

CHAPTER 3

Protection and Decontamination

Table 3-1. Mission-oriented protective posture (MOPP) levels.

MOPP Equipment	Mopp Levels				
	MOPP Zero	MOPP1	MOPP2	MOPP3	MOPP4
Mask	Carried	Carried	Carried	worn*	Worn
Overgarment	Available	Worn*	Worn*	worn*	Worn
Chemical Protective Undergarment	Carried	Worn**	worn**	Worn**	Worn**
Vinyl Overboot	Available	Available	Worn	Worn	Worn
Gloves	Available	Carried	Carried	Carried	Worn

*The jacket or hood can be left open for ventilation.
 **The CPU is worn under the BDU (primarily applies to SOF, armor vehicle crewman, and aviators).
 Modification of standard MOPP levels is authorized (for example, mask only or mask and gloves only).
 Chemical protective helmet cover is put on helmet MOPP1 through MOPP4.

Individual Protective Equipment

The BDO/CPOG becomes unserviceable if it is ripped, torn, or a fastener is broken or missing; or if petroleum, oils, or lubricants are spilled or splashed on the garment. Chemical protective glove set, greenback vinyl overboot, and chemical protective footwear covers become unserviceable if ripped, torn, punctured, cracked, or if the rubber becomes sticky. Serviceability tests for the chemical protective gloves set. Fill each glove with air and submerge in water, checking for air leaks. Fill glove with water and check for water leaks. Any leaks make the glove unserviceable. NOTE: See FM 3-4, Chapter 2, for detailed information.

When the commander directs his unit to go from MOPP Zero to MOPP1, the chemical officer/NCO will determine BDO/CPOG days of wear. Upon completion of the mission, the unit returns to MOPP Zero, and overgarments are returned to their vapor-barrier bag. The chemical officer/NCO at company or battalion level estimate the number of days of BDO/CPOG wear for his unit. Then uses the information on days of overgarment wear as input for risk assessment.

Table 3-2. Minimum IPE protection capabilities.*Item*

Item	Not exposed to chemical agent	Exposed to chemical agent
Battledress overgarment	*30 days	24 hours
Chemical protective overgarment	*14 days	6 hours
14/25-mil glove set	**	24 hours
Green/black vinyl overboot	**	24 hours
Chemical protective footwear cover	**	24 hours
7-mil glove set	**	6 hours
<p>* Times begin when item is removed from its sealed vapor bag, and stops when sealed back in its vapor-barrier bag.</p> <p>** Will protect against liquid chemical agents and vapor hazard as long as they remain serviceable.</p> <p>The key to effectiveness at any time during wear is serviceability.</p> <p>Wear time may be extended by the commander when operationally necessary. See FM 3-4, Chapter 3, Chemical Vulnerability Assessment and force protection for detailed information.</p> <p>Any operational hazards may have a degrading effect on protective capabilities (i.e., rivercrossings, moving through swampy/wet areas, heavy rain, excessive sweating by soldiers, POL spills while refueling, maneuver through areas where IPE is easily torn or ripped).</p>		

Table 3-3. BDO risk assessment.

Days of wear	Risk of injury
< 30	Negligible
> 30	(approx 5%-ID)
> 45	(approx 10%-ID)
> 60	(10%-ID)

Filter Exchange Criteria

Filter exchange criteria for all NBC filters in the inventory—from the mask filters to the filters on the simplified collective-protective equipment (SCPE)—are based on design, physical condition, climatic conditions, and the possible agent that could be employed. The following paragraphs discuss peacetime, transition-to-war, and wartime exchange criteria.

Peacetime

When assessing filter exchange criteria, consider several factors. Commanders and NBC personnel must monitor replacement schedules for pieces of NBC equipment with filters. Peacetime exchange criteria for all filters is based on the following conditions:

- Physical damage occurs.

- Immersion in water, or filters have become water logged by other means.
- High resistance to airflow is observed.
- Directed by higher headquarters.
- Listed as unserviceable in SB 3-30-2.

NOTE: When filters are listed as unserviceable in SB 3-30-2, they still can be used as training filters.

Transition to War

Leaders consider NBC issues when preparing for deployment. As part of that process, commanders will determine when their units should remove their training filters and replace them with filters from unit contingency stocks. The commander's guidance should be reflected in an SOP or order. Factors for consideration on whether to exchange filters include unit location, unit readiness/deployability alert

Table 3-4. Wartime Filter Exchange Criteria.

Climate Category					
Filter	Cold humid (weeks)	Warm moderate (weeks)	Hot dry (weeks)	Hot humid (weeks)	System
•C-2/M13A2	52	52	39	10	<ul style="list-style-type: none"> •M40/M17-series protective mask •M24/M25 protective mask •Filter comp of M13 tank GPFU •Fixed site filter use in structure and building •M1A1 task overpressure system •Modular collective protection equipment •Simplified protection equipment M20/M28 •M51 shelter •fixed site filter •GPFU M46 fixed site filter
•M10A1 canister	52	52	52	13	
•M18 gas	52	39	26	4	
•M12A1 gas	52	39	26	4	
•M48 gas/particulate	52	52	39	10	
•MCPE gas/particulate	52	39	26	4	
•HSFC gas/particulate	52	39	26	4	
•M23 gas	52	39	26	4	
•M10 gas	52	39	26	4	
•C-22 R1 gas	52	52	52	13	
Climatic Definitions					
Category	Mean temp (F)	Mean relative humidity (%)			
Cold, humid	< -15	< 90			
Warm, moderate	< 60	< 70			
Hot, dry	< 98	< 27			
Hot, humid	> 96	> 76			

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status, last time filters were exchanged, threat, time available, and stocks available. For example, a forward deployed unit commander, based on an enemy chemical capability in the area of operation, directs by SOP that his or her unit install its contingency set of filters. Alternatively, a CONUS-based unit commander determines that the basis for installing contingency filters would occur upon an increase in unit alert status for deployment to an area with an NBC threat.

Considerations commanders should use before initiating filter exchange include

- Mission—What is the unit mission?
- Enemy—What is the current threat assessment with respect to use of NBC weapons? Is our unit likely to encounter attack on arrival in the operational area?
- Terrain—Where should filters be exchanged: at home station, en route, or in the operational area?

Troop Preparation

Plan Ahead

- Check NBC defense guidance on OPLAN/OPORD; anticipate projected work requirements in the next 24-48 hours.
- Ensure serviceability or shortfalls of equipment through precombat inspections of NBC equipment.
- Know the most current weather data, particularly wind direction.
- Plan work/rest cycles appropriate to the environment and the mission.
- Ensure deployment and mounting of alarms.
- Use SOPs to reduce command, control, and communication tasks.
- Keep plans simple.

Think Teamwork

- Use methods of individual identification (name tags, personal items).
- Encourage “small-talk” while in MOPP.
- Pair an experienced soldier with an inexperienced “buddy” whenever possible.
- Use the buddy system to ensure that all members of the unit are regularly checked for signs of stress and agent exposure.

Work Smart

- Provide relief from MOPP4 as soon as the mission allows.
- Use work/rest ratios, slow work rate, and minimize work intensity.
- Work in the shade whenever possible.

- Enforce command drinking to reduce dehydration and heat casualties.

REMEMBER the most motivated soldiers and leaders are the most likely to ignore their needs for food, water, and rest.

- Use collective protection as much as possible.
- Enforce good eating, drinking, and sleeping discipline.
- Rotate jobs and people during long shifts or periods of inactivity.
- Provide relief from extreme temperatures (hot or cold) as soon as possible.
- Remember that even short breaks from total encapsulation are effective in sustainment performance.
- Augment units or divide work between two units.
- Schedule work for a cooler time of day or at night.

MOPP Analysis

Use intelligence preparation of the battlefield (IPB) to determine—

- An estimate on how many enemy fire support systems are in range, where, and what they are.
- How to support probable enemy courses of action (COA).
- Enemy's intent and capabilities.
- Enemy tactical doctrine.
- An evaluation of arms of operation and times of interest set by the commander.
- Terrain and weather.
- Threat integration (how the enemy will fight).

Prior planning based on information provided by the chemical officer will help the commander make sound decisions. Regular updates need to be provided to the commander because of rapid changes in the situation.

Using IPB, provide the commander and staff:

- Detailed information on enemy NBC capability based on the type of weapon systems that the enemy has available at that period of interest.
- How the enemy would employ chemicals.
- Areas of likely employment based on threat employment doctrine.
- Detailed analysis of terrain and weather in the unit's AO during each period of interest.
- MOPP guidance for each period of interest.
- Templates of predicted fallout data that are updated as conditions change.
- Alternative actions the commander can initiate prior to the time period in question to minimize degradation of affected units.
- Continuous monitoring of S2 message and radio traffic for any NBC-related information that could be important to the unit's mission.

MOPP System Flexibility

Flexibility is the key to providing maximum protection with the lowest risk possible while still allowing mission accomplishment. Commanders may place all or part of their units in different MOPP levels or authorize variations within a given MOPP level.

Soldiers may leave the overgarment jacket open at MOPP1, MOPP2, or MOPP3 allowing greater ventilation. Soldiers may leave the hood open or rolled at MOPP3. The various configurations of the last two MOPP levels with the hood rolled or open are referred to as “Mopp open.” Commanders decide which of these variations to use based on the threat, temperature, and unit work intensity.

Units may be granted the flexibility to raise or lower their protective posture from that recommended by higher headquarters. This may be done down to platoon level and by an element that finds itself isolated. If higher headquarters specifically denies this flexibility, then protective postures may only be raised, not lowered.

W A R N I N G

Do not use mask-only when blister or persistent nerve agents are present.

Managing Performance Problems

- heat stress
- hunger
- thirst
- discomfort
- performance degradation
- reduced ability to see and hear
- increased feelings of isolation and confusion
- frustration and claustrophobia or panic
- degraded alertness and attention

Physiological factors during sustained periods of MOPP are:

Table 3-5 provides examples that can be used as a guide in estimating the work

Table 3-5. Work intensities of military tasks.

Work intensity in MOPP Zero—MOPP1	Activity	Work intensity in MOPP2—MOPP4
Very light	<ul style="list-style-type: none"> •Lying on ground •Standing in foxhole •Sitting in truck •Guard duty •Driving truck 	Very light
Light	<ul style="list-style-type: none"> •Cleaning rifle •Walking, hard surface/1m/s, no load •Walking, hard surface/1m/s, 20 kg load •Manual of arms •Walking, hard surface/1 m/s, 30 kg load 	Light
Moderate	<ul style="list-style-type: none"> •Walking, loose sand/1 m/s, no load •Walking, hard surface- /1.56 m/s, no load •Calisthenics 	Moderate
	<ul style="list-style-type: none"> •Walking, hard surface/1.56 m/s, 20 kg load •Scouting patrol •Pick and shovel •Crawling, full pack •Digging foxholes •Field assaults 	Heavy
Heavy	<ul style="list-style-type: none"> •Walking, hard surface/1.56 m/s, 30 kg load •Walking, hard surface/2.0 m/s, no load •Emplacement digging •Walking, hard surface/2.25 m/s, no load •Walking, loose sand/1.56 m/s, no load 	<p>The work intensity categories of this table are based on metabolic expenditures.</p> <p>Very light = 105 to 175 watts Light = 172 to 325 watts Moderate = 325 to 500 watts Heavy = 500+ watts Moderate = 325 to 500 watts Heavy = 500+ watts</p> <p>The weight of the chemical protective overboots is a primary contributor to increased work intensity in MOPP.</p>

The following tables will provide information necessary to calculate recommended work/rest cycles, water requirements, maximum work times and recovery times.

Table 3-6. Number of minutes of work per hour in work/rest cycle (daylight operations).

		MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
78	82	NL	NL	NL	25	NL	30	10	5	NL	25	10	5
80	84			40	25		25	10	20		10		
82	87			35	20		20	5	15				
84	89			30	20								
86	91			30	20								
88	94			20	15				na				
90	96			20	10								
92	98			10	10			na	na			na	
94	100			30	10		10						
96	103			10									
98	105	na	na	na	na				na				
100	107	na	na										

KEY TO TABLE:
WBGT - Wet Bulb Globe Temperature (°F)
Ta - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
NL - No Limit (Continuous Work Possible)
na - Work/Rest Cycle Not Feasible (See Maximum Work Time in Table 3-8)

INSTRUCTIONS AND NOTES:
 This table provides, for four levels of work intensity (see Table 3-5), the number of minutes of work per hour in work/rest schedules tailored to the conditions specified. The remainder of each hour should be spent in rest. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimated; 2) 50% relative humidity; 3) windspeed = 2m/s; 4) clear skies; 5) heat casualties <5%. This guide should not be used as a substitute for common sense or experience. Individual requirements may vary greatly. The appearance of heat casualties is evidence that the selected work/rest schedule is inappropriate for the conditions. USARIEM 1/11/91

Table 3-7. Water requirements for work/rest cycles (qt/hr) (daylight operations).

		MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
78	82	0.5	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
80	84	0.5	1.0	1.0	1.0	1.0	1.0	1.0	na	1.0	1.0	1.0	na
82	87	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	na	
84	89	1.0	1.0	1.0	1.0	1.0	na	1.0		na	na		
86	91	1.0	1.0	1.0	1.0	1.0		1.0					
88	94	1.0	1.5	1.0	1.0	1.5		1.5					
90	96	1.0	1.5	1.0	1.0	1.5		1.5					
92	98	1.0	1.5	1.0	1.0	1.5		1.5					
94	100	1.0	1.5	1.5	1.0	1.5		1.5					
96	103	1.0	1.5	na	na	na		na					
98	105	1.5	na										
100	107	na	na										

KEY TO TABLE:

WBGT - Wet Bulb Globe Temperature (°F)
Ta - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
NL - No Limit (Continuous Work Possible)
na - Work/Rest Cycle Not Feasible (See Water Requirements in Table 3-9)
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INSTRUCTIONS AND NOTES:

Water requirements listed are for both the work/rest schedules specified in Table 3-6 for support of sustained work, and work times unrestricted by thermal stress (unshaded blocks), and work times unrestricted by thermal stress. Work intensities may be estimated using Table 2-1. Drinking should be divided over course of each hour to replace water as it is lost to sweat. The table was prepared using prediction capabilities of the USARIEM Heat Strain Model; assumptiong used in generating estimates include 1) troops fully hydrated, rested, and acclimated; 2) 50% relative humidity; 3) windspeed 2m/s; 4) clear skies;5) heat casualties <5%. This guidance is not a substitute for common sense or experience; appearance of heat casualties is evidence that safe work limits (<5% casualties) have been exceeded.

**Table 3-8. Maximum work times (minutes)
(daylight operations).**

		MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU				
WBGT	T _a	VL	L	M	H	VL	L	M	H	VL	L	M	H	
78	82	NL	NL	NL	65	NL	177	50	33	NL	155	49	32	
80	84			157	61		142	49	32		131	48	32	
82	87			114	56		115	47	31		110	46	30	
84	89			99	53		104	45	30		100	45	30	
86	91			87	50		95	44	29		93	44	29	
88	94			74	45		85	42	28		83	42	27	
90	96			67	43		79	41	27		78	41	27	
92	98			60	40		75	40	26		74	40	26	
94	100			193	55		37	70	39		25	70	39	25
96	103			101	48		33	203	65		37	23	194	65
98	105	82	44	31	141	62	36	22	140	62	36	22		
100	107	261	70	41	28	118	59	35	21	118	59	35	21	

KEY TO TABLE:
WBGT - Wet Bulb Globe Temperature (°F)
T_a - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
NL - No Limit (Continuous Work Possible)
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INSTRUCTIONS AND NOTES:
 This table provides for four levels of work intensity (see Table 3-6), the maximum number of minutes work can be sustained in a single work period without exceeding a greater than 5% risk of heat casualties. This table was prepared using the prediction capability of the USARIEM Heat Stain Model. Assumptions used in generating this table include 1) all troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2m/s; 4) clear skies. the guidance should not be used as a substitute for common sense or experience. Individual reuirements may vary greatly. The appearance of heat casualties is evidence that the safe limits of work time have been reached.

Table 3-9. Water requirements for maximum work times (qt/hr) (daylight operations).

		MOPP Zero				MOPP4 + Underwear				MOPP4 = BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
78	82	.5	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
80	84	.5	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
82	87	1.0	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
84	89	1.0	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
86	91	1.0	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	2.0	2.0	2.0
88	94	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0
90	96	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0
92	98	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0
94	100	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0
96	103	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0
98	105	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
100	107	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

KEY TO TABLE:

WBGT - Wet Bulb Globe Temperature (°F)
Ta - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
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INSTRUCTIONS AND NOTES:

Amounts listed are required to support maximum work times in Table 3-8; estimate work intensities using Table 3-5. Drinking should be divided over course of each hour. If water requirement is 2.0, sweat loss is greater than maximum water absorption during an hour, and troops will become increasingly dehydrated regardless of amount drunk; leaders should plan for an extended rest and rehydration period at work completion. The table was prepared using prediction capability of the USARIEM Heat Strain Model; assumptions used in generating estimates include 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) clear skies; 5) heat casualties <5%. This guidance is not a substitute for common sense or experience; appearance of heat casualties is evidence that safe work limits (<5% casualties) have been exceeded.

Table 3-10. Recovery time estimates after maximum work (hours of rest in the shade).

WBGT	Ta	MOPP Zero	MOPP4	KEY TO TABLE: WBGT - Wet Bulb Globe Temperature (°F) As Measured in shade (If Only Full Sun WBGT Is Available, Subtract 5°F WBGT Before Using This Table) Ta - Ambient Temperature (Dry Bulb -°F) MOPP Zero - Battle Dress Uniform Only MOPP4 - Battle Dress Overgarment and Mask (Closed) NCP - No Cooling Possible Under These Conditions - Seek Cooler Location and/or Remove BDO
60	88	0.25	1.0	<p>NOTES AND INSTRUCTIONS: This table provides the number of hours rest in the shade that should be required after working the maximum work times specified in Table 3-8 or 3-13. This table was prepared using the cooling capacity equations of the USARIEM Heat Strain Model. Assumptions used in generating this table include 1) troops fully hydrated and acclimatized; 2) 50% relative humidity; 3) windspeed = 2m/s; 4) no solar load; 5) recovery of normal body temperature. This guidance should not be used as a substitute for common sense or experience. Individual requirements may vary greatly. USARIEM 1/11/91</p>
66	75	0.25	1.0	
72	82	0.5	1.5	
74	84	0.5	1.5	
76	86	0.5	2.0	
78	88	0.5	2.0	
80	91	0.5	3.0	
82	93	0.5	4.0	
84	95	0.5	6.0	
86	97	1.0	15.0	
88	100	1.0	NCP	
90	102	1.0		
92	104	1.5		
94	106	2.0		
96	109	8.0		
98	111	NCP		
100	113			

Table 3-11. Number of minutes of work per hour in work/rest cycle (night operations).

		MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU			
WBG T	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
60	68	NL	NL	NL	40	NL	NL	30	20	NL	NL	25	15
66	75				40			25	15			25	15
72	82				35			20	15			20	10
78	88				30			15	10			15	10
80	91				25			15	5			15	5
82	93				25			30	10			5	25
84	95			40	25		25	10	20		5	na	
86	97			35	20		15	5	10		na		
88	100			30	20		na	na	na		na		
90	102			25	15		na	na	na		na		
92	104	20	15	na	na	na	na						
94	106	15	10	na	na	na	na						

KEY TO TABLE:
WBG T - Wet Bulb Globe Temperature (°F)
Ta - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
NL - No Limit (Continuous Work Possible)
na - Work/Rest Cycle Not Feasible (See Maximum Work Time in Table 3-13)

INSTRUCTIONS AND NOTES:
 This table provides, for four levels of work intensity (see Table 3-5), the number of minutes of work per hour in work/rest schedules tailored to the conditions specified. The remainder of each hour should be spent in rest. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimated; 2) 50% relative humidity; 3) windspeed = 2m/s; 4) clear skies; 5) heat casualties <5%. This guide should not be used as a substitute for common sense or experience. Individual requirements may vary greatly. The appearance of heat casualties is evidence that the selected work/rest schedule is inappropriate for the conditions. USARIEM 1/11/91

Table 3-12. Water requirements for work/rest cycles (qt/hr) (night operations).

WBG T	T _a	MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU						
		VL	L	M	H	VL	L	M	H	VL	L	M	H			
60	68	0.25	0.25	0.5	1.0	0.25	1.0	1.0	1.0	0.25	1.0	1.0	1.0			
66	75	0.25	0.25	1.0	1.0	0.5	1.0	1.0	1.0	0.5	1.0	1.0	1.0			
72	82	0.25	0.5	1.0	1.0	0.5	1.0	1.0	1.0	0.5	1.0	1.0	1.0			
78	88	0.25	0.5	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.5	1.0	1.0			
80	91	0.5	1.0	1.5	1.0	1.0	1.5	1.0	1.0	1.0	1.5	1.0	1.0			
82	93	0.5	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
84	95	0.5	1.0	1.0	1.0	1.0	1.0	1.0	na	1.0	1.0	1.0	na			
86	97	0.5	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	na		na		
88	100	0.5	1.0	1.0	1.0	1.0	na	na		1.0	na				na	
90	102	1.0	1.0	1.0	1.0	1.0				1.0						1.0
92	104	1.0	1.5	1.0	1.0	1.5				1.5						1.5
94	106	1.0	1.5	1.0	1.0	1.5			1.5							

KEY TO TABLE:

WBG T - Wet Bulb Globe Temperature (°F)
T_a - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
NL - No Limit (Continuous Work Possible)
na - Work/Rest Cycle Not Feasible (See Maximum Work Time in Table 3-13)
 USARIEM 1/10/91

INSTRUCTIONS AND NOTES:

Amounts listed are required to support work/rest schedules in Table 3-11; drinking should be divided over course of each hour to replace water as it is lost to sweat. Use Table 3-14 to determine water required to support maximum work times shown in Table 3-13. The table was prepared using prediction capabilities of the USARIEM Heat Strain Model; assumptions used in generating estimates include 1) troop fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load; 5) heat casualties <5%. This guidance is not a substitute for common sense or experience; appearance of heat casualties is evidence that safe work limits (<5% casualties) have been exceeded (that the selected work/rest cycle and/or water guidance is inappropriate for the conditions).

Table 3-13. Maximum work times (minutes) (night operations).

		MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
60	68	NL	NL	NL	188	NL	NL	76	42	NL	NL	73	41
66	75				119			66	39			64	38
72	82				90			58	36			57	36
78	88				72			53	34			52	33
80	91				64			50	32			50	32
82	93				60			206	49			32	168
84	95			139	55	144	47	31	133	47	30		
86	97			107	51	121	46	30	115	45	29		
88	100			82	46	100	44	28	97	43	28		
90	102			71	42	91	42	27	89	42	27		
92	104	63	39	83	41	26	82	41	26				
94	106	56	36	77	40	25	76	40	25				

<p>KEY TO TABLE: WBGT - Wet Bulb Globe Temperature (°F) Ta - Ambient Temperature (Dry Bulb - °F) VL - Very Light Work Intensity L - Light Work Intensity M - Moderate Work Intensity H - Heavy Work Intensity BDU - Battle Dress Uniform NL - No Limit (Continuous Work Possible) USARIEM 1/10/91</p>	<p>INSTRUCTIONS AND NOTES: This table provides for four levels of work intensity (see Table 3-5), the maximum number of minutes of work that can be sustained in a single work period without exceeding a greater than 5% risk of heat casualties. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include 1) all troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load. The guidance should not be used as substitute for common sense or experience. Individual requirements may vary greatly. The appearance of heat casualties is evidence that the safe limits of work time have been reached.</p>
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Table 3-14. Water requirements for maximum times (qt/hr) (night operations).

		MOPP Zero				MOPP4 + Underwear				MOPP4 + BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
60	68	0.25	0.25	0.5	1.0	0.25	1.0	1.5	2.0	0.25	1.0	1.5	2.0
66	75	0.25	0.25	1.0	1.5	0.5	1.0	2.0	2.0	0.5	1.0	2.0	2.0
72	82	0.25	0.5	1.0	1.5	0.5	1.0	2.0	2.0	0.5	1.0	2.0	2.0
78	88	0.25	0.5	1.0	1.5	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
80	91	0.5	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
82	93	0.5	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
84	95	0.5	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
86	97	0.5	1.0	1.5	2.0	1.0	1.5	2.0	2.0	1.0	1.5	2.0	2.0
88	100	0.5	1.0	1.5	2.0	1.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0
90	102	1.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0
92	104	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0
94	106	1.0	1.5	2.0	2.0	1.5	2.0	2.0	2.0	1.5	2.0	2.0	2.0

KEY TO TABLE:

WBGT - Wet Bulb Globe Temperature (°F)
Ta - Ambient Temperature (Dry Bulb - °F)
VL - Very Light Work Intensity
L - Light Work Intensity
M - Moderate Work Intensity
H - Heavy Work Intensity
BDU - Battle Dress Uniform
NL - No Limit (Continuous Work Possible)
 USARIEM 1/10/91

INSTRUCTIONS AND NOTES:

Amounts listed are required to support maximum work times in Table 3-13; drinking should be divided over course of each hour. If water requirement is 2.0, sweat loss is greater than maximum water absorption during an hour, and troops will become increasingly dehydrated regardless of amount drunk; leaders should plan for an extended rest and rehydration period at work completion (see Table 3-10). This table was prepared using prediction capability of the USARIEM Heat Strain Model; assumptions used in generating estimates include 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load; 5) heat casualties <5%. This guidance is not a substitute for common sense or experience; appearance of heat casualties is evidence that safe work limits (casualties) have been exceeded.

Table 3-15. Wind speed effects on arrival time of chemical agents.

Wind speed (kmph)	Time before agent reaches unit location (seconds)	Distance between unit and detectors (meters)
5	108	150
10	54	150
15	36	150
20	27	150
25	22	150

Table 3-16. Detectors required for different size unit fronts.

Unit front size (in meters)	Number of detector units
1—35	1
37—372	2
373—708	3
709—1,044	4
1,045—1,380	5

Table 3-17. M8A1 alarm battery life.

Average air temperature		Maximum number of 12-hour missions	
°F	°C	BB501/U	BA3517/U
120-90	50-32	14	6
80	27	12	8
70	21	12	8
60	15	10	5
50	10	9	3
40	4	8	2
32	0	6	1
20	-4	5	1
10	-13	3	Do not use below 20°F (-4°C)
0	-17	2	
-10 to -40	-22 to -40	1	

NOTE: If battery fails or you have no batteries, refer to TM 3-251-BD for a field expedient method of powering the alarm.

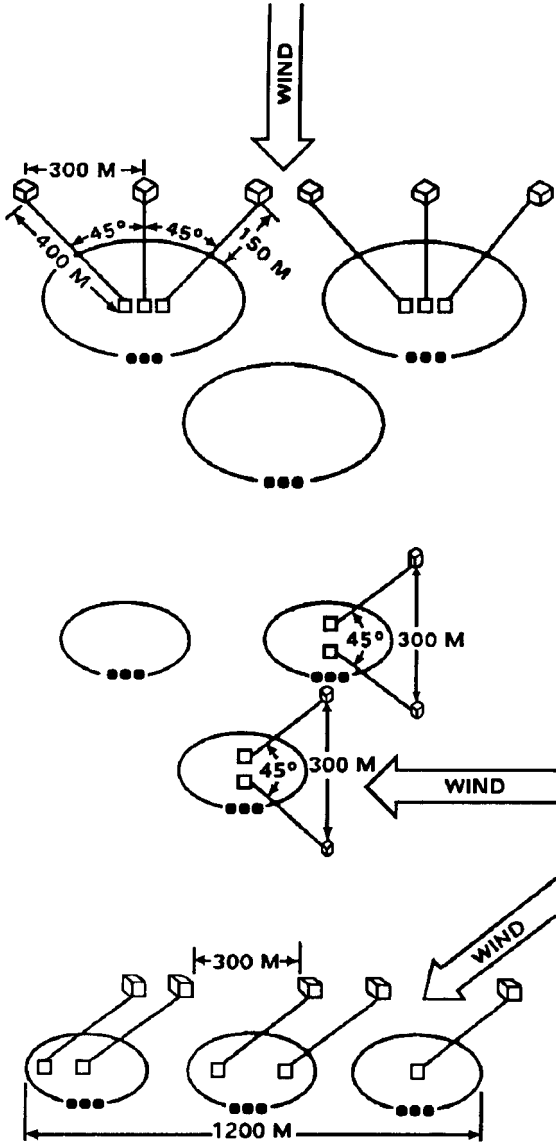


Figure 3-1. Fixed emplacement of M8A1 alarms.

CAM

There are eight bar indicators: one to three bars = low vapor hazard, four to six bars = low vapor hazard, four to six bars = high vapor hazard, and seven to eight bars = very high levels of vapor hazard.

Interferent	G bar response	H bar response
M258A1 decon kit		High
M280 DKIE		High
DS2	Low	
Insect repellent	Low-Very high	
Brake fluid	High-Very high	Very high
Cleaner, general purpose	High	
Burning kerosene		High
Breath mints	High	
Gasoline vapor	Low	Low
Burning grass	Low-High	Low
Burning gas	Low	

Unmasking Procedures

Without detection equipment

1. In a shady area, have one or two soldiers take a deep breath, hold it, and break their mask seals for 15 seconds with their eyes open.
2. Have them clear and reseal masks. Observe them for 10 minutes for symptoms.
3. If no symptoms appear, have the same soldiers break their mask seals, take two or three breaths, clear and reseal their masks. Observe them for 10 minutes for symptoms.
4. If no symptoms appear have the same soldiers unmask for 5 minutes and then remask. If no symptoms appear in 10 minutes, it is safe to give the all clear signal and unmask.
5. Continue to observe the soldiers in case delayed symptoms develop.

With M256 or M256A1 Detector Kit

1. Test with the detector kit.

FM 3-7

2. If the test is negative, have one or two soldiers move to a shady area if possible, and unmask for 5 minutes. Have the soldiers remask. Observe them for 10 minutes for symptoms.
3. If no symptoms appear, it is safe to give the all clear signal and unmask. The senior leader present may ask higher headquarters for permission.
4. Continue to watch soldiers for possible delayed symptoms.

**Using Estimated Wait Times Before Executing
Open/Unmasking Time Tables**

NOTE: All tables are ICT 5 risk level (Incapacitating dosage of vapor sufficient to disable 5% of exposed soldiers).

Formula Procedure

a. Variables

P = Percent of worst case time remaining

O = Original worst case time from table

N = New worst case time from table

T = Time between original estimate and weather change

U = Updated worst case time

b. Procedure.

Read O directly from table

Weather change:

$$P = (O - T) / O$$

$$U = P \times N$$

Weather changes again:

Set $O = U$

Set T = time since last weather change

Repeat as required

Table 3-19. Estimated worst case MOPP open times.

Agent: GA/GF

Terrain: Sand

The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	60 +	53	33	20	13	10	8	5
	Neutral	60 +	60 +	45	28	18	13	8	5
	Stable	60 +	60 +	58	38	23	15	10	8
11-24	Unstable	13	8	5	3	3	2	2	2
	Neutral	20	13	8	5	5	3	2	2
	Stable	20	13	8	5	5	3	2	2
> = 25	Neutral	2	2	2	2	2	2	2	2

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for GA/GF to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES!
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. To get times for grass terrain, multiply numbers in the chart by 0.4. DO NOT INTERPOLATE!
4. See FM 3-6 for definition of stability categories.

Table 3-20. Estimated worst case unmasking times.

Agent: GA/GF

Terrain: Sand

The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	60 +	60 +	60 +	55	35	25	15	13
	Neutral	60 +	60 +	60 +	60 +	45	30	20	13
	Stable	60 +	60 +	60 +	60 +	55	35	23	15
11-24	Unstable	60 +	60 +	60 +	38	23	15	10	8
	Neutral	60 +	60 +	60 +	43	28	18	13	10
	Stable	60 +	60 +	60 +	45	30	20	13	10
> = 25	Neutral	60 +	60 +	35	23	15	10	8	5

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for GA/GF to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES!**
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. To get times for grass terrain, multiply numbers in the chart by 0.4. **DO NOT INTERPOLATE!**
4. See FM 3-6 for definition of stability categories.

Table 3-21. Estimated worst case MOPP open unmasking times.

Agent: GA/GF
 Terrain: CARC
 The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	1.25	0.75	0.50	0.25	0.25	0.25	0.25	0.25
	Neutral	1.50	1.0	0.50	0.50	0.25	0.25	0.25	0.25
	Stable	1.50	1.0	0.50	0.50	0.25	0.25	0.25	0.25
11-24	Unstable	0.75	0.50	0.25	0.25	0.25	0.25	0.25	0.25
	Neutral	0.75	0.50	0.25	0.25	0.25	0.25	0.25	0.25
	Stable	1.0	0.50	0.50	0.25	0.25	0.25	0.25	0.25
> = 25	Neutral	0.50	0.50	0.25	0.25	0.25	0.25	0.25	0.25

NOTES:

1. Worst case MOPP open/unmasking time—information in the table indicates the time for GA/GF to weather below 5 percent incidence of incapacitation due to vapor-on-skin and inhalation. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES! DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES**
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. To get times for grass terrain, multiply numbers in the chart by 0.4. **DO NOT INTERPOLATE!**
4. If soldiers are working on vehicles, avoid skin contact with the vehicle.
5. See FM 3-6 for definition of stability categories.
6. For planning, ensure the following steps are taken:
 - a. Remove as much earth and debris as possible from the CARC painted surface and conduct operator spraydown.
 - b. Above times are estimated weathering times for CARC painted surfaces; confine contamination-free status by using detection devices before MOPP reduction.
 - c. If possible, move uncontaminated equipment from the contaminated area.
 - d. Anything not painted with CARC (such as concrete, plastics, and weapons) must be individually checked for contamination.

Table 3-22. Estimated worst case MOPP open times.

Agent: HD
 Terrain: Sand
 The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	60 +	60 +	60 +	60 +	48	32	23	15
	Neutral	60 +	60 +	60 +	60 +	60 +	43	28	20
	Stable	60 +	60 +	60 +	60 +	60 +	58	38	25
11-24	Unstable	60 +	60 +	43	28	18	13	8	5
	Neutral	60 +	60 +	60 +	38	25	18	10	8
	Stable	60 +	60 +	60 +	40	28	18	13	8
> = 25	Neutral	33	20	13	8	5	5	3	3

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for HD to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. To get times for grass terrain, multiply numbers in the chart by 0.4. DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES!
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. DO NOT INTERPOLATE!
4. See FM 3-6 for definition of stability categories.

Table 3-23. Estimated worst case unmasking times.

Agent: HD Terrain: Sand The numbers in the chart represent hours.									
Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	60 +	60 +	60 +	60 +	53	35	23	18
	Neutral	60 +	60 +	60 +	60 +	60 +	48	33	23
	Stable	60 +	60 +	60 +	60 +	60 +	60 +	45	28
11-24	Unstable	60 +	60	58	38	25	15	10	8
	Neutral	60 +	60 +	60 +	50	33	23	15	10
	Stable	60 +	60 +	60 +	53	35	23	15	10
> = 25	Neutral	53	33	20	13	8	5	5	3

NOTES:

1. Worst case unmasking time—information in the table indicates the time for HD to weather below 5 percent incidence of incapacitation due to inhalation. To get times for grass terrain, multiply numbers in the chart by 0.4. **DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES!**
2. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. **DO NOT INTERPOLATE!**
3. See FM 3-6 for definition of stability categories.

Table 3-24. Estimated worst case MOPP open/unmasking times.

Agent: HD
 Terrain: CARC
 The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	11	7	5	3	2	2	1	1
	Neutral	12	8	5	4	2	2	1	1
	Stable	13	8	5	4	2	2	1	1
11-24	Unstable	7	5	3	2	2	1	1	1
	Neutral	8	5	3	2	2	1	1	1
	Stable	8	5	3	2	2	1	1	1
> = 25	Neutral	5	3	2	1	1	1		1

- NOTES:**
1. Worst case MOPP open/unmasking time—information in the table indicates the time for HD to weather below 5 percent incidence of incapacitation due to vapor-on-skin and inhalation. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES! DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES!**
 2. *Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.*
 3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. **DO NOT INTERPOLATE!**
 4. If soldiers are working on vehicles, avoid skin contact with the vehicle.
 5. See FM 3-6 for definition of stability categories.
 6. *For planning, ensure the following steps are taken:*
 - a. Remove as much earth and debris as possible from the CARC painted surface and conduct operator spraydown.
 - b. Above times are estimated weathering times for CARC painted surfaces; confine contamination-free status by using detection devices before MOPP reduction.
 - c. *If possible, move uncontaminated equipment from the contaminated area.*

Table 3-25. Estimated worst case MOPP open/unmasking times.

Agent: VX

Terrain: Sand

The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	60 +	55	50	45	36	26	17	8
	Neutral	60 +	60 +	60 +	60 +	49	38	26	15
	Stable	60 +	60 +	60 +	45	51	41	32	23
11-24	Unstable	60 +	55	50	45	35	25	15	5
	Neutral	60 +	60 +	60 +	60 +	48	35	23	10
	Stable	60 +	60 +	60 +	60 +	49	38	26	15
> = 25	Neutral	60 +	60 +	60 +	60 +	47	34	21	8

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for VX to weather below 5 percent incidence of incapacitation due to vapor-on-skin and inhalation. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES! DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES!**
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. To get times for grass terrain, multiply numbers in the chart by 0.4. **DO NOT INTERPOLATE!**
4. See FM 3-6 for definition of stability categories.

Table 3-26. Estimated worst case MOPP open/unmasking times.

Agent: VX
 Terrain: CARC
 The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	8.25	5.25	3.5	2.25	1.5	1	0.75	0.5
	Neutral	8	5	3.25	2	1.25	1	0.75	0.5
	Stable	9.25	6	3.75	2.5	1.5	1	0.75	0.5
11-24	Unstable	5	3	2	1.25	0.75	0.5	0.25	0.25
	Neutral	5	3.25	2	1.25	0.75	0.5	0.5	0.25
	Stable	5.75	3.5	2.25	1.5	1	0.75	0.5	0.25
> =25	Neutral	3.25	2	1.25	0.75	0.5	0.5	0.25	0.25

NOTES:

1. Worst case MOPP open/unmasking time—information in the table indicates the time for VX to weather below 5 percent incidence of incapacitation due to vapor-on-skin and inhalation. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES! DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES!**
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. **DO NOT INTERPOLATE!**
4. If soldires are working on vehicles, avoid skin contact with the vehicles.
5. See FM 3-6 for definition of stability categories.
6. For planning, ensure the following steps are taken:
 - a. Remove as much earth and debris as possible from the CARC painted surface and conduct operator spraydown.
 - b. Above times are estimated weathering times for CARC painted surfaces; confine contamination-free status by using detection devices before MOPP reduction.
 - c. If possible, move uncontaminated equipment from the contaminated area.
 - d. Anything not painted with CARC (such as concrete, plastics, and weapons) must be individually checked for contamination.

Table 3-27. Estimated worst case MOPP open times.

Agent: TGD

Terrain: Sand

The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	8	6	4	3	3	3	3	3
	Neutral	8	7	6	5	4	4	3	3
	Stable	25	22	18	15	13	10	8	5
11-24	Unstable	3	3	3	3	3	3	3	3
	Neutral	5	4	3	3	3	3	3	3
	Stable	5	4	3	3	3	3	3	3
> = 25	Neutral	3	3	3	3	3	3	3	3

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for TGD to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES!**
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. To get times for grass terrain, multiply numbers in the chart by 0.4. **DO NOT INTERPOLATE!**
4. See FM 3-6 for definition of stability categories.

Table 3-28. Estimated worst case UNMASKING times.

Agent: TGD
Terrain: Sand
The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	60	46	32	18	14	10	6	3
	Neutral	60 +	53	47	40	33	25	18	10
	Stable	60 +	60 +	60 +	60	48	36	24	13
11-24	Unstable	25	18	12	5	4	4	3	3
	Neutral	60	45	30	15	12	9	6	3
	Stable	60	45	30	15	12	9	6	3
> = 25	Neutral	18	12	7	3	3	3	3	3

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for TGD to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. **DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES!**
2. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. To get times for grass terrain, multiply numbers in the chart by 0.4. **DO NOT INTERPOLATE!**
3. See FM 3-6 for definition of stability categories.

Table 3-29. Estimated worst case MOPP open times.

Agent: TGD
 Terrain: CARC

The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	1.75	1	0.75	0.5	0.25	0.25	0.25	0.25
	Neutral	1.75	1	0.75	0.5	0.25	0.25	0.25	0.25
	Stable	2	1.25	0.75	0.5	0.25	0.25	0.25	0.25
11-24	Unstable	1	0.75	0.5	0.25	0.25	0.25	0.25	0.25
	Neutral	1	0.75	0.5	0.25	0.25	0.25	0.25	0.25
	Stable	1.25	0.75	0.5	0.25	0.25	0.25	0.25	0.25
> = 25	Neutral	0.75	0.5	0.25	0.25	0.25	0.25	0.25	0.25

NOTES:

1. Worst case MOPP open time—information in the table indicates the time for TGD to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. **DO NOT OPEN MOPP WITHOUT FOLLOWING MOPP OPENING PROCEDURES!**
2. Opening the MOPP suit—unzip and/or unsnap MOPP clothing; do not remove.
3. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. **DO NOT INTERPOLATE!**
4. If soldiers are working on vehicles, avoid skin contact with the vehicles.
5. See FM 3-6 for definition of stability categories.
6. For planning, ensure the following steps are taken:
 - a. Remove as much earth and debris as possible from the CARC painted surface and conduct operator spraydown.
 - b. Above times are estimated weathering times for CARC painted surfaces; confine contamination-free status by using detection devices before MOPP reduction.
 - c. If possible, move uncontaminated equipment from the contaminated area.
 - d. Anything not painted with CARC (such as concrete, plastics, and weapons) must be individually checked for contamination.

Table 3-30. Estimated worst case unmasking times.

Agent: TGD
Terrain: CARC
The numbers in the chart represent hours.

Wind Speed KMPH	Stability	Temperature (°F)							
		50	60	70	80	90	100	110	120
0-10	Unstable	3.25	2	1.25	0.75	0.5	0.25	0.25	0.25
	Neutral	3.25	2	1.25	0.75	0.5	0.25	0.25	0.25
	Stable	3.5	2.25	1.5	1	0.5	0.5	0.25	0.25
11-24	Unstable	2	1.25	0.75	0.5	0.25	0.25	0.25	0.25
	Neutral	2	1.25	0.75	0.5	0.25	0.25	0.25	0.25
	Stable	2.25	1.25	1	0.5	0.25	0.25	0.25	0.25
> = 25	Neutral	1.25	0.75	0.5	0.25	0.25	0.25	0.25	0.25

NOTES:

1. Worst case unmasking time—information in the table indicates the time for TGD to weather below 5 percent incidence of incapacitation due to vapor-on-skin effects. **DO NOT UNMASK WITHOUT FOLLOWING UNMASKING PROCEDURES!**
2. When the actual temperature is between two listed temperatures, enter the table with the lower temperature. **TDO NOT INTERPOLATE!**
3. If soldiers are working on vehicles, avoid skin contact with the vehicles.
4. See FM 3-6 for definition of stability categories.
5. For planning, ensure the following steps are taken:
 - a. Remove as much earth and debris as possible from the CARC painted surface and conduct operator spraydown.
 - b. Above times are estimated weathering times for CARC painted surfaces; confine contamination-free status by using detection devices before MOPP reduction.
 - c. If possible, move uncontaminated equipment from the contaminated area.
 - d. Anything not painted with CARC (such as concrete, plastics, and weapons) must be individually checked for contamination.

Decontamination Resources Available at Each Level of Organization

Individual Soldiers

- One M258A1 or M291 skin decon kit.
- One canteen of water.

Operators and crews

- One onboard M11 decon apparatus or M13 decon apparatus, portable (DAP), for major pieces of equipment.
- Soap and water, M258A1 or M291 kits as needed for decon of sensitive or vulnerable surfaces.
- HTH mixture or bleach.
- M280 or M295 decon kit.

Company Level

- One 50-pound drum of STB.
- Two 5-gallon pails of DS2 or 2 M13 DAPs.
- Six long-handled brushes.
- 300 plastic garbage bags.
- Six 3-gallon buckets.
- Six large sponges.
- Two 32-gallon galvanized trash cans (from mess section).
- Two immersion heaters (from mess section).

Battalion PDDE Crews

- Power-driven decontaminating equipment (PDDE) or light weight decon system (LDS).
- Basic load liquid detergent.

Chemical Company Decon Squad

- Ten 5-gallon pails of DS2, or M13 DAPs, per M12A1 (IAW CTA 50-970).
- Twenty-six 50-pound drums of STB per M12A1 (IAW CTA 50-970).
- Power-driven decon equipment.

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- Basic load of liquid detergent.

Chemical Company Decon Platoon

- 5-gallon pails of DS2 or M13 DAPs, per M12A1 or M17 LDS (IAW CTA 50-970).
- 50-pound drums of STB per M12A1 (IAW CTA 50-970).
- Power-driven decon equipment or M17 light decon system (dual purpose platoon only).
- Basic load of decontaminants.

Levels of Decontamination

There are three levels of decon: immediate, operational, and thorough.

Immediate Decon minimizes casualties, saves lives, and limits the spread of contamination. Immediate decon is carried out by individuals upon becoming contaminated. There are three immediate techniques: skin decon, personnel wipedown, and operator's spray down.

Operational Decon sustains operations, reduces the contact hazard, and limits the spread of contamination to eliminate the necessity or reduce the duration of wearing MOPP gear. Operational decon is carried by individual and/or units. It is restricted to specific parts of operationally essential equipment/material and/or working areas, in order to minimize contact and transfer hazards and to sustain operations. Further decon may be required to reduce contamination to negligible risk levels. There are two operational decon techniques: vehicle washdown and MOPP gear exchange.

Thorough Decon reduces or eliminates the need for individual protective clothing. Thorough decon is carried out by units with assistance from chemical units to reduce contamination on personnel, equipment/material, and/or working areas to the lowest possible level (negligible risk) to permit the reduction or removal of individual protective equipment and maintain operations with minimal degradation. This may include decontamination of terrain as required. There are three thorough decon techniques: detailed troop decon, detailed equipment decon, and detailed aircraft decon.

The three levels of decon—immediate, operational, and thorough—are presented as part of this chapter to explain the seven standard decon techniques used for most decon operations. Your chemical officer or NCO advises on efficient ways to conduct operational or thorough decon operations. For example, conducting decon operations might require the use of one or a combination of the seven decon techniques.

Table 3-31. Comparison data for decon types.

Level	Technique	Best Start Time*	Done By	Gains
Immediate	Skin Decon	Before 1 minute	Individual	Stops agent from penetrating
	Personal Wipedown	Within 15 minutes	Individual or Crew	
	Operator Spraydown			
Operational	MOPP Gear Exchange**	Within 6 hours	Unit	Possible temporary relief from MOPP4. Limit liquid agent spread.
	Vehicle Washdown***		Battalion Crew or decon PLT (-)	
Thorough	Detailed Equipment/Aircraft Decon	When mission allows reconstitution	Decon platoon	Probable long-term MOPP reduction with minimum risk
	Detailed Troop Decon		Unit	
<p>* The techniques become increasingly less effective the longer they are delayed.</p> <p>** Performance degradation and risk assessment need to be considered when exceeding 6 hours. See FM 3-4, BDO risk assessment.</p> <p>*** Vehicle washdown is most effective if started within 1 hour, but will often have to be delayed for logistical reasons.</p>				

Operational Decontamination

Table 3-32. Operational decon responsibility matrix.

Phase		Task	Unit			
			Contaminated Unit	Battalion PDDE Crew	Battalion	Brigade
Planning	Preparation	Request	P		S	
		Coordination			P	S
		Site Selection	P		S	
		Rendezvous	P		S	
		Site Setup	S	P		
	Execution	Site Control and Security	P			
		Processing	P	S		
	Site Clearance	Cleanup		P		
		Marking and Reporting		P		
	Legend: P = Primary responsibility, S = Supporting responsibility					

Table 3-33. Sample operational decon checklist.

	Task	Procedure
1	Decon assessmnet	If the battalion has no decon assets, request assistance from the next higher headquarters for needed support.
2	Coordination	Battalion chemical section conducts coordination with contaminated unit on where to meet. The decon should be done between one to six hours after becoming contaminated.
3	Site selection	The contaminated unit chooses the decon site in coordination with the battalion. Consider the following items when selecting a site: <ul style="list-style-type: none"> • Off main route but easy access • Large enough area, (100 square meters per site for a squad-size element) • Good overhead concealment • water source, (plan for 100 gallons per vehicle) • Good drainage
4	Rendezvous	Ensure the battalion decon crew knows where to meet the contaminated unit, and site location for set up.
5	Site setup	Ensure the PDDE are positioned properly and ready to dispense hot, soapy water. Ensure that the contaminated unit operates the MOPP gear exchange at the same time as the vehicle washdown.
6	Site control and security	Ensure the drivers of the contaminated vehicles know when to move into position at the washdown location. Ensure the contaminated unit has provided site security.
7	Processing	Ensure the decon NCOIC is processing vehicles at a rate of three minutes per vehicle. Also ensure soldiers are going through the MOPP gear exchange, if needed.
8	Cleanup	Decon NCOIC ensures the MOPP gear exchange area is cleaned up.
9	Marking and reporting	Decon NCOIC has his team properly mark the decon site and send NBC 5 report forward.

Table 3-34. Unsupported one-lane washdown.

Steps and Risks	Equipment	Procedure
<p>Step 1. Button up vehicle/equipment. Performing this step prevents contamination from being washed or splashed into uncontaminated areas.</p> <p>Risks. Failure to perform this step may result in contamination being washed into uncontaminated areas, subjecting crew and maintenance personnel to hazards.</p>	<p>None</p>	<p>Equipment crew/operators close all access doors, hatches, windows, and other openings before washdown. Put muzzle covers on weapons. Nonessential personnel can dismount and begin MOPP gear exchange. They then act as "buddies" for essential crew/operators. NOTE: Ensure that vehicles equipped with over pressurized systems are operating with system on.</p>
<p>Step 2 Washdown vehicle/equipment. Performing this step limits spread of contamination, minimizes hazards, and enhances weathering to make detailed equipment decon easier and faster.</p> <p>Risks. If you do not do this step, expect casualties from contact hazards. Spreading or transferring the hazard most likely will increase. Weathering of the hazard most likely will be slowed. You will not be able to reduce MOPP level immediately because an after-vehicle washdown check for contamination is not made. (See decon in combat, Chapter 1, for when to unmask for brief periods.)</p>	<p>Use for all forms of contamination:</p> <ul style="list-style-type: none"> • One PDDE. • Adequate fuel for water heater (if available) and pump unit. • Adequate water supply (about 100 to 150 gallons per vehicle). • Liquid detergent to mix with water (see Appendix J). 	<p>Chemical, biological, and radiological: Two soldiers from the battalion PDDE crew operates washdown equipment. A third soldier supervises. Soldiers must wear toxicological agent protective (TAP) aprons or wet weather gear worn over MOPP gear to keep MOPP gear from becoming saturated. Soldiers spray hot, soapy water (under pressure) from PDDE onto equipment surfaces. This removes, neutralizes, or destroys most of the gross contamination trapped in dirt and mud. Unheated soapy water or plain water may be used, if necessary, but is less effective than hot, soapy water. Start at the top decks of vehicles and wash downward.</p>
<p>Step 3. Vehicles move into assembly area.</p>		<p>Exchange chemical suit.</p>



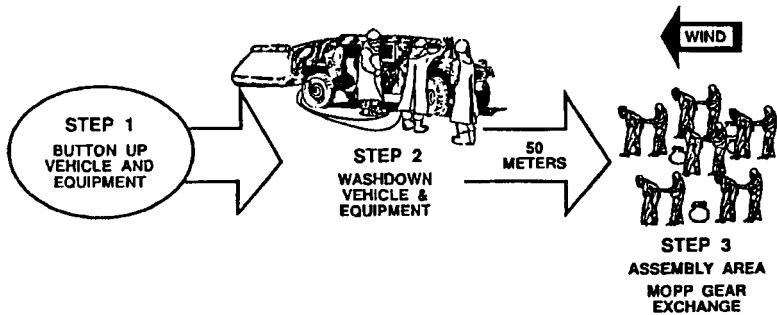
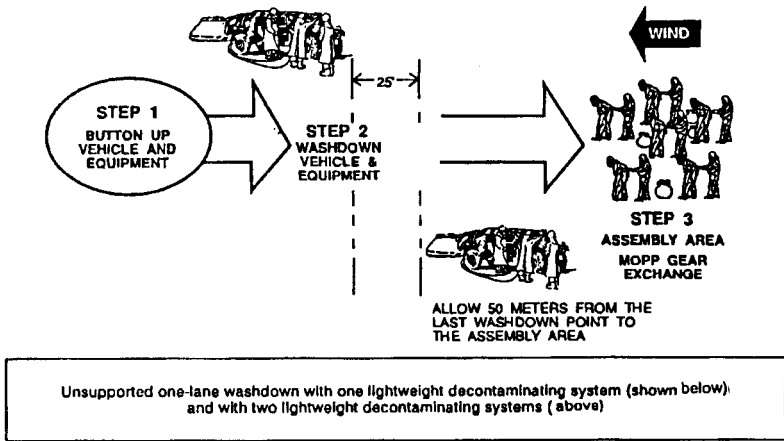



Figure 3-2. Unsupported one-lane washdown.

Table 3-35. Unsupported two lane washdown

Steps and Risks	Equipment	Procedures
<p>Preaction: Unit tactically disperses in concealed marshalling area. Makes contact with control point for final orders. Control point monitors and supervises rate of movement into lanes to prevent congestion.</p>	<p>Watch</p>	<p>One soldier from the battalion decon crew. Every three minutes two vehicles will be released from the marshalling area. On signal vehicles will proceed to the decon station in their respective lane.</p>
<p>Step 1. Button up vehicle/equipment. Performing this step prevents contamination from being washed or splashed into uncontaminated areas. This step applies for both lanes.</p> <p>Risks. Failure to perform this step may result in contamination being washed into uncontaminated areas, subjecting crew and maintenance personnel to hazards.</p>	<p>None</p>	<p>Equipment crew/operators close all access doors, hatches, windows, and other openings before washing down. Put muzzle cover on weapons. Nonessential personnel can dismount and begin MOPP gear exchange upon commander's orders. They they can act as "buddies" for essential crew/operators.</p> <p>NOTE:: Ensure that vehicles equipped with overpressurized systems are operating with the systems on. No MOPP gear exchange is required if crew/operators are inside vehicle and have not been exposed to any contamination.</p>
<p>Step 2. Wash down vehicles/equipment. Crews/drivers remain in vehicles. Sprayers use cross diagonal technique for two to three minutes, removing gross contamination. This technique avoids water splashing the crew members. Performing this step limits the spread of contamination, minimizes hazard, and enhances weathering to make detailed equipment decon easier and faster.</p>	<ul style="list-style-type: none"> • Adequate fuel for water heater (if available) and pump unit. • Adequate water supply (about 100 to 150 gallons per vehicle). • Liquid detergent to mix with water (see Appendix F). <p>NOTE: Use M12 PDDA, M17 LDS, 65-GPM pump, fire-fighting equipment, and/or combination.</p>	<p>Chemical, biological, and radiological: Two soldiers per lane from the battalion decon crew wash down equipment. A third soldier supervises. Soldiers must wear TAP aprons or wet weather gear over MOPP gear to keep MOPP gear from becoming saturated. Soldiers spray hot, soapy water (under pressure) from PDDE onto equipment surfaces. This removes, neutralizes, or destroys most of the gross contamination trapped in dirt and mud. Unheated soapy water or plain water may be used, if necessary, but is less effective than hot, soapy water. Start at the top decks of vehicles and wash downward.</p>
<p>Step 3. Vehicles move into assembly area. MOPP gear exchange is determined by the commander</p>		<p>Exchange MOPP suit.</p>

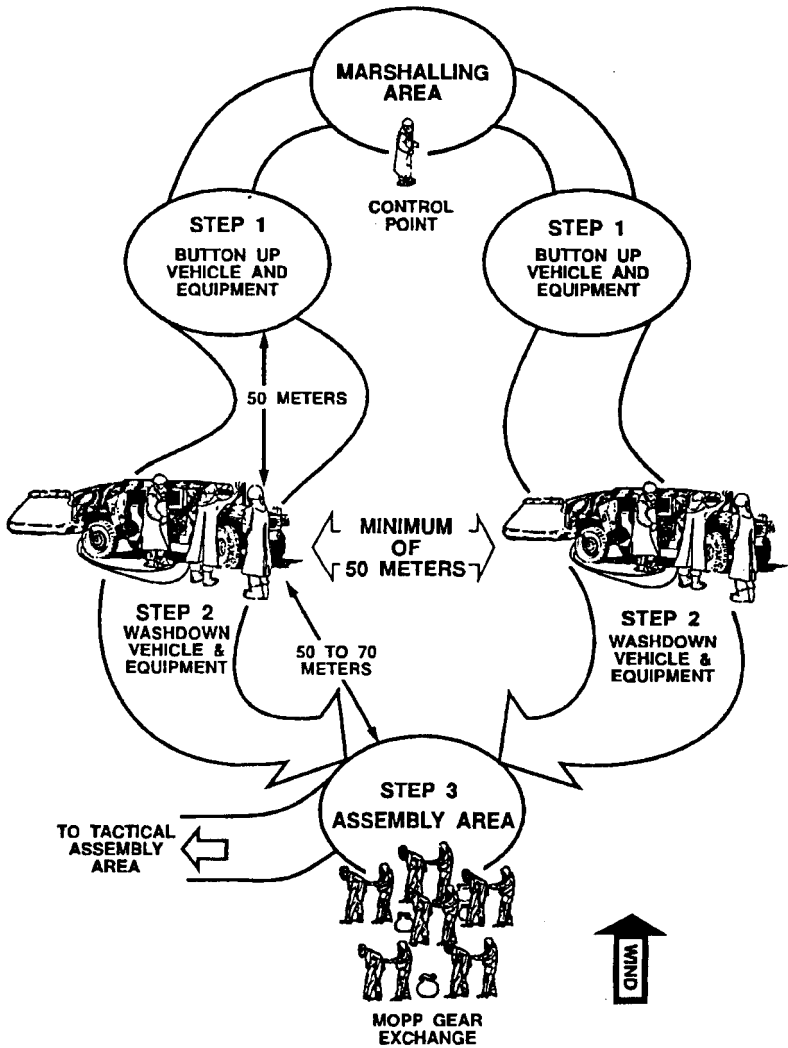


Figure 3-3. Unsupported two lane washdown

Table 3-36. Supported two-lane washdown.

Steps and Risks	Equipment	Procedures
<p>Preaction: Unit tactically disperses in a concealed marshalling area. Make contact with control point for final instructions. Control point monitors and supervises rate of movement into lanes to prevent congestion.</p>	<p>Watch</p>	<p>One soldier from the battalion decon crew required. Two vehicles will be released from the marshalling area every three minutes. On signal vehicles will proceed to the decon station in their respective lane.</p>
<p>Step 1. Button up vehicle/equipment. Performing this step prevents contamination from being washed or splashed into uncontaminated areas. This step applies to both lanes.</p> <p>Risks. Failure to perform this step may result in contamination being washed into uncontaminated areas, subjecting crew and maintenance personnel to hazards.</p>	<p>None</p>	<p>Equipment crew/operators close all access doors, hatches, windows, and other openings before washdown. Put muzzle covers on weapons. Nonessential personnel can dismount and begin MOPP gear exchange, upon commander's orders. They then act as "buddies" for essential crew/operators. NOTE: Ensure that vehicles equipped with overpressurized systems are operating with systems on.</p>
<p>Step 2. Wash down vehicles/equipment. Crews/drivers remain in vehicles. Vehicles stop by the first wash. Sprayers decon half of the vehicle/equipment facing their side, for one and one-half minutes. Vehicles then move to the second wash where sprayers will decontaminate the other half of the vehicle/equipment for one and one-half minutes.</p>	<ul style="list-style-type: none"> • 3 M17 LDS. • Adequate fuel for water heater and pump units. • Adequate water supply (approximately 100 to 150 gallons per wash point per vehicle). • Liquid detergents to mix with water. <p>NOTE: Use M12 PDDE, M17 LDS, 65-GPM pump, fire-fighting equipment, and/or combination.</p>	<p>Chemical, biological, and radiological: Four soldiers from the chemical decon platoon wash down equipment. A fifth soldier supervises. Soldiers must wear TAP aprons or wet weather gear worn over MOPP gear to keep from becoming saturated. Soldiers spray hot, soapy water (under pressure) from PDDE onto equipment surfaces. Start at the top decks of vehicles and wash downward.</p>
<p>Step 3. Vehicles move into assembly area. MOPP gear exchange is determined by the commander.</p>		<p>Exchange MOPP suit.</p>

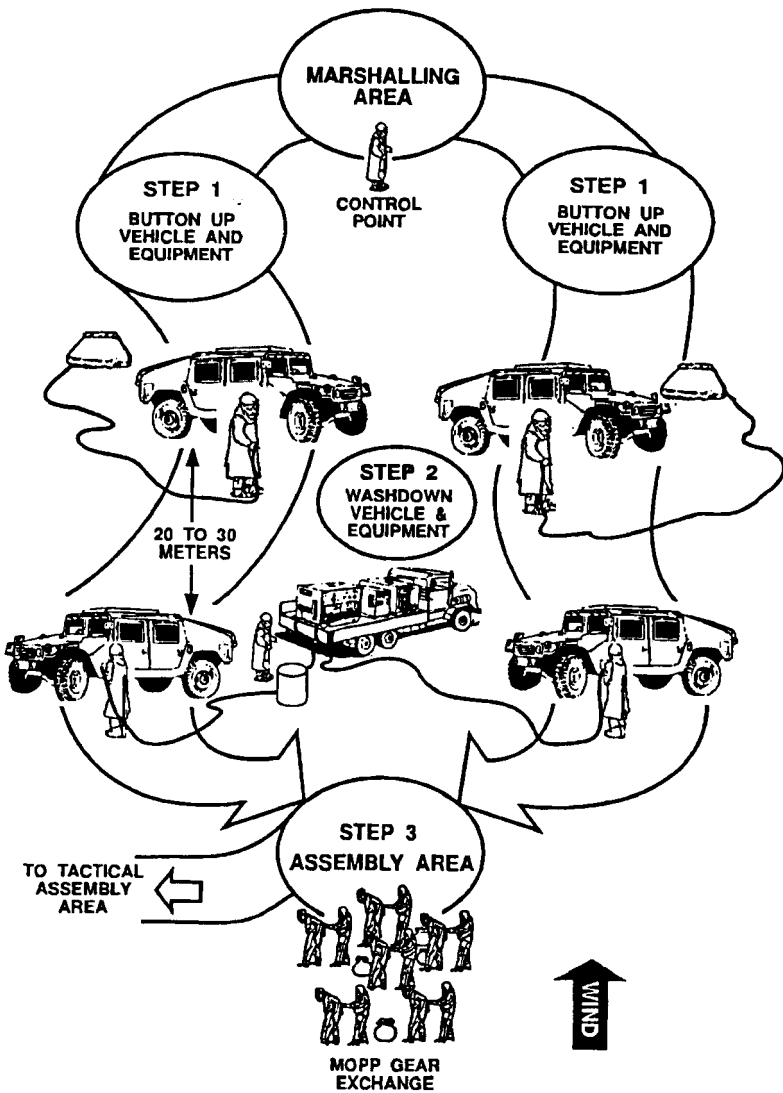


Figure 3-4. Supported two-lane washdown.

MOPP Gear Exchange	
Step	Procedure
1.	Decontaminate gear.
2.	Prepare for Decontamination.
3.	Decontaminate hood
4.	Remove overgarments and overshoes.
5.	Remove gloves.
6.	Put on overgarments.
7.	Put on overboots and gloves.
8.	Secure hood.

Table 3-37. MOPP gear exchange (buddy team method).

Steps and Risks	Equipment	Procedures
<p>STEP 1 DECON GEAR. Performing this step removes gross contamination from individual gear (weapon, helmet, load-bearing equipment, and mask carrier).</p> <p>RISKS. If you do not do this step, you will transfer contamination from your individual gear to your new MOPP gear. You will have to change MOPP gear within 24 hours, even if you do not receive any more contamination. If chemical/biological contamination is not removed from individual gear, the weathering process will be delayed (see FM 3-4). If radiological contamination is not removed, your radiation exposure may increase over time, prolonging the time you must remain in MOPP gear.</p>	<p>ALL CONTAMINATION:</p> <ul style="list-style-type: none"> • Four long-handled brushes. • Large piece of plastic (poncho or similar material) <p>CHEMICAL/BIOLOGICAL:</p> <ul style="list-style-type: none"> • One 5-gallon container STB dry mix. <p>RADIOLOGICAL: None.</p>	<p>CHEMICAL/BIOLOGICAL: If the personnel armor system, ground troops (PASGT) helmet is worn, remove and discard the chemical protective helmet cover. Brush or rub STB into personal equipment. Brush or rub STB dry mix onto hose if wearing the M24, M25A1, or M42 mask. Gently shake off any excess. Set aside gear on an uncontaminated surface.</p> <p>RADIOLOGICAL: Shake or brush contamination off.</p>
<p>STEP 2. PREPARE FOR DECON. Performing this step allows the soldier to remove his overgarment trousers and boots later. It also allows for the hood to be rolled easier.</p> <p>NOTE: A soldier can do this step by himself or with the help of his buddy.</p>	<p>ALL CONTAMINATION:</p> <ul style="list-style-type: none"> • Cutting tool. 	<p>Unfasten the shoulder straps on the hood and pull them over the shoulder and reattach them to the Velcro ® fastener. Loosen drawcord on hood of protective mask. Remove M9 paper. Untie drawcords on trouser legs of the garment, unzip the trouser legs, and roll a cuff in each leg. Ensure that the cuff does not come over the top of the overboot. Unfasten or cut fasteners on green vinyl overboots or untie/cut the laces on the protective overboot.</p>

**Table 3-37. MOPP gear exchange (buddy team method)
(Continued).**

Steps and Risks	Equipment	Procedures
<p>STEP 3 DECON HOOD. Performing this step removes the gross contamination from the mask and hood. The squad leader and companion or two personnel from the squad stand in the center of a circle. They supervise the other teams while they go through the technique themselves.</p> <p>RISKS: CHEMICAL/BIOLOGICAL CONTAMINATION. If this step is not done, small amounts of contamination may still be on the mask and hood. You will risk spreading contamination to your skin during the undressing.</p> <p>RISKS: RADIOLOGICAL CONTAMINATION. If you do not do this step, excessive radiation exposure could occur from contaminants on the hood and mask. You also risk spreading contamination to your skin during the undressing.</p>	<p>CHEMICAL/BIOLOGICAL:</p> <ul style="list-style-type: none"> • One M258A1 or two M295 skin decontaminating kits per person. <p>RADIOLOGICAL:</p> <ul style="list-style-type: none"> • Three containers (about 3-gallon capacity) • Two sponges. • Soapy water. • Rinse water. • Paper towels or similar drying material. • One IDK kit per person, if water is not available. 	<p>CHEMICAL/BIOLOGICAL: Using the M258A1 or M295 skin decon kit, decontaminate the hood and exposed parts of your buddy's mask. Start with the eye lens outserts, wiping from the top down. Then decon the rest of the hood, wiping from the top of the head to the bottom of the hood. When you have finished decontaminating your buddy's mask, decontaminate your gloves in preparation for rolling your buddy's hood. (NOTE: When decontaminating the mask, do not press so hard that you break your buddy's seal). Leave the zipper on the hood closed. Grab the straps where they connect to the back of the hood and lift the hood straight up of the buddy's shoulders. Pull the hood up and over the head until the bottom of the back of the hood is to the top of the eye lens outserts, but not over. Check for contamination on the underside of the hood edges and decon if necessary. Roll your buddy's hood. Put one tuck (about two inches) on the forehead, then begin rolling at both temples simultaneously by tucking in with the thumbs as you roll toward the bottom of the zipper.</p> <p>M40 MASK. The contaminated soldier holds the mask firmly in place to avoid breaking the seal. Make the rolls from each side of the hood come to a point at the bottom of the zipper, forming a V. Put a half twist in the V, forming two sides into a tail. Then tuck the tails between the upper part of the canister and mask. (Tie tail over and under the hose of the M42.)</p> <p>(Step 3 continues on next page.)</p>

**Table 3-37. MOPP gear exchange (buddy team method)
(Continued).**

Steps and Risks	Equipment	Procedures
<p>STEP 3. DECON HOOD (continued)</p>		<p>RADIOLOGICAL: Wipe your buddy's mask and hood with sponge dipped in hot, soapy water. Rinse with sponge dipped in clean water. Dry with paper towels or rags. The buddy does his or her own gloves. Cool, soapy water is not as effective for removing contamination, but can be used if you scrub longer. Use IDK skin decon kit ONLY if no water is available. If water supply is limited, soldier may use some of his drinking water (from his canteen) with a wet sponge or cloth. Do not reverse rolls. Only your buddy's hood will be decontaminated and rolled at this time.</p>
<p>STEP 4. REMOVE OVERGARMENTS/OVERSHOES. Performing this step limits the spread of agents and helps prevent agents from penetrating through to skin or undergarments.</p> <p>RISKS: If you do not do this step, the agent will penetrate your overgarment. The more agent on the garment, the quicker it will penetrate. If you do not do this step properly, you risk spreading the agent onto your undergarments or skin, causing casualties.</p>	<p>ALL CONTAMINATION:</p> <ul style="list-style-type: none"> • Two discard containers (recommend plastic bags.) 	<p>CHEMICAL/BIOLOGICAL:</p> <p>Unfasten the three snaps on the back of overgarment trousers. Do this by grasping the outside overgarment jacket and unsnapping the snaps individually. Untie the drawcord at the bottom of the jacket. Unfasten the Velcro® at the wrist and unfasten. Unfasten the Velcro® closures over the zippered front of the jacket and unzip the jacket. Grasp the jacket at the shoulders. Instruct the buddy to make a fist. Pull the jacket down and away from the soldier, ensuring that the black part of the jacket isn't touched. Lay the overgarment jacket on the ground, black side up. (It will be used for the buddy to stand on later.) Carefully unfasten and unzip the trousers. Do not loosen the waist tabs. Instruct the soldier to break the seals on the overshoes by alternately stepping on the heels and pulling up his foot. Grasp the trousers and pull them down to the knees. Instruct the soldier to walk out of the trousers/GVOs, (Step 4 continues on next page.)</p>

**Table 3-37. MOPP gear exchange (buddy team method)
(Continued).**

Steps and Risks	Equipment	Procedures
<p>STEP 4. REMOVE OVERGARMENTS/OVERSHOES (continued).</p>		<p>taking care not to step on the contaminated side of the overgarment. If wearing overboots, remove trousers first, then step out of overboots (with buddy's help) onto the black side of jacket. The soldier should step onto the jacket wearing mask, battledress uniform (BDUs), and gloves.</p>
<p>STEP 5. REMOVE GLOVES. Performing this step removes contaminated gloves and limits the spread of contamination. RISKS: If this step is not done, it is quite probable the agent will be transferred to clean overgarments (Step 6). Contamination may get on your skin because gloves, tear, rip, puncture, and wear out.</p>	<p>ALL CONTAMINATION:</p> <ul style="list-style-type: none"> • Two discard containers (from Step 4) 	<p>Hold finger tips of the gloves and partially slide the hand out. When fingers of both hands are free, hold arms away from body and let gloves drop off.</p>
<p>STEP 6. PUT ON OVERGARMENTS. Performing this step restores MOPP protection. RISKS: If you do not do this step properly, you risk contaminating your new overgarment or your skin.</p>	<p>ALL CONTAMINATION:</p> <ul style="list-style-type: none"> • One set of chemical protective overgarments per person (correct size). 	<p>Open package containing new overgarments, but do not touch the garment. Have your buddy reach into the package and pull out the overgarment without touching the outside of the package. Your buddy puts on the trousers and jacket, fastens overgarment, and leaves trouser legs open. Do not reverse roles. Only your buddy will put on clean overgarments at this time.</p>
<p>STEP 7. PUT ON OVERBOOTS AND GLOVES. Performing this step restores MOPP protection. RISKS: If you do not do this step, you run the risk of becoming a casualty by touching contamination remaining on unit equipment. You risk spreading contamination to your skin or undergarments. You risk contaminating your regular combat boots.</p>	<p>ALL CONTAMINATION:</p> <ul style="list-style-type: none"> • One set of chemical protective overboots per person. • One set chemical protective gloves per person (correct size). • M9 paper. 	<p>Pick up a package of clean overboots and open without touching the overboots inside. Have your buddy reach into the package (without touching outside of package), remove the GVO/overboots, put them on, and fasten trouser legs. Open a package of clean gloves without touching gloves. Have your buddy remove them from package (without touching the outside of the package) and put them on. Put on M9 paper. Do not reverse roles. Only your buddy will put on clean overgarments at this time. Table 3-37 continued on next page.</p>

Table 3-37. MOPP gear exchange (buddy team method) (Continued).

Steps and Risks	Equipment	Procedures
<p>STEP 8. SECURE HOOD. Performing this step restores MOPP protection. RISKS: If you do not do this step, you risk transferring contamination to the inside of the hood.</p>	<p>ALL CONTAMINATION: • One decon 1 and one decon 2 wipe packet from M2581 kit. • One M295 SDK decon packet.</p>	<p>Decontaminate your rubber gloves with M258A1 or M295 skin decon kit. Once gloves are decontaminated, unroll your buddy's hood and attach the straps and tighten neck cord. Check all zippers and ties on the hood and overgarment to ensure they are tight.</p>

Thorough Decon

Table 3-38. Thorough decon support matrix.

	UNIT								
	DIVISION CMLD	DIVISION	BRIGADE	DISCOM	FSB	CHEMICAL UNIT	CONTAMINATED UNIT	BATTALION	SITUATION DEPENDENT
Preparation Phase Tasks									
Request	S						P	S	
Coordination	S		S					P	
Site Selection		S or S				P			
Advance Party Link-up						S	P	S	
Site-Setup				S	S	P	S		
Execution Phase Tasks									
Site Control/Security						S	P		
Predecon Actions						P	S		
Processing						P	S		
Site Clearance Phase Tasks									
Cleanup						P	P		S
Marking & Reporting						P			S
P = Primary Responsibility, S = Supporting Responsibility									

Table 3-39. Equipment recapitulation for detailed troop decon of an average-sized company.

Three containers (2-gallon capacity). One will hold an immersion heater.	Two books of M8 paper per squad.
Three containers (3-gallon capacity). Four additional containers required for radiological decon.	One role of M9 paper per squad.
Two M258A1 or M291 decon kits per person.	Four M1 chemical agent monitors (CAMs).
Two boxes of plastic bags.	Four M8A1 automatic chemical agent alarms.
Ten 50-pound drums of STB.	Two immersion heaters with fuel.
One 5-pound drum of general purpose detergent.	Two shovels.
One 1-gallon container of mask sanitizing solution per ten tanks.	First aid supplies and antidotes.
Four long-handled brushes.	One M256A1 detector kit per squad.
Four large sponges (four additional sponges for radiological decon).	One role plastic per company.
Four bundles of rags.	One case paper towels per company.
Four cutting tools (scissors, knives).	Engineer tape.
One filter-pair or filter canister per mask.	Protective mask PLL parts.
One hood per mask.	NOTE: If only one radiacmeter is available, use it at Station 5 to monitor personnel. Pile together decontaminated equipment from Station 1 and decontaminate masks from Station 7. After a squad has been monitored through Station 5, an attendant should monitor the equipment pile.
Three AN/PDR27 radiacmeters or AN/VDR2 (for radiological only).	

Table 3-40. Detailed Troop Decon personnel and equipment recapitulation.

Station	Personnel	Equipment
Station 1 Individual Gear Decon	2 attendants 1 monitor (CAM operator)	3 30-gallon containers 2 long-handled brushes 2 ponchos or plastic sheets 1 CAM 8 M8 detector paper 4 M256A1 kits 100 trash bags
Station 2 Overboot and Hood Decon	1 attendant	2 cutting tools 60 M258A1 or M295 (or one per person) 2 ponchos or plastic tarps 100 trash bags
Station 3 Overgarment Removal	1 attendant	10 M258A1/M295 2 30-gallon containers 100 trash bags
Station 4 Overboot and Glove Removal	1 attendant	2 30-gallon containers 100 trash bags Engineer tape Cutting tool
Station 5 Monitor	1 attendant (CAM operator) 1 aidman (or combat lifesaver)	1 CAM 5 M8 detector paper 24 M258A1/M295
Station 6 Mask Removal	2 attendants	1 M8A1 chemical alarm
Station 7 Mask Decon Point	2 attendants 1 monitor	4 3-gallon containers 1 CAM 2 sponges 1 case paper towels 1 immersion heater w/container Mask sanitizing solution
Station 8 Reissue Point	Unit supply NCO Unit NBC NCO	Mask PLL

Table 3-41. Planning Factors for DS2 application.

Planning Category	Tank	Truck	APC
Gallons of DS2	15	8	7
Minutes to apply	35	29	18
CAUTION Do not mix HTH or STB with DS2. If mixed, a violent reaction will occur.			

Table 3-42. Preparation of decon mixtures.

Decon Mixtures		
Solution	1 Gallon of Water	5 Gallons of Water
5 percent	.6 pounds STB/HTH	3.6 pounds STB/HTH
10 percent	.75 pounds STB/HTH	4.5 pounds STB/HTH

Table 3-43. Planning factors for the rinse station.

Planning Category	Tank	Truck	APC
M12A1 Rinse (gal)	325	158	152
M12A1 Rinse (min)	12	7	9
M17 LDS (gal) *	57	42	31
M17 LDS (min) *	14	11	10
* With Spray Wands			

Table 3-44. Common interferences that can cause false positive readings on the CAM.

Interferent	G-Bar Response	H-Bar response
M258A1 Decon Kit		High
M280 DKIE		High
DS2	Low	
Insect Repellent	Low-Very High	
Brake Fluid	High-Very High	Very High
Cleaner, General Purpose	High	
Burnig Kerosene		High
Breath Mints	High	
Gasoline Vapor	Low	Low
Burning Grass	Low-High	Low
Burning Gas	Low	
Green Smoke	Low	Low-High
Breakfree Oil	Low	
Ammonia	Very High	

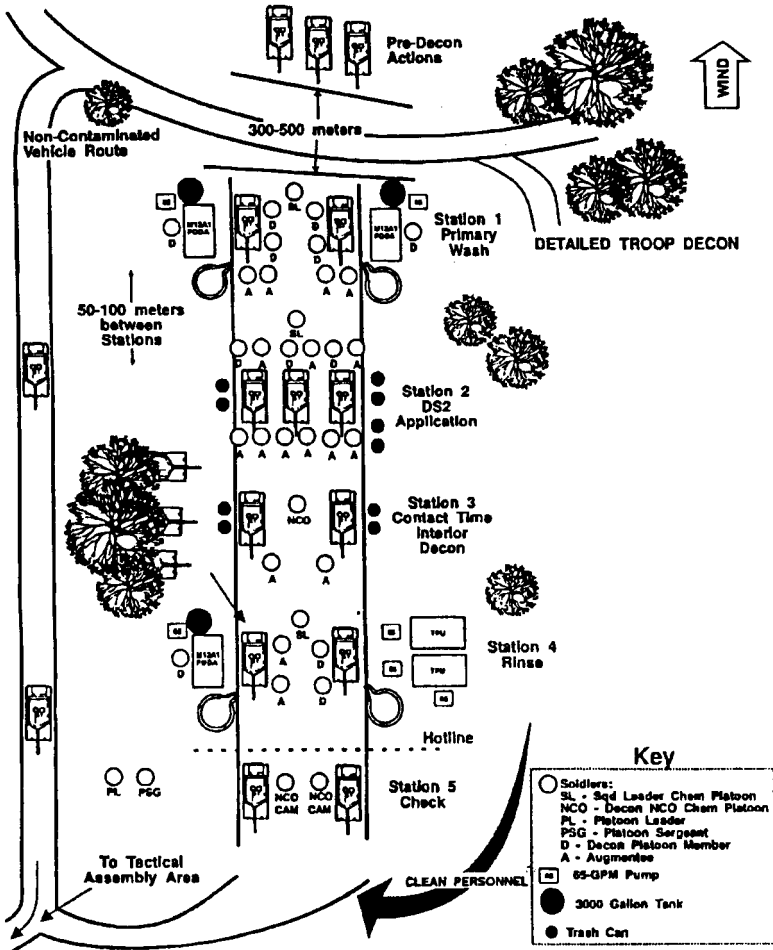


Figure 3-5. M12A1 PDDA-equipped unit-optimum DED layout.

Table 3-45. Personnel and equipment requirements for optimum M12A1 PDDA-equipped DED setup (see figure 3-5).

	Personnel		Equipment
	Decon Platoon	Augmentee	
Station 1 Initial Wash	1 Squad Leader 2 PDDA Operators 4 Sprayers	4 Scrubbers	2 M12A1 PDDAs 2 3,000-gal Tanks 2 65-GPM Pumps 6 Long-Handled Brushes 8 TAP Aprons Liquid Detergent
Station 2 DS2 Application	1 Squad Leader 3 Appliers	9 Appliers	18 Long-Handled Brushes 9 MOps with Extra Mop Heads 3 30-gal Containers 9 M13 DAPs Sufficient DS2
Station 3 Wail/Interior Decon	1 NCO	2 Interior Decon Assistants	2 AN/VDR2 or AN/PDR27 (I) 3 TAP Aprons 6 30-gal Containers 10 M8 Detector Paper 30 Sponges 8 M256A1 50 Trash Bags 1 Clipboard w/Pen 1 Stopwatch
Station 4 Rinse	1 Squad Leader 1 PDDA Operator 2 Pump Operators	2 Sprayers	1 M12A1 PDDA 1 3,000 gal Tank 3 65 GPM Pumps 2 TPU 2 TAP Aprons
Station 5 Check	2 NCO/CAM Operators		2 CAM 10 M256A1 20 M8 Detector Paper 2 AN/VDR2 or AN/PDR27 2 M8A1 Chem Alarms
C2	1 Platoon Leader 1 Platoon Sergeant		1 HUMMWV/CUCV w/Radio 3 NBC Marking Kits
Total Personnel	20	17	

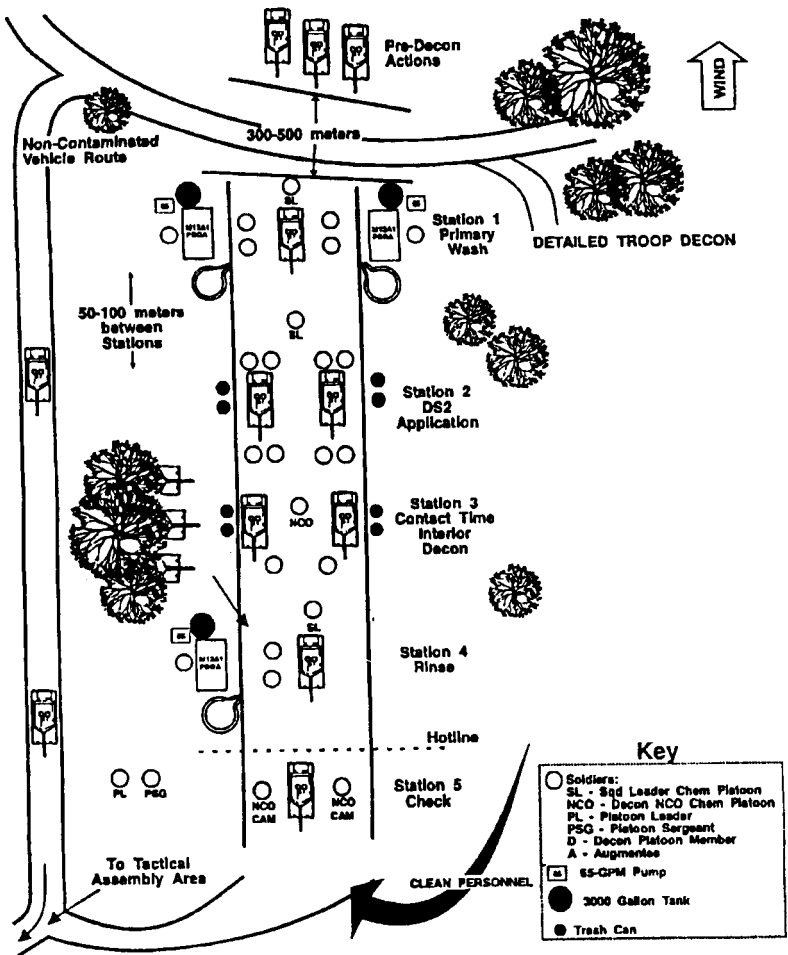


Figure 3-6. An Alternate DED layout for an M12A1 PDDA-equipped unit.

Table 3-46. Personnel and equipment requirements for an alternate M12A1 PDDA-equipped DED setup (see figure 3-6).

	Personnel	Equipment
Station 1 Initial Wash	1 NCOIC* 2 PDDA Operators* 4 Sprayers 2 Scrubbers	2 M12A1 PDDAs 2 3,000-Gallon Tanks 2 65-GAL Pumps 4 Long-Handled Brushes 6 TAP Aprons Liquid Detergent
Station 2 DS2 Application	1 NCOIC* 8 Appliers	14 Long-Handled Brushes 8 Mops with Extra Mop Heads 3 30-Gallon Containers 8 M13 DAPs Sufficient DS2
Station 3 Wait/Interior Decon	1 NCO* 2 Interior Decon Assistants	2 AN/VDR2 or AN/PDR27 3 TAP Aprons 6 30-Gallon Containers 10 M8 Detector paper 30 Sponges 8 M256A1 50 trash Bags 1 Clipboard w/Pen 1 Stopwatch
Station 4 Rinse	1 NCOIC* 1 PDDA Operator* 2 Sprayers	1 M12A1 PDDA 1 3,000-Gallon Tank 1 65-GPM Pump 1 TPU 2 TAP Aprons
Station 5 Check	2 NCO/CAM Operators*	2 CAMs 10 M256A1 20 M8 Detector Paper 2 AN/VDR2 or AN/PDR27 2 M8A1 Chem Alarms
C2	1 Platoon (Decon Platoon) 1 Platoon Sergeant (Decon Platoon)	1 HUMMWV/CUCV w/Radio 3 NBC Marking Kits
Total Personnel	29 (Minimum of 11 soldiers from the decon platoon)	
* These individuals should be from the decon platoon		

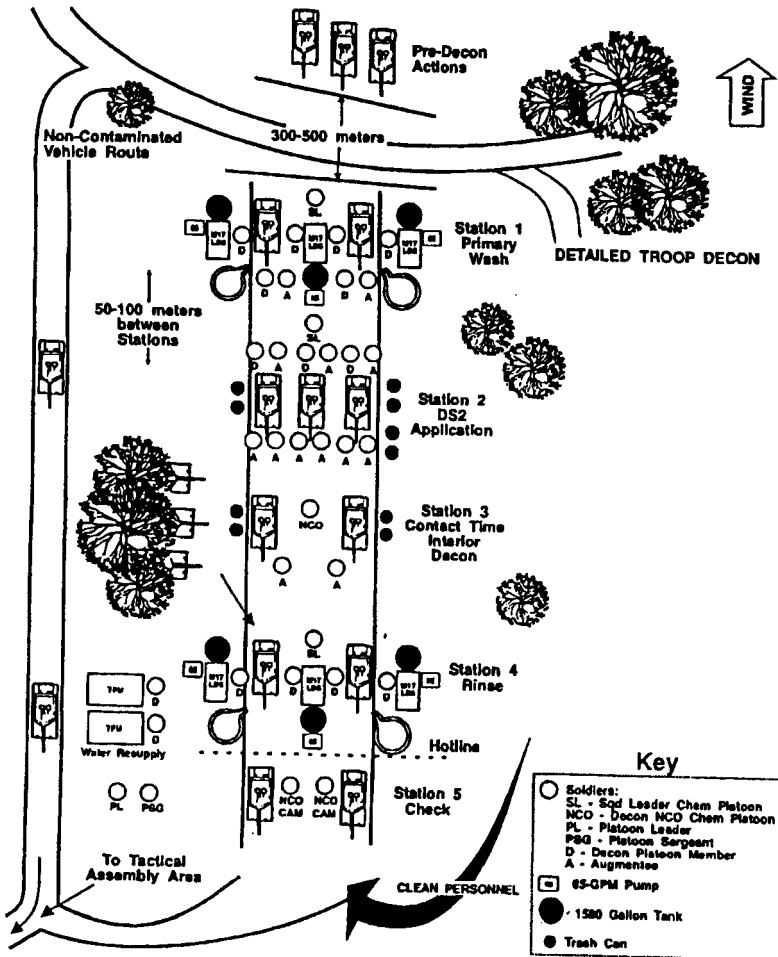


Figure 3-7. Optimum DED layout for an M17 LDS-equipped unit.

Table 3-47. Personnel and equipment optimum requirements for optimum M17 LDS DED setup (see figure 3-7).

	Personnel		Equipment
	Decon Platoon	Augmentee	
Station 1 Initial Wash	1 Squad Leader 4 Sprayers 2 Scrubbers	2 Scrubbers	3 M17 LDS 3 1,500-gal Tanks 3 65-GPM Pumps 6 Long-Handled Brushes 8 TAP Aprons Liquid Detergent
Station 2 DS2 Application	1 Squad Leader 3 Appliers	9 Appliers	18 Long-Handled Brushes 9 MOps with Extra Mop Heads 3 30-gal Containers 9 M13 DAPs Sufficient DS2
Station 3 Wail/Interior Decon	1 NCO 2 Interior Decon Assistants		2 AN/VDR2 or AN/PDR27 3 TAP Aprons 6 30-gal Containers 10 M8 Detector Paper 30 Sponges 8 M256A1 50 Trash Bags 1 Clipboard w/Pen 1 Stopwatch
Station 4 Rinse	1 Squad Leader 4 Sprayers		3 M17 LDS 3 1,500 gal Tank 3 65 GPM Pumps 4 TAP Aprons
Station 5 Check	2 NCO/CAM Operators		2 CAM 10 M256A1 20 M8 Detector Paper 2 AN/VDR2 or AN/PDR27 2 M8A1 Chem Alarms
C2	1 Platoon Leader 1 Platoon Sergeant		1 HUMMWV/CUCV w/Radio 3 NBC Marking Kits
Total Personnel	24	11	

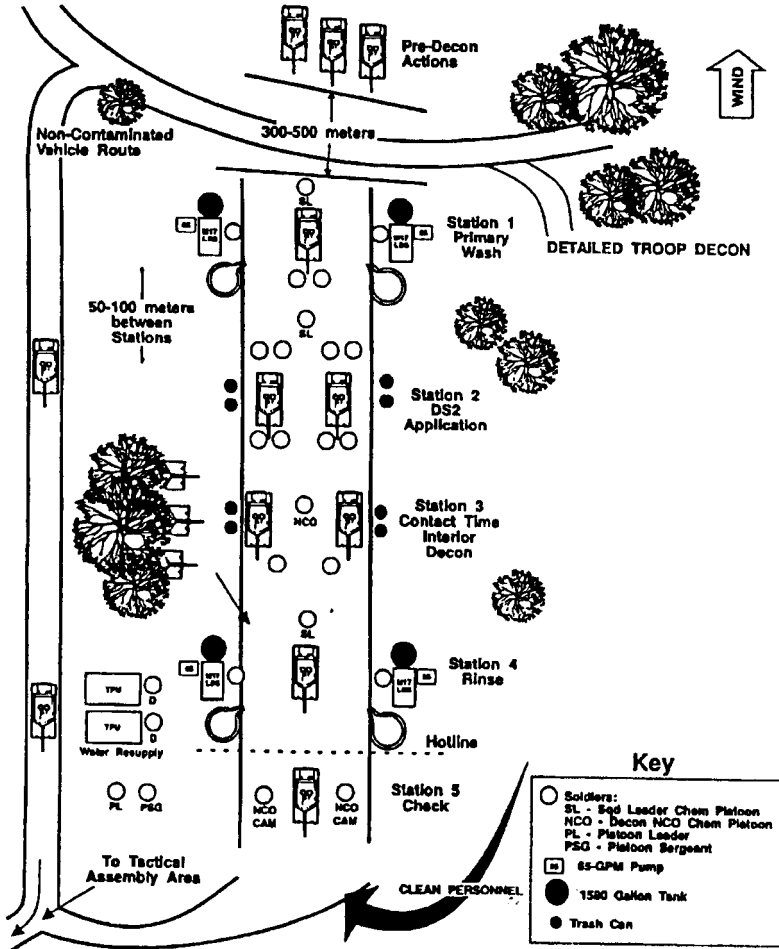


Figure 3-8. An Alternate DED layout for an M17 LDS-equipped unit.

Table 3-48. Personnel and equipment requirements for alternate M17 LDS DED setup (see figure 3-8).

	Personnel	Equipment
Station 1 Initial Wash	1 NCOIC* 4 Sprayers 4 Scrubbers	3 M17 LDS 3 1,500-Gallon Tanks 3 65-GAL Pumps 4 Long-Handled Brushes 8 TAP Aprons Liquid Detergent
Station 2 DS2 Application	1 NCOIC* 8 Appliers	14 Long-Handled Brushes 8 Mops with Extra Mop Heads 3 30-Gallon Containers 8 M13 DAPs Sufficient DS2
Station 3 Wait/Interior Decon	1 NCO* 2 Interior Decon Assistants	2 AN/VDR2 or AN/PDR27 3 TAP Aprons 6 30-Gallon Containers 10 M8 Detector paper 30 Sponges 8 M256A1 50 trash Bags 1 Clipboard w/Pen 1 Stopwatch
Station 4 Rinse	1 NCOIC* 4 Sprayers	2 M17 LDS 2 1,500-Gallon Tank 2 65-GPM Pump 4 TAP Aprons
Station 5 Check	2 NCO/CAM Operators*	2 CAMs 10 M256A1 20 M8 Detector Paper 2 AN/VDR2 or AN/PDR27 2 M8A1 Chem Alarms
C2	1 Platoon (Smoke/Decon Platoon) 1 Platoon Sergeant (Smoke/Decon Platoon)	1 HUMMWV/CUCV w/Radio 3 NBC Marking Kits
Water Resupply	2 Drivers*	2 TPUs
Total Personnel	32 (Minimum of 10 soldiers from the smoke/decon platoon)	
* These individuals should be from the decon platoon		

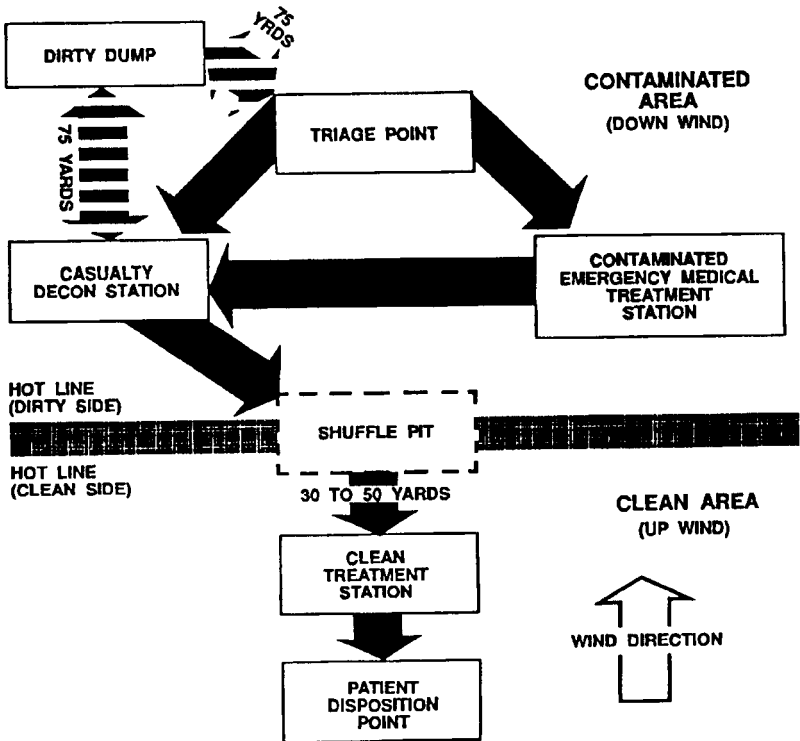


Figure 3-9. Layout for a patient decontamination station and a clean treatment area without Collective Protection Shelter (CPS).

Chemical Patient Decontamination Procedures

- Step 1. Decontaminate the patient's mask end hood.
- Step 2. Remove gross contamination from the patient's overgarment.
- Step 3. Remove patient's protective overgarment and personal effects.
- Step 4. Remove patient's battledress uniform.
- Step 5. Transfer the patient to a decon litter.
- Step 6. Decontaminate skin (M291/M258A1 kit or 0.5% chlorine solution).
- Step 7. Transfer the patient across the shuffle pit.

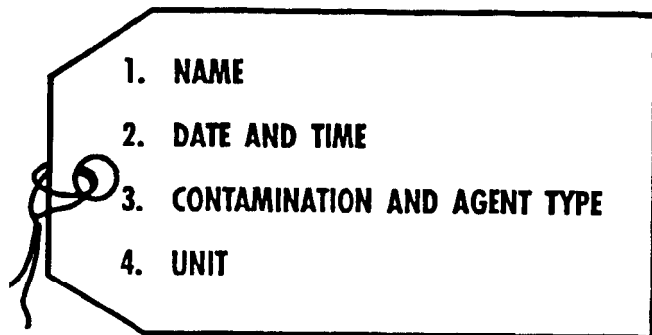


Figure 3-10. Field expedient NBC casualty tag.

Decontaminant	Chemical	Biological	Nuclear
DS2	X	X	
STB	X	X	
Mask sanitizing solution	X	X	
Soap and detergents	X	X	X

Table 3-50. Natural Decontaminants.

Decontaminant	Chemical	Biological	Nuclear
Weathering	X	X	X
Absorbents (earth, sawdust, ashes, rags)	X		
Sealants (concrete, asphalt, earth, paint)	X	X	X
Water	X	X	X
Steam	X	X	X
Fire	X	X	

Table 3-51. Average DS2 and Water Usage for Thorough Decon.

Vehicle	DS2 Req (gal)	Water Req (gal)	
		M17	M12A1
Tank	8.5	57	215
Truck	4.9	42	157
APC	3.8	31	151

Ref: Tech Report DPG/JOD-91/017 dated 26 Aug 91.

NOTE: Sump requirements calculations for the sump at each station are:

Total gallons x 0.00495 = cubic yards

Cubic yards x 1.5 = size hold to dig

Table 3-52. Nonstandard Decontaminants.

Decontaminant	Chemical	Biological	Nuclear
Oxidizing agents (potassium permanganate, potassium or sodium dichromate, nitric acid, or aqua regia)			X
Complexing (chelating) agents (citric acid, tartaric acid, sodium tartrate), kerosene, segesterene, sodium citrate, oxalic acid, sodium oxalate, or orthophosphoric acid			X
Iodine water purification tablets		X	
Disinfectant, chlorine, food service		X	
Formalin (formaldehyde)		X	
Peracetic acid (PAA)		X	
Ethylene oxide		X	
Carboxide		X	
Hyamine (benzathonium chloride)		X	
Sodium hypochlorite solution (household bleach)	X	X	
Calcium hypochlorite (HTH) (high-test bleach (HTB), or high-test hypochlorite)*	X	X	
2-Propanone (acetone)	X		
Diethyl ether	X		
Ethylene glycol	X		
Solvents (gasoline, JP4, diesel fuel, kerosene)	X		
Sodium hydroxide (caustic soda or lye)	X	X	
Sodium carbonate (washing soda, soda ash, sal soda, or laundry soda)	X		
Potassium hydroxide (caustic potash)	X	X	
Hexachloramelamine	X		
Ammonia or ammonium hydroxide (household ammonia)	X		
Perchloroethylene (tetrachloroethylene)	X		
Dichloramine-B and Dichloramine-T	X		
Acids (sulfuric acid, hydrochloric acid, acetic acid, or oxalic acid)			X
* A 5 percent solution hypochlorite solution is an effective decon solution against most chemical and biological agents. This solution can be used effectively for skin decon provided it is followed by a soap-and-water wash. Calcium hypochlorite is in the Army supply system.			

Decontamination of Specific Items

The following table lists more than two dozen specific surfaces or materials, and it explains briefly how to best decontaminate each for chemical, biological, and nuclear contamination. The best method for decon of a particular surface or material in a given situation could be any of those listed for that surface or material.

The order in which the methods are listed does not indicate preference of one over another. You should choose the best method for decon of a particular item. For a more in-depth understanding of the decon methods, refer to FM 3-5.

Table 3-53. Decontamination of Specific Items.

Surface or Material	Type of Contamination		
	Chemical	Biological	Nuclear
Asphalt: Roads (Applicable to small vital areas only)	<ul style="list-style-type: none"> • Flush with water. • Spray with slurry from PDDE. • Cover with STB; when liquid contamination is visible and personnel are nearby, use dry mix. • Weather. • Cover small areas or paths across roads with 10 cm (4 inches) of earth. 	<ul style="list-style-type: none"> • Weather. (Remain masked.) • Wet with water. (will help prevent secondary aerosols, but does not decon). • Apply 2% household bleach solution. • Spray with slurry from PDDE. • Pour, spray, or spread oil on surface (will help prevent secondary aerosol, but does not decon). 	<ul style="list-style-type: none"> • Brush or sweep. • Flush with water (this may drive some of the contamination into the surface; waste must be controlled). • Vacuum cleaning.
Roofs	Same as for asphalt roads.	<ul style="list-style-type: none"> • Same as for asphalt roads. • Apply dithionite (leave on at least 30 minutes, then flush with water.) 	Same as for asphalt roads.
Brick & Stone: Roads (Applicable to small vital areas only)	<ul style="list-style-type: none"> • Weather. • Spray with slurry from PDDE or apply with brushes and brooms. Let remain 24 hours, then flush with water. • Wash with soapy water, preferably hot. • Cover small areas or paths across roads with 10 cm (4 inches) of earth. 	Same as for asphalt roads.	<ul style="list-style-type: none"> • Same as for asphalt roads. • Abrasion (sand blasting). This provides direct and complete removal of contaminated dust; however, sand and equipment being used becomes contaminated.
Buildings	<ul style="list-style-type: none"> • Spray with slurry from PDDE or apply with brushes and brooms. Let remain 24 hours, then flush with water. • Use STB or dry mix around buildings where waste water runs. • Wash with soapy water, preferably hot. • Weather. 	<ul style="list-style-type: none"> • Same as for asphalt roads. • Apply STB slurry to vertical surfaces by manual means or PDDE. Slurry may be left on exteriors.. 	Same as for brick and stone roads.
Concrete: Roads (Applicable to small vital areas only)	<ul style="list-style-type: none"> • Spray with slurry from PDDE. • Cover with STB or dry mix. • Weather. • Cover small areas or paths across roads with 10 cm (4 inches) of earth. 	Same as for asphalt roads.	Same as for brick and stone roads.
Buildings, bunkers, gun emplacements, tank obstacles	Same as for brick and stone buildings.	Same as for brick and stone buildings.	Same as for brick and stone buildings.

continued

Table 3-53. Decontamination of Specific Items (continued).

Surface or Material	Type of Contamination		
	Chemical	Biological	Nuclear
Earth: Roads (Applicable to small vital areas only), gun emplacements, bivouac areas, path- ways, bomb craters	<ul style="list-style-type: none"> • Spray with slurry from PDDE. • Cover with STB, when liquid contamination is visible and personnel are nearby, use dry mix. • Weather. • Burn (may present downwind vapor hazard). • Cover small areas or paths across roads with 10 cm (4 inches) of earth. • Strip layer of contaminated earth to side or road. 	<ul style="list-style-type: none"> • Same as for asphalt roads • Burn. 	<ul style="list-style-type: none"> • Earthmoving (remove). Contaminated dust should be controlled. Equipment may become contaminated. Waste disposal must be considered. • Sealing (with earth). No waste disposal problem; however, equipment may become contaminated.
Fabrics: Canvas, covers, tarpaulins, tentage, mail carriers, web gear, clothing	<p>Cotton</p> <ul style="list-style-type: none"> • Immerse in boiling soapy water for 1 hr (1 lb soap to 10 gal water; stir. • Use 5% solution of sodium carbonate for G agents. • Immerse in boiling water for 1 hr. • Launder by standard methods. • Use slurry. • Weather (except for V agents). <p>Woolen (DS2 not recommended) Immerse in warm (100°F, soapy water for 1 hr or longer with light agitation; dry items slowly (fabric may shrink))</p>	<p>Cotton</p> <ul style="list-style-type: none"> • Boil in water for 15 minutes. • Autoclave for 45 minutes at 123°C (253°F). • Immerse in 2% household bleach solution for 30 minutes, rinse immediately. • Launder (destroys or inactivates all but highly resistant spores). <p>Woolen (DS2 not recommended). Launder (fabric may shrink).</p>	<p>Cotton and Woolen (DS2 not recommended for woolen).</p> <ul style="list-style-type: none"> • Brushing (removes contaminated dust, but presents dust hazard to personnel). • Laundering (most practical procedure; waste must be controlled; fabric may shrink).
Leather: Boots, gloves, and other items	<ul style="list-style-type: none"> • Scrub with hot, soapy water and rinse. • Immerse in soapy water at 120°F for 4 hrs and rinse. • Use 5% sodium carbonate solution for G agents. • Air. 	<ul style="list-style-type: none"> • Immerse in 2% household bleach solution. Rinse. • Immerse in 2% peracetic acid for 10 minutes, rinse, and air for 10 to 50 minutes. • Wipe with 2% peracetic acid, remove excess, and air 10 to 15 minutes. 	<ul style="list-style-type: none"> • Brushing • Flushing with water or soapy water.
Glass: Windows	<ul style="list-style-type: none"> • Decon kit, individual equipment. • M258A1 or M280 kit. • DS2. • Wash with hot, soapy water. • Wash with clear water or organic solvent. • Blot off surface. • Air. • Weather 	<ul style="list-style-type: none"> • M258A1 or M280 kit. • Wash with soap and water. • Wipe with disinfectant solution or 2% peracetic acid (see similar procedures below for mess gear). 	<ul style="list-style-type: none"> • M258A1 or M280 kit. • Wash with detergent. • Flush with water. • Wipe with solvents.
Lenses	<ul style="list-style-type: none"> • M258A1 or M280 kit. • Same as for windows (DS2 may damage lens coatings). • Decon kit, individual equipment. 	<ul style="list-style-type: none"> • M258A1 or M280 kit. • Wipe with soap and water. • Wipe with alcohol or household bleach. 	<ul style="list-style-type: none"> • M258A1 or M280 kit. • Brush or wipe (care must be exercised to prevent scratching of lens). • Use compressed air to blow contamination from surface.
Grass and Low Vegetation: Fields, open terrain	<ul style="list-style-type: none"> • Burn. • Spray with slurry from PDDE. • Cover with STB or dry mix. • Explode drums of STB. • Clear paths through area by use of detonating cord or other detonating devices. 	<ul style="list-style-type: none"> • Burn. • Same as for asphalt roads. 	Same as for earth.

continued

Table 3-53. Decontamination of Specific Items (continued).

Surface or Material	Type of Contamination		
	Chemical	Biological	Nuclear
Metals (unpainted): Ammunition	<ul style="list-style-type: none"> • Wipe with soapy water. • Wipe with organic solvent and dry. • Air. 	<ul style="list-style-type: none"> • Wipe with soapy water. • Wipe with 2% household bleach solution. • Air. 	<ul style="list-style-type: none"> • Brush or wipe.
Machinery	<ul style="list-style-type: none"> • Use DS2. • Same as for ammunition. 	<ul style="list-style-type: none"> • Use DS2. • Wipe with 2% peracetic acid, rinse, and air for 10 to 15 minutes. 	<ul style="list-style-type: none"> • Brush or wipe. • Wash with detergent. • Flush with water.
Meat peas and canned rations	<ul style="list-style-type: none"> • Immerse in boiling, soapy water for 30 minutes and rinse. • Immerse in boiling water for 30 minutes. • Spray with DS2. • Wash in hot, soapy water, rinse, and air. 	<ul style="list-style-type: none"> • Wash with soap and water, then immerse in disinfectant solution (disinfectant, chlorine, food service, or 1/3 canteen cup of household bleach per 10 gal water). • Boil in water 15 minutes. (Not effective on toxins and bacterial spores.) Immerse in 5% sodium carbonate (4 lb washing soda to 10 gallons water), rinse with potable water. • Immerse in household bleach solution (1/2 gal bleach to 25 gal water) for 30 minutes, then rinse and air for 10 to 15 minutes. • Immerse in HTH solution (1/2 lb to 25 gal water) 30 minutes, then rinse. • Immerse in STB solution (1 lb to 25 gal water) for 30 minutes, then rinse. • Immerse in 2% peracetic acid for 10 minutes, rinse, and air for 10 to 15 minutes. 	<ul style="list-style-type: none"> • Wash with soap and water, rinse. • Brush, wipe contamination from surfaces and containers.
Metals (painted): Vehicles, weapons, equipment	<ul style="list-style-type: none"> • DS2 (may soften paint). • Wash with hot, soapy water and rinse. • Spray with slurry from PDDE, remove from surface in 1 hour and oil surface. • Weather. • Air. • M291 kit may be used for individual weapon decon. • M280 (DKI) decon kit, individual equipment. 	<ul style="list-style-type: none"> • Wash with detergent and high-pressure water stream. • Apply detochlorite. Leave on 30 minutes, then remove by washing with a stream of water. • Steam clean, using detergent. • Use household bleach solution. • Use 2% peracetic acid. 	<ul style="list-style-type: none"> • Brush or wipe. • Wash. • Use organic solvents, caustics (not on aluminum or magnesium surfaces), complexing agents (of small value on weathered surfaces), or abrasives.
Plastics (opaque): Insulation, telephones, panel boards.	<ul style="list-style-type: none"> • DS2 (may soften or damage some plastics). • Wash with hot, soapy water and rinse. • Weather. • Air. 	<ul style="list-style-type: none"> • Same as for lenses. 	<ul style="list-style-type: none"> • Wash with detergents. • Flush with water. • Wipe or brush.
Plastics (transparent): Eyepieces, airplane canopies	<ul style="list-style-type: none"> • Wash with hot, soapy water and rinse. • Weather. • Air. • Blot off surface. 	<ul style="list-style-type: none"> • Same as for lenses. 	<ul style="list-style-type: none"> • Same as for plastics (opaque).

continued

Table 3-53. Decontamination of Specific Items (continued).

Surface or Material	Type of Contamination		
	Chemical	Biological	Nuclear
Rubber (impermeable): Aprons, suits, and other items	<ul style="list-style-type: none"> • Spray with DS2 and rinse after 30 minutes. • Immerse in hot, soapy water (just below boiling point) for 1 hour; do not agitate. Rinse with clear water and hang up to dry. • For G agents, use 10% sodium carbonate solution, rinse, and air. • Apply hot, soapy water with brushes and rinse. • Spray with slurry from PDDE. • After a few minutes, wash off with clear water. 	Same as for leather.	<ul style="list-style-type: none"> • Brushing. • Scrubbing or flushing with water or soapy water.
Rubber (natural and synthetic): Gloves, boots	<ul style="list-style-type: none"> • Spray with 10% mixture of HTH and rinse. • Immerse in slurry solution for 4 hours, rinse, and air. • Use the M291 kit in emergencies. • APL. 	Same as for leather.	Same as for impermeable rubber.
Mask facpieces and other rubber articles coming in direct contact with the skin.	<ul style="list-style-type: none"> • USE the M291 kit in emergencies. • Wash with warm, soapy water. • Use decon kit, individual equipment, M280. 	<ul style="list-style-type: none"> • Wash in warm, soapy water; rinse in clear water, and dry at room temperature • Wipe with 2% peracetic acid; wipe off excess immediately, and air 10 to 15 minutes. 	<ul style="list-style-type: none"> • Wipe or brush off. • Wipe off with water and detergent (avoid wetting mask filters).
Tires, hoses, mats, insulation.	<ul style="list-style-type: none"> • Spray with 10% mixture of HTH and rinse. • Apply slurry paste. Allow slurry to remain at least 30 minutes, then flush with clear water (may be left on tires). • Apply hot soapy water. • Air. • Weather. 	Use same methods used for chemical decon.	Same as for impermeable rubber.
Sand (Applicable to small vital areas only): Beaches, deserts.	<ul style="list-style-type: none"> • Flush with water. • Spread STB or spray slurry over surface. • Weather. • Cover paths with roofing paper. • Scrape off 5 to 10 cm (2 to 4 inches) of contaminated top layer. 	<ul style="list-style-type: none"> • Burn. • Wet with water (will help prevent secondary aerosols, but does not decon). • Apply 2% household bleach solution. • Apply slurry of 7 parts STB and 93 parts water (by weight). • Apply sodium hydroxide. 	Same as for earth.
Undergrowth and tall grass: Meadows, jungles, forests (Applicable to small vital areas only)	<ul style="list-style-type: none"> • Burn (downwind vapor hazard). • Spray slurry from PDDE. • Weather. • Explode drums of STB. • Clear paths with detonating cord, Bangalore torpedoes, or demolition snakes. 	<ul style="list-style-type: none"> • Burn. • Same as for sand. 	To extent possible, use same procedures as for earth.
Wood (unpainted): Buildings, vehicle bodies, boxes, crates, and similar items	<ul style="list-style-type: none"> • Apply slurry with PDDE, brooms, or swabs. Let slurry remain 12 to 24 hours; flush and repeat application, then flush again. • Scrub with hot, soapy water and rinse. • Weather. 	<ul style="list-style-type: none"> • Apply detrochlorite. Leave on at least 30 minutes; flush with water. • Apply STB slurry to vertical surfaces. Slurry may be left on interiors. • Weather (sun and rain eliminates most microorganisms within one day). • Burn. 	<ul style="list-style-type: none"> • Flanning. • Wash exterior with large amounts of water (some contamination may soak into surfaces).

continued

Table 3-53. Decontamination of Specific Items (continued).

Surface or Material	Type of Contamination		
	Chemical	Biological	Nuclear
Wood (painted surfaces): (DS2 may soften paint). Buildings, boxes	<ul style="list-style-type: none"> • Apply slurry with PDDE, brooms, or swabs. Let slurry remain 12 to 24 hours, then rinse off with water. • Scrub with hot water and rinse. Use DS2 and rinse. • Weather. 	Same as for wood buildings and boxes as previously indicated.	<ul style="list-style-type: none"> • Wash exterior with large amounts of water. • Wipe contamination from surface.
Water	Decon of water should only be undertaken by trained water purification personnel.	<ul style="list-style-type: none"> • Boil small amounts 15 minutes. • Chlorinate using chlorination kit. • Add iodine water purification tablets to small amounts of water. 	<ul style="list-style-type: none"> • Flocculation (requires special chemicals to remove suspended matter in water). • Ion exchange (removes radionuclides from solution).
Food: Not canned or protected by impermeable container	Food known or suspected to be contaminated with chemical agents should not be consumed until approved by veterinary personnel.	<ul style="list-style-type: none"> • Boil in water 15 minutes. Cook thoroughly. • Immerse in or spray with 2% household bleach solution. (Pack-aged food or food which is peeled or pared may be immersed or sprayed.) 	Wash or trim contamination from un-packaged food.
Food: Canned, bottled, or protected by impermeable container	See mess gear and canned rations.	See mess gear and canned rations.	See mess gear and canned rations.
Personnel	<ul style="list-style-type: none"> • Use M291 kit on exposed skin known or suspected to be contaminated; decon kit, individual equipment, M280. • Bathe with soap and water if readily available. 	<ul style="list-style-type: none"> • Bath with soap and hot water; decon kit individual equipment, M280. • Use the M291 kit. 	<ul style="list-style-type: none"> • Brush or wipe from skin and hair. • Bathe with soap and hot water.