

**LESSON PLAN**

**PART I**  
**COVER SHEET**

**LESSON TITLE:** Wartime Radioactive Fallout Decontamination

**TRAINING METHOD:** Lecture

**REFERENCES:** AFI 32-4001, Disaster Preparedness Planning and Operations  
AFMAN 32-4005, Personnel Protection and Attack Actions  
Army FM 3-5, NBC Decontamination  
Allied Tactical Publication (ATP) 45

**AIDS AND HANDOUTS:** Attachment 1 - Effectiveness of Natural Decontamination  
Attachment 2 - Decontamination Methods For Specific Materials

**LESSON OBJECTIVE:** Given a lecture on wartime radioactive fallout decontamination, the student, during the final course exam, must correctly answer questions relating to at least three samples of behaviors listed below:

**SAMPLES OF BEHAVIOR:**

1. Identify major considerations affecting decon operations.
2. Understand the decay rate of radioactive contamination using the 7/10 rule.
3. Identify the planning factors required for decon operations.
4. State the difference between the various levels of decon operations.
5. Identify the different methods of decontamination.

**ORGANIZATIONAL PATTERN:** Topical

**SUGGESTED COURSE(S) OF INSTRUCTION:** Contamination Control Teams  
NBC Defense Training

**STRATEGY:** This lecture presents basic principles of wartime radiological decontamination that the student must understand so they can perform decontamination. The instructor needs to stress that radioactive fallout can't be neutralized. Emphasize that until radiation decays to an acceptable level, immediate decontamination outside the shelters should be performed only when necessary to reduce dangerous exposure levels for personnel.

**LESSON OUTLINE:**

- MAIN POINT 1.       CONTAMINATION CONTROL
- A. Decontamination
  - B. Persistency - 7/10 Rule
  - C. Limitations
- MAIN POINT 2.       PLANNING FACTORS
- A. Commander's Determination
  - B. Levels of Decon
  - C. Identify What Is Contaminated
  - D. Select the Method of Decontamination
  - E. Amount of Help Needed
- MAIN POINT 3.       LEVELS OF DECON OPERATIONS
- A. Immediate
  - B. Operational
  - C. Thorough
  - D. Reconstitution
- MAIN POINT 4.       METHODS OF DECONTAMINATION
- A. Cautions
  - B. Covering
  - C. Scraping
  - D. Brushing/Vacuuming
  - E. Washing

**PART II**  
**TEACHING PLAN**  
**INTRODUCTION**

- ATTENTION:** Fallout can render facilities, vehicles, aircraft, and equipment unsafe or unusable by contaminating them with dangerous levels of radioactive material.
- MOTIVATION:** You can help the unit meet immediate mission requirements and maximize personal safety if you follow effective decontamination procedures.
- OVERVIEW:** This lecture covers the following important aspects of wartime radioactive fallout decontamination:
- ⇒ general decontamination considerations
  - ⇒ planning and preparation for decontamination
  - ⇒ levels of decon operations
  - ⇒ methods of decontamination
- TRANSITION:** First, let's discuss factors affecting decontamination decisions.

**BODY****MAIN POINT 1.  
CONTAMINATION  
CONTROL**

Contamination control consists of avoiding, marking, and detecting contamination as well as decontamination operations. Of these components, keep in mind that contamination avoidance before an attack is the most effective, cheapest, and easiest to perform.

**A. DECONTAMINATION**

A. Nuclear decontamination is defined as the process of making any person, object, or area safe by removing radioactive material clinging to or around it. As a part of the contamination control process, decontamination operations are intended to help sustain or enhance conduct of military operations by preventing or minimizing performance degradation, casualties, or loss of material.

B. PERSISTENCY - 7/10  
RULE

B. The length of time a hazard remains depends on the persistency of the contamination. Removing the contamination affects your immediate environment but, wherever the contamination is moved to still presents a hazard. True radiological contamination persistency is the rate of decay. A standard decay rate can be used to estimate the persistency of the hazard. For operational purposes you can use the "7-10 rule of thumb" to estimate future radiation levels.

**INSTRUCTOR'S NOTE:** This rule provides general estimates and should be used for planning only. Refer to ATP 45 standard decay nomograms to predict the decay rates.

The 7-10 rule means that for every sevenfold increase in time after the explosion, the dose rate decreases by a factor of 10.

For example, if the radiation dose rate (expressed as cGy) at 1 hour after the explosion is taken as a reference point, then 7 hours after the explosion the dose rate will have decreased to one-tenth. At  $7 \times 7 = 49$  hours (or roughly two days) the rate will decrease to one-hundredth of the initial rate.

$7 \times 7 = 49$  HOURS (OR  
ROUGHLY TWO DAYS)  
THE RATE WILL DECREASE  
TO ONE-HUNDRETH OF  
THE INITIAL RATE.

## C. LIMITATIONS

C. In wartime, manpower and time are critical resources that cannot be wasted on nonessential tasks. Therefore, decontamination of areas, facilities, and equipment will be limited to that which is necessary to allow protected personnel to resume operations.

During a decontamination operation, completing the mission is paramount. Protected people can work with contaminated equipment. Therefore, decontamination must be aimed at restoring mission capability rather than totally eliminating the hazards.

## MAIN POINT 2. PLANNING FACTORS

The effectiveness of a decontamination operation will depend on certain factors:

- ⇒ the need for decontamination
- ⇒ the level of decontamination
- ⇒ what is decontaminated
- ⇒ the method of decontamination
- ⇒ amount of help needed for the decon operations

A. COMMANDER'S  
DETERMINATION

A. The commander determines the need for decontamination operations based on the tactical situation, the nature and extent of contamination, resources available, and potential results of the operation.

If decontamination is not possible or needed, non-mission essential areas may be marked and restricted from use. Always give first priority to personnel decontamination to prevent casualties and reduce manpower losses. For the second priority, decontaminate mission essential aircraft and related equipment and material/facilities.

B. LEVELS OF DECON

B. Levels of decontamination include:  
⇒ immediate  
⇒ operational  
⇒ thorough  
⇒ reconstitution

Decontamination beyond the individual level is accomplished by organizational personnel under the supervision of specially trained and assigned personnel (i.e. Contamination Control Teams), using available decontamination equipment and supplies. We will cover these levels in more detail later in this lesson.

### C. IDENTIFY WHAT IS CONTAMINATED

C. Identify facilities, equipment, and material within the contaminated area. This step is required to prioritize decontamination of facilities, equipment, and material critical to the mission. The type of surface being contaminated is also a factor. For example, decontaminating a field or porous earth requires different procedures than cleaning a paved surface.

DO NOT SUBJECT  
VULNERABLE EQUIPMENT  
TO UNNECESSARY DECON

Do not subject vulnerable equipment to unnecessary decon. Radiac meters may measure low levels of radiation that are not dangerous.

D. SELECT THE METHOD  
OF DECONTAMINATION

D. Select the method of decon. Some options include:

- ⇒ covering
- ⇒ scraping
- ⇒ brushing/vacuuming
- ⇒ washing

We'll cover these methods in more detail later in this lesson.

E. AMOUNT OF HELP  
NEEDED

E. Determine the number of people required to perform decon operations. The number should be based on decon procedures, and methods used for the operation.

TRANSITION:

Let's continue this lesson by discussing levels of decon operations.

MAIN POINT 3.  
LEVELS OF DECON  
OPERATIONS

Decontamination operations are broken down into four levels: immediate, operational, thorough, and reconstitution. Radiological fallout decontamination normally is immediate or operational. To select the best method to use, consider the amount of time, materials required, and what level of decontamination is acceptable for mission activities.

## A. IMMEDIATE

IF CONTAMINATION IS  
NOT REMOVED,  
RADIATION EXPOSURE  
INCREASES OVER TIME

A. Immediate decontamination is aimed at minimizing casualties, saving lives, and limiting the spread of contamination. It is conducted by the individual as soon as someone suspects they have been contaminated. It involves decontaminating the skin, personal clothing, and equipment. However, because no immediate life-threatening hazard is caused by radiological contamination, no immediate skin decon is required.

However, wash exposed areas of your skin when possible. If radiological contamination is not removed, your radiation exposure will increase over time.

Brush the dust off your equipment and mask carrier. Wash exposed areas of your skin. Avoid breathing dust you shake or brush off by wearing a piece of cloth over your face. If you were contaminated by a wet radiological contaminant, you must exchange your IPE as soon as possible because brushing or shaking will not remove the contamination or its hazard.

B. OPERATIONAL

B. Operational decontamination is aimed at minimizing contact or transferring hazards, and sustained operations. It is conducted by individuals, crews, teams, or units when operations require. It involves decontaminating specific parts of operationally essential equipment, material, work areas and exchange of individual protective equipment.

For radiological contamination, hot, soapy water is the primary method of decontamination. Colder water can be used but requires more scrubbing. If water is not available, you can use your M258A1 kit.

C. THOROUGH

C. Thorough decontamination is aimed at reducing contamination to the lowest possible levels, to permit partial or total removal of IPE, and maintain operations with minimum degradation. It is conducted by units or wings, with or without external support when operations, manning, and resources permit. It involves decontaminating personnel, equipment, material, or work areas and may include some terrain beyond the scope of operational decontamination.

## D. RECONSTITUTION

D. Reconstitution decontamination is aimed at eliminating contamination to restore mission critical resources to a condition which permits unrestricted use, handling, or operation, and release from military control. It is conducted by units or wings with external support after hostile actions have terminated, when the commander determines it is in the unit's best interest, or when directed by higher authority. It involves decontaminating critical aircraft, equipment, material, work areas and terrain.

### MAIN POINT 4. METHODS OF DECONTAMINATION

The primary methods of decontamination used for wartime radioactive fallout: covering, scraping, brushing, vacuuming, and washing.

#### A. CAUTIONS

A. Note that none of these methods will neutralize radioactive contamination. The contamination control teams should periodically monitor until the radiation is at a safe level. Radiological contamination can readily be detected and located with monitoring equipment.

WEATHER HAS LITTLE  
AFFECT

Although the term "weathering" is used to describe some decon processes, weather has little affect on radiological hazards. Heavy rain and wind may remove some contamination, but only time will reduce the radiation emanating from the contamination.

AVOID BURNING  
RADIOLOGICAL  
CONTAMINATION

Avoid burning radiological contaminated surfaces. Although this works well for biological and chemical contamination, burning will not destroy radiological contamination or its hazards. It may however, spread contamination if radioactive particles become suspended in smoke spread by wind.

**INSTRUCTOR'S NOTE:** Attachment 1, in Part IV, shows the effectiveness of natural decontaminants.

B. COVERING

B. Radiological contamination can be covered by thick layers of dense material, like earth. Eight centimeters (3 inches) of earth will decrease radiation dose rates by half because of the shielding provided by the soil. This dirt obviously must come from an uncontaminated source. The job will be easier with earth-moving equipment, but the equipment and operators probably will need to undergo decon.

## C. SCRAPING

C. Scraping is used in unpaved areas and will depend on the availability of earth-moving equipment and trained personnel. Scraping is suited for removal of firm soil and snow on any long, open area where contamination can be dumped along the edge. Fallout does not penetrate the top layer of soil unless it is followed by rain and, therefore, can be scraped aside.

MOVE SOIL AWAY; PILES  
TEND TO CONCENTRATE  
RADIATION

Move contaminated soil as far away as possible; the piles tend to concentrate radiation. Immediately below a nuclear blast area, the soil may be radioactive to a depth of 1-1/2 meters. In most cases, decon of this much earth is not practical.

Scraping can be accomplished with graders, bulldozers, plows, hand shovels, tractor scrapers, and front-end loaders.

D. BRUSHING/  
VACUUMING

D. Brushing/vacuuming is effective on paved and finished surfaces. This method requires brooms, brushes, vacuums etc., for inside shelters and for personnel. Street sweepers are ideal for roadways and flight lines.

E. WASHING

E. Washing with hot water and detergent is effective on wood, roofing material, masonry products, steel surfaces, asphalt and concrete. Using a firehose or power drive decon apparatus provides enough force to loosen and flush away fallout particles. Scrubbing with brooms followed by flooding produces excellent results on paved surfaces.

SET UP SERVICE STATIONS

Service-station type decon sites could be set up to service a given region on the base. These sites must be evenly spaced across the support areas so contaminated personnel and equipment do not have to travel far.

CONTROL RUNOFF

Control the runoff by using drainage ditches that flow into a sump. Remember, you have not destroyed the contamination -- just moved it. The runoff will still be hazardous.

**INSTRUCTOR'S NOTE:** Attachment 2, in Part IV, provides a list of decon methods for specific materials.

## CONCLUSION

### SUMMARY:

In summary, remove the contamination and you reduce the hazard. We have just covered decontamination of radioactive fallout. The main topics were:

⇒ contamination control such as decontamination and its limitations.

⇒ planning and preparation for decontamination to include the level and methods of decontamination.

⇒ levels of decon operations: immediate, operational, thorough, and reconstitution.

⇒ methods of decontamination: covering, scraping, brushing and vacuuming, and washing (the most common method).

### REMOTIVATION:

By following effective decontamination procedures, we'll be better able to help our unit meet immediate mission requirements and to maximize personnel safety.

### CLOSURE:

This concludes this lesson on wartime fallout decontamination.

### TRANSITION:

(Develop locally to transition to the next topic.)

**PART III**  
**EVALUATION**  
**STUDENT PERFORMANCE STANDARDS**

**TEST ITEMS**

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1. LESSON OBJECTIVE: Identify major considerations affecting decon operations.

QUESTION: (TRUE or FALSE)

In wartime, manpower and time are critical resources that cannot be wasted on nonessential tasks. Therefore, decontamination of areas, facilities, and equipment will be limited to that necessary to allow protected personnel to resume operations.

- a. True
- b. False

KEY: a

REFERENCE: Main Point 1

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2. LESSON OBJECTIVE: Understand the decay rate of radioactive contamination using the 7/10 rule.

QUESTION: (Multiple Choice)

At one hour after the detonation, the radiation level was recorded as 1000 cGy per hour. Two weeks later the estimated radiation level should be:

- a. 0.1
- b. 1.0
- c. 10.0
- d. 100.0

Key: b

Main Point 1

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3. LESSON OBJECTIVE: Identify the planning factors required for decon operations.

QUESTION: (Multiple Choice)

Which of the following is **NOT** a factor in planning decontamination operations?

- a. Determining the level of capability to perform certain decon operations.
- b. Identifying the shelters required to conduct exposure control operations.
- c. Determining the need for a decon operation based on the tactical situation.
- d. None of the above.

Key: b

REFERENCE: Main Point 2

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4. LESSON OBJECTIVE: State the difference between the various levels of decon operations.

QUESTION: (Multiple Choice)

The types of radioactive fallout decon operations include:

- a. Immediate, Expedient, Detailed, and Restoration
- b. Immediate, Expedient, Thorough, and Reconstitution
- c. Immediate, Operational, Expedient, and Restoration
- d. Immediate, Operational, Thorough, and Reconstitution

KEY: d

REFERENCE: Main Point 3.

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QUESTION 2: (Multiple Choice) State the difference between the various levels of decon operations.

Which method of decontamination is restricted to specific parts of essential equipment, material, and working areas, in order to minimize contact and transfer hazards and to sustain operations.

- a. Immediate
- b. Operational
- c. Thorough
- d. Reconstitution

Key: b

REFERENCE: Main Point 3

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5. LESSON OBJECTIVE: Identify the different methods of decontamination.

QUESTION: (Matching) Select the best method of decontamination listed on the right to the materials listed in the column on the left.

- |                                   |  |
|-----------------------------------|--|
| 1. Roads, bivouac areas, pathways | a. Requires special process                            |
| 2. Mess gear and canned rations   | b. Planning  |
| 3. Wood                           | Wash exterior with large amounts of water              |
| 4. Water                          | c. Wash with soap and water, rinse                     |
|                                   | Brush, wipe contamination from surfaces and containers |
|                                   | d. Earthmoving (removal)                               |
|                                   | Sealing (with earth)                                   |

KEY: 1d, 2c, 3b, 4a

REFERENCE: Main Point 4



**PART IV**  
**RELATED MATERIALS**

**RTP C1** - Nuclear Warfare Defense Actions

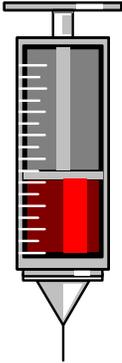
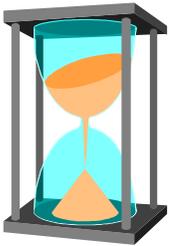
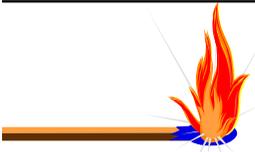
**RTP C7** - Alpha, Beta, and Gamma Radiation Hazards and Protective Actions

**RTP F15** - Wartime Decontamination of Chemical/Biological Agents

**Attachment 1** - Effectiveness of Natural Decontamination

**Attachment 2** - Decontamination Methods For Specific Materials



			
 <b>Weathering/Aging</b>	Fair	Fair	Fair
 <b>Earth</b>	Fair	Fair	Fair
 <b>Fire</b>	Useless	Excellent	Excellent
 <b>Water</b>	Excellent	Fair	Poor
	<b>Nuclear</b>	<b>Biological</b>	<b>Chemical</b>

Attachment 1 - Effectiveness of Natural Decontaminants

**Decontamination of Specific Items**

Surface or Material	Nuclear Contamination	Surface or Material	Nuclear Contamination
Asphalt	<ul style="list-style-type: none"> <li>• Brush or sweep</li> <li>• Flush with water</li> <li>• Vacuum cleaning</li> </ul>	Roofs	<ul style="list-style-type: none"> <li>• Same as for asphalt</li> </ul>
Brick and Stone roads	<ul style="list-style-type: none"> <li>• Brush or sweep</li> <li>• Flush with water</li> <li>• Vacuum cleaning</li> <li>• Abrasion (sand blasting)</li> </ul>	Buildings	<ul style="list-style-type: none"> <li>• Same as for brick and stone roads</li> </ul>
Concrete roads	<ul style="list-style-type: none"> <li>• Same as for brick and stone roads</li> </ul>	Earth roads, bivouac areas, pathways	<ul style="list-style-type: none"> <li>• Earthmoving (removal)</li> <li>• Sealing (with earth)</li> </ul>
Fabrics	<ul style="list-style-type: none"> <li>• Brushing</li> <li>• Laundering</li> </ul>	Leather	<ul style="list-style-type: none"> <li>• Brushing</li> <li>• Flushing with water or soapy water</li> </ul>
Glass	<ul style="list-style-type: none"> <li>• M258A1 kit</li> <li>• Wipe with soap and water</li> <li>• Wipe with alcohol or household bleach</li> </ul>	Grass/low vegetation	<ul style="list-style-type: none"> <li>• Earthmoving (removal)</li> <li>• Sealing (with earth)</li> </ul>
Metals	<ul style="list-style-type: none"> <li>• Brush or wipe</li> <li>• Flush with water</li> </ul>	Mess gear and canned rations	<ul style="list-style-type: none"> <li>• Wash with soap and water, rinse</li> <li>• Brush, wipe contamination from surfaces and containers</li> </ul>
Plastics	<ul style="list-style-type: none"> <li>• Wash with detergents</li> <li>• Flush with water</li> <li>• Wipe or brush</li> </ul>	Rubber (impermeable)	<ul style="list-style-type: none"> <li>• Brushing</li> <li>• Scrubbing or flushing with water or soapy water</li> </ul>
Sand	<ul style="list-style-type: none"> <li>• Earthmoving (removal)</li> <li>• Sealing (with earth)</li> </ul>	Wood	<ul style="list-style-type: none"> <li>• Planning</li> <li>• Wash exterior with large amounts of water</li> </ul>
Water	<ul style="list-style-type: none"> <li>• Flocculation (requires special process)</li> <li>• Ion exchange</li> </ul>	Food - not canned or protected by impermeable container	<ul style="list-style-type: none"> <li>• Wash or trim contamination from unpackaged food</li> </ul>
Personnel	<ul style="list-style-type: none"> <li>• Brush or wipe from skin and hair</li> <li>• Bathe with soap and hot water</li> </ul>	Food - canned, bottled, or protected by impermeable container	<ul style="list-style-type: none"> <li>• Wash with soap and water, rinse</li> <li>• Brush, wipe contamination from surfaces and containers</li> </ul>

TRAINING PACKAGE COMMENT REPORT

RTP #	RTP DATE
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**Comments:** \_\_\_\_\_  
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