Chapter 1
Vulnerability Analysis

The focus of this field manual is Chemical and Biological (CB) Contamination Avoidance. Like most concepts in the Army, contamination avoidance is a process. This process involves—

- Assessing the threat facing friendly forces.
- Identifying whether friendly units are a target.
- Understanding the field behavior of CB contamination.
- Locating CB hazards on the battlefield.

By identifying and locating CB hazards on the battlefield, units will be able to either avoid the hazard or implement those protective procedures outlined in FM 3-4 to minimize the effects of the hazard on unit performance.

However, before we begin the discussion of contamination avoidance, we must first discuss two critical, often overlooked, aspects of successful operations on the contaminated battlefield. These two aspects are CB threat assessment and vulnerability analysis. Both are described in this chapter.

The CB threat now and in the future will be global from low to high intensity. Terrorists may be encountered at any level of conflict. The proliferation of CB capable nations in all contingency regions and the availability of toxic CB materials increase the liklihood of US forces being direct or inadvertent targets of attack. These attacks may range from limited use in terrorist actions to planned targeting in support of military operations.

As Chapter 1 of FM 3-100 points out, CB proliferation is increasing. Deploying US forces must be capable of accurately assessing the CB threat imposed by the opposing force and be capable of addressing unit vulnerability to attack. Chapter 2 in FM 3-100 describes in detail how CB agents may be used and how their use may shape the battle.

When planning operations, commanders must consider the potential effects of CB weapons on personnel and equipment. In conventional operations, concentration of forces increases the chance for success, but this same concentration increases the effects of CB attacks and the likelihood of their occurrence. Consider the timing of force concentration to reduce the effects from a CB attack.

To assess a unit's vulnerability to CB attack, the commander determines how well protected the unit is and the type and size of weapon likely to be used against it. The commander then weighs various courses of action and determines which presents an acceptable risk to allow accomplishment of the mission. This whole process starts with the Intelligence Preparation of the Battlefield (IPB) with an initial assessment of the CB threat.

The IPB Process

The IPB process is a staff tool that helps identify and answer the commander's priority intelligence requirements (PIR), it's part of the operational planning that is necessary for battle management.

IPB is initiated and coordinated by the S2 and used to predict battlefield events and synchronize courses of action. IPB is designed to reduce the commander's uncertainties concerning weather, enemy, and terrain for a specific geographic area in a graphic format. It enables the commander to see the battlefield: where friendly and enemy forces can move, shoot, and communicate where critical areas lie; and where enemy forces (and his own) are most vulnerable. IPB guides the S2 in determining where and when to employ collection assets to detect or deny enemy activities. These assets, working collectively, fulfill intelligence requirements and answer the PIR. IPB is the key for preparing for battle. It analyzes the intelligence data base in detail to determine the impact of enemy, weather, and terrain on the operation and presents this information graphically. It is a continuous process which supports planning and execution for all operations. IPB consists of a systematic five-function process involving—

- Evaluation of the battlefield (areas of operation and influence).
- Terrain analysis.
- Weather amlysis.
- Threat evaluation.
- Threat integration.

On the battlefield, units will have incomplete intelligence concerning enemy chemical and biological capabilities and / or intentions. However, commanders, must ensure that the IPB becomes an integrated process through which key members of the staff contribute. IPB is a process involving intelligence and operations personnel. It must also be integrated with input from chemical officers.

Chemical officers and NCOs, in coordination with the S2/3, must address CB warfare during all phases of the battle. This is accomplished only by direct participation in the IPB process. Working with the S2, the chemical staff should—

- Template potential chemical targets or areas of contamination.
- Designate templated areas that effect the scheme of maneuver as named areas of interest (NAI).
- Include NAIs into the collection plan and identify indicators.
- Include designated NAIs into the reconnaissance and surveillance plan (R&S) and designate responsibility for confirming or denying the template.

Using the IPB process, the chemical officer/NCO provides the commander updates on the CB situation, as well as flame and smoke operations.

Based on the time periods of interest, the chemical staff will provide the battle commander with—

- Detailed information on enemy CB capabilities based on the type of units and weapons the enemy has available in the area of operations/area of influence (AO/AI) during a selected time period.
- How the enemy would employ chemical, biological, flame, or smoke to support his battle plan.
- 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 and how they could impact on CB, flame, and smoke warfare.
- MOPP guidance for each period of interest (such as, minimum MOPP, automatic masking).
- Alternative actions the commander can initiate prior to the phase time line in question so as to minimize degradation of forces.
- Continuous monitoring of intelligence messages and radio traffic for any CB related information which could be important to the unit's mission.

It is important that the chemical officer/NCO be succinct during the commander's briefing or have his information presented by the S3 during his portion of the briefing. Therefore, for input to be addressed, chemical personnel must be a player in the IPB process. Although it is developed under the direction of the S2, once completed, the decision support template (DST) becomes an operational document and is briefed to the commander by the S3. As active participants in the IPB process, the CB concerns will be included in the threat analysis and shown usually on the IPB template. It is through this participation that the chemical staff best serves the commander as special staff warfare experts, for the appropriate templates of IPB process will include CB concerns and visually present them, in a user-friendly manner, to the commander.

During battle management activities, the chemical staff advisor works with the S2 on the IPB. He coordinates with the intelligence officer to analyze and identify chemical targets based on threat, terrain, and the AO. Potential threat chemical targets could be key terrain, choke points, command and control facilities, counterattack routes, mobility corridors, troop concentrations and rear area assembly points.

A CB vulnerability assessment constitutes an important part of battlefield assessment and risk analysis and is a primary means through which the chemical staff advisor participates in the battlefield assessment process.

In this assessment, the chemical officer must develop information for integration into the various staff estimates. From the S2, the chemical officer/NCO obtains—

- Time period of interest.
- Threat probable courses of action and intent.
- Names areas of interest (NAIs) and target areas of interest (TAIs).

Summary of enemy activity, including any CB attacks, movements of CB equipment or material, or presence and level of training of threat forces, and indicators of enemy CB warfare comments such as queuing up weather radar.

Specific items of interest from the S2 would be:

- Direction and speed of prevailing winds.
- Average temperature and humidity and how these weather conditions may effect CB warfare agents, terrain, availability of water sources, transportation assets (railways, airfields, road networks) available for shipment of CB munitions, and the availability and location of industrial assets capable of producing and/or weaponizing CB warfare agents, availability of CB agents and delivery systems, and location of stockpiles.

From the Fire Support Officer (FSO), the chemical officer obtains information on casualty percentages from friendly and threat conventional munitions. Examples of information obtained might include—

- Casualty percentages based on target size
- Casualty percentages based on weapon systems

The chemical staff should also prepare a list of information that is compiled from various sources (news bulletins, spot reports, intelligence summaries (INSUMs), and is general in nature. This information, when viewed as a single event, may appear to be meaningless. However, when added to other pieces of information it may provide the key that connects the information and present the best view of the enemy's intent. Items of general information include, but is not limited to the following—

- Availability of CB defense equipment to enemy forces. If no protective equipment is available (such as MOPP, antidotes, masks) it may indicate that the enemy does not intend on using CB weapons.

- Amount of overhead cover or collective protection shelters or systems; if enemy forces seek overhead cover or move into collective protection shelters, it may indicate that the enemy intends on using CB weapons.
- Stated national policy or philosophy on the use of CB weapons. Has the enemy declared a no use, first use or limited use only for retaliation in kind policy? Does the enemy consider the use of flame or smoke as CB agents?
- Leadership—Is the enemy's national or military leadership willing to use CB weapons on their own territory or expose their own populations to the hazards generated from CB munitions?
- If the enemy does not possess CB munitions, the capability to produce agents or expertise to employ munitions; have attempts been made to gain this ability? Reports indicating the presence of advisors from other nations working with enemy forces, international trade agreements or shipments of agricultural equipment (such as sprayers, fertilizers, insecticides or raw chemicals) may provide insight to the enemy's intent.

Once information is gathered, it will provide input to the formulation of the CB Threat Status.

CB Threat Status

US forces may not have to carry CB defense equipment (such as MOPP) based on the initial threat estimate. If the threat condition were to change and indicators were present to suggest the possible use of CB agents by the threat forces, CB defense equipment would be deployed forward (such as division support area or to the brigade support area). These stocks may be prepalletized for immediate deployment by aircraft to the affected unit if required. However, this decision must be made based on available aircraft or other transportation systems. This could be done so that the forces would not have to carry the mission oriented protective posture (MOPP) ensemble in their field pack, ALICE (ruck sacks).

The minimum CB threat status is set at division or separate brigade level and is a flexible system determined by the most current enemy situation, as depicted by the continuously updated IPB process. This allows local commanders to increase the threat status as conditions change in their area of operations. Threat status governs the initial deployment of chemical assets (such as equipment or units) and the positioning of those assets on the battlefield or in the operational area. The CB threat status serial numbers are for planning purposes in accordance with STANAG 2984. These numbers, however, may be substituted for a color code (serial 0 = white; serial 1 = green.). It does, however, require chemical personnel at brigade and division level to stay abreast of the intelligence picture. The CB threat status is outlined below—

a. Serial 0 (none).

1. The opposing force does not possess any CB defense equipment, is not trained in CB defense or employment and do not possess the capability to employ CB warfare agents or systems. Further, the opposing force is not expected to gain access to such weapons and if they were able to gain these weapons, it is considered highly unlikely that the weapons would be employed against US forces.

2. Under this status a deploying force would not have to carry CB defense equipment nor decon assets. However, protective masks should be carried. Chemical personnel should concentrate efforts in smoke, herbicides, flame field expedients (FFE) and monitoring threat communication channels for CB threat indicators.

b. Serial 1 (low).

1. The opposing force has an offensive CB capability, has received training in defense and employment techniques, but there is no indication of the use of CB weapons in the immediate future. This indication may be based on whether CB munitions are dispersed or deployed, or the stated objectives and intent of opposing forces.

2. Given this threat status, all personnel carry their individual defense equipment or chemical defense equipment stockpiles are identified and would be readily available for deployment to the operational area if the threat status should increase. NBC reconnaissance systems deploy to the operational area of interest to provide a monitoring capability. Chemical personnel continue to concentrate their efforts on NBC planning and analysis for threat indicators.

c. Serial 2 (medium).

1. The opposing force is equipped and trained in CB defense and employment techniques. CB weapons and employment systems are readily available. CB weapons have been employed in other areas of the theater. Continued employment of CB weapons is considered probable in the immediate future. Indicators would be—

- CB munitions deployed to either field storage sites or firing units.
- Enemy troops wearing or carrying protective equipment.
- CB recon elements observed with conventional recon units.
- CB decon elements moved forward.

2. Unit CB defense equipment should be either pre-palletized and located forward for easy access or

issued to the soldiers responsible for use within the unit. Individual soldiers should beat MOPP levels 1 or 2; MOPP 0, if MOPP gear is readily available. Erect collective protection shelters if the tactical situation permits. Personnel and equipment should be kept under cover as much as possible to protect them from contamination. Chemical Downwind Messages (CDMs) should be sent to subordinate units. Decontamination assets, CB recon assets and smoke support should be deployed as part of the force structure. Detection and monitoring (such as CAM) equipment should be issued to the operators. Unit should fill M11 and M13 Decontamination Apparatuses (DAP) and mount on vehicles.

d. Serial 3 (high).

1. The opposing force possesses CB warfare agents and delivery systems. CB defense equipment is available and training status is considered at par or better than that of the United States. CB weapons have already been employed in the theater and attack is considered imminent. Indicators are—

- CB attack in progress but not in your area of operation.
- CB warnings/signals to enemy troops.
- CB munitions delivered to firing units within range of friendly forces.
- Movement of surface-to-surface missiles to a launch site.

2. US forces should deploy with CB defense equipment in the unit load. Soldiers should either carry the overgarments in their rack sacks, CB bag, or wear the overgarments. This will depend on the CB threat to the airfield or port on which they land. Soldiers should change protective mask filters prior to deployment. Decontamination and CB recon assets should be task organized and moved forward. Contingency stocks of CB defense equipment may be moved forward to the battalion trains. CDMs are initiated and place collective protection systems into a state of readiness including those systems in combat vehicles.

This threat status can be used as a single number representing both C and B or as individual C and B statuses. It is possible to have a C status of three and a B status of zero. This threat status provides the commander with guidance for deployment and operational purposes. It allows the commander to tailor chemical units to fit any situation.

Threat status can change rapidly. Although a C status of zero may exist during deployment, the opposing force may seize industrial chemicals or obtain warfare agents from a sponsoring nation. Therefore, the ground commander must be capable of upgrading the CB defense posture quickly.

To assist in the formulation of the threat status, the chemical staff, (in conjunction with the S2) must analyze all information received. A tool in this analysis is the threat status matrix depicted in figure 1-1.

CONDITION	SERIAL NUMBER			
	0	1	2	3
A. Enemy force information— • training status • NBC equipment availability • wearing overgarments • in collective protection shelters, in positions with overhead cover, or exposed				
B. CB weapon systems— • availabilitly of CB weapons • CB weapons moved to firing unit • or launch sites				
C. Enemy CB Policy and Capabilities— • what is enemy's stated policy on CB weapons employment? • can enemy produce CB agents? • has industrial output increased or changed for production of CB munitions or protective equipment?				

Figure 1-1. CB Threat Status Matrix.

Use X's to mark applicable boxes or degree of threat. Total columns and use serial number with largest number of X's as the current threat status.

More than one matrix may be necessary to determine the threat status for chemical and biological attack.

To use the matrix, place an "x" in the appropriate block. Add each column; and whichever column has the most "x's" provides a means to identify what threat status serial number could be used to identify an indication of the enemy force intent. If an overall threat status cannot be determined due to an informational shortfall, collection assets should be reallocated or positioned to gain the needed information.

Once the threat status estimate has been assessed the chemical staff must analyze the protection level required for friendly forces. This is accomplished by using MOPP analysis—key factors include analyzing mission, environment, and soldier factors—as discussed in FM 3-4 and the factors listed below.

- Understanding the mission and commander's intent for friendly forces.
- Capabilities and level of training of friendly forces.
- MOPP analysis and work degradation factors contained in FM 3-4.
- Availability of chemical defense equipment and decontamination assets. In this regard, information may be obtained from the S2 or G5.

Other factors include—

- Location and availability of desalination plants (for arid areas).
- Location of civilian chemical manufacturing and storage facilities. Chemicals at these facilities may be used, through civilian contract, for supplementary decon supplies. Further, chemicals or hazardous materials stored in these facilities may produce areas of contamination if storage containers leak (either intentional or unintentional). To assess these hazards and how such a leak may impact on operations refer to Department of Transportation (DOT) Regulation 5300.3, Emergency Response Guidebook or the Department of Defense (DOD) Regulation 4145.19-R-1, Hazardous Materials Storage and Handling criteria.
- Availability of civilian contracted labor and water transport for decon operations.
- For urban areas, location of car washes. These car washes may be used in lieu of hasty decon stations. Obtain data on local fire hydrants (such as location, hookups). Hydrants may be used to provide water for decon operations.

The chemical staff must properly prepare the threat status and identify the protection level required for friendly forces to withstand an CB attack. This information is vital to the commander and for the successful accomplishment of the mission. The commander may be required to reallocate or position units on the battlefield to reduce vulnerability to an attack.

Chemical Vulnerability Analysis

There is no difference in vulnerability analysis procedures between chemical agents and biological toxins. The following applies to both.

Unit vulnerability to a CB attack depends primarily on the protection the unit has taken and the type and amount of chemical agents delivered. For nonpersistent agents, the risk of casualties to units in MOPP 4 is negligible. This is also true for persistent agents if appropriate and timely decon measures are taken. Persistency, as defined in FM 3-9, is an expression of the duration of effectiveness of a chemical agent. This is dependent on physical and chemical properties of the agent, weather, methods of dissemination, and conditions of terrain. Nonpersistent agents generally include: choking agents, blood agents, and G-series nerve agents. Persistent agents generally include: blister agents, VX, GD and thickened nerve agents. If personnel are forced to stay in MOPP gear, performance is degraded and heat casualties may occur. Refer to FM 3-4 for detailed information on degradation factors. The commander must achieve a balance between reducing the number of casualties from the attack, avoiding heat casualties, and reducing individual performance degradation.

Analyzing chemical vulnerability is difficult. Casualties can result from on-target attacks, off-target attacks, downwind hazards, and residual liquid contamination. Table 1-1 is a guide to help evaluate chemical hazard vulnerability. The chart is safesided and assumes a direct attack on troops in MOPP 1 or 2. Use the chart in the same manner as the radius of vulnerability tables for nuclear weapons. Remember that chemical weapons are delivered as battery or battalion volleys and not single munitions as with nuclear weapons.

If troops are wearing MOPP 4 at the time of the attack, reduce these percentages to a negligible level.

The figures in Table 1-1 are for employment under optimum attack conditions. Optimum conditions for employment of chemical weapons is generally considered to be stable or neutral temperature gradients and light winds less than 10 kmph. If troops are in some form of shelter such as a building, the percentages initially will be less. The percentages will also be less if high winds exist or during hot temperatures.

Table 1-2 shows the effects of temperature change on an agent's persistency. Cooler conditions increase the persistency of chemical agents. As a general rule, persistency triples as contamination levels increase from moderate to heavy. Moderate contamination is defined as one gram of agent per square meter. This concentration can be further defined as the amount of vapor contamination that would cause one-to-four bar display on the Chemical Agent Monitor (CAM). Heavy contamination is defined as ten grams or more of agent per square meter. Heavy concentrations would cause five-to-eight bars on the CAM. Moderate and heavy

TABLE 1-1. Casualty estimate for initial chemical hazards.

TYPE MUNITION	TARGET RADII (METERS)	PERCENT CASUALTIES*			
		NONPERSISTENT		PERSISTENT	
		NERVE	BLOOD	NERVE	BLISTER
BURSTING	150	40	10	25	10
	500	30	5	20	5
	1,000	15	2	15	2
SPRAY	150			45	10
	500			30	5
	1,000			20	2

*Troops in MOPP 1 or 2.
*For troops in MOPP 4, reduce casualty percentages to a negligible level.

TABLE 1-2. Chemical Agent Persistency in Hours on CARC Painted Surfaces.

Temperature		GA/ GF[1]	GB[2,3]	GD[2,3]	HD[1]	VX[2,3]
C°	F°					
-30	-22	*	110.34	436.69	**	***
-20	-4	*	45.26	145.63	**	***
-10	14	*	20.09	54.11	**	***
0	32	*	9.44	22.07	**	***
10	50	1.42	4.70	9.78	12	1776
20	68	0.71	2.45	4.64	6.33	634
30	86	0.33	1.35	2.36	2.8	241
40	104	0.25	0.76	1.25	2	102
50	122	0.25	0.44	0.70	1	44
55	131	0.25	0.34	0.51	1	25

NOTE
1 For grassy terrain multiply the number in the chart by 0.4.
2 For grassy terrain multiply the number in the chart by 1.75.
3 For sandy terrain multiply the number in the chart by 4.5.
* Agent persistency time is less than 1 hour.
** Agent is in a frozen state and will not evaporate or decay.
*** Agent persistency time exceeds 2,000 hours.

contamination detected on M9 Chemical Agent Detection Paper is depicted in Figures 1-2 and 1-3.

Chemical agent persistency data given for surface winds of 10 kmph. For other surfaces use the following multiplication factors for the times given alkyd paint = 1.3, bare soil = 4.0. Agent HL is not shown. To approximate HL use GD persistency times. To convert C° to F°; F° = 1.8C+32. To convert F° to C°; C = (F - 32) ÷ 1.8. All concentrations of contamination is considered to be heavy (10 grams square meter). One week is considered to be 168 hours. One month (30 days) is equal to 720 hours. One year (365 days) is equal to 8640 hours.

The information presented in tables 1-1 and 1-2 provide a quick planning guide for chemical agent persistency. For a more detailed discussion of chemical agent persistency, see FM 3-4, Chapter 3.

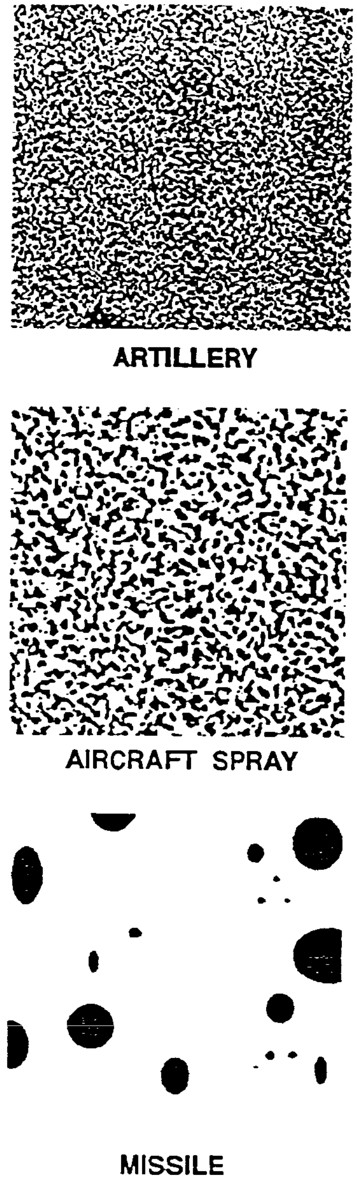

Figure 1-3. Heavy liquid contamination on M9 paper (10 grams/square meter).

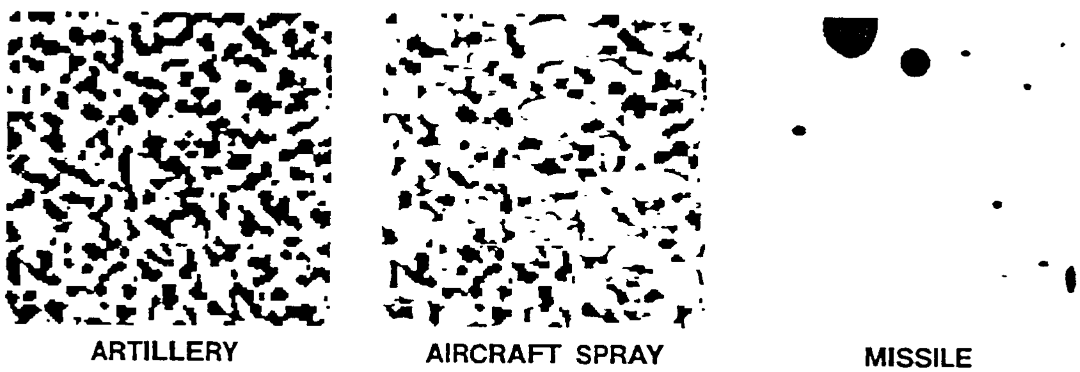

Figure 1-2. Moderate liquid contamination on M9 paper (1 gram/square meter).

Biological Vulnerability Analysis

The effects of biological agents are very unpredictable, unlike nuclear and chemical weapons. Biological agents are effective in low concentrations, and personnel outside the target area may be affected. Vulnerability reduction methods include

- Employ a good immunization program before deployment
- Ensure personnel wear MOPP gear.
- Eat food only from protective wrappers and sealed containers.
- Drink only purified water.
- Report and seek treatment for illness promptly.
- Ensure personnel practise good personnel hygiene.

For a more detailed discussion on biological warfare agents, their properties and effects, refer to Chapter 4.

Vulnerability Reduction

Active measures prevent the enemy from using CB weapons; passive measures increase survivability. Individual and unit collective measures are only discussed briefly here. See FM 3-4 for detailed information.

Active Measures

Active measures are those measures taken to find and destroy either the munitions or the delivery systems. Destruction of delivery systems and munitions is the best method of reducing the chances of being attacked.

The destruction of stockpiles of CB munitions and production facilities is usually beyond the capabilities of lower level commanders. Echelons above corps have the responsibility and sufficient assets for finding and destroying these targets.

Corps and divisions do not have the capability to locate and destroy stockpiles or production facilities; but they do have the capability to find and destroy delivery systems. Recon flights, counterbattery radar, and other intelligence collection assets are used to find delivery systems such as long-range cannons and missile systems.

Passive Measures

It is not possible to destroy all threat CB munitions and/or delivery systems; units must always take precautions to avoid being targeted or to reduce the effects of an attack if one does occur. These are passive measures. All units must use passive measures as part of normal operations to reduce the effects of operating under CB conditions. These measures include—

- Plan ahead.
- Avoid detection.
- Provide warning.
- Maintain discipline.
- Seek protection.
- Disperse.
- Remain mobile.
- Cover supplies and equipment.
- Prevent spread of contamination.
- Follow unit SOPs.
- Camouflage.

Plan Ahead

Tasks may become more complicated in a CB environment due to the degradation of protective equipment. Again, FM 3-4 contains tables to help commanders estimate how long it takes to accomplish missions in an CB environment. Commanders must take time to carefully think out Courses Of Action (COA's) and allow for the additional time requirement. This is commonly referred to as wargaming. A bad decision could cause the unit to become needlessly contaminated or suffer casualties. Use the CB threat status for planning and stocking CB defense/equipment. Units must prepare to continue the mission after an CB attack. Following an enemy CB strike, commanders must quickly assess the damage and reconstitute lost or weakened units.

Avoid Detection

Avoiding detection is the best way to prevent CB attacks. Do this by employing good operational security (OPSEC) measures. These include camouflage, light discipline, and especially, signal security. Both active and passive measures must be used to prevent the enemy from gaining target information. Use defensive electronic warfare (ECM and ECCM) to reduce the chances for identification and location. Once a CB attack is detected or suspected, commanders should consult higher headquarters for guidance if unit displacement is necessary.

Provide Warning

If the unit is unable to avoid CB attacks, early warning of battlefield hazards is very important. The NBC Warning and Reporting System (NBCWRS) notifies units that adjacent units have been attacked or that a downwind hazard is present. Automatic alarms, such as the M8A1, positioned upwind to detect the arrival of an agent cloud may warn of probable attacks. When no NBCWRS warning is received, these alarms let the unit adjust MOPP levels to meet the threat. Troops must be able to identify CB attacks and take appropriate actions. CB recon teams using the NBC Reconnaissance System (NBCRS) alert moving units before they enter contaminated areas.

Maintain Discipline

The unit must maintain discipline and confidence in their ability to survive and operate if they are to overcome the shock of an CB attack and continue the mission. Troops must be conditioned physically and mentally to wear and function in MOPP gear for extended periods of time. Commanders must be able to rely on their troops to wear MOPP gear when required and to remain in MOPP until told to reduce the level. Again, plan ahead. Develop MOPP acclimation plans within the unit. Use these plans whenever possible during unit training. Use the information contained in FM 3-4 to assist in developing a unit acclimation plan.

Seek Protection

Natural terrain may provide shelter from the effects of CB weapons. However, ditches, ravines, and natural depressions allow accumulation of chemical agents. Heavy forests and jungles protect against liquid chemical agents, but vapor hazards will increase.

Foxholes with overhead cover and shelters offer good protection against the explosive and liquid effects of CB weapons. However, any overhead cover such as tents, tarpaulins, and ponchos offer at least some protection from liquid chemical agents. Use NBC protective covers (NBC-PC) whenever possible.

Disperse

Combat service support (CSS) installations and troops in compact assembly areas are vulnerable to CB weapons. Commanders must determine how much dispersion is needed. Dispersion must reduce vulnerability but not hinder operations or prevent the unit from concentrating when necessary. Supplies especially food, POL, and ammunition must be dispersed so they will not all be destroyed at once. The more dispersed a unit is, the longer it will take to do even routine tasks. The degree of acceptable dispersion depends upon mission, enemy, terrain, troops, and time available (METT-T).

Remain Mobile

Tactical mobility gives the commander the best chance for avoidance. Constant movement prevents the enemy from pinpointing locations and accurately employing CB weapons. However, the battlefield will be a difficult place in which to maneuver. Contaminated areas, tree blowdown, urban rubble, fires, flooding, fallout, and craters are obstacles that will have to be dealt with. CB recon teams and the serving S2/G2 can provide useful information. The best source of information on mobility routes, however, is the Movement Control Center (MCC).

Cover Supplies and Equipment

Store supplies and equipment under cover to prevent contamination. Buildings offer excellent protection. NBC protective covers (NBC-PC), tarpaulins, pallets, packing materials, dunnage, and plastic (sheets, bags, and rolls) all can be used. Field expedient covers, especially canvas and cardboard, provide protection from liquid agents for a short period of time. Contamination seeps through all such covers, however, the NBC-PC will provide protection for up to 24 hours. Units must replace the covers as soon as possible after heavy contamination. Canvas will keep out more than 95 percent of liquid contamination if it is removed within 60 minutes after the attack. Although these covers may provide protection against liquid agents, a contact hazard will remain until the agent on the ground and the protective cover has weathered.

Limit Exposure

All plans should include postattack procedures for limiting exposure to CB hazards. The longer a person is exposed to chemical contamination, the greater the chance of becoming a casualty. Only personnel required to accomplish a mission are sent into a contaminated area.

Limit exposure with time. By waiting to enter a contaminated area, the contamination level will usually be reduced and with it the chance of exposure. Exposure can also be accidental. Personnel may not know that equipment is contaminated. Usually, this can be prevented by always marking contaminated equipment. But there are places where CB contamination hazards can accumulate such as in air filters. All engines have air filters which trap CB contaminants. These contaminants accumulate. So even if the hazard area is small, it can be deadly. Persons working around equipment should be aware of hidden hazards. Always dispose of contaminated collectors, such as air filters, as contaminated waste.

Prevent Spread of Contamination

Limit the number of personnel and amount of equipment in the contaminated area. Confine CB contamination to a small area as possible. This begins with monitoring to determine the amount and extent of contamination. Units moving from a contaminated area into a clean area should decontaminate at or near the edge of contamination. Mark all contaminated areas and report them to higher headquarters and adjacent units to prevent them from entering the contaminated area unknowingly.

If the situation permits, contaminated material can be left and allowed to weather. If the equipment is mission essential, it must be decontaminated or brought back to the rear for decontamination.

Decontaminate as far forward as possible. If contaminated material must be moved, the unit runs the risk of transferring contamination to road networks or ground surface which is proportional to the amount of contamination on the material, location of the contamination, type of contamination, and type of surface on which the contamination is present. When moving this equipment:

- Notify the MCC of contaminated vehicles or contaminated routes.
- Use as few transport vehicles as possible.
- Use one route (especially around congested areas).
- Monitor the route periodically for contamination.
- Cover the material to keep contamination from being blown onto the road. (Weigh the risk of ground contamination with additional burden of decontamination/disposing of potentially contaminated covering material).
- Warn personnel downwind if a vapor hazard is present.
- Monitor and decontaminate transport vehicles before transporting noncontaminated material.
- Ensure transport crews wear appropriate MOPP gear.

When contaminated material or waste material must be destroyed, either burn or bury the contaminated material. Agents destroyed by burning produce a vapor hazard. So if material is burned, send a warning to downwind units. Burial is effective for all types of contamination. Mark and avoid the area where contaminated waste is buried. Procedures for marking contaminated waste burial sites is outlined in FM 3-5. This consists of submitting an NBC-5 Chemical Report outlining the contaminated waste burial site. However, this report must be sent by the NBCC so that line item Alpha, (strike serial number) may be assigned. The unit, therefore, that closes the decontamination site, must notify the NBCC.