FTC on Nuclear/Radiological
Emergency Preparedness (NREP)
August 20, 2025

Protection Strategies During Nuclear Emergencies

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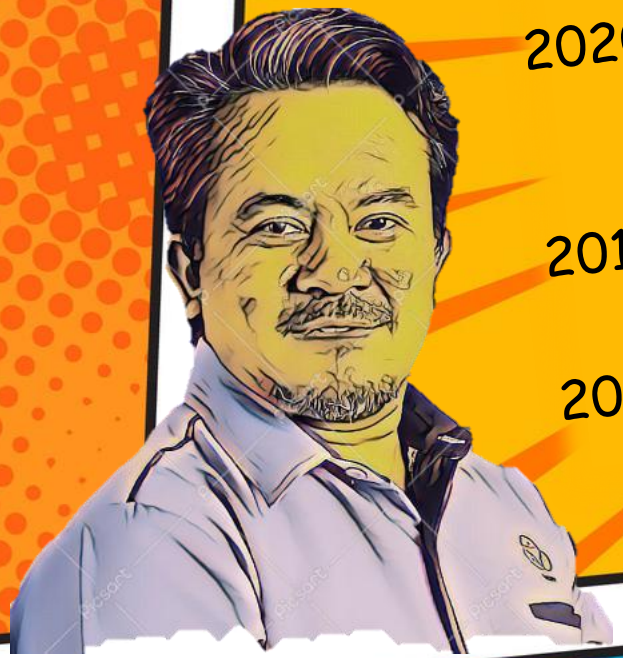
Experiences



2022-now	NPC for RCA Project on Enhancing Emergency Preparedness and Response Capabilities in the ASEAN Region through Building Technical Capacity in Radiation Monitoring and Dose Assessment Phase 2
2021-now	Researcher at Research Center for Safety, Metrology and Nuclear Quality Technology - BRIN
2020-now	Alternate NPC for IAEA/RCA RAS9092 Strengthening the Capacity to Respond to Radiological Emergencies of Category II and III Facilities in the RCA Region
2019-2020	Head of Personnel Dose and Environmental Monitoring Division - BATAN
2014-2018	Head of Environmental Monitoring and Nuclear Emergency Subdivision - BATAN

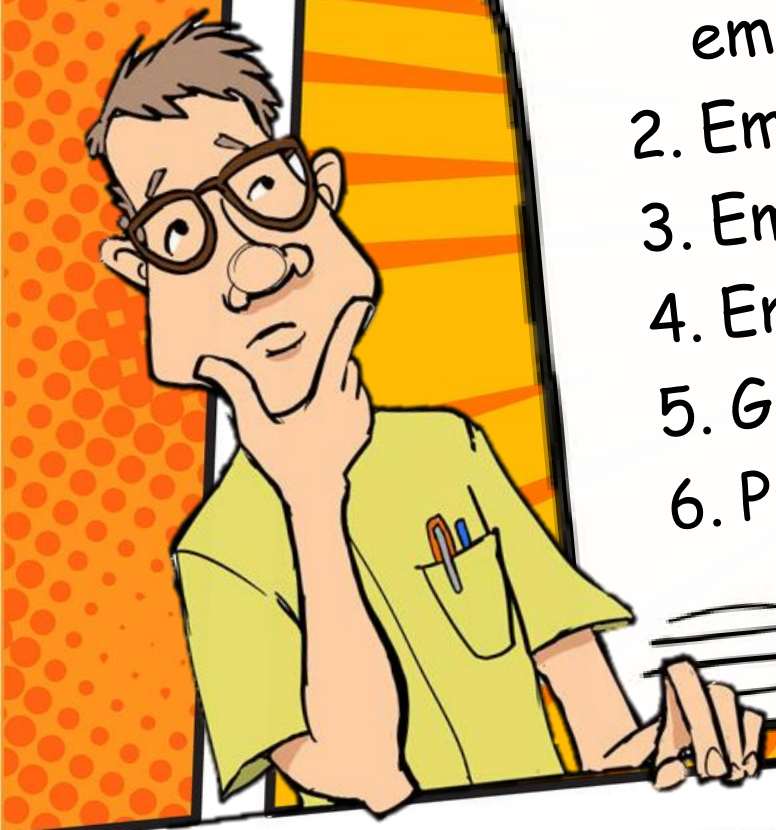
Teaching Experiences

- FTC on Nuclear/Radiological Emergency Preparedness (NREP), 2024.
- IAEA Postgraduate Education Course on Radiation and Safety. 2023.
- FTC on Gamma Spectrometry Analysis of Environmental Sample at Nuclear Facilities. 2018.
- FTC on Meteorology and Radiation Monitoring System at Nuclear Facilities. 2017.
- FTC on Radiation Protection and Environmental Monitoring During a Nuclear Emergency. 2016.
- FTC on Radiological Assessment of Radioactive Material Release on Nuclear Facility Accident. 2015.

Training & Workshop

- Regional Workshop on Long Term Issues Following a Nuclear or Radiological Emergency, MALAYSIA, 2014.
- RTC on EPR in Severe Accidents, Fuzhou, CHINA, 2014.
- Regional Workshop on an Effective National Emergency Centre for Radiological and Nuclear Emergencies, Including the Establishment of an Off-Site Centre, KOREA, 2015.
- Regional Workshop on Information Exchange during Radiation Emergencies and Cooperation regarding Coordination of Emergency Preparedness and Response, Vienna, AUSTRIA, 2017.
- Technical Meeting on "Twenty Years of EPREV: Building on Two Decades of Experience", Vienna, AUSTRIA, 2019.
- IAEA/RCA RTC on Development and Use of Operational Intervention Levels (OILs) for Reactor Emergencies, Bangkok, THAILAND, 2022.
- Mid-term Review Meeting IAEA/RCA RAS9092 Strengthening the Capacity to Respond to Radiological Emergencies of Category II and III Facilities in the RCA Region, MALAYSIA, 2023.
- Mid-term Review Meeting Project on Enhancing Emergency Preparedness and Response Capabilities in the ASEAN Region through Building Technical Capacity in Radiation Monitoring and Dose Assessment Phase 2, KOREA, 2023.

Outlines



1. Goal of emergency preparedness and goal of emergency response
2. Emergency preparedness categories
3. Emergency classification system
4. Emergency planning zones and distances
5. Generic criteria and operational criteria
6. Protective action during nuclear emergencies

Goal of Emergency Preparedness

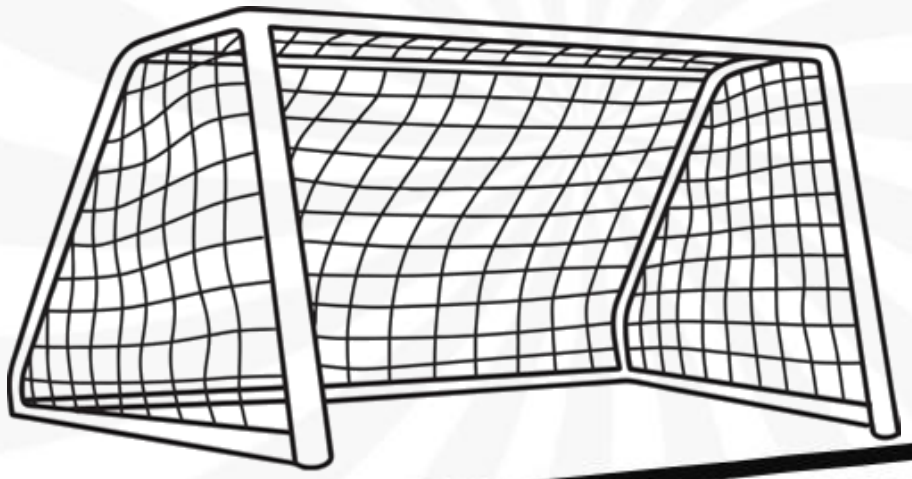
&

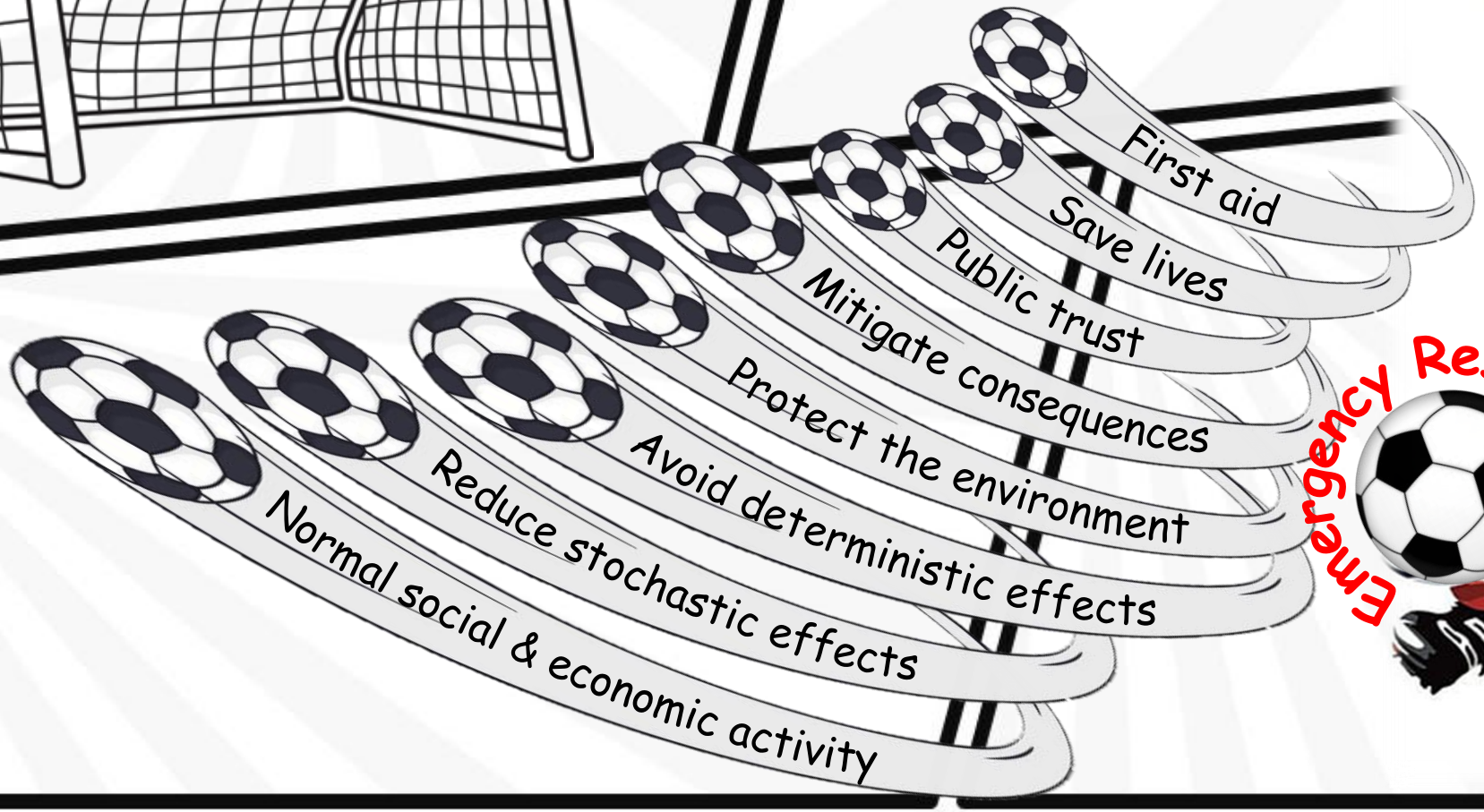
Goal of Emergency Response

Goal of Emergency Preparedness

The goal of emergency preparedness is to ensure that an adequate capability is in place within the operating organization and at local, regional and national levels and, where appropriate, at the international level, for an effective response in a nuclear or radiological emergency.

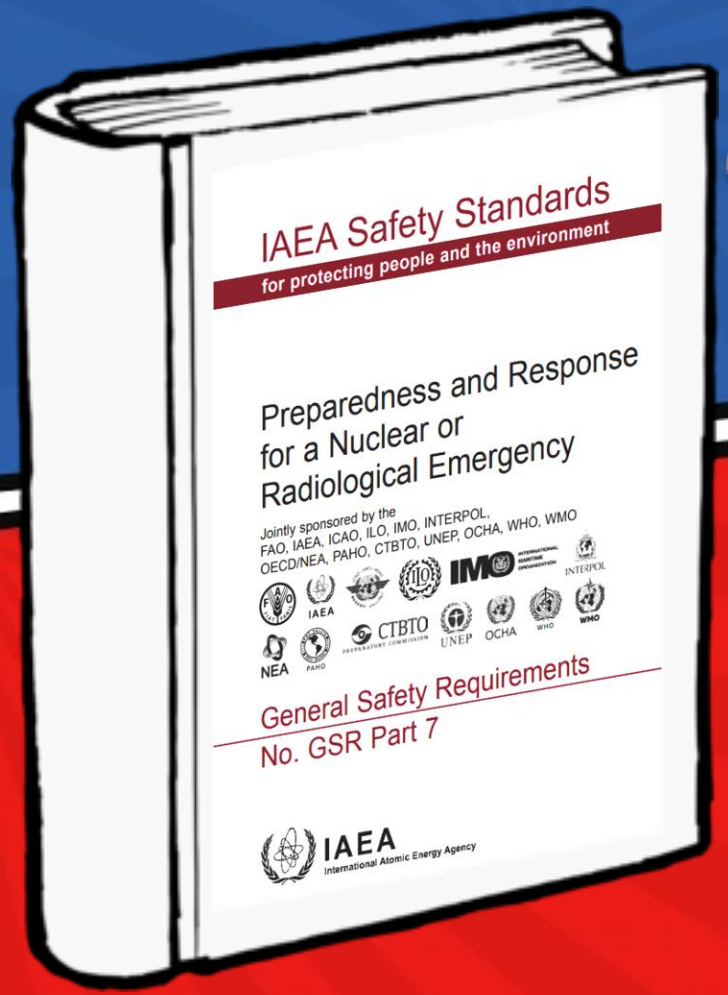
Goals of Emergency Response






BAPTIST HEALTH
Emergency Preparedness Categories

Emergency Preparedness Categories



GSR Part 7 Requirement 4: Hazard Assessment

4.19. For the purposes of these safety requirements, **assessed hazards** are grouped in accordance with the **emergency preparedness categories**. The five emergency preparedness categories (hereinafter referred to as '**categories**') establish the basis for a **graded approach** to the application of these requirements and for developing generically justified and optimized arrangements for **preparedness** and **response** for a nuclear or radiological emergency.

Emergency Preparedness Categories

Hazard Assessment

Emergency Preparedness Categories

For the purposes of the safety requirements, **assessed hazards** are grouped in accordance with the **emergency preparedness categories**.

Emergency Preparedness Categories

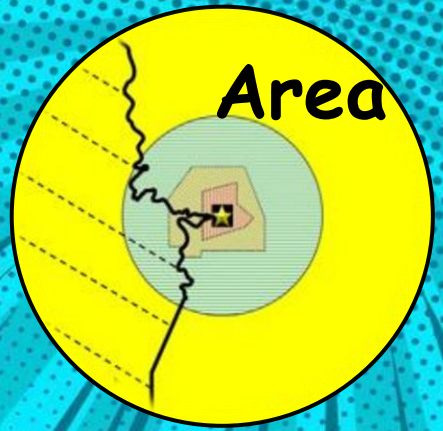
Facilities

Category I
Category II
Category III

Activities & Acts

Category IV

Area



Category V

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Emergency Preparedness Categories

Facilities, such as nuclear power plants, for which on-site events (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site that would warrant precautionary urgent protective actions, urgent protective actions or early protective actions, and other response actions to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities.

Category I

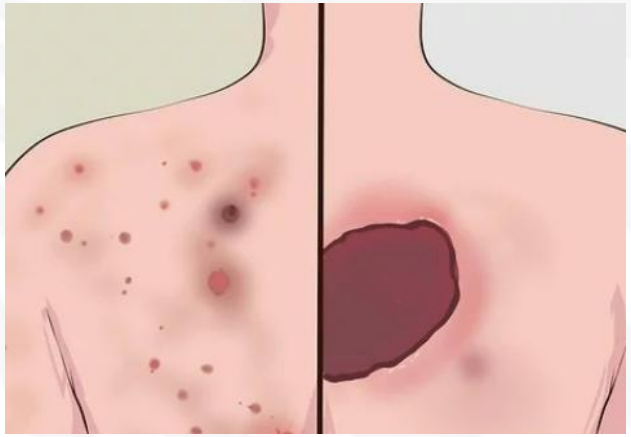
Emergency Preparedness Categories

Category I

Accident

Nuclear power plant

Off-Site Effects



Severe Deterministic Effects

Emergency Preparedness Categories

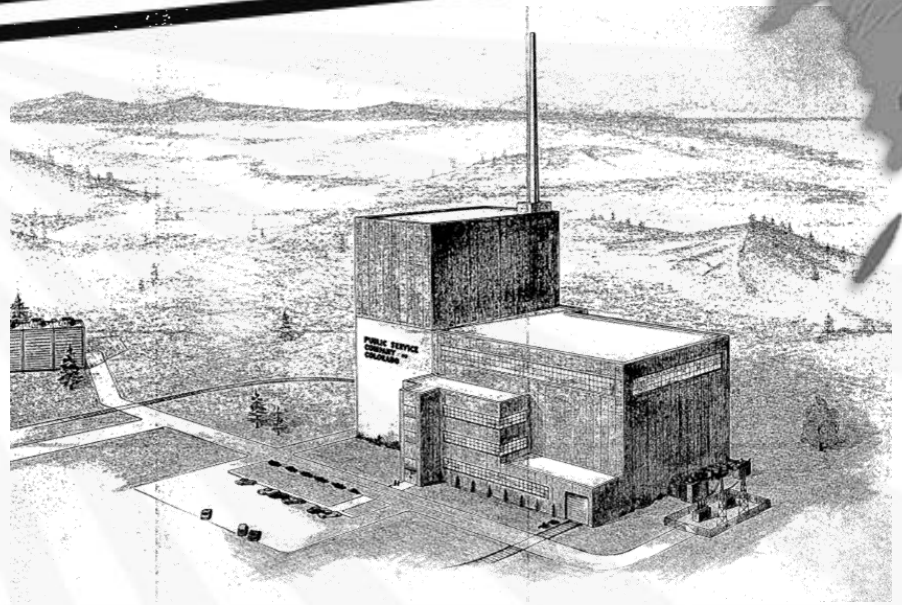
Facilities, such as some types of research reactor and nuclear reactors used to provide power for the propulsion of vessels (e.g. ships and submarines), for which on-site events, are postulated that could give rise to doses to people off the site that would warrant urgent protective actions or early protective actions and other response actions to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities. Category II (as opposed to category I) does not include facilities for which on-site events (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site, or for which such events have occurred in similar facilities.

Category II

Emergency Preparedness Categories

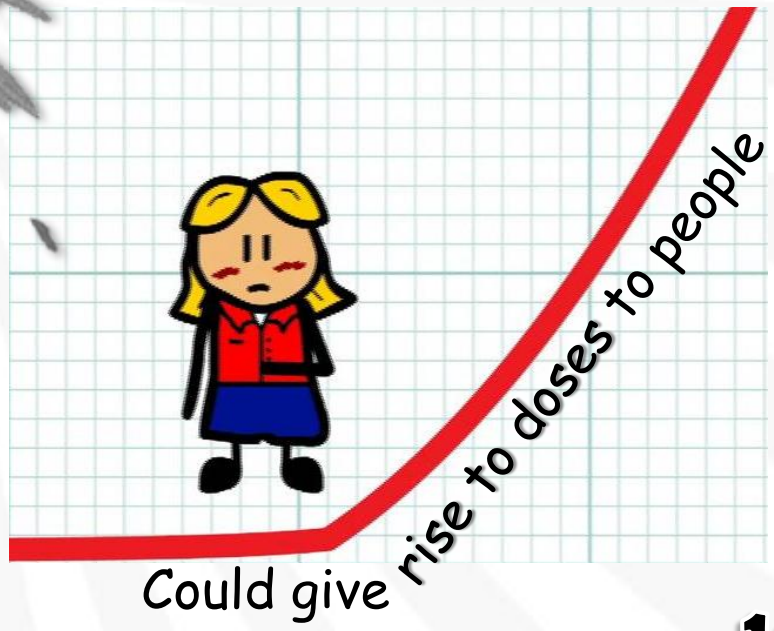
Category II

Research reactor and nuclear reactor used to provide power for the propulsion of vessels



Accident

Off-Site Effects



Emergency Preparedness Categories

Facilities, such as industrial irradiation facilities or some hospitals, for which on-site events are postulated that could warrant protective actions and other response actions on the site to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities. Category III (as opposed to category II) does not include facilities for which events are postulated that could warrant urgent protective actions or early protective actions off the site, or for which such events have occurred in similar facilities.

Category III

Emergency Preparedness Categories

Category III

Industrial irradiation facilities or some hospitals

Accident

Off-Site Effects

No Effect

Emergency Preparedness Categories

Activities and acts that could give rise to a nuclear or radiological emergency that could warrant protective actions and other response actions to achieve the goals of emergency response in accordance with international standards in an unforeseen location. These activities and acts include: (a) transport of nuclear or radioactive material and other authorized activities involving mobile dangerous sources such as industrial radiography sources, nuclear powered satellites or radioisotope thermoelectric generators; and (b) theft of a dangerous source and use of a radiological dispersal device or radiological exposure device. This category also includes: (i) detection of elevated radiation levels of unknown origin or of commodities with contamination; (ii) identification of clinical symptoms due to exposure to radiation; and (iii) a transnational emergency that is not in category V arising from a nuclear or radiological emergency in another State. Category IV represents a level of hazard that applies for all States and jurisdictions.

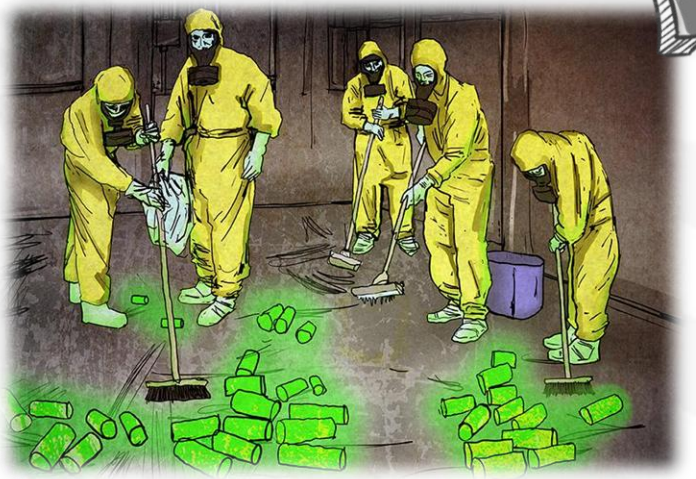
Category IV

Emergency Preparedness Categories

Category IV

Activities and Acts

Unforeseen Location



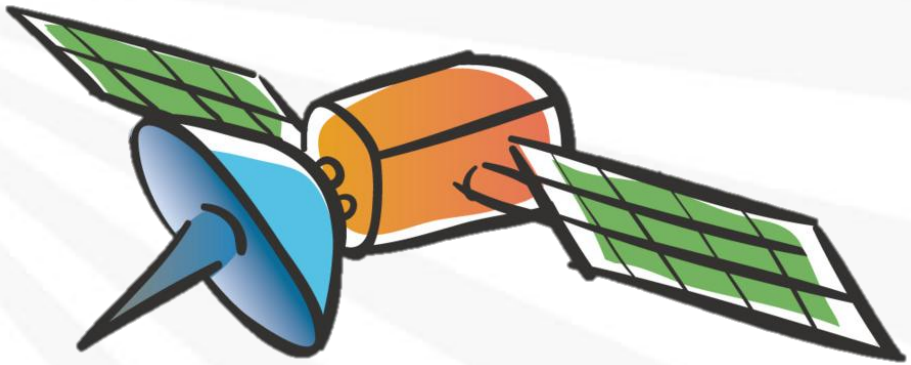
Nuclear/ Radiological Emergency

Emergency Preparedness Categories

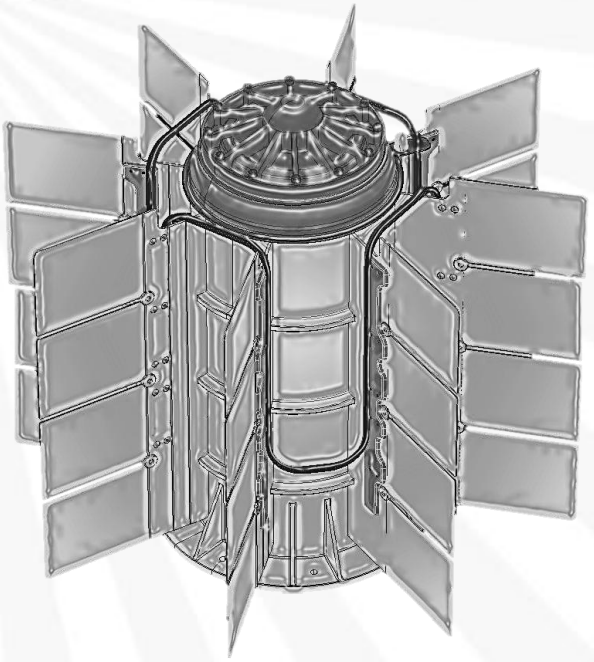
Category IV (cont'd)

Transport of nuclear or radioactive material and other authorized activities involving **mobile dangerous sources**, such as:

Industrial radiography source



Nuclear powered satellites



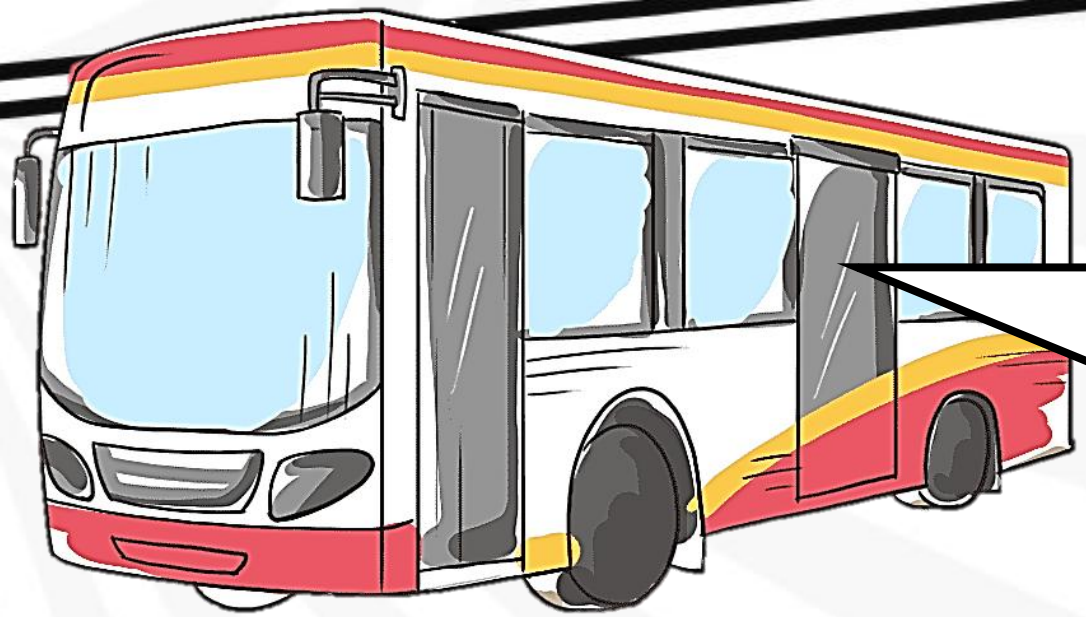
Radioisotope thermoelectric generator

Emergency Preparedness Categories

Category IV (cont'd)

Theft of a dangerous source and use of a radiological dispersal device or radiological exposure device.

Radiological Dispersal Device



Radiological Exposure Device

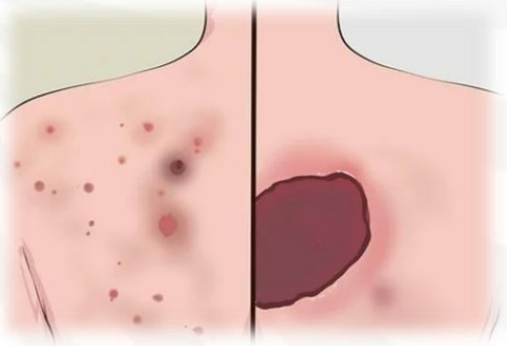
Emergency Preparedness Categories

Category IV (cont'd)

Category IV represents a level of hazard that applies for all States and jurisdictions.

A transnational emergency that is not in category V arising from a nuclear or radiological emergency in another state.

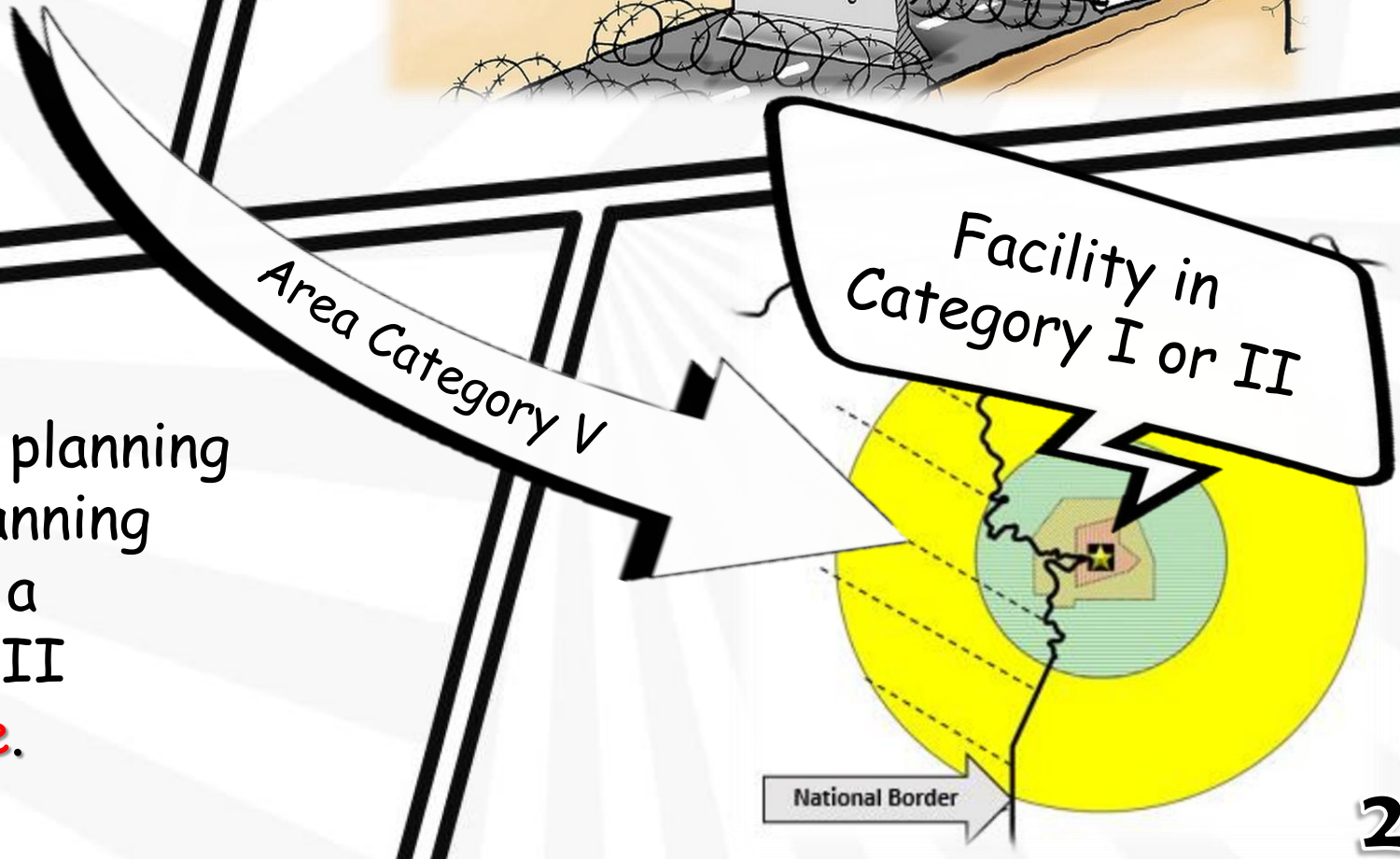
Detection of elevated radiation levels of unknown origin or of commodities with contamination



Identification of clinical symptoms due to exposure to radiation

Emergency Preparedness Categories

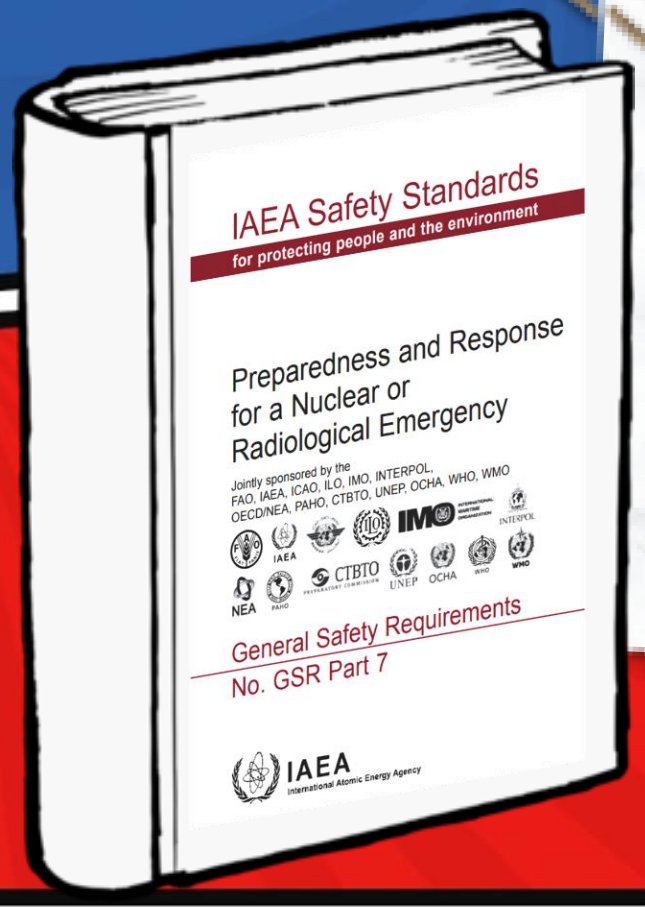
Category V



Areas within emergency planning zones and emergency planning distances in a State for a facility in category I or II **located in another State**.

Emergency Classification System

Emergency Classification System



GSR Part 7 Requirement 7: Identifying and notifying a nuclear or radiological emergency and activating an emergency response

5.14. The operating organization of a facility or activity in **category I, II, III or IV** shall make arrangements for promptly classifying, on the basis of the hazard assessment, a nuclear or radiological emergency warranting protective actions and other response actions to protect workers, emergency workers, members of the public and, as relevant, patients and helpers in an emergency, in accordance with the protection strategy. This shall include a **system for classifying** all types of nuclear or radiological emergency.

Emergency Classification System

1 General Emergency

2 Site Area Emergency

3 Facility Emergency

4 ALERT

5 Other Nuclear or Radiological Emergency

Emergency Classification System

1 General Emergency

General emergency at facilities in category I or II for an emergency that warrants taking precautionary urgent protective actions, urgent protective actions, and early protective actions and other response actions on the site and off the site.

Upon declaration of this emergency class, appropriate actions shall promptly be taken, on the basis of the available information relating to the emergency, to mitigate the consequences of the emergency on the site and to protect people on the site and off the site.

Emergency Classification System

1 General Emergency

On the site
& Off the site

General emergency declared

Facilities in Category I or II

Emergency Classification System

Site Area Emergency

Site area emergency at facilities in category I or II for an emergency that warrants taking protective actions and other response actions on the site and in the vicinity of the site.

Upon declaration of this emergency class, actions shall promptly be taken:

1. to mitigate the consequences of the emergency on the site and to protect people on the site;

2. to increase the readiness to take protective actions and other response actions off the site if this becomes necessary on the basis of observable conditions, reliable assessments and/or results of monitoring; and

3. to conduct off-site monitoring, sampling and analysis.

Emergency Classification System

2 Site Area Emergency

Site area emergency declared

Facilities in Category I or II

On the site & Vicinity of the site

Emergency Classification System

3 Facility Emergency

Facility emergency at facilities in category I, II or III for an emergency that warrants taking protective actions and other response actions at the facility and on the site but does not warrant taking protective actions off the site.

Upon declaration of this emergency class, actions shall promptly be taken to mitigate the consequences of the emergency and to protect people at the facility and on the site. Emergencies in this class do not present an off-site hazard.

Emergency Classification System

3 Facility Emergency

At the facility
& On the site

Facility emergency declared

Facilities in Category I, II or III

Emergency Classification System

4 Alert

Alert at facilities in category I, II or III for an event that warrants taking actions to assess and to mitigate the potential consequences at the facility.

Upon declaration of this emergency class, actions shall promptly be taken to assess and to mitigate **the potential consequences** of the event and to increase the readiness of the on-site response organizations.

Emergency Classification System

4 Alert

Facilities in Category I, II or III

Assess and mitigate the potential consequences of the event. Increase **the readiness** of the on-site response organizations.

I'm ready !!!

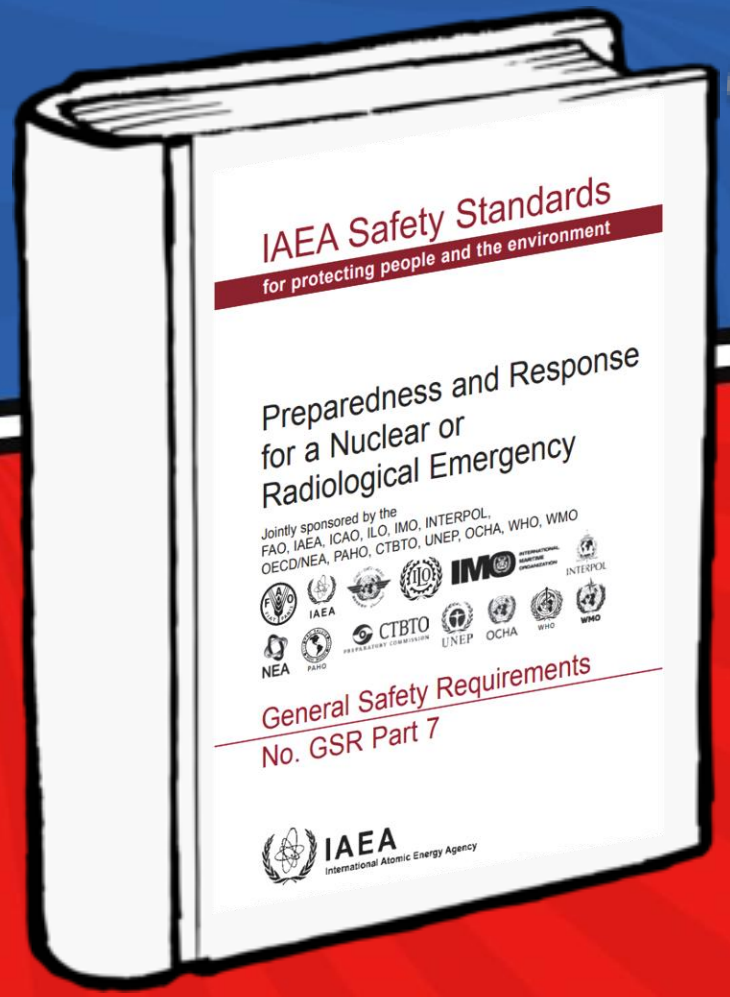
Emergency Classification System

Other nuclear or radiological emergency

Other nuclear or radiological emergency for an emergency in **category IV** that warrants taking protective actions and other response actions at any location.

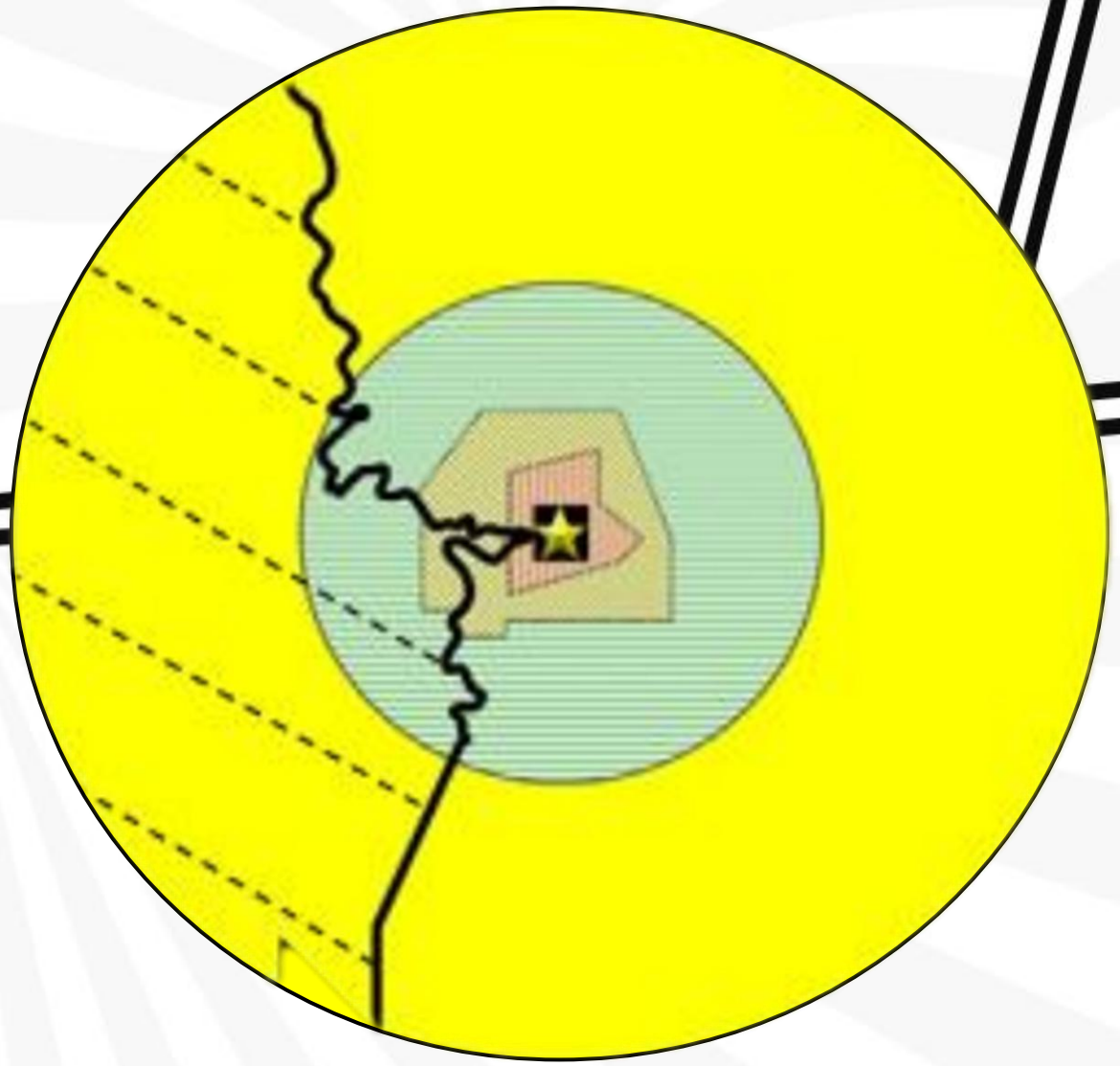
Emergency Planning Zones and Distances

Emergency Planning Zones and Distances



It is required by **para 5.38** of **GSR Part 7** that for facilities in emergency preparedness category I and II off-site **emergency planning zones** and **emergency planning distances** should also be defined for effective decision making on urgent protective actions, early protective actions and other response actions.
They should be established based on the results of the hazard assessment taking into account established generic criteria.

Emergency Planning Zones and Distances



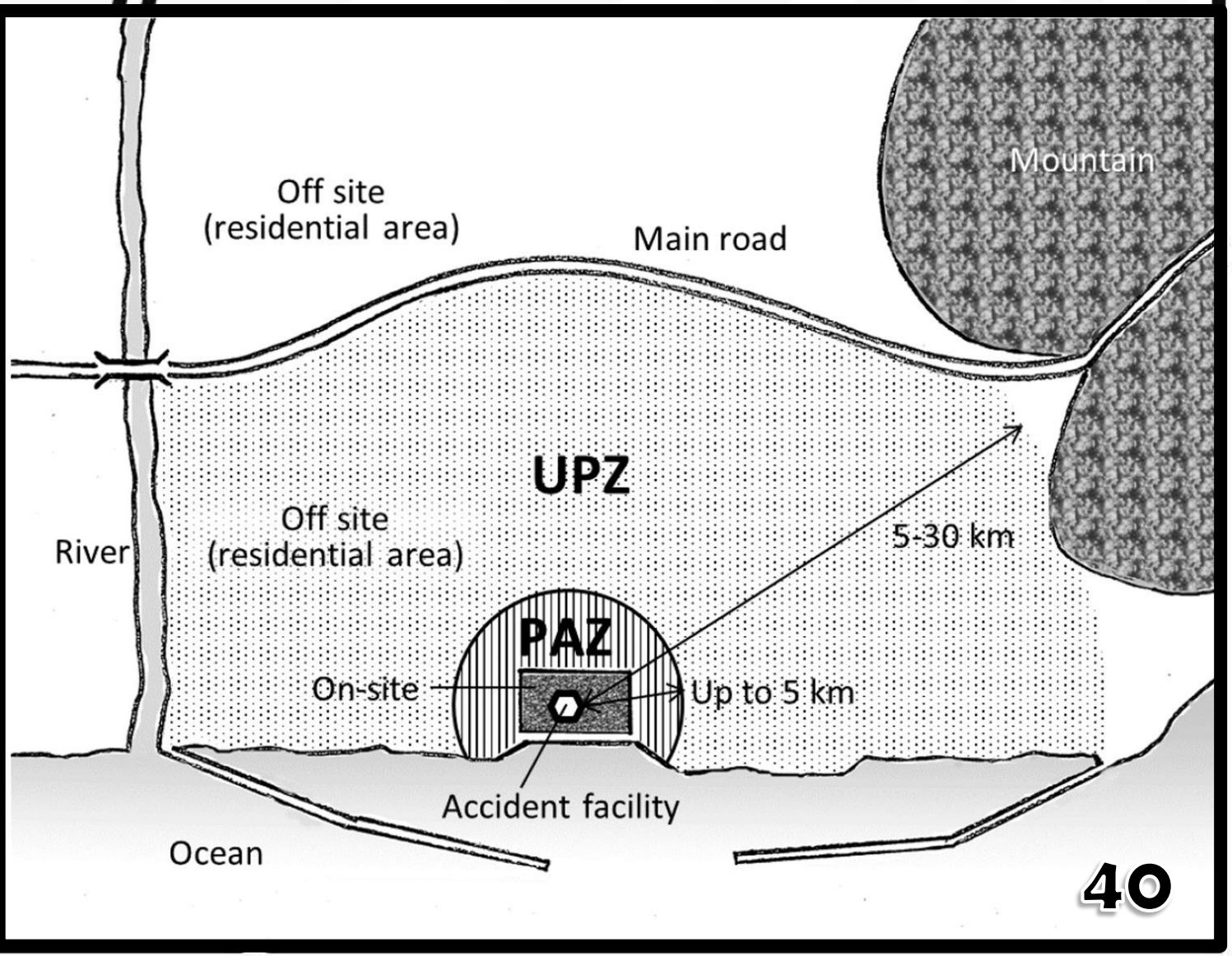
Arrangements shall be made at the preparedness stage for taking protective actions and other response actions effectively.

- Facility
- PAZ - Precautionary action zone
- UPZ - Urgent protective action planning zone
- EPD - Extended planning distance
- ICPD - Ingestion and commodities planning distance

Emergency Planning Zones and Distances

It should be noted that the zones should not stop at national borders.

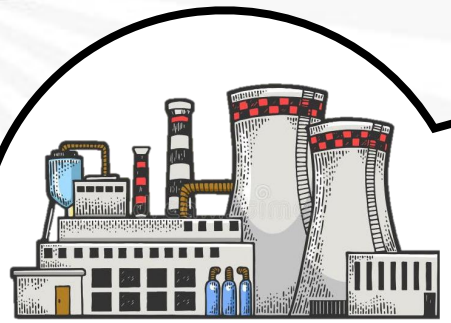
The PAZ and UPZ should be roughly circular areas around the facility, and their boundaries should be defined, where appropriate, by local landmarks (e.g. roads or rivers) to allow easy identification during a response.



Emergency Planning Zones and Distances

Precautionary action zone (PAZ), for facilities in category I, for which arrangements shall be made for taking urgent protective actions and other response actions, before any significant release of radioactive material occurs, on the basis of conditions at the facility (i.e. conditions leading to the declaration of a general emergency), in order to avoid or to minimize severe deterministic effects.

Emergency Planning Zones and Distances



Category I

Precautionary Action Zone (PAZ)

Urgent protective action

Before any significant release

Avoid severe deterministic effects

General Emergency declaration

Emergency Planning Zones and Distances

Urgent protective action planning zone (UPZ),

for facilities in category I or II, for which arrangements shall be made to initiate urgent protective actions and other response actions, if possible before any significant release of radioactive material occurs, on the basis of conditions at the facility (i.e. conditions leading to the declaration of a general emergency), and after a release occurs, on the basis of monitoring and assessment of the radiological situation off the site, in order to reduce the risk of stochastic effects.

Any such actions shall be taken in such a way as not to delay the implementation of precautionary urgent protective actions and other response actions within the precautionary action zone.

Emergency Planning Zones and Distances

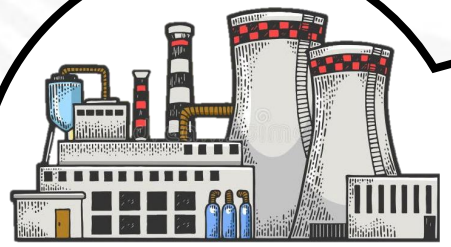
Before any significant release

Urgent protective action planning zone (UPZ)

Urgent protective action

Reduce the risk of stochastic effects

Monitoring and assessment of the radiological situation



Category I or II

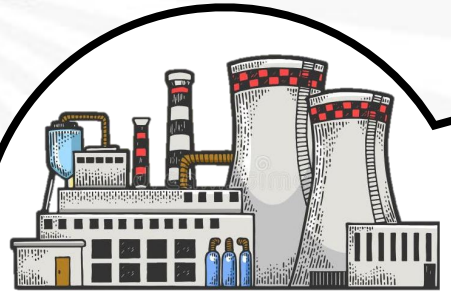
General Emergency declaration

After release occurs

Emergency Planning Zones and Distances

Extended planning distance (EPD) from the facility, for facilities in category I or II (beyond the urgent protective action planning zone), for which arrangements shall be made to conduct monitoring and assessment of the radiological situation off the site in order to identify areas, within a period of time that would allow the risk of stochastic effects in the areas to be effectively reduced by taking protective actions and other response actions within a day to a week or to a few weeks following a significant radioactive release.

Emergency Planning Zones and Distances



Category I or II

Extended Planning Distance (EPD)

Conduct monitoring and assessment of the radiological situation

Following a significant radioactive release

Reduce the risk of stochastic effects

General Emergency declaration

Emergency Planning Zones and Distances

Ingestion and commodities planning distance (ICPD) from the facility, for facilities in category I or II (beyond the extended planning distance), for which arrangements shall be made to take response actions:

(1) for protecting the food chain and water supply as well as for protecting commodities other than food from contamination following a significant radioactive release and

(2) for protecting the public from the ingestion of food, milk and drinking water and from the use of commodities other than food with possible contamination following a significant radioactive release.

Emergency Planning Zones and Distances

Ingestion and Commodities Planning Distance (ICPD)

For protecting the food chain and water supply from contamination

For protecting the public from the ingestion of possible contaminated food, milk and drinking water

Category I or II

General Emergency declaration

Emergency Planning Zones and Distances

Suggested sizes for the off-site emergency planning zones and emergency planning distances

Facilities	PAZ	UPZ	EPD	ICPD
Emergency preparedness category I facilities				
Reactors ≥ 1000 MW(th)	3-5 km	15-30 km	100 km	300 km
$\left[\frac{A}{D}\right]_2 \geq 10^5$				
Reactors 100–1000 MW(th)	3-5 km	15-30 km	50 km	100 km
$\left[\frac{A}{D}\right]_2 \geq 10^4 - 10^5$				

Emergency Planning Zones and Distances

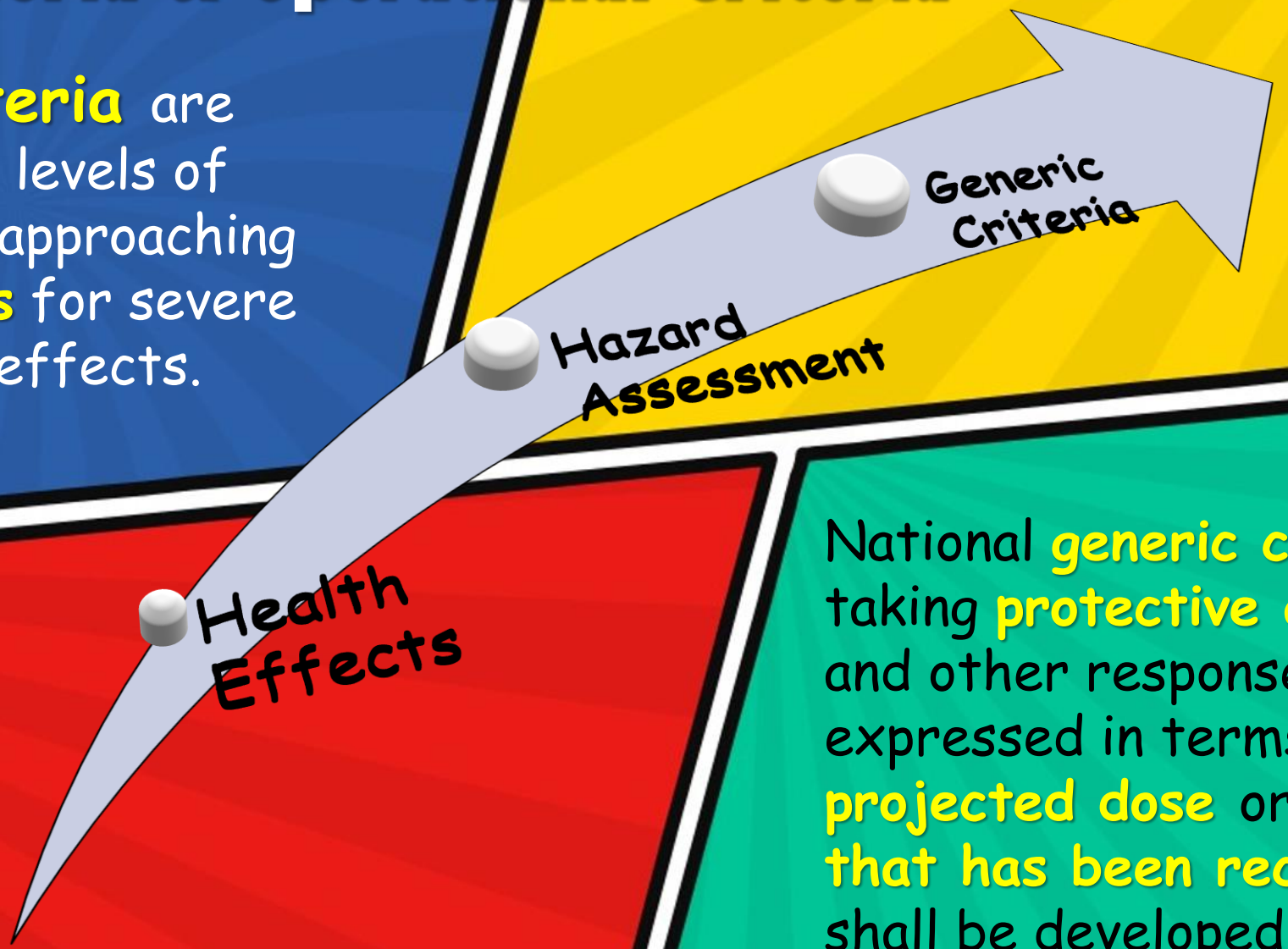
Suggested sizes for the off-site emergency planning zones and emergency planning distances (cont'd)

Facilities	PAZ	UPZ	EPD	ICPD
Emergency preparedness category II facilities				
Reactors 10–100 MW(th)	None	0.5-5 km	10 km	20 km
$\left[\frac{A}{D}\right]_2 \geq 10^3 - 10^4$				
Reactors 2–10 MW(th)	None	0.5 km	2 km	5 km
$\left[\frac{A}{D}\right]_2 \geq 10^2 - 10^3$				

Generic Criteria & Operational Criteria

Generic Criteria & Operational Criteria

Generic criteria are established at levels of dose that are approaching the **thresholds** for severe deterministic effects.



National **generic criteria** for taking **protective actions** and other response actions, expressed in terms of **projected dose** or of **dose that has been received**, shall be developed.

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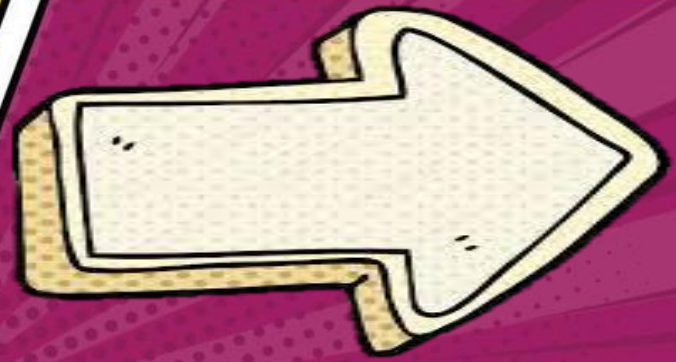
Generic Criteria & Operational Criteria

Generic Criteria
Can't be seen or measured



Operational Criteria
Can be observed or measured

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Generic Criteria & Operational Criteria

Generic Criteria

Operational Intervention Levels (OILs)

Emergency Action Levels (EALs)

Observables / Indicators

Operational Criteria

Field and Laboratory Measurements

Abnormal Facility Conditions

Conditions on the Scene

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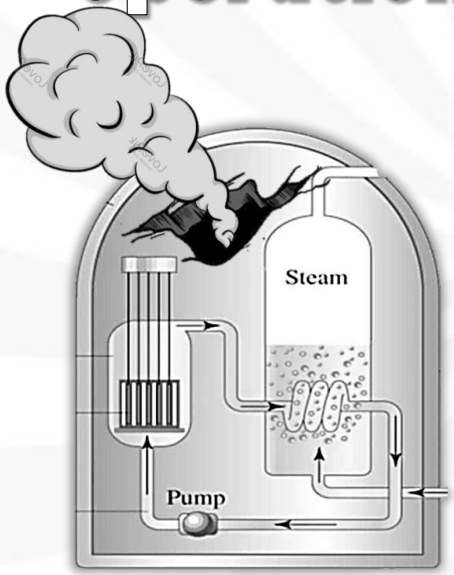
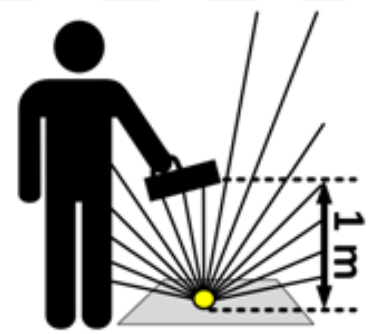
Operational Intervention Levels (OILs)

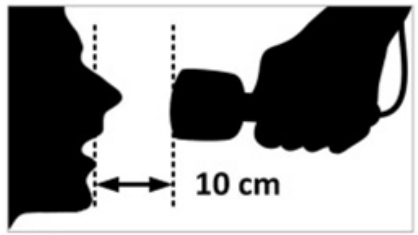


OILs are basis for action **after a release** and provided for:

1

Dose rate above the ground for determining if the evacuation, relocation or food restrictions are warranted;

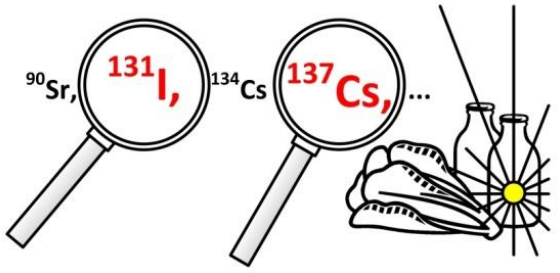




2

Dose rate from skin contamination to determine if the decontamination or **medical follow up** is warranted;

3

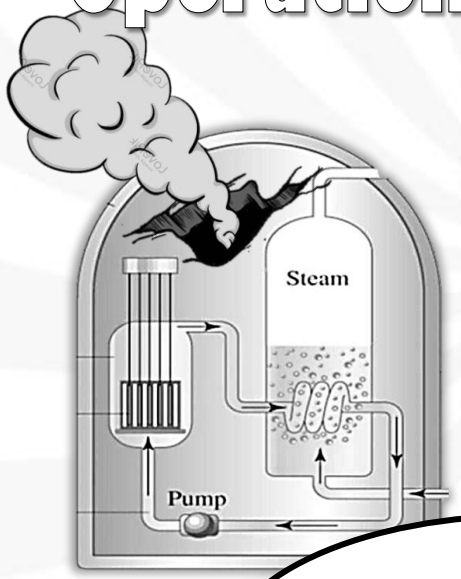


Concentrations of cesium 137 and iodine 131 in food and water and milk to determined if restrictions are warranted.

Operational Intervention Levels (OILs)

OIL Value (OIL1)	Response action (as appropriate) if the OIL is exceeded
Environmental measurements	
Gamma (γ) 1000 μSv/h at 1 m from surface or a source	▪ Immediately evacuate or provide substantial shelter ▪ Provide for decontamination of evacuees ▪ Reduce inadvertent ingestion ▪ Stop consumption of local produce, rainwater and milk from animals grazing in the area ▪ Register and provide for a medical examination of evacuees ▪ If a person has handled a source with a dose rate equal to or exceeding 1000 μSv/h at 1 m, provide an immediate medical examination
2000 counts/s direct beta (β) surface contamination measurement	
50 counts/s direct alpha (α) surface contamination measurement	

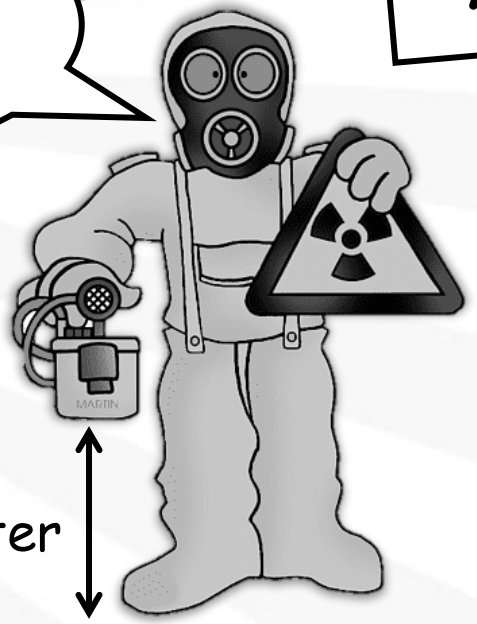
Operational Intervention Levels (OILs)



Emergency occurred in NPP. **Beginning** of major releases of radioactive materials.

OIL 1
is exceeded

OIL 1
Gamma (γ) 1000 μSv/h
at 1 m from surface or
a source



Response Actions

Medical examination

Decontamination

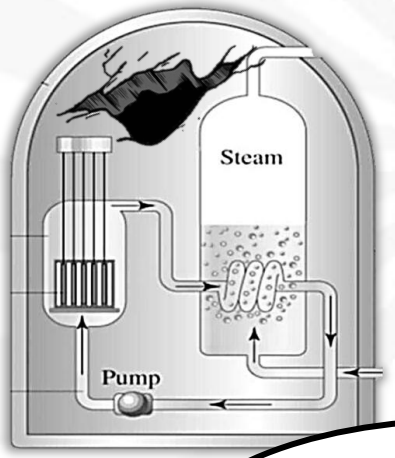
Evacuate

Local produce

Operational Intervention Levels (OILs)

OIL Value (OIL2)	Response action (as appropriate) if the OIL is exceeded
	Environmental measurements
Gamma (γ) 100 μSv/h at 1 m from surface or a source	▪ Stop consumption of local produced, rainwater and milk from animals grazing in the area until they have been screened and contamination levels have been assessed using OIL5 and OIL6 ▪ Temporarily relocate those living in the area; before relocation, reduce inadvertent ingestion; register and estimate the dose to those who were in the area to determine if medical screening is warranted; relocation of people from the areas with the highest potential exposure should begin within days ▪ If a person has handled a source with a dose rate equal to or exceeding 100 μSv/h at 1 m, provide medical examination and evaluation; any pregnant women who have handled such a source should receive immediate medical evaluation and dose assessment
200 counts/s direct beta (β) surface contamination measurement	
10 counts/s direct alpha (α) surface contamination measurement	

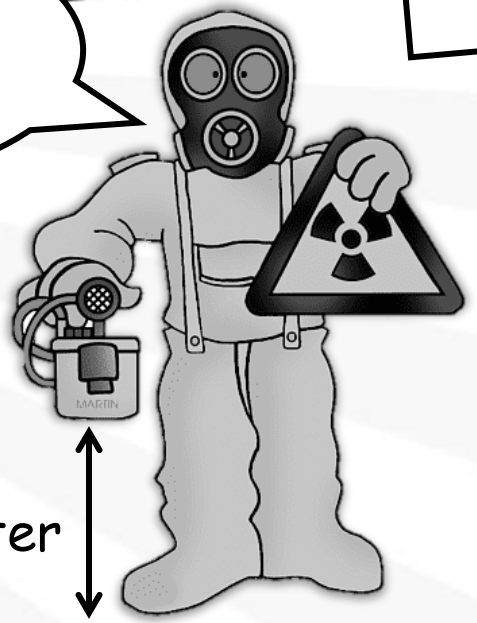
Operational Intervention Levels (OILs)



Emergency occurred in NPP. **End** of major releases of radioactive materials.

OIL 2
is exceeded

OIL 2
Gamma (γ) 100 μSv/h
at 1 m from surface or
a source



Response Actions

Local produce

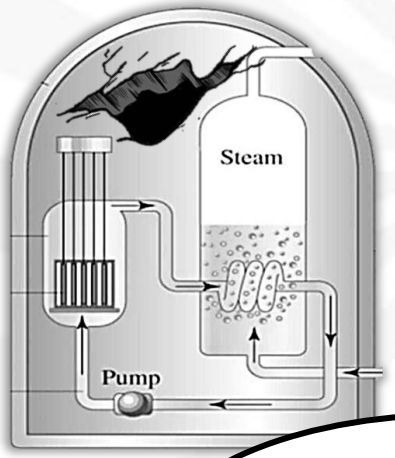
Medical examination

Temporary relocation

Operational Intervention Levels (OILs)

OIL Value (OIL3)	Response action (as appropriate) if the OIL is exceeded
Environmental measurements	
Gamma (γ) 1 μSv/h at 1 m from surface or a source 20 counts/s direct beta (β) surface contamination measurement 2 counts/s direct alpha (α) surface contamination measurement	▪ Stop consumption of non-essential local produced, rainwater and milk from animals grazing in the area until it has been screened and contamination levels have been assessed using OIL5 and OIL6 ▪ Screen local produce, rainwater and milk from animals grazing in the area out to at least 10 times the distance to which OIL3 is exceeded and assess samples using OIL5 and OIL6 ▪ Consider providing iodine thyroid blocking for fresh fission products and for iodine contamination if replacement for essential local produce or milk is not immediately available ▪ Estimate the dose of those who may have consumed food, milk or rainwater from the area where restrictions were implemented to determine if medical screening is warranted

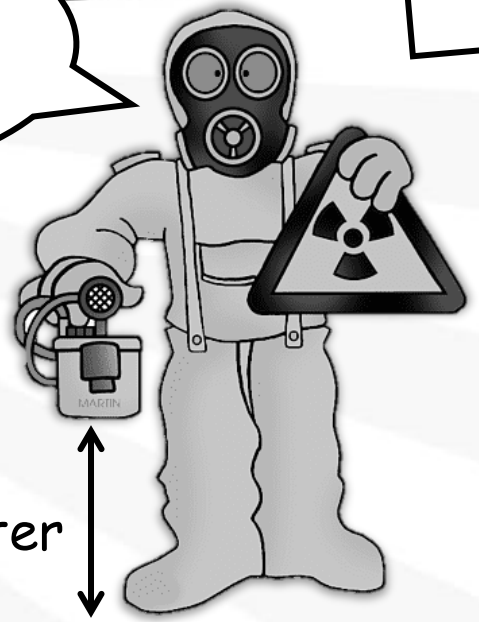
Operational Intervention Levels (OILs)



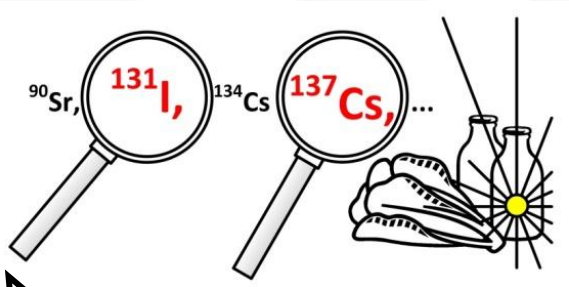
Emergency occurred in NPP. **End** of major releases of radioactive materials.

OIL 3
is exceeded

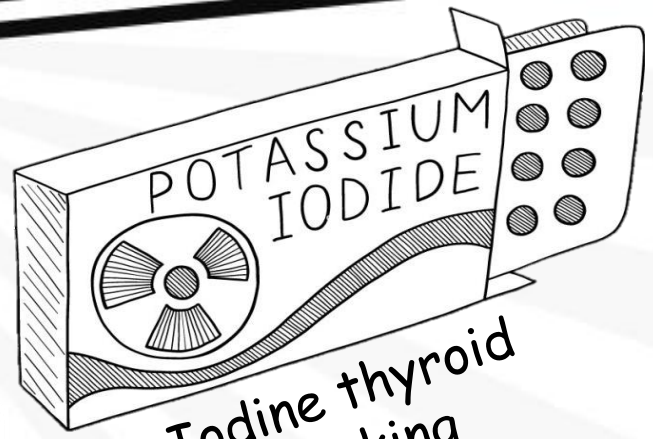
OIL 3
Gamma (γ) 1 μSv/h at 1 m from surface or a source



Response Actions



Medical examination



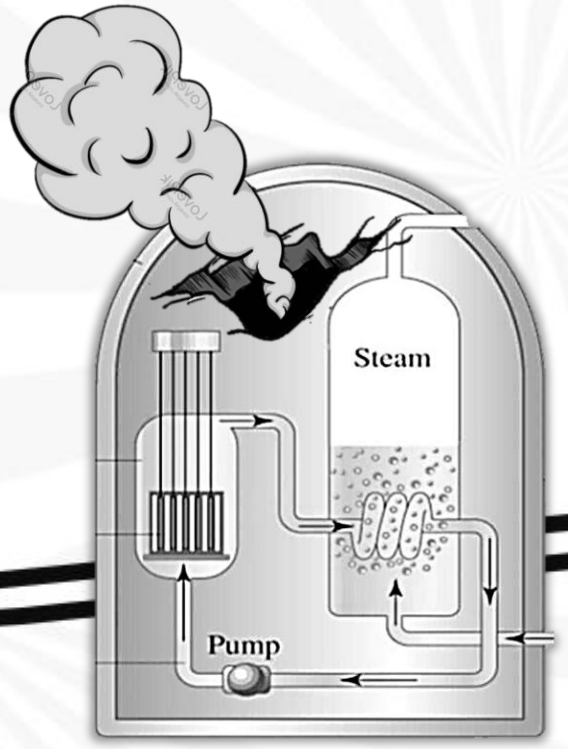
Iodine thyroid blocking

Local produce

Operational Intervention Levels (OILs)

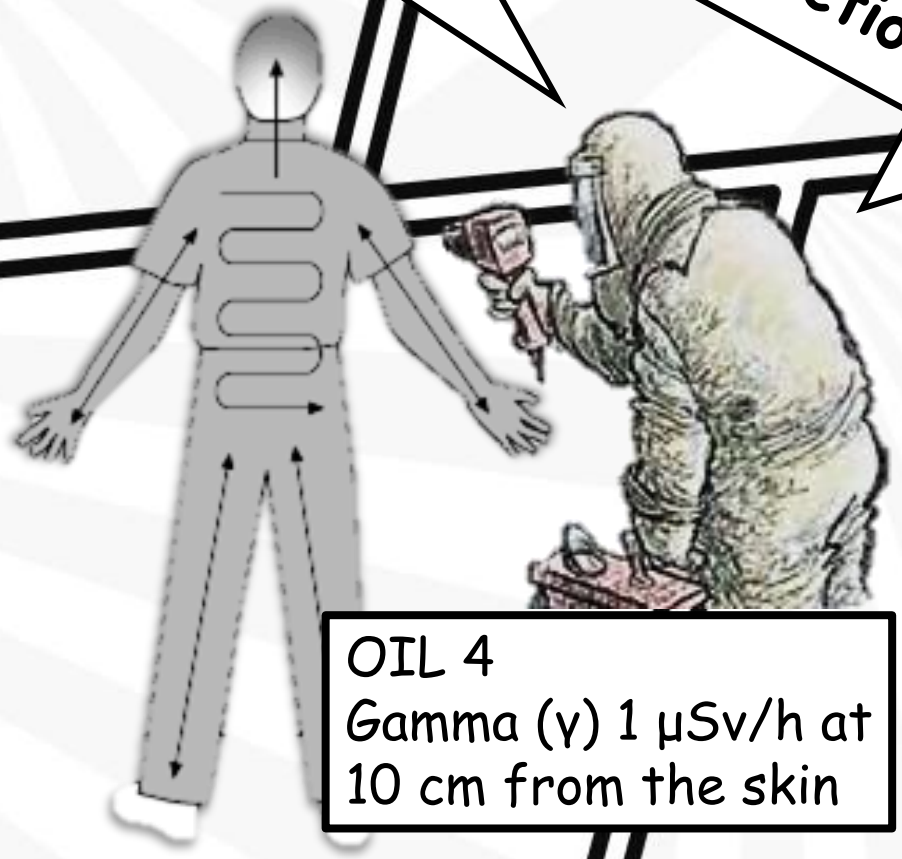
OIL Value (OIL4)	Response action (as appropriate) if the OIL is exceeded
Skin Contamination	
Gamma (γ) 1 µSv/h at 10 cm from the skin	▪ Provide for skin decontamination and reduce inadvertent ingestion ▪ Register and provide for a medical examination
1000 counts/s direct beta (β) skin contamination measurement	
50 counts/s direct alpha (α) skin contamination measurement	

Operational Intervention Levels (OILs)



Emergency occurred in NPP. **Beginning** of major releases of radioactive materials.

OIL 4
is exceeded



OIL 4
Gamma (γ) 1 μSv/h at 10 cm from the skin

Response Actions

Medical examination

Decontamination

Emergency Action Levels (EALs)

1 The criteria used for **classifying** the events.

2 Predetermined **threshold** for an emergency in a given **emergency class**.

3 Used for **classification** and for decisions on the implementation of **precautionary urgent protective** actions.

Emergency Action Levels (EALs)

Symptom Based
Site specific instrument readings
(e.g. reactor coolant system pressure higher than a certain level)

Event Based
More subjective criteria requiring the judgement of the operating staff, e.g. 'fire detected in an area containing vital safety systems'

Emergency Action Levels (EALs)

QUIZ

Which type of EALs is better, symptom based or event based ???

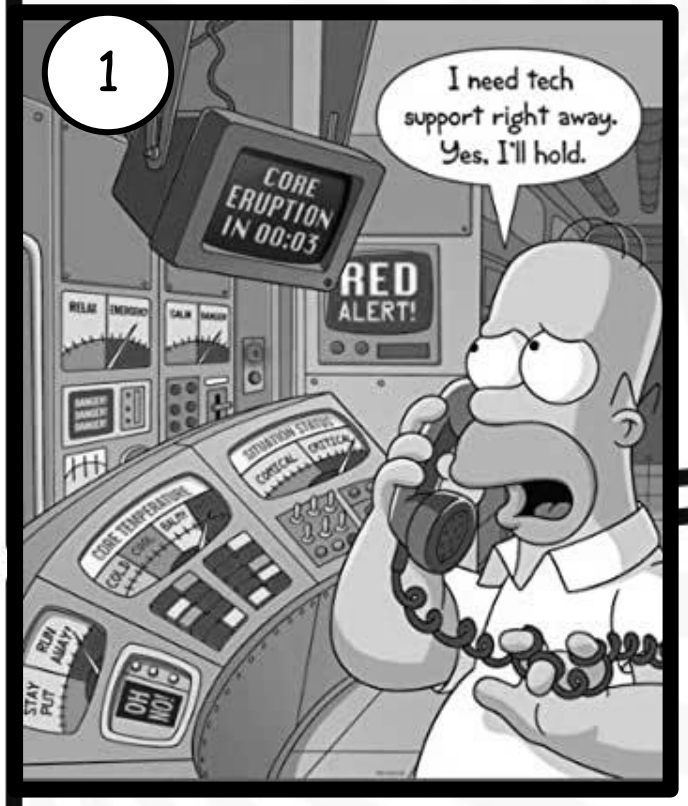
Emergency Action Levels (EALs)

When possible, symptom based EALs should be used because they make the classification process more timely and less subject to error.

id.pinterest.com

Emergency Action Levels (EALs)

1



High radiation levels in the control room or other areas requiring continuous access for safety system operation and maintenance

2

Radiation levels greater than **10 mSv/h**

3

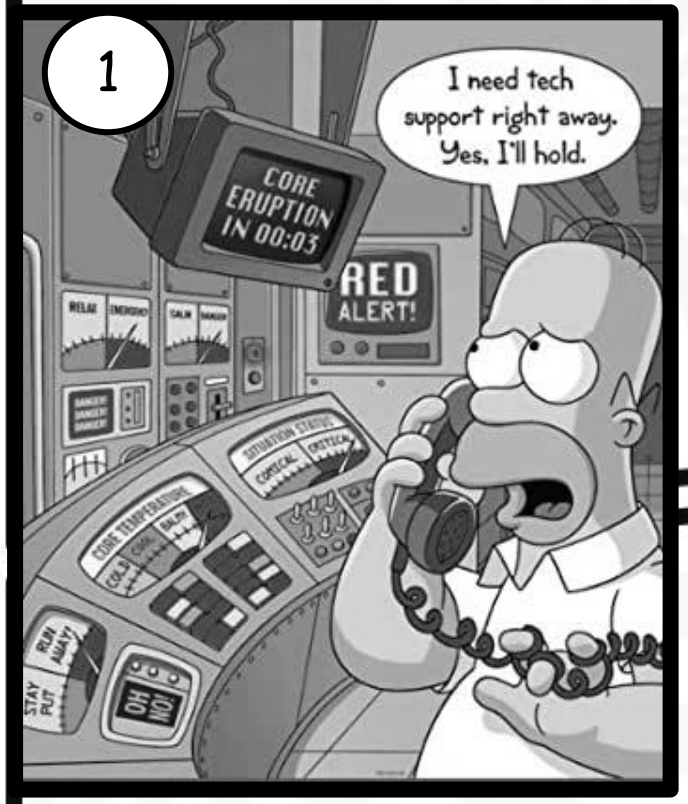
General emergency declared

4

Protective actions on the site and off the site

Emergency Action Levels (EALs)

1



High radiation levels in the control room or other areas requiring continuous access for safety system operation and maintenance

2

Radiation levels greater than **1 mSv/h** potentially lasting several hours

3

4

Protective actions on the site and vicinity of the site

Emergency Action Levels (EALs)

1

High radiation levels in the control room or other areas requiring continuous access for safety system operation and maintenance

2

Radiation levels greater than **0,1 mSv/h** potentially lasting several hours

3

Alert declared

4

Assess and mitigate the potential consequences of the event.

Increase **the readiness** of the on-site response organizations.

Observables/ Indicators

1

In a **radiological emergency**, the inner cordoned area (safety perimeter) is where protective action is implemented to protect responders and the public. Initially the size of the area is determined on the basis of information that can be directly observed (e.g. markings).

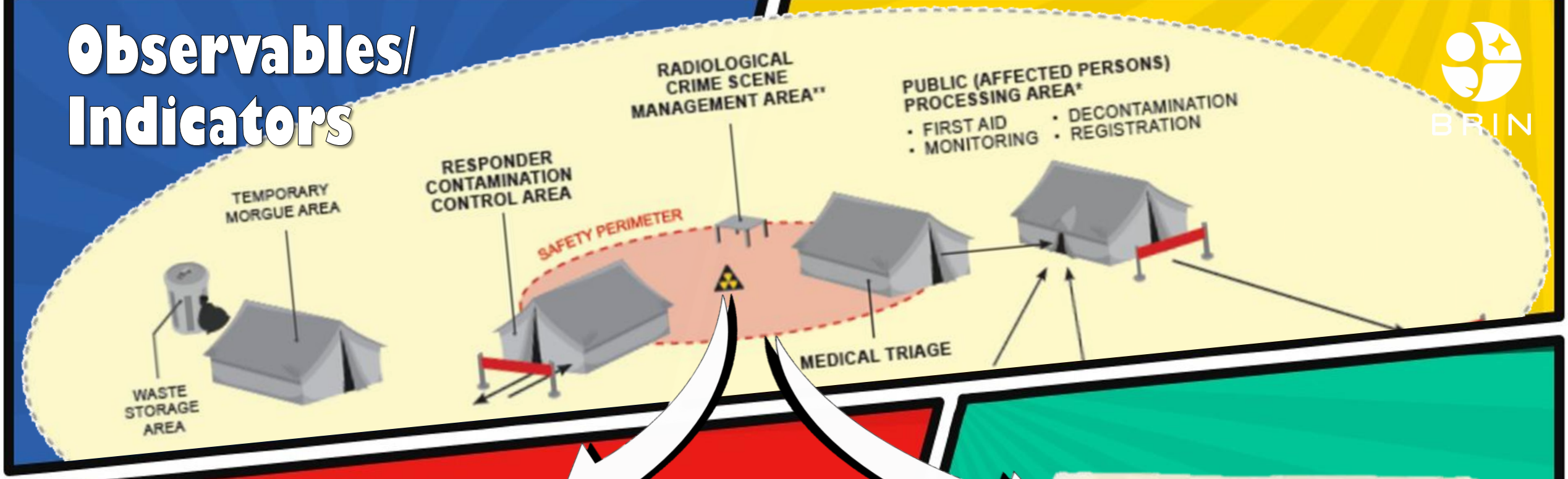
2

The size of the area may be expanded on the basis of dose rates and environmental measurement **OILs** when these data become available. The actual boundaries of the safety perimeters should be defined in such a way that they are **easily recognizable** (e.g. by roads) and should be secured.

3

However, the safety perimeter should be established at least as far from the source as is indicated in the following pictures until the **radiological assessor** has assessed the situation.

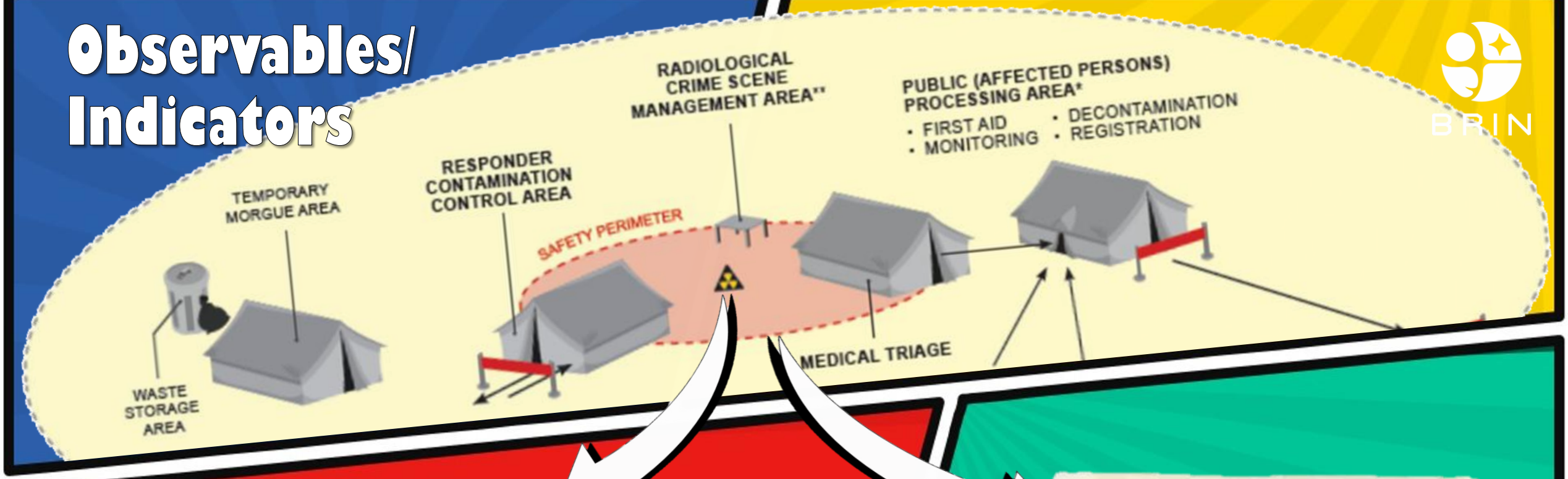
Observables/ Indicators



Unshielded or damaged potentially dangerous source

30 m radius around the source

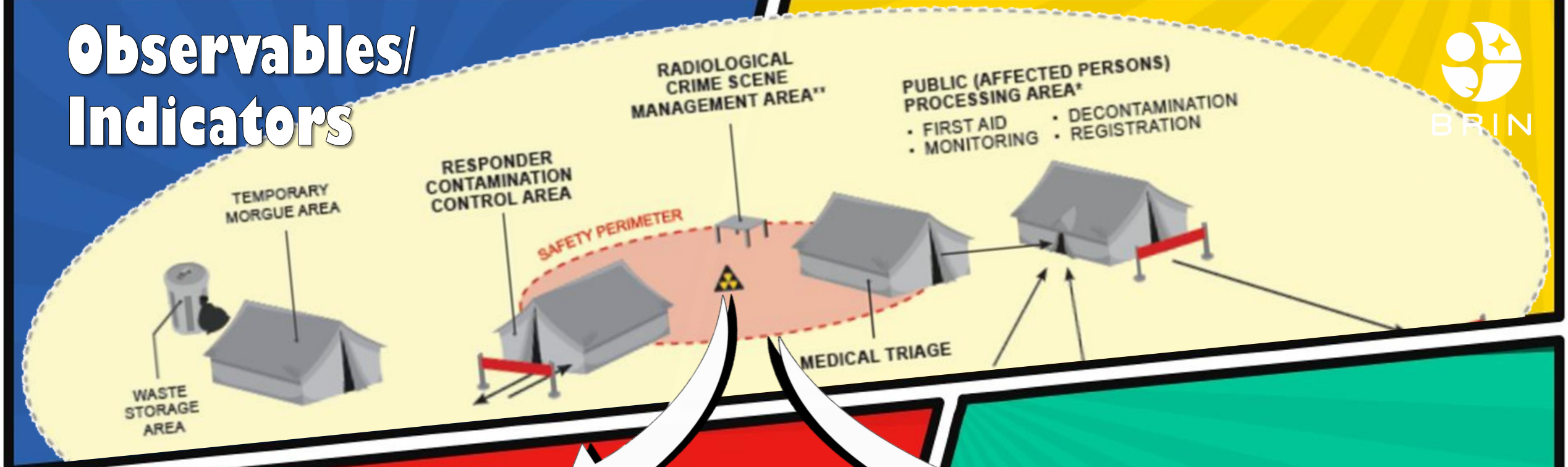
Observables/ Indicators



Major spill from a potentially dangerous source

100 m radius around the source

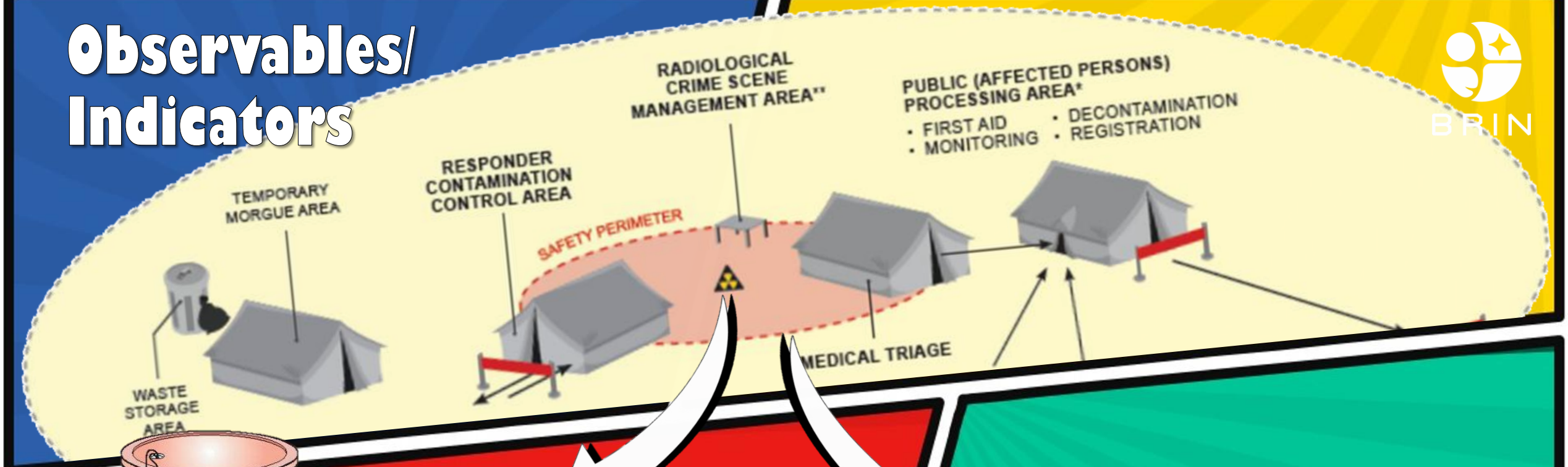
Observables/ Indicators

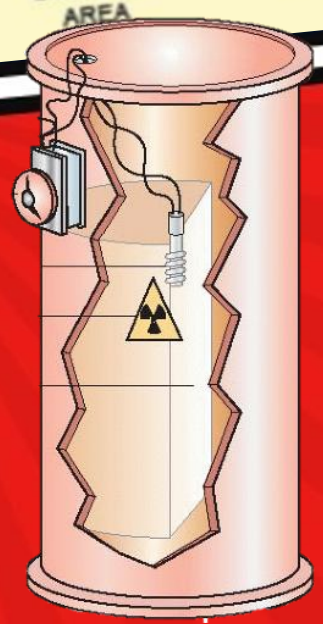


Fire, explosion or fumes involving a dangerous source

300 m radius

Observables/ Indicators





Suspected bomb (possible **radiological dispersal device**), exploded or unexploded

400 m radius or more to protect against an explosion

Observables/ Indicators

Damage, loss of shielding or spill involving a potentially dangerous source

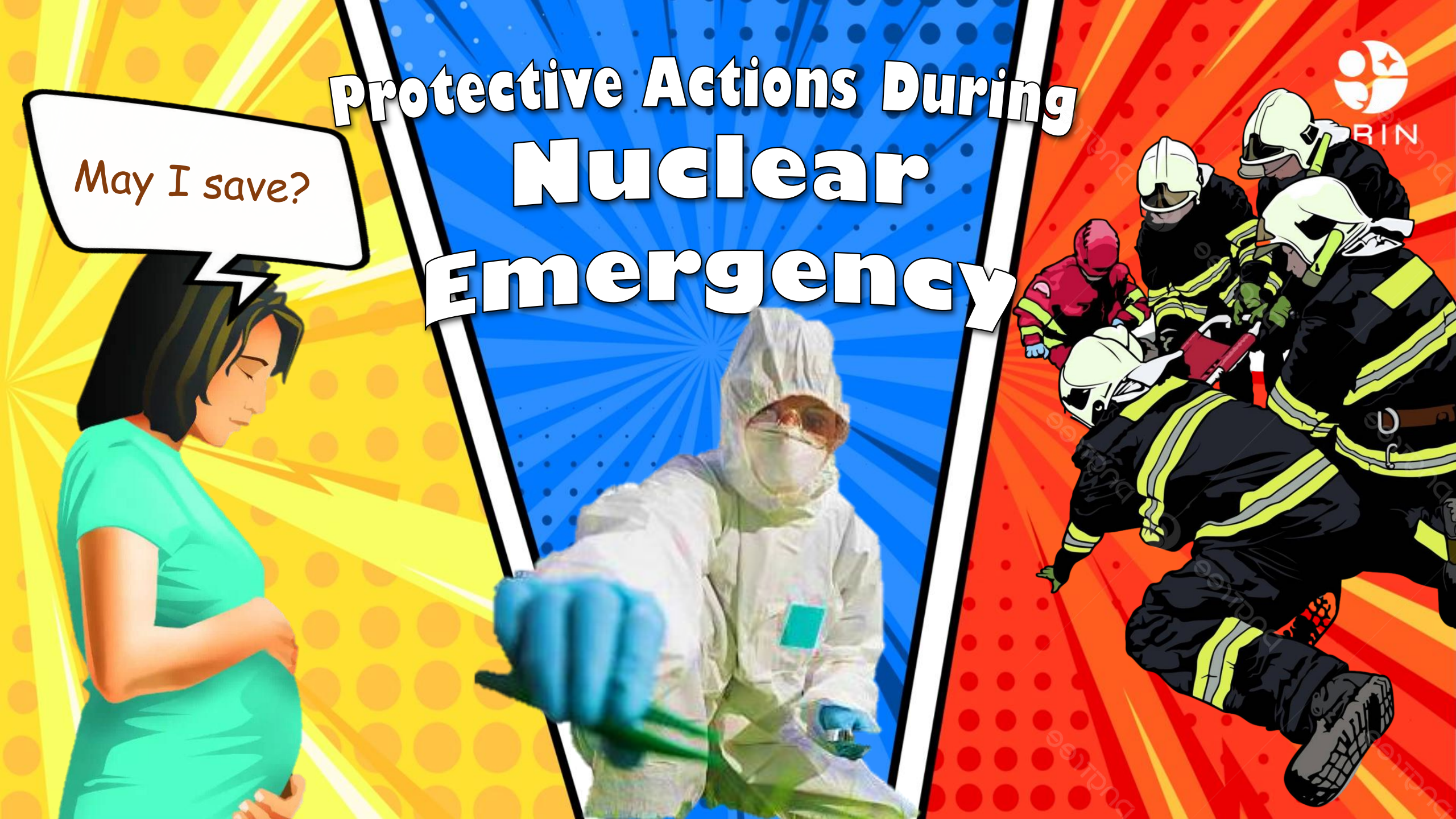
Affected and adjacent areas (including floors above and below)

Observables/ Indicators

Fire or other event involving a potentially dangerous source that can spread radioactive material throughout the building (e.g. through the ventilation system)

Entire building and appropriate outside distance as indicated above

Protective Actions During Nuclear Emergency



Protective actions during nuclear emergencies

Category I

PAZ

UPZ

EPD

ICPD

General Emergency declared

- Take a pre-distributed stable iodine tablets
- Reduce inadvertent ingestion

Promptly & safely evacuate to beyond the UPZ

Substantial sheltering (i.e. shelter in large buildings)

Protective actions during nuclear emergencies

Category I

PAZ

UPZ

EPD

ICPD

General
Emergency declared

In case of prolonged release

- Evacuate beyond this zone on the basis of the conditions at the facility

- Reduce inadvertent ingestion
- Check for further instructions

- Remain indoors (sheltering in place)
- Take stable iodine

Protective actions during nuclear emergencies

Category I

PAZ

UPZ

EPD

ICPD

General Emergency declared

Promptly conduct monitoring including shelters in the PAZ and assess radiological situation

Reduce inadvertent ingestion until the deposition levels are assessed

Protect food chain, water supply and commodities from contamination

Protective actions during nuclear emergencies

Category II

PAZ

UPZ

EPD

ICPD

General
Emergency declared

In case of prolonged release

- Evacuate beyond this zone on the basis of the conditions at the facility
- Remain indoors and close the windows and doors, and check further instructions
- Take stable iodine and reduce inadvertent ingestion
- Promptly conduct monitoring and assess radiological situation

Protective actions during nuclear emergencies

Category I & II

Site Area
Emergency declared

PAZ

UPZ

EPD

ICPD

In case of prolonged release

- Evacuate beyond this zone on the basis of the conditions at the facility
- Remain indoors and close the windows and doors, and check further instructions
- Take stable iodine and reduce inadvertent ingestion
- Promptly conduct monitoring and assess radiological situation

Protective actions during nuclear emergencies

PAZ

UPZ

EPD

ICPD

Reduce inadvertent ingestion

Advised to wash hands before drinking, eating, smoking or touching the face

Advised not to let children playing on the ground

Advised not to do activities that could result in the creation of dust

Protective actions during nuclear emergencies

PAZ

UPZ

EPD

ICPD

'Safely evacuating' means not endangering the lives of those being evacuated.

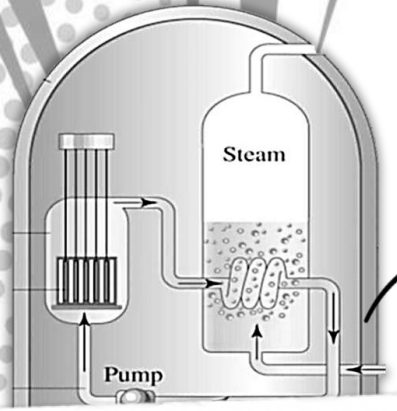
Patients & those requiring specialized care should be evacuated beyond the EPD.

Substantial sheltering is provided by large multistorey structures without any special features

Sheltering is not intended to be carried out for long periods (i.e. more than approximately 2 days)

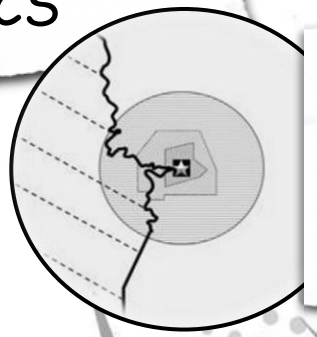
Summary

Hours

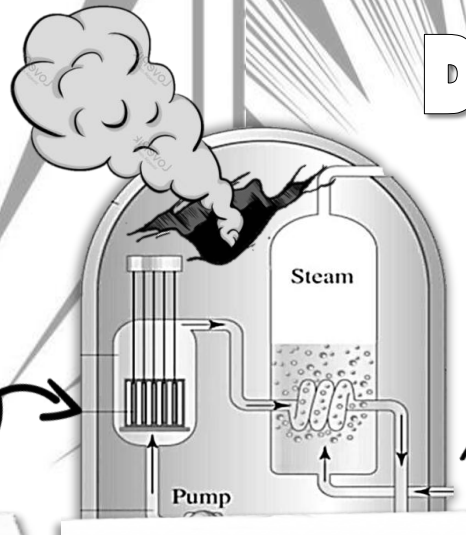


Abnormal facility condition.

EALs → ECS



Days

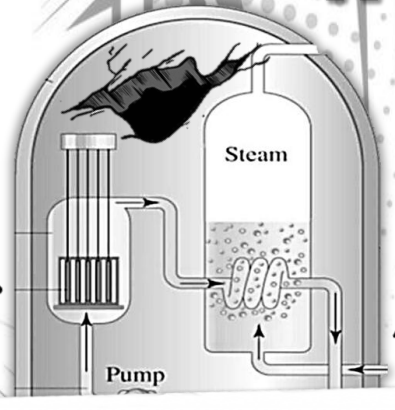


Beginning of major releases of RA

Take response actions based on ECS within EPZ and EPD

Expand response action based on OIL1

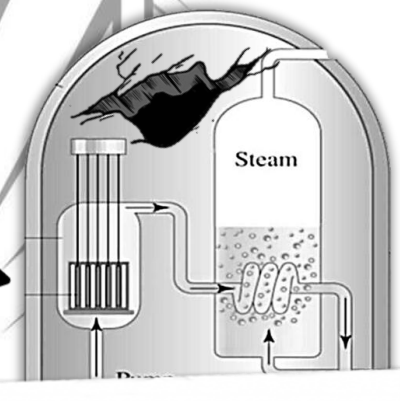
Weeks



End of major releases of RA

Adjust response action based on OIL2 and OIL3

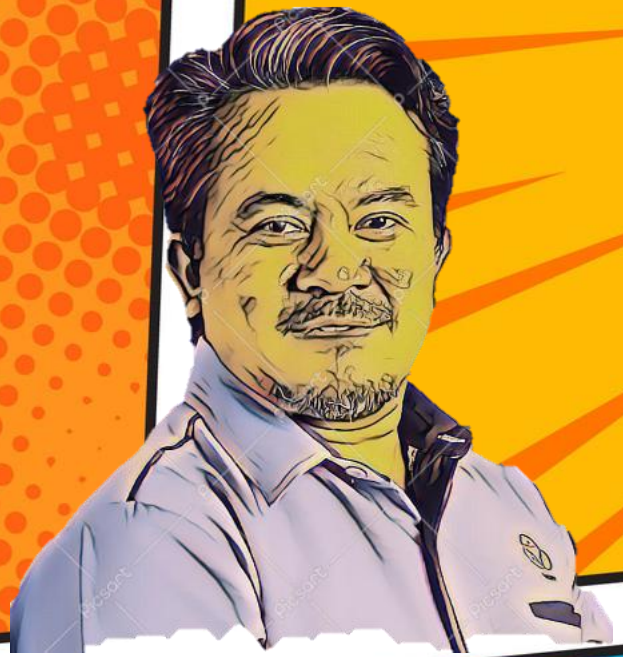
Months



The exposure situation is well characterized

Thank You

Chevy Cahyana
chev001@brin.go.id



BRIN

Discussion

BRIN

References

BRIN

Additional Information:

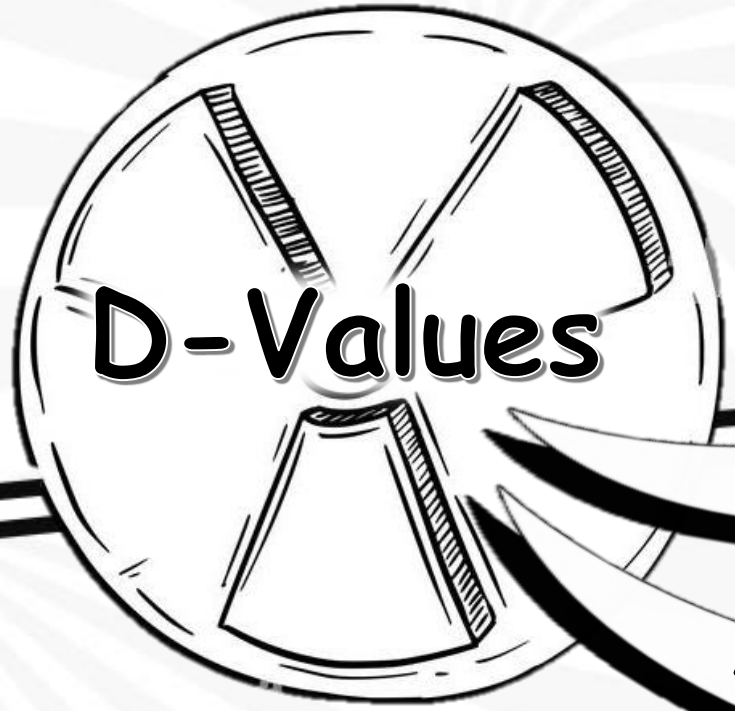
Dangerous Source

Dangerous Source

IAEA Safety Glossary

Dangerous source is a source that **if not under control**, could give rise to exposure sufficient to cause severe deterministic effects.

Dangerous Source



Non-dispersed RA material

Dispersed RA material

The term 'dangerous source' relates to dangerous quantities of radioactive material (D-values).

Dangerous Source

For non-dispersed materials, the following ratio should be calculated:

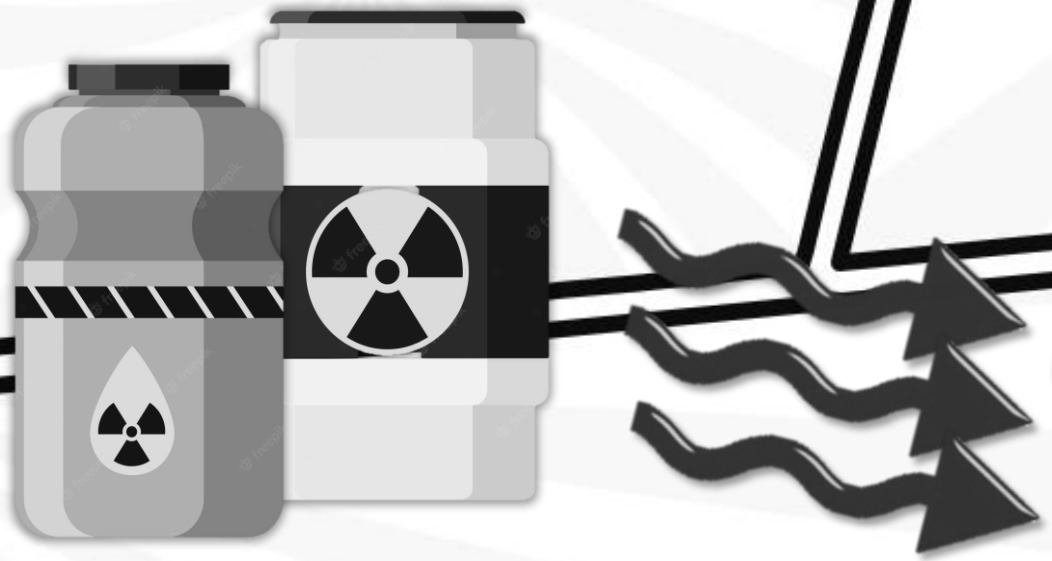
$$\left[\frac{A}{D}\right]_1 = \sum_i \frac{A_i}{D_{1,i}}$$

where:

A_i is the activity (TBq) of the radionuclide i over which control could be lost in an emergency;

$D_{1,i}$ is the D_1-value for radionuclide i that represents activity of a radionuclide i in a source that if uncontrolled, but not dispersed, might result in an emergency that could reasonably be expected to cause severe deterministic health effects.

Dangerous Source



NON-DISPERSED RADIOACTIVE MATERIAL means an unshielded and encapsulated radioactive source.

Only external exposure is considered

Dangerous Source

For dispersible materials, the following ratio should be calculated:

$$\left[\frac{A}{D}\right]_2 = \sum_i \frac{A_i}{D_{2,i}}$$

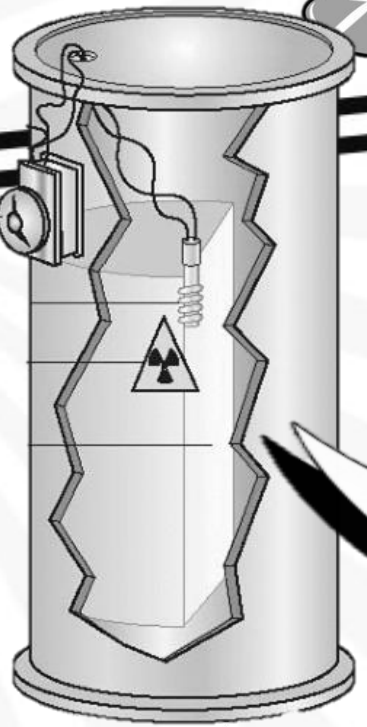
where:

A_i is the activity (TBq) of the radionuclide i over which control could be lost in an emergency;

$D_{2,i}$ is the D_2-value for radionuclide i that represents activity of a radionuclide i in a source that if uncontrolled, and dispersed, might result in an emergency that could reasonably be expected to cause severe deterministic health effects.

Dangerous Source

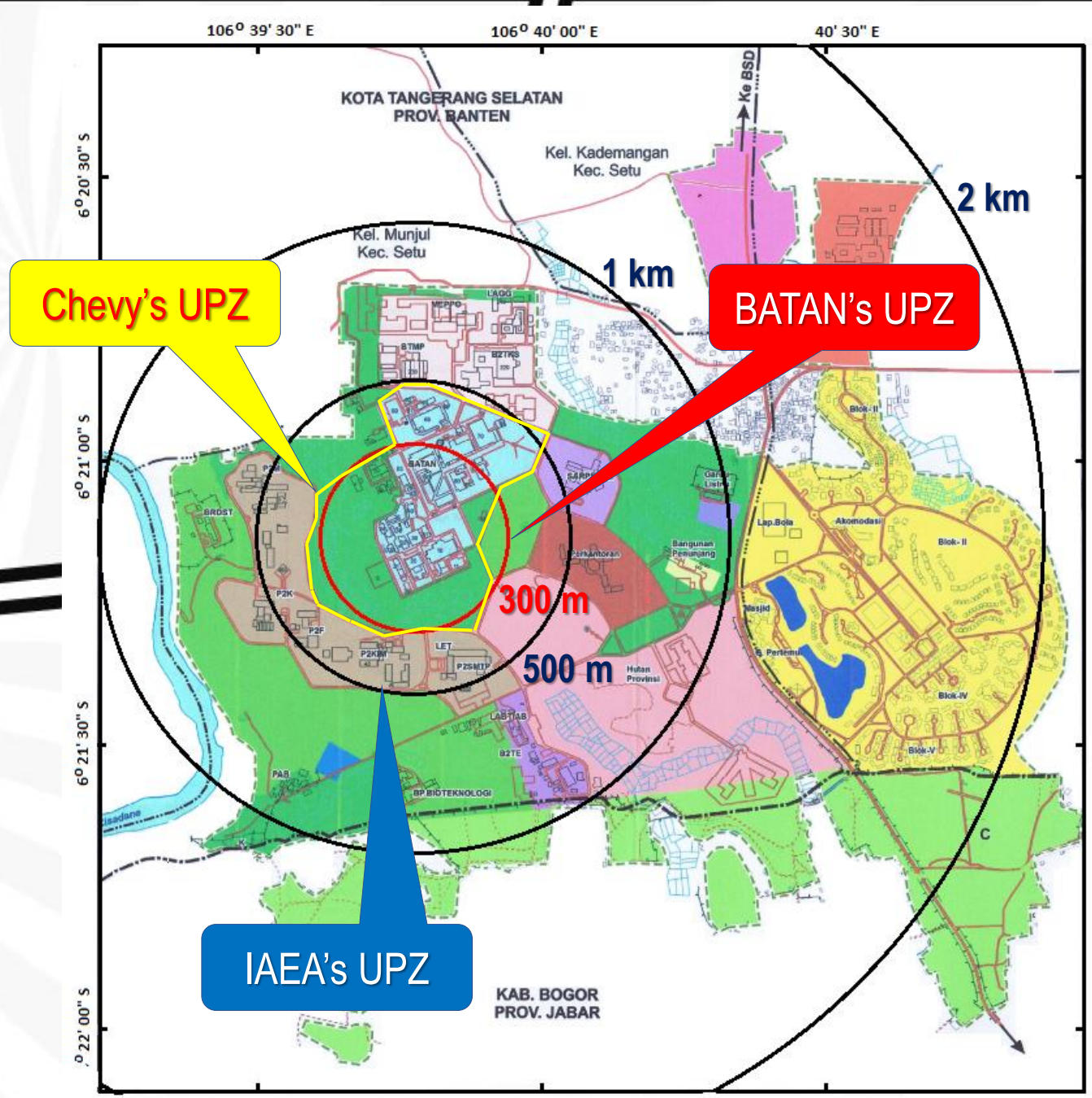
DISPERSED RADIOACTIVE MATERIAL results from leakage, dismantlement or other disruption of a sealed radioactive source such as in a fire or explosion.



Radiological Dispersal Device

internal exp. & exp. of the skin

immersion in a local cloud


106° 39' 30" E
106° 40' 00" E
40' 30" E
6° 20' 30" S
6° 21' 00" S
6° 21' 30" S
° 22' 00" S
KOTA TANGERANG SELATAN
PROV. BANTEN
Ke BSD
Kel. Kademangan
Kec. Setu
Kel. Munjul
Kec. Setu
2 km
1 km
Chevy's UPZ
BATAN's UPZ
300 m
500 m
IAEA's UPZ
KAB. BOGOR
PROV. JABAR
BATAN
BRDST
P2K
P2F
P2KIM
LET
P2SMTP
LABTIAB
B2TE
PAB
BP BIOTEKNOLOGI
Hutan Provinsi
Lap.Bola
Akomodasi
Blok- II
Blok-IV
Blok-V
Masjid
Perkantoran
Bangunan Penunjang
C