Update on the work of ICRP TG120 on radiation emergencies and malicious events

ICRP Committee 4 meeting

22 November 2024

Iwaki –

GT CIPR

3 décembre 2024

Anne Nisbet
ICRP Committee 4 (member)
ICRP TG120 (chair)
Yann Billarand
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Outline

- **Overview of work of ICRP Task Group120**
  - Background
  - Mandate & membership
  - Scope and case studies
  - TG120 progress to date
  - Next steps
  - Communication
  - Challenges
  - Interaction with other projects
  - Timeline

Background

- Pub 96: Protecting People against Radiation Exposure in the Event of a Radiological Attack published in 2005
- Pub 103 published in 2007 changes
  - Exposure situations
  - Criteria
  - Values of criteria
- Pub 146 dealing with large nuclear accident issued in 2020
- Armed conflict in Ukraine

ICRP TG120: Mandate

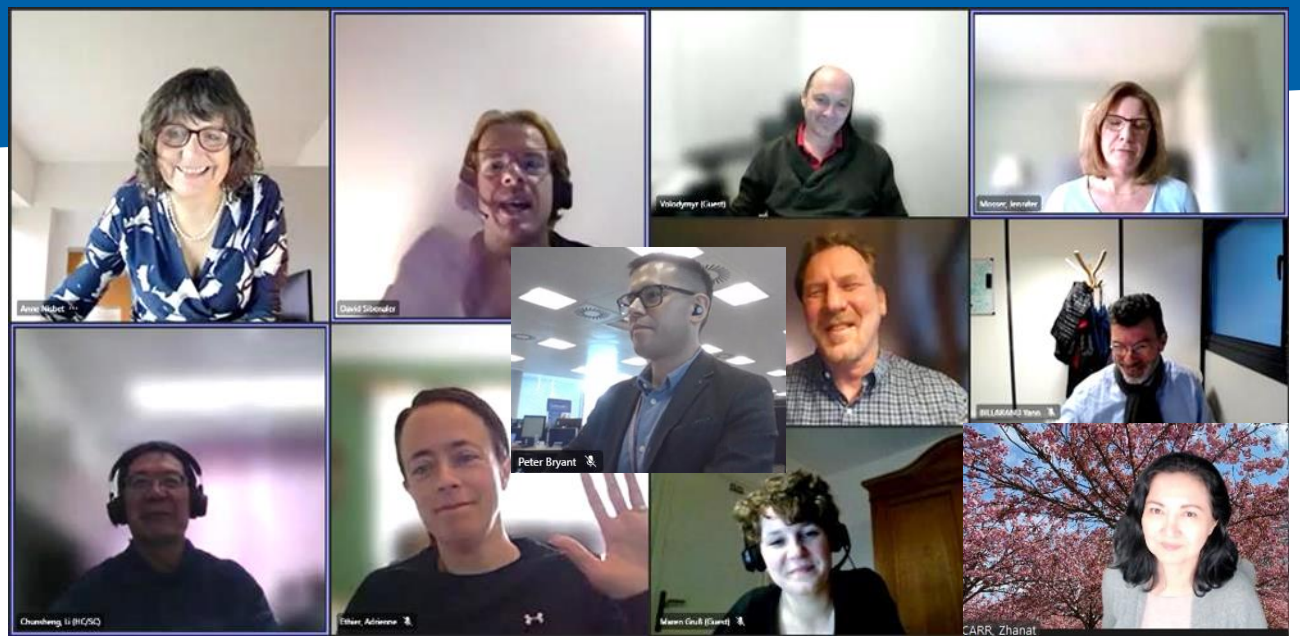
The Task Group will develop ICRP recommendations for radiation emergencies and malicious events*. These recommendations will complement those given in Publication 146 for large nuclear accidents.**

* Since September 2022, this now includes nuclear detonation

** Should the ToR and Mandate include ‘including in times of armed conflict’?

Membership

Anne Nisbet (**Chair**), C4, UK
Chunsheng Li, Canada
Jennifer Mosser, USA
Peter Bryant, UK
Yann Billarand, C4, France
Volodymyr Berkovskyy, C2, Ukraine
Brooke Buddemeier, USA
Zhanat Carr (WHO)
Mentees (communication):
Maren Gruß, Germany BfS
David Sibenaler, Australia Arpansa



C4: Critical reviewers:
Julie Burtt, Eduardo Gallego, John Takala
MC: Critical reviewers:
Werner Rühm, Michiaki Kai
ICRP Scientific secretariat:
Adrienne Ethier, Win Thuzar (intern)

Scope

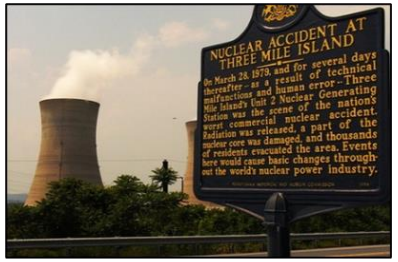
Radiation accidents

- Accidents at nuclear facilities
  - Criticalities; Operating faults
  - Fires/explosions; Leaks
- Transport (plane, train, road, satellite, sea)
- Lost, damaged or stolen sources
- Nuclear medicine isotopes

Malicious events

- Radiation Exposure Device (RED)
- Radiological Dispersal Device (RDD)
- Contamination of food & drinking water
- Targeted poisoning of individuals
- Sabotage of nuclear facilities
- Nuclear weapon detonation
  - Airburst; Ground burst

Windscale 10 October 1957



Three Mile Island 28 March 1979

Recommandations extraites de la publication 96 en cours de révision

Exposition professionnelle :

- **Les primo intervenant devraient être équipés de dosimètres électroniques**
- **Pour les operations de reconquête et de restauration, les limites applicables aux travailleurs devraient être celles d'une situation normale**

Exposition du public :

- **les périmètres reflexes des zones concernées par des actions de protection devraient être confirmées par des mesures**

Dosimétrie : **la dose équivalente et la dose efficace ne devraient pas être utilisées pour quantifier l'exposition à de forte doses**

Prise en charge médicale :

- **les installations médicales devraient recevoir l'information necessaire pour se preparer en cas d'événement radiologique**
- **Toutes les victimes devraient être stabilisées médicalement avant toute consideration radiologique**

Case studies & hypothetical scenarios

Scenario type	What	Cause	Specifics
Accident	Nuclear facility	Criticality	Tokaimura, Japan (1999)
		Operating fault	Three Mile Island (1979)
		Fire/explosion	Windscale (1957)
			Kyshtym (1957)
			Hanford (1976)
		Leakage	Techa River (1961)
	Inadvertent theft, damage, loss of sources. Orphaned sources	Theft	Goiania (1987)
		Damage to sealed source	Harborview (2019)
		Lost/orphaned	Chile (2005)
	Transport	Satellite	Cosmos 954 (1978)
		Bus	Cochabamba (2002)
		Plane (nuclear weapons)	Palomares (1966)
	Other	Nuclear medicine isotopes	Birmingham hospital (2018)
Malicious	Sabotage	Nuclear facility	Hypothetical Military attack
	Nuclear weapon detonation	Airburst	Hiroshima (1945)
		Ground burst	Hypothetical 10kT
	RDD	Explosive	Hypothetical RDD
	RED	Covert	Hypothetical RED
	Poison Individuals	Food and drink	Litvinenko (2006)

Scenario summary template

Topic	Sub-headings
Description	What happened; radionuclides; type of release - airborne/aquatic; HASS; affected environments; scale
Timelines & duration	Phases: response (threat, early and intermediate); recovery (long-term)
Exposure pathways	External exposure; Internal exposure; direct exposure
RP criteria & protective actions	Dose criteria applied; protective actions implemented; if/how protection decisions were justified; if/how protection was optimised; SDGs considered?
Consequences: Human and society	Radiation-induced health effects: tissue reactions, cancer & heritable diseases; Non-radiological impacts: mental health, psychological, other. Societal impact
Consequences: Affected biota	Radiation-induced effects: direct damage, changes in biodiversity; Impact on ecosystem services, pets and livestock
Stakeholder engagement	How, when and who
Communication	When, what, how, impact
Lessons learned	What worked well and why. What could be improved

TG120 Progress

- Carried out a critical review of Pub 96 and Pub 146 (May 22)
- Populated detailed templates for 15 case studies, 3 still to complete, 1 new one?
- Produced webpage on ‘Public Protection in case of Nuclear Detonation’ (Oct 22)
- Recruited 2 mentees to provide input on communication (Mar 23-Feb 26)
- Drafted Chapter 2 on ‘General Considerations’ of TG Report (Sep 24)
- Convened 11 TG meetings (mix F2F and online)
- Convened 8 online ‘topical’ meetings (e.g. ND, RP criteria, communication)
- Significant outreach 2023/24:
  - ConRad (Munich), REMPAN (Seoul), ERPW (Dublin), ICRP Symposium (Tokyo). SRP (Eastbourne); IRPA (Orlando); NERIS (Rome)
- Drafted paper on TG120 scenarios and scope for REMPAN proceedings

TG120 Report

Section 2: General considerations

Section 3: Emergency response

Section 4: Recovery

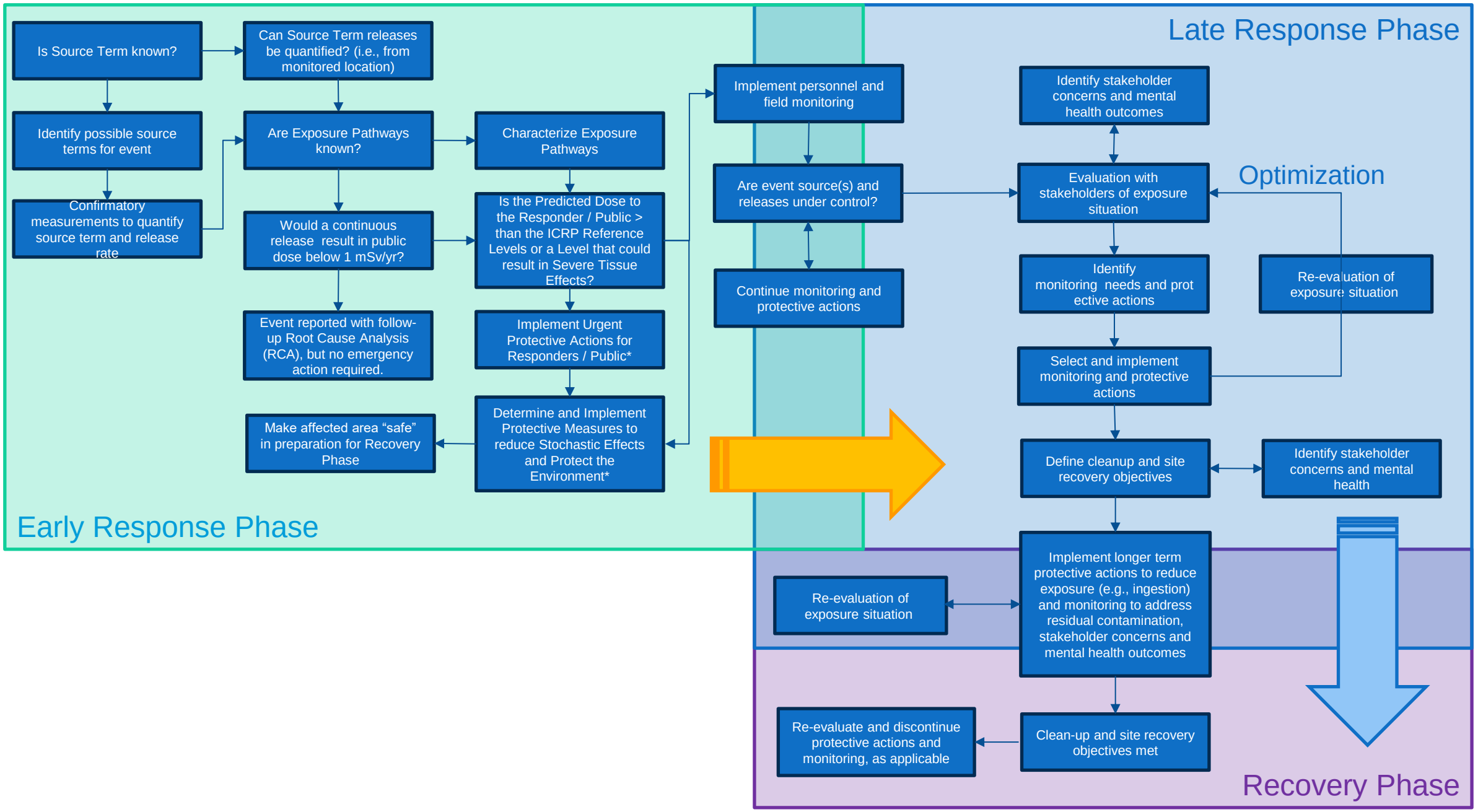
Section 5: Preparedness & planning

Section 2: General considerations

Subsection	Detail
Scenarios	• Accidents (4 categories)) • Malicious events (5 categories)
Timelines	• Response: early response; late response; recovery; transition to normal living
Exposure pathways	• Direct external; airborne; aquatic
Consequences: people	• Affected populations (members of the public, responders) • Radiation induced health effects • Non-radiological health effects • Impact on society and economy
Consequences: environment	• Affected biota (flora, fauna, soil, groundwater) • Radiation induced health effects on biota • Non-Radiological Effects and sustainable decision making
Goals and objectives of RP in emergencies	• Goals and objectives • Principles of protection (justification, optimization & reference levels; dose limits) • Application of dose criteria (emergency exposure, existing exposure)
Stakeholder engagement & communication	• Processes for engagement • Role of communication

Feedback from C4 reviewers

- Useful feedback on additional scenarios to consider and reclassification of others
- Provision of additional references and sources of information (throughout)
- Suggestion for additional exposure pathways (i.e. skin)
- Still to resolve debate about affected populations (public and responders ...)
- Suggestions for clarifying ‘goals’ and ‘objectives’ of protection
- Re-ordering of paragraphs (justification)
- Recommendation to introduce ‘reasonableness’ sooner
- Combine section on ‘stakeholder engagement’ with ‘communication’ section
- More information on use of social media – Fukushima
- More insight on countering mis- and dis-information


Is Source Term known?
Can Source Term releases be quantified? (i.e., from monitored location)
Identify possible source terms for event
Are Exposure Pathways known?
Characterize Exposure Pathways
Confirmatory measurements to quantify source term and release rate
Would a continuous release result in public dose below 1 mSv/yr?
Is the Predicted Dose to the Responder / Public > than the ICRP Reference Levels or a Level that could result in Severe Tissue Effects?
Event reported with follow-up Root Cause Analysis (RCA), but no emergency action required.
Implement Urgent Protective Actions for Responders / Public*
Make affected area "safe" in preparation for Recovery Phase
Determine and Implement Protective Measures to reduce Stochastic Effects and Protect the Environment*
Early Response Phase
Implement personnel and field monitoring
Are event source(s) and releases under control?
Continue monitoring and protective actions
Late Response Phase
Identify stakeholder concerns and mental health outcomes
Evaluation with stakeholders of exposure situation
Optimization
Identify monitoring needs and prot ective actions
Re-evaluation of exposure situation
Select and implement monitoring and protective actions
Define cleanup and site recovery objectives
Identify stakeholder concerns and mental health
Re-evaluation of exposure situation
Implement longer term protective actions to reduce exposure (e.g., ingestion) and monitoring to address residual contamination, stakeholder concerns and mental health outcomes
Re-evaluate and discontinue protective actions and monitoring, as applicable
Clean-up and site recovery objectives met
Recovery Phase

Next steps

- Next topical meeting on communication (Australian lost capsule; US Radiological Assistance Programme scenarios – 3/12/24)
- Next full TG meeting – 16/12/24
- Addressing a few remaining comments from C4 reviewers on Chapter 2
- Completing 3 remaining case study templates (RDD, RED and sabotage of nuclear facilities) and considering an extra ‘transport’ case study
- Reviewing initial drafts of social media templates
- Updating graphic (flow chart on actions and activities along timeline)
- Drafting Chapter 3 on Emergency Response
- Planning a workshop in 2025

Communicating with the public during a radiation emergency

TG120 recruited mentees

- To support the drafting of the communication sections of the Task Group's Report
- To develop simple, and effective social media messages for preparedness and response

Social media – benefits and challenges

Benefits

- Fast distribution of information
- Increased outreach
- Two-way dialogue
- Monitoring of social media
- Increased visability

Challenges

- Too many voices
- Conflicting information
- Misinformation & disinformation
- Polarization & politisation
- Resource-intensive

Acknowledgement: Maren Gruß (BfS, sociologue

Learning from past radiation emergencies

- **TG120 examining communication strategies used in the past to derive social media templates for a wide range of emergencies**
- **Series of topical meetings:**
  - Litvinenko (2006)
  - Goiania (1987)
  - Harborview (2019)
  - Birmingham hospital (2018)
  - Australian lost capsule (2023)
  - US Radiological Assistance Programme (RAP) terrorist scenarios
- **‘Communication in radiation emergencies’ – already covered by IAEA, WHO, IRPA etc. Therefore, ICRP advice must add value**

Challenges

- **Applicability of recommendations when:**
  - Numerous and wide-ranging scenarios
  - Malicious events versus accidents
- **Impact of armed conflict on:**
  - Justification of decisions
  - Optimisation of protection
  - Dosimetry. monitoring
  - Implementation of urgent protective actions, and medical management
- **Communication**
  - How to use social media effectively
  - Countering mis- and dis-information
- **Designing one or more meaningful graphics**

Interaction with other projects

ICRP Task Groups

- TG112 Emergency dosimetry
- TG114 Reasonableness & tolerability
- TG124 Justification
- TG127 Exposure situations and categories of exposure

Other international projects

- IAEA work on communication (Pete)
- EC projects
  - RRADEW – Resilience to Radiological Events in Wartime (Pascal)
  - PREDICT – Improvements in atmospheric dispersion modelling and protective action strategies in case of a nuclear detonation(BfS)

TG120 Timeline

Phase 1 (Oct 21 – Mar 25):

- Preparation of materials

Phase 2 (Apr 25 – Sep 25):

- Workshop(s) and continue preparation of materials

Phase 3 (Oct 25 – May 26):

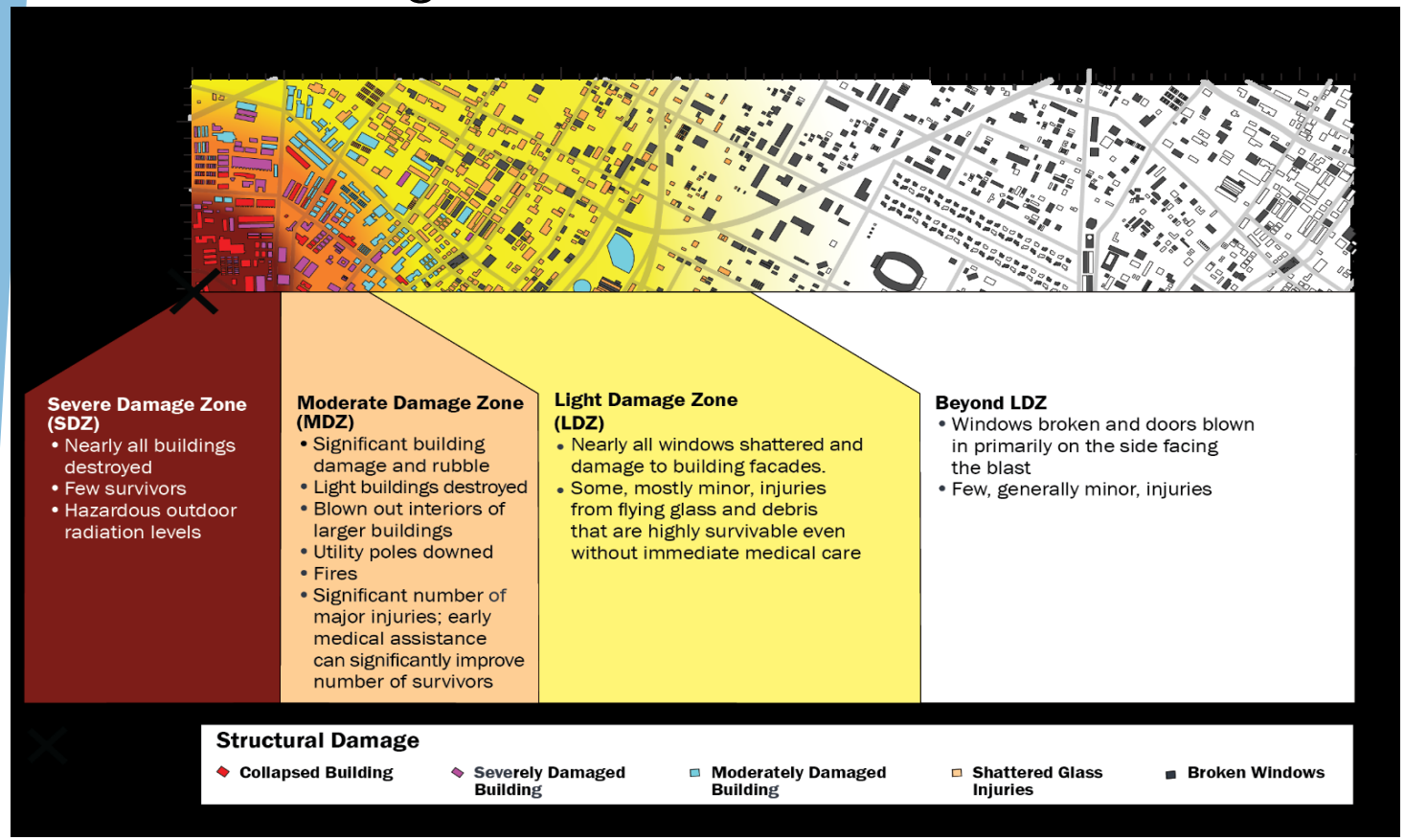
- Draft report for SLO & public consultation

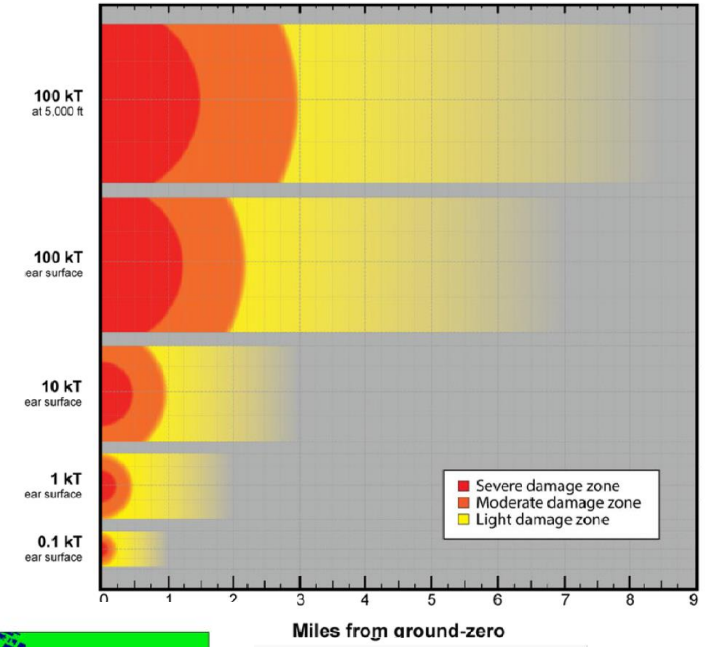
Phase 4 (Dec 26):

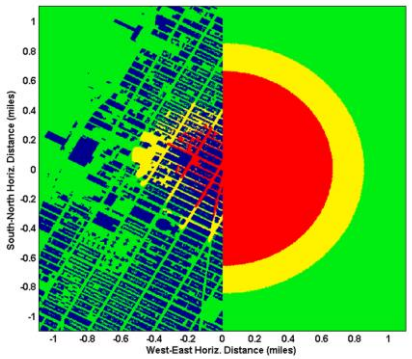
- Publish final report

Advice for the public in case of a nuclear detonation

- Damaged zone scale







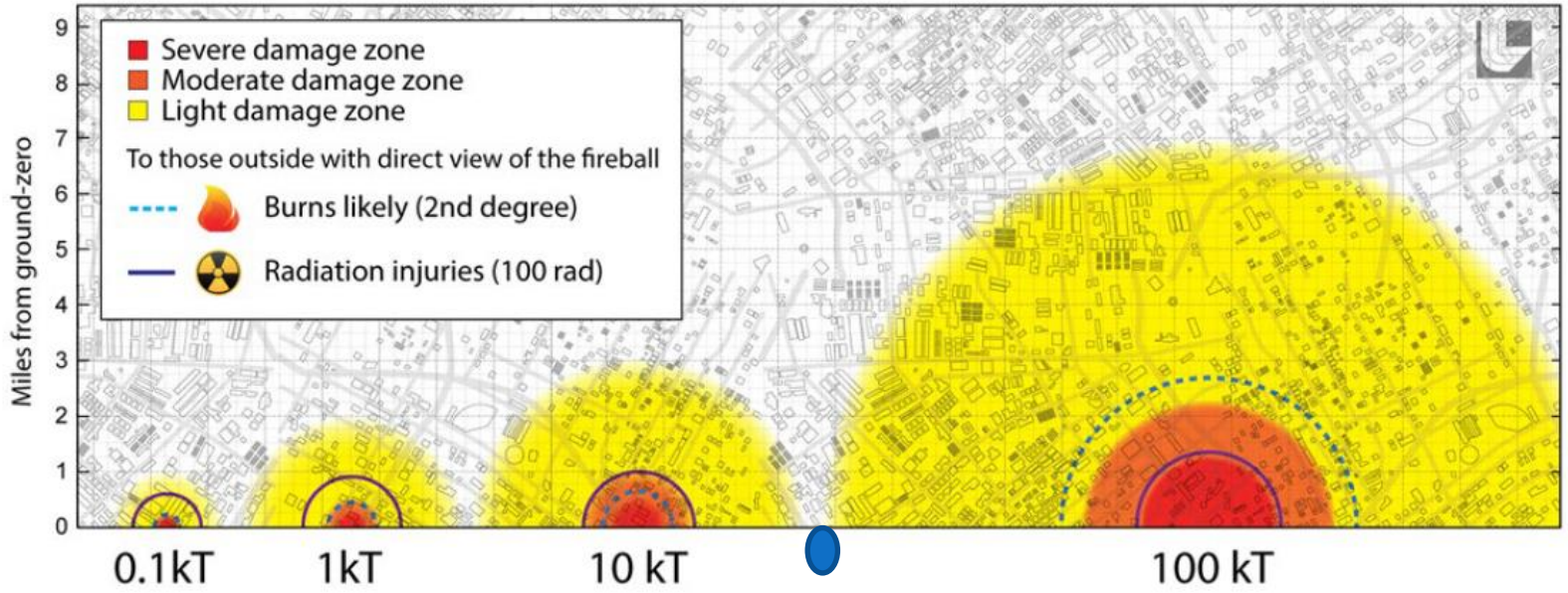
Main risk for health: Blast injuries

- often fatal in SDZ and MDZ
- more common injuries beyond MDZ

An unusual work performed by ICRP

- Radiation
  - Dangerous Radiation Zone (DRZ): prolonged outdoor exposure can result in injury or death
    - Radiation levels of 10 R/hr (100 mSv/h) and above.
  - Hot radiation zone: Operating in the HZ is unlikely to result in acute radiation effects, but radiation dose should be minimized.
  - 0.01 R/hr (10 μSv/hr) to 10 R/hr radiation levels

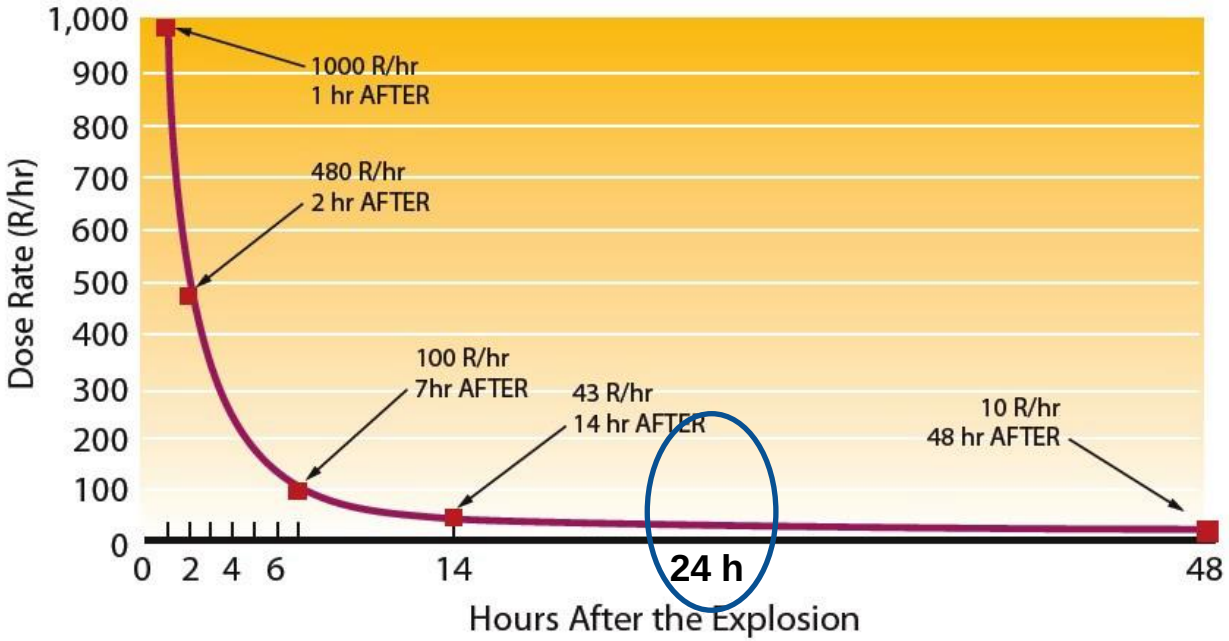
Initial radiation (first minutes)



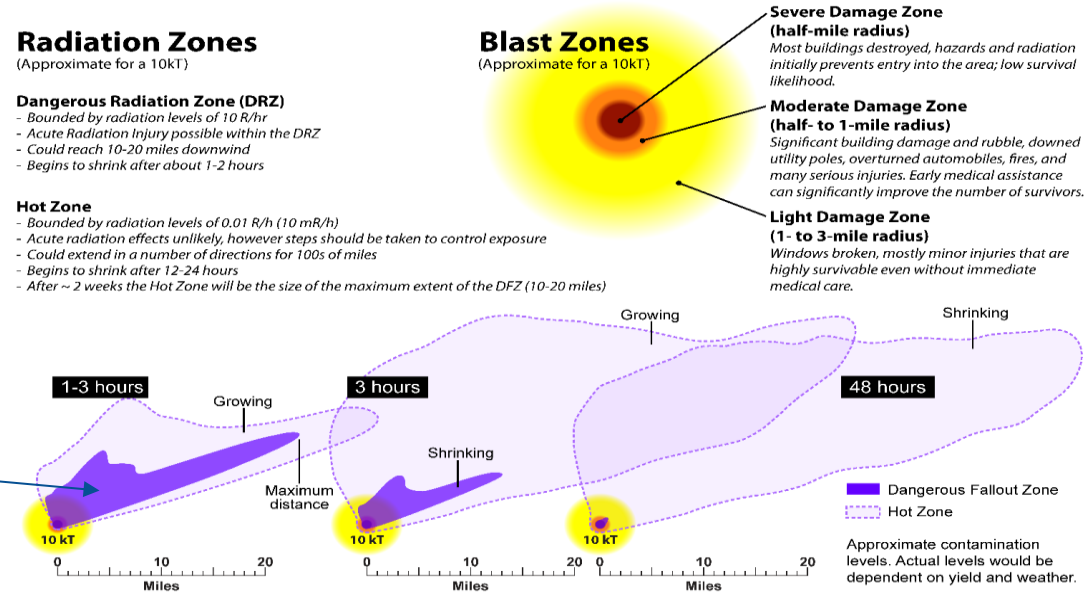
Means that if P > 10 kT, Radiation is not the most dangerous hazard

An unusual work performed by ICRP

Residual radiation (activation products and fission products)



Public actions **in dangerous radiation zone or in hot radiation zone**: "Get Inside, Stay Inside, Stay Tuned" for at least 12-24 hours unless threatened by fire, building collapse, medical needs, or other immediate threats.



DRZ goes beyond radius provoking injuries

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