

**FM 3-5**  
**MCWP 3-37.3**

***NBC***  
***Decontamination***

**Headquarters,  
Department  
of the  
Army**

**Commandant,  
US Marine Corps**

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# FOREWORD

This publication may be used by the US Army and US Marine Corps during training, exercises, and contingency operations.

**JOHN N. ABRAMS**  
General, United States Army  
Commanding  
Training and Doctrine Command



**J. E. RHODES**  
Lieutenant General, US Marine Corps  
Commanding General  
Marine Corps Combat Development  
Command

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# NBC DECONTAMINATION

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## Preface

FM 3-5 integrates the nuclear, biological, and chemical (NBC) fundamentals published in FM 3-100 and implements Standardized North Atlantic Treaty Organization Agreement (STANAG) 2426.

The extent and timing of decon depends on the tactical situation, the mission, the area of contamination, and the decon resources available. Survivability and reducing the effect of any chemical threat are the ultimate goals of decon. This manual provides detailed guidance on conducting decon operations performed by chemical and nonchemical personnel. Individual soldiers and leaders must be familiar with the basic procedures and concepts in this manual.

Appendix A contains an English to metric measurement conversion chart.

The proponent of this publication is Headquarters TRADOC. To submit changes for improving this publication use Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to Commandant, US Army Chemical School, ATTN: ATSN-CMZ, Fort Leonard Wood, Missouri 65473-8926.

*Unless this publication states otherwise, nouns and pronouns do not refer exclusively to men.*

## Chapter 1

# Introduction

The use of NBC weapons creates unique residual hazards that may require decon. In addition to the deliberate use of these weapons, collateral damage, natural disasters, and industrial emitters may require decon. The presence of contamination generally reduces the effectiveness of our combat power. Contamination forces us into protective equipment that degrades our ability to perform individual and collective tasks.

### CONTAMINATION FORMS

1-1. The following are the different forms of contamination:

- Solids – radioactive particles, biological spores, or dusty agents that could appear as a fine dust.
- Liquids – liquid droplets that fall like rain. Droplets can range from thick and sticky to the consistency of water.
- Vapors or gases – created by bursting munitions or generators. These clouds are affected by the weather and can cover large areas.
- Aerosols – fine liquids or solid particles suspended in the air. They behave much like vapors.

### CONTAMINATION-HAZARDS TRANSMISSION

1-2. Contamination hazards can be transmitted in the following manner:

- **Transfer.** Anything that touches a surface covered with liquid or solid contamination will tend to pick up that contamination and move it from one surface to another.
- **Spread.** Touching a surface covered with liquid chemical agent can spread contamination on the same surface, thereby, increasing the size of the contaminated area.
- **Vapor.** Vapors can be carried through the air in the form of a dust, atomized liquids (aerosols), or true gases. Vapors in an open/outdoor area disperse rapidly, so there is no need to decon.
- **Desorption.** Liquid-chemical contamination absorbs into porous surfaces. Once absorbed, it begins to desorb or give off gas; that is, low levels of vapor pass out of the contaminated surface into the air and can be transferred to any surface that contacts it, including bare skin.
- **Radiation.** Radiation is given off by radioactive dust or dirt, most of which appears as fallout. For decon purposes, radiation can be thought of as a solid.

## AGENT CLASSIFICATION

1-3. Depending on the length of time agents will be a hazard, they are classified as—

- Nonpersistent – an immediate threat that lasts a few minutes. They rarely require decon.
- Persistent – takes a longer time to act and may last for days. In a protected environment, these agents can last for long periods of time. All agents are affected to some extent by the weather. Even radiological particles can “rain out” of the air and form hot spots on the ground. Biological organisms are greatly affected by sunlight. Chemical agents can be decontaminated by the weather. The duration of a hazard is a complex estimation that is based on numerous factors which include the—
  - Type of contamination.
  - Contamination density and droplet size.
  - Temperature.
  - Wind speed.
  - Sunlight.
  - Humidity and rain.
  - Composition of the contaminated surface.
  - Type of soil and terrain.

## DECONTAMINANTS

1-4. Decontaminants are described as follows:

- Natural – weather (rain, wind, and humidity).
- Standard – supertropical bleach (STB) and decontaminating solution number 2 (DS2).
- Nonstandard – soaps and detergents.

1-5. For more information on the types of decontaminants, see Appendix B.

## DECON CONCEPTS

1-6. Whenever soldiers are unable to avoid contamination and have to use protective measures, decon is necessary to allow them to remove their protective gear and resume normal operations. Weathering is the most desirable means of decon; however, time and operational needs may not permit that option.

1-7. This chapter describes when, where, and how much to decon. Protective clothing (mission-oriented protective posture [MOPP] gear), protective equipment, and collective protective shelters (CPSs) offer only a temporary solution. Decon is the removal, destruction, or naturalization of contamination. If you become contaminated, some decon must occur as soon as possible.

## DECON DECISIONS

1-8. The decision to decon is a risk assessment and is made within the context of the mission, enemy, terrain, troops, time available, and civilian

consideration (METT-TC) and the resources available. Decon must be considered if the contamination levels exceed the negligible risk levels as follows:

- Chemical and biological contamination causes mild incapacitation in 5 percent or less of unprotected soldiers operating for 12 continuous hours within 1 meter of contamination. For the chemical-agent monitor (CAM), this equates to a one-bar reading at a distance of 1 inch from the surface.
- Radiological contamination can cause mild incapacitation in 2.5 percent or less of unprotected, nonpreviously exposed soldiers. This equates to a reading of no more than 0.33 centigray per hour (cGy/hr).

1-9. MOPP-gear exchange provides excellent protection against field concentrations of agents; however, wearing the gear causes performance degradation. Decon is performed to restore the normal operating tempo, but the logistical support that is required to keep soldiers in MOPP gear impacts operations. Therefore, decon should be conducted as soon as practical. Table 1-1 provides comparison data for decon levels/techniques.

**Table 1-1. Comparison Data for Decon Levels/Techniques**

Levels	Techniques <sup>1</sup>	Best Start Time	Performed by	Advantages
Immediate	Skin decon	Before 1 minute	Individual	Stops agent from penetrating.
	Personal wipe down	Within 15 minutes	Individual or crew	
	Operator's spray down			
Operational	MOPP-gear exchange <sup>2</sup>	Within 6 hours	Unit	Provides possible temporary relief from MOPP <sup>4</sup> . Limits liquid agent spread.
	Vehicle washdown <sup>3</sup>		Battalion crew or decon platoon (-)	
Thorough	DED and DAD	When mission allows reconstitution	Decon platoon	Provides probable long-term MOPP reduction with minimum risk.
	DTD		Unit	

<sup>1</sup>The techniques become less effective the longer they are delayed.  
<sup>2</sup>Performance degradation and risk assessment must be considered when exceeding 6 hours. See FM 3-4 for battle-dress overgarment (BDO) risk assessment.  
<sup>3</sup>Vehicle washdown is most effective if started within 1 hour.

## DECON PRINCIPLES

1-10. Decon immediately for a chemical agent on the skin. Perform higher levels of decon as a result of the risk assessment. Personnel should—

- Decon as soon as possible. The sooner the contamination is removed, the sooner MOPP levels can be reduced and combat power can be restored.
- Decon only what is necessary. Weathering is the least costly method of decon. Expend resources where they count.
- Decon as far forward as possible. While METT-TC dependent, performing decon as close to the point as possible reduces the spread of contamination and minimizes any transfer hazard.
- Decon by priority. The commander identifies which items are most critical to the mission. Restoring combat power and reestablishing operating tempo are key.

## **DECON LEVELS**

1-11. The three levels of decon operations are immediate, operational, and thorough (see Table 1-1, page 1-3).

### **IMMEDIATE**

1-12. Skin decon is a soldier's basic survival skill and should be performed within 1 minute of being contaminated using the skin decontaminating kit (SDK).

1-13. Personal wipe down should be performed within 15 minutes. This is done to remove contamination from individual equipment by using an individual equipment decon kit (IEDK). Use detector paper or a CAM to locate the agent. For radiological contamination, use a radiac set to locate it and then brush, wipe, or shake it off.

1-14. Operators' spray down should be done within 15 minutes. Operators use the on-board decon apparatus to decon surfaces that they must touch or contact to operate the equipment. Radiological contamination in the form of dust particles may be wiped, scraped, or brushed off.

### **OPERATIONAL**

1-15. A MOPP-gear exchange should be performed within 6 hours of being contaminated when thorough decon cannot be done. Soldiers will continue to wear MOPP gear and the operating tempo will be reduced.

1-16. Vehicle washdown should be performed within 6 hour of being contaminated when the mission does not permit a thorough decon. This process removes gross contamination and limits the spread of it.

### **THOROUGH**

1-17. Detailed equipment decon (DED) and detailed aircraft decon (DAD) restore items so that they can be used without MOPP gear. Normally, the DED and the DAD are conducted as part of a reconstitution or during breaks in combat operations. These operations require support from a chemical decon unit.

1-18. Detailed troop decon (DTD) normally takes place in conjunction with DED/DAD. The contaminated unit conducts this process and supports the DED/DAD operations.

## **CHEMICAL-AGENT-RESISTANT COATING (CARC)**

1-19. Army equipment is painted with CARC, which precludes the absorption of chemical agents and, thus, facilitates decon. By preventing penetration of an agent, contamination is easier to remove. Thickened agents are still a problem, but detergent and water should remove them.

1-20. The proper CARC paint colors should be used to paint bumper numbers, spot painting, and so forth. Do not use other paints in lieu of CARC.

## **WEATHER EFFECTS**

1-21. If METT-TC allows, leaving the contamination alone is the easiest method of decon. However, marking, reporting, and periodically rechecking the contamination are required.

### **TEMPERATURE**

1-22. The higher the temperature, the faster the rate of evaporation. Contamination persistency decreases as the temperature rises. It has no effect on radiological contamination.

### **WIND**

1-23. Aeration aids in decon. Agents are dispersed by the wind, thus reducing the concentration.

### **HUMIDITY AND RAIN**

1-24. Moisture tends to break down chemical agents but does so slowly. Heavy rain physically removes contamination; however, contaminated runoff may build up in drainage areas. Biological agents dehydrate (dry out) in low humidity, thus reducing their persistency. Rain may prevent the desorption of aerosols and leach contamination into the soil.

### **SUNLIGHT**

1-25. Sunlight hastens the evaporation and decomposition of agents. Ultraviolet and infrared radiation in sunlight rapidly kills most biological agents.

### **TIME**

1-26. Only time will neutralize and destroy radiological contamination. Other techniques merely shield or remove the problem.

## **DECON IN COMBAT**

1-27. Combat effectiveness is degraded by MOPP. Decon can remove the contamination and restore combat power. The detection and warning network is vital to ensure that soldiers and equipment are protected when contamination is encountered. Considerations of decon in combat are—

- Immediate decon. It saves lives and permits the use of individual equipment and key systems.
- Operational decon. It reduces the spread and the level of contamination. In some cases, when combined with weathering, MOPP levels may be reduced without further decon.
- Thorough decon. It removes the unit from the fight but allows it to return with restored effectiveness.

1-28. Figure 1-1 depicts the drop in effectiveness as the affected unit and soldiers react.

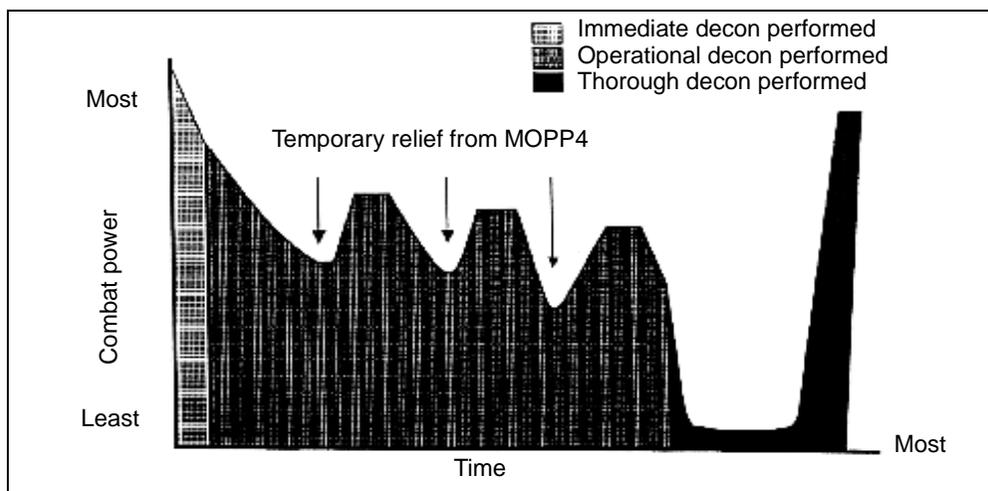


Figure 1-1. How Decon Affects Combat Effectiveness

## Decon-Operation Scenario

*You are the commander of the 155-millimeter Self-Propelled Howitzer Battery. Your unit is hit by a persistent nerve agent. Soldiers react by taking cover and going to MOPP4. The warning system provided sufficient alert and only a few have to conduct skin decon; most contamination is on the outside of your howitzers and vehicles.*

*The ongoing fire mission continues with minimal disruption, and the enemy is being detected. Your well-trained soldiers complete a personal wipe down and an operator's spray down as soon as possible. During this period, you are capable of providing fire support and moving, as necessary.*

*The temperature is 55°F, and humidity is low. While the work rate is strenuous, your troops drink water and suffer no heat casualties. However, after several hours, your response times to the fire mission are getting longer and soldiers have not eaten in more than 12 hours.*

*Upon making a decision to decon, you request support from your battalion. Coordination is made for an operational decon en route to an alternate position. You have 2 ½ hours to complete the movement and be in a firing position. The alternate position is 20 minutes away, with the decon site about halfway.*

*You send the advance party to meet the supporting power-driven decon-equipment (PDDE) crew and organize the site. The crew sets up and runs the vehicle washdown while the advance party, with battery supply personnel, prepares the MOPP-gear exchange.*

*The battalion chemical noncommissioned officer (NCO) directs the vehicle washdown as you rotate one platoon at a time through the site. The firing platoons go quickly as it is critical to have the artillery firing tables available. You complete the operation and are in position to fire at the prescribed time. Your soldiers are in MOPP4 because a vapor hazard still exists from the residual contamination. The advance party found the new area clear of contamination, and ammo resupply commences.*

*As sections begin improving their positions, gun crews one and two leave one soldier on each gun and move the rest of the soldiers 65 feet upwind. After a check on contamination proves negative, the battery NBC NCO directs unmasking procedures using two crew members. When no symptoms show up, the crews eat and get relief from the masks. The wind direction is monitored to ensure that the soldiers stay upwind of any vapors desorbing from their equipment.*

*Soldiers on the guns rotate into the clean area for rest and relief. Those returning to the guns assume MOPP4.*

## Chapter 2

# Immediate Decon

Once a soldier is aware of chemical or biological contamination on his bare skin, he initiates immediate decon techniques, without command, by using his personal SDK. He decontaminates his hood, mask, gloves, and weapon using the IEDK or an additional SDK. To remove radiological contamination from equipment and personnel, brush it off and/or use soap and water.

**NOTE: Throughout this manual, SDK refers to the M291 kit and IEDK refers to the M295 kit.**

### SKIN DECON

2-1. Start the skin-decon techniques within 1 minute of becoming contaminated. Some toxic chemical agents, especially nerve agents, kill in minutes.

### CHEMICAL

2-2. Use the SDKs within 1 minute of contamination (see Figure 2-1). Instructions for use are listed on the outside of the kit itself, on the individual packet within the kit, and in STP 21-1-SMCT.

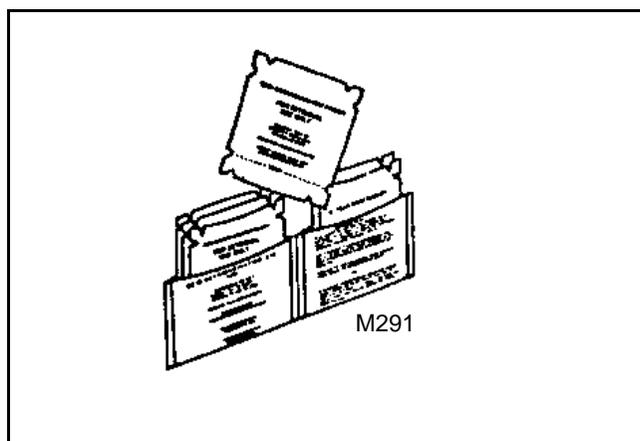


Figure 2-1. M291 SDK

2-3. If an SDK is not available, chemical contamination may be pinch-blotted from the skin with a cloth and flushed with water from a canteen. Soap, if available, can also be used to wash the agent from the skin. Washing with soap and water (or hot water) is the next best method for toxic-agent decon if SDKs are not available, but this method is not as effective as using the decon kits.

## **BIOLOGICAL**

2-4. Washing with soap and water removes nearly all biological agents from the skin. A 0.5 percent chlorine (calcium hypochlorite [HTH] or household bleach) solution is an effective biological decontaminant. See Appendix B for details on how to make this solution.

## **RADIOLOGICAL**

2-5. To remove radiological dust particles, brush, wash, or wipe them off.

## **PERSONAL WIPE DOWN**

2-6. The personal wipe-down techniques are most effective when done within 15 minutes of being contaminated. The CAM and/or M8/M9 detector paper is used to detect and monitor equipment.

**NOTE: Very high concentrations of DS2 can cause a CAM response in the G mode.**

2-7. Wipe down your mask, hood, gloves, and other essential gear. Do not attempt to remove chemical contamination from your protective overgarment unless there are obvious clumps of the agent. In this case, scrape off the material. Brush off radiological or frozen chemical-agent contamination. See FM 3-4 for detailed information on your overgarment's protective qualities.

## **CHEMICAL**

2-8. Decon individual equipment using the IEDKs. Wearing your Kevlar® helmet protective cover will prevent or reduce the adsorption of any liquid chemical agent. Washing with soap and water and bleach solutions is partially effective (see Appendix B).

## **BIOLOGICAL**

2-9. Wash with soap and water. If water is not available, use SDKs in the same manner as described for chemical-agent decon.

## **RADIOLOGICAL**

2-10. Locate radiological contamination with monitoring equipment and remove by brushing and shaking it off. Wash exposed areas of your skin and pay particular attention to your hair and fingernails. Avoid breathing the dust particles you shake off by wearing your protective mask or a piece of cloth over your nose and mouth. If wet, conduct a MOPP-gear exchange as soon as possible because brushing or shaking will not remove the contamination. Wipe off your equipment with warm, soapy water using rags or damp paper towels.

## **OPERATOR'S SPRAY DOWN**

2-11. Decon other mission-essential portions of your equipment before continuing your mission. The CAM and/or M8/M9 detector paper is used to determine what surfaces require decon.

2-12. Operator's spray down is most effective when done within 15 minutes of contamination.

**CHEMICAL**

2-13. Decon those surfaces that you must touch on the exterior of the vehicle or equipment you must use to do your job with the on-board portable decon apparatus (such as the M11 or M13) (see Figure 2-2). The IEDK may be used on equipment that DS2 may cause damage to by corrosive action (see Figure 2-3).

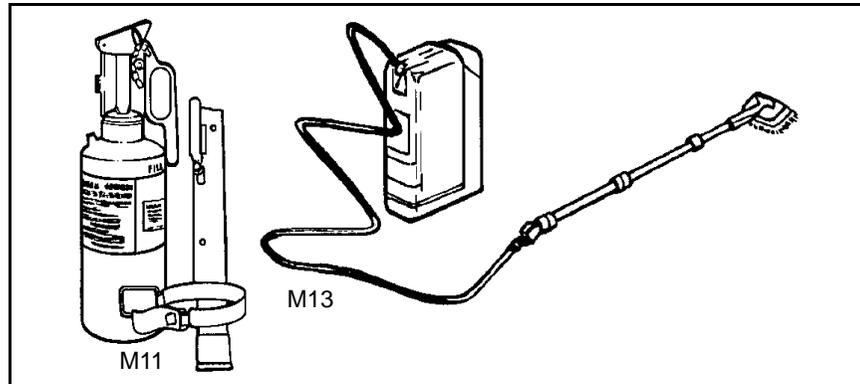


Figure 2-2. Portable Decon Apparatuses

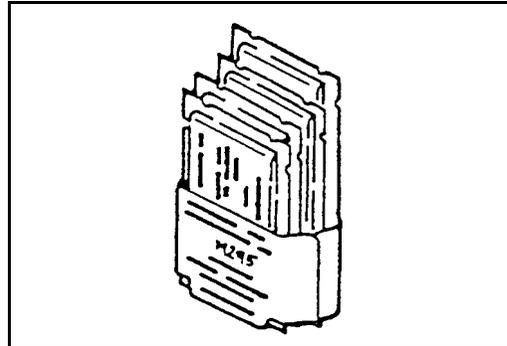


Figure 2-3. M295 IEDK

**WARNING**

Use extreme caution at all times when handling DS2. Do not mix DS2 and STB because it will cause a fire. Do not allow DS2 to be sprayed on personnel or protective clothing. DS2 is a combustible solution. Do not spray DS2 on hot engine blocks. Severe chemical burns can result if personnel fail to observe all safety precautions. DS2 can severely injure eyes and skin and, if inhaled, can cause illness. DS2 can damage the NBC protective overgarment. Long-term contact with DS2 can damage the NBC protective gloves, hood, and overboots.

2-14. Scrub the DS2 into the exterior surface with brushes. Wait 30 minutes, then wash off. If a decon apparatus is not available, use the field-expedient resources that are available to apply DS2 or STB from bulk containers. If necessary, use the nonstandard decontaminants that are discussed in Appendix B.

### **BIOLOGICAL**

2-15. Use a bleach solution for biological contamination; however, if bleach is not available, use hot, soapy water. Apply with brushes and scrub the surface well. Rinse the surface after scrubbing (no wait is required). DS2 and STB are also effective against most known biological contamination, but because of their caustic nature, they are not preferred. Other nonstandard biological decontaminants are described in Appendix B.

### **RADIOLOGICAL**

2-16. If you are contaminated by fallout, rain out, neutron-induced contamination, or any type of radiological agent, use your monitoring equipment to help locate it and decon as required. If detection equipment is not available and you suspect that you are contaminated, decon. Radiological contamination can usually be removed by brushing or scraping. Water is effective for flushing away radiological contamination; however, the runoff should be controlled by using drainage ditches that flow into a sump. Remember, you have not destroyed the contamination, it has just been moved. The runoff will still be hazardous. If you have time, brush or scoop away the top inch of soil from your fighting position to lower the amount of radiological contamination affecting you.

## Chapter 3

# Operational Decon

An operational decon limits the spread of contamination, allows temporary relief from MOPP4, and facilitates additional decon requirements. By speeding up the weathering process, the need for a thorough decon may be eliminated. This process requires about a 120-square-yard area and, depending on the number of contaminated vehicles, may not require a nearby water source. An operational decon consists of a vehicle washdown and a MOPP-gear exchange. The techniques that may be used to conduct an operational decon are decentralized company control, centralized battalion control, or centralized brigade control.

### TECHNIQUES

3-1. Decentralized company control is provided by the unit commander. The commander requests PDDE support, selects the decon site, links up with the PDDE crew, and executes the operational decon.

3-2. Centralized battalion control is similar to the above except that the battalion chemical NCO controls the decon. The site is selected by the battalion commander, and the battalion chemical NCO directs site setup and security and provides command and control (C<sup>2</sup>). The battalion chemical NCO travels with the PDDE and communicates via the radio.

3-3. Centralized brigade control is done when decon assets within the brigade have been consolidated. In this technique, the brigade chemical NCO performs those functions described for the battalion chemical NCO. The advantages and disadvantages of operational-decon techniques are listed in Table 3-1, page 3-2.

### PHASES

3-4. The three phases for an operational decon are preparation, execution, and site clearance.

### PREPARATION

3-5. The preparation phase starts with the decision to conduct an operational decon and ends with a site that is set up and ready for operation. (The decision to decon was described in Chapter 1.) The CAM is used to identify which vehicles need decontaminating, and PDDE support is requested. Coordination with higher headquarters (HQ) includes identifying the linkup point and the unit that will provide the PDDE support. Signal operating instructions (SOI) information is exchanged and the technique (decentralized company control, centralized battalion control, or centralized brigade control) is selected. The number and type of vehicles and the number of personnel for a MOPP-gear exchange are provided.