



دکتر زهره بیگدلی رئیس گروه مراقبتهای پزشکی مرکز نظام ایمنی هسته ای کشور مسئول امور پزشکی پرتوی پژوهشگاه علوم و غنون هسته ای

پائیز ۱۳۹۶

Emergency Medical management on Site and at Prehospital Level

WHAT IS DIFFERENCE OF RADIATION ACCIDENT FROM OTHERS?



IN NUCLEAR EVENTS, PARADIGM SHIFTS

Radiation can not be seen, heard, smelt, or felt & dose not cause immediate symptoms.

Contamination complicates.

FLOW OF MANAGEMENT





WHO ARE FIRST RESPONDERS?

A general team (police, fire, EMS) referring to an initial response in emergency.

NOTIFICATION

 Get call-back number and verify accident prior to assembling radiological emergency team.

Assume that victim is contaminated until proven otherwise.

RADIOLOGICAL INCIDENT CONTROL - INFORMATION -



ASSESSMENT OF ACCIDENT SCENE

- What hazards present?
- How many people were injured (too many, many....)?
- > When did the accident/incident occur?
- How were the material released into environment?
- Where are victims contaminated with/exposed to radioactive material?

ASSESSMENT OF ACCIDENT SCENE

	Severe trauma	Hazardous chemicals	Radioactive materials
Immediately threatens the lives of rescuers and victims?	Rescuers: no Victims: possibly	Possibly	No
Causes immediate visible evidence of skin injury?	Usually	Possibly	No
Causes cardiac or respiratory problems, pain, or unconsciousness?	Frequently	Possibly	Rarely

RADIOLOGICAL INCIDENT CONTROL ON SCENE

- Identify the substance if possible
- Consider all potential hazards
- Establish contamination control zones
- Protect personnel from radiation exposure
- Follow EPA protective action guides for radiation exposure
- Time , distance, shielding
- Protect equipment from contamination



RADIOLOGICAL CONTROL ON SCENE - ZONING -



EPA protective action guides for radiation exposure

FIELD TRIAGE DURING RADIATION EMERGENCY



INITIAL ASSESSMENT AND ESTABLISHING OF RESPONSE AREAS AND FACILITIES

After arrival on the scene of a radiological emergency, first responders should perform an initial assessment of the situation and radiological hazard.

Establish a safety perimeter.

ZONING

Ensure safety of the area and visualize the zoning lines by rope.



Safety perimeter line



SURVEY METERS

- Geiger-Muller (GM) Counters good use for contamination
- Ion Chambers more accurate, generally good overall field
- Scintillation Counters very sensitive; ideal for looking for sources or levels of radiation; not good in high radiation field000





GEIGER-MULLER (GM) COUNTERS

- **Detection** of β and γ-radiation (/min, cpm)
- Generally rugged field instruments, but window can be damaged, and then instrument is out of order
- It can be "maxed out" and will under-respond



PERSONAL DOSIMETER



Personal dosimeter – use as an alarming dosimeter and accumulated dose meter

DOSIMETRY

* TLD Badges

- Are passive (no batteries needed)
- Clip onto front of clothing
- Mandatory Everyone wears one
- Dose information is read later

***** Electronic Dosimeters

- Must have battery inserted to function
- > Are <u>optional</u>
- > Provide direct dose readout







DOSE RATE LIMIT RECOMMENDATIONS

Activities	Suggested Turn-back Exposure Rate	Guidelines for Total Accumulated Dose	Increased cancer Risk*
Emergency worker dose limit	Follow Radiation safety Officer instructions	50 mSv	0.5%
Non-lifesaving activities (major critical property protection)	100 mSv/hr	0.5 Sv**	5%
Lifesaving activities	2 Sv/hr	1 Sv**	1.0%

*National Council on Radiation Protection and Measurements Report No. 138. ** International Atomic Energy Agency EPR-First Responders 2006.

EMERGENCY WORKER TURN BACK DOSE GUIDANCE*

Tasks	Do not exceed unless Approved by incident commander
 Actions to avert a large collective dose, such as: Environmental sample collection and analysis for environmental monitoring of populated areas; Localized decontamination if required to protect the public. 	50 mSv

*IAEA EPR-First Responders 2006.

EMERGENCY WORKER TURN BACK DOSE GUIDANCE*

Tasks	Do not exceed unless Approved by incident commander
Actions to prevent severe health effects or injuries,	
such as:	
•evacuation/protection of the public;	
•environmental monitoring of populated areas to	
identify where evacuation, sheltering or food	
• Rescue from potential threats of serious injury:	SOO IIISV
•Immediate treatment of serious injuries;	
•Urgent decontamination of people	
•Prevention or mitigation of fires;	
•Apprehension of terrorist suspects.	

*IAEA EPR-First Responders 2006.

EMERGENCY WORKER TURN BACK DOSE GUIDANCE*

Tasks	Do not exceed unless Approved by incident commander
 Life saving actions, such as: Rescue from immediate threats to life; Provision of first aid for life threatening injuries; Prevention /mitigation of conditions that could be life threatening. 	1000 mSv
*IAEA EPR-First Responders 2006.	



RADIOACTIVE MATERIALS

Can be in the form of :
Solid (Powder, dust, metal)
Liquid
Gas
Others

WHAT IS CONTAMINATION?

Radioactive material in the form of smokes, dust or liquids is called contamination and if such material gets on a surface, object or person, they become contaminated.

INTERNAL VS. EXTERNAL CONTAMINATION





External Contamination

BASIC PRINCIPLES FOR HANDLING CONTAMINATED PATIENTS

- 1. **Treat life-threatening** conditions first without regard to radiation or contamination
- Isolate patient and restrict access to the treatment/evaluation area
 Maintain contamination control
- 3. Internal contamination is never immediate lifethreatening

RADIATION DOES NOT CAUSE :

Immediate death

Immediate symptoms (burns, wounds)

Contaminations alone :
 Not immediate threat to victim
 Not threat to responders or others



TRIAGE OF RADIATION CASUALTIES (1)

Triage – first task for multiple casualties :

 Sorting of victims depending on condition, urgent needs and number

Decision on prompt FIRST medical intervention

 life saving immobilization of fractures urgent
 investigations

TRIAGE OF RADIATION CASUALTIES (2)

- Always employ standard medical triage principle
- Decontamination can be done before, during, or after initial stabilization, depending on the severity

The most important decontamination is to remove all clothes at the site
CONTAMINATION CONTROL : AT THE SITE

Remove contaminated clothing

Cover patient and secure

Transfer patient by cold team

PROTECTIVE CLOTHING (1)

- Effective in stopping α and some β
 particles
- Not effective for γ-rays
- Lead aprons are not recommended since they will not stop most

PROTECTIVE CLOTHING (2)

- Use water proof materials
- Place clothing and any accompanying sheets, blankets, and others in a plastic bag
- Change instruments, outer gloves, and drapes after handling clothing or other potentially contaminated items

DO NOT CONTAMINATE PERSONAL DOSIMETER



Personal dosimeter

Not to contaminate, it should be put inner the personal protective clothing.

TYPICAL PROTECTIVE CLOTHING



RESPIRATORY PROTECTION

- Respiratory protection if necessary
- **Breath filtered air**
- It protect from inhalation of radioactive materials.



PROTECTIVE EQUIPMENT FROM CONTAMINATION



CONTAMINATION CONTROL DURING RESCUE OPERATIONS

- Use personal protective measures and means
- Do not eat, drink, smoke, rub eyes, or apply make-up in contaminated area
- Use good work practices
 - Appropriate equipment
 - Control lines

Assume contamination when in doubt



RECOMMENDED PROCEDURES FOR ON-SCENE RESPONDERS (1)

- 1. Personal protective gears with a personal dosimeter
- 2. Transport medically unstable patients. A survey, decon may be performed in the ambulance.
- 3. Move the stable patients to a low background area, remove the other clothing and wrap in a sheet or a blanket.
 4. Treat injuries.



RECOMMENDED PROCEDURES FOR ON-SCENE RESPONDERS (2)

- 5. Do not release stable patients to ambulance before radiological survey. Perform preliminary decontamination.
- 6. Decontaminate gently.
- Save everything (clothing, bedding, watch, coins, buckles, jewelry, cellular phone, vomitus, etc.), tag each item.
- 8. Transport the patient to medical facility.

CONTAMINATION CONTROL FOR AMBULANCE PERSONNEL

- Remove protective gear at control line and get surveyed
 - Clean team can transport patient to hospital
 - or
 - Put on clean gloves and gown, and transport patient
- At hospital, transfer patient to clean treatment table in contaminated patient area
- >Await survey for contamination

REMOVE VICTIMS FROM HAZARDOUS AREA

- If there is immediate lifethreatening hazard in the area, remove victim first.
- > Hazardous area :
 - ► Fire
 - ► Smoke
 - ► Steam
 - ► Chemicals
 - ► Electrical
 - Radioactive contamination
 - high air dose rate



RESCUE

 Remove injured person from the hazard area into the triage area as soon as possible.



LIFE SAVING

- Medical triage
- Assess and treat lifethreatening injuries immediately
- Life-threatening injured victim should transport into hospital immediately, even if contamination survey has not been done.





EXTERNAL CONTAMINATION REMOVAL



Contaminated Patient after removal of outer clothing and shoes



REMOVE CONTAMINATED CLOTHING AT THE ACCIDENT SCENE



CONTAMINATION SURVEY



It is possible to perform radiological survey during stabilization of victim if monitoring procedures do not interfere with medical actions at scene.

COVER CONTAMINATED WOUNDS



Cover contaminated wounds with sterile dressings before transport into hospital emergency room.

PATIENT MANAGEMENT -DECONTAMINATION-

Carefully remove and bag patient's clothing and personal belongings

(Typically removes 95% of contamination) **Decontamination priorities:**

Decontaminate wounds first, then intact skin

Start with highest levels of contamination

Change outer gloves frequently to minimize spread of contamination

Do not delay surgery or other necessary medical procedures or exam...residual contamination can be controlled

PERFORM GROSS DECONTAMINATION

If needed and also If it will not interfere with critical care





TRANSPORT OF CONTAMINATED VICTIMS (1)

- Victims are to be transported by medical or paramedical personnel who have not entered the controlled area on scene.
- Assume all victims are contaminated until proven otherwise.
- Continue medical assessment and treatment during transport when necessary.

TRANSPORT OF CONTAMINATED VICTIMS (2)

- Place the ambulance stretcher on the clean side of the outer
 cordoned line and pass
 the victims across the
 outer cordoned line to
 the prepared stretcher.
- Cover victim by folding a sheet or blanket.



CONTAMINATION CONTROL ON TRANSPORTATION









USE CAUTION AROUND CONTAMINATION



CONTAMINATION CONTROL

- Use universal precautions
 Frequently survey hands and clothing with radiation meter
- Replace gloves or clothing that is contaminated
- Keep the work area free of contamination and radiation sources





PROTECTION AGAINST CONTAMINATION

 Protection can be improved by performing frequent measurements for contamination, dealing with it as it is found and controlling the accumulation of radioactive waste.







CONTAMINATION CONTROL

Contamination that cannot be cleaned can be controlled by taping over it with an impervious covering.





* The White Rose *

DETECTING RADIATION

Compared to chemical and biological hazards, radiation and radioactive materials are easy to detect and measure.







RADIOLOGICAL INCIDENT CONTROL - PREVENTION OF CROSS CONTAMINATION -



Tool drop before leaving hot zone

Contamination check





Hot area marked off with tape and stanchions

CONTAMINATION CONTROL

Before leaving the inner cordoned area, first responder should be checked contamination and change clothing if needed.

MANAGEMENT OF RADIOACTIVE WASTE

- Collect radioactive waste in plastic bags.
- Survey bags periodically to prevent high radiation levels in the work area.
- Use distance to protect against radiation from radioactive waste.
- Use walls, dirt mounds, hills, etc. as shielding for radioactive waste.



RULES OF THUMB

- Removing outer clothing will remove majority of contamination.
- Washing hands and heads can remove most of the remaining contamination.
- For large incidents, containment of runoff is not necessary.


RULES OF THUMB

 Most of the airborne radioactive dust from an outdoor explosion will settle to the ground within 10 minutes.

Without better information, evacuate away from plume settling to at least 500 meters.

SUMMARY

Actions of Primary Significance in Pre-hospital Medical Management of Radiation Accidents

- 1. Rescue, resuscitation, emergency aid
- 2. Medical stabilization of general condition of victim and of serious injuries
- 3. Removal of patients from contaminated area
- 4. Assessment of external contamination
- 5. Decontamination and DE corporation preventing internal contamination of patient and contamination of staff



Thank you for your attention