóide	5	Hipotiroidismo	Primeiro ano
Cristalino	2	Catarata	6 meses
Gônadas	3	Esterilidade Permanente	Semanas
Feto	0.1	Teratogenese	-

Tabela 3: Níveis de Intervenção recomendados para a Relocação e para o Reassentamento (SS-109 e SS-115).

Ação de Proteção	Dose Evitada
Reassentamento Temporário (Relocação)	30 mSv no primeiro mês 10 mSv em um mês subsequente
Reassentamento Definitivo	1 Sv em toda a vida

Tabela 4: Níveis de Intervenção recomendados para alimentos. (SS-115 e SS109)

Radionuclídeo	Valor recomendado (kBq / kg)	
	Alimentos para consumo em geral	Leite, alimentos infantis e água potável
Cs-134, Cs-137, Ru-103, Ru-106, Sr-89	1	1
I-131	1	0.1
Sr-90	0.1	0.1
Am-241, Pu-238, Pu-239, Pu-240, Pu-242	0.01	0.001

Observação: Os limites devem ser aplicados de forma independente para as 4 categorias de radionuclídeos envolvidos.

Como complemento, o documento TECDOC-955 da AIEA também sugere níveis operacionais genéricos de intervenção para serem aplicados a acidentes com reatores a água leve. Os valores recomendados são apresentados na Tabela 5.

Tabela 5: Níveis Operacionais de Intervenção (NOI) recomendados pela AIEA (TECDOC-955).

Base	NOI Nº	Critério		Medida de Proteção Recomendada
Taxa de dose ambiente (pluma)	1	1 mSv/h		Evacuação ou Abrigagem
	2	0.1 mSv/h		Se disponível, administrar bloqueador de tiróide, manter pessoas dentro de casa com janelas fechadas aguardando instruções por rádio ou TV
Taxa de dose ambiente (deposição)	3	1 mSv/h		Evacuação ou Abrigagem
	4	0.2 mSv/h		Considerar a relocação de pessoas
	5	1 μSv/h		Restrição imediata de alimentos até avaliação
Nível de deposição no solo		Alimento	Leite	
I-131	6	10 kBq/m^2	2 kBq/m^2	Restrição imediata ao consumo de alimentos produzidos na área até avaliação detalhada
Cs-137	7	2 kBq/m^2	10 kBq/m^2	
Contaminação em água, alimento, leite		Alimento	Leite e água	
I-131	8	1 kBq/kg	0.1 kBq/kg	Restrição ao consumo
Cs-137	9	0.2 kBq/kg	0.3 kBq/kg	Restrição ao consumo

Tabela 6 : Categorias de liberação de acidentes com reatores PWR, segundo o estudo de segurança de reatores (SURRY – WASH 1400).

Seqüência de Acidente	Probabilidade por reator - ano	Tempo [a] (h)	Duração[b] (h)	Advertência[c] (h)	Energia 10^6 Btu/h	Fração do inventário total de produtos de fissão liberada do núcleo						
						Xe-Kr	I[d]	Cs-Rb	Te-Sb	Ba-Sr	Ru[e]	La[f]
PWR - 1	9×10^{-7}	2,5	0,5	1,0	20 & 520	0,9	0,7	0,4	0,4	0,05	0,4	3×10^{-3}
PWR - 2	8×10^{-6}	2,5	0,5	1,0	170	0,9	0,7	0,5	0,3	0,06	0,02	4×10^{-3}
PWR - 3	4×10^{-6}	5,0	1,5	2,0	6	0,8	0,2	0,2	0,3	0,02	0,01	3×10^{-3}
PWR - 4	4×10^{-7}	2,0	3,0	2,0	1	0,6	0,09	0,04	0,01	5×10^{-3}	3×10^{-3}	4×10^{-4}
PWR - 5	7×10^{-7}	2,0	4,0	1,0	0,1	0,3	0,03	0,9	5×10^{-3}	1×10^{-3}	6×10^{-4}	7×10^{-5}
PWR - 6	6×10^{-6}	12,0	10,0	1,0	N / A	0,3	8×10^{-4}	8×10^{-4}	1×10^{-3}	9×10^{-5}	7×10^{-5}	1×10^{-5}
PWR - 7	4×10^{-5}	10,0	10,0	1,0	N / A	6×10^{-3}	2×10^{-5}	1×10^{-5}	2×10^{-5}	1×10^{-6}	1×10^{-6}	2×10^{-7}
PWR - 8	4×10^{-5}	0,5	0,5	N/A	N / A	2×10^{-3}	1×10^{-4}	5×10^{-4}	1×10^{-6}	1×10^{-8}	0	0
PWR - 9	4×10^{-4}	0,5	0,5	N/A	N / A	3×10^{-6}	1×10^{-7}	6×10^{-7}	1×10^{-9}	1×10^{-11}	0	0
B.E.E.D.	4×10^{-7}	2,0	3,0	2,0	N / A	0,6	0,01	1×10^{-5}	2×10^{-4}	2×10^{-4}	2×10^{-4}	-

a Intervalo de tempo entre o início de um acidente hipotético e a liberação de material radioativo para a atmosfera.

b Tempo total durante o qual a maior porção do material radioativo é liberada para a atmosfera.

c Intervalo de tempo entre o reconhecimento de uma liberação iminente (decisão de iniciar medidas de proteção ao público) e a liberação de material radioativo para a atmosfera.

d Iodo orgânico está combinado com o Iodo nos cálculos. Qualquer erro é desprezível desde que a fração de liberação seja relativamente pequena para todas as categorias de grande liberação.

e Inclui Ru, Rh, Co, Mo, Tc.

f Inclui Y, La, Zr, Nb, Ce, Pr, Md, Np, Pu, Am, Cm.

- **General Emergency:**

- **(a) Events occurring at the plant may lead to severe damage to the spent fuel pool or core**

- **(b) Severe core damage has been identified.**

- **An emergency is declared when a specific action level is exceeded (OIL)**

IAEA Suggested Levels of Intervention (OILs)

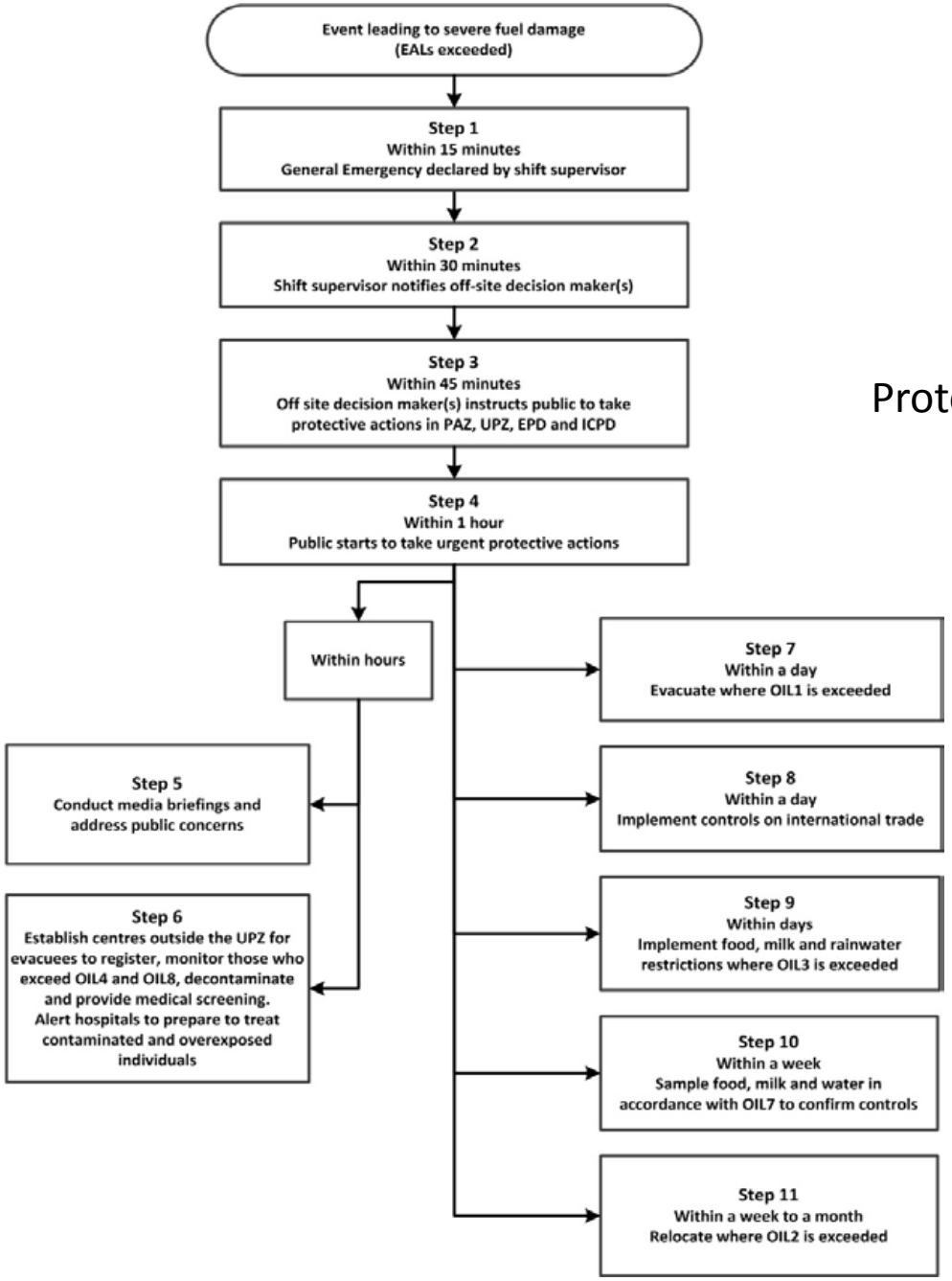
- OILs are provided for:
- Soil deposition (OIL1, OIL2, OIL3),
- Deposition of radioactive material on the skin (OIL4),
- TIREOIDE dose rate (OIL8),
- Dose Rate for Food, Milk and Water (OIL7)
- OILs upon release due to reactor or fuel pool damage.
- EPR Appendix II provides the basis for the calculation of OILs (OIL1, OIL2, OIL3, OIL4, OIL7 and OIL8).
- OIL5 and OIL6 are used for other purposes not relevant to a release.

OILs	Conclusion Time	Objective
OLI 1	In 1 day	Identify where evacuation is required beyond the areas evacuated when a General Emergency is declared.
OLI 2	1 week – 1 month	Identify and relocate areas with dose rates within a factor of twice the value of OIL1. Identify and relocate areas where the dose rate is higher twice the OIL2 values.
OLI 3	In days	Identify where additional food, rainwater, or commodity restrictions are needed, beyond the established areas, after the General Emergency statement (e.g. ICPD).

INTERVENTION LEVELS EXAMPLES		
OIL exceeded	**Dose rate above ground level**	**IMMEDIATE ACTIONS REQUIRED**
OIL1 red	**≥ 1000 µSv/h**	**- Instructions for the public to take ITB;** **- safe evacuation;** **- Reduction inadvertent intake;** **- Interruption of distribution and consumption of local products, milk, rainwater, and distribution of commodities;** **Provide medical records, monitoring, decontamination and selection for affected areas.**
OIL2 orange	**≥ 25 µSv/h (for t > 10 daysb)** **≥ 100 µSv/h (for t ≤ 10 daysb)**	**- Instructions for the public to prepare to relocate while taking action to reduce inadvertent ingestion;** **- Interruption of distribution of local products, milk to rainwater, and** **- Interruption of commodity distribution**
OIL3	**≥ 1 µSv/h**	**- Interruption of distribution and consumption of non-essential local products, milk, rainwater until radionuclide concentration has been assessed using OIL7; and** **- Interruption of commodity distribution.**
NONE	**< 1 µSv/h**	NONE

IAEA Recommended Sequence

Protection Actions



- **Step 1. Up to 15 minutes - Shift Supervisor declares General Emergency based on predetermined conditions and I&C based (EAL exceeded)**

- **Step 2. 30 minutes - The Shift Supervisor informs the CCCEN Coordinator - responsible for public protection in the PAZ, UPZ, EPD and ICPD areas.**

- **Step 3. 45 minutes - CCCEN Coordinator initiates implementation of urgent protection actions for public protection.**
- **- Immediate instructions within PEACE:**
- **take an ITB (Iodine Thyreoide Blocking) agent;**
- **Reduction of inadvertent intake; and**
- **Safe evacuation beyond UPZ;**
- **- Instructions within UPZ:**
- **Housing until evacuation;**
- **take an ITB agent immediately;**
- **Reduction of inadvertent intake; and**
- **Safe evacuation if potential for release persists considering that there will be no delay in evacuation of PAZ**

- - Instructions within PAZ and UPZ when it cannot be evacuated immediately:
- take an ITB agent; and,
- Housing (if possible in large buildings), closing doors and windows, and radio and TV monitoring for additional instructions. The shelter should not extend for more than 1 day; and
- Prepare evacuation beyond the UPZ so that it can be safely performed.
- -Instructions for responsible transport systems (air, land and sea) to prevent UPZ.
- - Instructions within the EPD to take action to reduce inadvertent ingestion.
- - Instructions within the ICPD to:

- Place grazing animals on protected eg covered - feeding as appropriate and possible;
- Protection of food and water sources (e.g., disconnecting rainwater pipes);
- Interrupting consumption and distribution and distribution of non-essential local products, milk, rainwater, until radionclide concentration levels have been assessed; and
- Interruption of the distribution of commodities until the above assessment is reapplied.

- **Step 6. Within hours:**

- **Establish centers outside UPZ to register people who were in PAZ and UPZ, monitor to identify people - to identify those for whom skin or thyroid monitoring results exceed OIL4 or OIL8, decontaminate and perform medical screenings; and**
- **Alert hospitals' to prepare treatment for people who are contaminated and exposed to radiation.**

- **Step 7. Within 1 day - Monitor locations where OIL is exceeded:**

- **- Safely evacuate the residents of the arthea; and**

- **- Take other actions as shown in table 7**.

- **Step 4. 1 hour - The public begins to take the recommended urgent protective actions.**

- **Step 5. Within Hours:**
- **CIEN informs the media and initiates public disclosure**
- **Provide consistent and understandable messages to the public and other stakeholders and address their concerns; and**
- **Monitor public and other media actions (including websites and social media) to identify and address responders and take appropriate action to correct information.**

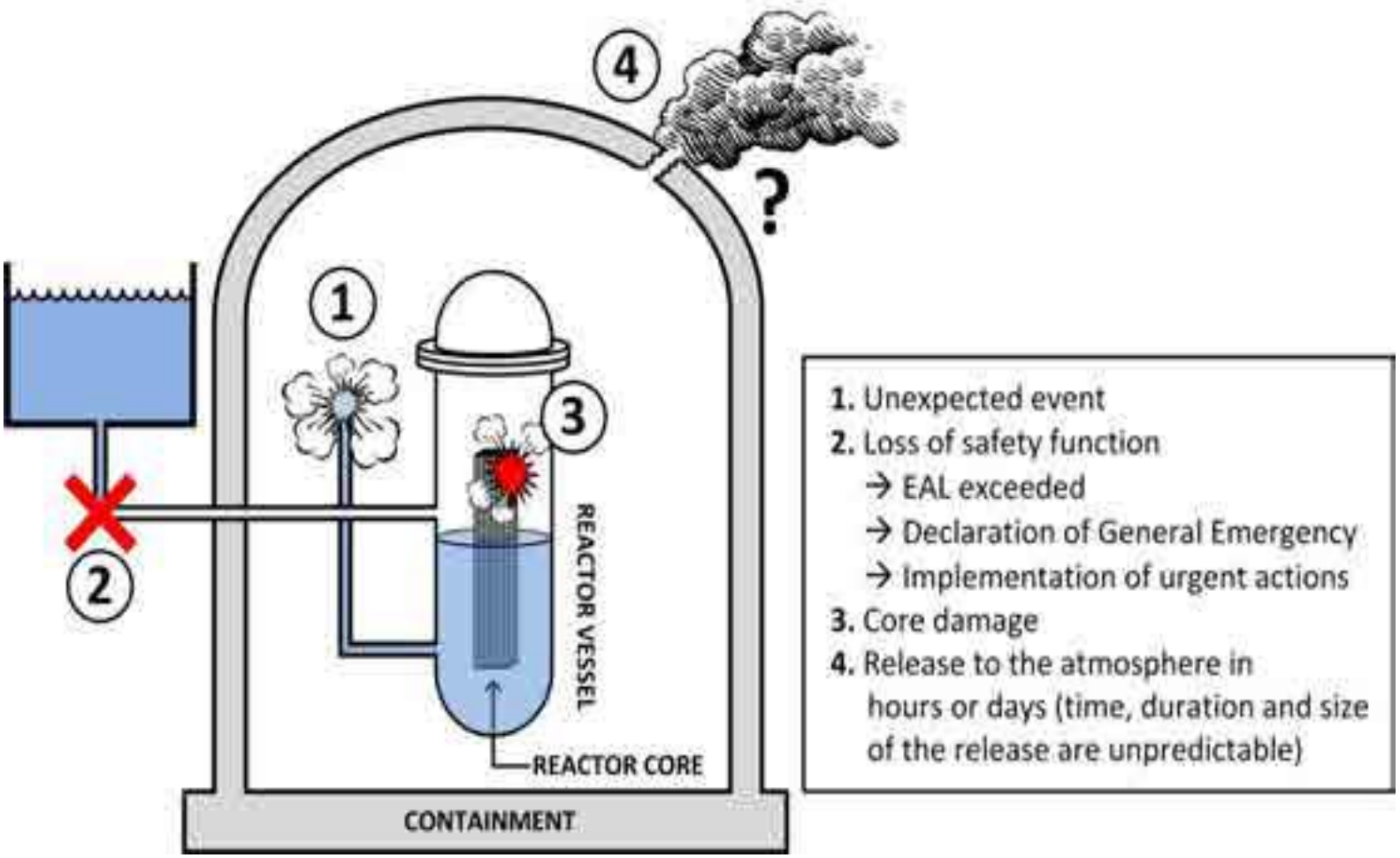
- **Step 8. Within 1 Day - International Actions, where applicable - CNEN**

- **Step 9. Within Days - Monitor to identify locations where OIL is exceeded, in addition to ICPD, and at these locations:**
- **Implement additional food restraint actions; and**
- **Refrain distribution and consumption of local products, milk, rainwater, and animal feed, as per table 7 ..**

- **Step 10. Within 1 Week - Implement a sampling and analysis program to verify that food, water, and milk controls are adequate to ensure concentrations are below the OIL values in table 9.**

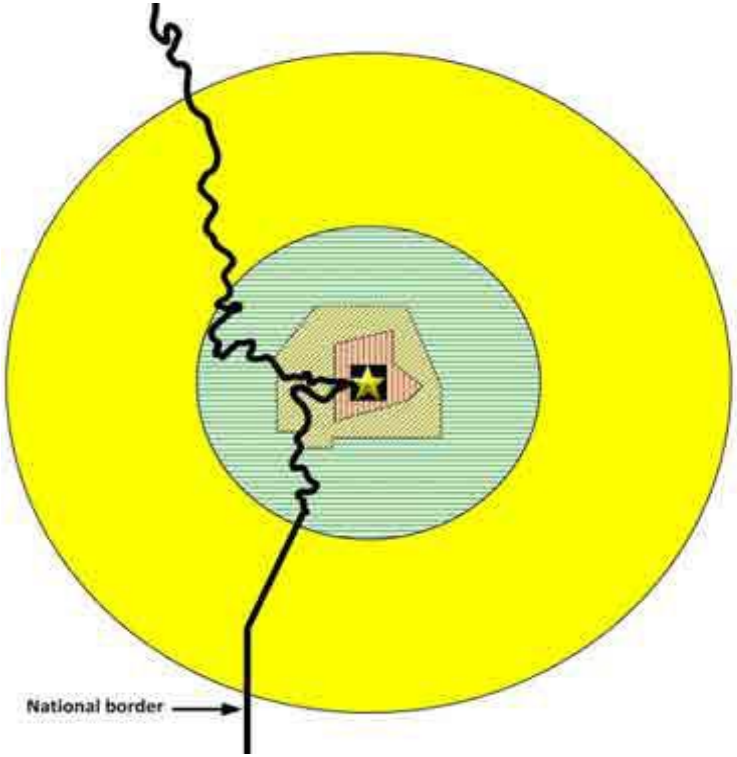
- **Step 11. Between 1 Week and 1 Month - Monitor to find where OILs are exceeded at these locations:**
- **Safely relocate residents; and**
- **Take response actions as indicated in table 7**

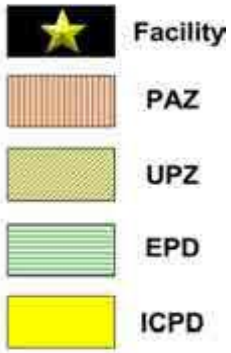
Sequencia de eventos conduzindo a uma liberação de material radioativo para a atmosfera

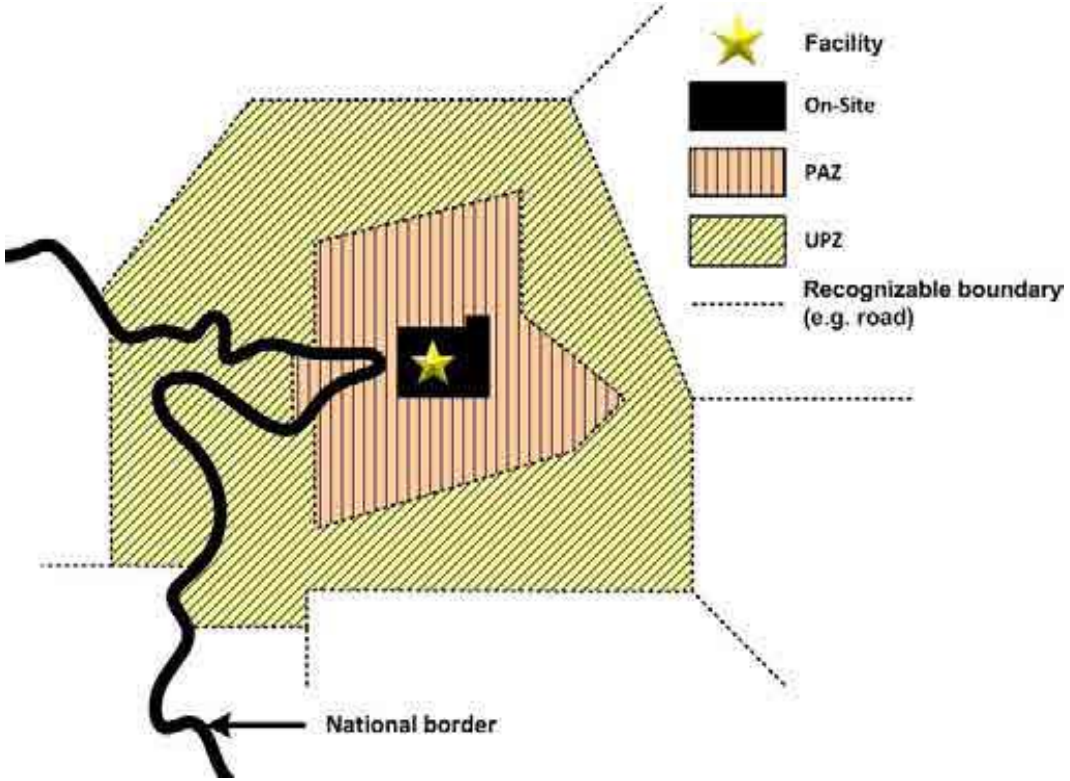


IAEA Recommended Emergency Planning Zones

- Precautionary action zone (PAZ);
- Urgent protective action planning zone (UPZ);
- Extended planning distance (EPD); and
- Ingestion and commodities planning distance (ICPD).


National border


Facility
PAZ
UPZ
EPD
ICPD


Facility
On-Site
PAZ
UPZ
Recognizable boundary
(e.g. road)
National border

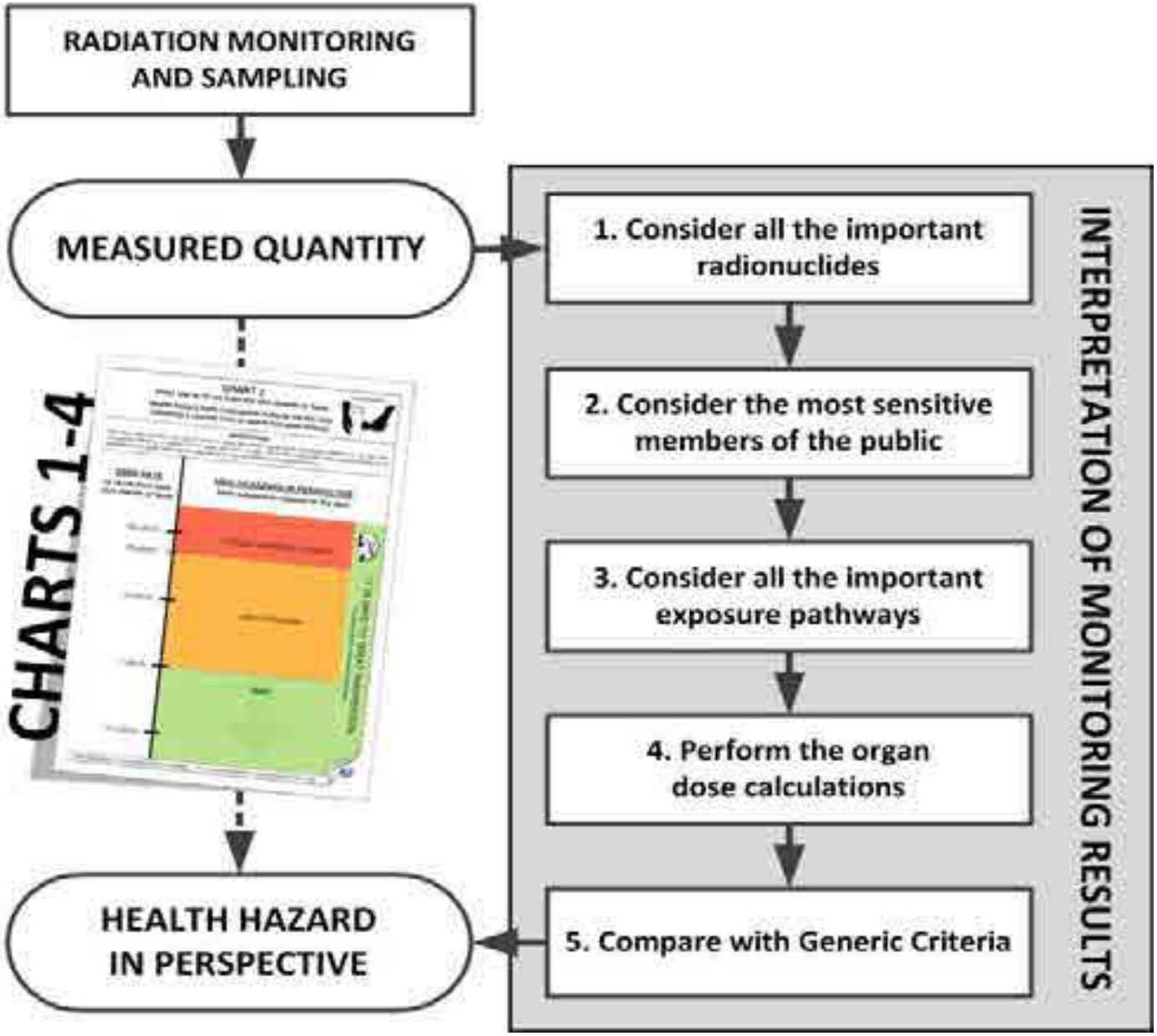
Emergency zones and distances	DESCRIPTION
Precautionary action zone (PAZ)	An area where comprehensive arrangements are made at the preparedness stage to notify the public and have the public start to take urgent protective actions and other response actions listed in Table 4 *within one hour of the declaration of a General Emergency by the shift supervisor* of the nuclear power plant. The goal is to initiate protective actions and other response actions before the start of a release warranting protective actions off the sitea, in order to prevent severe deterministic effects. The boundary of the PAZ needs to be established to minimize evacuation times and evacuation of the PAZ to beyond the UPZ is given priority over evacuation of the UPZ. In addition, provisions are made within this zone for the protection of personnel staffing special facilities such as hospitals, nursing homes and prisons that cannot be immediately evacuated.

Emergency zones and distances	DESCRIPTION
Urgent protective action planning zone (UPZ)	An area where comprehensive arrangements are made at the preparedness stage to notify the public and have the public start to take the urgent protective actions and other response actions listed in Table 4 within about one hour of the declaration of a General Emergency by the shift supervisor. The goal is to initiate protective actions and other response actions before or shortly after the start of a release warranting protective actions off the sitea, but in such a way as not to delay the implementation of the urgent protective actions and other response actions within the PAZ. In addition, provisions are made within this zone for the protection of personnel staffing special facilities such as hospitals, nursing homes and prisons that cannot be immediately evacuated.

Emergency zones and distances	DESCRIPTION
Extended planning distance (EPD)	The distance to which arrangements are made at the preparedness stage so that upon declaration of a General Emergency: (a) instructions will be provided to reduce inadvertent ingestion; and (b) dose rate monitoring of deposition conducted to locate hotspots following a release which could require evacuation within a day and relocation within a week to a month. Evacuation of patients and those requiring specialized care would be to locations outside of the EPD to ensure that further evacuations would not be required after a release.

Emergency zones and distances	DESCRIPTION
Ingestion and commodities planning distance (ICPD)	The distance to which arrangements are made at the preparedness stage so that upon declaration of a General Emergency instructions will be provided to: (a) place grazing animals on protected (e.g. covered) feed, (b) protect drinking water supplies that directly use rainwater (e.g. to disconnect rainwater collection pipes), (c) restrict consumption of non-essential local produce, wild-grown products (e.g. mushrooms and game), milk from grazing animals, rainwater and animal feed, and (d) stop distribution of commodities until further assessments are performed. The ingestion and commodities planning distance is also the distance within which arrangements are made at the preparedness stage to collect and analyse, during the emergency, samples of local produce, wild-grown products (e.g. mushrooms and game), milk from grazing animals, rainwater, animal feed and commodities to confirm the adequacy of controls.

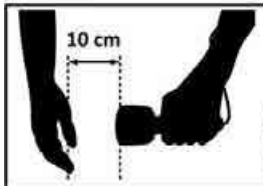
- Emergencies that do not involve severe core accidents may result in
- (a) Significant Concerns
- (b) Taking inappropriate actions by the public, and
- (c) Economic consequences if protection and response actions are not properly taken.


RADIATION MONITORING AND SAMPLING
MEASURED QUANTITY
CHARTS 1-4
HEALTH HAZARD IN PERSPECTIVE
INTERPRETATION OF MONITORING RESULTS
1. Consider all the important radionuclides
2. Consider the most sensitive members of the public
3. Consider all the important exposure pathways
4. Perform the organ dose calculations
5. Compare with Generic Criteria

- **Measured values shall not be disclosed to the public prior to the availability of the following information:**

- **What was measured?**
- **Who was exposed?**
- **How were they exposed?**
- **What is the risk in terms of health effect?**

STOP **ONLY USE AFTER COMPLETING THE CHECKLIST ON THE BACK.**



RADIOACTIVE MATERIAL ON THE SKIN
CHART 2

- For a release of radioactive material from a LWR or RBMK
- For all members of the public (including children and pregnant women)
- Based on the dose rate at 10 cm from bare skin (hands or face).

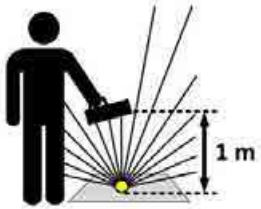
DOSE RATE above background at 10 cm from bare skin (hands or face)	HEALTH HAZARD
100 µSv/h	POSSIBLY DANGEROUS TO HEALTH (check OIL4)
50 µSv/h	
10 µSv/h	HEALTH CONCERNS (check OIL4)
1 µSv/h	
0.1 µSv/h	SAFE * FOR EVERYONE

IT IS SAFE TO TREAT THIS PERSON by taking simple universal precautions

EXPLANATION

* Safe according to international safety standards - **For further information read the back of this chart**

STOP **ONLY USE AFTER COMPLETING THE CHECKLIST ON THE BACK.**



LIVING IN THE AFFECTED AREA
CHART 1

- For a release of radioactive material from a LWR or RBMK
- For all members of the public (including children and pregnant women)
- Based on the dose rate at 1m above ground level.

DOSE RATE at 1 m above ground level	HEALTH HAZARD — Living normally in the affected area for: 7 days	1 month	1 year
10 000 µSv/h	POSSIBLY DANGEROUS TO HEALTH (check OIL1 and OIL2)	POSSIBLY DANGEROUS TO HEALTH (check OIL1 and OIL2)	POSSIBLY DANGEROUS TO HEALTH (check OIL1 and OIL2)
5 000 µSv/h			
2 000 µSv/h	HEALTH CONCERNS (check OIL1 and OIL2)		
1 000 µSv/h		HEALTH CONCERNS (check OIL1 and OIL2)	
500 µSv/h	PROVISIONALLY SAFE** FOR 7 DAYS, PROVIDING ACTIONS ARE TAKEN TO REDUCE INGESTION OF RADIOACTIVE MATERIAL		HEALTH CONCERNS (check OIL1 and OIL2)
100 µSv/h		PROVISIONALLY SAFE** FOR 1 MONTH, PROVIDING ACTIONS ARE TAKEN TO REDUCE INGESTION OF RADIOACTIVE MATERIAL	
Read footnote * for measurements between 25 and 100 µSv/h			
25 µSv/h			
10 µSv/h	SAFE** FOR EVERYONE, PROVIDING FOOD, MILK AND DRINKING WATER ARE SAFE		
1 µSv/h			
NATURAL BACKGROUND DOSE RATE			

* Areas showing a dose rate of 25 to 100 µSv/h during the first 10 days after the release are safe (according to international safety standards), providing food, milk and drinking water are safe.

** Safe according to international safety standards - **For further information read the back of this chart**

EXPLANATION

CNEN

- **CNEN, NN 3.01, Diretrizes Básicas de Proteção Radiológica", Comissão Nacional de Energia Nuclear, 2014**
- **PSE – Plano para Situações de Emergência**
- **PESRPot – 2016**
- **Critérios Básicos para o Estabelecimento de Diretrizes para Planejamento de EPR – 2000**
- **Procedimento CODRE/CORAN**
- **Procedimento CODRE/DIANG**
- **Procedimento IRD**

QUESTIONS

DOUBTS

Suggestions

THANKS

Márcia & Jefferson

Jefferson