

# LA-UR-23-27271

Approved for public release; distribution is unlimited.

**Title:** RCT Continuing Training: Radiological Emergency Response

**Author(s):** O'Sullivan, Patrick Timothy

**Intended for:** Web

**Issued:** 2023-07-06



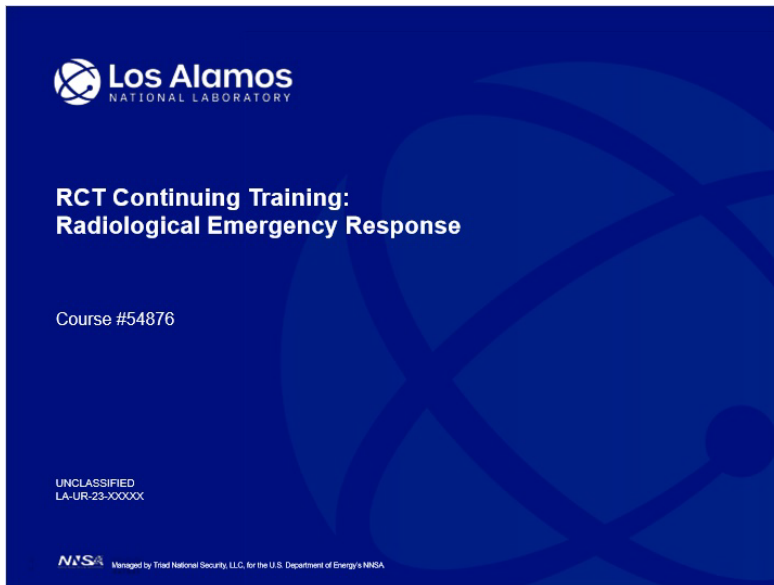
Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

## **RCT Continuing Training:**

### **Radiological Emergency Response**


## **1. RCT Continuing Training - Radiological Emergency Response**

### ***1.1 Radiological Emergency Response Training***



#### **Notes:**

## 1.2 Introduction



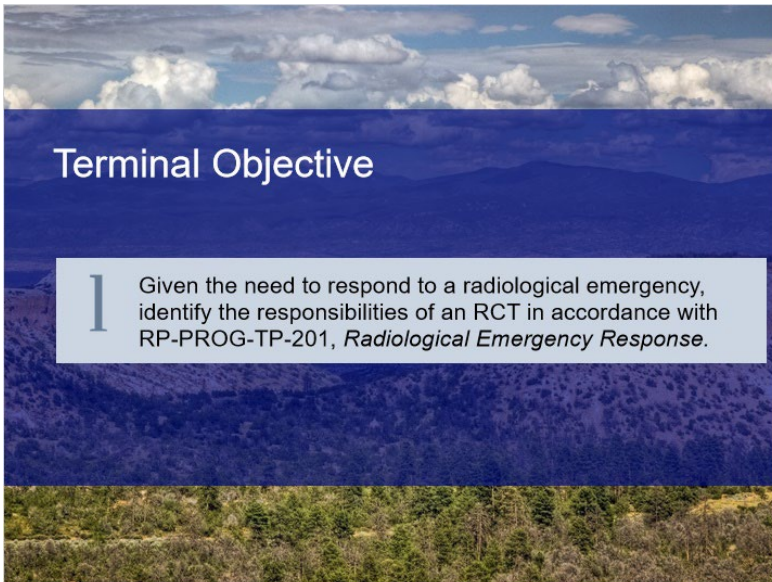
Welcome to RCT Continuing Training. This quarter's online topic will review the necessary actions for radiological emergency response, based on **RP-PROG-TP-201**.

To complete the online portion of this training, you will be required to view this presentation and independently complete its associated quiz.

A required in-person training will also accompany this quarter's presentation. To sign up, simply look up UTrain course 57833 and register for a day that works with your schedule.

Notes:

## 1.3 Terminal Objectives

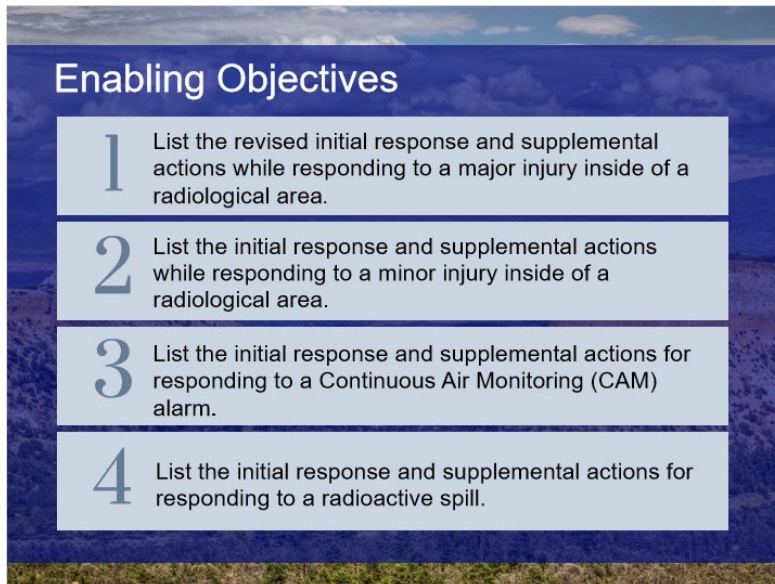


### Terminal Objective

**1** Given the need to respond to a radiological emergency, identify the responsibilities of an RCT in accordance with RP-PROG-TP-201, *Radiological Emergency Response*.



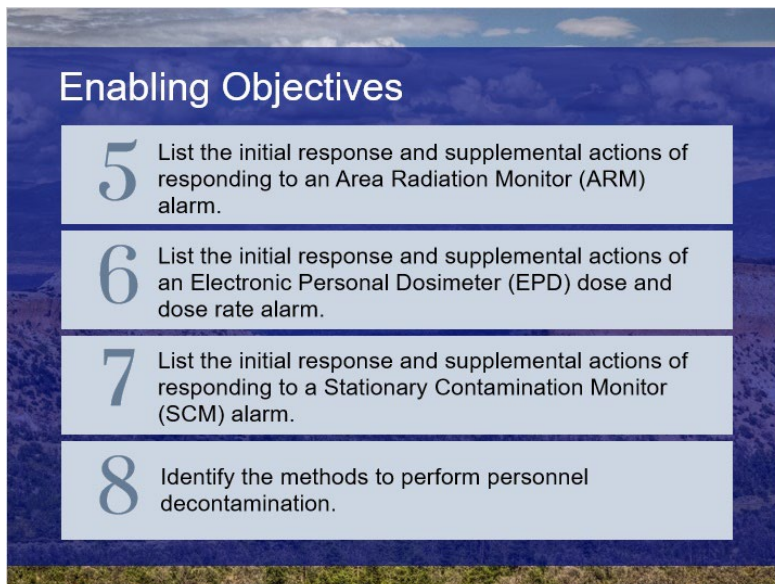
## **1.4 Enabling Objectives**



### Enabling Objectives

- 1 List the revised initial response and supplemental actions while responding to a major injury inside of a radiological area.
- 2 List the initial response and supplemental actions while responding to a minor injury inside of a radiological area.
- 3 List the initial response and supplemental actions for responding to a Continuous Air Monitoring (CAM) alarm.
- 4 List the initial response and supplemental actions for responding to a radioactive spill.


## **1.5 Enabling Objectives Cont.**



### Enabling Objectives

- 5 List the initial response and supplemental actions of responding to an Area Radiation Monitor (ARM) alarm.
- 6 List the initial response and supplemental actions of an Electronic Personal Dosimeter (EPD) dose and dose rate alarm.
- 7 List the initial response and supplemental actions of responding to a Stationary Contamination Monitor (SCM) alarm.
- 8 Identify the methods to perform personnel decontamination.

## 1.6 Training Purpose



### Training Purpose

The Radiation Protection Program provides for worker safety, emergency response, regulatory compliance & oversight, facility operability, and programmatic support through:

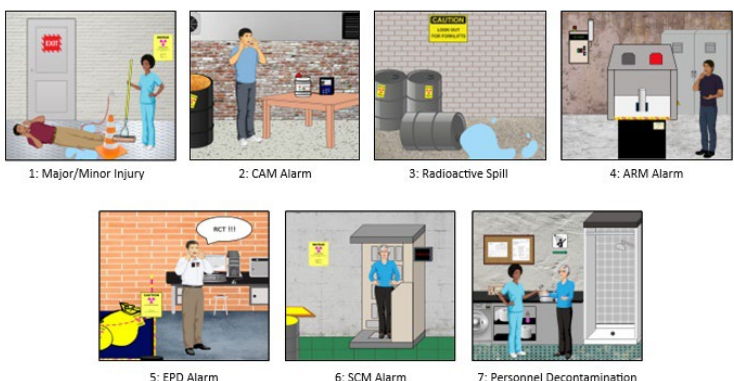
- Core, centralized, and deployed capabilities from RP Division
- Facility-specific radiation protection requirements
- Line & facility organization implementation of requirements

Understanding the necessary actions during a radiological emergency is the responsibility of an RCT in order to achieve this scope for the LANL Radiation Protection Program.

Notes:

## 1.7 Lesson Modules


### Radiological Emergency Response Lesson Modules



1: Major/Minor Injury      2: CAM Alarm      3: Radioactive Spill      4: ARM Alarm

5: EPD Alarm      6: SCM Alarm      7: Personnel Decontamination


Click the next button after completing all lessons


 Los Alamos  
NATIONAL LABORATORY

## 1.8 Conclusion

**Conclusion**

Congratulations! You have successfully completed the online instruction of this RCT Continuing Training. To receive credit for the online course, you must complete the associated quiz. Please note that you must also attend in person training for this quarter by signing up on UTrain course 57833. Click the EXIT COURSE button below to close this lesson.





EXIT COURSE

## 2. ARM Alarm

### 2.1 ARM Alarm



## 2.2 ARM Alarm Initial Actions

### ARM Alarm Initial Actions

RP-PROG-TP-201, 4.7 ARM Alarm

1. Ensure all personnel evacuate the area.
2. Prevent personnel from entering the area.



## 2.3 Evacuate

### 1. Ensure All Personnel Evacuate the Area

Evacuate the area and exit to an area of lower background radiation. Notify others in the area of the alarm. The magnitude of the radiation levels have exceeded the alarm set point and the source location may not be known. Radiation surveys will assist in locating areas of low radiation.





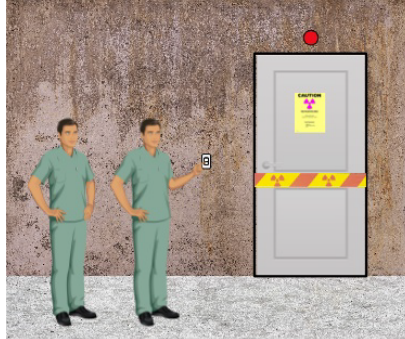
## 2.4 Prevent Entry

### 2. Prevent Personnel From Entering the Area

Use barriers, notifications, postings, or personnel if necessary to keep personnel out of the affected area. Until the area is characterized by survey, radiation levels will remain unknown, and could lead to dose limits being exceeded if entry is made.

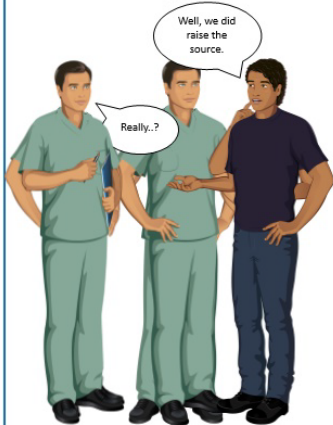
Do not leave an unposted area unattended.

If an area will be posted as an HJEA, an RCT knowledgeable of the area must remain to guard the entrance.



## 2.5 Supplemental and Follow-Up Actions

### Supplemental and Follow-Up Actions



- Obtain the name and Z number of all personnel in the area at time of the alarm.
- Notify the HPFC, Team Leader, and management as appropriate. Request assistance as needed.
- Check ARM remote indicators if available.
- Determine the cause of the ARM alarm.
- Perform re-entry IAW section 4.12.
- Initiate an RPIN.



## 2.6 ARM Alarm Knowledge Check

(True/False, 10 points, 1 attempt permitted)

It is permitted to leave a room unguarded with an ARM alarm while you search the area for postings.

- ☐ False  
☐ True

Correct	Choice
X	False
	True

### Correct (Slide Layer)

It is permitted to leave a room unguarded with an ARM alarm while you search the area for postings.

- ☐ False  
☒ True



Correct


That's right! You selected the correct response.

Continue

### Try Again (Slide Layer)

It is permitted to leave a room unguarded with an ARM alarm while you search the area for postings.

☐ False  
☒ True



Incorrect

That is incorrect. Please try again.

Try Again

## 3. Radiological Spill

### 3.1 Radioactive Spill





### 3.2 Hazardous Material Exception

#### Radioactive Spills Initial Actions




RP-PROG-TP-200, 4.6 *Radioactive Spills*


**WARNING**  
Do **NOT** attempt to stop or secure the spill if taking action will result in bodily injury, personnel contamination, or inhalation.

If the spill involves known or suspected hazardous materials or highly toxic chemicals, then:

- a) Immediately exit the area. Do not attempt to stop or secure the spill.
- b) Follow facility-specific response plans, and contact all of the following:
  - 911
  - Emergency Operations Support Center (EOSC)

EOSC Phone Number: 505-667-2400






### 3.3 Initial Response Overview


#### Radioactive Spills Initial Actions

RP-PROG-TP-200, 4.6 *Radioactive Spills*

If the spill does not involve known or suspected hazardous materials or highly toxic chemicals, then:

- a) Stop or secure the operation causing the spill.
- b) Warn others in the area.
- c) Isolate the spill to prevent further spread of contamination.
- d) Prevent personnel from entering the affected area.
- e) Secure unfiltered ventilation.





### 3.4 Stop the Spill

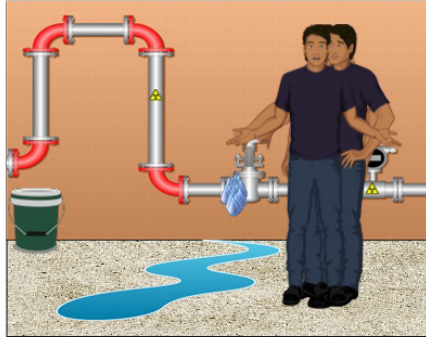
#### 1. Stop or Secure the Action Causing the Spill

Stopping the spill is the first action that should be taken to minimize the further spread of contamination.

Examples of stopping a spill:

- Shutting a valve
- Securing a pump
- Covering with absorbent
- Placing the container upright

If you are not trained on operation of the leaking components or it is unsafe to stop the spill, move onto the next actions and ensure the spill is communicated to the necessary personnel.



### 3.5 Warn Others

#### 2. Warn Others in the Area

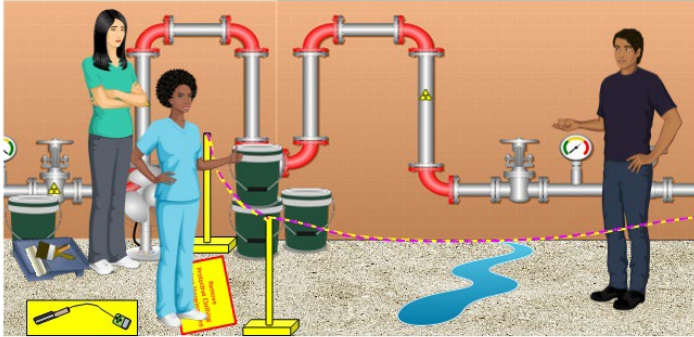
Warning others in the area can help prevent personnel from coming in contact with the spill and further spreading the contamination. Getting the word out will also start the process of getting other RCT's to the scene and provide additional assistance.



### 3.6 Isolate the Area

#### 3. Isolate the Spill to Prevent Further Spread

Isolate the affected area by means of physical barriers, notifications, and personnel if necessary. This protects uninvolved personnel from exposure and allows for easier recovery from the release.



### 3.7 Prevent Personnel Entry

#### 4. Prevent Personnel from Entering the Area

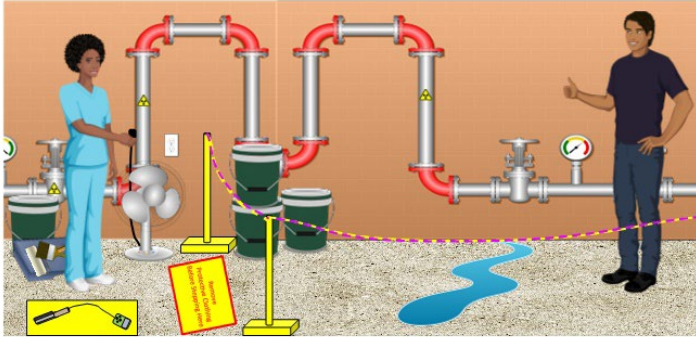
In addition to barriers, responding personnel should remain vigilant of those not obeying posted boundaries so personnel contamination does not occur.



### 3.8 Secure Unfiltered Ventilation

#### 5. Secure Unfiltered Ventilation

Airflow from ventilation has the potential to spread contamination from the spill to other areas or even into other rooms. This is especially true for dry radiological spills. To prevent or mitigate this from occurring, secure any unfiltered (non-HEPA) ventilation.



### 3.9 Supplemental Actions

#### Radioactive Spill Supplemental Actions

##### RP-PROG-TP-201, 4.6.2

1. Obtain the names and Z numbers of all personnel in the area at the time of the spill.
2. Notify the HPFC, Team Leader, and management as appropriate, and request assistance as needed.
3. Monitor potentially contaminated personnel, if contamination is found, then go to section 4.10, *Personnel Contamination*.
4. Perform area re-entry in accordance with Section 4.12, *Re-Entry*.

##### RP-PROG-TP-201, 4.6.3



1. Initiate a Radiation Protection Initial Notification (RPIN).



### 3.10 Additional Spill Considerations

#### Radiological Spill Considerations

- Utilize damp absorbents to cover dry spills until it can be cleaned up to prevent the contamination from going airborne
- Only use HEPA-filtered vacuums to clean up dry spills
- Verify spill did not fall down to lower levels (as applicable)
- Monitor radiation levels of spill cleanup material to prevent inadvertently creating an HRA
- Establish airborne monitoring (CAM, giraffe, etc.)
- Spill cleanup may take some time so post the area accordingly (CA, HCA, etc.)



### 3.11 Radioactive Spill Knowledge Check

(Multiple Choice, 10 points, unlimited attempts permitted)

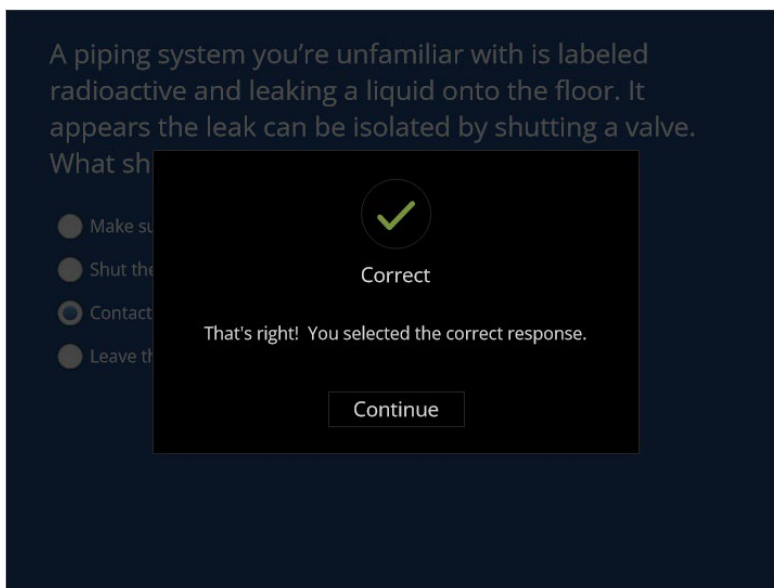
A piping system you're unfamiliar with is labeled radioactive and leaking a liquid onto the floor. It appears the leak can be isolated by shutting a valve. What should you do to stop the spill?

- ☐ Make sure the liquid has a drain it can flow into
- ☐ Shut the valve to stop the further spread of contamination
- ☐ Contact the facility operations center
- ☐ Leave the area

Correct	Choice
	Make sure the liquid has a drain it can flow into

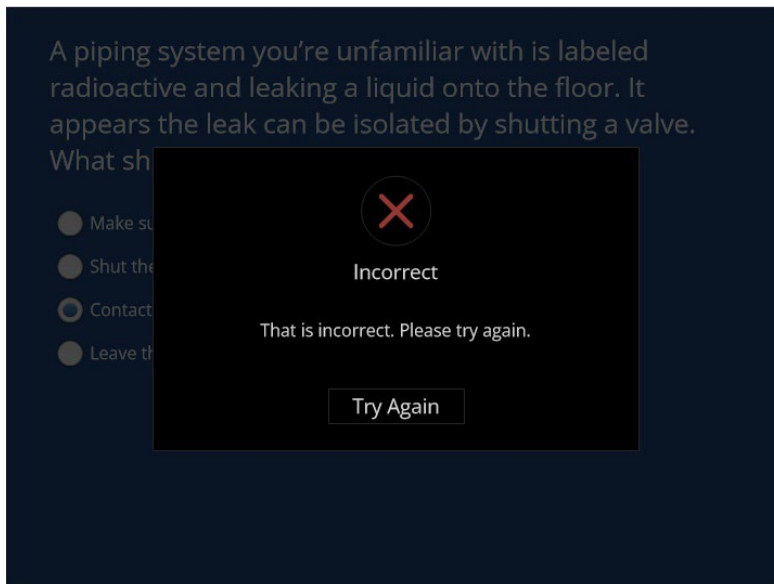
	Shut the valve to stop the further spread of contamination
X	Contact the facility operations center
	Leave the area

### Correct (Slide Layer)





## Try Again (Slide Layer)



## 4. SCM Alarm

### 4.1 SCM Alarm





## 4.2 SCM Alarm Initial Actions

### SCM Alarm Initial Actions

RP-PROG-TP-201, 4.9.1 *SCM Alarm*

1. Perform a whole body frisk on the individual with a handheld instrument.
2. **IF** contamination is detected and radon is **NOT** suspected, **THEN GO TO** Section 4.10, *Personnel Contamination*.
3. **IF** no contamination is detected **OR** there is indication of radon, **THEN**:
  - a) Allow time for radon to decay.
  - b) Instruct the individual to count on the same SCM that alarmed.
    - **IF** the SCM that the individual alarmed is not available, **THEN** escort the person to the nearest available SCM
  - c) **IF** the SCM does **NOT** indicate the presence of contamination, **THEN** the individual can be released.
  - d) Document the name and Z number of the individual **AND** the reasoning for the individual's release in the RCT logbook.
  - e) **IF** the SCM alarms, **THEN GO TO** Section 4.10.

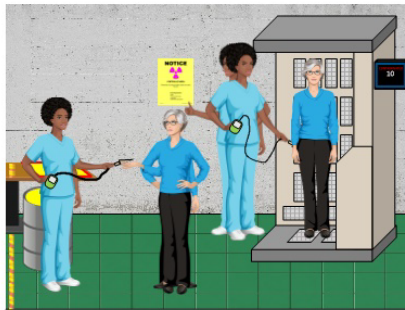


## 4.3 WBF

### 1. Perform a Whole Body Frisk on the Individual with a Hand-held Instrument

Most stationary contamination monitors only provide a general area to search. A more detailed survey is necessary to identify the area of contamination.

If no contamination is found by frisk, the person may enter the SCM to be monitored again.



## 4.4 Finding Contamination

### 2. If Contamination is Detected and Radon is not Suspected, Perform Personnel Decontamination.



Contamination has been confirmed on the worker and must be removed.

Los Alamos  
NATIONAL LABORATORY

## 4.5 Radon

### 3. If Radon is Suspected, Allow Time for the Radon to Decay

There are multiple factors that can lead to suspecting radon such as a beta to alpha activity ratio of about 2:1, work areas of low air flow, weather conditions, the contamination is located on plastic/polyester material, etc.

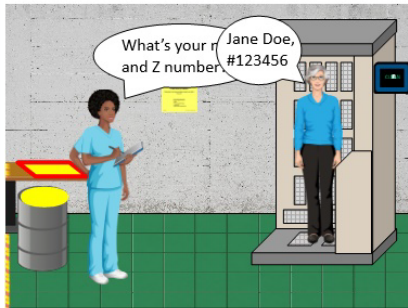
Radon and its decay products have a half-life of approximately 30 minutes. Time for decay must be allotted to allow contamination levels to fall below P121 table 14-2 limits.



Los Alamos  
NATIONAL LABORATORY

## 4.6 2nd SCM Processing

### 4. Process Personnel Through a SCM Again



Assuming the radon has decayed or there was an error with the initial count verified by personnel frisk, the worker should pass the second screening through the contamination monitor. Another SCM may be used if the initial SCM is unavailable or potentially defective. Document the name and Z number of the individual and the reason for their release in the RCT logbook.



## 4.7 2nd SCM Alarm

### 4. If the Stationary Contamination Monitor Alarms, then Proceed to Decontaminate the Person

Either contamination has been confirmed on the worker and must be removed or there is a detector failure on the SCM. In either case, it is safer to take precautionary measures to isolate potential contamination before troubleshooting.



## 4.8 SCM Alarm Knowledge Check

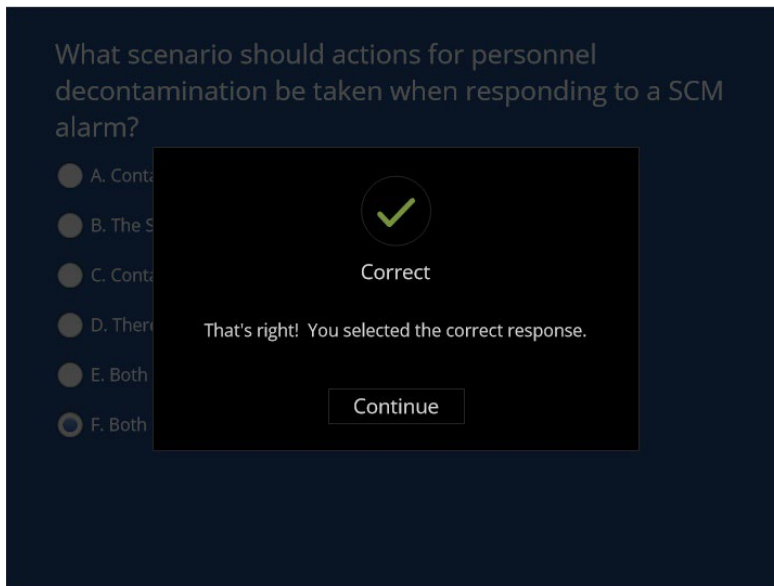
(Multiple Choice, 10 points, unlimited attempts permitted)

What scenario should actions for personnel decontamination be taken when responding to a SCM alarm?

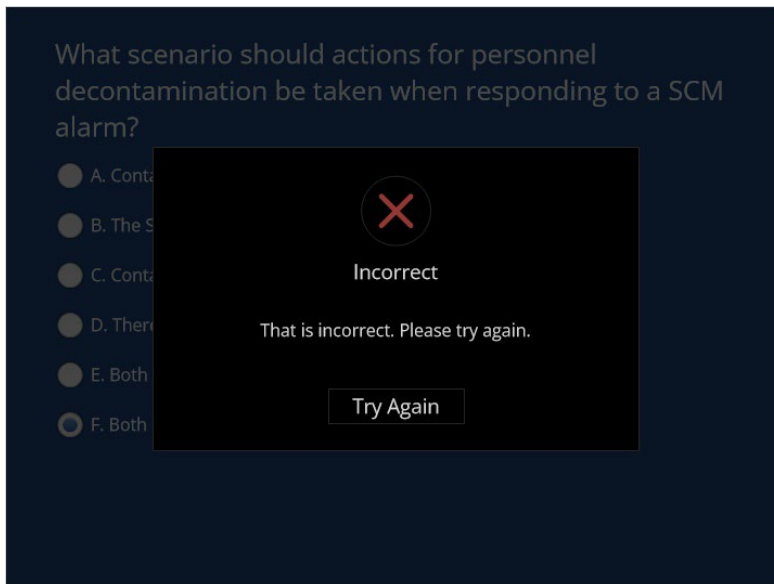
- ☐ A. Contamination is found and radon is suspected
- ☐ B. The SCM alarms on the second attempt at processing
- ☐ C. Contamination is found and radon is not suspected
- ☐ D. There is visible dirt on the worker's body
- ☐ E. Both A and C
- ☒ F. Both B and C

Correct	Choice
	A. Contamination is found and radon is suspected
	B. The SCM alarms on the second attempt at processing
	C. Contamination is found and radon is not suspected
	D. There is visible dirt on the worker's body
	E. Both A and C
X	F. Both B and C

### Correct (Slide Layer)



### Try Again (Slide Layer)



## 5. Major/Minor Injury

### 5.1 Major/Minor Injury



### 5.2 Injury Classification

#### Major/Minor Injury Classification

<b>Major Injury (LAMC)</b> <ul style="list-style-type: none"><li>Any head injury</li><li>Any disorientation</li><li>Loss of motor function</li><li>Amputations</li><li>Inhalation of abnormal substance</li><li>Extensive bleeding</li><li>Loss of consciousness</li><li>Loss of sensation</li><li>Limbs at abnormal angles</li><li>Abnormal breathing</li><li>Any chemical, thermal, and/or radiation burn</li></ul>	<p>What is the difference between a major and minor injury?</p>
<b>Minor Injury (OCCMED)</b> <p>An injury which poses no significant risk to the health or life of the victim and does not fall under the list above. Typically can be treated at Occupational Medicine.</p>	

Los Alamos NATIONAL LABORATORY

Notes:



## 5.3 Major Injury Initial Response

### Major Injury Initial Actions

RP-PROG-TP-201, 4.2.1 Major Injury

1. Call 911.
2. IF it is safe to do so, THEN attend to the victim until medical help arrives.
3. Protect yourself.
4. Provide reassurance to the individual.
5. IF it is apparent that failure to move the victim would result in further injury or loss of life, THEN move the victim.
6. IF trained AND volunteer to do so, THEN apply first aid.
7. Notify medical response personnel of actions taken, hazards, radiological conditions, and any information that may aid in their response upon arrival.
8. *If an RP Communication Checklist is available and completed, then provide a copy to medical response personnel.*
9. Assist on-scene medical response personnel as requested.
10. *Identify an RCT to accompany the injured individual in the ambulance if contamination is present or suspected on the victim.*

#### WARNING

Medical response to major injuries takes precedence over radiological control measures.



## 5.4 Call 911

### 1. Call 911

When tending to an injured person with a major injury, instruct an individual, if one is present in the area, to call 911.



Contacting 911 as soon as possible is crucial to get medical responders onto the scene quickly. If nobody is around to assist in calling 911, you should immediately do so.

Failing to perform this initial action may cause a delay in medical response and potentially lead to increased risk to the victim.

Supervisors should contact LAMC about radiological conditions.

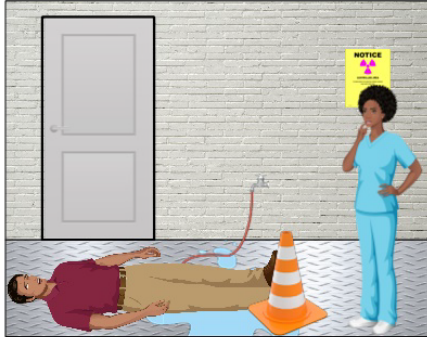




## 5.5 Attend to the Victim

### 2. If Safe to Do So, Attend to the Victim

Assess the situation prior to attending to the victim. The emergency does not need to be further complicated with another victim. Pause, review the area for potential hazards, and then go to the victim if you feel safe doing so.



Examples of hazards in the area:

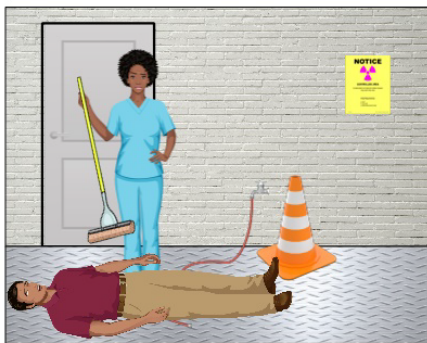
- Electrical
- Toxic gas
- Toxic chemicals
- Lack of oxygen (tanks, vaults)
- Slips, trips, falls
- Fire
- Falling objects

Los Alamos  
NATIONAL LABORATORY

## 5.6 Protect Yourself

### 3. Protect Yourself

Ensure you remain vigilant and protect yourself from any potential hazards. This may include actions such as placing absorbents over spilled water, wearing PPE, or placing a barrier around a fall hazard.



Los Alamos  
NATIONAL LABORATORY

## 5.7 Provide Reassurance

### 4. Provide Reassurance

While attending to them ensure you provide reassurance. In a medical emergency the victim may be scared or even go into shock. This positive encouragement can be very helpful to the injured individual while you are waiting for medical assistance.



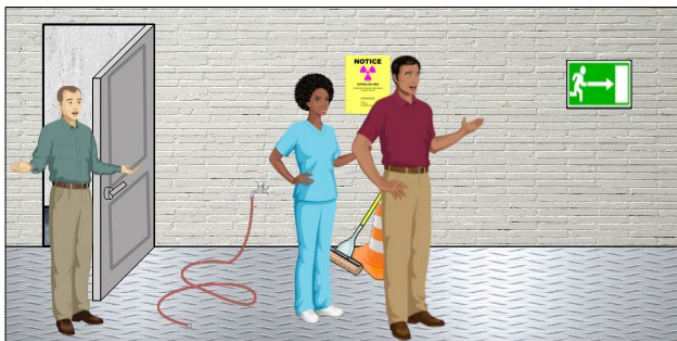
Tips while providing reassurance:

- Listen to the victim
- Remain calm
- Lighten the mood
- Address concerns head on
- Express empathy
- Provide status updates

## 5.8 Move Victim

### 5. Move victim if potential for more harm exists

If the location will cause further harm to the victim, move them to a safer area. Examples of this can be if the victim is near a door or high traffic area, fall hazards are present, hot/cold conditions exist, and industrial hazards are present.



## 5.9 Provide First Aid

### 6. Provide First Aid if Trained and Volunteer to Do So

Only if you are trained and volunteer to do so, provide first aid for the victim. Ensure you do not go beyond your training capabilities and cause more harm. Continue to provide reassurance to the victim if first aid cannot be provided.



Los Alamos  
NATIONAL LABORATORY

## 5.10 Brief Medics

### 7. Inform Actions Taken and Hazards to Medical Response

Once the medical response has arrived on scene inform them of the actions you have taken, as well as any hazards in the area. Remember, medical treatment takes precedence over radiological concerns so you should not worry about the need to issue dosimetry or PPE.




Los Alamos  
NATIONAL LABORATORY

## 5.11 RP Communications Checklist

### RP Communication Checklist


- Located in Attachment 2 of TP-201
- Provides useful information to RCTs and medical personnel
- Should not delay transport to LAMC



Title: Radiological Emergency Response
No. RP-PRDG-19-003
Page 82 of 83

Revision: 2
Effective Date: 04/25/2019

ATTACHMENT 2 - RP COMMUNICATION CHECKLIST  
Page 1 of 1



RCT

Emergency Contact Information

Back		Next
<p>1. Is there a procedure for the individual to be transported? If it is unknown, <b>assess the individual's contamination.</b></p> <p><b>ISDS</b></p> <ul style="list-style-type: none"> <li>ISDS/ISDS-2017-2003 to communicate checklist and assess (ISDS) and (ISDS) are verified.</li> <li>ISDS and personnel instructions in the emergency.</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p>2. Will use of the decontamination room be required?</p> <ul style="list-style-type: none"> <li>The decontamination room provides the spread of radiological and non-radiological contaminants into the hospital. If there is any potential for the spread of contamination, if it is unknown whether the individual is contaminated, <b>the decontamination room should be utilized.</b></li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p>3. Will additional personnel or additional PPE be required for the medical staff providing treatment?</p> <p><b>ISDS/ISDS and PPE (Check all that apply)</b></p> <ul style="list-style-type: none"> <li>ISDS (Showering treatment) ISDS/ISDS provides a priority over controls for radiological hazards. In most cases, external decontamination is required to reduce medical staff and facility risks. Consider PPE to facilitate decontamination control.</li> <li>Access control should be established for all individuals working in the decontamination room.</li> <li>No additional control be required to service until released by the RCT.</li> <li>Additional Controls: _____</li> <li>Additional PPE: _____</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p>4. When any other hazards (e.g., chemical, asbestos, non-radiological) present at the scene of the incident (i.e., release, spill, release, etc.)</p> <ul style="list-style-type: none"> <li>Assess hazard.</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p>5. Will a second count be required? If so, contact RCTs for further assistance.</p> <p><b>ISDS/ISDS and PPE (Check all that apply)</b></p> <ul style="list-style-type: none"> <li>ISDS (Showering treatment) ISDS/ISDS provides a priority over controls for radiological hazards. In most cases, external decontamination is required to reduce medical staff and facility risks. Consider PPE to facilitate decontamination control.</li> <li>Access control should be established for all individuals working in the decontamination room.</li> <li>No additional control be required to service until released by the RCT.</li> <li>Additional Controls: _____</li> <li>Additional PPE: _____</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p>6. When any other hazards (e.g., chemical, asbestos, non-radiological) present at the scene of the incident (i.e., release, spill, release, etc.)</p> <ul style="list-style-type: none"> <li>Assess hazard.</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
<p>7. Will a second count be required? If so, contact RCTs for further assistance.</p>	<input type="checkbox"/>	<input type="checkbox"/>

4/5/21 dls

## 5.12 Assist Medics

### 8. Assist the Medical Response Team as Requested

While the medical response team tends to the victim assist them as requested. Do not interfere with their actions. Good practice is to monitor where they travel and how long they are in certain locations. This can help with future dose assessments and give an idea of where to monitor for the spread of contamination.





### 5.13 Ride in Ambulance

#### 9. Identify an RCT to Ride in the Ambulance

An RCT should accompany the victim in the ambulance to assist with any radiological concerns of the medical team. The RCT will also need to monitor for any potential spread of contamination inside of the ambulance. Typically, more RCTs should be tasked to meet the ambulance at the hospital to assist with the radiological monitoring.



Los Alamos  
NATIONAL LABORATORY

### 5.14 Medical Staff Training for Response to a Major Injury

#### Medical Staff Training for Response to a Major Injury



Video courtesy of Oak Ridge Institute for Science and Education (<https://orise.ornl.gov/resources/reacts/index.html>)

### 5.15 Knowledge Check 1

(Multiple Choice, 10 points, unlimited attempts permitted)



The EMTs arrive on scene to help an injured worker. As you assign an RCT to ride in the ambulance, an EMT tells you that they do not want anyone riding along in the ambulance to the hospital. What should you do?

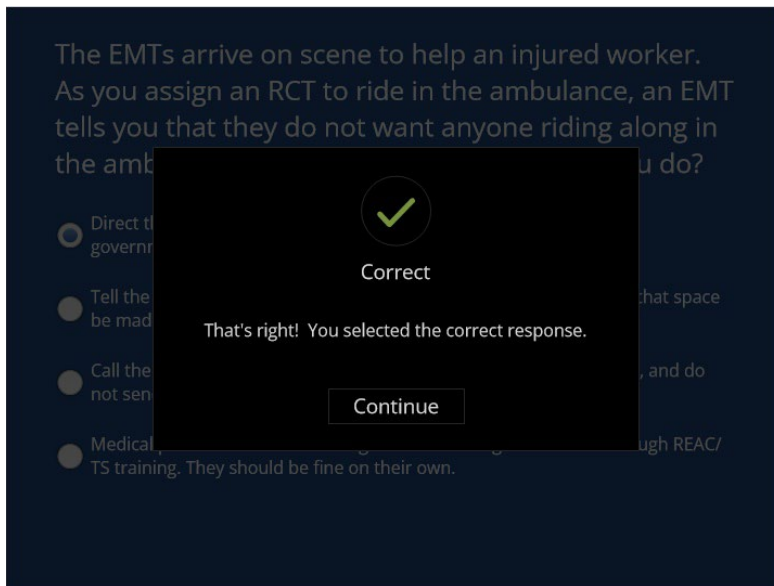
- ☐ Direct the assigned RCT to follow the ambulance to the hospital in a government vehicle.
- ☐ Tell the EMT that the RCT must ride in the ambulance and demand that space be made for them.
- ☐ Call the hospital, brief them on the controls they need to implement, and do not send an RCT to the hospital.
- ☐ Medical personnel have been taught basic radiological controls through REAC/TS training. They should be fine on their own.

Correct	Choice
X	Direct the assigned RCT to follow the ambulance to the hospital in a government vehicle.
	Tell the EMT that the RCT must ride in the ambulance and demand that space be made for them.
	Call the hospital, brief them on the controls they need to implement, and do not send an RCT to the hospital.
	Medical personnel have been taught basic radiological controls through REAC/TS training. They should be fine on their own.

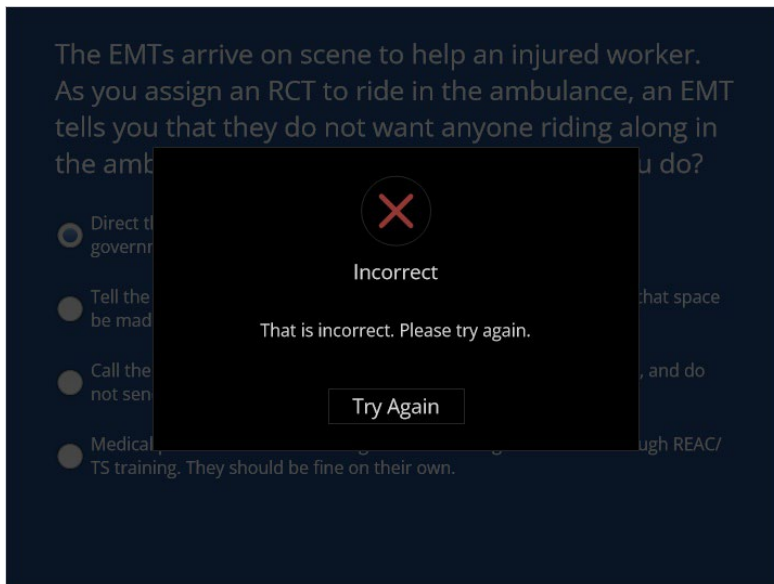
**Feedback when correct:**

That's right! You selected the correct response.

### Correct (Slide Layer)

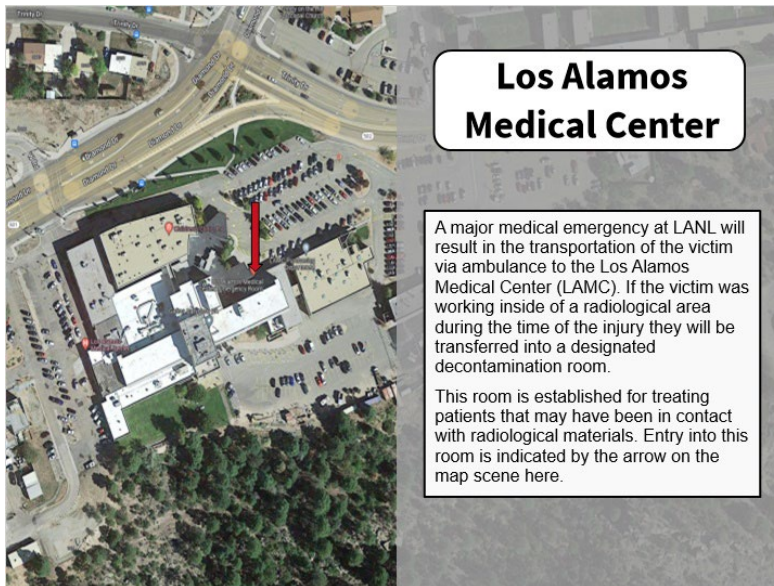


### Try Again (Slide Layer)



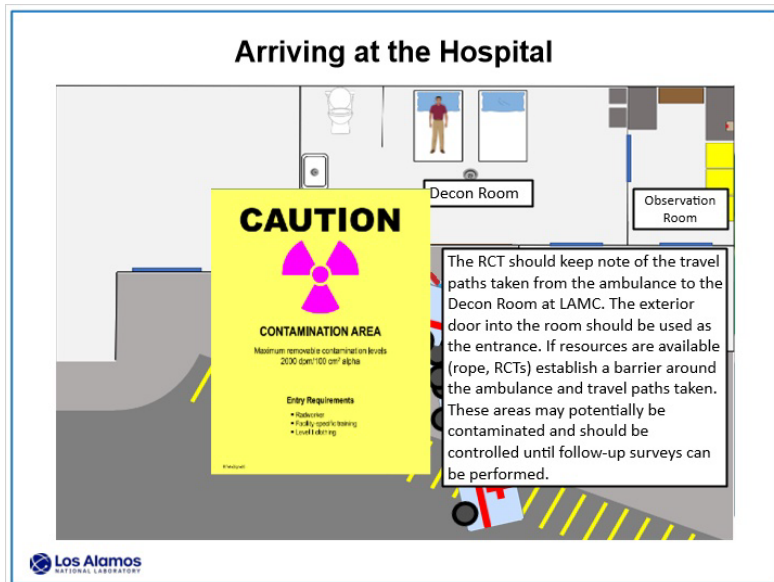


## 5.16 LAMC Arrival

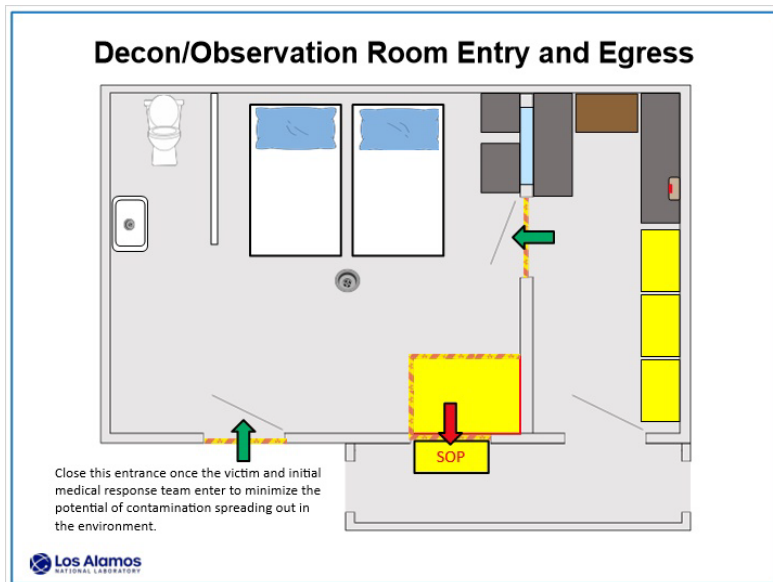


Notes:

## 5.17 LAMC Arrival Cont.



## 5.18 Decon/Observation Room Entry and Egress



## 5.19 LAMC Coverage

**Medical Treatment Facility Actions**

**RP-PROG-TP-201, 4.2.2**

1. Upon arrival at the medical treatment facility, notify medical personnel of actions taken, hazards, radiological conditions, and any information that may aid in their response.
2. Assist medical personnel as requested.
3. Perform monitoring and assist in the control of contamination without interfering with medical response.
4. Upon exit from potentially contaminated areas, perform monitoring and provide information needed for control of contamination for medical staff.
5. Provide radiological support during contaminated area recovery.

A photograph of a medical treatment facility, showing a patient bed, medical equipment, and a clock on the wall.

Los Alamos  
NATIONAL LABORATORY

## 5.20 Additional On Scene Actions

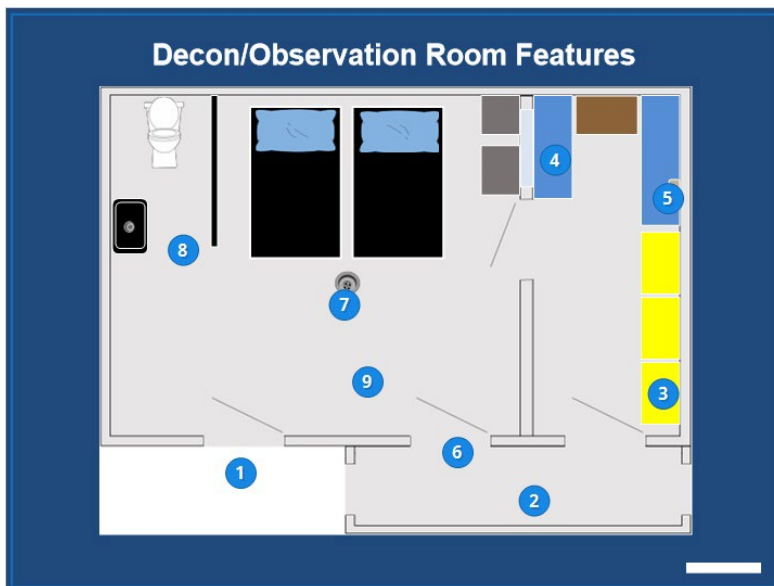
### Additional On-Scene Actions

#### RP-PROG-TP-201, 4.2.3

1. Notify facility management to obtain additional assistance and for notification purposes as required by facility level emergency response.
2. Without interfering with medical efforts, control the spread of contamination by:
  - Segregating potentially contaminated personnel
  - Placing a disposable surface on the egress route
  - Directing personnel to don proper PPE
  - Surveying the egress route after medical evacuation has occurred
3. Control the egress route to prevent the spread of contamination following evacuation of the injured person by medical response personnel.



## 5.21 Decon/Observation Room Features



## 5.22 LAMC Wound Count

### Need a Wound Count at the Emergency Room?

HPAL has a portable wound counter on hand to be taken out to medical facilities. They may be contacted at the following numbers:

- 505-665-8888
- 505-664-8138 (pager)

They can only count victims with no exterior contamination and request to know what nuclides are suspected.



## 5.23 Additional LAMC Tips

### Things to Consider

#### Instruments

Bring a contamination instrument to monitor the victim. Additional instruments will be available for use at LAMC upon arrival.

A photograph of a "Contamination Survey Form" template. It includes fields for "Victim Name", "Date", "Time", "Location", and "Surveyor". There are also sections for "Contamination Levels" and "Remarks".

#### Survey Form

If the injured victim has contamination on them, note the levels to be logged on a survey form later.

#### Terminology

The medical staff will not understand units of contamination or radiation. When relaying levels to the medical team, use terms such as "no", "low", "high", or "dangerous" levels.

A color-coded chart showing radiation levels and their corresponding health effects. The chart is divided into four main categories: "No Radiation", "Low Radiation", "High Radiation", and "Dangerous Radiation". Each category has a range of values and a description of the potential health effects. For example, "No Radiation" is defined as 0.01 to 0.1 mSv, with a description of "No health effects".

#### Ambulance

The ambulance will need to be controlled with postings or guards until it can be thoroughly surveyed. Assign an RCT to start this process as soon as possible.

## 5.24 Additional RCT Assistance

### RCT Additional Assistance

Major medical injuries inside of radiological areas will need the assistance of multiple RCTs. When it is known that the victim is going to be transferred to LAMC, an HPFC or the Person in Charge (PIC) should assign additional RCTs to go to the hospital to help prepare materials and assist as needed. Some of these actions may include:

- Establishing boundaries such as travel paths, SOP, control point, etc.
- Getting the instruments at the medical facility ready for use (these are routinely checked as an RMI from RP-FS)
- Working as the inside RCT that will assist in monitoring the victim and hospital staff inside of the Decon Room
- Work as the outside RCT to assist the inside RCT in monitoring survey material, document results, hand-in supplies, and survey personnel leaving the Decon Room
- Survey the ambulance for release (important for ambulance to be placed back in service for potential emergency needs)



## 5.25 Major Injury Knowledge Check 2

(Multiple Choice, 10 points, unlimited attempts permitted)

Medical staff ask you to survey a victim's injured arm. Frisking the area, your meter reads <20 DPM/100cm<sup>2</sup> alpha and <1,000 DPM/100cm<sup>2</sup> beta. What is the best response?

- ☒ There is no contamination concern for the arm
- ☐ The arm is below P121 table 14-2 limits
- ☐ It's NDA
- ☐ The arm is less than 20 DPM/100cm<sup>2</sup> alpha and 1,000 DPM/100cm<sup>2</sup> beta

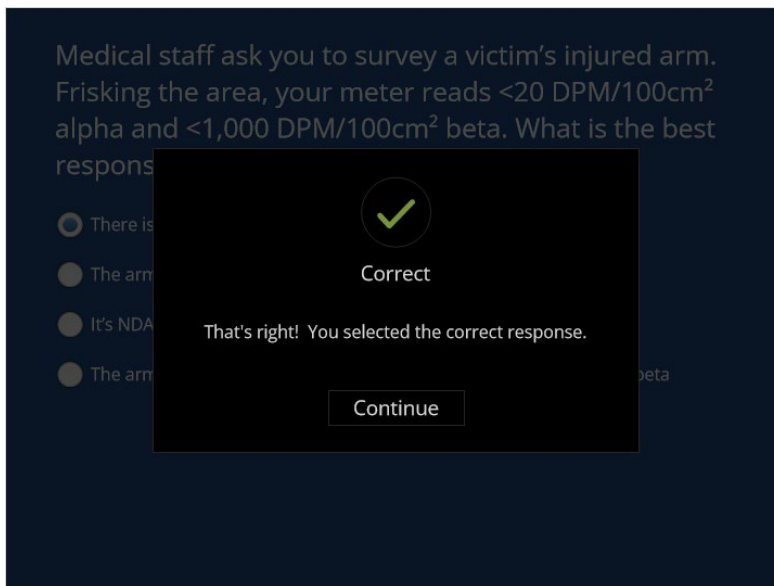
Correct	Choice
X	There is no contamination concern for the arm

The arm is below P121 table 14-2 limits
It's NDA
The arm is less than 20 DPM/100cm <sup>2</sup> alpha and 1,000 DPM/100cm <sup>2</sup> beta

**Feedback when correct:**

That's right! You selected the correct response.

**Correct (Slide Layer)**





## Try Again (Slide Layer)

Medical staff ask you to survey a victim's injured arm. Frisking the area, your meter reads  $<20$  DPM/100cm<sup>2</sup> alpha and  $<1,000$  DPM/100cm<sup>2</sup> beta. What is the best response?

- ☐ There is no problem.
- ☐ The arm is contaminated.
- ☐ It's NDA.
- ☐ The arm is not contaminated.

Incorrect

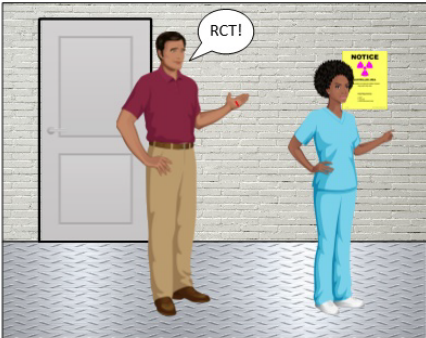
That is incorrect. Please try again.

Try Again

## 5.26 Minor Injury

### Minor Injury Initial Response

Direct AND/OR assist injured personnel to exit the immediate area.



Egress the injured person promptly to be seen by a medical professional. Minor injuries in industrial or hazardous areas can quickly escalate to major ones if not given the attention and treatment needed before returning to work.

Los Alamos  
NATIONAL LABORATORY

## 5.27 Wound Actions

### Minor Injury Supplemental Actions

Is there a wound?



If there is no open wound, and no further radiological emergencies are present, process the victim out of the facility for further medical attention at OCCMED.

Any wound requires a survey.



## 5.28 Wound Count

### Minor Injury Supplemental Actions

Is a wound count needed?

Wound counts are required if contamination is found on the wound or the following is true:

- A wound is or is thought to be sustained (including skin irritation, abrasion, cuts, and tearing)
- nuclides involved are known or thought to be  $\alpha$  or hard to detect  $\beta/\gamma$  emitters AND
- the injury occurred in a CA, HCA, ARA, from an engineered barrier breach, or from a contaminated object.

If in doubt, perform a wound count.



## 5.29 Lessons Learned

### Lessons Learned with Regard to Wound Counts

The supplemental actions for minor injury were revised after an incident involving the intake of plutonium 238 was nearly missed as summarized below from the lesson learned [LANL-2019-1672](#).

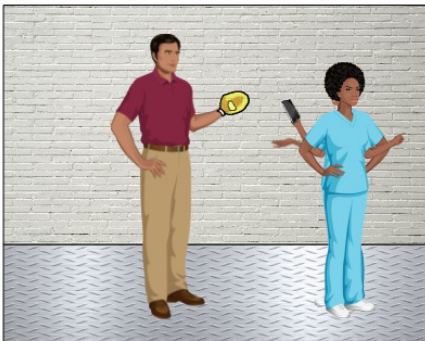
- A worker replacing cables in a glovebox felt a “poke.”
- No blood, redness or irritation was seen at the site of the poke.
- Skin contamination was seen but removed by tape press.
- Plutonium under the skin is not detectable by frisk.
- No wound count was performed because no intake was suspected.
- The intake was only discovered by bioassay.



## 5.30 Prep for OCCMED

### Minor Injury Supplemental Actions

Preparation for OCCMED



If a wound count is to be performed:

- Cover the wound with non-restrictive dressing
- Cover any contaminated areas
- Do not cover any orifice on the face
- Notify OCCMED that a potentially contaminated person is arriving
- Accompany the victim in a government vehicle
- Ensure the object that caused the injury is surveyed
- Notify supervision and request help as needed



### 5.31 OCCMED Arrival

#### Minor Injury Supplemental Actions

Arrival at OCCMED

- Enter through the northern sliding doors at OCCMED
- Provide a briefing to medical personnel
- Assist OCCMED personnel as requested
- Monitor and assist in controlling the spread of contamination, but do not interfere with medical actions
- Support contaminated area recovery actions



### 5.32 Minor Injury Knowledge Check

(Multiple Choice, 10 points, unlimited attempts permitted)

An injured person needs a wound count. What two organizations are capable of performing a wound count?

- ☒ Health Physics Analysis Laboratories (HPAL) and Occupational Medicine (OCCMED)
- ☐ Occupational Medicine (OCCMED) and Emergency Operations Support Center (EOSC)
- ☐ Los Alamos Medical Center (LAMC) and Health Physics Analysis Laboratories (HPAL)
- ☐ Emergency Operations Support Center (EOSC) and Los Alamos Medical Center (LAMC)

Correct	Choice
X	Health Physics Analysis Laboratories (HPAL) and Occupational Medicine

(OCCMED)
Occupational Medicine (OCCMED) and Emergency Operations Support Center (EOSC)
Los Alamos Medical Center (LAMC) and Health Physics Analysis Laboratories (HPAL)
Emergency Operations Support Center (EOSC) and Los Alamos Medical Center (LAMC)

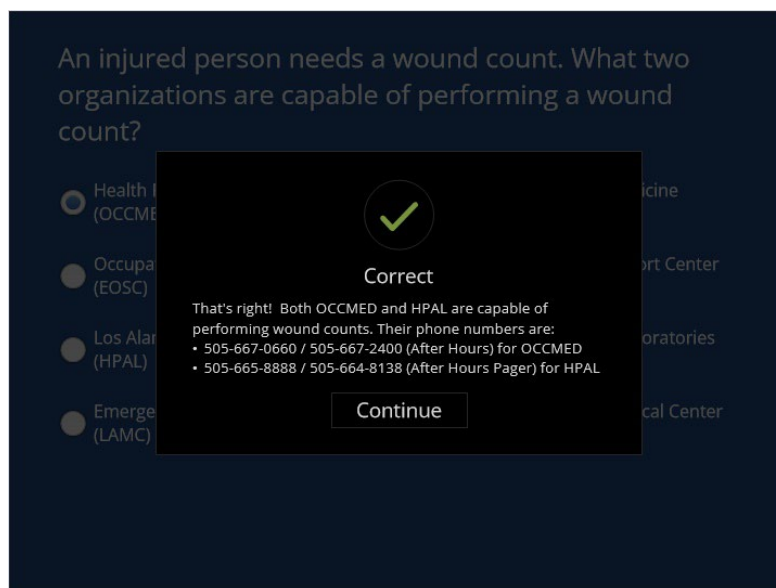
**Feedback when correct:**

That's right! Both OCCMED and HPAL are capable of performing wound counts. Their phone numbers are:

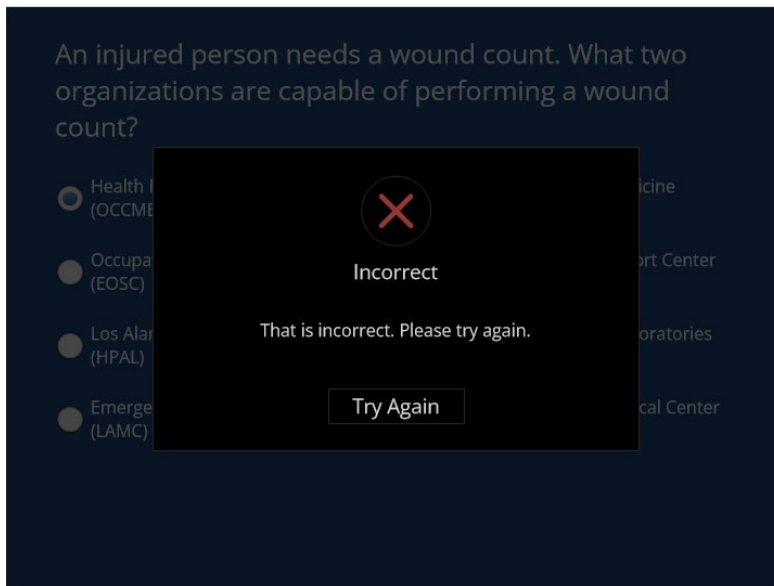
505-667-0660 / 505-667-2400 (After Hours) for OCCMED

505-665-8888 / 505-664-8138 (After Hours Pager) for HPAL

**Correct (Slide Layer)**

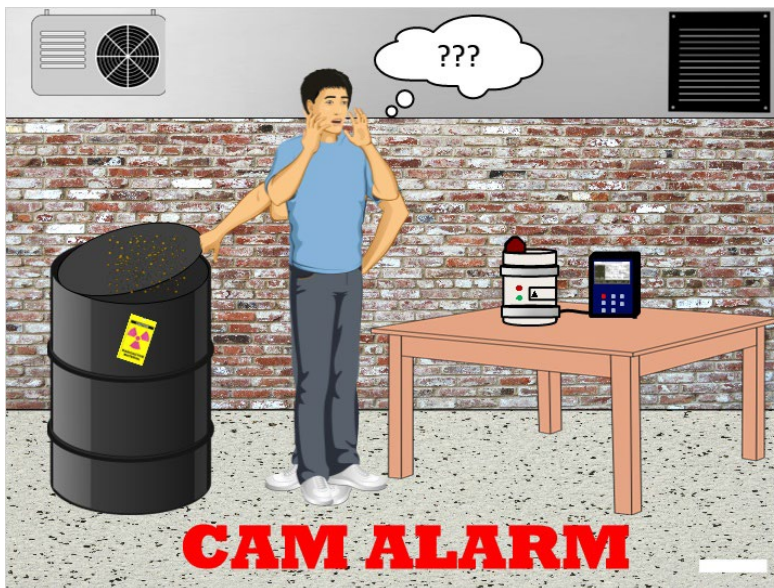


## Try Again (Slide Layer)



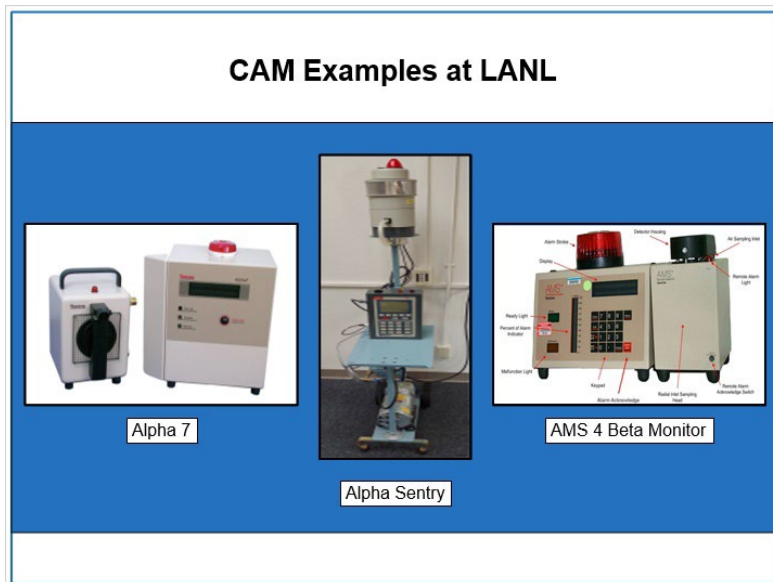
## 6. CAM Alarm

### 6.1 CAM Alarm





## 6.2 Different Types of CAMs



## 6.3 Exception to CAM Alarms

**Exception to CAM Alarm Initial Actions**



RP-PROG-TP-200, 4.5 Continuous Air Monitoring (CAM) Alarm

3. If all of the following are true, then work may continue:

- A CAM alarm is expected
- Workers were previously provided specific instructions in the work document regarding CAM alarms
- It is safe to continue work

The illustration shows two workers wearing respirators and hard hats. They are standing next to a table that holds a CAM unit and a laptop. The worker on the left is gesturing with his hands, while the worker on the right has his arms crossed. The CAM unit is a white box with a red alarm light on top. The laptop is open and displaying some data. The background is a simple floor and wall.


## 6.4 The Two Types of CAM Alarm Response

Response to a CAM Alarm	No respirator or insufficient protection	With a respirator
<p>Continuous Air Monitoring (CAM) systems are found throughout the Laboratory to help provide a response for airborne radioactivity levels.</p> <p>In the case of one of them alarming, different initial responses will need to be followed dependent on the situation. We will discuss these different scenarios as well as supplemental actions that should be followed.</p>		

Notes:

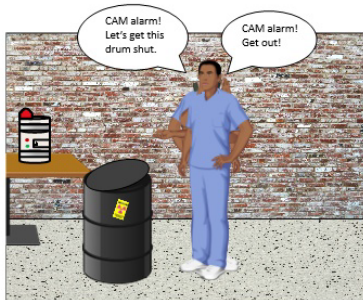
## 6.5 Initial Response Overview

CAM Alarm Initial Actions
<p>RP-PROG-TP-201, 4.5.1 CAM Alarm</p> <ol style="list-style-type: none"><li>1. If personnel are not wearing respiratory protection or respiratory protection is not adequate, then:<ol style="list-style-type: none"><li>a. Immediately evacuate the area in a safe manner.</li><li>b. Prevent personnel from entering the area.</li><li>c. If wearing a respirator, then direct personnel to not remove their respirator until told to do so unless immediate medical actions are necessary.</li></ol></li><li>2. If personnel are wearing respiratory protection and a CAM alarm is not expected, then:<ol style="list-style-type: none"><li>a. Place the work in a safe configuration.</li><li>b. Evacuate the area in a safe manner.</li><li>c. Prevent personnel from entering the area.</li><li>d. Direct personnel to not remove their respirator until told to do so unless immediate medical actions are necessary.</li></ol></li></ol>

 Los Alamos  
NATIONAL LABORATORY

## 6.6 Evacuation

### Evacuation



Without sufficient respiratory protection, all personnel must evacuate the area immediately, minimizing exposure to airborne radioactivity.

When there is sufficient protection, there is less risk to personnel and they may take time to place work in a safe condition prior to evacuation, which may isolate the source of airborne radioactivity and prevent its spread.



## 6.7 Prevent Entry

### Preventing Entry

Use barriers, notifications, postings, or personnel if necessary to keep personnel out of the affected area. No one should re-enter the area until a plan has been made by supervision to recover the area from the source of the CAM alarm.

Do not leave an unposted area unattended.

If an area will be posted as an HJEA, an RCT knowledgeable of the area must remain to guard the entrance.



## 6.8 Respirator Removal

### Respirator Considerations



Wait until personnel are in a clean area to direct removal of respirators.

Medical emergencies take precedence over radiological ones. Therefore, if a person is having difficulty breathing, immediate removal of the respirator is permitted.



## 6.9 Supplemental Actions

### CAM Alarm Supplemental Actions


1. Obtain the names and Z numbers of all personnel in the area at the time of the alarm.
2. Notify the HPFC, Team Leader, and management as appropriate, and request assistance as needed.
3. Perform a whole body frisk, including respirator (if applicable), for all personnel involved.
  - If contamination is found, then go to section 4.10, *Personnel Contamination*.
  - If contamination is not found, then continue to step 4.
4. Doff PPE and respirator (if applicable).
5. Segregate PPE and respirators (if applicable) for each individual.




## 6.10 Supplemental Actions Cont.

### CAM Alarm Supplemental Actions

- Perform a whole body frisk of personnel without PPE and respirator.
  - If contamination is found without PPE and respirator, then go to section 4.10.
  - If no contamination is found, then personnel may be released from the area. If a PCM is available, then personnel shall clear the PCM before being released.
- Segregate personnel who have been monitored from those who have not been monitored.
- Ensure nasal swipes are performed in accordance with section 4.11, *Nasal Swipes*.

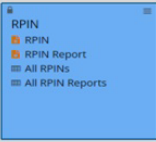








## 6.11 Follow-up Actions

### CAM Alarm Follow-Up Actions

- If there is known or suspected exposure to air concentrations  $\geq 40$  DAC-hr, then contact the Radiation Protection Services (RP-SVS) Internal Dosimetry team to determine if a special bioassay is necessary.
- Contact HPFC for re-entry in accordance with Section 4.12, *Re-Entry*, and change air monitoring filters.
- Send filters to HPAL with emergency priority for analysis.
- Initiate a Radiation Protection Initial Notification (RPIN).





## 6.12 CAM Alarm Knowledge Check

(Multiple Choice, 10 points, unlimited attempts permitted)

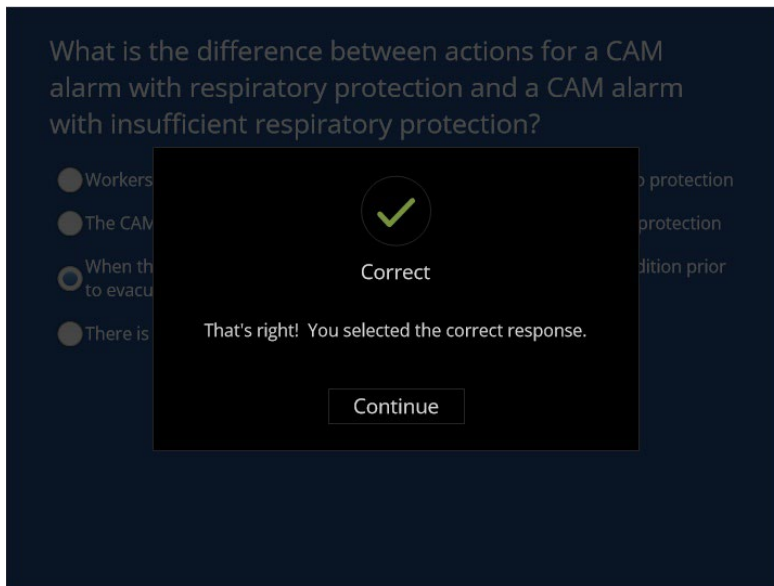
What is the difference between actions for a CAM alarm with respiratory protection and a CAM alarm with insufficient respiratory protection?

- ☐ Workers have five minutes to clean up their work area if they have no protection
- ☐ The CAM alarm can be ignored if everyone has sufficient respiratory protection
- ☒ When there is sufficient protection, work can be placed in a safe condition prior to evacuation
- ☐ There is no difference

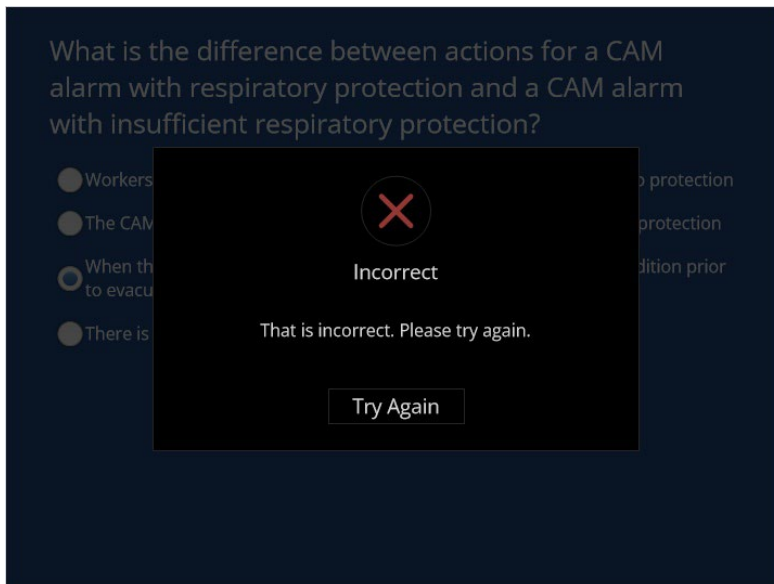
Correct	Choice
	Workers have five minutes to clean up their work area if they have no protection
	The CAM alarm can be ignored if everyone has sufficient respiratory protection
X	When there is sufficient protection, work can be placed in a safe condition prior to evacuation
	There is no difference



### Correct (Slide Layer)

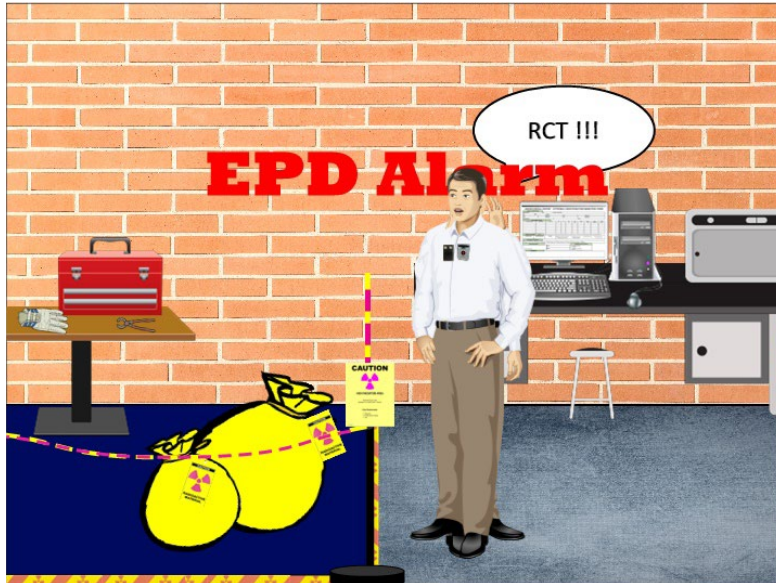


### Try Again (Slide Layer)



## 7. EPD Alarm

### 7.1 EPD Alarm



### 7.2 Dose Alarm Initial Response

#### EPD Dose Alarm Initial Actions

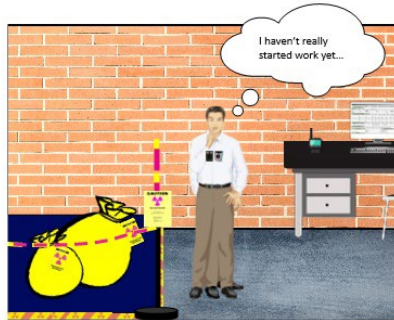
RP-PROG-TP-201, 4.8.1 *Dose Alarm*

1. Stop work.
2. Place work in a safe condition AND exit the area.
3. While Exiting the area, notify personnel of the dose alarm.
4. Record reading from the EPD and personal information associated with the alarming EPD.
5. Notify HPFC, Team Leader, and management as appropriate, AND request assistance as needed.
6. Return EPD to reset alarm.
7. Perform re-entry in accordance with Section 4.12, *Re-Entry*.

## 7.3 Stop Work and Exit

1. Stop work
2. Place work in a safe condition and exit the area

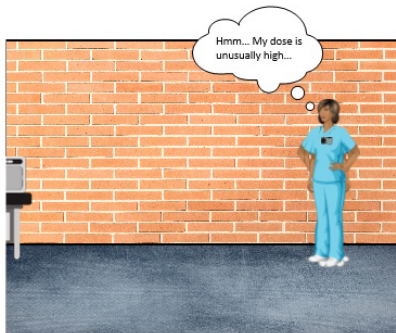
Work in a quick manner to secure the work area, preventing the spread of contamination and minimizing the possibility of hazards.



Los Alamos  
NATIONAL LABORATORY

## 7.4 While Exiting, Notify Others

3. While exiting, notify personnel of dose alarm



If others are unaware of the abnormally high dose rates, they may be close to alarming their EPDs as well. Other workers in the area should check their EPDs for high readings.

Evacuate to an area of low radiation levels verified by survey at the earliest opportunity.

Los Alamos  
NATIONAL LABORATORY

## 7.5 Remaining Initial Response Actions

### Remaining Initial Response Actions

4. Record EPD reading and the worker's personal information (name and Z number).
5. Notify the HPFC, Team Leader, and management. Request assistance as needed.
6. Return the EPD to reset the alarm.
7. Perform re-entry IAW Section 4.12



## 7.6 Dose Rate Initial Actions

### EPD Dose Rate Alarm Initial Actions

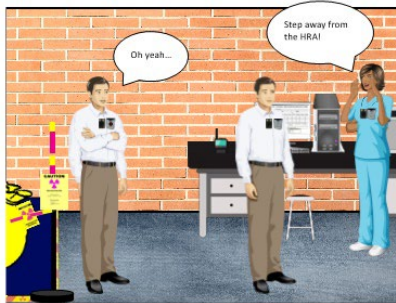
RP-PROG-TP-201, 4.8.2 EPD Dose Rate Alarm

1. Immediately proceed to an area of lower dose rate.
2. While moving to a low background area, notify personnel of the dose rate alarm.
3. Check the dose measurement on the EPD. IF a dose limit has been exceeded, THEN GO TO Section 4.8.1, *Dose Alarm*.
4. IF the EPD dose rate alarm subsides, THEN evaluate the need to proceed with the task using known data.
5. IF guidance is needed on how to proceed with the task, THEN notify HPFC and/or Team Leader as applicable.



## 7.7 Leave to Area of Lower Dose

### 1. Immediately proceed to an area of lower dose rate.



If high dose is not seen on the EPD but it is still alarming, the dose rate is high instead of total dose. Moving to an area of lower dose rate will silence the alarm.



## 7.8 Notify Others While Exiting

### 2. While moving to a low background area, notify personnel of the dose rate alarm.

If others are unaware of the abnormally high dose rates, they may be close to alarming their EPDs as well. Other workers in the area should check their EPDs for high readings.



## 7.9 Check EPD

3. Check the dose measurement on the EPD. If a dose limit has been exceeded, then take action for EPD dose alarm.

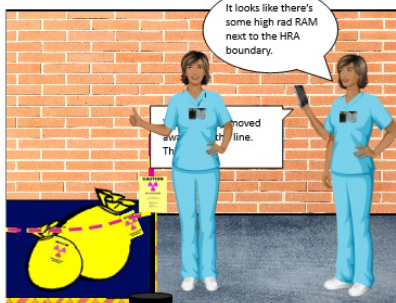


Workers should be aware of their allowed exposure based on what exposure they have left for the remainder of the year or what was written in their RWP. Another indicator of exceeding dose is that the EPD alarm does not silence after moving to an area of lower dose rate.



## 7.10 Seek Guidance

4. If the EPD alarm subsides, evaluate the need to proceed with known data.
5. If guidance is needed on proceeding, then notify the HPFC or Team Leader as needed.



Investigate the work area for possible reasons the dose rate is elevated, then determine if work can continue as written by moving worker position, nearby sources of radiation, or waiting for other evolutions to end.



## 7.11 EPD Alarm Knowledge Check

(Multiple Choice, 10 points, unlimited attempts permitted)

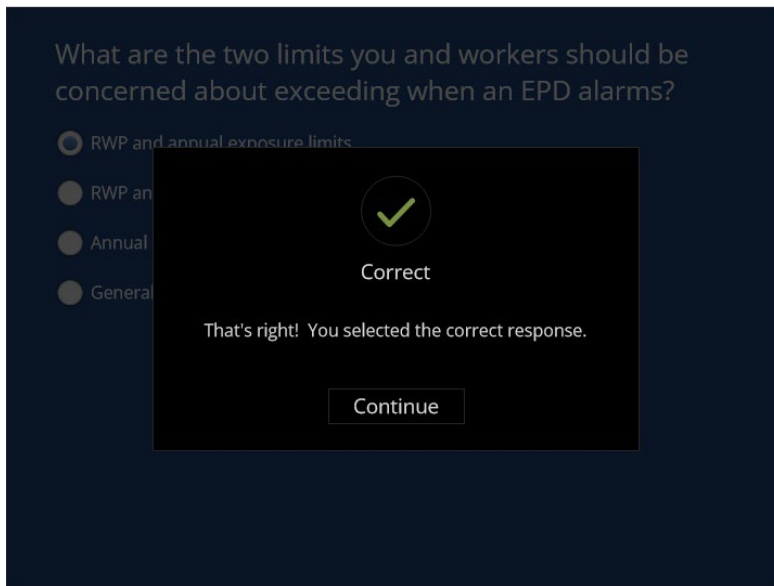


What are the two limits you and workers should be concerned about exceeding when an EPD alarms?

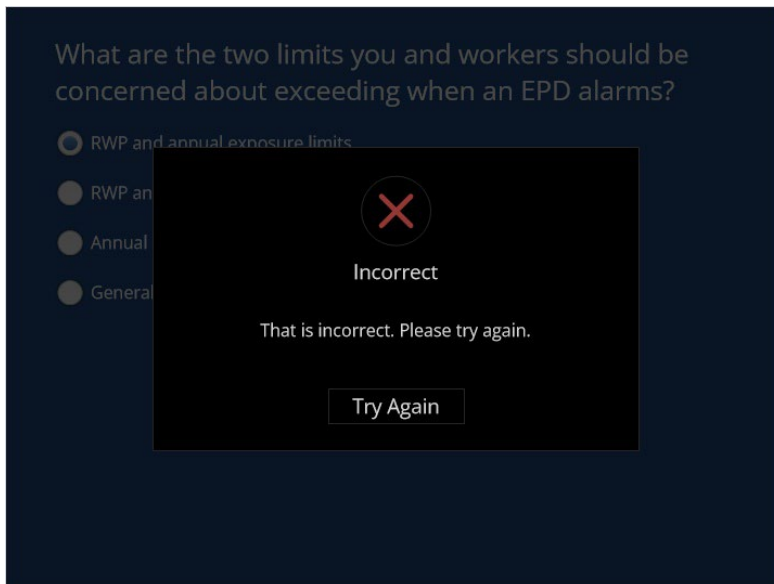
- ☒ RWP and annual exposure limits
- ☐ RWP and instrument exposure limits
- ☐ Annual and general public exposure limits
- ☐ General public and instrument exposure limits

Correct	Choice
X	RWP and annual exposure limits
	RWP and instrument exposure limits
	Annual and general public exposure limits
	General public and instrument exposure limits

### Correct (Slide Layer)



### Try Again (Slide Layer)



## 8. Personnel Decontamination

### 8.1 Personnel Decontamination



### 8.2 Hot Particles

#### Hot Particles

**P121 definition of a hot particle:** A small, loose, highly radioactive particle with an activity of nominally 15,000 dpm or greater ( $\alpha$  or  $\beta/\gamma$ ) and/or capable of producing an equivalent skin dose of  $>100$  mrem/hr.

If a hot particle is identified:

- Remove it by tape lift method
- Conduct an isotopic analysis on the particle



## 8.3 Clothing Contamination

### Clothing Contamination



Los Alamos  
NATIONAL LABORATORY

- Use tape press to remove contamination or cover it with tape
- Contaminated clothing is removed
- Isolate contaminated materials for further evaluation
- Perform a whole body frisk

## 8.4 Respirator Contamination

### Respirator Contamination

- Contamination on respirator filters is removed by wiping
- Tape lift or the covering with tape method is used for contamination in all other places
- Remove the respirator
- Isolate the respirator for further evaluation
- Perform a whole body frisk and obtain nasal smears



Los Alamos  
NATIONAL LABORATORY

## 8.5 Body Contamination

### Body Contamination




- Prevent contamination from entering any wound or orifice
- Wash areas with mild soap and lukewarm water (cool water for tritium)
- Tape press may be used for skin
- Do not use abrasive material
- Survey affected areas again
- Repeat decon efforts until:
  - contamination is removed
  - decon is no longer effective
  - reddening or irritation of skin is observed


 Los Alamos  
NATIONAL LABORATORY

## 8.6 Body Contamination Cont.

### Body Contamination


- Save contaminated materials for further evaluation
- Perform nasal smears if:
  - Non-PPE contamination occurred on the chest, shoulders, neck, or head
  - Respirators are contaminated or compromised
- Process decontaminated personnel through a PCM
- Contact OCCMED if in doubt on how to proceed at any time




 Los Alamos  
NATIONAL LABORATORY

## 8.7 Follow-up Actions

### Follow-Up Actions




- Is special bioassay needed?
  - Tritium liquid spilled on skin or clothing
- If skin contamination is:
  - $\geq 1,000$  dpm plutonium or americium
  - $\geq 10,000$  dpm uranium
  - contaminated by any other radionuclide
- What about a confirmatory count?
  - Hair/scalp, face, skin and/or whole body contamination includes  $\alpha$  or hard to detect  $\beta/\gamma$  radionuclides AND
  - Contamination occurred in a CA, HCA, ARA, from breach of an engineered barrier, or involved a contaminated object




## 8.8 Follow-up Actions Cont.

### Follow-Up Actions

- Complete RP-PROG-FORM-036 *Contaminated Person Survey* for any non-PPE contamination
  - Attach any related HPAL results
- Notify HPFC, Team Leader, and management as appropriate. Request assistance as needed.
- Initiate RPIN for:
  - any non-PPE contamination
  - unplanned PPE contamination
    - $>1,000$  dpm/100 cm<sup>2</sup>  $\alpha$
    - $>5,000$  dpm/100cm<sup>2</sup>  $\beta$
    - $>0.25$  mR/hr





## 8.9 Personnel Decontamination Knowledge Check 1

(Multiple Choice, 10 points, unlimited attempts permitted)

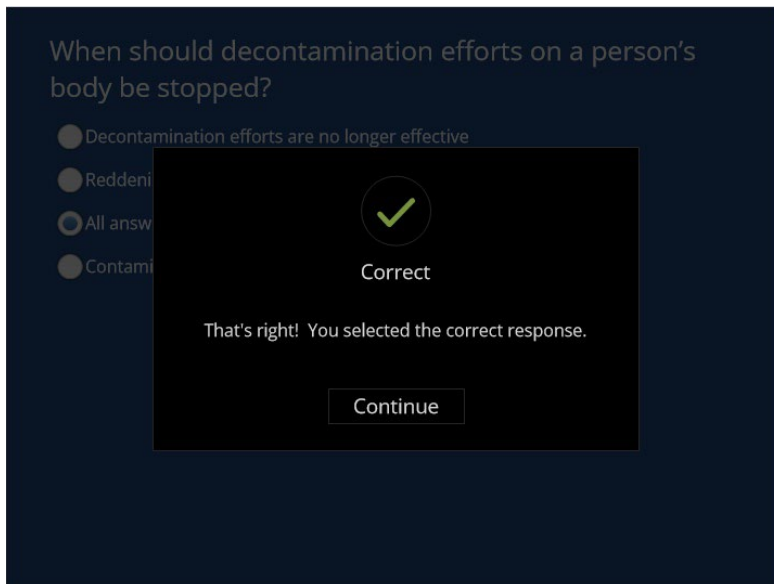


When should decontamination efforts on a person's body be stopped?

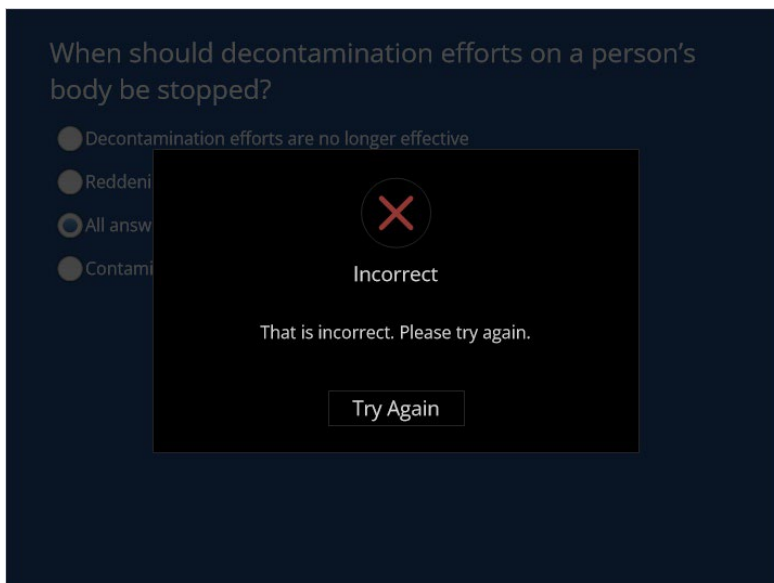
- ☐ Decontamination efforts are no longer effective
- ☐ Reddening or irritation of the skin is observed
- ☒ All answers are correct
- ☐ Contamination is removed

Correct	Choice
	Decontamination efforts are no longer effective
	Reddening or irritation of the skin is observed
X	All answers are correct
	Contamination is removed

### Correct (Slide Layer)



### Try Again (Slide Layer)



## 8.10 Personnel Decontamination Knowledge Check 2

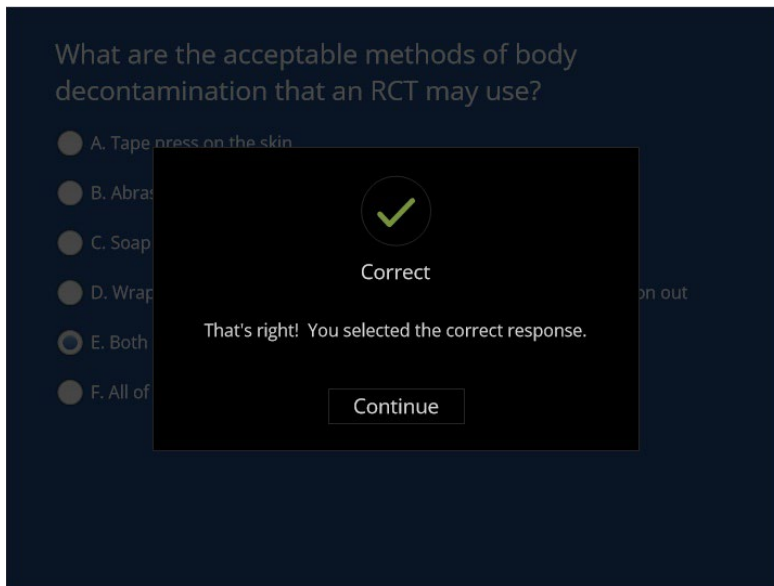
*(Multiple Choice, 10 points, unlimited attempts permitted)*

What are the acceptable methods of body decontamination that an RCT may use?

- ☐ A. Tape press on the skin
- ☐ B. Abrasive soaps
- ☐ C. Soap and lukewarm water (cool for tritium)
- ☐ D. Wrapping the affected area in poly and sweating the contamination out
- ☒ E. Both A and C
- ☐ F. All of the above

Correct	Choice
	A. Tape press on the skin
	B. Abrasive soaps
	C. Soap and lukewarm water (cool for tritium)
	D. Wrapping the affected area in poly and sweating the contamination out
X	E. Both A and C
	F. All of the above

### Correct (Slide Layer)



### Try Again (Slide Layer)

