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Radiological assessment and protection of first responders during a radiation emergency in EPC III and EPC IV

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First responders

A first responder is any first emergency worker to respond at the scene of an emergency.

An emergency worker is any person having a specified role as a worker in an emergency and who might be exposed while taking actions in response to the emergency.

Emergency workers may include those **employed by registrants and licensees** as well as **personnel from response services**, such as police officers, firefighters, medical personnel, rescue brigades and control teams for hazardous materials.



Exposure of emergency workers

- ✓ In an emergency exposure situation, the relevant **requirements for occupational exposure in planned exposure situations** shall be applied for emergency workers, in accordance with a graded approach.
- ✓ Response organizations and employers shall ensure that no emergency worker is subject to an exposure in an emergency in excess of **50 mSv** other than those who perform exceptional tasks.
- ✓ Assigned exceptional tasks have to be adequate to a **skills and experience** of emergency worker.

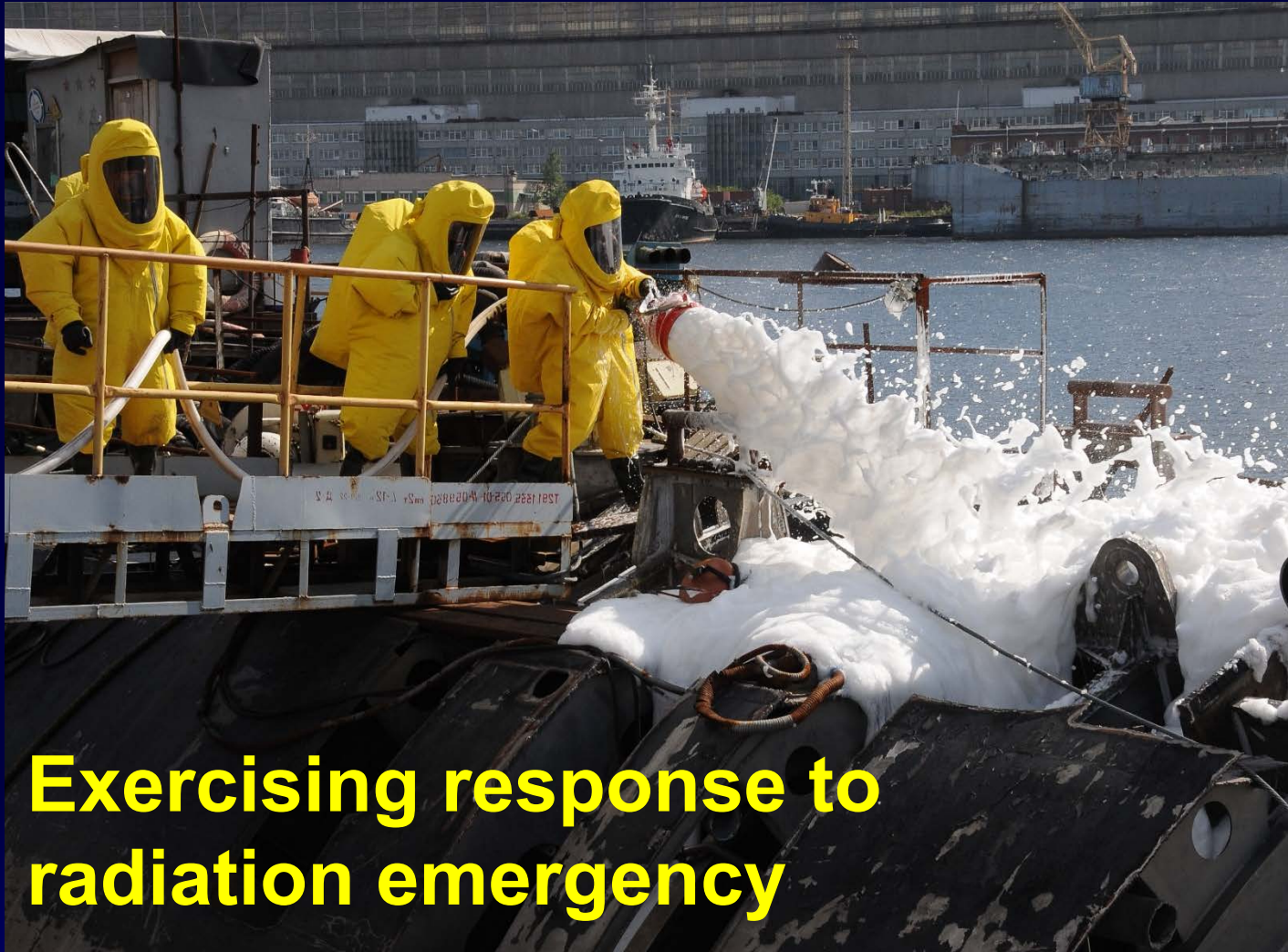


Emergency Preparedness Categories

Hazard and Emergency Planning Areas (EPA)	EPC
On-site: Severe deterministic effects Off-site: Severe deterministic effects. Warranting precautionary and urgent protective actions	I
On-site: Severe deterministic effects Off-site: Warranting urgent and other protective actions	II
On-site: Severe deterministic effects Off-site: No urgent protective actions are warranting	III
Unpredictable location in the country: Severe deterministic effects	IV
Continuation of EPA of EPC I facility in neighboring country: Warranting urgent and other protective actions	V



Radiation protection of first responders



**Exercising response to
radiation emergency**



Radiation protection of first responders











Conditions at scene

- ✓ First responder at scene has no
 - adequate information about radiation conditions.
 - adequate Individual protection devices.
 - adequate support from Radiological Assessor/Team.
- ✓ First responder has only his skills and knowledge for self protection.
- ✓ First responder **has the primary responsibility for protection from risks** at scene



Source emergencies in which first responders will be involved

EPC	Situation	What	Where
III	Loss of control over source in EPC III		
IV	Physical loss of controlled source in EPC III or IV		
IV	Orphan or stolen source		
IV	Malicious act		



Categorization of radionuclide sources

Activity	Danger to the person	Cat.
$A/D > 1000$	Extremely dangerous	1
$10 < A/D < 1000$	Very dangerous	2
$1 < A/D < 10$	Dangerous	3
$0.01 < A/D < 1$	Unlikely to be dangerous	4
$A/D < 0.01$	Most unlikely to be dangerous	5



Indication of dangerous sources

**Yellow Ionizing
Radiation Symbol
for any source**

ISO 361:1975
Basic ionizing
radiation symbol



**Red Ionizing
Radiation Symbol
for dangerous
sources in
category 1, 2 or 3**

ISO 21482:2007
Ionizing Radiation
Warning -
Supplementary
Symbol

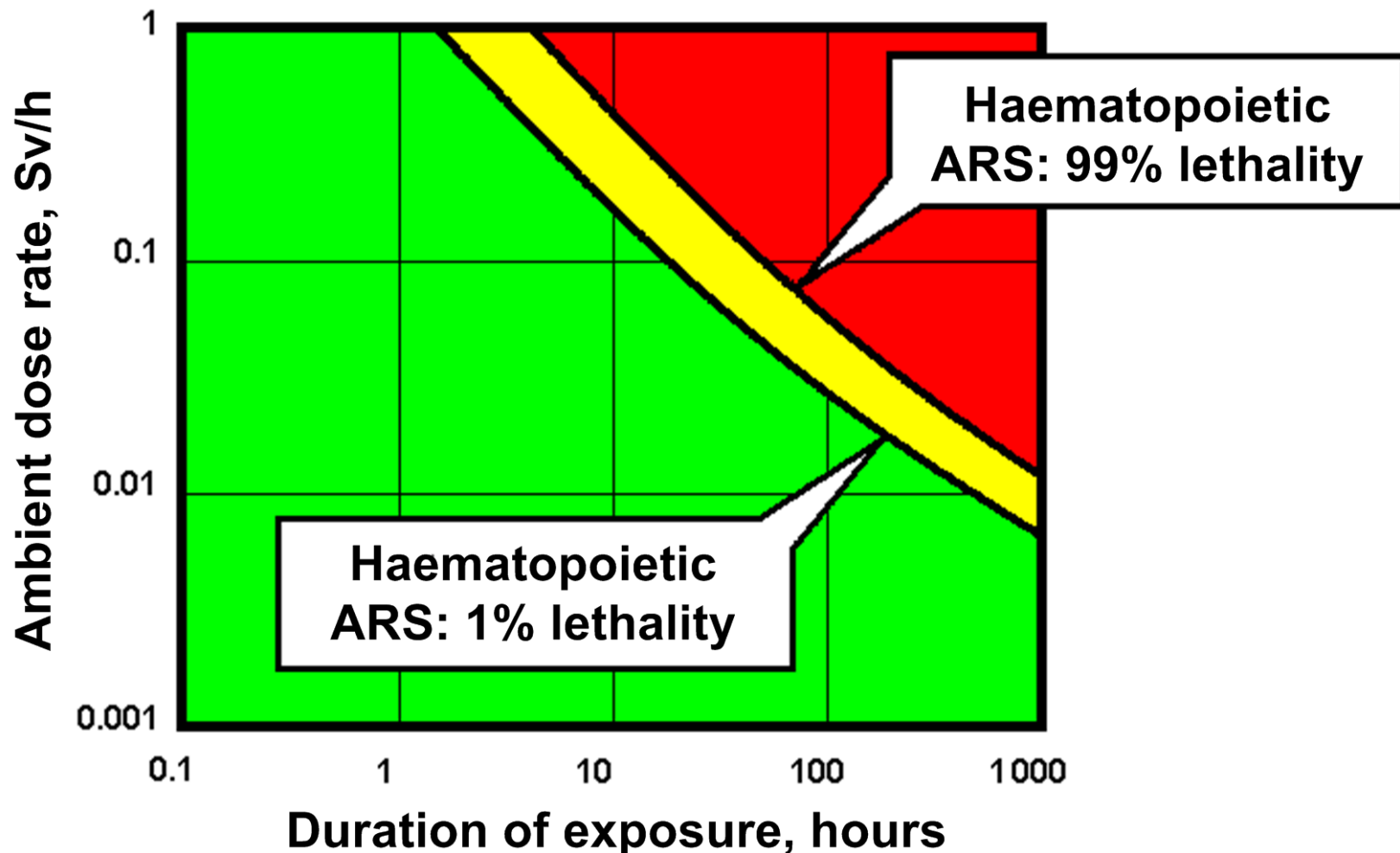


Radiation factors to be considered for first responders in EPC III and IV

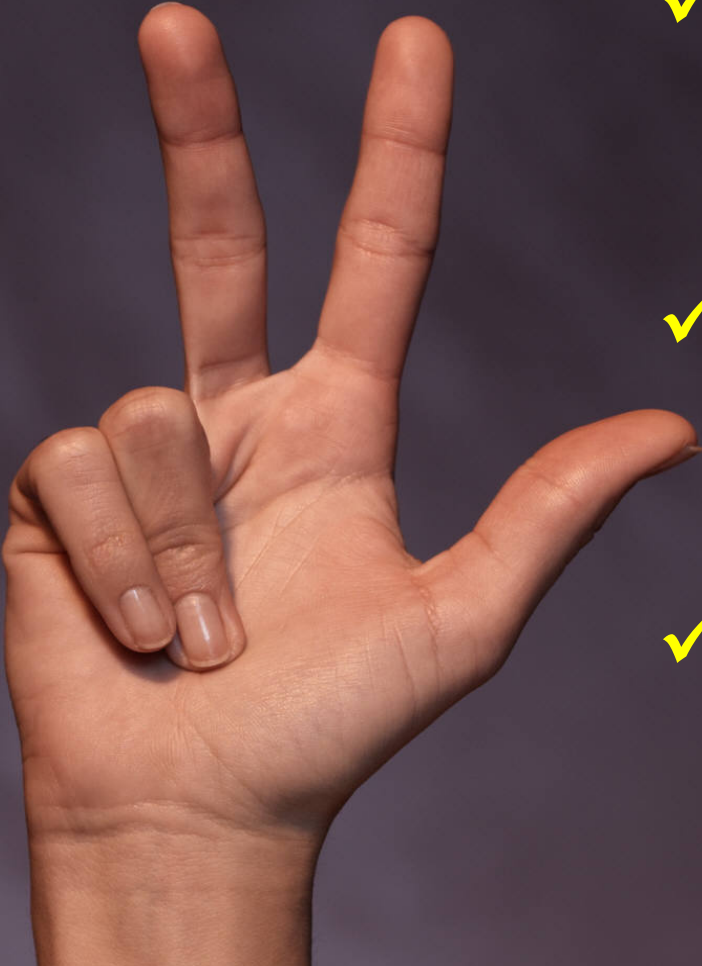
- ✓ **Whole body external exposure** from sealed source, ground deposition and surfaces ;
- ✓ **External exposure of open skin and lense of eye** from strong beta-emitters on surfaces
- ✓ **Contact exposure of skin** from strong beta-emitters fixed on/in the clothes;
- ✓ **Internal exposure** due to intake of radionuclides from fire/explosion or via dirty palms or inhalation.



Criteria of worker's protection from risks of external exposure



Radiation Protection: Rules of Thumb

- 
- ✓ **Protection with time:**
Shorter time of contact with the source - the lower dose
 - ✓ **Protection with distance**
Longer distance to the source – the lower dose
 - ✓ **Protection with shield**
More protective layers to the source – the lower dose

Individual protection of first responders

- ✓ Inform first responders of the radiological hazards present and safe working rules
 - external dose - time, distance, shielding
 - surface contamination - personal protective equipment
 - airborne contamination - respiratory protection
 - ingestion - don't put your hands in your mouth
 - inhalation - stay up wind
 - skin contamination- wear gloves, don't touch face
 - contamination spread - set up contamination control zones, monitor people in and out.
 - second devices/other non-radiological hazards - be alert for your own safety.



Skin/clothing contamination

- ✓ Not normally a concern only burns to skin or severe effects from inadvertent ingestion
- ✓ Only from direct contact with contamination from leaking container
- ✓ Unlikely from secondary contamination
 - For example, from a contaminated person
- ✓ Severe health effects not possible from contamination resulting from smoke
- ✓ Dangerous levels of contamination removed by:
 - Washing hands and face
 - Removing outer clothing
- ✓ Can be done by the public at home – if it can not be performed promptly at the site



Self-protection against Internal exposure



Radiation instrumentation can not see dangerous smoke or contamination



Be self-protected!



Avoid within 100 m



Summary

- ✓ Designation of the first responders in advance;
- ✓ Training of first responders on how to perform their specified duties under emergency conditions and how to protect themselves;
- ✓ Managing, controlling and recording the doses;
- ✓ Provision of appropriate specialized protective equipment and monitoring equipment;
- ✓ Medical follow-up;
- ✓ Obtaining informed consent to perform duties.



Thank you for your attention!



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