

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Title: Radiological Emergency

Purpose:

To make sure procedures are in place to ensure a maximum degree of safety for the safe and effective response to a radiological emergency incident. It shall establish minimum requirements to control and mitigate an incident involving a radioactive material. This procedure is not intended to address WMD radiological incidents.

Policy:

This procedure will apply to incidents where the Hazardous Materials Response Team responds to and determines or suspects that radiological materials are involved. It is the intent of this policy to utilize the appropriate portions of Title 10 CFR part 20, Title 44 CFR, OSHA 29 CFR 1910.120, DOT 49 CFR, and EPA 40 CFR for emergency response to actual or suspected discharges radioactive materials.

Applicability:

This policy shall be utilized to guide activities of a Hazardous Materials Response Team when confronted with a radiological incident. The Hazardous Materials Group Supervisor is responsible for making sure the Incident Commander is aware of the hazards involved and the Hazardous Materials Response Team shall follow these guidelines in assuring the safety of the Hazardous Materials Response Team members, operations personnel, and the public.

Procedures:

1. Approach site with caution. Position personnel, vehicles, and command post at a safe distance upwind and upslope of the site, if possible. Get no closer than 330' from suspected source.
 - Verify downwind evacuation.
2. Ensure safety of responders.
 - Identify all hazards (danger of fire, explosion, toxic fumes, electrical hazards, structural collapse, etc.).
 - Identify cargo.
 - Obtain information concerning the cargo from package markings, labels, placards, shipping documents, and other immediately available sources.
 - Identify physical and chemical form of radioactive material.
 - Identify radiological characteristics and hazards of radioactive material.

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

- Keep upwind of smoke, vapors, etc.
 - Follow usual protocols for respiratory protection, use of protective clothing, and turnout gear. As an example - hooded jump suit, positive pressure SCBA, chemical boots and surgical type disposable gloves.
 - Monitor changing conditions that could create hazardous situations.
3. Locate patients and facilitate extrication, emergency care, and transportation of the injured.
- Make any immediate rescue of victims as required. Consider all personnel that were in radiation hot zone to be contaminated until monitoring proves otherwise, if radioactive material was released or spilled. (Have Medcom advise the local hospital to prepare for possible radioactive contaminated patients).
4. Communications.
- Make sure appropriate notifications have been made.
 - Notify hospital of possible contamination/exposure of patient.
 - Notify state radiological assistance (emergency response center) of accident conditions.
5. Ensure radiation protection and contamination control.
- Assign each person a dosimeter – zero dosimeter, record time, don dosimeter.
 - Evacuate personnel who were in the immediate downwind area. Detain personnel who were in the accident area until they can be surveyed for contamination. Follow instructions of radiation authority.
 - Keep all personnel that may have been exposed / contaminated in the warm zone until evaluated and/or decontaminated. If monitoring indicates 2 times background, this may indicate contamination.
 - Do not allow eating, drinking, smoking, chewing, or other activities within contaminated areas that might lead to intake of radioactive material.
 - Avoid exposure to smoke, fumes, vapors, dust, or direct contact.
 - Avoid direct contact with radioactive material where possible. Utilize protective clothing and anything available for remote handling (shovels, branches, ropes, etc.).
 - Do not touch damaged containers or contact any spilled material.

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

- Limit time near radioactive material. Rotate staff as necessary.
 - Prepare radiological detection equipment – establish background level.
 - Make sure zones are established – use survey meter to establish. Establish Hot Zone at the 2 mR/hr level above normal background for a full 360 degrees. Designate with Bannerguard or other physical barrier.
 - Set up contamination survey area and decon area. This will be the warm zone.
 - Remove protective gear/clothing in the decon corridor
 - Wrap, label, and isolate all clothing, tools, etc., used in the hot zone, and retain them until they can be cleared by radiation authority.
 - Determine if measures are needed to contain all accident debris in the hot zone until cleanup is achieved. Prevent unnecessary handling of incident debris.
6. Documentation.
- Record the names and addresses of all persons involved, including those who insist on leaving the area; rescuers; those removed for medical attention; and ambulance personnel.
 - If exposures were identified, then make sure proper paperwork and follow-up are done.
 - Make detailed records of the incident.
7. Delay cleanup pending instructions from radiation authority. Coordinate cleanup activities at the site with public officials.

To Avoid Unnecessary Radiation Exposure/ Contamination Rely on two Key Elements:

1. **TIME:** The rule is “*Keep contact time with packages short. Handle packages of radioactive material without delay when moving them. DO NOT do time-consuming tasks near packages*”.
2. **DISTANCE:** The rule is “*Avoid staying close to packages unnecessarily*”.

Shielding can be Used in some cases to reduce or minimize exposure.

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Additional Guidance:

Recommendations for Emergency Screening in Areas Not Qualifying as Low Background Areas.

This section provides the recommended surface contamination screening levels for emergency screening of people and objects at monitoring stations in areas with elevated background radiation (exceeding 0.1 mR/hr or 1 μ Sv/hr gamma exposure rate). Monitoring stations in such high exposure rate areas are for use only during the early phase of an incident involving major atmospheric releases of particulates (otherwise see Low Background Areas below). For such emergency screening at monitoring stations, recommended actions for a detection instrument reading at either less than or greater than 2x existing background are outlined below.

a) Before Decontamination:

- If **<2x** existing background — *recommended action*: Release for further screening outside affected area.
- If **>2x** existing background — *recommended action*: Perform gross decontamination (carefully remove outer layer of clothing) and/or simple decontamination (examples include washing hands and face, wiping of exposed skin, washing feet or soles of shoes). Equipment may be stored for decay, reuse, or disposal in the same area, as appropriate.

b) After Decontamination:

- If **<2x** existing background — *recommended action*: Release for further screening outside affected area.
- If **>2x** existing background — *recommended action*: Continue to decontaminate or refer to low background monitoring and decontamination station. Equipment may be stored for decay, reuse, or disposal in the same area, as appropriate.

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Recommendations for Screening in Low Background Areas:

This section provides the recommended surface contamination screening levels for people and objects at monitoring stations in low background radiation areas (<0.1 mR/hr or 1 μ Sv/hr gamma exposure rate). People reporting to monitoring stations in low background radiation areas have been previously instructed to change and bag clothes, wash other exposed surfaces such as cars and their contents, and then report to these centers for monitoring. Levels higher than 2x existing background (not to exceed the meter reading corresponding to 0.1 mR/hr) may be used to speed the monitoring of evacuees in very low background areas. For screening at monitoring stations in low background areas, recommended actions for a detection instrument reading at either less than or greater than 2x existing background are outlined below.

1. Contamination Levels:

- Up to measuring 1000 cpm beta/gamma — *recommended action:* Decon can occur at home, discard clothing and shower.
- Levels 1,000 – 10,000 — *recommended action:* Remove Clothing and Decon on site
- Higher Levels — *recommended action:* recommend medical follow-up

a) Before Decontamination:

- If **<2x** existing background — *recommended action:* Unconditional release.
- If **>2x** existing background — *recommended action:* Perform gross decontamination (carefully remove outer layer of clothing) and/or simple decontamination (examples include washing hands and face, wiping of exposed skin, washing feet or soles of shoes).

b) After Simple Decontamination Effort:

- If **<2x** existing background — *recommended action:* Unconditional release”.
- If **>2x** existing background — *recommended action:* Full decontamination.

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

c) After Full Decontamination Effort: Changing Clothes and/or showering are examples of a full decontamination effort. Washing or gentle scrubbing with soap or other mild detergent followed by flushing is another example of a full decontamination effort:

- If **<2x** existing background — *Recommended action:* Unconditional release.
- If **>2x** existing background — *Recommended action:* Continue to decontaminate people.

d) After Additional Full Decontamination Effort:

- If **<2x** existing background — *Recommended action:* Unconditional release.
- If **>2x** existing background — *Recommended action:* Send people for further evaluation.

Emergency Worker Guidelines

Guideline	Activity	Condition
5 rem (50 mSv)	All occupational exposures	All reasonably achievable actions have been taken to minimize dose.
10 rem (100 mSv) a	Protecting critical infrastructure necessary for public welfare (e.g., a power plant)	Exceeding 50 rem (50 mSv) unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
25 rem (250 mSv) b	Lifesaving or protection of large populations	Exceeding 5 rem (50 mSv) unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
>25 rem (250 mSv)	Lifesaving or protection of large populations	All conditions above and only for people fully aware of the risks involved.
<p>a - For potential doses >5 rem (50 mSv), medical monitoring programs should be considered.</p> <p>b - In the case of a very large incident, such as an Improvised Nuclear Device, Incident Commanders may need to consider raising the property and lifesaving emergency worker guidelines to prevent further loss of life and massive spread of destruction.</p>		

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Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Following is a list of prefixes and their meanings:

- micro (μ) means "one millionth of" or (0.000001)
- milli (m) means "one thousandth of" or (0.001)
- centi (c) means "one hundredth of" or (0.01)
- kilo (k) means one thousand (1,000)
- mega (M) means one million (1,000,000)
- giga (G) means one billion (1,000,000,000)
- tera (T) means one trillion (1,000,000,000,000)

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Acute Radiation Syndrome

Feature or Illness	Effects of Whole Body Absorbed Dose from External Radiation or Internal Absorption, by dose range in rad (Gray)				
	0-100 (0-1 Gy)	100-200 (1-2 Gy)	200-600 (2-6 Gy)	600-800 (6-8 Gy)	>800 (>8 Gy)
Nausea, Vomiting		5-50%	50-100%	75-100%	90-100%
Time of Onset	None	3-6 hr	2-4 hr	1-2 hr	< 1 hr to minutes
Duration		< 24 hr	< 24 hr	< 48 hr	< 48 hr
Lymphocyte Count	Unaffected to Slight Decrease	Minimally Decreased	<1000 at 24 hr	<500 at 24 hr	Decreases within hours
Central Nervous System Function	No Impairment	No Impairment	Cognitive impairment for 6-20 hr	Cognitive impairment for >20 hr	Rapid incapacitation
Mortality	None	Minimal	Low with aggressive therapy	High	Very High: Significant neurological symptoms indicate lethal dose

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Label	Label Information	Example
Radioactive White-I	Extremely low radiation levels 0.5 mrem/hr (0.005mSv/hr) maximum on surface	
Radioactive Yellow-II	Low radiation levels >0.5 – 50 mrem/hr (0.5 mSv/hr) maximum on surface; 1.0 mrem/hr (0.01 mSv/hr) maximum at 1 meter	
Radioactive Yellow-III	High radiation levels >50 – 200 mrem/hr (2mSv/hr) maximum on surface; 10 mrem/hr (0.1 mSv/hr) maximum at 1 meter	
Fissile	Applied to packages that contain fissile materials. The Criticality Safety Index (CSI) for each package will be noted on the label. When used, the fissile label will appear adjacent to the radioactive material label.	

Limits for Exclusive-Use Vehicles	In Cabin	At the vehicle surface
Radioactive LSA	2 mrem/hr (0.02 mSv/hr)	200 mR/hr (2mSv/hr)

Model Hazardous Materials Emergency Response Procedures

Florida State Working Group HazMat Operations

Rev. June 26, 2019.

Radiological Emergency

Glossary:

Becquerel: The SI unit of radioactivity, or "activity" 1 disintegration per second; 37 billion Bq=1 curie.

Curie: A unit of measure used to describe the amount of radioactivity in a sample of material. Symbol: Ci (SI unit is Bq, becquerel).

Exclusive use: When a single shipper transports the material and all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the shipper or receiver.

Fissile Material: Material whose atoms are capable of nuclear fission (capable of being split). Department of Transportation (DOT) regulations define fissile material as plutonium-239, plutonium-241, uranium-233, uranium-235, or any combination of these radionuclides.

Gray (Gy): The SI unit of absorbed dose; 1 gray=100 rad.

LSA: Low Specific Activity material means the radioactive material is distributed throughout a substance to such an extent that it poses little hazard even if released in an accident. Examples would include uranium and thorium ores.

Rad: The unit of radiation absorbed dose. (SI unit is gray).

Rem: A measure of radiation dose related to biological effect. (SI unit is Sievert).

Roentgen (R): The unit of exposure from X or gamma rays.

Sievert (Sv): The SI unit of dose equivalent; 1 Sv=100 rem.

Conversion Table

United States Unit	SI Unit
100 rad	1 Gray (Gy)
10 rad	0.1 Gy
1 rad	0.01 Gy
1 mrad	0.01 mGy
100 rem	1 Sievert (Sv)
10 rem	0.1 Sv
1 rem	0.01 Sv
1 mrem	0.01 mSv
1 Curie (Ci)	37 billion Becquerel (Bq)