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*FM 3-21

Headquarters
Department of the Army
Washington, DC
23 February 1978

FM 3-21

CHEMICAL ACCIDENT CONTAMINATION CONTROL

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DIAGRAMS AND PHOTOGRAPHS

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* This publication supersedes FM 3-21, 14 August 1972.

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CHEMICAL ACCIDENT CONTAMINATION CONTROL

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This publication was written by the U.S. Army Missile and Munitions Center and School. Users are encouraged to submit recommended changes and comments to improve the publication. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments can be prepared using DA Form 2028 (Recommended Changes to Publications). Forward your suggestions to:

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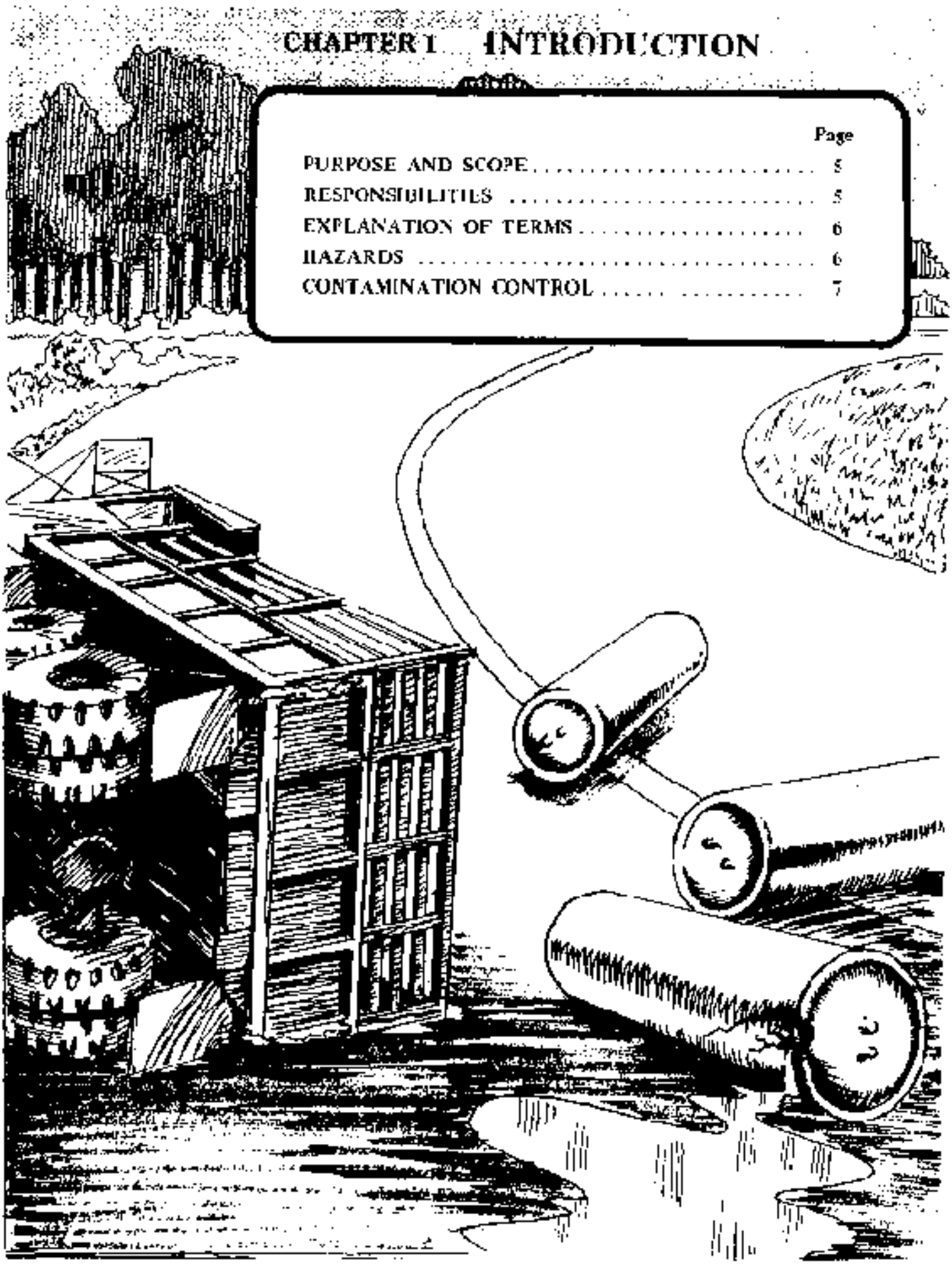
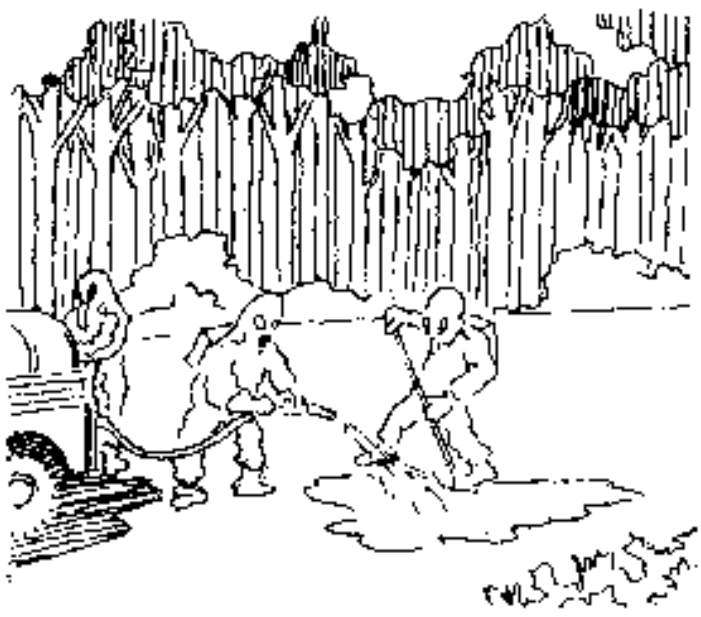
CHAPTER 1 INTRODUCTION



PURPOSE

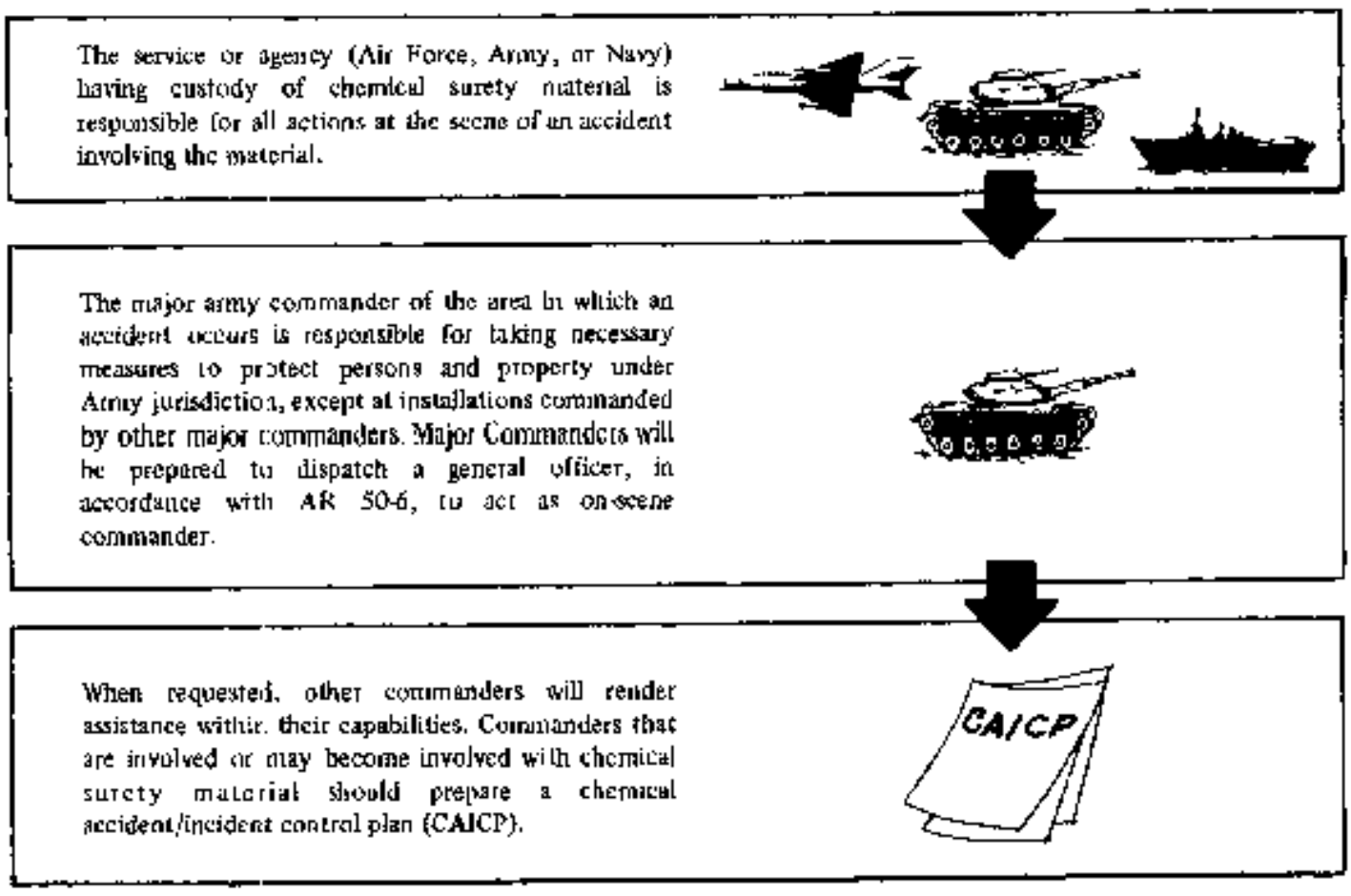
This manual provides guidance for training, equipping, and utilizing teams for contamination control during accidents/incidents involving chemical surety material. Specific guidance is provided for nuclear, biological, chemical (NBC) teams and decontamination teams, but the general principles presented apply to all special teams and personnel concerned with chemical accident/incident control (CAIC). Explosive ordnance disposal (EOD) unit operations for CAIC are specified in FM 9-15.



SCOPE

This manual covers procedures and techniques for reducing chemical hazards from accidents and incidents. It describes procedures for detecting, identifying, controlling and decontaminating chemical contamination. This manual is designed primarily for peacetime operations but is applicable in wartime operations.

RESPONSIBILITIES



The Commander, United States Army Forces Command (FORSCOM) is responsible for all Army chemical accident/incident control (CAIC) activities within CONUS except on DARCOM or TRADOC installations.

The Commander, United States Army Training and Doctrine Command (TRADOC) is responsible for CAIC on TRADOC installations.

The Commander, United States Army Materiel Development and Readiness Command (DARCOM) is responsible for CAIC on DARCOM installations and will assume complete CAIC responsibility when the effect of an accident/incident on a USADARCOM Installation in CONUS extends beyond the boundaries of that Installation.

The Commander, United States Army Training and Doctrine Command (TRADOC) will develop standardized CAIC training for technical escort personnel, EOD teams, and CAIC officers and teams, and is responsible for CAIC on TRADOC installations.

The Commander, United States Army Technical Escort Center at Aberdeen Proving Ground is responsible for providing technical escort in accordance with AR 50-6.

EXPLANATION OF TERMS

Chemical Accident -- Any situation involving chemical surety materiel which results in:

- Injury to personnel or exhibition of physiological symptoms requiring more than standard first aid procedures.
- Off-post contamination by a chemical agent.
- Property damage of $10,000 or more.
- An unintentional or uncontrolled release of a chemical agent which exceeds maximum agent concentration-time levels for exposure of unprotected personnel.
- Unusual interest by the public news media.

Chemical Incident -- Any situation that results in:

- Unintentional exposure of personnel to a chemical agent.
- Release of a chemical agent without exposure of personnel which is not reported as a minor leak or an accident.
- Property damage of at least $250, but less than $10,000.
- Actual or attempted theft or diversion of chemical surety materiel.
- Actual or attempted penetration of a chemical exclusion area.

Technical Escort -- Individuals technically qualified and properly equipped to accompany shipment of designated materiel which requires a high degree of safety and security.

HAZARDS

EXPLOSIVES

Some chemical munitions may contain explosives when shipped. In the event of an accident, these explosives constitute an additional hazard. Fires should be fought in accordance with the provisions of TM 5-315 and TM 9-1300-206.

CHEMICAL MATERIAL

Chemical material may present hazards if inhaled, ingested, absorbed, or any combination thereof. Technical escort personnel accompanying shipments should be consulted, as should the shipper, for specific hazards associated with military chemical agents. A listing of commercial publications appears at the appendix under that heading.

CONTAMINATION CONTROL

If contamination is suspected, protective masks and protective clothing will be worn when approaching the accident /incident site. The site shall be approached from upwind, avoiding visible concentrations of liquids, powders, and smoke.

When the specific chemical hazard is known, wear the recommended protective clothing, as indicated in Table 3 of this manual. When entering the contaminated area, wear the maximum protective uniform if the type of hazard is initially unknown and if identification is necessary.

The hot line (fig. 1) must be established in a clean area, upwind of, and as close as possible to, the accident site. The hot line must be outside the fragmentation radius of the munition involved. All personnel and equipment entering or leaving the accident area will be channeled through the control point on the hot line, which must be at least 50 meters downwind from the Command Post (CP).

The contamination reduction area (fig. 1) is located upwind from the hot line in a clean area. This area contains several stations and various items of equipment and supplies used to eliminate, or reduce to an acceptable level, contamination picked up by personnel. The contamination reduction area, although established on a clean site, can, and probably will, become contaminated during operations. For this reason the area should be considered contaminated and no one allowed in this portion of the contamination control station (CCS) if not wearing the proper protective clothing.

The contamination control line (fig. 1) is an arbitrary line separating the contamination reduction area from the clean area. Individuals will not step across this line into the clean area until they have been monitored and found to be free of contamination or be down to an acceptable level of contamination. The contamination control line is also a control line used to prevent personnel from entering the contamination reduction area without proper protective clothing. Foodstuff and smoking material will not be permitted in the contaminated area. Unnecessary contact with possible contamination surfaces (puddles, powder spills, and vegetation) should be avoided. Any contamination on protective clothing should be decontaminated immediately.

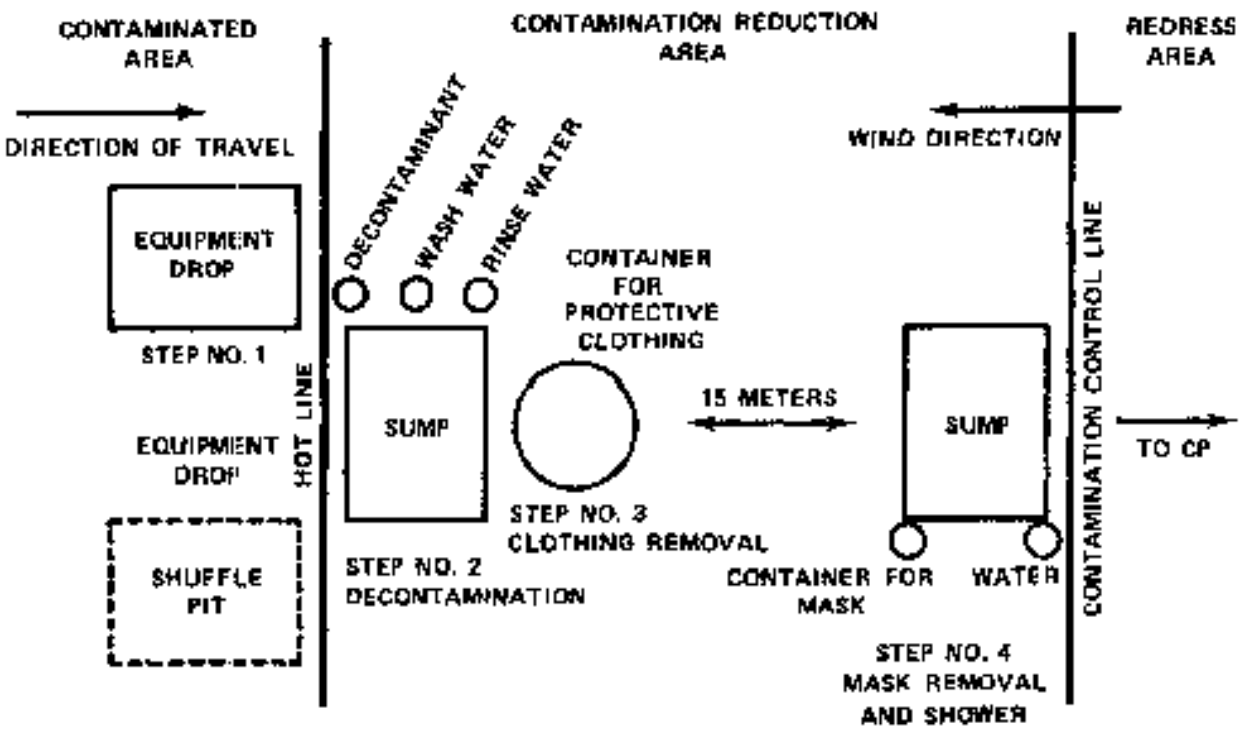


Figure 1. Emergency Personnel Decontamination Station

APPENDIX

REFERENCES

Department of the Army Publications

AR 50-6 Chemical Surety Program

AR 55-16 Movement of Cargo by Air and Surface--Including Unit and Parcel Post Shipments

AR 55-56 Transportation of Dangerous or Hazardous Chemical Materials

AR 75-14 Responsibilities for Explosive Ordnance Disposal

AR 75-15 Responsibilities and Procedures for Explosive Ordnance Disposal

AR 310-25 Dictionary of United States Army Terms

AR 310-50 Authorized Abbreviations and Brevity Codes

AR 360-5 Information, General Policies

AR 360-80 Release of Information (Joint Services)

(FOUO) AR 380-86 Classification of Chemical Warfare and Biological Research Data

AR 385-32 Protective Clothing and Equipment

AR 385-40 Accident Reporting and Records

AR 740-32 Responsibilities for Technical Escorts of Chemical, Biological, and Etiological Agents

FM 3-8 Chemical Reference Handbook

FM 3-9 Military Chemistry and Chemical Compounds

FM 3-15 Nuclear Accident Contamination Control

FM 3-20 Technical Escort Operations

FM 8-9 NATO Handbook on the Medical Aspects of NBC Defensive Operations (AMed P-6)

FM 9-15 Explosive Ordnance Disposal Unit

FM 21-11 First Aid for Soldiers

FM 21-40 Chemical, Biological, Radiological, and Nuclear Defense

FM 21-41 Soldiers Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare

FM 21-48 Chemical, Biological, and Radiological (CBR), and Nuclear Defense Training Exercises

FM 24-18 Field Radio Techniques

TB 34-9-122 Anti-Gas First Aid Equipment

TM 3-220 Chemical, Biological, and Radiological (CBR) Decontamination

TM 3-240 Field Behavior of Chemical, Biological, and Radiological Agents

TM 3-250 Storage, Shipment, Handling, and Disposal of Chemical Agents and Hazardous Chemicals

TM 3-4230-203-12 Operator's and Organizational Maintenance Manual: Decontaminating Apparatus, Power-Driven, Truck-Mounted, 400-Gallon, M9

TM 3-4230-209-12 Operator's and Organizational Maintenance

Manual: Decontaminating Apparatus, Power-Driven, Skid-Mounted, Multipurpose, Non-integral, 500-Gallon, ABC-M12A1

TM 3-6665-254-12 Operator's and Organizational Maintenance Manual: Detector Kit, Chemical Agent, ABC-M18A2

TM 3-6665-268-10 Operator's Manual: Sampling Kit, CBR Agent, M34

TM 5-315 Firefighting and Rescue Procedures in Theaters of Operations

TM 8-285 Treatment of Chemical Agent Casualties

TM 9-1300-206 Care, Handling, Preservation, and Destruction of Ammunition

TM 10-277 Protective Clothing--Chemical Operations

TM 750-5-15 Army Equipment Data Sheets: Chemical Weapons and Defense Equipment

ASubjScd 3-2 Nuclear, Biological, and Chemical (NBC) Decontamination

AsubjScd 3-54B20 MOS Technical Training and Refresher Training of Decontamination Specialist--MOS 54B20

CTA 50-900 Individual Safety and Protective Clothing and Equipment

CTA 50-901 Clothing and Equipment (Peace)

CTA 50-970 Expendable Supplies

Commercial Publications

Fire Protection Guide on Hazardous Materials, 5th Edition

National Fire Protection Association International, 60 Batterymarch St., Boston, MA 02110

Dangerous Properties of Industrial Materials, 3d Edition

Author: N. Irving Sax; Van Nostrand Reinhold Company, New York

Laboratory Waste Disposal Manual.

Manufacturing Chemists Association, 1825 Connecticut Ave., NW, Washington, DC 20009

Chemical Toxicology of Commercial Products, 3d Edition

Authors: Gleason, Gosselin, Hodge, and Smith, The Williams and Wilkins Co., Baltimore, MD

Recommended Protective Clothing

Clothing	Nerve	Blister	Agent liquid antagonist	Blood choking	Dry biological, incapacitating riot	Liquid smoke	Rocket fuel and oxidizer	Foreign chemicals (unknown)
Impregnated undergarments (drawers, shirt, socks, gloves)	(1)	X	X					X
Coveralls, TAP (Cooling suit aerogl	X	X	X					X
Coveralls, RFH (___do___)							X	
Coveralls, explosive handlers or field clothing	(2)			X	X	X	X	
Boots, TAP	X	X	X			X	X	X
Boot covers TAP [3]	X	X	X	X	X	X		X
Boots combat				X				
Hood, TAP	X	X	X	X(6)	X(6)			X
Hood, M6A2				X(6)	X	X		
Hood, RFH							X	
Protective mask, M17A1				X(6)	X(6)			
Protective mask, M9A1	X	X		X(6)	X(6)			X
Self-contained breathing apparatus	(4)					X	X	
Gloves, cotton				X	X			
Gloves, surgeons or plastic	(2)					X		
Gloves, TAP	X	X	X	X	X	X		X
Gloves, RFH, gray							X	
Gloves, RFH, red							Oxidizers	
Gloves, RFH, green							Fuels	
Apron, TAP				X(5)	X(5)	X		

[1] V-series only.
[2] U-series only.
[3] Boots, rubber, may be substituted if Boot Cover, TAP, is worn.
[4] Self-contained breathing apparatus should be used in lieu of protective masks whenever an oxygen deficient atmosphere exists or in closed areas where high agent concentrations may exist.
[5] Apron, TAP, is used as protection from liquid decontaminants.
[6] Either the M9A1 or the M17A1 mask can be worn.
TAP—Toxicological Agent Protective.
RFH—Rocket Fuel Handlers.

Table 1

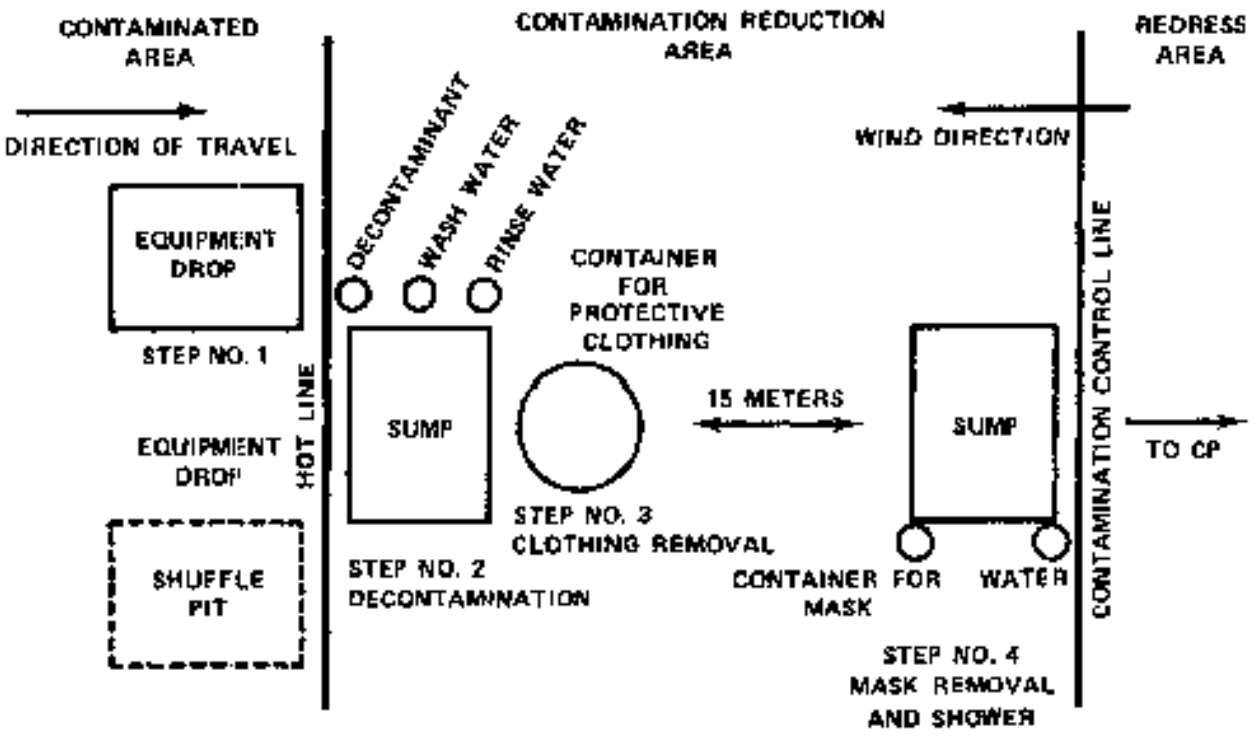
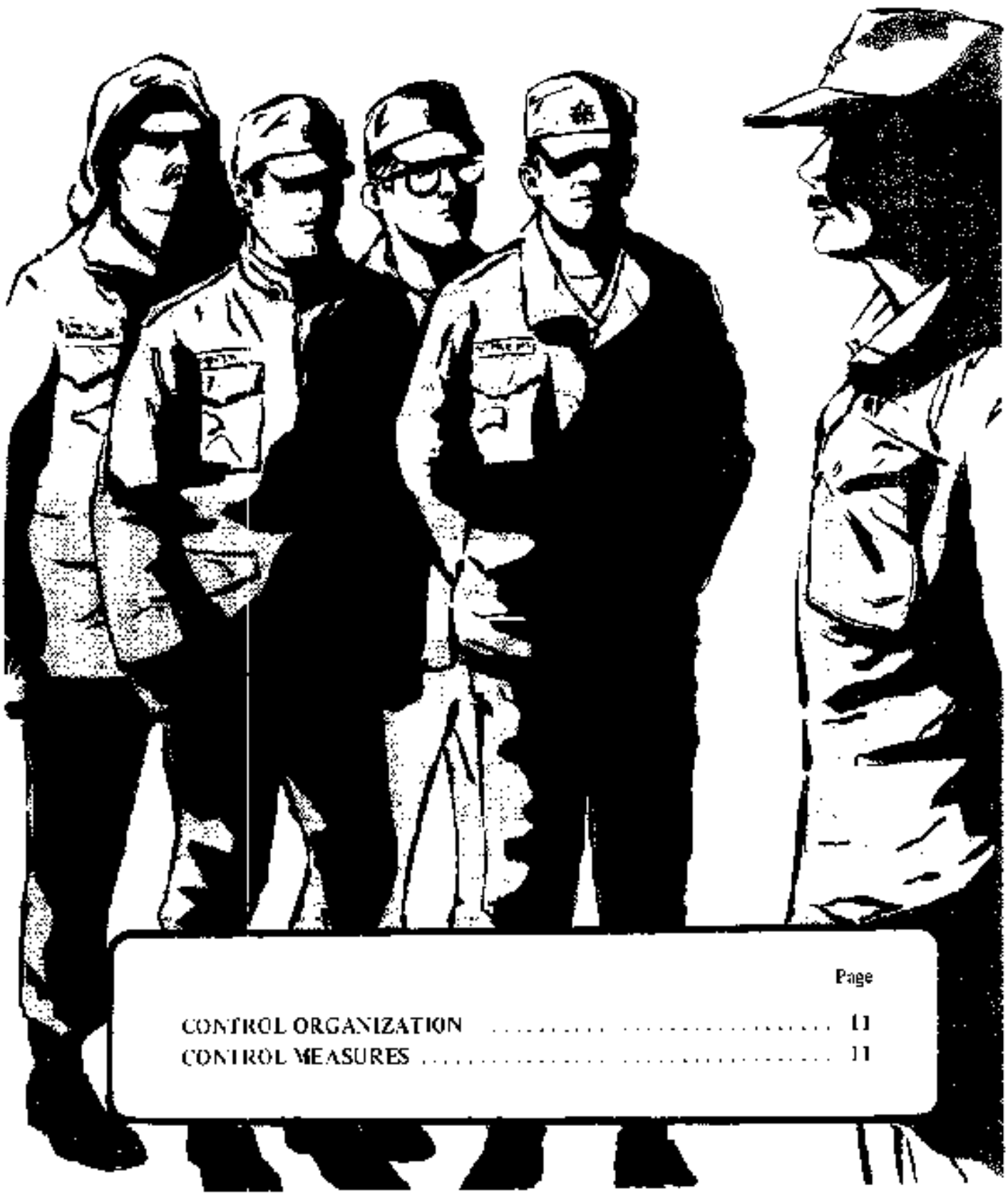


Figure 1 Emergency Personnel Decontamination Station

CHAPTER 2 CONTROL OF CHEMICAL ACCIDENT/INCIDENT SITE



Immediate control of a military chemical surety materiel accident site will be established by the nearest military commander pending arrival of the on-scene commander, the CAIC officer, or the representative of the service having possession of the material. Control requirements will vary according to the magnitude of the accident effects.

In controlling the chemical accident site, the first consideration is saving lives. Untrained military personnel or civilians may have performed some emergency actions in the contaminated area. These individuals should be detained and inspected for possible contamination and observed for effects of the material involved. Injured personnel requiring evacuation should be decontaminated as rapidly as possible and local medical authorities should be notified of the possibility of contamination.

Fires in which high explosives are involved should not be fought except to save lives or with the advice of EOD personnel (TM 5-315).

The on-scene commander (OSC) will request additional support personnel as required from the nearest military installation to augment the emergency teams and to provide security and control of the area.

CONTROL ORGANIZATION (CAIC ORGANIZATION)

A CAIC organization will be formed to control personnel, materiel, and CAIC operations at the scene of a chemical accident. Teams and equipment will be formed from local assets. Minimum composition of a CAIC organization is shown in figure 2.

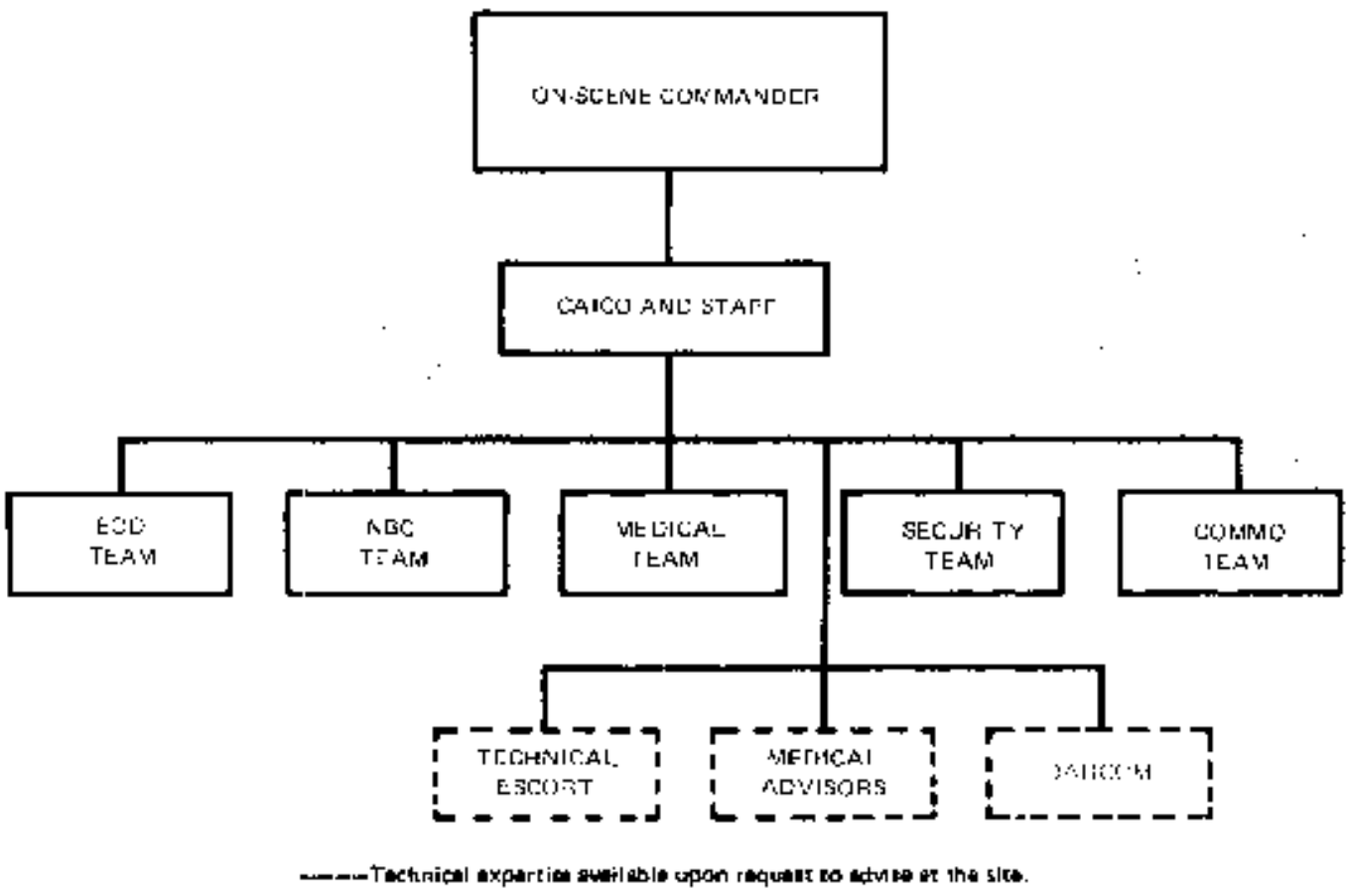


Figure 2. The CAIC Organization Augmented by Specialized Teams

On-Scene Commander (OSC). When the OSC, a general officer, arrives at the accident or incident scene, he commands all emergency forces and directs all operations at the scene, including but not limited to--

- Security, safeguarding and disposition of all classified material involved.
- Surveys to determine actual and potential hazards.
- Actions to minimize the hazardous effect of a chemical accident/incident.
- Requests for required assistance.
- Reports.
- Public information.
- Control and logistic support of observers and other authorized personnel.
- Claims.
- Requests to local intelligence units for counter-intelligence inspections and surveys.
- Relations with local civilian groups.
- Communications between the accident or incident site and higher headquarters.

Chemical Accident and Incident Control Officer (CAICO). A CAICO, normally a field grade, is designated by the commander responsible for CAIC. The CAICO acts as the designated representative of the OSC when the latter is not present at the accident site. Each CAICO will be qualified by experience or training to command and coordinate the activities associated with CAIC. The CAICO and staff will respond as soon as possible after notification of a chemical accident or incident. The CAICO will be responsible for the duties of the OSC until the arrival of the OSC.

- The CAICO'S staff consists of:
  - Assistant CAICO Operations Officer
  - Provost Marshall
  - Staff Judge Advocate
  - Public Affairs Officer
  - Communications Officer
  - Engineer Officer
  - Medical Officer
  - Safety Officer
  - Chaplain
- The supporting teams working under the direction of the CAICO consist of:

- EOD Team
- NBC Team
- Medical Team
- Physical Security Team
- Communications Team

The CAIC organization augmented by specialized teams is shown in figure 2. All members of the CAIC organization will be equipped with individual protective masks and three atropine injectors, and will wear the field uniform during operations unless other types of protective clothing are needed. Other minimum essential equipment will be designated by the CAICO.

CONTROL MEASURES

Upon arrival at the scene of the accident, the senior military representative will establish a command post to coordinate all activities. Measures must be taken to control the area for physical security, personnel, traffic, and contamination.

Area Control. The nature of the accident, meteorological conditions, and terrain conditions will determine the area control measures to be employed. The following guides should be used to establish the exclusion and downwind hazard areas.

- **Exclusion Area.** The initial exclusion area is that area inside a 450 meter radius circle around the accident site. This area (fig. 3) should be marked on an overlay and maintained on the situation map at the command post. Criteria for adjustment of the initial exclusion area is based on the explosive hazard of the munitions in question as determined by the EOD Personnel.

- **Downwind Hazard Area.** An initial downwind hazard tires should be established when the amount and or type agent are unknown. This area may be adjust after coordination with EOD, technical escort. and NBC team leaders. The initial downwind distance extends 2,000 meters downwind from the accident site. The downwind hazard area is established by extending two radial lines at an angle of 20 degrees on either side of the primary wind direction (total angle of downwind hazard area is 40 degrees). Two buffer zones, extending from the edge of the initial exclusion area, are then drawn to intersect the right and left radial lines as shown in figure 3. All unprotected personnel should be evacuated from this area. The personnel performing the evacuation operations must wear a protective mask.

- **Evacuation.** The CAICO will make a determination of the area that should be evacuated after evaluating reports from the emergency team leaders.

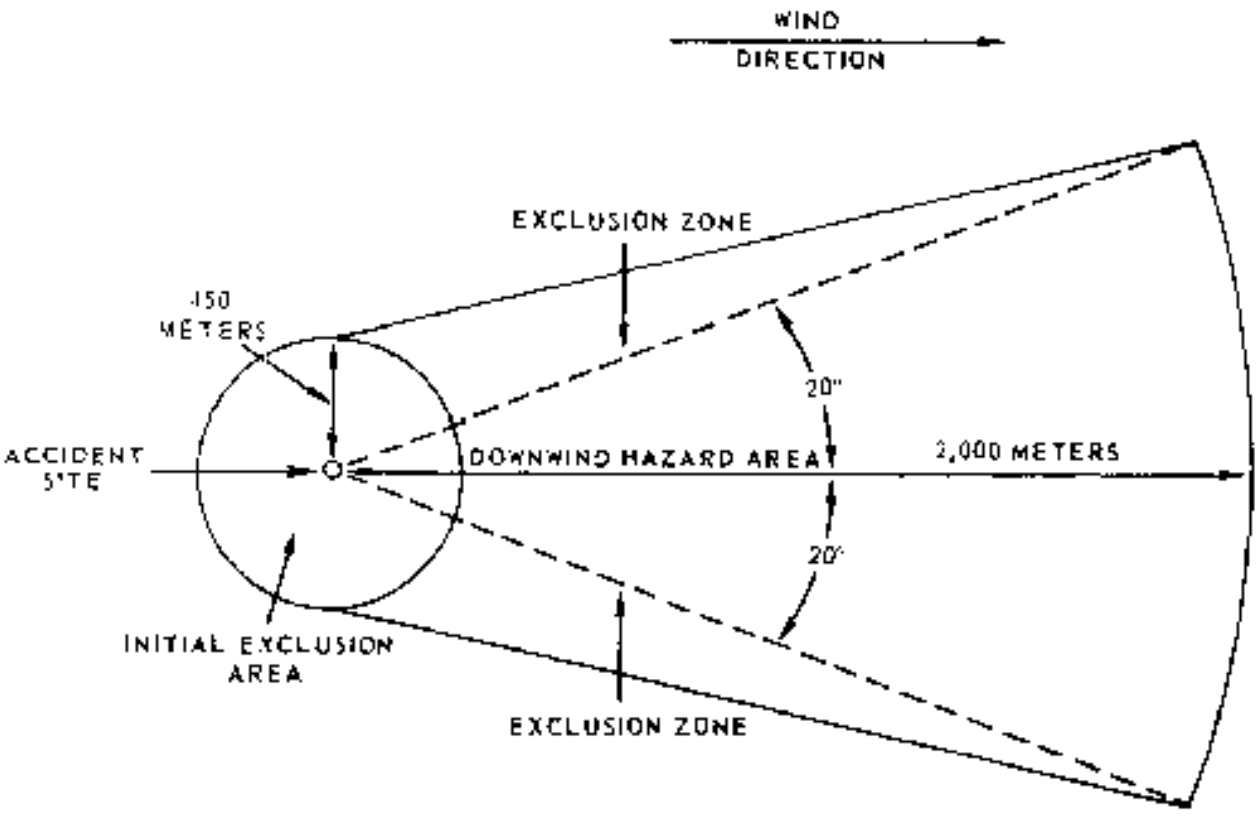


Figure 3. Initial Hazard Area

Physical Security and Personnel Control. The Provost Marshal will advise the CAICO on physical security matters and coordinate the use of military security forces with representatives of state or local governments and with other military services. Control of news media personnel will be coordinated with the information officer (AR 360-5 and AR 360-80).

- **Command Post (CP).** The command post will be established upwind from, and a minimum of 50 meters outside the exclusion area. Control of activities around the accident site will be exercised from the CP.

- **Personnel Decontamination Station (PDS).** Personnel entering and departing the exclusion area will pass through the personnel decontamination station.

Traffic Control. Upon the report of an accident/incident, a designated military police unit will dispatch traffic control elements to the accident area. These elements are under the control of the CAICO once they arrive at the area.

- Traffic Control posts will be established at:
    - Entrances to and exits from the area.
    - Assembly areas.
    - Critical points.
- Traffic patrols will cordon off the area by their patrol activity and reroute traffic.
- A military police team will erect temporary direction signs, traffic signs, and contamination markers, as appropriate.

Contamination Control. Every effort must be made to contain the contamination. Personnel and animals should be evacuated quickly to the control point on the hotline.

- Personnel and animals evacuated from the immediate accident site should be inspected for contamination and processed through the PDS as necessary. Personnel and animals evacuated from the downwind hazard area should be placed under observation. Identification of personnel and their location at the time of the accident/incident is essential to the processing of claims.
- Equipment will be decontaminated in place or in a designated area established for that purpose.
- Leaking chemical munitions or containers of hazardous material should be leak sealed, packaged, and placed in a storage area by technical escort or EOD personnel until further disposition instructions are received.

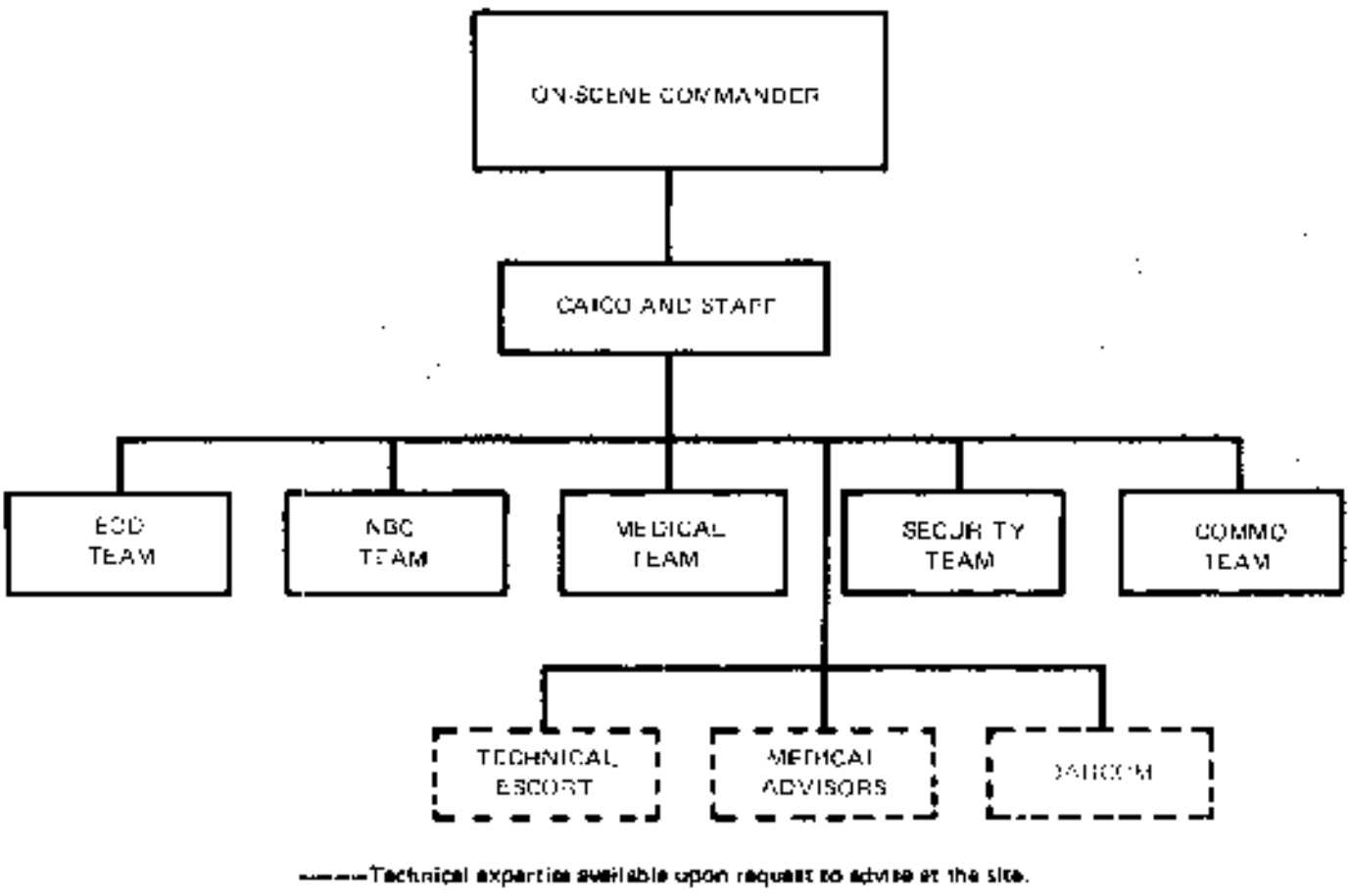


Figure 2. The CAIC Organization Augmented by Specialized Teams

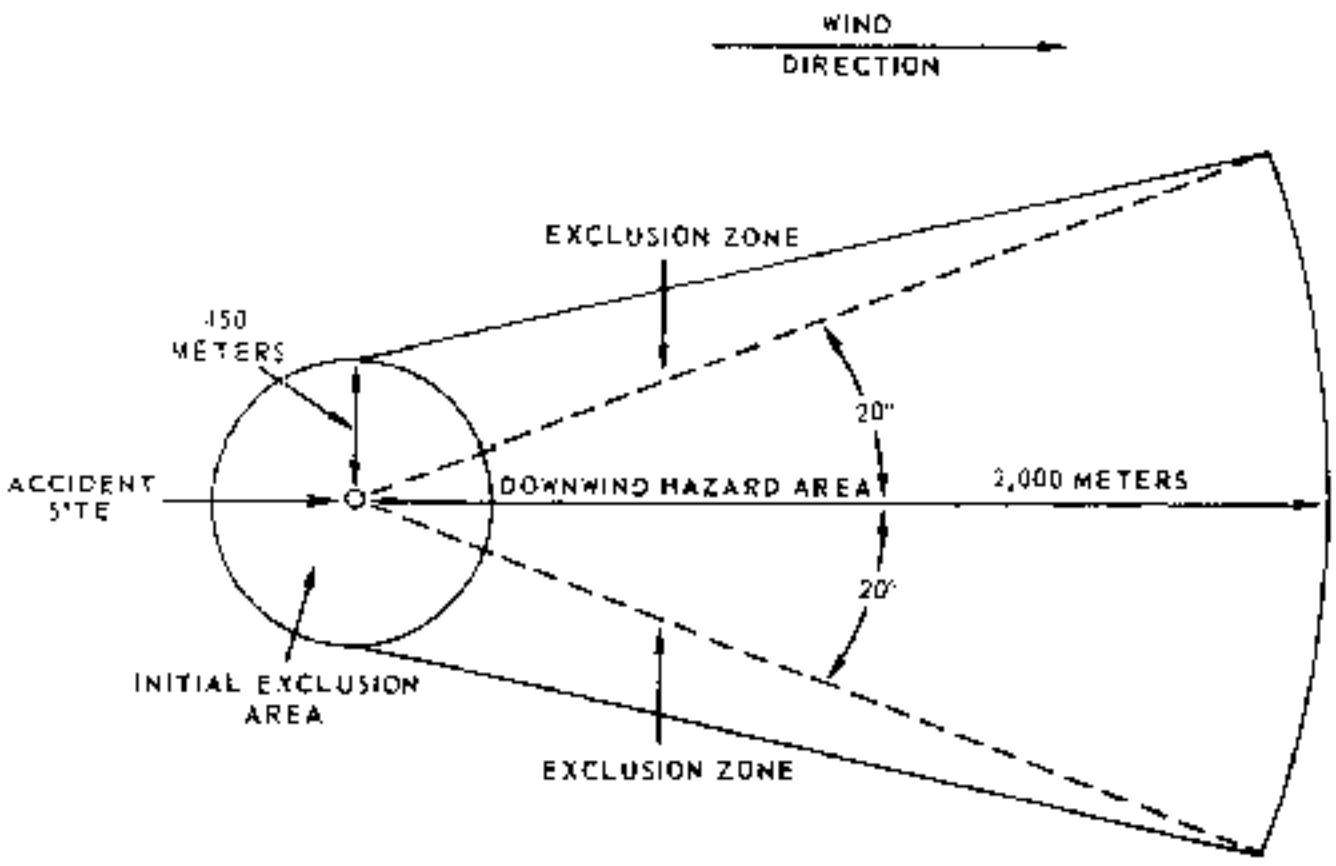
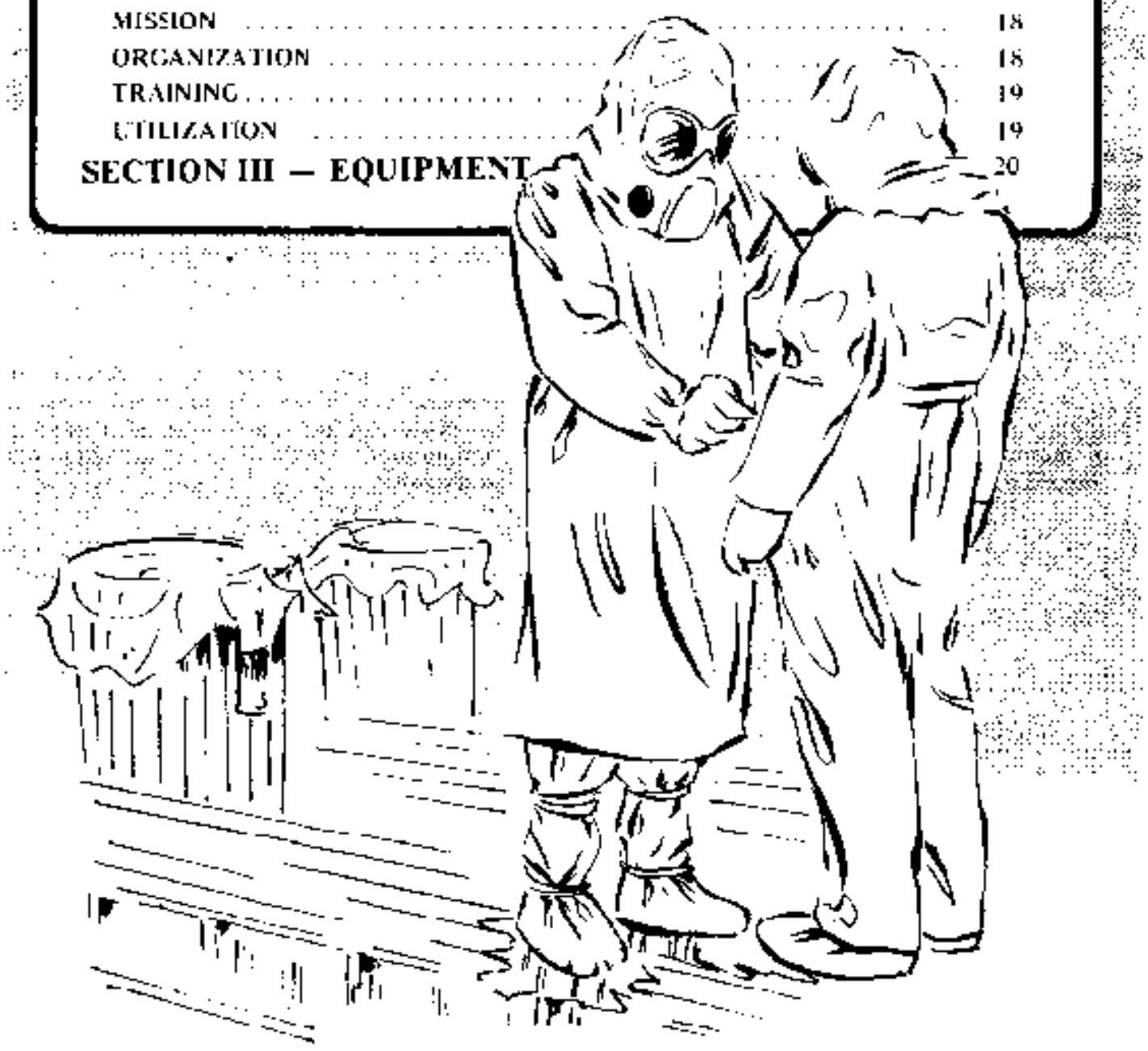


Figure 3. Initial Hazard Area

CHAPTER 3 NBC TEAMS DECONTAMINATION SECTIONS AND EQUIPMENT



Section I -- NBC TEAM

An NBC team is a specially trained and equipped unit capable of responding to any accident/incident involving agent release or exposure. This team may also be designated the NBC Alpha Team when given the additional capability and responsibility for alpha monitoring.

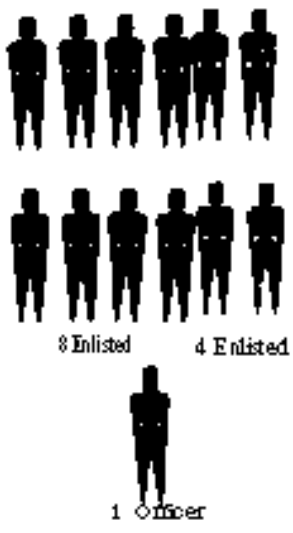
Mission

The mission of the NBC team is to--

- Assist technical escort teams.
- Determine the extent of the hazard.
- Identify the chemical agent involved.
- Direct the survey, mark and record the contaminated area, and take samples of biological material.
- Recommend procedures for controlling movement of personnel and equipment into and out of the contaminated area.
- Decontaminate personnel, equipment, structures, and land surfaces as directed.

The NBC team chief, in conjunction with technical representatives from DARCOM and other government agencies as appropriate, will advise the Chemical Accident/Incident Control Officer (CAICO) when the hazard has been sufficiently reduced to allow unprotected personnel to enter the area.

Organization



The NBC team should consist of a minimum of one officer and eight enlisted personnel when the team does not have an area decontamination responsibility. When the NBC team is assigned an area decontamination responsibility, it should be augmented with at least four additional enlisted personnel to form a decontamination section. The personnel of the NBC team should be assigned duties as follows:

- **Team Leader.** The team leader is responsible for the operation of the team and will be located in a position most advantageous for the successful completion of the team mission.

- **Assistant Team Leader.** The senior enlisted person will be assigned duties as the assistant team leader and must be capable of assuming the team leader's responsibility when necessary. In addition, the assistant team leader is responsible for operating the team command post and for supervising personnel of the decontamination station, the detection teams, and the decontamination section, as required.

- **Personnel Decontamination Station (PDS) Operators.** At least two PDS operators should be assigned to set up and maintain the personnel decontamination station. They will inspect personnel entering the exclusion area for the proper uniform. They will assist personnel to insure that proper undressing and decontaminating procedures are followed on leaving the contaminated area. PDS operators will insure that all equipment leaving the contaminated area is decontaminated prior to crossing the hot line (equipment operators can assist in the decontamination before going through the PDS themselves). The uniform for the PDS operators will be, as a minimum (since gross contamination is not anticipated), the field uniform, protective mask w/hood, and impermeable accessory items (boot covers, apron, and gloves).

- **Detection Parties.** Two detection parties with at least two people each will be assigned to perform detection, identification, and survey of the contaminated area. One detection party will be composed of the party leader or assistant party leader and one other party member. The protective clothing for the detection party members will be designated by the NBC team leader. As the minimum, each detection party will carry detection and or sampling equipment, appropriate first-aid material, marking equipment, and a means of communication. A small amount of general purpose decontaminant may be carried by the parties, or if the nature of hazardous material is known, the specific decontaminant may be selected.

When the NBC team is given an area decontamination capability and augmented with additional personnel, a decontamination section should be formed. At least four people will be assigned to perform decontamination of equipment, structures, and land surfaces under the supervision of the assistant NBC team leader. The section members will operate and maintain the decontaminating equipment on hand and perform the recheck of the contaminated area. The uniform for decontamination operations will be designated by the NBC team leader. Duties of the individual members are described later in this chapter.

All team members will be qualified in the detection and identification of chemical agents; in the sampling of biological material; and in the decontamination of personnel, equipment, and material. At least four enlisted personnel should be qualified as drivers and as radio operators. All members will be cross-trained to perform any task assigned. The team leader will coordinate the activities of the NBC team with other emergency teams at the accident site and furnish advice to personnel on chemical detection, biological sampling, survey procedures, and emergency decontamination measures.

Training

Individual team members will be trained at an NBC school conducted at installation, brigade, or higher level.

Team training will be conducted in conjunction with the training of other emergency teams. A suggested training program is summarized in Table 1. A formal training course for the CAICO, the Senior Chemical Accident/Incident Control Officer, 2E-F43 (4 days) is taught at USAMMCS, Redstone Arsenal, AL.

Suggested Training for NBC Team and Decontamination Team

ACTIVITY	REFERENCES
Orientation. Definition of terms; description of chemical accident/incident control basic plan (CAICI.	FM 3-21; CAICP of pertinent Army basic plan, AR 50-6, AR 385-40.
Chemical (Biological) Material and First Aid Procedures. Types of chemical and biological material that may be encountered; hazards and first aid for those types of material.	FM 3-8, FM 8-15, FM 21-11, FM 21-40, FM 21-41, FM 21-48, TM 3-216, TM 8-285.
Detection, Identification, and Sampling. Procedures and techniques in detection and identification of chemical material; sampling of biological material.	FM 3-9, FM 3-21, FM 8-15, TM 3-216, TM 3-220, TM 3-6665-253-12, TM 3-6665-264-12, TM 3-6665-268-10.
Protection. Protection and protective clothing required for CB hazards.	FM 3-21, FM 21-40, FM 8-15, TM 3-216, TM 10-277.
Decontamination. Procedures and techniques of decontaminating areas and equipment.	FM 3-21, TM 3-220, TM 3-250.
Operation and Maintenance of Power-Driven Decontaminating Apparatus (PDDA). The operation and organization maintenance of a PDDA.	ASubjSod 3-2; ASubjSod 3-54B20. PDDA FMs on hand.
Radio/Telephone Procedures. Military radio/telephone procedures and operation of communications equipment on hand.	FM 24-18; TMs for equipment on hand.
Practical Exercise. Practical application of all previous instructions in a simulated accident/incident. Exercise should be conducted in connection with other emergency response teams and simulations kept at a minimum.	All above

Table 1

Utilization

Major commands with area chemical/biological accident control responsibilities will organize and train NBC teams, as necessary. Commands must insure arrival of a team at the scene of a chemical accident as soon as possible after being notified.

Upon arrival at the accident site, the NBC team leader will report to the CAICO and coordinate with other emergency teams present, i.e., explosive ordnance disposal (EOD), fire, or medical. If the NBC team is the first to arrive at the site, and the technical escort leader is not present, the team leader will assume responsibility for emergency actions until properly relieved. The team leader will also insure that the command post location is checked for contamination and that the initial hazard area is established. These functions will normally be accomplished by EOD personnel.

After coordination with other emergency teams, the NBC team will:

- Assume responsibility for the operation of the Emergency PDS, if established by the EOD team. This action will be coordinated with the EOD, CP supervisor. The Emergency PDS will normally be expanded into a Personnel Decontamination Station as shown in Figure 6.
- Move into the area to identify the hazard and locate areas of contamination.
- Mark all areas of contamination conspicuously.
- Assist in the decontamination of personnel and equipment found in the contaminated area.
- Within its capability, decontaminate the area or advise and assist as directed by the CAICO.

When dealing with civilian personnel, team members should not alarm or frighten them unnecessarily. Assistance of the civil authorities should be used, especially for controlling civilian personnel in the area.

Relationship with news media personnel is prescribed in AR 360-5. No news releases will be made except through CAICO.

Section II -- DECONTAMINATION TEAM

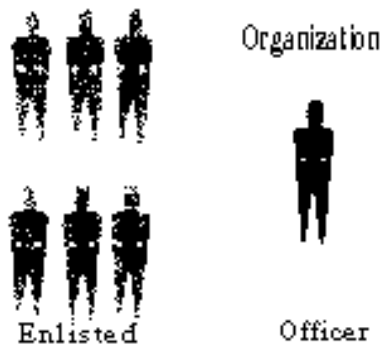
Major commanders with area chemical accident/incident control responsibilities may desire to organize and train decontamination teams in lieu of assigning the NBC teams an area decontamination responsibility.

Mission

The mission of the decontamination team is to:

- Decontaminate personnel, equipment, structures, and land surfaces.
- Recheck areas for completeness of decontamination. The assistance of a technical advisor from the Chemical Systems Laboratory at Aberdeen P. G., MD, may be required.
- Perform other duties as assigned by the CAICO.

Organization



The decontamination team should consist of a minimum of one officer and six enlisted personnel. Personnel should have the same qualifications as those of the NBC team. At least two of the enlisted personnel should be qualified drivers and decontamination equipment operators. All personnel should be cross-trained to perform any task assigned in the team. The decontamination team leader will coordinate the actions of the team with other emergency teams at the accident site and furnish advice on decontamination procedures and additional support requirements. The NBC team leader will assume this function when the team has the area decontamination responsibility.

The personnel of the decontamination team are assigned duties as follows:

- **Team Leader.** The Team Leader (TL) is responsible for accomplishing the decontamination mission and will be located in a position most advantageous for controlling the team. The TL will also designate the protective clothing to be worn by each team member.

- **Assistant Team Leader.** The senior enlisted person is assigned duties as the Assistant Team Leader (ATL) and must be capable of assuming the responsibilities of the team leader. The ATL should be able to make a reconnaissance of the contaminated area to evaluate the situation; devise a plan for the decontamination of personnel, equipment, structures, and land surfaces; supervise the operation and maintenance of decontaminating equipment; and assist in the recheck of the area. The ATL will also be able to assume the duties of the drivers and equipment operators, and be able to operate the sprayers.

- **Personnel Decontamination Station Operators.** Duties of the PDS operators are as cited under Section I -- NBC Teams.

- **Driver/Equipment Operator.** At least two people will be assigned as the decontaminating equipment operator and vehicle driver. They will operate decontaminating equipment and insure that the proper mixing procedures are followed.

- **Sprayers.** At least two people will be assigned as sprayers when a power-driven decontaminating apparatus is used. In addition, they will assist in the recheck of the area and be used in other capacities as directed.

Training

The individual members of the decontamination team will be trained the same as are those of the NBC team. Team training will also follow that of the NBC team and the suggested training program (Table 1) is applicable.

Utilization

Response times for the decontamination teams are designated by the commander having area CAIC responsibility.

Upon arrival at the accident site, the team leader will report to the CAICO. Coordination should then be made with other emergency teams.

After coordination with other emergency teams, the decontamination team will:

- Assume control of the PDS.
- With the NBC team leader, make a reconnaissance of the contaminated area and devise a plan for decontamination.
- Advise the CAICO of procedures recommended and additional support requirements.
- Conduct decontamination operations as necessary to eliminate hazards.
- After decontamination, conduct a recheck of formerly contaminated equipment and surfaces and decontaminate as required.

Release of information is prescribed in AR 360-5. No news releases will be made except through the CAICO.

Section III -- EQUIPMENT

The equipment listed in Table 2 represents essential items for the accomplishment of the assigned missions of the NBC team and the decontamination team. For extended or massive operations, both teams will require additional support which will be requested from the nearest military installation by the CAICO. The equipment list should be kept as small as possible, consistent with accomplishment of team missions.

Suggested Equipment for NBC Team and Decontamination Team

	ITEM		QUANTITY	
			NBC TEAM	DECON TEAM
A. Detection and Identification Equipment	1.	Kit, chemical agent detector, ABC-M18A2	2	1/team
	2.	Kit, sampling, CBR agent, M34	2	1/team
	3.	Paper, detector, ABC-M8	4	2/team
B. Communications Equipment	4.	Radio/transmitter, AN/PRC 77	3	2/team
	6.	M8 chemical agent automatic alarm w/M229 refill kit	2	0/team
C. Decontaminating Equipment	6.	Power-driven decontaminating apparatus		1/team
	7.	Personnel decontamination station	1	1/team
	8.	Decontaminating apparatus, portable, ABC-M11	4	4/team
D. Protective Equipment	9.	Clothing, outfit, cml, protective liner (line 40710)	1/mbr	1/mbr
	10.	Ensemble, toxicological agents protective (TAP)	1/mbr	1/mbr
	11.	Apron, TAP (line A37412)	1/mbr	1/mbr
	12.	Coveralls, cloth, pr explosive handlers or field clothing	2/mbr	2/mbr
	13.	Gloves; autopsy, pr	2/mbr	2/mbr
	14.	Canvas/leather gloves	2/mbr	2/mbr
	15.	Mask, protective, field, ABC-M17 series (or equivalent)	1/mbr	1/mbr
	16.	Mask, protective, special purpose, M9A1	1/TAP Outfit	1/TAP Outfit
	17.	Hood, field protective mask, M9A2	1/mbr	1/mbr
	18.	Hood TAP or M3	1/TAP Outfit	1/TAP Outfit
E. Individual Equipment	19.	Atropine automatic injector or nerve agent antidote	3/mbr	3/mbr
	20.	Individual decontaminating and repackaging kit M13	1/mbr	1/mbr
	21.	First aid packet, individual	1/mbr	1/mbr
	22.	Lensatic compass	2/team	1/team
	23.	Canteen w/cup	1/mbr	1/mbr
	24.	Pistol belt	1/mbr	1/mbr
	25.	Poncho	1/mbr	1/mbr
	26.	Flashlight w/batteries	1/mbr	1/mbr
	27.	Entrenching tool	1/team	1/team
	28.	Individual skin decontamination kit, M258	1/mbr	1/mbr
F. Marking Equipment	29.	Tape, textile, white, herringbone weave (engineer), 3/4-inch wide, ft	6,000	
	30.	Chemical and biological hazard marking signs w/stakes	As rqr	
G. Decontaminants	31.	Supertropical bleach	50 lb	As rqr for PDDA on hand
	32.	Antiset		As rqr for PDDA on hand
	33.	DS2	5 gal	20 gal
	34.	Sodium Carborate	50 lb	As rqr for PDDA on hand
	35.	Calcium Hypochlorite (HTH)	50 lb	As rqr for PDDA on hand
H. Administrative and Maintenance Equipment and Supplies	36.	Notebook; road maps of area of responsibility	As rqr	As rqr
	37.	Paper, pencils, eraser, grease pencils, tape, marking, 1-2-3 in. rolls; plastic bags, large, medium, small; foot lockers; spare batteries for radios and flashlights; rakes; shovels; brooms	As rqr	As rqr

Table 2

Both the NBC team and the decontamination team should be provided transportation to maintain a high degree of mobility. The most expeditious mode of transportation will be used to move the teams to the accident site.

Based on team strengths cited in this manual:

- NBC teams with alpha monitoring responsibility may have items of equipment listed in FM 3-15. Only those items not duplicated should be procured.
- The AN/PRC-77 radio/transmitter set is safe to use in the vicinity of explosives. Commercial hand held radios may also be used.
- The M12A1 decontaminating apparatus requires vehicular support for mobile operations.
- TAP outfit as listed in TM 10-277. Individual and unit clothing and equipment cited are for technical mission use.
- Standard A, AMCTC item No. 8097.
- Personal clothing and sundry requirements should support team members for 72 hours.
- Toll tickets and Bell system and POL credit cards are recommended where feasible.
- Do not store or use DS2 with either STB or HTH as a spontaneous fire could result.

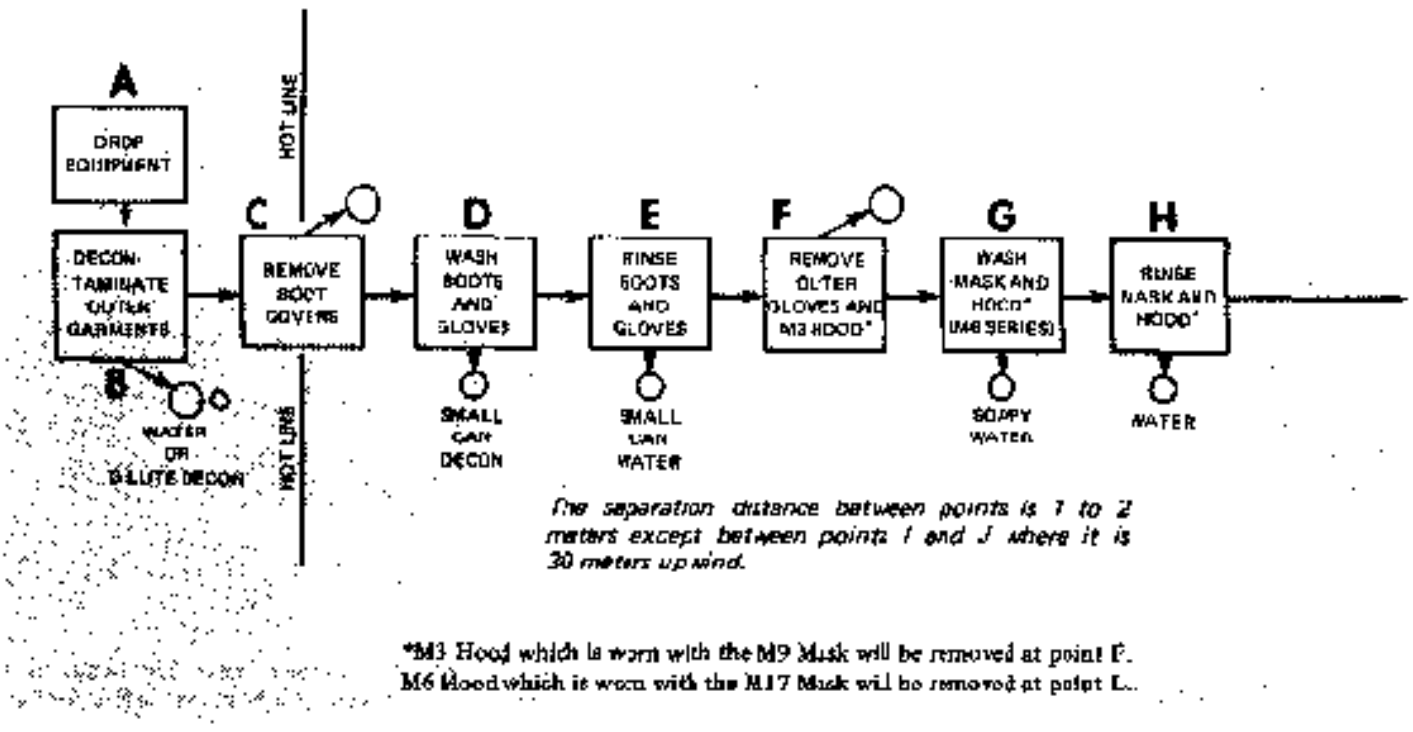
Suggested Training for NBC Team and Decontamination Team

ACTIVITY	REFERENCES
Orientation. Definition of terms; description of chemical accident/incident control basic plan (CAICI.	FM 3-21; CAICP of pertinent Army basic plan, AR 50-6, AR 385-40.
Chemical (Biological) Material and First Aid Procedures. Types of chemical and biological material that may be encountered; hazards and first aid for those types of material.	FM 3-8, FM 8-15, FM 21-11, FM 21-40, FM 21-41, FM 21-48, TM 3-216, TM 8-285.
Detection, Identification, and Sampling. Procedures and techniques in detection and identification of chemical material; sampling of biological material.	FM 3-9, FM 3-21, FM 8-15, TM 3-216, TM 3-220, TM 3-6665-253-12, TM 3-6665-264-12, TM 3-6665-268-10.
Protection. Protection and protective clothing required for CB hazards.	FM 3-21, FM 21-40, FM 8-15, TM 3-216, TM 10-277.
Decontamination. Procedures and techniques of decontaminating areas and equipment.	FM 3-21, TM 3-220, TM 3-250.
Operation and Maintenance of Power-Driven Decontaminating Apparatus (PDDA). The operation and organization maintenance of a PDDA.	ASubjScd 3-2; ASubjScd 3-54820. PDDA FMs on hand.
Radio/Telephone Procedures. Military radio/telephone procedures and operation of communications equipment on hand.	FM 24-18; TMs for equipment on hand.
Practical Exercise. Practical application of all previous instructions in a simulated accident/incident. Exercise should be conducted in connection with other emergency response teams and simulations kept at a minimum.	All above

Table 1

Figure 6. Typical Arrangement of PDS at a CB Accident Site

Figure 6. Typical Arrangement of PDS at a CB Accident Site (Continued)



*M3 Hood which is worn with the M9 Mask will be removed at point F. M6 Hood which is worn with the M17 Mask will be removed at point L.

Figure 6. Typical Arrangement of PDS at a CR Accident Site

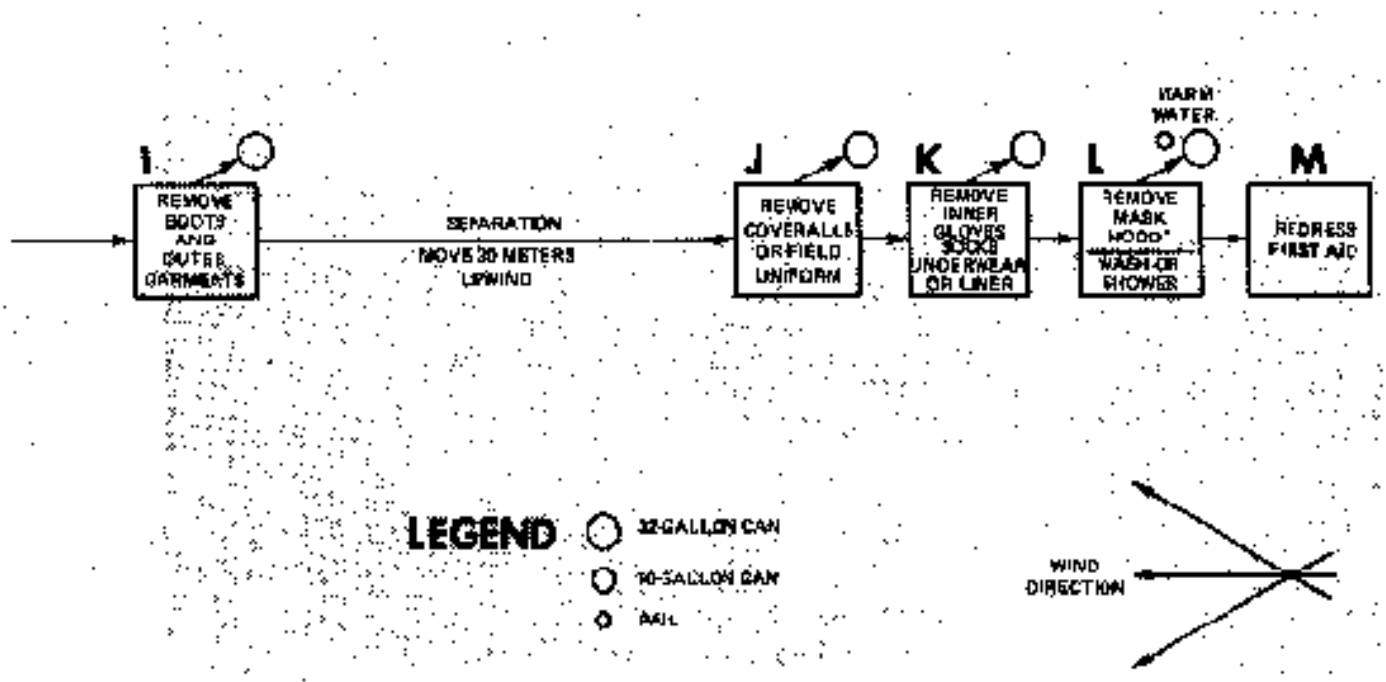
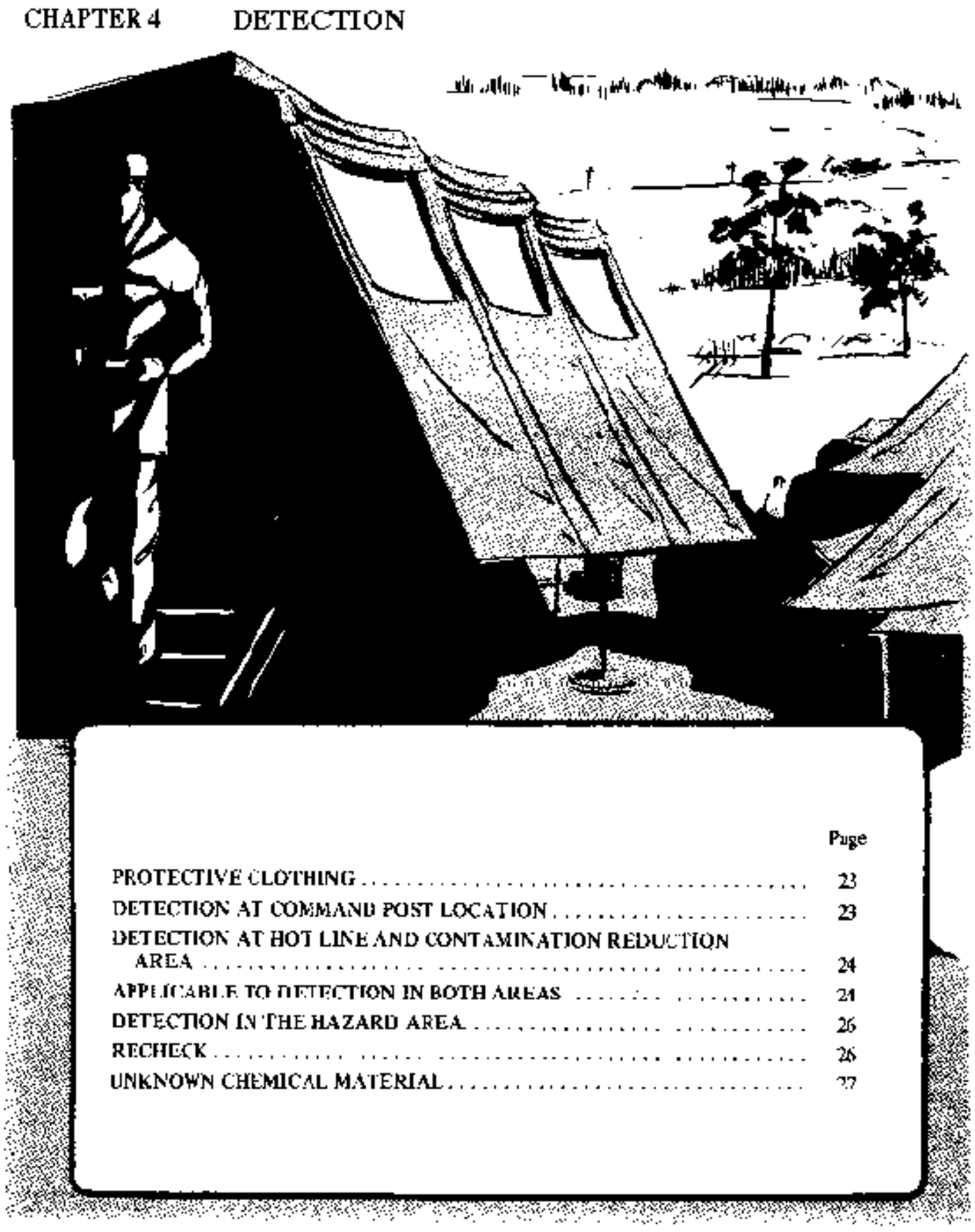


Figure 6. Continued

Suggested Equipment for NBC Team and Decontamination Team

	ITEM		QUANTITY	
			NBC TEAM	DECON TEAM
A. Detection and Identification Equipment	1.	Kit, chemical agent detector, ABC-M18A2	2	1/team
	2.	Kit, sampling, CBR agent, M34	2	1/team
	3.	Paper, detector, ABC-M8	4	2/team
B. Communications Equipment	4.	Radio/transmitter, AN/PRC 77	3	2/team
	6.	M8 chemical agent automatic alarm w/M229 refill kit	2	0/team
C. Decontaminating Equipment	6.	Power-driven decontaminating apparatus		1/team
	7.	Personnel decontamination station	1	1/team
	8.	Decontaminating apparatus, portable, ABC-M11	4	4/team
D. Protective Equipment	9.	Clothing, outfit, cml, protective liner (line 40710)	1/mbr	1/mbr
	10.	Ensemble, toxicological agents protective (TAP)	1/mbr	1/mbr
	11.	Apron, TAP (line A37412)	1/mbr	1/mbr
	12.	Coveralls, cloth, pr explosive handlers or field clothing	2/mbr	2/mbr
	13.	Gloves; autopsy, pr	2/mbr	2/mbr
	14.	Canvas/leather gloves	2/mbr	2/mbr
	15.	Mask, protective, field, ABC-M17 series (or equivalent)	1/mbr	1/mbr
	16.	Mask, protective, special purpose, M9A1	1/TAP Outfit	1/TAP Outfit
	17.	Hood, field protective mask, M9A2	1/mbr	1/mbr
	18.	Hood TAP or M9	1/TAP Outfit	1/TAP Outfit
E. Individual Equipment	19.	Atropine automatic injector or nerve agent antidote	3/mbr	3/mbr
	20.	Individual decontaminating and repackaging kit M13	1/mbr	1/mbr
	21.	First aid packet, individual	1/mbr	1/mbr
	22.	Lensatic compass	2/team	1/team
	23.	Canteen w/cup	1/mbr	1/mbr
	24.	Pistol belt	1/mbr	1/mbr
	25.	Poncho	1/mbr	1/mbr
	26.	Flashlight w/batteries	1/mbr	1/mbr
	27.	Entrenching tool	1/team	1/team
	28.	Individual skin decontamination kit, M258	1/mbr	1/mbr
F. Marking Equipment	29.	Tape, textile, white, herringbone weave (engineer), 3/4-inch wide, ft	6,000	
	30.	Chemical and biological hazard marking signs w/stakes	As rqr	
G. Decontaminants	31.	Supertropical bleach	50 lb	As rqr for PDDA on hand
	32.	Antiset		As rqr for PDDA on hand
	33.	DS2	5 gal	20 gal
	34.	Sodium Carborate	50 lb	As rqr for PDDA on hand
	35.	Calcium Hypochlorite (HTH)	50 lb	As rqr for PDDA on hand
H. Administrative and Maintenance Equipment and Supplies	36.	Notebook; road maps of area of responsibility	As rqr	As rqr
	37.	Paper, pencils, eraser, grease pencils, tape, marking, 1-2-3 in. rolls; plastic bags, large, medium, small; foot lockers; spare batteries for radios and flashlights; rakes; shovels; brooms	As rqr	As rqr

Table 2



CHAPTER 4 DETECTION

CHEMICAL

Normally, the NBC team can expect to be briefed at the assembly area by the CAICO and at the site by technical escort personnel or the EOD team commander as to the type of agent involved. However, there may be an accident/incident where these teams are not present, and the NBC team leader must determine the type of agent involved. In any event, it is the function of the NBC team to determine the extent of contamination and confirm the type of chemical material involved.

PROTECTIVE CLOTHING

The items of protective clothing recommended for protection against chemical hazards are summarized in Table 3. The team leader can readily select the items required for protection against the hazard present.

- **Known Hazard.** If the type of agent is known, the NBC team may dress in the protective clothing most suitable for protection against that hazard (Table 3).

- **Unknown Hazard.** If the team must react quickly and if the type of agent is unknown, the team leader may choose to send a detection team (at least two people), dressed in protective clothing (Table 3), into the contaminated area to make a quick identification. Once the chemical is identified, the remainder of the team must dress in the most suitable protective clothing. If the chemical cannot be identified, it will be assumed to be the most hazardous, and the butyl rubber suit with liner should be worn.

Recommended Protective Clothing

Clothing	Nerve	Blister	Agent liquid-vapor	Blood poisoning	Dry biological incapacitating riot	Liquid smoke	Rocket fuel and oxidizers	Foreign chemicals (unknown)
Impregnated undergarments (drawers, shirt, socks, gloves)	(1)	X	X					X
Coveralls, TAP (Cooling suit armor)	X	X	X				X	X
Coveralls, RFH; do	(2)			X	X	X	X	
Coveralls, explosive handlers or field clothing	X	X	X	X	X	X	X	X
Boots, TAP	X	X	X	X	X	X	X	X
Boot covers TAP [3]				X				
Boots combat				X(6)	X(6)			X
Hood, TAP	X	X	X	X(6)	X(6)	X		
Hood, M6A2				X(6)	X(6)		X	
Hood, RFH				X(6)	X(6)			
Protective mask, M17A1	X	X				X	X	X
Protective mask, M9A1	(4)			X	X			
Self-contained breathing apparatus								
Gloves, cotton	(2)							
Gloves, surgeons or plastic	X	X	X	X	X	X	X	X
Gloves, TAP								
Gloves, RFH, gray								
Gloves, RFH, red							X	
Gloves, RFH, green							Oxidizers	
Apron, TAP				X(5)	X(5)	X	Fuels	

1 y-series only.
2 o-series only.
3 Boots, rubber, may be substituted if Boot Cover, TAP, is worn.
4 Self-contained breathing apparatus should be used in lieu of protective masks whenever an oxygen deficient atmosphere exists or in closed
5 Use where high agent concentrations may exist.
6 Effective as protection from liquid de
TAP Toxicological Agent Protective.
RFH—Rocket Fuel Handlers

Table 2

DETECTION AT COMMAND POST LOCATION

When it is initially unknown as to whether explosives are involved in an accident, or the quantity of explosives involved is not known, the command post complex will be located approximately 500 meters upwind of the site to insure that it is out of the fragmentation range and free of contamination. However, the NBC team may be required to perform this function. If the command post and initial hazard area have not been designated by another commander, the first team leader/commander (EOD, NBC, or DECON) that arrives at the incident is required to designate a tentative CP and establish an initial hazard area (downwind vapor and fragmentation). The procedures outlined below should be followed:

- Approach the site from upwind. Protective masks will be worn when within approximately one mile of the accident/incident site. Periodic sampling for chemical agents will be conducted during the approach to determine when contamination is encountered, its identity, and an opportunity to reassess the team's level of protection.

- There is no fixed location or size for the actual CP area; however, certain rules must be observed.

  Mandatory

  - The CP area must be upwind of the incident.

  - The downwind edge will be at least 500 meters from the incident as indicated by figure 4.

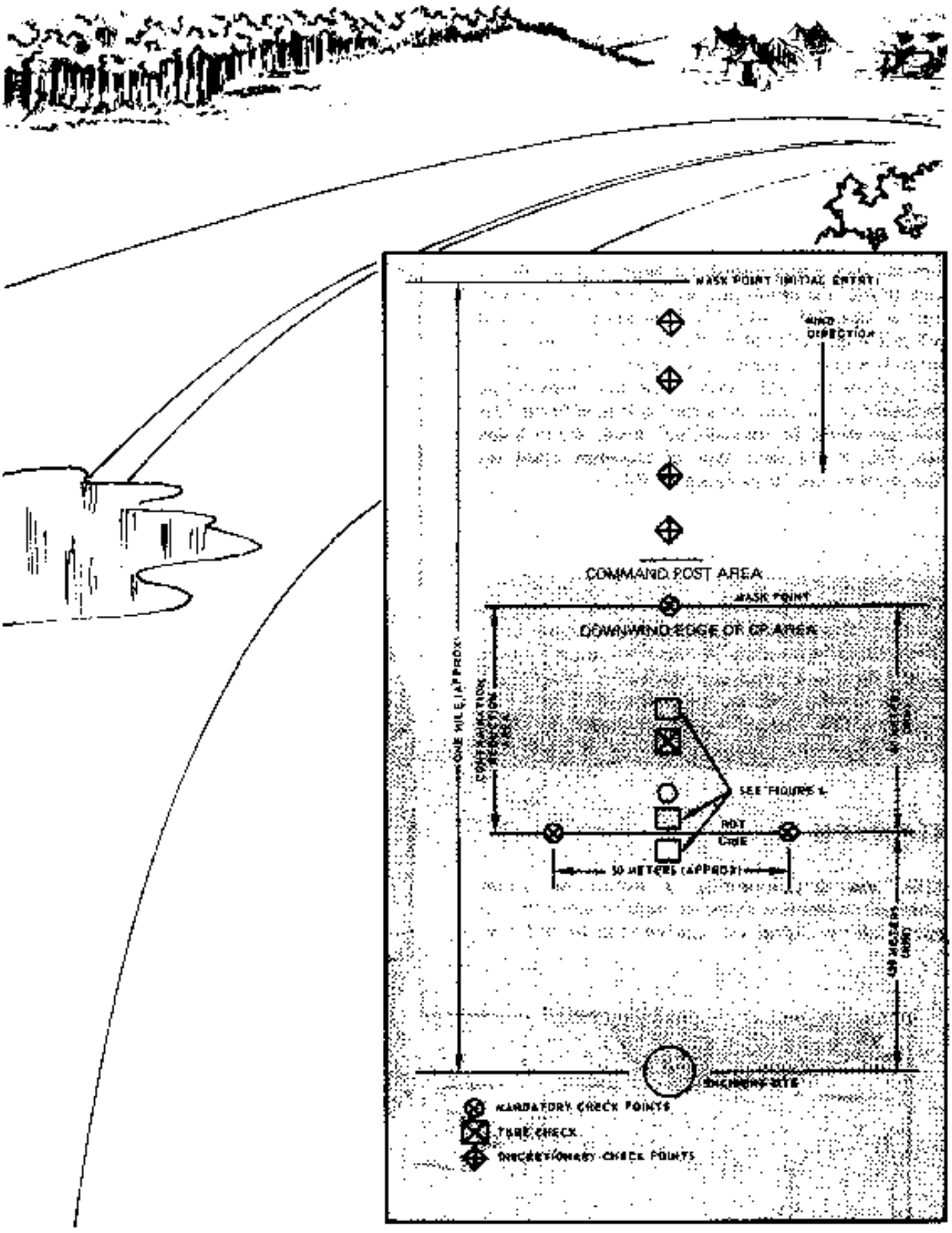


Figure 4. Organization for a Typical Chemical Incident

Other Considerations. The following should be considered when selecting the CP area:

- **Elevation.** Keep CP at a higher elevation than the accident site with at least one point in the CP area within sight of the accident site.

- **Access.** Area must be readily accessible to vehicles and equipment needed to perform the mission.

- **Natural Protection.** If possible, pick an area where at least a portion of the CP can be shielded from the explosive hazards presented by the incident.

- **Shielding.** Being shielded from public view is desirable, but it is particularly important where a personnel decontamination station is being operated.

- After a favorable area for the CP has been selected, additional checks for agent contamination must be made.

DETECTION AT HOT LINE AND CONTAMINATION REDUCTION AREA

Additional checks must be made to insure that the hot line and contamination reduction area are located in a contamination free area. A minimum of three aerosol/vapor tests using the enzyme ticket and one test using the color banded tubes (mandatory checks in figure 4) should be made. These tests should be performed approximately 50 meters apart on the hot line to insure complete coverage of the contamination reduction area. The surface of the ground should be visually checked for obvious liquid agent contamination and should be sampled with the ABC M8 Detector Paper. The vapor tests (blue, yellow, green, and red band tube tests) need only be accomplished once, in the center of this area (see TM 3-6665-254-12 for use of the ABC M18A2 Detector Kit). If all tests are negative the team leader can have the team unmask in accordance with instructions contained in FM 21-40. If the contaminant is known, tests need be made only for that material. Periodic checks of the wind direction will be made at approximately 30-minute intervals to insure that the CP remains upwind of the site as long as a downwind hazard exists.

APPLICABLE TO DETECTION IN BOTH AREAS

Biological agents cannot be detected by current field detection procedures. The area can be assumed to be free of biological agent contamination unless intelligence information of physical evidence at the site indicates an enemy biological agent has been used. See FM 21-40 for further information on indications of an enemy biological attack. If biological agent contamination is suspected, a sample may be taken using the M34 CBR sampling kit and sent to a medical laboratory for identification.

DETECTION IN THE HAZARD AREA

Upon entry into the exclusion area, the detection teams will be concerned mainly with confirming if a downwind hazard exists, and the amount of liquid contamination on surfaces. One detection team should begin at the control point on the hot line of 0° from the site, and the second team should move around outside the exclusion area and begin at the opposite side, 180° from the site (fig. 5). When liquid contamination is encountered, the detection teams should mark it with the appropriate hazard sign or a stake with engineer tape (FM 21-40). The team should not proceed farther into their area but should return to the boundary of the exclusion area, proceed a few degrees clockwise around the exclusion area, then re-monitor toward the contamination site until contamination is again found. This procedure should be repeated 360° around the exclusion area. This is the same type of procedure called the "in-and-out method" in paragraph 45, FM 3-15.

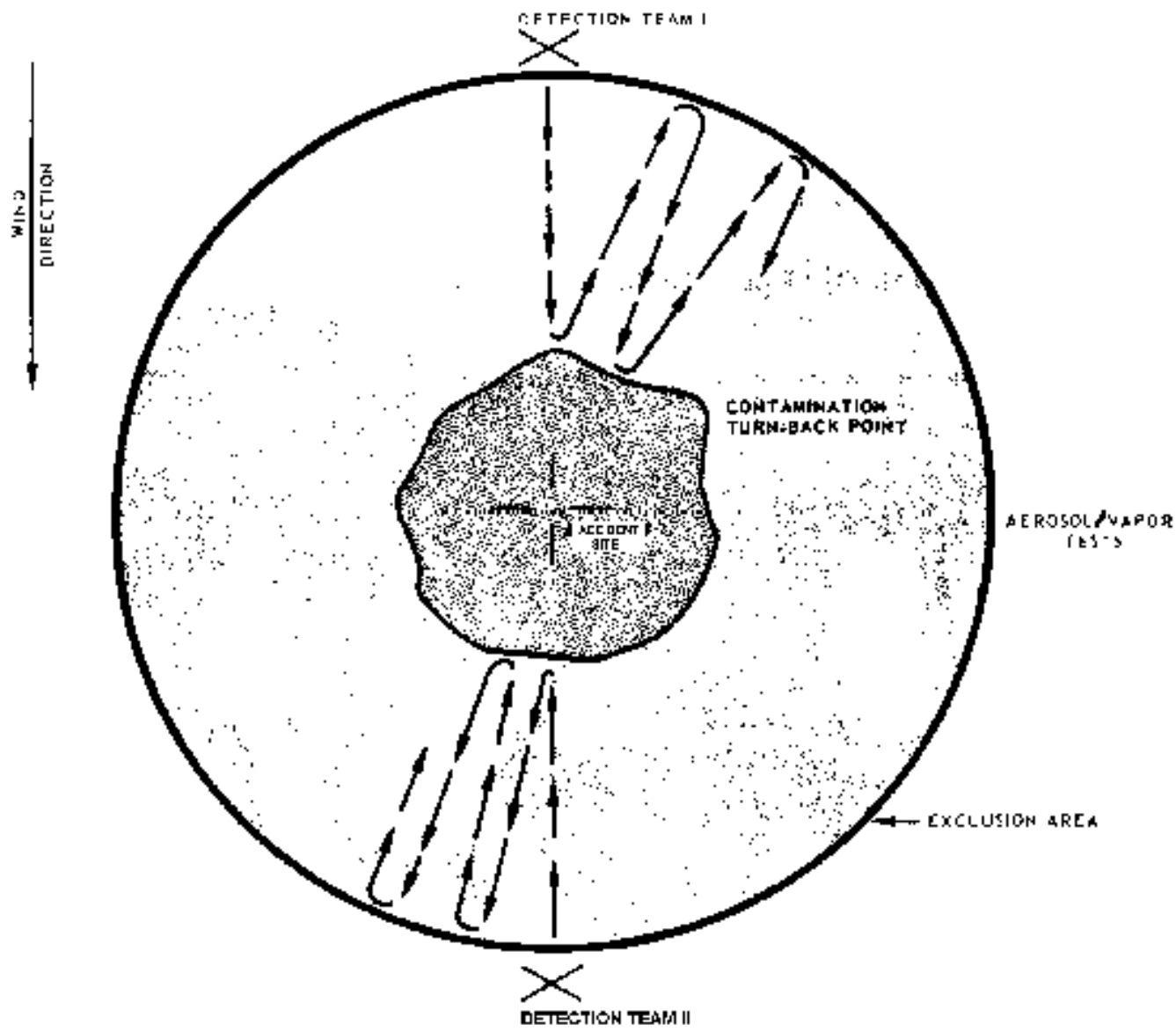


Figure 5. In-and-Out Method

On the downwind side of the site, 90° to 270°, frequent aerosol/vapor tests should be made for the specific agent to confirm if a downwind hazard exists. If a downwind hazard is confirmed, tests should be made farther downwind to establish the extent of travel. This distance will be established by the CAICO.

RECHECK

After area decontamination, a recheck of known contaminated locations should be made to insure that the area is safe for normal use. Caution must be used when ABC-M8 detector paper is used for rechecking as some decontaminants may cause a color to change; for example, DS2 turns M8 detector paper greenish-black.

UNKNOWN CHEMICAL MATERIAL

Normally, chemical material can be identified by either the technical escort personnel, the shipper, or the shipping documents. However, if the type chemical material is unknown and it cannot be identified with the chemical agent detector kit or by any other means available at the site, aerosol/vapor samples of the material should be taken with the white band tubes. Samples of the material should be sealed in test tubes or other suitable containers. The M34 CBR agent sampling kit maybe used for this purpose.

Decontaminate an unknown chemical using a general purpose decontaminant such as supertropical bleach or DS2. Following decontamination, collect samples again to insure complete decontamination once the material has been identified.

The Commander/Director Chemical Systems Laboratory, Aberdeen P. G., MD 21010, should be contacted for instructions for the disposition of all unknown chemical samples. The Edgewood Arsenal operator at AUTOVON 584-2011 can relay incoming calls to the appropriate official.

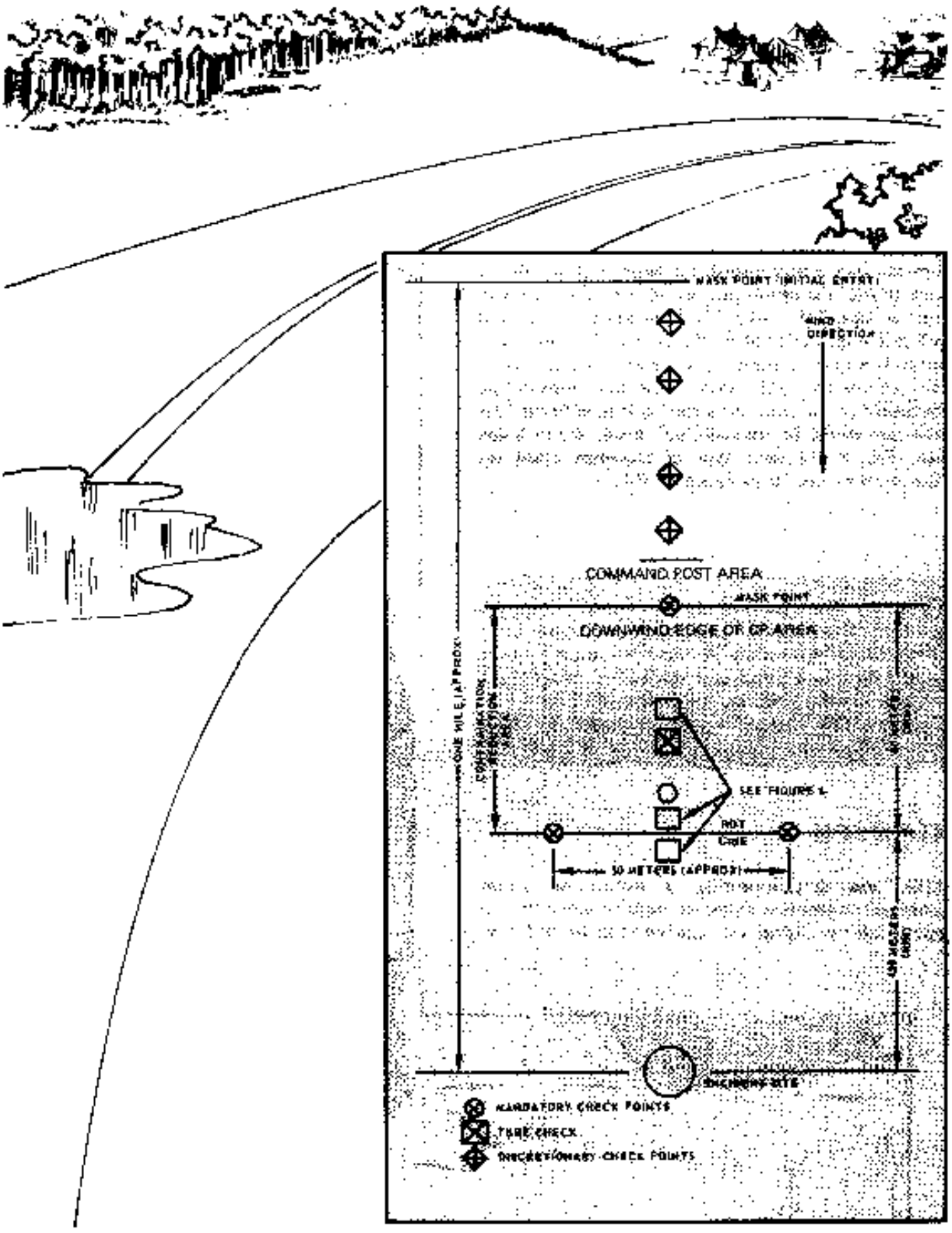


Figure 4. Organization for a Typical Chemical Incident

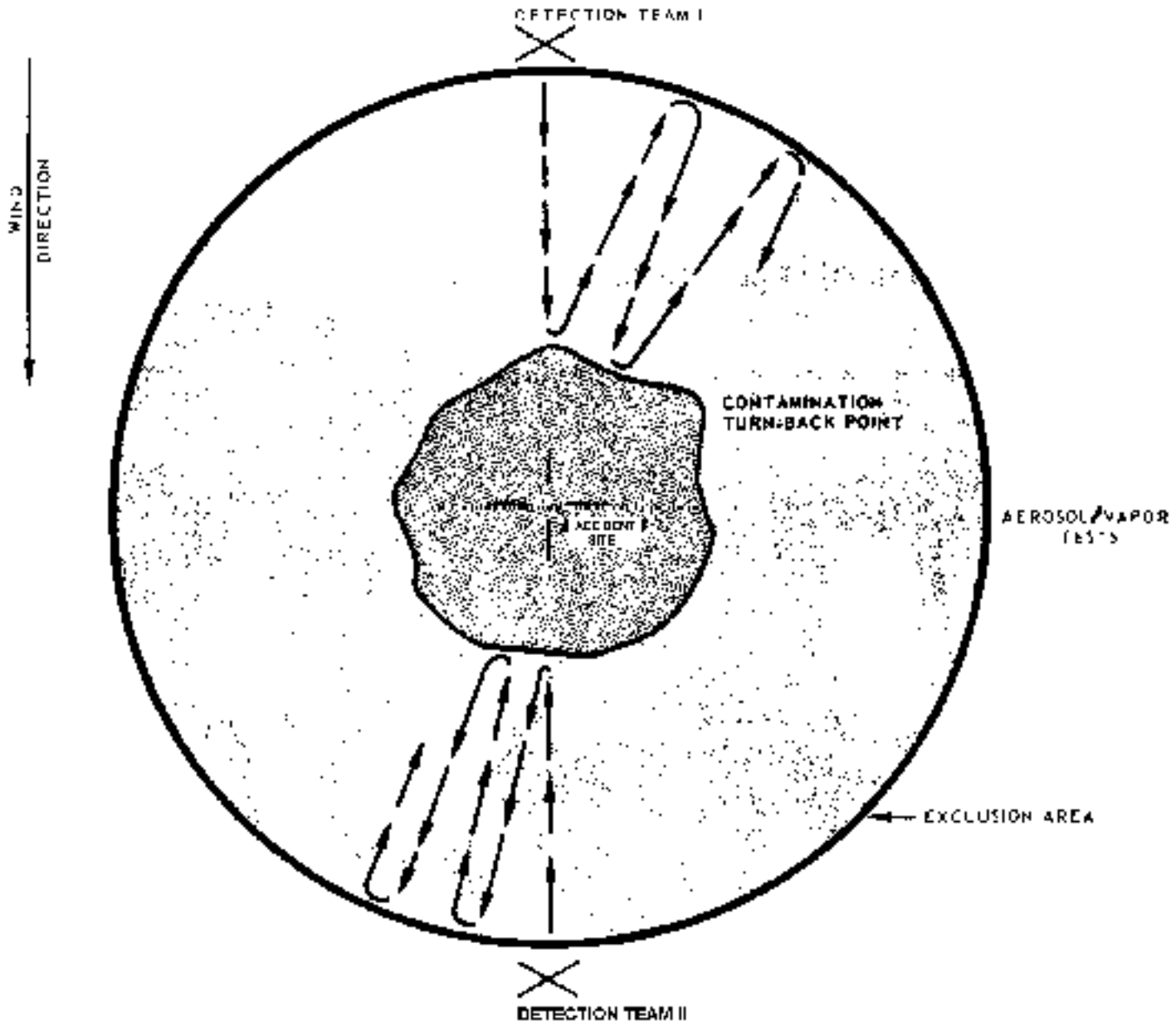
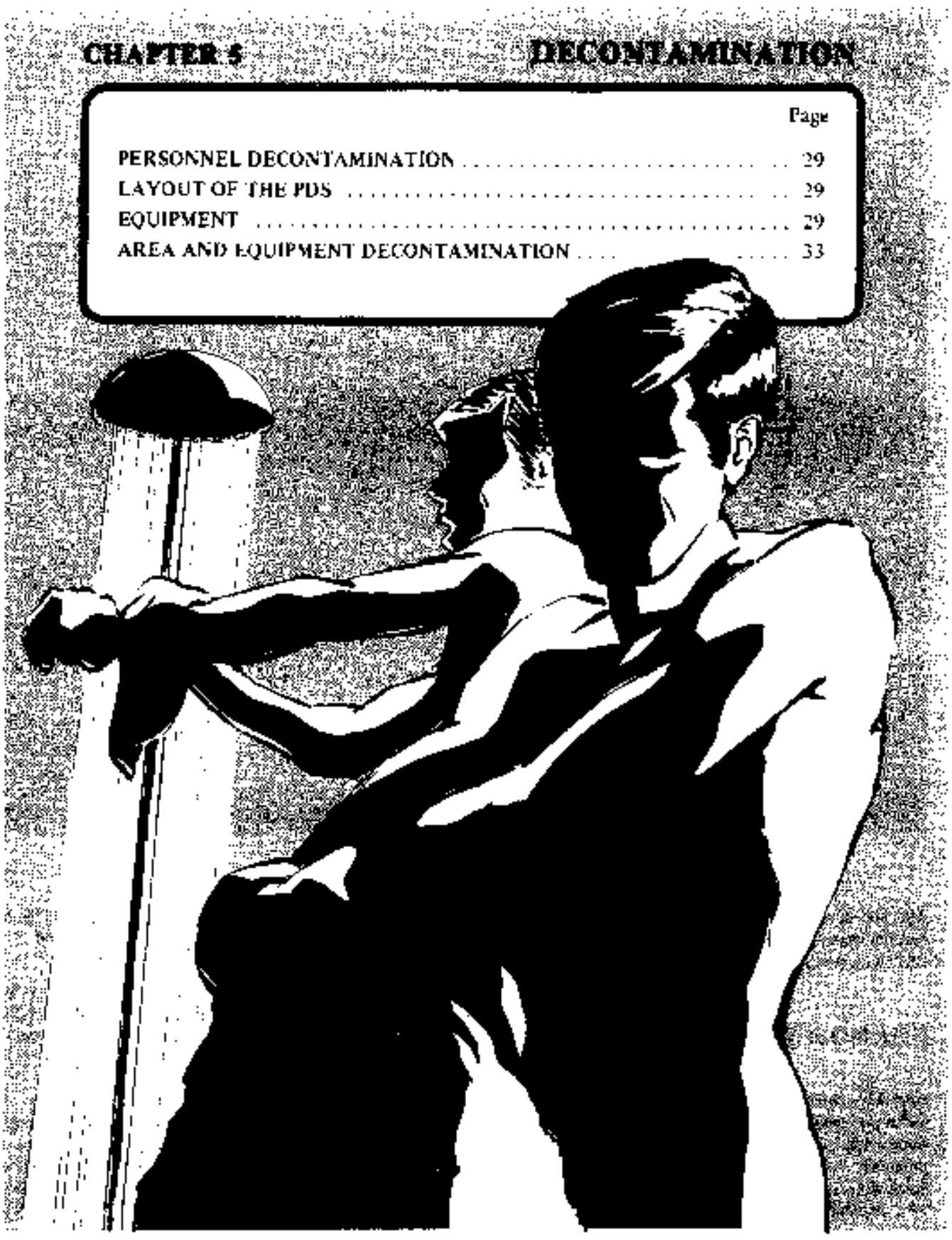


Figure 5. In-and-Out Method



Decontamination means neutralizing or removing the contaminant. Emergency teams usually will have to be augmented with specialized equipment before large-area decontamination can be accomplished. Team leaders normally will be required to provide advice on decontamination procedures and will supervise such operations.

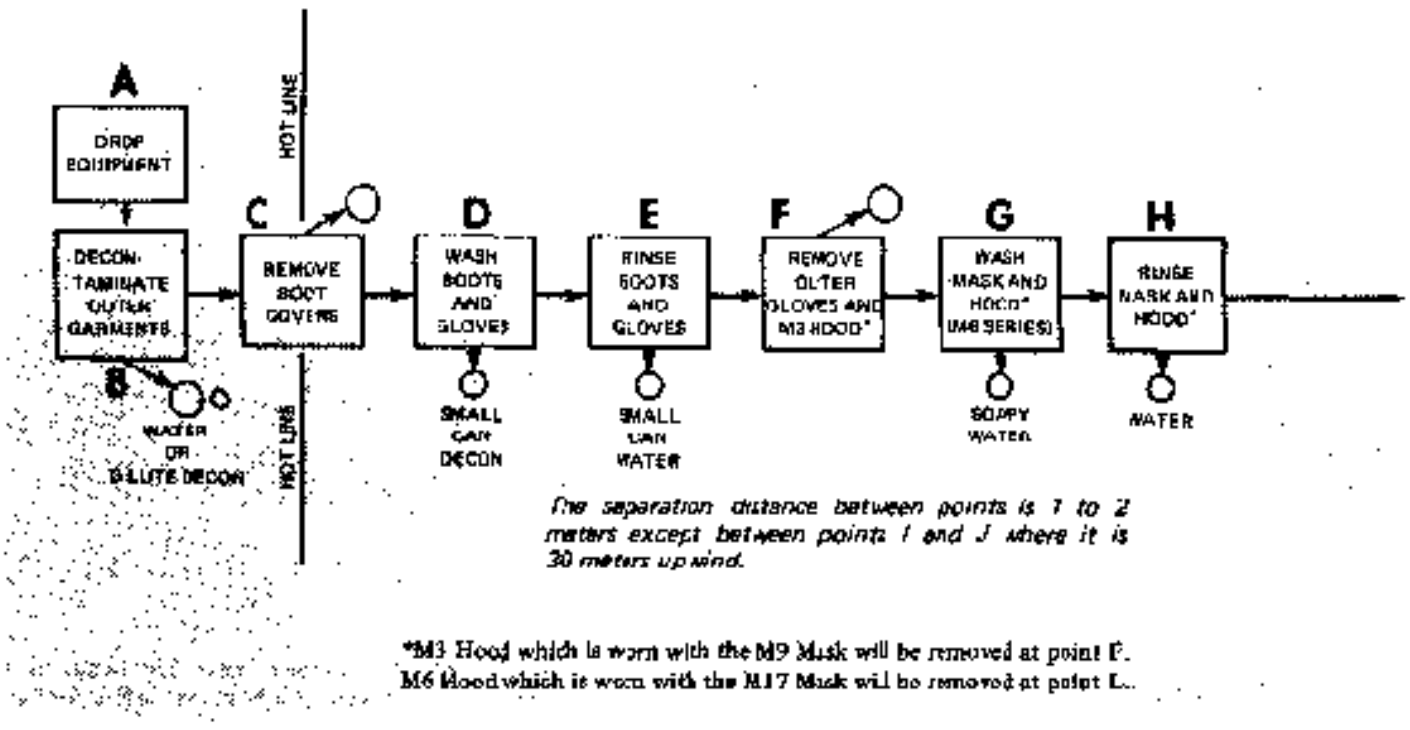
PERSONNEL DECONTAMINATION

One of the first priorities at any chemical accident site is to insure that personnel found in or leaving the suspected contaminated area are properly decontaminated. The PDS is used for this purpose. It is established as a control point on the hot line to prevent the spread of contamination. It should be located outside the contaminated area. However, the first stages of decontamination occur on the "hot side" of the hot line. It is of prime importance to determine if any personnel in the area at the time of the accident may have left the scene prior to the arrival of personnel setting up a hot line; thus risking exposure, not being treated, and agent spreading contamination.

LAYOUT OF THE PDS

A typical PDS is shown in figure 6. The actual arrangement will depend on the type and amount of hazardous material involved and the equipment available. Four general principles should be followed when establishing the PDS:

- Move into the wind as undressing progresses.
- Decontaminate contaminated items and remove the most heavily first.
- Follow the undressing sequence and procedures shown in figure 6 as closely as possible. All articles of clothing worn at the site will be removed and decontaminated.
- Remove the protective mask and hood, hold breath, and step directly into shower before resumption of breathing.



*M3 Hood which is worn with the M9 Mask will be removed at point F. M6 Hood which is worn with the M17 Mask will be removed at point L.

Figure 6. Typical Arrangement of PDS at a CB Accident Site

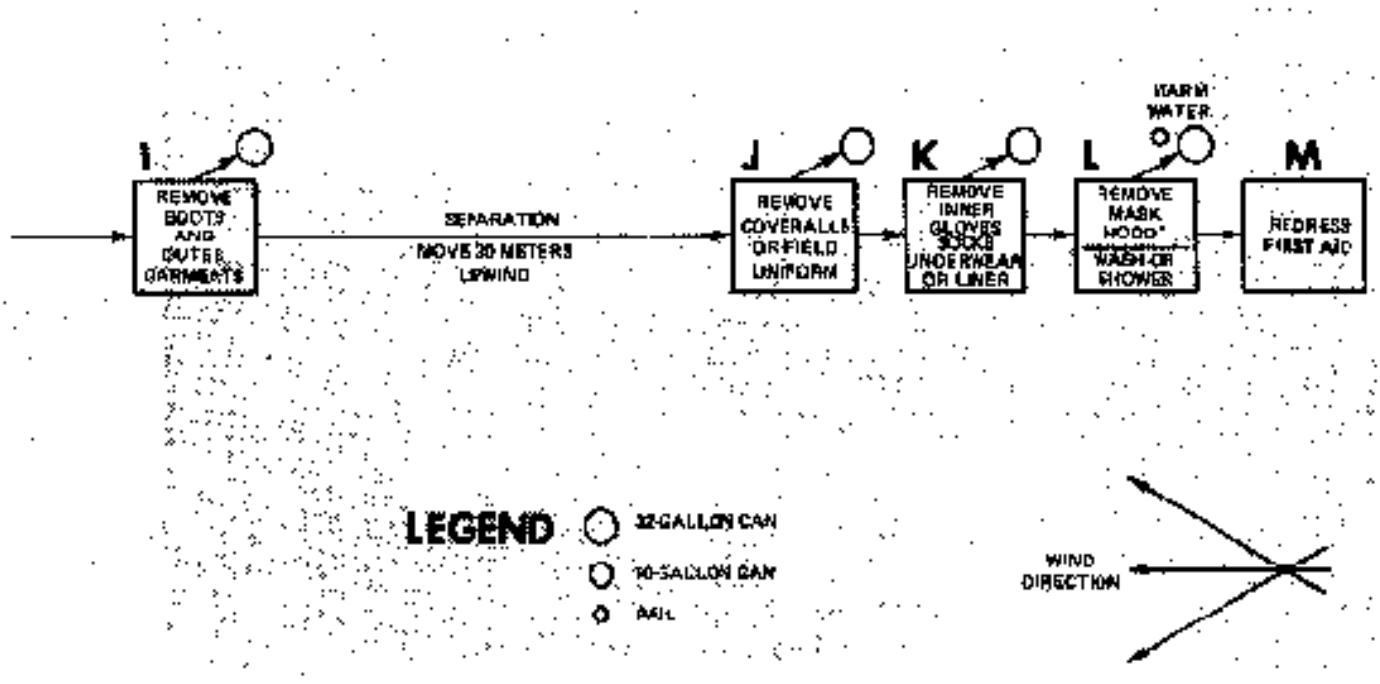


Figure 6. Continued

EQUIPMENT

The recommended items for the set up and operation of the PDS are as follows:

- Can, utility, 32-gallon, 8 each.
- Bag, plastic, polyethylene, 12 each.
- Can, galvanized or plastic, 10-gallon, 4 each.
- Brush, chassis, and running gear, 4 each.
- Decontaminants. Specific type is determined by agent involved; general types are DS2 and STB.
- Pail, metal, 3 1/2 gallon, 2 each.
- Soap, powder, 10 pounds.
- Water, 50 to 100 gallons.
- Immersion heater, 1 each (if available).
- Aid station items. Atropine injector, 100 each; M13 decontaminating and reimpregnation kit, 50 each.

POINT A - EQUIPMENT DROP

This point will be designated on the hot line for deposit of contaminated equipment returned from the accident/incident site. If a cooling suit is worn, it is removed and deposited at this point. A sheet of plastic, a poncho, or an apron spread on the ground will reduce surface contamination problems. Equipment left at this point will be decontaminated by the undressing assistants after all personnel have been processed through the PDS.

POINT B - OUTER GARMENT DECONTAMINATION

The impermeable suit, to include the hood, apron, and boot covers, will be flushed with water or a dilute solution of an appropriate decontaminant to remove the majority of contamination. The contaminated runoff water should be collected in a sump. A large can is needed to hold the decontaminant, and a brush is required for boot cover decontamination.

POINT C - BOOT COVER REMOVAL

Boot covers are removed and placed in a can or plastic bag. As the first boot cover is removed, the uncovered boot is placed across the line and then the second boot cover is removed. The procedure will reduce the spread of contamination throughout the undressing line.

POINT D - BOOT AND GLOVE WASH

Boots and outer gloves are washed with appropriate decontaminant. Caustic soda solution is not recommended due to the possibility of skin contact. Washing soda (sodium carbonate) solutions, calcium hypochlorite solutions, STB slurry, and hot soapy water are suitable, depending on the agent involved. A small can (10-gallon) should be used to allow submersion of each boot.

POINT E - BOOT AND GLOVE RINSE

A small can of clear water will serve as a second stage wash and will remove decontaminants.

POINT F - OUTER GLOVES REMOVAL

A small can or plastic bag is used for deposit of the toxicological agent protective (TAP) gloves and the hood of the M3 TAP suit.

POINT G - HOOD WASH

The exterior of the M9 mask is washed with hot soapy water, taking care not to allow water to enter the canister. If the M17 series mask is being worn. the entire surface of the M6A2 hood will be swabbed along with the eye-lens and inlet valve covers of the mask. A small can of soapy water and a sponge or rag will be used.

POINT H - HOOD RINSE

A small can of clear water and sponge or rag will be used to rewipe the hood. If the M17 series mask is being worn, follow the same procedure used at Point G.

POINT I - BOOTS AND OUTER IMPERMEABLE GARMENTS

Generally, the rubber boots and M3 TAP coveralls will be removed as a unit. If the TAP apron is worn it will be removed. All rubber items will be placed in a large can or a plastic bag.

Note: Separate point I from point J by 30 meters upwind.

POINT J - CLOTH COVERALLS OR FIELD CLOTHING

If coveralls or environmental field clothing items are worn, these items will be removed and placed in large cans or plastic bags.

POINT K - INNER GLOVES, SOCKS, UNDERWEAR OR LINER

Remove and place in a large can or plastic bag.

POINT L - MASK, HOOD, AND UNDERSHIRT REMOVAL; AND SHOWERING

Undershirt should be removed last, Hold the breath, remove mask and hood, remove undershirt, and move quickly to shower or washpoint. Rinse head and upper body, and resume breathing. Using a small bucket, pour water over body and lather with soap. Rinse with another bucket of water from large can.

AREA AND EQUIPMENT DECONTAMINATION

Since the types of equipment, surfaces, and hazardous material to be decontaminated will vary with each separate accident, TM 3-220 should be referred to before starting decontamination operations.

Decontaminants are listed in Table 4 for hazardous material that may be encountered and in the order of preference for each hazard. Decontaminants not on hand may be acquired through local supply channels. Table 5 lists the mixing ratio and use of decontaminants for small amounts or when a power-driven decontaminating apparatus (PDDA) is not available. Mixing ratios for PDDAs can be found in applicable technical manuals.

Decontaminants for Chemical Accidents/Incidents

Listed in Order of Preference*

AGENT	DECONTAMINANT
Blister H-HN-HD-HT-HL-L	1. HTH-HTB Solution (Calcium Hypochlorite) 2. DS-2 (Decontamination Solution) 3. STB Slurry (Supertropical Bleach) 4. Commercial or Household Bleach Solution (Sodium Hypochlorite)
CX	1. DS-2 (Decontamination Solution No. 2)
Nerve GA GB	1. Caustic Soda Solution (Sodium Hydroxide) 2. DS-2 (Decontamination Solution No. 2) 3. Washing Soda Solution (Sodium Carbonate) 4. STB (Supertropical Bleach) Slurry 5. Hot Soapy Water
VX	1. HTH-HTB Solution (Calcium Hypochlorite) 2. DS-2 (Decontamination Solution No. 2) 3. STB (Supertropical Bleach) Slurry 4. Commercial or Household Bleach Solution (Sodium Hypochlorite)
Blood AC-CK **Choking** CG	1. DS-2 (Decontamination Solution) 2. Caustic Soda Solution (Sodium Hydroxide)
Riot Control DM DA	1. DS-2 (Decontamination Solution) 2. Caustic Soda Solution (Sodium Hydroxide)
CS	1. DS-2 (Decontamination Solution No. 2) 2. Alcoholic Caustic (Alcohol Mixed w/Sodium Hydroxide Solution) 3. Hot Soapy Water 4. 5 percent Sodium Bisulfite Solution
CN	1. Caustic Soda (Sodium Hydroxide) Solution 2. Washing Soda (Sodium Carbonate) Solution 3. Hot Soapy Water
Incapacitating BZ	1. Alcoholic Caustic (Alcohol Mixed w/Sodium Hydroxide Solution) 2. Sulphuric Acid 1 percent Solution 3. Hot Soapy Water

The decontaminant selected depends on the type of materiel being decontaminated and its intended use.

Table 4

DECONTAMINANTS	DECONTAMINATES	MIXING PROCEDURES	CONTACT TIME	REMARKS
Supertropical bleach (STB)	Blister agents Nerve agents	Dry Mix: 2 parts STB to 3 parts soil. Slurry Mix: 10 pounds STB to 5 gallons of water. Always add STB to the water slowly while agitating.	1. Leave slurry on for 30 minutes. 2. Rinse off with water. 3. Recheck for contamination.	1. Decontaminates: GB—Vapor check HT—Vapor check VX—M8 paper 2. Pure undiluted STB will burn on contact with liquid blister agents. 3. DS-2 solution STB will spontaneously ignite. 4. Corrodes most metals.
Decontaminating Solution No. 2 (DS-2)	All known chemical agents	No mixing required. Issued in ready-to-use containers.	1. Leave DS-2 on for 30 minutes. 2. Rinse off with water. 3. Recheck for contamination.	1. Can be used at temperatures from -25° to 120°F. 2. Turns M8 paper black. 3. DS-2 put on STB or HTH will spontaneously ignite. 4. Harmless to painted surfaces.
Sodium Hydroxide (Caustic Soda)	G agents Blood agents CS	10% solution—10 lbs. of caustic soda to 12 gallons of water.	Chemical agents—5 minutes.	1. Corrosive; avoid contact by heavy rubber or other skin coating. 2. Does not work well on oily surfaces or those contaminated with thickened agents, such as soaps, greases, or map markings. 3. Caustic soda turns M8 paper red. 4. Recheck as a precaution. 5. Possible sources: commercial lye, drain cleaners, chemical firms, drug stores, and manufacturers of metal products.
Sodium Hydroxide in Alcohol-water Solution	BZ CS Unknown sources	Same as sodium hydroxide. Once solution cools, add 2 gallons of rubbing alcohol or isopropyl alcohol.	Disperse agent over the contaminated area and allow to stand for 24 hours.	After 24 hours burn the solution using external fuel.
Calcium Hypochlorite (HTH-HTB)	Blister agents V agents	10% solution—10 lbs. of HTH to 12 gallons of water.	Chemical agents—5 minutes.	1. Recheck G agents—M8 paper, blister vapor check. 2. DS-2 put on dry HTH will spontaneously ignite. 4. Pure, undiluted HTH-HTB will burn on contact with liquid blister agent and VX. 4. Possible sources: commercial bleaches, drug and chemical firms.
Sodium Carbonate Washing Soda	CN G agents	10% solution—10 lbs. of washing soda to 12 gallons of water.	Chemical agents—5 minutes.	1. Recheck G agents—M8 paper. 2. Possible sources—commercial laundries and chemical firms.
Sodium Hypochlorite Solution (Household Bleach)	Blister agents V agents	No mixing required.	Chemical agents—5 minutes.	1. Recheck G agents—M8 paper. Blister vapor check. 2. Use full strength solution. 3. Possible sources—commercial laundries and chemical firms. (Purex, Clorox)

Table 5

Decontamination can be achieved by neutralizing or removing the contaminant. Allowing the contaminant to weather will not normally be acceptable for hazardous chemical materials at an accident site.

Neutralizing.

- Neutralizing is an excellent method of eliminating the hazard presented by the contaminant. Certain factors must be considered before neutralization procedures are begun.
  - Type of hazard (liquid or solid).
  - Type of surface (soil, vegetation, roadways).
  - Type of decontaminant (best available).
  - Method of applying decontaminant (PDDA, pump, bucket).

- Neutralization procedures for chemical contaminants should begin at the farthest point of contamination from the accident site and proceed inward, moving in a back-and-forth direction (fig. 7) or in a circular direction (fig 8). To insure complete decontamination of the area, operations should begin several meters from known contaminated locations.

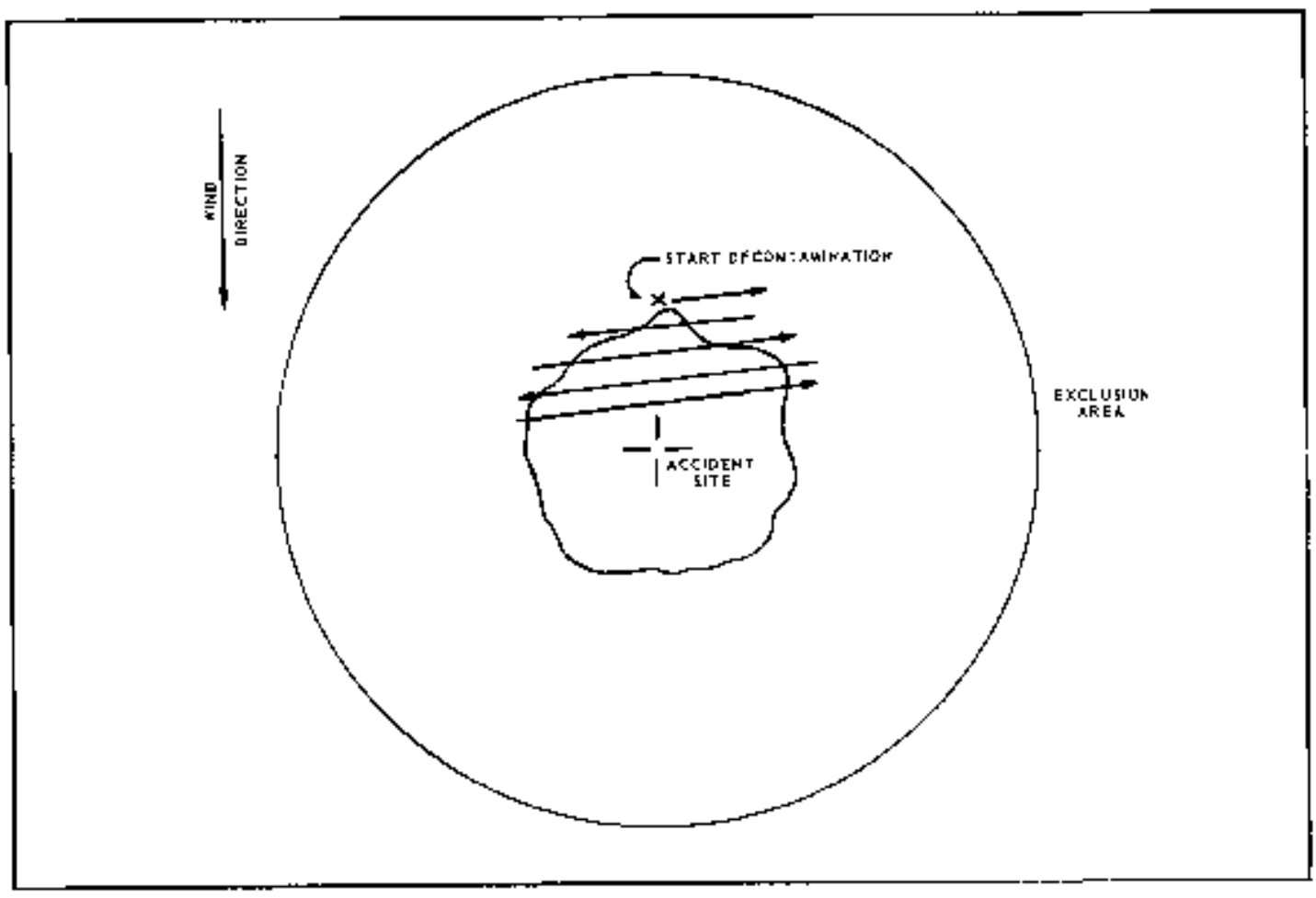
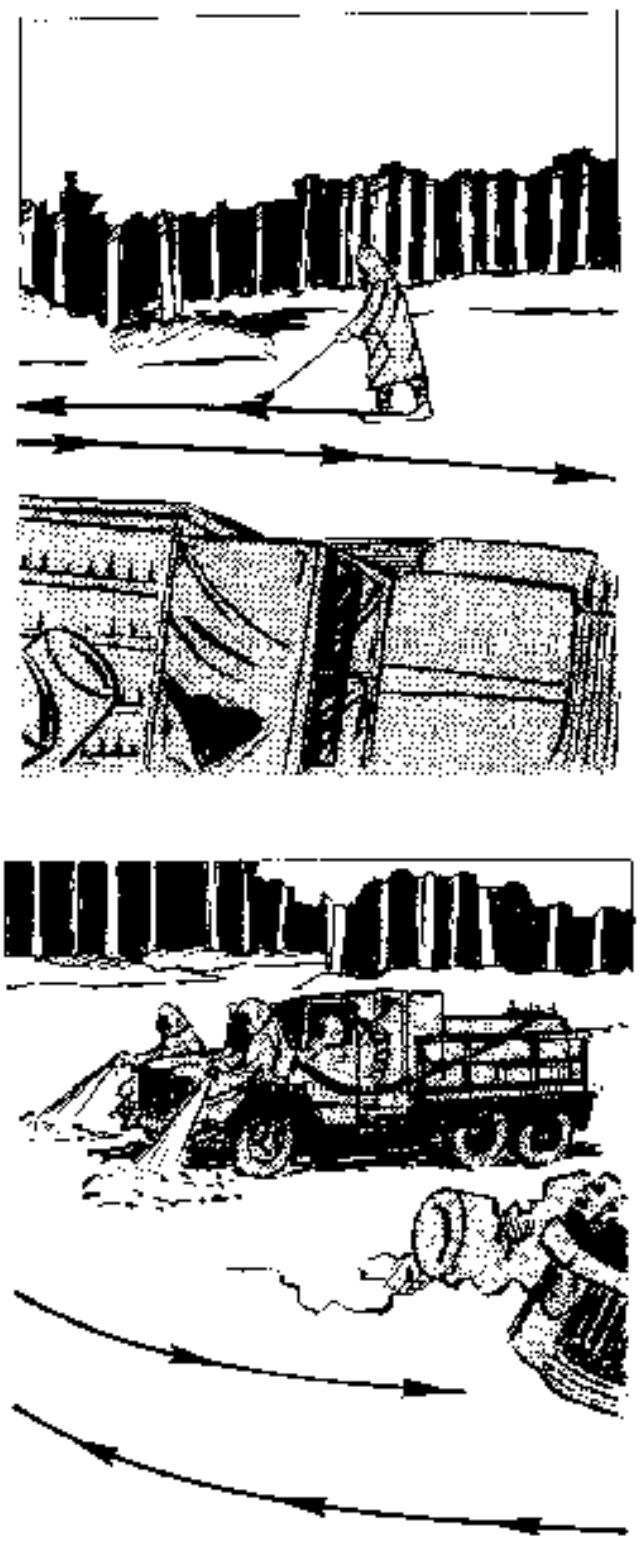


Figure 7. Area Decontamination by the Back-and-Forth Procedure



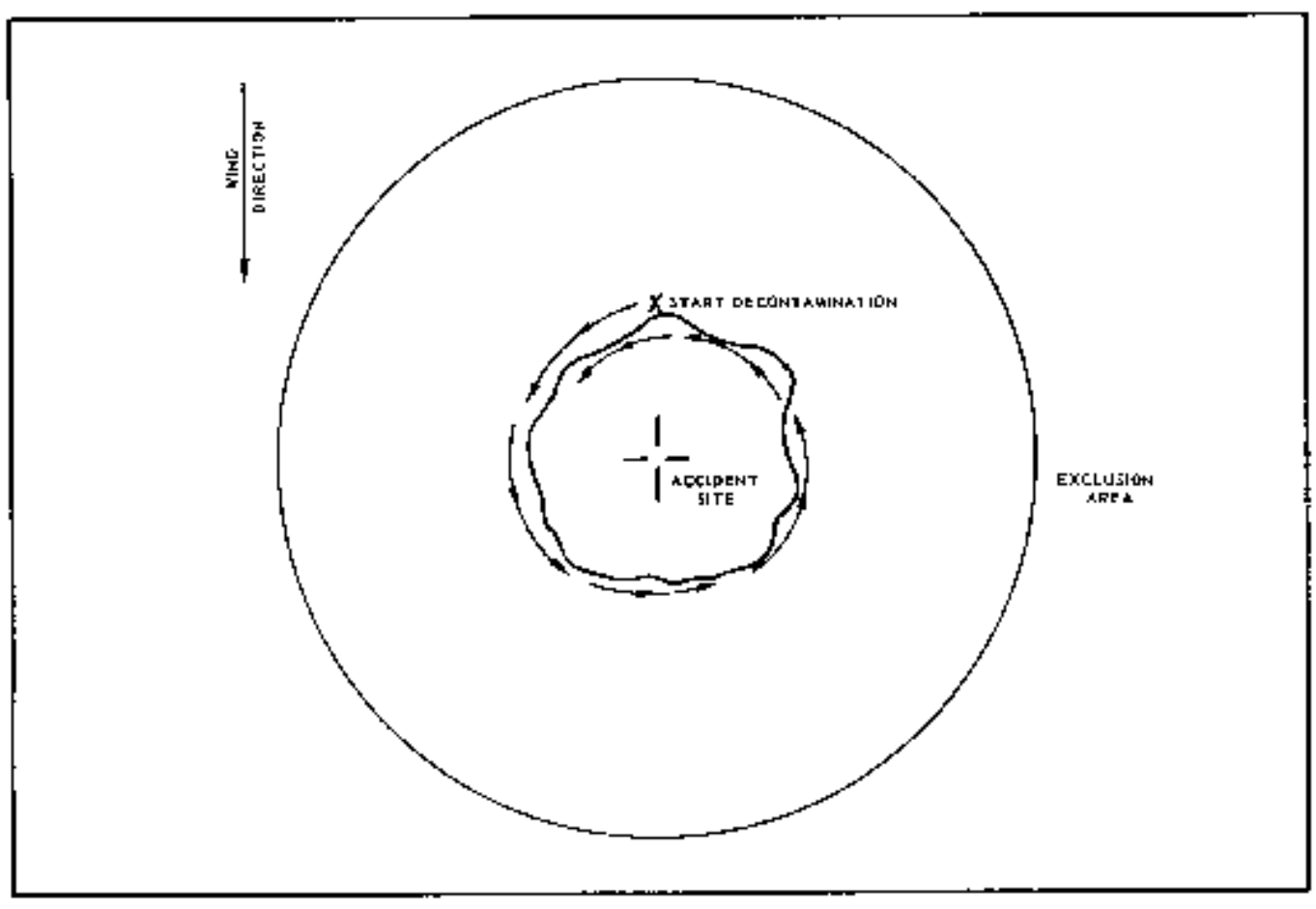


Figure 8. Area Decontamination by the Circular Procedure

Removal. Decontamination by removal consists of physically removing the contaminant from the surface. With heavy liquid contamination on porous soil, this method may involve removal of several inches or possibly feet of soil. However, this method may be preferred in cases when powdered or frozen hazardous material cannot be feasibly decontaminated where it lies or when the material may have been absorbed by the surface. Removal requires considerable equipment and manpower and is quite expensive as a decontamination method. Further, the contamination removed will still require decontamination by some other means.

Decontaminants for Chemical Accidents/Incidents

Listed in Order of Preference*

AGENT	DECONTAMINANT
Blister H-HN-HD-HT-HL-L	1. HTH-HTB Solution (Calcium Hypochlorite) 2. DS-2 (Decontamination Solution) 3. STB Slurry (Supertropical Bleach) 4. Commercial or Household Bleach Solution (Sodium Hypochlorite)
CX	1. DS-2 (Decontamination Solution No. 2)
Nerve GA GB	1. Caustic Soda Solution (Sodium Hydroxide) 2. DS-2 (Decontamination Solution No. 2) 3. Washing Soda Solution (Sodium Carbonate) 4. STB (Supertropical Bleach) Slurry 5. Hot Soapy Water
VX	1. HTH-HTB Solution (Calcium Hypochlorite) 2. DS-2 (Decontamination Solution No. 2) 3. STB (Supertropical Bleach) Slurry 4. Commercial or Household Bleach Solution (Sodium Hypochlorite)
Blood AC-CK **Choking** CG	1. DS-2 (Decontamination Solution) 2. Caustic Soda Solution (Sodium Hydroxide)
Riot Control DM DA	1. DS-2 (Decontamination Solution) 2. Caustic Soda Solution (Sodium Hydroxide)
CS	1. DS-2 (Decontamination Solution No. 2) 2. Alcoholic Caustic (Alcohol Mixed w/Sodium Hydroxide Solution) 3. Hot Soapy Water 4. 5 percent Sodium Bisulfite Solution
CN	1. Caustic Soda (Sodium Hydroxide) Solution 2. Washing Soda (Sodium Carbonate) Solution 3. Hot Soapy Water
Incapacitating BZ	1. Alcoholic Caustic (Alcohol Mixed w/Sodium Hydroxide Solution) 2. Sulphuric Acid 1 percent Solution 3. Hot Soapy Water

**The decontaminant selected depends on the type of materiel being decontaminated and its intended use.*

Table 4

DECONTAMINANTS	DECONTAMINATES	MIXING PROCEDURES	CONTACT TIME	REMARKS
Super Tropical Bleach (STB)	Blister agents Nerve agents	Dry Mix—2 parts STB to 3 parts soil. Slurry Mix—10 pounds STB to 5 gallons of water. Always add STB to the water slowly while stirring.	1. Leave slurry on for 30 minutes. 2. Rinse off with water. 3. Recheck for contamination.	1. Use: GB—Vapor check HT—Vapor check VX—M8 paper 2. Pure, undiluted STB will burn on contact with liquid chlorides agents. 3. DS 2 put on STB will spontaneously ignite. 4. Corrodes most metals from CA agents.
Decontaminating Solution No. 2 (DS-2)	All known nonatomic agents	No mixing required. Issued in ready-to-use containers.	1. Leave DS-2 on for 30 minutes. 2. Rinse off with water. 3. Recheck for contamination.	1. Can be used at temperatures from −25° to 120° F. 2. Turns M8 paper black. 3. DS 2 put on STB or HTH will spontaneously ignite. 4. Harmful during vapor exposure.
Sodium Hydroxide (Caustic Soda)	G agents Blood agents CA	10% solution—10 lbs. of caustic soda to 12 gallons of water.	Chemical agents—5 minutes.	1. Oxygen evolved tends to slowly solvent in the water while stirring. 2. Corrosive to most metals (except stainless steel, nickel, monel, tin, zinc, copper, or magnesium. 3. Destroys soda burns VX paper red. 4. Recheck for vapor contamination. 5. Possible sources—commercial lye, photographic chemical firms, drug stores, and manufacturers of metal products.
Sodium Hypochlorite in Alcohol-Water Solution	B7 CS Unknown powders	Store at sodium hydroxide. Once solution cools, add 2 gallons of ethyl, methyl, or isopropyl alcohol.	Dissolve agent in solution and allow to stand for 24 hours.	After 24 hours burn the solution using external fuel.
Calcium Hypochlorite (HTH, HTB)	Blister agents V agents	10% solution—10 lbs. of HTH to 12 gallons of water.	Chemical agents—5 minutes.	1. Recheck V agents—M8 paper Blister vapor check. 2. DS 2 put on dry HTH will spontaneously ignite. 3. Pure, undiluted HTH–HTB will burn on contact with liquid blister agent and VX. 4. Possible sources—commercial bromine and chemical firms.
Sodium Carbonate (Washing Soda)	GN G agents	10% solution—10 lbs. of washing soda to 12 gallons of water.	Chemical agents—5 minutes.	1. Recheck for vapor exposure. 2. Possible sources—commercial laundries and chemical firms.
Sodium Hypochlorite Solution (Household Bleach)	Blister agents V agents	Mixing not required.	Chemical agents—5 minutes.	1. Recheck—V: M8 paper Blister: Vapor check. 2. Dry to thorough solution. 3. Possible sources—commercial laundries and chemical firms. (Purex, Clorox)

Table 5

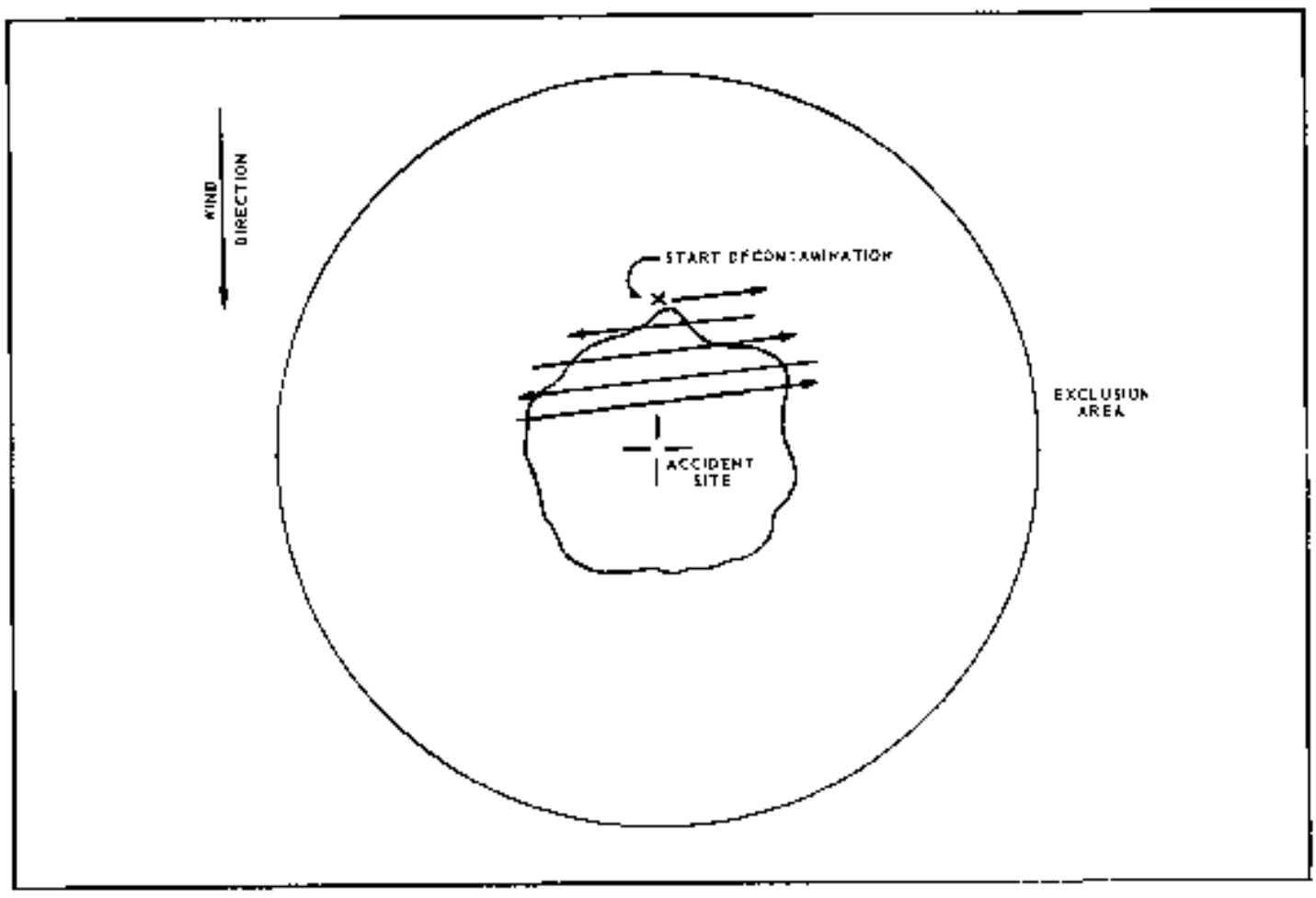


Figure 7. Area Decontamination by the Back-and-Forth Procedure

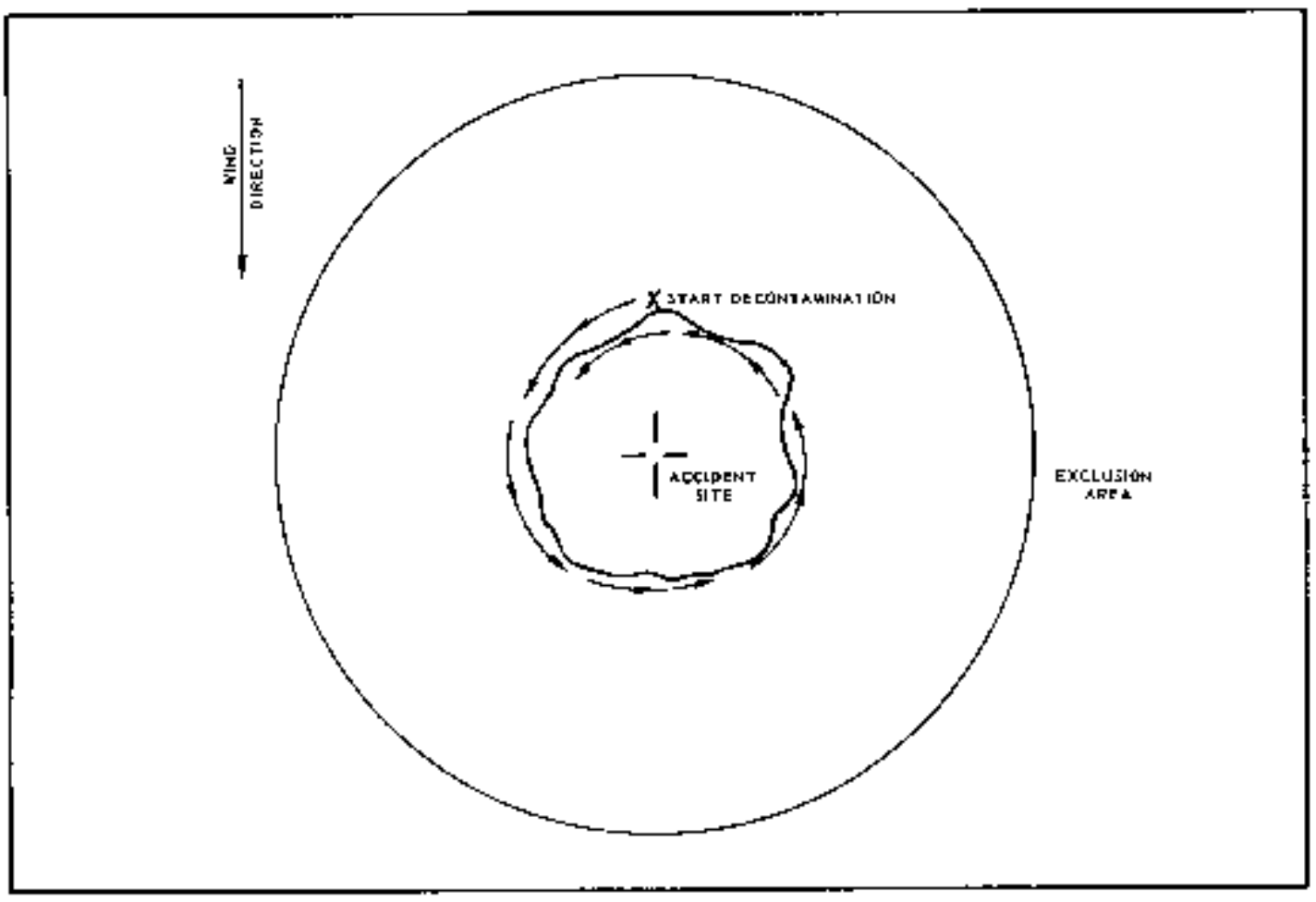


Figure 8. Area Decontamination by the Circular Procedure

FM 3-21

23 FEBRUARY 1978

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

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