

# **HANDBOOK FOR RESPONDING TO A RADIOLOGICAL DISPERSAL DEVICE**

**FIRST RESPONDER'S GUIDE**

**THE FIRST 12 HOURS**

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New York State Department of Health

**DEVELOPED BY THE  
CONFERENCE OF RADIATION  
CONTROL PROGRAM DIRECTORS  
(CRCPD)**

**HS-5 TASK FORCE**

**WITH FUNDING FROM THE  
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CDC	Robert Whitcomb
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# **TARGET AUDIENCE**

**First Responders with  
various degrees of  
radiological experience  
(from none to advanced)**



# FIRST PRODUCT: THE RDD POCKET GUIDE

### SUGGESTED ZONES FOR IMPACTED AREA

★ Incident Command

Extreme Caution Zone Boundary @ 100 ft/hr

High Radiation Zone Boundary @ 100 ft/hr

Medium Radiation Zone Boundary @ 100 ft/hr

Low Radiation Zone Boundary @ 100 ft/hr

Assume 1 milliroentgen (mR) = 1 millirem (mrem)  
1 R/hr = 1000 mR/hr

### INCIDENT ZONES AND SUGGESTED ACTIVITIES FOR EACH ZONE DURING THE FIRST 12 HOURS

Boundary mR/hr	Incident Zones mR/hr	Activities	Total Stay Time*
Background	Uncontrolled	No restrictions. Best location for Incident Command and decontamination activities.	Unlimited
<10	Low Radiation Zone <10-100	If feasible, restrict access to essential personnel. Initial decontamination of responders should occur near outer boundary. Uninjured personnel can be directed home to shower if contamination surveying at the scene is not feasible.	Full 12 hours
100	Medium Radiation Zone 100-1000	Only authorized personnel. Personal dosimetry should be worn. Buffer zone/transition area between the high and low radiation zones. Survey people for contamination before releasing.	5 - 12 hours (12 hours for critical property and lifesaving)
1000	High Radiation Zone 1000-10,000	Only authorized personnel with specific critical tasks such as firefighting, medical assistance, rescue, extrication, and other time-sensitive activities. Personal dosimetry should be worn. Survey people for contamination before releasing.	30 minutes - 5 hours
10,000	Extreme Caution Zone > 10,000	Located within the high radiation zone. Restricted to the most critical activities, such as lifesaving. Personal dosimetry required (only monitor for severe responders is acceptable). Limit time spent in this area to avoid Acute Radiation Sickness. Survey people for contamination before releasing.	Minutes to a few hours

\*Total Stay Time is calculated by dividing total allowed dose by exposure rate. For example, if total allowed dose for lifesaving is 50,000 mrem, Total Stay Time in a 200,000 mR/hr field is 15 minutes.

### TURN-BACK EXPOSURE RATES AND DOSE GUIDELINES

Activities	Suggested Turn-Back Exposure Rates	Guidelines for Total Accumulated Dose	Increased Cancer Risk*
Emergency worker dose limit	Follow Radiation Safety Officer Instructions	5,000 mrem**	0.9%
Non-lifesaving activities (major critical property protection)	10,000 mR/hr	10,000 mrem	1%
Lifesaving activities	200,000 mR/hr***	50,000 mrem	9%

\*National Council on Radiation Protection and Measurements Report No. 138.  
\*\*Note that the 5,000 mrem dose guideline represents the standard occupational dose limit for one year. The 50,000 mrem dose guideline is a level where effects from short-term radiation exposure are possible.  
\*\*\*Specific approval and controls required to exceed this turn-back exposure rate.

### The Penetrating Ability of Radiation

Alpha: Stopped by sheet of paper or skin.

Beta: Stopped by layers of clothing.

Gamma: Penetrates through several feet of lead or concrete.

Neutron: Penetrates through several feet of lead or concrete.

### FIRST RESPONDER'S GUIDE RADIOLICAL DISPERSAL DEVICE DIRTY BOMB

The First 12 Hours

Conference of Radiation Control Program Directors, Inc. (CRCPD)  
For ordering information, visit www.crcpd.org or call 822/227-4543.  
CRCPD-P.A. 06-1

This guide is a quick reference for State and local first responders. It provides general information for use during the first 12 hours after the detonation of an explosive radiological dispersal device (RDD), also called a *dirty bomb*.

It does not attempt to address all situations, but many concepts can be applied to other types of radiation incidents. A CRCPD RDD companion handbook provides additional information including contacts. The last page of this booklet provides an area to list your contact numbers.

Law enforcement and local/State radiation control staff play a key role in response to an RDD event. It is assumed that an incident command structure has been established and its role is not discussed in this guide.

Radiation usually is measured by field survey instruments in Roentgens per hour (R/hr), milliroentgens per hour (mR/hr), or counts per minute (cpm). It is strongly recommended that you become familiar with your radiation detection equipment prior to responding to an incident. Refer to your instrument user's manual or the CRCPD RDD handbook for additional guidance.

Contact your State or local radiation control program for recommended policies and procedures or if you have questions.

## Remember ... Saving Lives is a Priority!

### Rules of Thumb

- For outdoor explosions, most of the airborne radioactive dust will have settled to the ground within 10 minutes.
- In the absence of any other information, evacuate to 500 meters (1650 feet) from the detonation site in all directions.
- Check batteries and turn on your radiation detection instrument prior to arriving at the incident scene.
- Do not plan to perform decontamination if a large number of people are affected.
- Removing outer clothing can eliminate the majority of contamination.
- For large incidents, it is not necessary to retain runoff.

### Contacts

Local/State Radiological Lead Agency \_\_\_\_\_

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# **THE RDD HANDBOOK**

# **What is the RDD Handbook?**

- **Companion to the RDD pocket guide**
- **Developed for state and local responders who may be called upon to respond to a radiological dispersal device or “dirty bomb”**
- **Training and Reference tool for Responders**

# **Why did we put it together?**

- **Ability to deal with radiological incidents at the local and state level varies across the country**
- **Some states/localities have very advanced plans (especially those that have nuclear power plants) to deal with radiological emergencies, while others do not**



- **Focuses on the first 12 hours**
- **Assumes local/state Radiation Control Staff will be available within 12 hours (Usually only a “phone call” away)**



**Note: In New York State, one call to the State Warning Point (Emergency Coordinating Center) gets the system moving!**

# Highlights of the Handbook

- **Flowchart**
- **Definition of Radiation Zones aka the “Bull’s Eye”**
- **Suggested Activities for each zone**
- **Turn back exposure rates**
- **Decontamination Guidelines**
- **Conducting Radiation Surveys**
- **Forms**
- **Contacts (Local/State/Federal)**

# **EXAMPLE OF AN RDD SCENARIO**

- **Radiological attack occurs in center of a major city**
- **Contaminated area is about 20 city blocks**
- **Radiation levels range from 2 -2000 mrem/hr**
- **Contamination levels are from background to 10 million cpm**
- **About 200,000 people live and work in affected area and 2.5 million people live and work in the city**

# **TRANSPORTATION SCENARIO**

- **At 0650, the City of Albany 911 dispatcher received a call that a tanker truck hit a shipping truck while changing lanes southbound on 787 near the Port of Albany exit**
- **Caller stated that a van travelling on the right lane, couldn't stop in time and collided with the shipping truck**
- **The tanker truck is on fire**
- **There appear to be several casualties**
- **The roads are wet and sleek (with freezing rain and sleet)**

# THE SCENARIO

- **At 0702 Albany City Police, two ambulances and three fire trucks arrive at the scene**
- **Police note that the truck belongs to Radio-pharmacy Inc. Paperwork indicates that it was en-route to deliver radiopharmaceuticals to Albany Medical Center**
- **The Radio-pharmacy truck sustained a lot of damage. Some of the packages have been breached**
- **A woman and two children were riding the van. The mom is still trapped in the van. Rescuers are able to get the kids out of the van**

# **THE SCENARIO**

- **Albany City FD is putting out the fire. Upon learning that the truck was carrying radioactive materials, the Fire Chief requests help from Albany HAZMAT**
- **Police closes 787 (North and South) and are detouring cars to the Port of Albany exit**
- **At 0720 HAZMAT arrives**
- **The radio-pharmacy truck driver is hurt and is taken to the hospital - Police escort him**
- **The tanker truck driver is also hurt, but does not require immediate medical attention - Police are questioning him**

**NOW**

**Assume you are  
the Incident  
Commander**

- **What do you know?**
- **What do you need to find out?**
- **What actions you need to take?**
- **How do you prioritize your actions?**



# • **What do you know?**

- **Radiation (possible)**
- **Fire is still burning (dark plume moving towards the City)**
- **Injured victims**
- **Fatalities?**
- **Non-injured victims**
- **Intentional?**
- **Weather**
- **Scene (highway, near rail yard and industrial area, next to the Hudson River, School)**

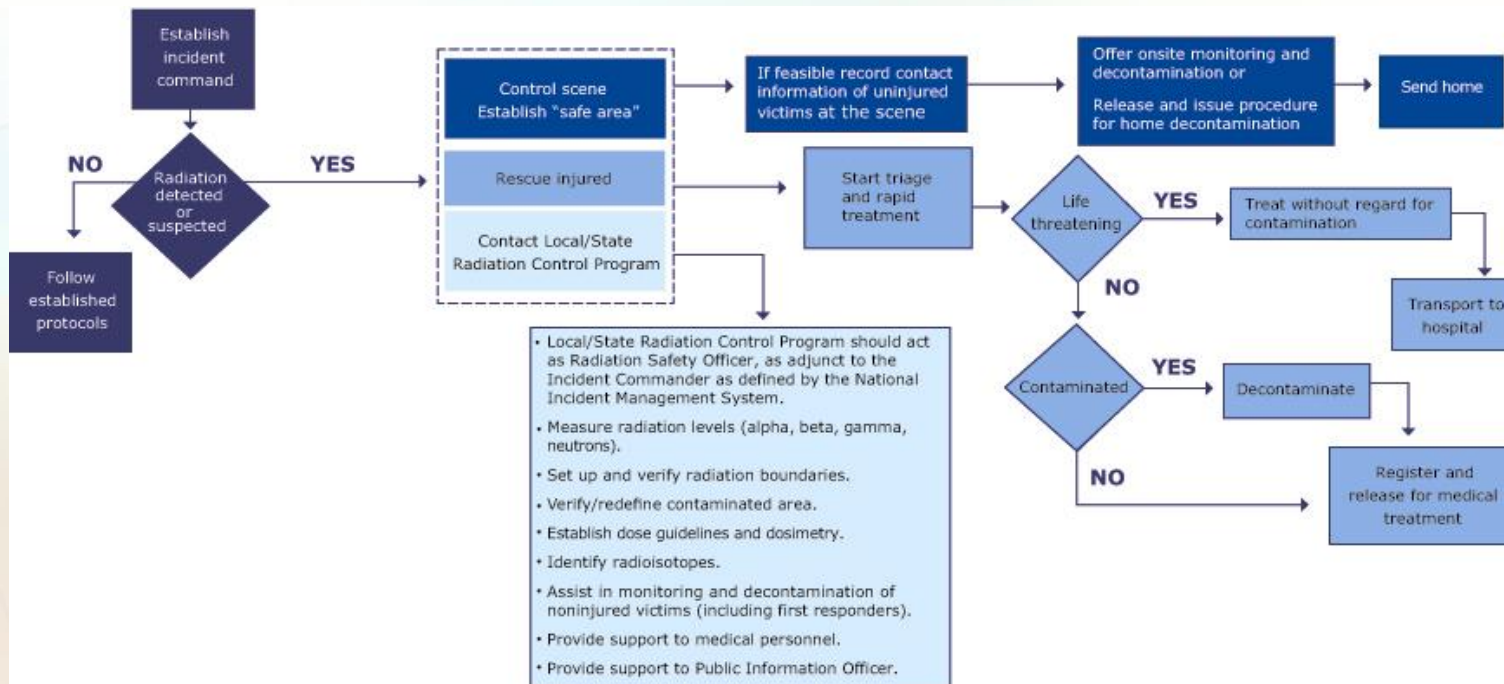
- **What do you need to find out?**
  - **Where to set IC**
  - **Radiation levels**
  - **Isotope(s)**
  - **Any chemicals**
  - **Once the fire is out, when can we re-open the highway?**
  - **Should school be closed?**
  - **Evacuation?**

- **What actions you need to take?**

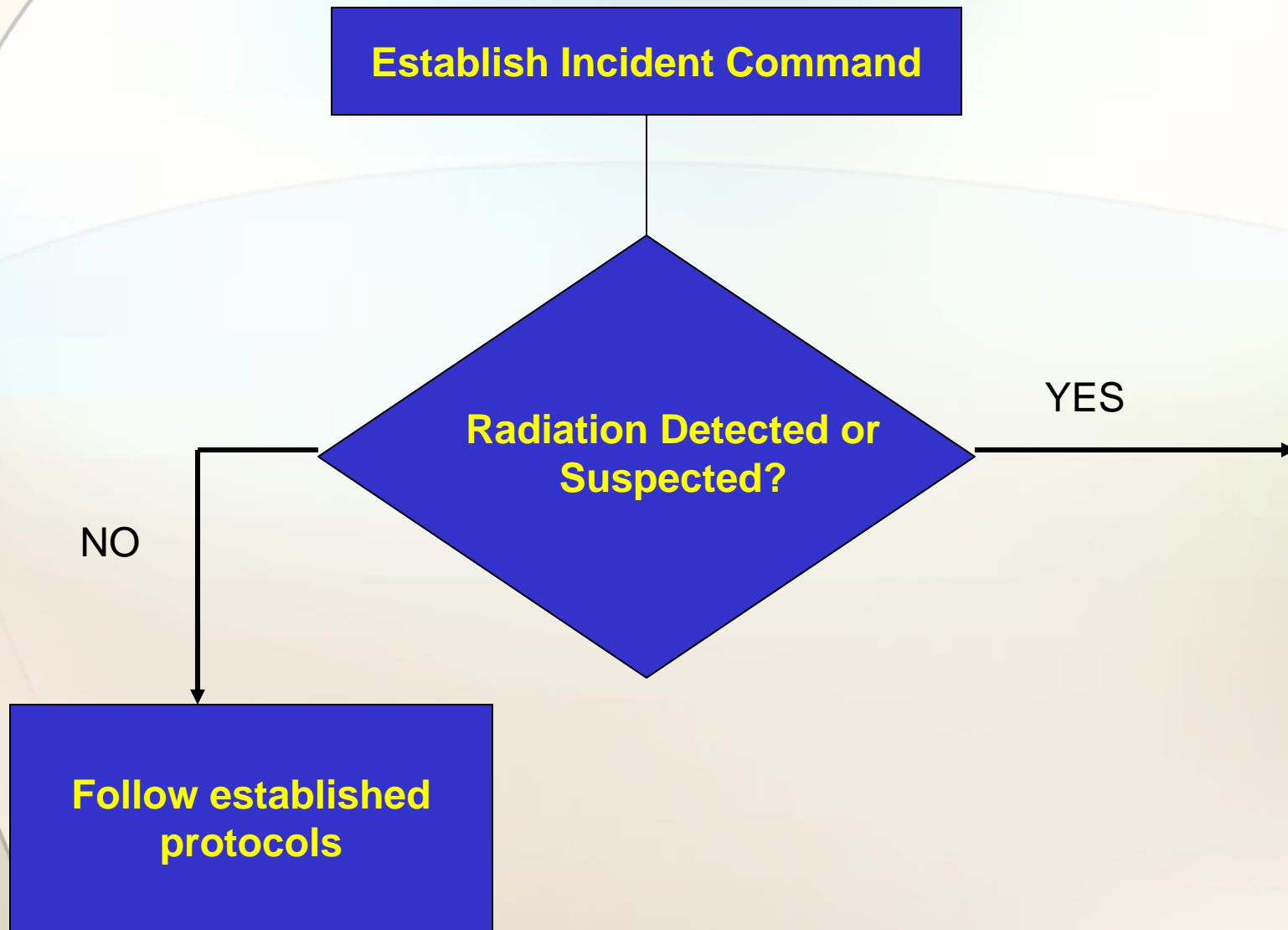
- **How do you prioritize your actions?**

# FLOWCHART OF ACTIONS

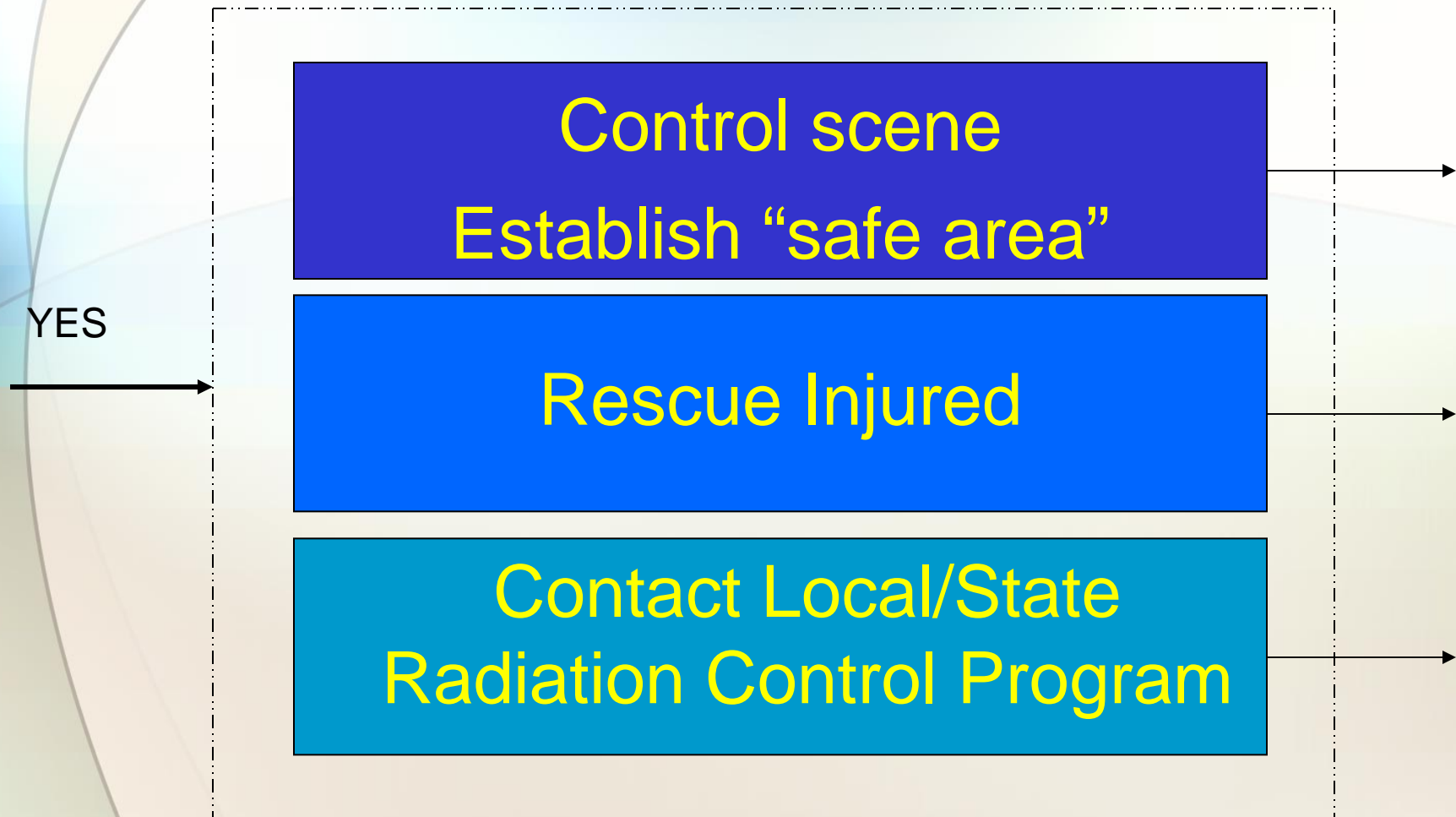
Remember ... Saving Lives is a Priority!



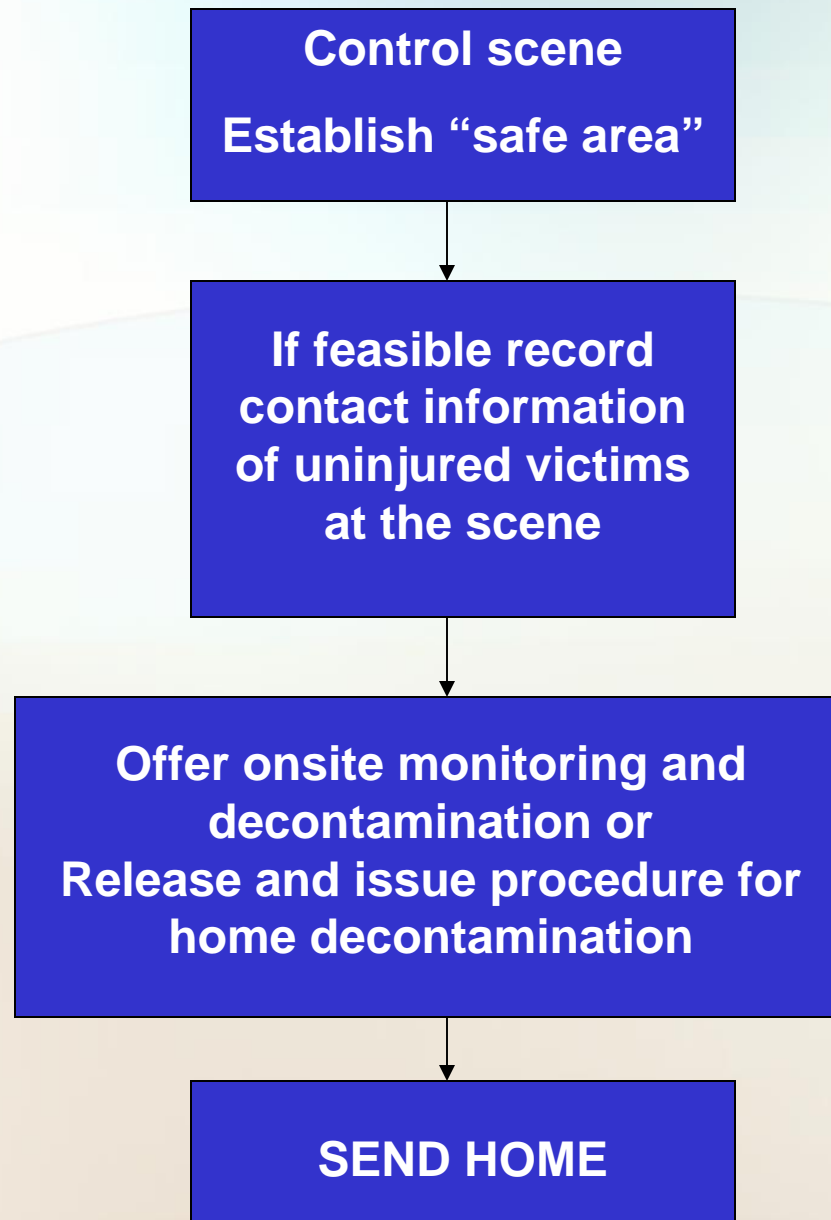
# The Flowchart



# The Flowchart

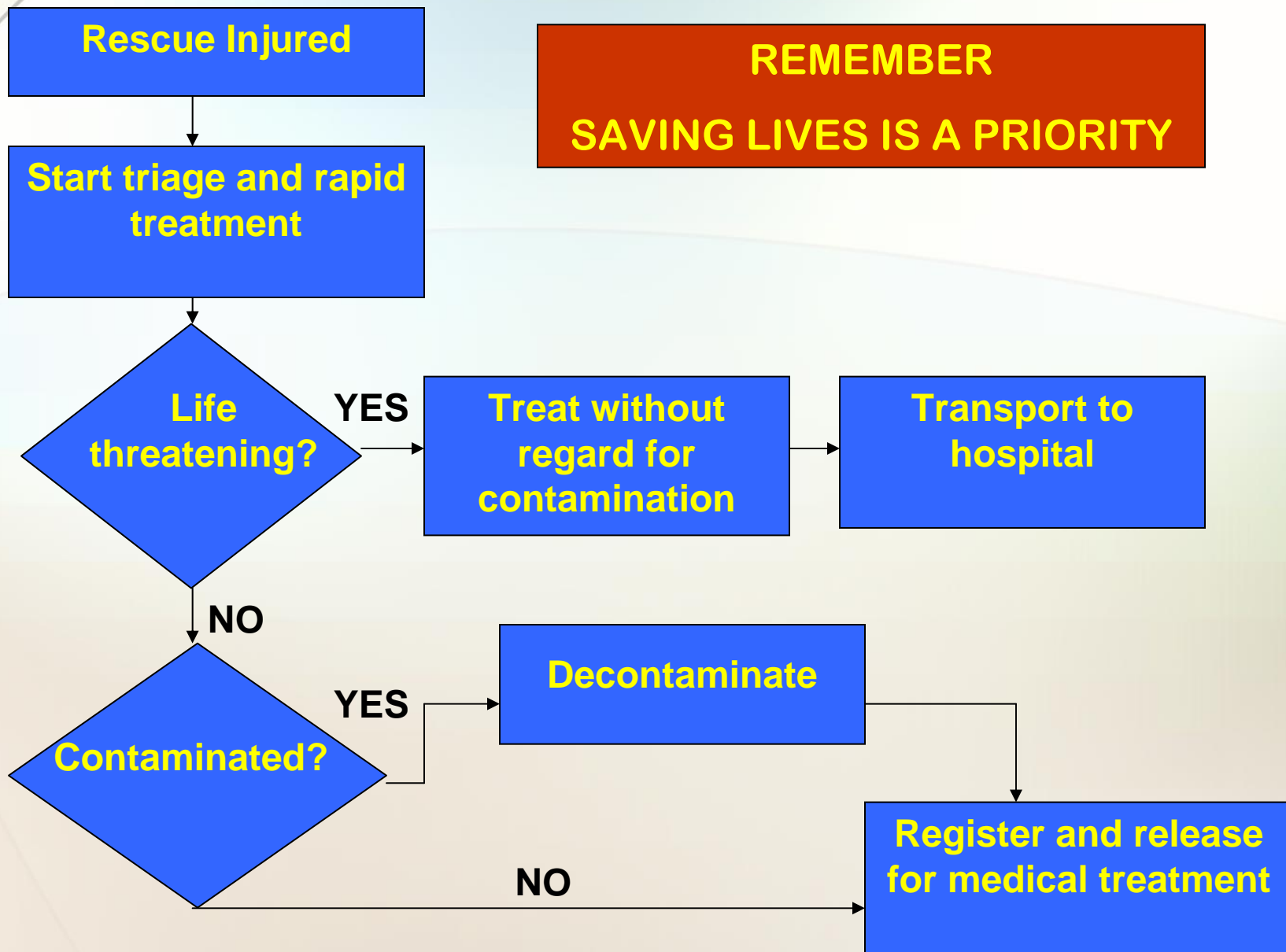


# The Flowchart





# The Flowchart



# The Flowchart

**Contact Local/State Radiation Control Program**

**In New York State – 518-292-2200**

- **Measure radiation levels (alpha, beta, gamma, neutrons)**
- **Set up and verify radiation boundaries**
- **Verify/redefine contaminated area**
- **Establish dose guidelines and dosimetry**
- **Identify radioisotopes**
- **Assist in monitoring and decontamination of victims (including first responders)**
- **Provide support to medical personnel**
- **Provide support to Public Information Officer**

## **Rules of Thumb:**

- **For outdoor explosions, most of the airborne radioactive dust will have settled to the ground within about 10 minutes**
- **In the absence of any other information, evacuate to 500 meters (1650 ft) from the detonation site in all directions**
- **Check batteries and turn on your radiation detection instrument prior to arriving at the incident scene**
- **You may not be able to perform decontamination onsite if a large number of people are affected**
- **Removing outer clothing can eliminate the majority of contamination**
- **For large incidents, it is not necessary to retain runoff**

# **ESTABLISH INCIDENT COMMAND**

**Since ICS training is required training for first responders:**

- RDD handbook assumes ICS will be established according to existing protocols**
- A staff member of the state/local radiation control program should function as the Radiation Safety Officer in the Incident Command upon arrival at the scene**

# **ESTABLISH INCIDENT COMMAND**

- **If feasible, establish the Incident Command Post at a location upwind with background radiation levels**
- **If not feasible, use an area of less than 2 mR/hr and contamination levels < 1,000 cpm (measured 1-2 inches from the ground with a pancake probe)**
- **Check with Radiation control staff if it is necessary to establish Incident Command Post in a higher radiation/contamination area**

# RADIATION DETECTED OR SUSPECTED

- If you suspect radiation or your meter shows a positive reading (above background), assume you are in a radiation field
- **Always believe your instrument if it tells you radiation is present**
- Some instruments saturate (“peg”) and indicate low or no reading in a very high radiation field
- If possible wrap the probe and instrument with plastic wrap or place in a plastic bag (unless you are measuring alpha radiation) prior to use to minimize contamination of the instrument

# **CONTROL THE SCENE AND ESTABLISH “SAFE” AREAS**

- **No Official Guidance is available**
- **Proposed values to be used when Radiation Control staff are not yet at the site and responders have limited instrumentation**

**THESE ARE RECOMMENDATIONS !**

- **Responders should consult with Radiation Control program in their state**

# **CONTROL THE SCENE AND ESTABLISH “SAFE” AREAS**

- **Not an “homogeneous” distribution of exposure levels**
- **Multiple “hot” spots may be present in “low” radiation areas**
- **Deposition may be uneven, so may not be able to have well defined radiation (zone) boundaries**



# **CONTROL THE SCENE AND ESTABLISH “SAFE” AREAS**

## **Radiation Area Boundaries or “Decision Points”**

- **Demarcations of various radiation levels that will help define types of activities and time limits**
- **Will help prioritize activities**
- **Location and exposure rates will depend on physical size of impacted area**

**NOTE: THE PROPOSED GUIDELINES FOR RADIATION EXPOSURE FOR EXPLOSIVE RDD ARE EXPECTED TO BE GREATER THAN THOSE TRADITIONALLY USED WHEN RESPONDING TO A TRANSPORTATION ACCIDENT INVOLVING RAM**

# Radiation Area Boundaries or “Decision Points”

- Number of radiation zones will depend on the event
- For a very large area - may be difficult to set up a Low Radiation Boundary at  $< 10$  mR/hr within a reasonable distance from epicenter of blast

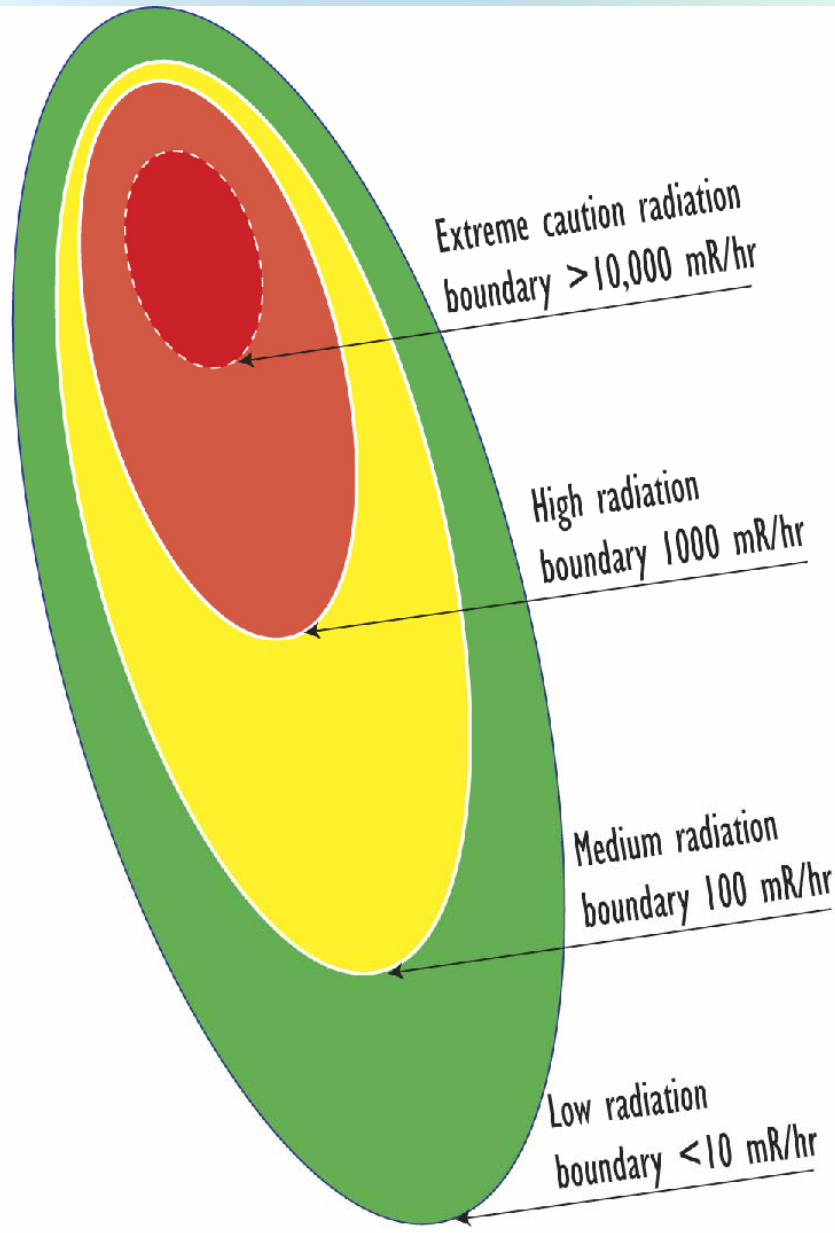
**SHOULD BE SET AS LOW AS PRACTICAL**

# Radiation Area Boundaries or “Decision Points”

**Guidance is provided for:**

- **Setting Up Zones when Instrumentation IS NOT available**
- **Setting Up Zones when Instrumentation IS available**

★  
Incident  
Command



# Radiation Area Boundaries or “Decision Points”

- Controlling radiation exposure to responders while saving lives and preserving critical properties
- Definition of “stay times”

**Table 1. Radiation Zones and Boundaries**

Boundary between Zones	Radiation Exposure Rates	
	mR/hr	R/hr
Extreme Caution and High Radiation	10,000	10
High and Medium Radiation	1,000	1
Medium and Low Radiation	100	0.1
Low Radiation	< 10	< 0.01

## RADIATION ZONES AND SUGGESTED ACTIVITIES FOR EACH ZONE DURING THE FIRST 12 HOURS

Decision Exposure Rate mR/hr	Incident Zones	Activities	Total Accumulated Stay Time for First 12 Hours
Background	Uncontrolled	No restrictions. The best location for Incident Command and decontamination activities.	Unlimited
< 10	Low-Radiation Zone < 10 -100 mR/hr	If feasible, restrict access to essential personnel. Initial decontamination of first responders should occur near the outer boundary of this area. Uninjured personnel within this zone at the time of the RDD explosion can be directed to proceed directly home to shower if resources do not permit contamination surveying at the scene. (For RDDs containing up to ~1000 Ci, this may be the only zone that exists.)	Full 12 Hours
100	Medium-Radiation Zone 100-1000 mR/hr	Restrict access to only authorized personnel. Personal dosimetry should be worn. Serves as a buffer zone/transition area between the High and Low radiation zones. People within this zone at the time of the explosion should be surveyed for contamination before being released. (For RDDs up to ~ 10,000 Ci, this may be the highest radiation zone that exists.)	5 - 12 Hours (12 hours for critical property and life saving activities)

## RADIATION ZONES AND SUGGESTED ACTIVITIES FOR EACH ZONE DURING THE FIRST 12 HOURS

Decision Exposure Rate mR/hr	Incident Zones	Activities	Total Accumulated Stay Time for First 12 Hours
1000	High-Radiation Zone 1000 - <10,000 mR/hr	Restrict access to authorized personnel with specific critical tasks such as fire fighting, medical assistance, rescue, extrication, and other time sensitive activities. Personal dosimetry should be worn. People within this zone at the time of the explosion should be surveyed for contamination before being released.	30 minutes – 5 Hours
10,000	Extreme Caution Zone = 10,000 mR/hr	This area, located within the High radiation zone, is restricted to the most critical activities, such as lifesaving. Personal dosimetry required, although one monitor for several responders is acceptable if they remain near the person with the monitor. Limit time spent in this area to avoid Acute Radiation Sickness. People within this zone at the time of the explosion must be surveyed for contamination before being released.	Minutes to a few hours

# DOSE GUIDELINES

- **Ensure critical doses are not exceeded**
- **Help manage doses to As Low as Reasonably Achievable (ALARA)**
- **Seek assistance from Radiation control program staff for dose tracking**
- **Use “Turn back” exposure rates and guidelines to minimize doses**
- **Emergency worker dose limits provided for completeness**

**Dose Guidelines and Turn Back Exposure Rates**

<b>Activities</b>	<b>Suggested turn-back exposure rates</b>	<b>Guidelines for total accumulated dose</b>	<b>Increased Cancer Risk <sup>4,5</sup></b>
<b>Emergency worker dose limit</b>	<b>Follow Radiation Safety Officer instructions</b>	<b>5,000 mrem<sup>1</sup></b>	<b>0.4 %</b>
<b>Non-lifesaving activities (major critical property protection)</b>	<b>10,000 mR/hr</b>	<b>10,000 mrem</b>	<b>0.8 %</b>
<b>Lifesaving activities</b>	<b>200,000 mR/hr<sup>2</sup> Extreme Caution</b>	<b>50,000 mrem<sup>3</sup></b>	<b>4 %</b>



- **Optimally, personnel dosimeters should be provided and used**
- **Follow Guidance for areas  $> 1$  R/hr,  $>10$  R/hr,  $>200$  R/hr**

# RESCUE INJURED

## ASSESS AND TREAT LIFE-THREATENING INJURIES IMMEDIATELY

- Patients with non-life threatening conditions: decontaminate (if not medically contraindicated) then treat
- Uninjured contaminated persons should NOT be directed to a medical facility.
- Externally irradiated patients are NOT contaminated. Exposure without contamination requires no decontamination
- Contaminated patients who do not have life threatening or serious injuries may be decontaminated onsite (or a designated decontamination center)

# DECONTAMINATION GUIDELINES

- If there is a large population to be evacuated in the *low radiation zone* (<10-100 mR/hr) self decontamination at home may be advised
- Use portal monitors if available
- If event is small and adequate resources are available, use more restrictive guidelines
- If individuals do not require immediate medical attention - decontaminate on site or allow to go home to decontaminate

# **DECONTAMINATION GUIDELINES**

## **Suggested Release Levels (pancake GM at 1 inch from source)**

- Up to 1,000 cpm - allow individuals to leave; Instruct people to go home and shower**
- If event is large and adequate decontamination resources are NOT available - release level up to 10,000 cpm; Instruct people to go home and shower**
- If > 10,000 cpm - send to designated decontamination area**
- If >100,000 cpm - Likely to have internal contamination  
- Priority for follow-up for internal contamination**

# **HOW TO PERFORM A RADIATION SURVEY FOR CONTAMINATION - INSTRUCTIONS FOR WORKERS**

- **Screening Survey**
- **Complete Whole Body Survey**
- **Instructions on How to Decontaminate**

# **FORMS AND HANDOUTS**

- **INITIAL RDD INCIDENT FORM**
- **INITIAL SITE SURVEY**
- **ICS FORMS**
- **HOW TO PERFORM A RADIATION SURVEY**
- **CONTAMINATION SURVEY SHEET**
- **HOW TO PERFORM DECONTAMINATION AT HOME**
- **INSTRUCTIONS TO THE PUBLIC WAITING FOR DECONTAMINATION AT THE SCENE OF THE INCIDENT**
- **SUGGESTED MASS DECONTAMINATION SUPPLIES LIST**

# APPENDICES

- FLOW CHART (FULL SIZE)
- OVERVIEW OF THE TYPES OF RADIATION
- PRIMER ON RADIATION MEASUREMENT
- HOW TO DISTINGUISH BETWEEN ALPHA, BETA AND GAMMA RADIATION USING A PANCAKE GM SURVEY METER
- EXPOSURE VS. CONTAMINATION
- GUIDANCE FOR ASSESSING INTERNAL CONTAMINATION
- HEALTH EFFECTS OF RADIATION EXPOSURE
- ACCUTE RADIATION SYNDROME
- STATE AND LOCAL RADIATION CONTROL PROGRAM CONTACTS
- FEDERAL RADIATION CONTROL PROGRAM CONTACTS
- SUGGESTED INTERNET SITES FOR ADDITIONAL INFORMATION
- ACKNOWLEDGEMENTS
- GLOSSARY

# The RDD Handbook

- **Does NOT apply to all situations that may be encountered by responders but**
  - **Many of the concepts can be applied to other radiation incidents**
- **Does NOT include description of incident command or law enforcement activities but**
  - **Assumes that all responders are familiar with ICS**
- **Does NOT include response to an IND**



