BY ORDER OF THE SECRETARY OF THE AIR FORCE

AIR FORCE MANUAL 32-4017

1 JUNE 1998

Civil Engineering

CIVIL ENGINEER READINESS TECHNICIAN'S MANUAL FOR NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE

NOTICE: This publication is available digitally on the SAF/AAD WWW site at: http://afpubs.hq.af.mil. If you lack access, contact your Publishing Distribution Office (PDO).

OPR: HQ AFCESA/CEXR (MSgt Steven J. Reed)

Certified by: HQ AFCESA/CEX (Col Randall L. Turner)

Pages: 273

Distribution: F

This manual provides guidance for establishing an installation nuclear, biological, and chemical (NBC) Defense Program. It covers NBC defense policy, national guidance and proliferation of weapons of mass destruction. It also describes processes and provides checklists for pre-, trans-, and post-attack operations in a contaminated NBC environment. This manual provides guidance and direction for the principles of NBC defense outlined in the USAF Chemical and Biological Defense Concept of Operations and also provides a vulnerability assessment tool for commanders, as introduced in AFPAM 32-4019, *Chemical-Biological Warfare Commander's Guide.*

All Civil Engineer Readiness Flights should use this manual as the basis for NBC planning and training. Procedures and checklists outlined in this manual should be tailored to specific installation contingency plans. The reporting requirements in this manual are exempt from licensing in accordance with paragraph 2.11.10 of AFI 37-124, *The Information Collections are Reports Management Program: Controlling Internal Public, and Interagency Air Force Information Collections*. Send commends and suggested improvements to HQ AFCESA/CEX, 139 Barnes Drive, Tyndall AFB, FL 32403-5319.

Chapter 1

INTRODUCTION

1.1. Purpose. This manual is a technical reference and a consolidated source of chemical and biological warfare reference materials in greater depth than is practical for inclusion in Air Force Handbook 32-4014 volume 2, *Chemical and Biological Warfare Defense Hazards Guide*, or Air Force Pamphlet 32-4019 *Chemical, Biological Warfare Commander's Guide.* This manual is primarily intended for use by Civil Engineering Readiness personnel. Joint Publication 3-11, Field Manual (FM) 3-9, and FM 8-285 are the primary source materials for this document. Other sources are cited as used.

1.2. U.S. NBC Warfare Defense Policy. The ultimate goal of U.S. policy is the elimination of NBC weapons. Arms control is directed to these ends and has been deemed to be in the best interest of the U.S. Treaties and agreements are viewed as a means of reducing the NBC threat.

1.2.1. The U.S. has renounced use of chemical and biological weapons (Joint Pub 3-11, 1992) and has eliminated its chemical-biological warfare (CBW) offensive capability. Instead, we rely on conventional and nuclear capability for deterrence. While this policy has been deemed in the overall interest of the US, it nevertheless has a price and raises the possibility of U.S. forces having to operate on an asymmetrical battlefield. The ability to operate effectively in an NBC environment is thus of paramount importance.

1.2.1.1. The impact of chemical-biological (CB) agent use will vary with strike type, size, dissemination effectiveness, attack objective, and agent type. Even small attacks can force personnel into cumbersome protective ensembles, perhaps for significant periods of time, and may require decontamination. Harassment with low intensity CB attacks is a feasible and effective way of reducing operational capabilities with minimal use of resource.

1.2.1.2. There is little doubt that CB attack by missile, aircraft bomb, or high performance aircraft spray would be devastating to unprotected personnel. But there should be no unprotected personnel on an air base, in an aircraft or missile-delivered chemical attack. Doctrine and policy requires donning of protective equipment when incoming missiles or aircraft are detected and properly trained, properly equipped personnel can achieve sufficient protection for all but the most unusual circumstances.

1.3. Nuclear Arms Control. The 1988 Intermediate Range Nuclear Forces (INF) Treaty addresses nuclear arsenal and delivery system reduction. It requires elimination of U.S. and former Soviet ground-launch cruise and ballistic missiles with ranges of 500 to 5,500 km. The elimination of these missiles has been accompanied by an expansion of Third World missile arsenals and by growth of Russian short-range missile capabilities. INF-prohibited SS23 missiles were replaced by still legal 300 km SCUD missiles.

1.3.1. Delivery systems with ranges less than 500 km are not covered by the INF. When equipped with nuclear warheads, these are called Short-Range Nuclear Forces (SNF). The U.S. has proposed an SNF treaty with Russia. But successful negotiation of a U.S./Russian SNF treaty will not eliminate Third World arsenals. U.S. forces still face a very substantial nuclear threat. The delivery systems addressed by the SNF are fully capable of delivering chemical and biological, as well as nuclear weapons.

1.4. Biological Arms Control. The Geneva Protocol of 1925 was an early, imperfect effort to control bacteriological warfare. Most biological warfare programs were established after it was enacted. The U.S. abandoned its biological warfare (BW) program in 1969 and subsequently ratified the 1972 Biological and Toxic Weapons Convention. This Convention outlaws development, production, and stockpiling of bacteriological and toxin weapons. It does not provide for inspection or sanction procedures against violators.

1.5. Chemical Arms Control. The U.S. has long been an advocate of chemical arms control. The Geneva Convention of 1925 bans chemical weapon use but not its development, production, or stockpiling. It is generally interpreted as a prohibition of first-use only. A later U.S. draft treaty banning development, use, transfer, and stockpiling of chemical warfare agent has long served as a basis for negotiations. Effective verification is a critical component of any credible agreement. Unfortunately, effective verification is intrusive and, therefore, is objectionable on constitutional, national security, and industrial espionage grounds. In 1975, the U.S. ratified the 1925 Geneva Protocol with the caveat that the agreement does not apply to any state failing to observe these same provisions.

1.5.1. The U.S. does not consider herbicides and Riot Control Agents (RCAs) to be chemical warfare agents. Even so, the U.S. agrees not to use these agents except in a limited number of well defined circumstances. The President has renounced U.S. use of chemical weapons for any reason, including retaliation, effective when the Chemical Weapons Convention enters into force (statement by the President on Chemical Weapons Initiative, May 13, 1991).

1.6. U.S. National Policy Guidance. It is the intention of U.S. policy to deter nuclear, biological, or chemical weapon use against U.S. and Allied forces through the maintenance of decisive military advantage. The U.S. maintains strategic nuclear forces as a deterrent as well as conventional weapon use with precision. Policy allows use of these weapons to safeguard the basic security interests of the U.S. and its allies. Biological and chemical agents (except herbicides and riot control agents) will not be used by the U.S. for any reason. The U.S. seeks to stem CBW threat proliferation through a worldwide ban on development, production, and stockpiling.

1.7. CBW Defense Background. USAF chemical/biological defense is based on three principles: Avoidance, Protection, and Contamination Control. A variety of actions support these objectives. Elimination of the use of CB weapons is the ultimate U.S. CB defense goal. Treaty initiatives are in constant pursuit of CB weapons elimination. Force projection during conflict can disrupt or eradicate an adversary's CB agent production, storage, and delivery capabilities. This may be undertaken as a means of avoiding or minimizing CB exposure.

1.7.1. Being informed about an adversary's offensive CBW capabilities, intentions, and actions is critical for the rational management of CB defensive responses. Strategic information can come from the Department of State, from satellite imaging, or from Airborne Warning and Control (AWAC) sources. Operational information can be expected from battlespace intelligence, from Service, Joint Command and Coalition sources. Tactical information can come from base detector systems, base control centers, specialized teams, and base personnel.

1.7.2. Effective air base CBW detection and warning systems make optimization of protective responses possible. The better we are able to detect, warn, and protect against CB attacks, the less the impact will be on mission continuation. It is through the effective use of detection and warning systems that we decrease the likely impact of CB weapon use. CB detection and warning requires real-time or near-real-time detection equipment, a reliable warning system and a well trained base populace.

1.7.3. The USAF relies on protective masks, individual protective ensembles, and, where feasible, on collective protection systems for physical protection against CB agent exposures. Adequate training is necessary for effective mask and individual protective equipment (IPE) use. Initial issue of masks and IPE and support of scheduled IPE changes requires informed, coordinated logistics support. Scheduled IPE exchange is necessary for rest, relief, decontamination, and to counter protection limitations of the ensemble. Collective protection requires that facilities be available, stocked, manned, and operations preplanned. Collective protection facilities provide filtered air "shirtsleeve" environments for work (command posts, survival recovery centers, squadron operations, medical facilities) or rest and recovery.

1.7.4. Medical countermeasures to CBW rely on the timely and effective mix of preventive and treatment measures. These countermeasures are intended to reduce mortality, morbidity, or simply to return casualties to active duty more promptly. Most CB agents are more difficult to control and there is neither prophylaxis nor specific therapy for many agents.

1.7.5. Control of exposure to NBC contamination minimizes attack effectiveness. Contamination can be minimized by moving resources under overhead cover or by protecting them with coverings. Area decontamination is impractical unless the affected area is relatively small and is essential to operations. However, contaminated personnel and small asset decontamination (individual, immediate decontamination) can effectively reduce contact hazard. Thorough decontamination will be deferred until resources, manpower, and time are available. **Chapter 7** and 8 provide more information on decontamination operations.

1.7.6. Current NBC defense policy relies on conventional and nuclear force for NBC deterrence. When deterrence fails, U.S. forces may have to fight the war in Mission Oriented Protective Posture (MOPP).

1.8. Base Level Programs. Credible CB defenses are a deterrent to CB attack. Commanders must develop and maintain chemical and biological defense capabilities. Commanders must understand the regional CB threat as thoroughly as intelligence information allows and must understand the capabilities and limitations of available CB countermeasures. The effectiveness of CB defenses will depend, in large measure, on the success of efforts to assure pre-attack use of threat-appropriate medical prophylaxis, early and reliable detection and warning, respiratory protection from contamination onset, and timely medical treatment. The acceptance of near-term compromises in mission execution may be required to assure the adequacy of CB defensive measures. This trade-off can have significant consequences to long-term operational capabilities.

1.8.1. Commanders must assure that all unit personnel have the necessary CB defense training and equipment and that special CB defense functions such as shelter management and contamination control teams are appropriately manned. Personnel must be trained and supplied for self-aid and buddy care. Provisions must be made for unit care of casualties when medical resources are overwhelmed.

1.8.2. Personnel are individually responsible for appropriate use of protective resources (IPE and shelters) when notified, for use of appropriate precautions to avoid or minimize contamination, for use of medical countermeasures when directed, and for recognition and reporting of indications of CB attack.

1.9. NBC Impact on Operations. NBC weapons are capable of profoundly altering the tempo of operations. Introduction of such weapons can disrupt normal personnel and materiel replacement processes and thus hamper component commanders' capabilities for mission continuation and force survivability. The scale of the requirement for reconstitution can be dramatic. Even if personnel are afforded some protection, casualty rates can severely degrade operations and morale.

1.9.1. The use of protective equipment can degrade mission performance especially for personnel. Some functions, such as the use of optical gun sights or the operation of some electronic equipment are difficult, even impossible to execute while in protective ensembles. And the compromise of body heat dissipation which accompanies use of protective ensembles limits physical exertion, alters work/rest cycle time requirements and, in warm environments, can produce heat casualties. The ability of personnel to perform assigned duties can be seriously degraded.

1.10. Sustainment. Maintaining operations in a CB environment will be demanding. AirLand Battle Doctrine cites the following sustainment imperatives:

1.10.1. Anticipation. Sustainment planners must study and anticipate asset requirements as accurately as possible for all likely contingencies.

1.10.2. Integration. Tactical and operational plans must integrate anticipated requirements for NBC defense. Plans must be in place for protection of supplies and equipment. Effects of supply route, supply point, and fixed-site contamination must be anticipated and incorporated into overall planning.

1.10.3. Continuity. Plans must assure optimal use of supplies and services for maintenance of the fighting strength of committed forces. The Combatant Commander must plan for logistics support for joint NBC defense. These plans must address medical, services (including mortuary), supply, transport, and host nation support requirements.

1.10.4. Improvisation. Improvisation is key to response to unforeseen emergencies. Logistics commanders will prioritize to best use available assets to satisfy mission-essential tasking.

1.10.5. During CB attack, and for some time afterwards most air base operations will be conducted in MOPP. In many situations heat stress concerns arise. IPE use always imposes visual and tactile limitations. Operations suffer. Commanders must reduce protective posture whenever possible, establish work/rest cycle use and encourage fluid intake to manage the consequences of heat stress, and assure regular rotation of personnel to collective protection or toxic-free environments for rest and recovery.

1.11. Recovery/Reconstitution. Command authorities will direct recovery efforts. A comprehensive recovery plan, extensive testing, and test validation are vital. Readiness technicians should be assigned to the Survival Recovery Center (SRC) to analyze and recommend CB defensive actions and initiate Nuclear, Biological, Chemical, Warning and Reporting System (NBCWRS) reports. CB recovery should be initiated only at the end of attacks. It can be manpower, time, and materials intensive, but required to sustain operations.

1.11.1. CB agents affect different materials in different ways. **Attachment 2** and **Attachment 3** provide specific agent characteristics for chemical and biological agents. Rely on medical and bioenvironmental personnel in restoration efforts. Some materials can not be decontaminated and will need to be destroyed.

1.11.2. Monitoring for CB contamination must begin as soon after attack as possible. Upon detection and verification of contamination, the Commander must decide whether to sustain operations in place, suspend operations until contamination subsides, or move portions of the operations to another location. This decision will be based on mission demands, the nature and extent of contamination, the estimated duration of contamination, as well as unit readiness.

1.11.3. Losses on an NBC battlefield can be catastrophic. Destroyed or debilitated units, if deemed critical, must be replaced or brought back to operational effectiveness from available assets. Assessment of criticality is essential. Component Commanders must prioritize and utilize available assets. Accordingly, personnel may come from the replacement system, or other less critical organizations. Equipment may come from the supply system, maintenance facilities, or any other available resources.

1.11.4. Unified and Specified Commands are responsible for planning of defense posture requirements for operations in an NBC environment. Plans must be consistent with the anticipated threat. Consult National Intelligence Estimates for assessments of the chemical and biological capabilities of potential adversaries. Commanders of units in or deployable to CB threat areas should task civil engineer, intelligence, medical, security police, and bioenvironmental staffs to plan CB defense responses. Plans should define local responsibilities and procedures. A CB assessment team should be established. The team should advise the commander on CB threat to the current and to possible future deployment sites. They will recommend precautions, including predeployment immunoprophylaxis, to be taken. Commanders in areas subject to CB threat must assure that their forces are appropriately equipped and trained. Civil engineer staff will provide general and specialized NBC defense training for base populace, shelter management and contamination control. They will identify IPE, collective protection, and detector requirements. Medical staffs will train self-help and buddy-care trainers and will identify sampling, analysis, and immunoprophylaxis requirements. Plans must address predeployment, deployment, and employment phases of operations. For more detail see USAF Concept of Operations for Chemical and Biological Defense 1997. Finally, unit CB defense plans will define detector and sampler locations, sampling and analysis schedules, shelter designation, rest area designation, asset protection and covering, and Nuclear, Biological, and Chemical Warning and Reporting System (NBCWRS) management. Implementation of this plan, deployment of detectors and samplers, initiation of MOPP use, and initiation of decontamination are unit commander responsibilities.

1.11.5. Unified and Specified Commands are responsible for:

1.11.5.1. Implementation of nuclear detonation detection and reporting processes.

1.11.5.2. Implementation of radiation monitoring.

1.11.5.3. Implementation of chemical and biological reporting processes.

1.11.5.4. Planning of procedures to verify enemy use of chemical/biological warfare.

1.11.5.5. Planning of support measures to augment NBC defense operations by allied forces.

1.11.5.6. Acquisition and reporting of foreign information and intelligence on NBC activities.

1.11.5.7. Planning of primary and alternative means of communications and procedures for use during and immediately after CB attack.

1.11.5.8. Plans for conduct of NBC defense in accordance with Combatant Commander plans and directives.

1.11.5.9. Insuring adequate NBC defense for component forces.

1.11.5.10. Informing the Chairman, Joint Chiefs of Staff, and component commands of any inability to support the plans and requirements of unified and specified commands.

1.11.6. Plans are to include the following elements listed in **Table 1.1.**

Table 1.1. Recovery/Reconstitution Planning Factors.

Rules of Engagement
Requirements for individual and collective protection
Provisions for issuance of protective ensembles
Medical requirements
Transport requirements
Escort requirements
Decontamination requirements
Shelter requirements
Guidance for civilians and dependents

Chapter 2

NBC PROLIFERATION

2.1. The Regional Proliferation Challenge. The May 1997 Report of the Quadrennial Defense Review (QDR) concluded that the threat or use of nuclear, biological, or chemical (NBC) weapons is a likely condition of future warfare and could occur in the early stages of war to disrupt U.S. operations and logistics. These weapons may be delivered by ballistic missiles, cruise missiles, aircraft, special operations forces, or other means. In many of the world's regions where the United States is likely to deploy forces-including Northeast Asia and the Middle East—potential adversaries have chemical and/or biological weapons and the missile systems to deliver them, and are either passively or actively seeking nuclear weapons. Potential adversaries may seek to counter American conventional military superiority using less expensive and more attainable, asymmetrical means, including NBC weapons. To meet this challenge, as well as the possibility that NBC weapons might also be used in some smaller-scale contingencies, U.S. forces must be properly trained and equipped to operate effectively and decisively in the face of NBC attacks. This chapter details the proliferation of NBC weapons and the threat it poses to U.S. interests and forces.

2.2. Northeast Asia. The strategic significance of Northeast Asia continues to grow. U.S. ties to Asian allies and friends span the range of security, economics, culture, and politics.

2.2.1. The United States continues to seek a stable and economically prosperous region. Strong bilateral relations with friends and allies, particularly Japan and South Korea, are the foundation of U.S. efforts to encourage regional stability. Central to this goal are the approximately 100,000 soldiers, sailors, Marines, and airmen present in the region who reassure U.S. allies, deter aggression, and enhance stability.

2.2.2. China, a nuclear weapons state since 1964, remains a source of concern because of the role Chinese companies continue to play in supplying a wide range of dual-use materials, equipment, and technologies that contribute to indigenous missile and chemical weapon programs in some countries of proliferation concern. China's influence is of critical importance in this region. Beijing has signaled some willingness to adopt a more responsible supply policy by adhering to international nonproliferation norms like the Nuclear Non-Proliferation Treaty (NPT), by ratifying the Chemical Weapons Convention (CWC), and by reaffirming to the United States its pledge to abide by the basic terms of the Missile Technology Control Regime (MTCR) regarding ballistic missile sales. However, the continued willingness of Chinese firms to engage in nuclear, chemical, and missile cooperation with countries of serious proliferation concern, such as Pakistan and Iran, presents security concerns in many regions where the United States has national interests at stake. China will continue to take actions that will advance its status as an international power. China's current actions indicate that it will gradually improve its NBC weapon and missile capabilities. While it will support nonproliferation regimes publicly, China is most likely to take concrete steps in support of arms control regimes only when such steps serve its overall larger interests.

2.2.3. In Northeast Asia, North Korea and China have substantial NBC weapons and missile capabilities. Should there be a conflict on the Korean peninsula, U.S. and allied forces must be prepared to defend against North Korean use of chemical weapons and ballistic missiles. The potential for China's use of ballistic missiles, should a regional conflict occur involving China, also is a particular concern.

2.2.4. Although the October 1994 Agreed Framework with North Korea over its nuclear facilities mitigated the immediate nuclear threat, North Korea still possesses an unreasonably large conventional force, as well as militarily significant chemical weapons and the means to deliver them. Proliferation, particularly the broad-based NBC weapons and missile programs that North Korea has implemented, poses a significant challenge to U.S. security interests, as well as to those of U.S. allies and friends.

2.2.5. In the event of another war on the Korean peninsula, NBC weapons present a significant threat to U.S. forces and the security of U.S. allies. Should a conflict occur, North Korea would likely try to consolidate and control strategic areas of South Korea by striking quickly and attempting to destroy allied defenses before the United States can provide adequate reinforcements. North Korea would most likely attempt to accomplish this with its large conventional force and its chemical weapons and ballistic missiles.

2.2.6. North Korea's Nuclear Program. Since the 1950s, Pyongyang's defense programs have been aimed at developing a strong military force designed to preserve its regime, provide political leverage, and reunify the peninsula. The development of its NBC weapon and ballistic missile capabilities is viewed by North Korea as an important means of augmenting its large conventional land forces in the event of a conflict on the peninsula.

2.2.6.1. North Korea is abiding by its provisions of the October 1994 Agreed Framework. As a result of the 1994 Agreed Framework, key facilities at North Korea's Yongbyon nuclear complex either were shut down or construction was halted, although it is believed that the North previously produced enough plutonium for at least one weapon. Nevertheless, it retains key technology and expertise to restart its effort, should it decide to do so. The North also retains chemical warfare and ballistic missile capabilities, which it could employ against both military and civilian targets if war were to break out on the peninsula.

2.2.6.2. North Korea's economic situation has continued to decline for the last five years. This situation has severely limited Pyongyang's ability to support both the military and civilian sectors of the economy. Shortages, especially food, have been common in recent years. On several occasions, the North has requested and received emergency relief from the international community. Nevertheless, North Korea continues to invest scarce resources in developing and maintaining its military forces, including its chemical and biological warfare and missile programs. See Table 2.1.

Table 2.1. North Korea: NBC Weapons and Missile Program.

Nuclear	Signed the 1994 Agreed Framework, freezing nuclear weapons material production at Yongbyon complex. Produced enough plutonium prior to 1994 agreement for at least one nuclear weapon. Ratified the Nuclear Non-Proliferation Treaty; later declared it has a special status. This status is not recognized by the United States or the United Nations. Has not signed the Comprehensive Test Ban Treaty
Chemical	Produces and is capable of using wide variety of agents and delivery means, which could be employed against U.S. and allied forces. Has not signed the Chemical Weapons Convention.

Biological	Pursued biological warfare research and development for many years. Possesses biotechnical infrastructure capable of supporting limited biological warfare effort. Ratified the Biological and Toxin Weapons Convention.
Ballistic Missiles	Produces and is capable of using SCUD B and SCUD C missiles. Developed the No Dong Missile (approximately 1,000 kilometers). Developing longer range missiles: - Taepo Dong 1 (more than 1,500 kilometers) and - Taepo Dong 2 (4,000-6,000 kilometers). Not a member of the Missile Technology Control Regime.
Other Means of Delivery Available	Land- and sea-launched anti-ship cruise missiles; none have NBC warheads. Aircraft (fighters, bombers, helicopters). Ground systems (artillery, rocket launchers, mortars, sprayers).

2.2.7. North Korea's Chemical Program. Today North Korea is believed to have a sizable stockpile of chemical weapons. In keeping with Pyongyang's self-reliant philosophy, it has achieved the capability to manufacture large quantities of nerve, blister, choking, and blood agents. As a result of this effort, chemical weapons may have become an integral part of North Korea's warfighting strategy.

2.2.7.1. In any attack on the South, North Korea could use its arsenal of chemical weapons to attack U.S. or allied forces deployed along the demilitarized zone (DMZ), as well as to try to isolate the peninsula from strategic reinforcements by attacking ports and airfields deeper inside South Korea. The North could use a variety of means to deliver chemical agents, including domestically produced artillery, multiple rocket launchers, mortars, aerial bombs, and ballistic missiles.

2.2.7.2. North Korea's huge military, as well as its civilian population, is prepared for operations in a contaminated environment. Many troops are equipped with chemical protective gear, including masks, suits, detectors, and decontamination systems. North Korean forces regularly train for operations in chemically contaminated environments. Additionally, North Korean civilians conduct regular chemical warfare drills; the civilian population is required to store and maintain chemical warfare protective equipment at home.

2.2.8. North Korea's Biological Program. North Korean resources, including a biotechnical infrastructure, are sufficient to support production of limited quantities of infectious biological warfare agents, toxins, and possibly crude biological weapons. North Korea has a wide variety of means available for military delivery of biological warfare agents. North Korea has ratified the Biological and Toxin Weapons Convention (BWC).

2.2.9. North Korea's Ballistic Missiles. North Korea produces two variants of the former Soviet Union's SCUD SRBM, the SCUD B and SCUD C. North Korea has hundreds of SCUDs in its inventory and available for use by its missile forces. It also has developed the No Dong medium range ballistic missile (MRBM), based on SCUD technology, likely for its own use as well as for export. North Korea has two additional ballistic missile systems in the early stages of development, the Taepo Dong 1 and Taepo Dong 2. **Figure 2.1.** illustrates the estimated ranges of North Korea's ballistic missiles. North Korea has several types of short range land- and sea-launched anti-ship cruise missiles. In the past, North Korea has produced two versions of cruise missiles based on Soviet and Chinese designs; these have ranges of about 100 kilometers. North Korea also has a variety of fighters, bombers, helicopters, artillery, rockets, mortars, and sprayers available as potential means of delivery for NBC weapons.

2.2.10. North Korea maintains a large army, threatening South Korea and U.S. military forces positioned there. The basic goal of North Korea's offensive strategy is to consolidate and quickly control strategic areas of the South and destroy the allied defense before the United States can provide significant military reinforcement. North Korea could use chemical weapons and ballistic missiles, and possibly biological weapons, to support this strategy. North Korea's NBC weapons and missiles also threaten Japan, and North Korea has declared publicly its intentions to target U.S. facilities in Japan to disrupt the resupply of South Korea. Pyongyang's policy of supplying rogue states with ballistic missiles and related technology remains a factor in the advancement of several Middle Eastern missile production programs. As the North develops even longer range missiles and improves its chemical warfare capabilities, the potential exists for additional North Korea exports.

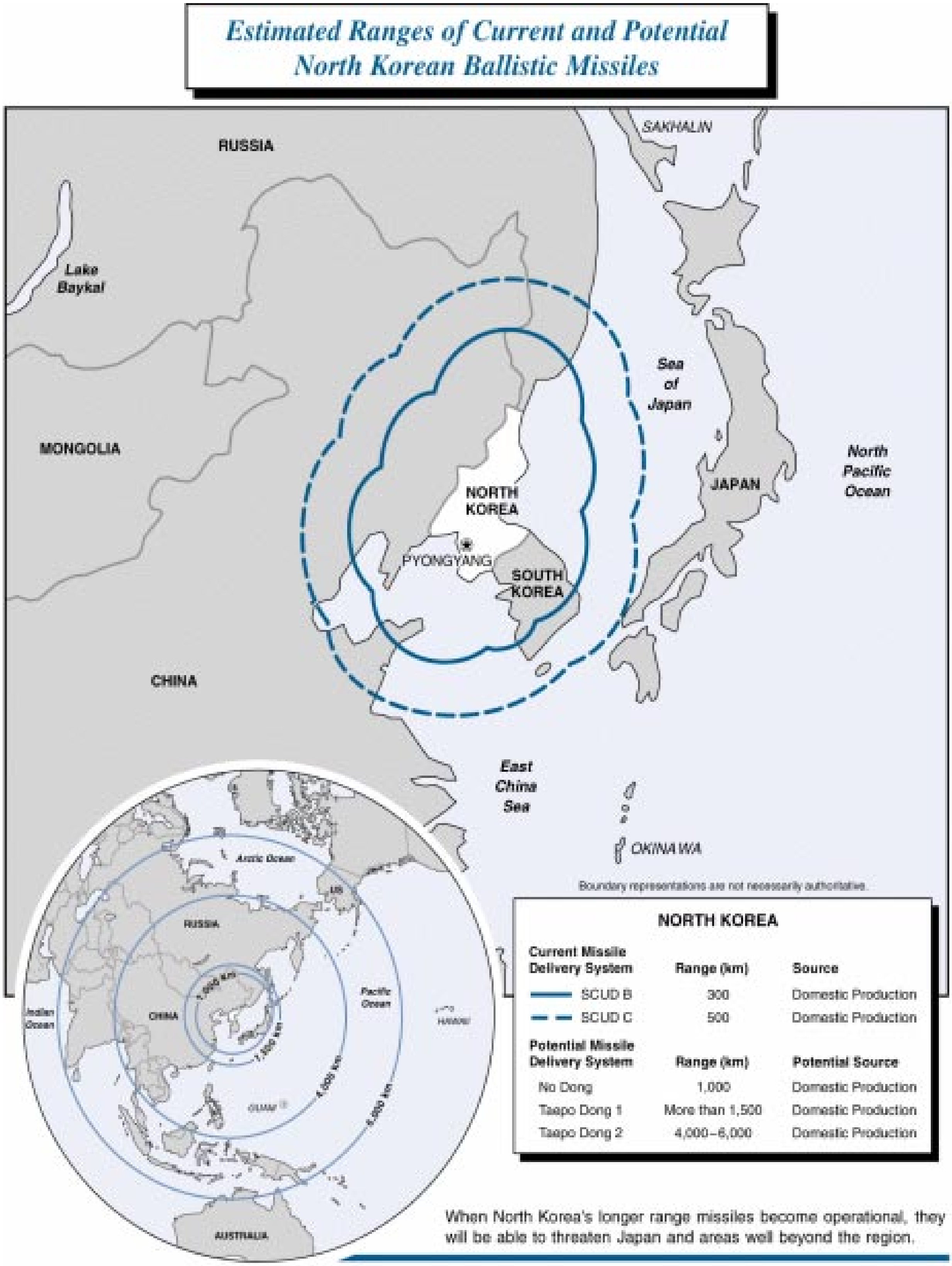
2.3. The Middle East and North Africa. U.S. goals in the Middle East and North Africa include securing a just, lasting, and comprehensive peace between Israel and all Arab parties; maintaining a steadfast commitment to Israel's security and well-being; building and maintaining security arrangements that assure the stability of the Gulf petroleum reserves; combating terrorism; ensuring fair access for American business to commercial opportunities in the region; and promoting more open political and economic systems and respect for human rights and the rule of law. In this volatile region, the proliferation of NBC weapons and the means to deliver them poses a significant challenge to the ability of the United States to achieve these goals. The Middle East and North Africa have the highest concentration of emerging NBC weapons and missile programs of any region in the world. This region also has a long history of conflict based on territorial disputes as well as ethnic, cultural, and religious rivalries. While intense negotiating efforts over the past two decades have resulted in a number of positive steps toward a comprehensive peace settlement of the Arab-Israeli dispute, at the present time virtually every major power in the region retains at least one of these dangerous programs.

2.3.1. Iran, Iraq, Libya, and Syria, which are aggressively seeking NBC weapons and increased missile capabilities, constitute the most pressing threats to regional stability.

2.3.1.1. Iran is actively attempting to acquire or produce a full range of NBC weapons and missiles. The United States believes Iran is committed to acquiring nuclear weapons, either through indigenous development or by covertly acquiring enough fissile material to produce them. During its eight-year war with Iraq, Tehran initiated biological and chemical warfare programs, the latter in direct response to Iraq's use of chemical weapons. In addition, Iran is expanding its ballistic missile programs.

2.3.1.2. Iraq has long had NBC weapons and missile efforts. The challenges these weapons pose in time of conflict became clear during the Gulf War, when U.S. and allied forces had to deal with real and potential complications posed by Iraq's arsenal of NBC weapons and missiles. Iraq entered the Gulf War with a known chemical warfare capability and a demonstrated willingness to use it (Iraq used chemical weapons against Iranian troops and its Kurdish population during the 1980s); a known biological warfare capability; and a developing, complex nuclear weapons program despite intense nonproliferation and export control efforts by the United States and the international community. Iran and Iraq probably regard NBC weapons and missiles as necessary to support their political and military objectives.

Figure 2.1. North Korean Ballistic Missile Ranges.



2.3.1.3. Libya remains a significant proliferation concern. Libyan leader Muammar Qadhafi has shown that he is willing and capable of using chemical weapons and missiles against his enemies. Although Libya's capabilities to use chemical agents and missiles are limited, Qadhafi could provide these weapons to states or terrorist groups he supports and that support him in return.

2.3.1.4. Syria possesses a substantial force of ballistic missiles capable of reaching targets throughout Israel and has an active chemical weapons program. Syria views Israel as its primary external threat and sees its chemical weapons and ballistic missiles as means to counter Israel's conventional superiority.

2.3.2. Iran's Objectives, Strategies, and Resources. Iran remains hostile to the ongoing Middle East peace process and supports the use of terrorism as an element of policy. Within the framework of its national goals, Iran continues to give high priority to expanding its NBC weapons and missile programs. Iran perceives that it is located in a volatile and dangerous region, virtually surrounded by potential military threats or unstable neighbors. These include the Iraqi government of Saddam Hussein, Israel, U.S. security agreements with the Gulf Cooperation Council (GCC) states and accompanying U.S. military presence in the Gulf, and instability in Afghanistan and the Central Asian states of the former Soviet Union.

2.3.2.1. Iran's Nuclear Program. Iran is trying to acquire fissile material to support development of nuclear weapons and has set up an elaborate system of military and civilian organizations to support its effort. Barring outright acquisition of a nuclear weapon from a foreign source, Iran could pursue several other avenues for weapon development. The shortest route, depending on weapon design, could be to purchase or steal fissile material. However, Iran does not yet have the necessary infrastructure to support a nuclear weapons program, although is actively negotiating for purchase of technologies and whole facilities to support all of the above strategies.

2.3.2.2. Iran's Chemical Program. Iran has had a chemical weapons production program since early in the Iran-Iraq war. It used chemical agents to respond to Iraqi chemical attacks on several occasions during that war. Since the early 1990s, it has put a high priority on its chemical weapons program because of its inability to respond in kind to Iraq's chemical attacks and the discovery of substantial Iraqi efforts with advanced agents, such as the highly persistent nerve agent VX. Iran ratified the CWC, under which it will be obligated to eliminate its chemical program over a period of years. Nevertheless, it continues to upgrade and expand its chemical warfare production infrastructure and munitions arsenal.

2.3.2.3. Iran's Biological Program. Iran's biological warfare program began during the Iran-Iraq war. The pace of the program probably has increased because of the 1995 revelations about the scale of Iraqi efforts prior to the Gulf War. The relative low cost of developing these weapons may be another motivating factor. Although this program is in the research and development stage, the Iranians have considerable expertise with pharmaceuticals, as well as the commercial and military infrastructure needed to produce basic biological warfare agents. Iran also can make some of the hardware needed to manufacture agents. Therefore, while only small quantities of usable agent may exist now, within 10 years, Iran's military forces may be able to deliver biological agents effectively. Iran has ratified the BWC.

2.3.2.4. Iran's Ballistic Missiles. Iran has an ambitious missile program, with SCUD B, SCUD C, and CSS-8 (a Chinese surface-to-surface missile derived from a surface-to-air missile) missiles in its inventory. Iran's missiles allow it to strike a wide variety of key economic and military targets in several neighboring countries, including Turkey, Saudi Arabia, and the other Gulf states. (See **Figure 2.2.**) Possible targets include oil installations, airfields, and ports, as well as U.S. military deployment areas in the region. All of Iran's missiles are on mobile launchers, which enhance their survivability. Should Iran succeed in acquiring or developing a longer range missile like the North Korean No Dong, it could threaten an even broader area, including much of Israel.

2.3.2.5. Iran has purchased land, sea, and air-launched short range cruise missiles from China; it also has a variety of foreign-made air-launched short range tactical missiles. Many of these systems are deployed as anti-ship weapons in or near the Gulf. Iran also has a variety of Western and Soviet-made fighter aircraft, artillery, and rockets available as potential means of delivery for NBC weapons.

2.3.3. Iraq's Objectives, Strategies, and Resources. Saddam Hussein appears to retain the same national objectives as prior to his defeat in the Gulf War. These include establishing Iraq as the leading Arab political and military power and as the dominant power in the Gulf region. However, Iraq's ability to achieve its goals is limited by a weak economy and continuing UN sanctions.

2.3.3.1. UN Security Council Resolution (UNSCR) 687, in force since 1991, calls for Iraq to eliminate its NBC weapons and missiles and forbids it from developing, producing, or possessing any NBC weapons or missiles with ranges greater than 150 kilometers. However, Saddam Hussein's government endeavors to conceal and protect these weapons and related equipment, technology, or documentation from UN Special Commission on Iraq (UNSCOM) inspections and monitoring.

2.3.3.2. In addition to Iraqi noncompliance with UNSCR 687, other activities during the last several years show that Iraq has expended considerable resources rebuilding, and in some cases expanding, facilities previously dedicated to its chemical and biological weapon or missile programs. In addition, Iraq is believed to retain documentation, some equipment, and substantial expertise to provide a basis for renewed efforts. Iraq has also continued covert procurement efforts, attempting to acquire a variety of technologies prohibited under UN resolutions. All these actions indicate Iraq's clear intent to rebuild its NBC weapons and missile programs, should UN sanctions and monitoring end or be substantially reduced. See **Table 2.2.**

2.3.3.3. Iraq's Nuclear Program. Iraq's nuclear weapons program suffered a very significant setback both from the Gulf War bombing of nuclear-related facilities and the International Atomic Energy Agency (IAEA) monitoring since the war. All fissile material was removed from Iraq by the IAEA, but considerable expertise (scientists and technicians) and possibly some documentation and infrastructure, survived. Disclosures in 1991 revealed that Iraq had explored virtually all the viable uranium enrichment techniques; 1995 disclosures revealed a crash program to build a weapon, which was curtailed by the war.

Figure 2.2. Iranian Ballistic Missile Ranges.

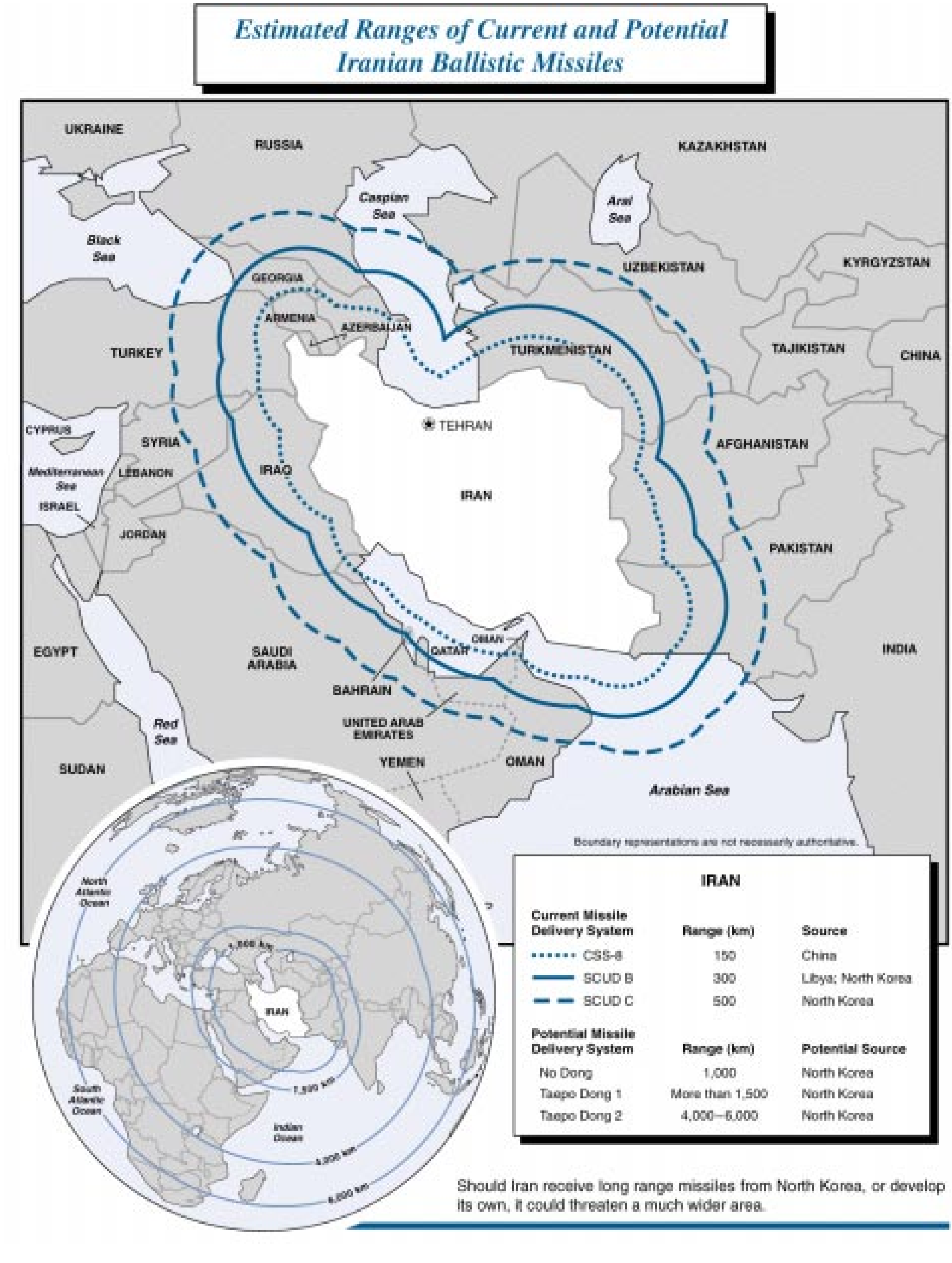


Table 2.2. Iraq's NBC Weapons and Missile Programs.

Nuclear	Suffered considerable damage from Coalition bombing and (International Atomic Energy Agency) IAEA monitoring; all fissile material removed. Retains considerable expertise (scientists); possibly hidden some documentation, infrastructure. Could manufacture fissile material for nuclear device in 5 or more years, if sanctions were lifted, or substantially reduced, and considerable foreign assistance provided. Ratified the Nuclear Non-Proliferation Treaty; has not signed the Comprehensive Test Ban Treaty.
Chemical	Suffered considerable damage from Coalition bombing and UNSCOM destruction. Probably has hidden precursor chemicals, agents, munitions, documentation for future effort; has rebuilt key portions of production facilities for commercial use. Could restart agent production and have small usable stockpile in several months, if sanctions and monitoring were lifted or substantially reduced. Has not signed the Chemical Weapons Convention.
Biological	Prior to Operation Desert Storm, had largest and most advanced program in Middle East. Despite Coalition bombing, UNSCOM destruction, and UN sanctions and monitoring, Iraq may retain elements of its old program, including some missile warheads. Could restart some limited agent production quickly, if sanctions and monitoring were lifted or substantially reduced. Ratified the Biological and Toxin Weapons Convention.
Ballistic Missiles	Suffered considerable damage from Coalition bombing and UNSCOM destruction. Allowed to maintain 150-kilometer missile program (Ababil) under UNSCR 687; likely using this effort to support future long range missile effort. Continues to conceal a number of SCUD missiles and launchers. Could restart limited missile production within one year, if sanctions and monitoring were lifted or substantially reduced. Not a member of the Missile Technology Control Regime.
Other Means of Delivery Available	Land-launched anti-ship cruise missiles; air-launched tactical missiles; none have NBC warheads; stockpile likely is very limited. Aircraft (fighters, helicopters). Ground systems (artillery, rockets).

2.3.3.4. Iraq's Chemical Program. The Iraqis had a wide variety of chemical warfare agents available before the Gulf War, including blister (mustard) and nerve (tabun and sarin) agents, as well as several means of delivery, including artillery, rockets, mortars, spray tanks, aerial bombs and SCUD-type missiles. Although Iraq's chemical warfare program suffered extensive damage from Coalition bombing during the Gulf War and from UNSCOM destruction and monitoring activities after the war, Iraq retains a limited ability to reconstitute its chemical warfare program. Equally important, Iraq retains the technical knowledge to reconstitute and improve the chemical warfare capability it had prior to the Gulf War. Information revealed that Iraq had:

2.3.3.4.1. A program to develop the nerve agent VX begun in May 1985 and continued without interruption until December 1990.

2.3.3.4.2. Production of large amounts of precursors sufficient to produce 400 tons of VX per year.

2.3.3.4.3. Development of a binary sarin-filled artillery round, as well as rockets and aerial bombs in quantities well beyond prototype level.

2.3.3.4.4. Testing of an Al Hussein variant of the SCUD missile with a chemical warhead and a range of 600-650 km.

2.3.3.5. Iraq's Biological Program. During the 1980s, Iraq developed the largest and most advanced biological warfare program in the Middle East. A variety of biological agents were studied, including bacteria, viruses, and fungal toxins. Anthrax, botulinum, and aflatoxin were declared to be weaponized.

2.3.3.5.1. Iraq claims that all biological agents and munitions were unilaterally destroyed after the Gulf War. However, Iraq's record of misrepresentation and the lack of documentation to support these claims leave the status of Iraqi biological warfare stockpile in doubt.

2.3.3.5.2. Iraq may still retain some biological agents and weapons. It also has a number of medical, veterinary, and university facilities where biotechnical research and development can be carried out.

2.3.3.6. Iraq's Ballistic Missiles. Like its other programs, Iraq's ballistic missile efforts suffered severe damage from Coalition bombing during the Gulf War and from destruction activity by UN inspectors after the war. However, Iraq has rebuilt substantial portions of its missile production infrastructure.

2.3.3.6.1. The 1995 disclosures revealed a much broader and more sophisticated missile effort, raising serious questions about the number of missiles and missile launchers Iraq had hidden but claimed it had destroyed.

2.3.3.6.2. Despite sanctions, Iraq continues to seize any opportunity to advance its missile program. It is clear from its actions that Iraq fully intends to reestablish and broaden its ballistic missile program should UN sanctions and monitoring end or be substantially reduced. Iraq could start initial production efforts within one year.

2.3.4. As the states of the Middle East and North Africa continue to make progress toward an independent production capability for NBC weapons and missiles, they will become less susceptible to efforts to stem proliferation. Further, as their capabilities to employ the weapons improve, some countries may be more willing to use them in a conflict, especially since the threshold for chemical weapons and ballistic missile use has been crossed in recent years. Should conflict again occur in this region, particularly in the Gulf area, use of some form of NBC weapons or missiles seems likely.

2.4. South Asia. The United States seeks to persuade India and Pakistan to exercise restraint in their nuclear and missile programs and to bring their programs into conformity with international standards. The consequences of a nuclear war between India and Pakistan would be catastrophic, both in terms of the loss of life and in lowering the threshold for nuclear use in other parts of the world, particularly the adjacent Middle East/North Africa region. In addition to the immediate risks to regional security, the development of NBC weapons in South Asia has the potential to undercut broader U.S. and international nonproliferation objectives. Both India and Pakistan, for different reasons, have refused to sign the NPT.

Their nuclear programs, outside of this widely accepted international norm, serve as dangerous examples for nations in other regions.

2.5. Russia, Ukraine, Kazakhstan, and Belarus. The United States has a tremendous stake both in the democratization and reform of Russia, Ukraine, and the other New Independent States (NIS) and in the further normalization of U.S. relations with NIS governments, militaries, and other institutions. Given the Soviet weapons arsenal legacy, these states are key to ensuring that the security environment remains favorable and stable.

2.5.1. The steady decline in the number of operational strategic nuclear warheads and delivery systems over the last five years is a strong indication of the adherence of Russia, Ukraine, Kazakhstan, and Belarus to arms control regimes. All states are meeting their commitments regarding strategic weapons and delivery systems. At the same time, however, the threat of possible diversion of nuclear material, some from the very weapons that have been deactivated, remains a serious security challenge.

2.5.2. The possible continued presence of large chemical and biological warfare programs remains a serious concern.

2.6. USSOUTHCOM. The area of responsibility (AOR) controlled by U.S. Southern Command (USSOUTHCOM) is free from proliferants and WMD. The most probable way that WMD proliferation could be introduced into this region in the near term is through the efforts of criminal groups.

2.7. USACOM. Like USSOUTHCOM, the WMD proliferation threat in the U.S. Atlantic Command (USACOM) is virtually nonexistent.

2.8. The Transnational Threat. Transnational proliferation includes those NBC threats that cross national or regional boundaries or are not otherwise easily categorized. Threats from terrorism and the lack of security of nuclear material in the states of the former Soviet Union are two issues that greatly concern the United States and its allies.

2.8.1. Terrorism. Many of the technologies associated with the development of NBC weapons, especially chemical and biological agents, have legitimate civil applications and are classified as dual-use. The increased availability of these technologies, coupled with the relative ease of producing chemical or biological agents, has increased concern that use of chemical or biological weapons may become more attractive to terrorist groups intent on causing panic or inflicting large numbers of casualties. In addition, the proliferation of such weapons raises the possibility that some states or entities within these states could provide chemical, biological, or radiological weapons to terrorists.

2.8.1.1. The likelihood of a state sponsor providing such a weapon to a terrorist group is believed to be low. It is possible, however, that groups, especially extremist groups with no ties to a particular state, could acquire and attempt to use such weapons in the future. The March 1995 attack on the Tokyo subway by the religious group Aum Shinrikyo using the nerve agent sarin was the most glaring example of terrorist use of these kinds of weapons. This attack crossed a psychological boundary and showed that the use of NBC weapons was no longer restricted to the traditional battlefield.

2.8.1.2. As a result of the Tokyo subway attack, government authorities became concerned about the potential use of NBC agents by non-state groups and have placed such groups under increased scrutiny. However, this increased scrutiny is no guarantee of thwarting a potential terrorist attack.

2.8.2. Security for nuclear materials is a major proliferation problem, particularly in Russia. The Russians have made substantial efforts to consolidate and secure nuclear weapons. A similar effort in cooperation with the United States to secure Russia's vast quantities of nuclear materials has made substantial progress, although it is far from complete.

2.8.2.1. The combination of lax security at some nuclear facilities, poor economic conditions in Russia and other states of the former Soviet Union, and the continuing presence of organized criminal groups has increased the potential for theft or smuggling of this material.

2.8.2.2. Nevertheless, the trend is dangerous and likely will continue because of the deteriorating economic conditions in the former Soviet Union and the associated poor security at various nuclear facilities.

2.8.2.3. In the longer term, U.S. and Russian efforts to improve security procedures, such as instituting material protection, control, and accountability procedures, will help reduce the diversion of nuclear materials. Concerns about inadequate security are not confined to nuclear materials. This could also be the case for facilities in the former Soviet Union that house chemical or biological warfare-related materials.

2.9. Proliferation Potential. The potential for the proliferation of nuclear, biological, and chemical (NBC) weapons is widespread. Any state with nuclear reactors has the technological resources needed to produce radiological weapons or to start a nuclear weapons program. For chemical and biological weapons in particular, the potential for proliferation is almost unlimited. Any state with a basic chemical, petrochemical, pharmaceutical, biotechnological, or related industry can produce basic chemical or biological agents.

2.10. Risks Associated With Possession or Use of NBC Weapons. The deployment or use of NBC weapons by a proliferant entails significant strategic risks and costs, particularly in confrontations or conflicts in which opponents have capable conventional forces. A proliferant nation is likely to disperse both the locations of the production facilities and the weapons deployment. This will increase the logistics strain on the proliferant, but also will make targeting of these sites more difficult.

2.10.1. Significant collateral hazards can result if NBC production and storage facilities are attacked with conventional weapons. The spillover effects produced by the NBC targets can be much more dangerous than those induced by the conventional weapons involved in such an attack.

2.10.2. NBC weapons use can involve significant risks to a proliferant's own forces and population. For example, dispersal of some NBC hazards depends heavily on meteorological conditions that can vary unpredictably over time, and partly on other conditions that cannot be controlled.

2.10.3. Notwithstanding the significant risks associated with possession or use of NBC weapons, situations may occur during a regional contingency in which a proliferant considers using such weapons against U.S., allied, or coalition forces and facilities.

2.11. Department of Defense Response to Proliferation. The United States leads international efforts to develop and sustain global norms against the proliferation of nuclear, biological, or chemical (NBC) weapons and their delivery means (NBC/M), often referred to as weapons of mass destruction (WMD). It actively engages in dialogues with states around the world to persuade them not to acquire these NBC weapons capabilities or to eliminate capabilities already developed. The United States also works with states to combat proliferation by assisting them in gaining and assuring greater control over sensitive dual-use equipment and technology.

2.11.1. The Gulf War experience showed the implications of NBC proliferation for defense planning. As noted in the 1997 National Security Strategy, the United States must plan and prepare to fight and win under conditions where an adversary may use unconventional approaches that avoid U.S. strengths while exploiting U.S. vulnerabilities. Because of U.S. conventional military dominance, adversaries who might challenge the United States are likely to do so using unconventional means, including NBC weapons. As a result, DoD must continue to prepare for the potential NBC dimension of future conflicts. U.S. forces must be trained and equipped for all potential missions, including those in which opponents might use or threaten to use NBC weapons.

2.11.2. Effective deterrence will depend on a range of nuclear and conventional response capabilities, as well as active and passive defenses and supporting command, control, communications, and intelligence. In particular, military preparations for operations in an NBC environment will make clear that threats or use of NBC weapons will not deter the United States from applying military power in defense of its national interests. The United States will be prepared to fight and win under conditions where an adversary may use asymmetric means, thereby demonstrating to any potential aggressor that the risks incurred from using NBC weapons would far outweigh any advantages gained.

2.11.3. DoD's response to proliferation takes three forms: international proliferation prevention; protection of U.S. civilians and military forces if faced with the threat or use of NBC weapons; and counterforce capability to eliminate NBC targets.

2.11.3.1. Prevention. Proliferation prevention is the United States' primary objective. DoD's contributions are part of a coordinated national and international effort involving many U.S. government departments and agencies, allied nations, and international organizations.

2.11.3.2. Protection. DoD recognizes that a country determined to obtain NBC weapons and their delivery systems, and willing to violate global nonproliferation norms, might succeed despite the strongest prevention efforts. Because experience has shown that countries armed with NBC weapons can use these weapons to challenge U.S. security interests, U.S. forces must be fully prepared to deal with the military threats posed by NBC proliferation. Protection against chemical and biological agents must provide an effective defense against the complete spectrum of new or novel agents in gaseous, liquid, or solid aerosolized form that may be produced or acquired by potential enemies. This would include any agents that circumvent the provisions of the Chemical Weapons Convention.

2.11.3.3. Counterforce. The combat air forces have issued a standing mission need statement, in response to urgent warfighting CINC requirements, to detect, characterize, and defeat NBC/M facilities with minimal collateral effects. U.S. forces must be able to interdict an adversary's biological and chemical capability during each stage of the agent's employment. Counterforce operations include (but are not limited to) attacking agent production facilities, storage complexes, and deployed mobile weapon platforms.

2.12. AF/IL Counterprolifieration Responsibilities. The Office of the Deputy Chief of Staff from Installations and Logistics (AF/IL) combines logistics and engineering functions. AF/IL oversees the Readiness Programs Branch, AF/ILEOR, which manages civil engineering functions such as NBC defense, explosive ordnance disposal (EOD), firefighting, and air base operability support. AF/IL organizes, trains, and equips personnel to perform Base Recovery After Attack Team (BRAAT) functions such as NBC reconnaissance and decontamination. AF/IL is responsible for the following tasks related to counterproliferation:

2.12.1. Battlefield Surveillance. AF/IL will support prompt, reliable post-attack damage assessment and battle damage assessment (BDA) by providing training. CE Readiness flights train personnel to perform post-attack damage, NBC reconnaissance, BDA, and related duties.

2.12.2. Passive Defense. AF/IL will detect and identify NBC agents promptly and accurately. To identify contaminated areas and any CBW agents that might have been used, personnel monitor the chemical detectors after attack. Close coordination with medical personnel is necessary, since morbidity of troops and clinical diagnosis may be the first indication of CB agents on the battlefield.

2.13. U.S. Air Force Counterproliferation Master Plan. Refer to the U.S. Counterproliferation Master Plan, December 1997, for more information and breakdown of counterproliferation responsibilities. This document is classified SECRET.

Chapter 3

NBC ORGANIZATION

3.1. Purpose of the Readiness Flight. CE Readiness plans for and assists in the protection of Department of Defense people and assets during disasters, accidents, or hostile action either at home station or at a deployed location. The flight helps ensure rapid response to and recovery from the effects of such incidents. It also ensures tasked CE Prime BEEF Unit Type Codes (UTCs) are prepared to deploy as necessary in support of national objectives.

3.1.1. Wartime flight manning for active forces is derived from AFMS W44EBC, 24 Feb 94. Manning for the ANG and AFR during wartime or Military Operations Other Than War (MOOTW) is derived from their UTCs. In general, the deployed manpower available for MOOTW and combat operations are based on the "Lead," "Follow," and "DP High Threat Augmentation" Prime BEEF UTC structure.

3.1.2. The manpower requirements for MOOTW and combat operations vary. Some deployment locations may end up with a combination of "in-place" and deployed personnel; however, the total numbers should approximate the following strengths. Flights in locations which are not subject to attacks with Nuclear, Biological, or Chemical (NBC) weapons should anticipate one officer and nine 3E9X1. Every "High Threat" location, i.e., areas which are considered subject to attack with NBC weapons, should receive one officer and 21 3E9X1.

3.1.2.1. The "Lead" Prime BEEF UTCs include one officer with AFS 32E3B or D and three NCOs (one AFS 3E971 and two 3E951 -- ***NOTE:*** ANG and AFR "LEAD" UTCs have different skill levels). Each deployment location should have the equivalent of one "Lead" UTC.

3.1.2.2. The "Follow" Prime BEEF UTCs include three NCOs (one AFS 3E971 and two AFS 3E951 -- Note: ANG and AFR "LEAD" UTCs have different skill levels). Each deployment location should have the equivalent of two "Follow" UTCs.

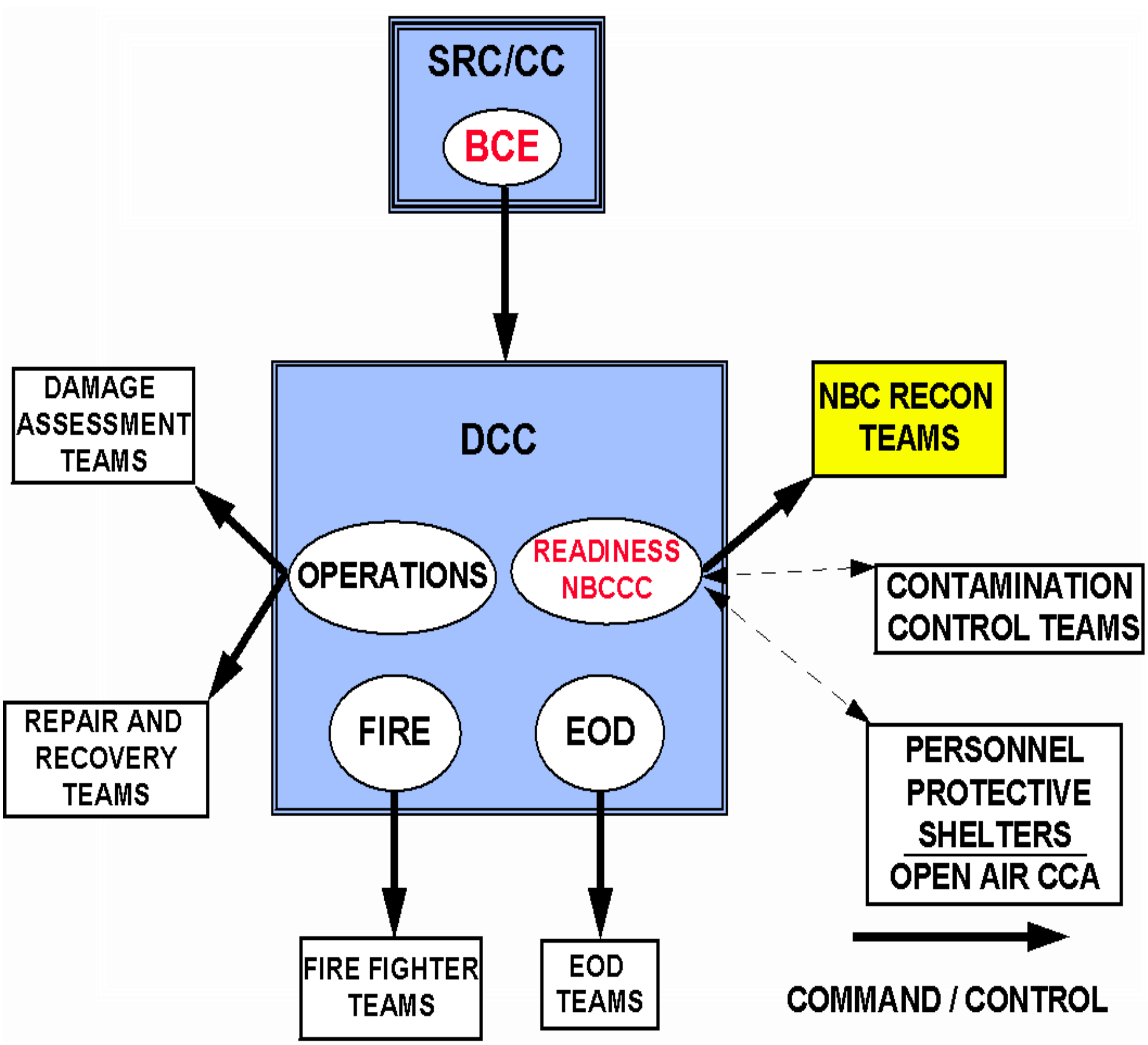
3.1.2.3. The "DP High Threat Augmentation" Prime BEEF UTC includes two NCOs (one 3E971 and one 3E951). Each " High Threat" deployment location should have the equivalent of six "DP High Threat Augmentation" UTCs.

3.1.3. Wartime: During wartime, the Readiness Officer, other assigned 32E3B or D officers, and/or the senior Readiness NCO should report according to local plans to advise and support the BCE and Survival Recovery Center (SRC) commander (or the equivalent). As directed or according to local plans, other Readiness NCOs should man additional posts in the installation's command and control centers (Wing Operations Center (WOC), SRC, Damage Control Center (DCC), Nuclear, Biological, and Chemical Control Center (NBCCC), etc.), NBC reconnaissance teams, and Contamination Control Teams (CCT) for the open air contamination control areas (CCA), or other positions, as required (see **Figure 3.1.**).

3.2. Deployment Operations. These are the functions required to prepare, assemble, and process deployment tasked UTC(s). These actions may be taken at the unit's home station or in preparation for return from a theater of operations. These actions could also be required if a redeployment within or to another theater of operations is tasked. Specific functions and timing will be according to the installation's deployment plan. The BCE will direct implementation of the squadron deployment plan as directed by higher authority or according to local plans. The Readiness Flight should normally conduct and supervise the squadron's deployment operations, however, all military personnel in Readiness may deploy, so the BCE should also identify alternate people to assume deployment management (the BCE should consider using resources, such as civilians, which are not subject to deployment).

3.3. Force Beddown/Sustainment/Reconstitution Operations. CE Readiness should perform or assist in essential beddown/sustainment/and reconstitution functions. The capability to perform them is associated with their particular Prime BEEF UTC and designed operational capability (DOC) statements. For a recommended priority list of Readiness beddown functions, see **Attachment 4**.

Figure 3.1. Sample CE Wartime Organizational Structure.



3.3.1. All Readiness personnel and equipment packages will not be present on the first day the operations plan's TPFDD is implemented. The personnel and equipment arrive at different times from plan to plan and base to base. In many cases the 4F9D1 and 4F9D2 packages are scheduled to arrive at the employment locations before the main engineering UTCs. This occurs because of the need to establish an NBC defense capability as soon as possible and the fact these small packages can be ready to move quicker than the larger packages.

3.4. Combat Operations. These actions are taken to prepare for, respond to, and recover from the effects of attacks with conventional or NBC weapons. The Readiness personnel should work with the installation threat working group to perform a threat analysis and develop, coordinate, and implement, or supervise implementation of, passive defense plans. In addition, the Readiness function should conduct nuclear, biological, chemical, and conventional (NBCC) combat survival training as required; assist and advise shelters teams, open air CCA teams, and contamination control teams when requested; help the BCE coordinate CE's role in support of Air Base Defense operations if required; and perform other combat tasks, as needed. The Readiness function exercises control of Readiness personnel and conducts reconnaissance for NBC hazards. All forces should implement the theater standard Base Recovery After Attack Team (BRAAT) concepts. Combat operations described below are divided into Command and Control Support and NBC plotting and reporting.

3.4.1. Command and Control Support.

3.4.1.1. As directed by the BCE and according to the plans, the senior Readiness representative should help U.S., Host Nation, and Allied forces and civil authorities develop, coordinate, and implement plans for combat-related operations, as necessary.

3.4.1.2. The senior Readiness person available, officer or NCO, and other experienced Readiness NCOs should man positions in the installation command and control facilities (usually WOC, SRC, DCC, etc.) on alternate 12-hour shifts. They will analyze the threat, attack information, and NBC hazard reports then advise the BCE, SRC commander, and SRC staff on execution and modification of measures for passive defense. This includes recommending initiation of smoke generation or other actions to enhance CCD, hardening, and dispersal measures. In addition, based upon the NBC threat, plotting, and reporting, the Readiness representative will provide advice concerning contamination control procedures, individual and collective protection, etc. He/she will also control the NBC Control Center (NBCCC) in NBC high threat areas.

3.4.2. NBC Plotting and Reporting.

3.4.2.1. In NBC high threat areas all Readiness NCOs who are not serving in the installation command and control facilities form the NBC Plotting and Reporting system. This system consists of the NBCCC, the NBC reconnaissance teams, and other unit control centers. The NBCCC may be collocated with the WOC, SRC, or the DCC. Regardless of its location, the NBCCC must be able to contact the SRC commander, the BCE, and the Readiness representative immediately in order to pass on crucial NBC hazard information. **Chapter 7** provides more details on NBCCC operations.

3.4.2.2. The NBC reconnaissance teams operate and monitor NBC detection and warning devices, analyze enemy tactics, apparent targets, and the state of passive defenses and advise the Readiness representative or other SRC or DCC representatives on the effectiveness of various passive defense measures. When requested, they provide technical assistance and help units establish contamination control teams, personnel protective shelters, and open air CCAs.

3.5. Readiness UTCs. U.S. Air Force deliberate planning documents such as operations plans and base support plans generally call for 22 Readiness personnel and the equivalent of two Disaster Preparedness equipment packages to be present at each employment location within a chemical-biological (CB) high threat area. Roles and responsibilities for the Readiness flight vary according to either the "Lead", "Follow", or "Augmentation" UTC.

3.5.1. On "Lead" UTCs, deployed Readiness personnel conduct their specific beddown and sustainment functions according to the applicable plans and as directed by the BCE.

3.5.1.1. The Readiness Officer will initiate a disaster and accident hazard analysis and work with the installation threat working group to analyze the NBCC threats at the deployed location. He/she will develop, coordinate, and implement plans for major accidents, natural disasters, attack actions, and reconstitution or redeployment, as required. At the direction of the BCE, the Flight Chief will also:

3.5.1.1.1. Coordinate with other U.S., Host Nation, and Allied forces and civil authorities to establish command and control centers (SRC, DCC, NBCCC, etc.) based upon the applicable Joint/Base Support plans, Host Nation and Status of Forces agreements, or standardization agreements.

3.5.1.1.2. Help the other U.S., Host Nation, and Allied forces and civil authorities develop, coordinate, and implement plans for major accidents, natural disasters, attack actions, and reconstitution or redeployment, as required.

3.5.1.1.3. Advise the deployed USAF installation commander and BCE on policy and procedures, protective measures, and response or recovery actions.

3.5.1.2. The NCOs will help conduct the hazard and threat analysis; work with U.S., Host Nation, and Allied forces and civil authorities to establish a notification and warning system; and help develop required plans. The NCOs will also conduct emergency and contingency response training or operations as required. In addition, the NCOs will continue to handle Prime BEEF personnel and equipment related issues, maintain required records, and submit required reports for the deployed forces.

3.5.2. "Follow" UTC. The Readiness NCOs will continue and expand on the functions or operations initiated by the "Lead" UTC. They provide manning for 24-hour operations of the command and control centers, expanded training and operations, and small-scale NBC reconnaissance, monitoring, control, and reporting, if necessary.

3.5.3. "DP High Threat Augmentation" UTC. These Readiness NCOs will deploy to provide the "Lead" and "Follow" UTCs with the additional manpower necessary to perform the complete range of any required NBCC combat functions on a 24-hour basis.

3.5.4. In terms of assembling this force through the UTC and Time Phase Force Deployment Data (TPFDD) process, the appropriate plan OPR will adhere to the following principles.

3.5.4.1. Main Operating Bases.

3.5.4.1.1. Start with desired number of personnel (22 in this example).

3.5.4.1.2. Subtract number of Readiness personnel assigned at the employment location (11 for instance - this leaves a requirement for 11 additional Readiness personnel).

3.5.4.1.3. Determine how many lead (4F9E5/6) and/or follow (4F9E7/8) engineering teams are tasked to augment the home-station force (one lead and one follow for example). This step is necessary because Readiness personnel are imbedded in existing Prime BEEF UTCs.

3.5.4.1.4. Subtract the appropriate number of Readiness personnel from the remaining requirement. In this example, since there are four Readiness personnel on each lead team and three Readiness personnel on each follow team, subtract seven people from the remaining requirement of 11 personnel and there still is a need for four additional Readiness personnel.

3.5.4.1.5. Meet the remaining requirement (four in our example) by tasking the appropriate number of 4F9D1 packages. Since there are two Readiness personnel in each 4F9D1 package, the plan OPR would task two 4F9D1 UTCs in this case. Consequently, this particular Readiness personnel package would consist of in-place personnel, one lead team (4F9E5 or 4F9E6), one follow team (4F9E7 or 4F9E8), and two Readiness Augmentation Teams (4F9D1) as shown in **Table 3.1.**

Table 3.1. Main Operating Base Readiness Requirements Process.

Total Readiness personnel required = 22	
SOURCE OF PERSONNEL	**NUMBER OF PERSONNEL**
In-place forces	11
(1) Lead team (4F9E5 or 4F9E6)	4
(1) Follow team (4F9E7 or 4F9E8)	3
(2) Readiness Augmentation Teams (4F9D1)	4
TOTAL	22

3.5.4.1.6. It's important to note that active duty and Air Reserve Component forces (ARC - Air National Guard and/or Air Force Reserve) are treated equally in terms of Readiness personnel taskings. There is no difference between an active duty and an ARC member in the eyes of plan developers and each location's Readiness force may be composed entirely of active duty members, entirely ARC members, or a combination of both.

3.5.4.2. Collocated Operating Bases.

3.5.4.2.1. Start with desired number of personnel (22 in this example).

3.5.4.2.2. Determine how many lead (4F9E5/6) and/or follow (4F9E7/8) engineering teams are tasked to deploy to the location (one lead and two follow for example). Subtract the appropriate number of Readiness personnel from the requirement. In our example, we would subtract 10 people from our requirement of 22 personnel and still have a need for 12 additional Readiness personnel.

3.5.4.2.3. Meet the remaining requirement (12 in our example) by tasking the appropriate number of 4F9D1 packages. The plan OPR would task six 4F9D1 UTCs in this case. Consequently, this particular Readiness personnel package would consist of one lead team (4F9E5 or 4F9E6), two follow teams (4F9E7 or 4F9E8), and six Readiness Augmentation Teams (4F9D1) as shown in **Table 3.2.**

Table 3.2. Collocated Operating Base Readiness Requirements Process.

Total Readiness personnel required = 22	
SOURCE OF PERSONNEL	**NUMBER OF PERSONNEL**
In-place forces	0
(1) Lead team (4F9E5/6)	4
(2) Follow team (4F9E7/8)	6
(6) Readiness Augmentation Teams (4F9D1)	12
TOTAL	22

3.6. Typical Task Breakout. While each individual location can adjust their force as needed, the Readiness Wartime Manpower Standard breaks out the taskings for the 22 personnel as listed in **Table 3.3.**

Table 3.3. Typical Readiness Task Breakout.

Total Readiness personnel required = 22	
TASK	**NUMBER PER SHIFT**
Survival Recovery Center	1
Alternate Survival Recovery Center	1
NBC Control Center	2
Alternate NBC Control Center	1
NBC Reconnaissance Teams	3 Teams 2
TOTAL	11
CCA	TO BE DETERMINED
Perhaps the largest shortfall this breakout leaves is in the area of open-air contamination control area (CCA) processing. While Readiness personnel are not responsible for processing every member of the base populace, they are responsible for establishing the installation's main CCA and ensuring it's ready to receive wing personnel as needed.	
Note:	

3.6.1. Readiness should advise the wing or support group commander to assign personnel to the CCA from units across the base. Readiness should provide oversight and guidance. It's up to each base to determine how they will accomplish this tasking. Some potential methods are to:

3.6.1.1. Call in the off-shift to establish the CCA infrastructure.

3.6.1.2. Release the personnel from the alternate Survival Recovery Center and Alternate NBC Control Center to establish the CCA infrastructure.

3.6.1.3. Release one or two of the NBC reconnaissance teams to establish the CCA infrastructure.

3.6.1.4. Convince the wing leadership that the CCA operation is critical to mission sustainment to the point that the leadership element directs the assignment and training of specific personnel as CCA OPRs (preferably in the pre-deployment stages), and then have NBC reconnaissance personnel check on their progress as the need arises.

3.6.2. The above mentioned suggestions are not all inclusive and involve the installation's open-air CCA. If an employment location has one or more collective protection facilities (to include transportable collective protection systems), a specific unit should be assigned responsibility for the facility in the pre-deployment stages, given appropriate training, and then be tasked to prepare and utilize the facility as the need arises.

3.7. NBC Defense Equipment. As a rule, each projected employment location will have the equivalent of two equipment packages for use. This requirement can be fulfilled through in-place assets, war reserve material assets, the equipment contained in the lead team set, the equipment contained in the Disaster Preparedness Equipment Augmentation package, or a combination of these possibilities.

3.8. Ability of Theater Command to Modify the TPFDD. Each projected employment location within a particular theater of operations will not have the same Readiness requirements. For example, some locations may be outside of missile range, others may have additional requirements such as the theater NBC Control Center or be a large frame aircraft decontamination center, and others may have a number of joint-service units available to assist in the NBC defense business. As a result, the operations plan OPR must assess the Readiness requirements for each projected operating location. This assessment may result in a deviation (increase or decrease) from the baseline established in the Readiness Wartime Manpower Standard and the "two equipment package" guideline mentioned earlier. Readiness personnel should have a current copy of the appropriate base support plan because this plan should provide the best picture as to the Readiness requirements and anticipated resources (both personnel and equipment) at the employment location.

3.9. BEE NBC Teams. The Bioenvironmental Engineering (BEE) NBC Team, in conjunction with the Readiness Flight, can help provide increased wing survivability through NBC agent surveillance, detection, and abatement. The BEE NBC Team UTC FFGL1 is composed of one officer (43E3A), one Craftsman (4B071), and four Journeyman (4B051). This expertise should be available in the SRC as well as potentially available for the NBCCC and NBC reconnaissance teams.

Chapter 4

NBC EQUIPMENT AND COUNTERMEASURES

4.1. Principle of Protection. Protection is afforded by IPE, shelters, and medical countermeasures. IPE and shelters are self-defining; preventive countermeasures includes medical protection through use of immuno- and chemo-prophylaxis. The common way of expressing the amount of protection is to refer to the protection factor. The protection factor is actually a reduction factor indicating the degree to which the protective device or item reduces the amount of contamination that an individual is exposed to, or the effect the contamination produces. Since IPE, primarily the protective mask, is the most likely type of available protection, training for correct use and proper maintenance is critical.

4.1.1. Individual Protective Equipment. IPE protects the wearer from direct exposure to CBW agents. The IPE consists of a protective mask, an impermeable hood, a protective suit of either coverall (CWU-66/P) or jacket and trouser configurations (BDO or JSLIST), gloves and overboots. The mask keeps agent from entering the body through the nose, mouth, or eyes; and an overgarment which prevents skin contact, absorption through the skin, and entry through cuts or abrasions of the skin. Masks provide a critical and unique form of protection not available through normal combat clothing, whereas protective suits generally duplicate or enhance the protection offered by normal combat clothing. Poor mask fit and careless mask donning seriously degrade the protection the ensemble is capable of providing. Hoods provide additional head, neck, and face protection from gaseous agent and from falling agent droplets. Protective garments serve as a barrier between environmental agent and skin. They can be fabricated from impermeable materials or from air-permeable protective materials which rely on a thin layer of chemical agent-sorbent carbon to prevent agent penetration. This allows water vapor to escape and is generally more comfortable and cooler than impermeable materials. NOMEX is often incorporated in these materials for its flame resistant properties.

4.1.2. Shelters. Shelters are structures that protect from the effects of NBC contamination. Walls, doors, and windows offer limited physical barriers to the penetration of contamination. Although filter systems in heating, ventilation, and cooling systems can remove certain levels of particulates, they should be shut down to prevent unnecessary spread of contamination. Unless employed in combination with other types of weapons, CB weapons normally involve less destructive force, so that agent can be disseminated without destroying it in the dispersal process. Collective protection (ColPro) systems protect those inside a building, room, shelter or tent against contamination through the combination of nonpenetrable structural materials, air filtration equipment, air locks, and overpressurization. ColPro systems reduce contamination levels when personnel enter or exit the structure. They enable personnel to work or gain rest and relief without the encumbrance of IPE. If ColPro systems are not available and NBC contamination is present and persists beyond a few hours, it may become necessary to locate and designate contamination-free areas for rest and relief.

4.1.3. Preventive Medicine. Preventive medicine measures for CB defense include immuno- and chemoprophylaxis. These measures protect or lessen the effects of agents against personnel.

4.2. Mission Oriented Protective Postures. IPE can be utilized in a variety of ways through Mission Oriented Protective Postures (MOPP) levels and options. With MOPPs come differing levels of protection, differing grades of inconvenience, tactile loss, visual loss, communication loss, and heat stress. **Table 4.1.** summarizes MOPP levels. Refer to AFMAN 32-4005, Personnel Protection and Attack Actions, and AFVA 32-4012, *Mission Oriented Protective Posture*, for complete details.

Table 4.1. Mission Oriented Protective Postures.

<table>
<tr><th>MOPP LEVEL 0</th><th>MOPP LEVEL 1</th><th>MOPP LEVEL 2</th><th>MOPP LEVEL 3</th><th>MOPP LEVEL 4</th><th>MOPP LEVEL ALPHA</th></tr>
<tr><td>WORN[1]</td><td>WORN</td><td>WORN</td><td>WORN</td><td>WORN</td><td>WORN</td></tr>
<tr><td>MASK
CARRIER
FIELD GEAR[2,3]</td><td>OVERGAR-MENT
MASK CARRI-ER FIELD GEAR[2]</td><td>OVERGAR-MENT
MASK CARRI-ER FIELD GEAR[2]
FOOTWEAR COVERS</td><td>OVERGAR-MENT
MASK/HOOD
FIELD GEAR[2]
FOOTWEAR COVERS</td><td>OVERGARMENT
MASK/HOOD
FIELD GEAR[2]
FOOTWEAR COVERS
GLOVES</td><td>MASK/HOOD
FIELD GEAR[2]
GLOVES</td></tr>
<tr><td>AVAILABLE</td><td>CARRIED[3]</td><td>CARRIED[3]</td><td>CARRIED[3]</td><td>CARRIED[3]</td><td>CARRIED[3]</td></tr>
<tr><td>IPE ISSUED, PREPARED, AND AVAIL-ABLE WITHIN 5 MINUTES</td><td>FOOTWEAR COVERS
MASK/HOOD
GLOVES</td><td>MASK/HOOD
GLOVES</td><td>GLOVES</td><td></td><td>OVERGAR-MENT
FOOTWEAR COVERS</td></tr>
<tr><td>PRIMARY USE</td><td>PRIMARY USE</td><td>PRIMARY USE</td><td>PRIMARY USE</td><td>PRIMARY USE</td><td>LIKELY USE</td></tr>
<tr><td>CB THREAT PRE-ATTACK</td><td>CB THREAT PRE-ATTACK</td><td>CB THREAT PRE-ATTACK</td><td>CB THREAT TRANS/POST ATTACK</td><td>CB THREAT TRANS/POST ATTACK</td><td>CB THREAT TRANS/POST ATTACK</td></tr>
<tr><td>- DURING PE-RIODS OF IN-CREASED ALERT WHEN ENEMY HAS CHEMICAL BI-OLOGICAL EM-PLOYMENT CAPABILITY BUT THERE IS NO INDICA-TION OF USE IN THE IMMEDI-ATE FUTURE.</td><td>- CHEMICAL BIOLOGICAL ATTACK IN THEATER IS POSSIBLE</td><td>- CHEMICAL BIOLOGICAL ATTACK IN THEATER IS PROBABLE</td><td>- IN AREAS WITH NEGLIGI-BLE CONTACT HAZARD</td><td>- WHEN THE HIGHEST DE-GREE OF CB PROTECTION IS REQUIRED
- WHEN PERSIS-TENT CHEMI-CAL AGENTS ARE PRESENT
- WHEN CB AGENTS ARE PRESENT; THE ACTUAL HAZ-ARD HAS NOT BEEN DETER-MINED</td><td>- UPWIND FROM A NEGLI-GIBLE CHEMI-CAL VAPOR HAZARD AGENT.
- BIOLOGICAL WARFARE AGENTS ARE BEING EM-PLOYED
- INSIDE VEHI-CLES, BUILD-INGS OR AIRCRAFT UNDER NU-CLEAR FALL-OUT CONDITIONS</td></tr>
<tr><td>VARIATIONS[4]: Authorized varia-tions include: Ventilation, No BDUs, and Mask-Only.</td><td colspan="4">Ventilation - Open Overgarment: In some cases, personnel may, with little risk, open the overgarment jacket to aid ventilation and reduce thermal build-up. This variation is automatically revoked with each MOPP level increase, unless specifi-cally reauthorized by the commander.
No BDUs: Individuals, when directed, wear the overgarment over underwear when heat stress is expected to be a significant factor</td><td></td></tr>
<tr><td colspan="3">Notes:</td><td colspan="2">Mask-Only: The mask, hood, and long sleeve duty uniform (for limited skin protection) may be worn.</td><td></td></tr>
</table>

MOPP LEVEL 0	MOPP LEVEL 1	MOPP LEVEL 2	MOPP LEVEL 3	MOPP LEVEL 4	MOPP LEVEL ALPHA
1. Field Gear consists of helmet, web belt, canteen, and, if issued, body armor (WORN OVER THE BDUs OVERGARMENT). 2. Carry or keep at hand protective equipment such as M8/M9 paper, Nerve agent antidotes, and decontamination kits.			3. If "All Clear, MOPP 0" is announced, web belt and canteen may be worn if desired. 4. Only the installation commander directs the MOPP levels and variations listed above. Modifications to MOPPs and variations must be approved by MAJCOM or Theater commander.		

4.3. Individual Protective Equipment - Skin Protection.

4.3.1. CWU 66/P Coveralls. The CWU-66/P integrated chemical protection flight coverall is a light-weight, one-piece garment of Blucher SARATOGA material. It has a fire-resistant Nomex-rich outer layer, a filter layer of moisture-insensitive Blucher spherical carbon absorber, and a knit inner layer. The coverall can be washed ten times without loss of flame or chemical agent vapor protection and has a 30-day service life.

4.3.2. CP Undercoverall. The Chemical Protective flyer's undercoverall is a one-piece garment made of nonwoven fabric. It is impermeable to CW agents and is lined with activated charcoal for agent vapor sorption. It is worn over cotton long-sleeve undershirt and drawers.

4.3.3. Mark 1 Chemical Undercoverall. The Mark-1 Undercoverall is a UK-designed, charcoal impregnated garment intended to be worn with long cotton underwear and a flight suit. It provides flame protection and six hours of chemical agent vapor protection. It can not be laundered and is hot. It has a 50-hour service life.

4.3.4. Aircrew Cape. The aircrew cape is a disposable plastic bag to be worn over the body enroute from shelter to aircraft. It is to be removed before entering shelter or aircraft.

4.3.5. Overboots, Vinyl. This is an impermeable chemical protective overboot.

4.3.6. CP Footware Covers. These are butyl rubber protective covers with eyelets at the toe, heel, and sides designed to allow fit to be adjusted to any size foot. There is no distinction between left and right. They are designed to fit over combat footwear.

4.3.7. Disposable CP Footware Covers. These light plastic overboots are worn over flyer's boots to protect enroute from shelter to aircraft. They are to be removed before entering a shelter or aircraft. They come in only one size.

4.3.8. CP Gloves. The CP glove set consists of a butyl rubber, chemical protective outer glove, and a cotton liner for perspiration absorption. They can be worn without liners. CP gloves are available in 25 mil, 14 mil, 7 mil thickness. Thinner gloves provide more feel and facilitate the execution of tasks requiring greater dexterity. They should be replaced every six hours. Fourteen and 25 mil gloves provide at least 24 hours of protection. Thicker gloves are more durable and better suited for heavy labor.

4.3.9. Battledress Overgarnmet (BDO). The BDO provides the user with whole body protection from solid, liquid, and vapor wartime chemical agents. Technical Order (T.O.) 14P3-1-141 provides complete guidance.

4.3.9.1. General Description. The BDO is a heavy, two-piece, air-permeable, overgarment intended to be worn over the duty uniform. Jacket and trousers are of composite material with a nylon/cotton twill outer layer in woodland or desert camouflage patterns. An inner layer of activated carbon-impregnated polyurethane foam provides protection against chemical agent vapor and aerosol CB agent. The BDO is designed to be worn with mask, hood, gloves, and overboots.

4.3.9.2. Components. A complete groundcrew ensemble includes the BDO, protective gloves, glove inserts, and footwear covers. **Table 4.2.** list the BDO components.

Table 4.2. BDO Components.

BDO: 8 sizes available, Woodland Pattern. BDO, Desert Pattern (three color). BDO, Desert Pattern (six color).	Protective gloves: butyl rubber, gauntlet style. Two types: 7 mil and 14 mil thickness. There are four sizes available (small, medium, large, extra large) - 7 mil provides more dexterity. - 14 mil are standard issue.
Footwear covers: come in three types: four eyelet, five eyelet, and green or black vinyl overshoes (GVOs/BVOs). - Four eyelet type, two sizes: small and large. - Five eyelet type, two sizes: small and large. GVO/BVO, available in 12 full sizes (3-14) -- no half sizes available. Multipurpose Overboot (MULO): A one-piece overboot worn over combat or field boots utilizing an integrated strap/clip closure system. - Future fielding item that will replace current overboots.	Glove inserts: cotton, gauntlet style, three sizes available (small, medium and large).

4.3.9.3. Service Life. Service life is the amount of time the GCE will provide protection once taken from protective bag. It is influenced by wear, not exposure to air.

4.3.9.3.1. BDO: 22 days once removed from its protective bag. 24 hours after contact with liquid chemical agents.

4.3.9.3.2. GVO/BVO: 14 days once removed from protective bag, provided the bag is free from cracks, tears, and punctures. 12 hours after contact with liquid chemical agents.

4.3.9.4. Shelf life. Currently, the shelf life is 14 years after date of manufacture.

4.3.9.5. Inspection. The individual user is responsible for inspection of the GCE. Inspection must be done prior to use and every 12 months. Do Not remove any item from its factory bag for the sole purpose of inspection or sizing. Complete inspection of all components is identified in T.O. 14P3-1-141, Table 5-1.

4.3.9.6. Donning/Doffing, Decontamination, Operational Use. Complete procedures are identified in T.O.14P3-1-141 and AFMAN 32-4005. Failure to follow these procedures could result in contamination to the individual.

4.3.10. Joint Service Lightweight Integrated Suit Technology Overgarment (JSLIST OG). The JSLIST OG provides the user with whole body protection from both liquid and vapor wartime chemical agents. T.O. 14P3-1-141 provides complete guidance.

4.3.10.1. General Description. The JSLIST OG is a two-piece, coat and trousers, overgarment with an integral hood that is compatible with existing protective masks. The coat and trousers are issued separately, but worn together as a uniform. The overgarment is made of permeable materials.

4.3.10.2. Components. The ensemble includes the JSLIST OG, protective gloves, glove inserts, and footwear covers. **Table 4.3.** list the JSLIST OG components.

Table 4.3. JSLIST OG Components.

JSLIST OG Coat: 7 sizes available, Woodland Pattern. 7 sizes available, Desert Pattern. JSLIST OG Trousers: 7 sizes available, Woodland Pattern. 7 sizes available, Desert Pattern.	Protective gloves: butyl rubber, gauntlet style. Two types: 7 mil and 14 mil thickness. There are four sizes available (small, medium, large, extra large) - 7 mil provides more dexterity. - 14 mil are standard issue.
Footwear covers: come in three types: four eyelet, five eyelet, and green or black vinyl overshoes (GVOs/BVOs). - Four eyelet type, two sizes: small and large. - Five eyelet type, two sizes: small and large. GVO/BVO, available in 12 full sizes (3-14) -- no half sizes available. Multipurpose Overboot (MULO): A one-piece overboot worn over combat or field boots utilizing an integrated strap/clip closure system. - Future fielding item that will replace current overboots.	Improved CB Protective Glove (ICBPG): A semi-permeable glove in an integrated glove design. Future fielding item that will replace rubber glove/Inserts by attrition. Glove inserts: cotton, gauntlet style, three sizes available (small, medium and large).

4.3.10.3. Service Life. Service life is the amount of time the JSLIST will provide protection once taken from protective bag. It is influenced by wear, not exposure to air. **Table 4.4.** provides more specifics on service life.

Table 4.4. JSLIST OG Service Life.

Uncontaminated OG disposal requirements Whichever comes first:		
After 6 launderings	upon 45th day of service life	upon 10th year shelf life
Contaminated wear time: 24 hrs (regardless of type of contamination).		
GVO/BVO: 14 days once removed from protective bag, provided the bag is free from cracks, tears, and punctures. 12 hours (extendible to 24) after contact with liquid chemical agents.		

4.3.10.4. Inspection. The individual user is responsible for inspection of the GCE. Inspections must be done prior to use and every 12 months. Do Not remove any item from its factory bag for the sole purpose of inspection or sizing. Complete inspection of all items are listed in T.O. 14P3-1-141.

4.4. Individual Protective Equipment--Respiratory Protection.

4.4.1. Filter Canisters, C-2/C2A1. The C-2 series filter canisters are procured for use with the MCU-2A/P, aircrew, and firefighter SCBA masks. The canister has standard NATO threads and can be used with many different NATO masks. The C-2 series filter can be mounted on either side of the MCU-2A/P mask.

4.4.2. Mask, Aircrew Eye-Respiratory Protection (AERP), MBU-19/P, MBU-18/P. The MBU-18s and MBU-19s are second generation (replaced the MBU-13P) aircrew eye/respiratory protective systems. They are intended to optimize visibility and comfort. MBU-18s and MBU-19s are to be worn under standard HGU-55/P flight helmets. They rely on neck, instead of face seals. A nonhelmeted version of the MBU-19 is available. The AERP is replacing existing aircrew masks. The MBU-18 and MBU-19 units consist of a butyl rubber hood incorporating an MBU-12/P pressure-demand oxygen mask, feed gas CB filter, a clear plastic lens, a neckdam, drinking and communications capabilities. Oxygen or ambient air is delivered under slight positive pressure for respiration, ventilation, and lens defogging. Exhaust gases vent through an exhaust valve in the rear of the hood. The MBU-18 differs from the MBU-19 in having a chest-mounted oxygen regulator and a high-pressure hose assembly.

4.4.3. Mask, M24, Aviator. The M24 is used by the Army in rotary wing aircraft. It is not in widespread USAF use. There are only a few in USAF inventory but the service has access to substantial Defense Logistic Agency (DLA) M24 stores. The M24 is a molded mask with a large single lens using a face seal design. It uses a hose-mounted M10A1 filter canister, a pouch-type carrier, an antiglare eye lens outsert, and an M7 hood. The mask incorporates an oxygen supply adapter and microphone

4.4.4. Mask, MCU-2A/P. The MCU-2A/P mask with a serviceable canister filter installed protects the faces, eyes, and respiratory tract from chemical and biological warfare agents and radioactive dust particles. A properly worn mask provides a gas-tight face seal which prevents unfiltered air from reaching the wearer’s respiratory system. T.O. 14P4-15-1 and T.O. 14P4-1-151 provides details on the mask and filter canisters.

4.4.4.1. The MCU-2A/P is the primary USAF eye/respiratory protection device. It is molded of silicone rubber, with a single, large, polyurethane viewing lens, a drinking tube, and a voicemitter. MCU-2A/P series masks use a single screw on/off C-2 canister filter. The MCU-2A/P also has an intercom and microphone adapter. The mask is to be worn with a protective hood. MCU-2A/P masks satisfy USAF and NATO Standards for protection against tactical concentrations of CB agent and radioactive dust.

4.4.4.2. Operational Limitations. This mask is not authorized for use during industrial chemical spills. Chemicals of this nature normally require a self-contained breathing apparatus. For example, the mask would not be effective against chemicals such as ammonia, chlorine, or even carbon monoxide fumes. The mask is not effective in confined spaces when there is insufficient oxygen to support life. The MCU-2A/P mask is simply a filter respirator; it does not supply or produce oxygen.

4.4.4.3. Mask Size. The mask comes in three sizes (short, medium, long). Correct mask size is determined by facial measurements. A spring caliper, vernier dial, and/or the M-41 Protection Assessment Test System (PATS) is required to determine proper fit. Proper mask size will be determined upon issue.

4.4.4.4. Inspection and Documentation. The user must inspect the mask upon issue, every six months during peacetime, and every seven days during wartime. Refer to Table 5.1 in the T.O. Document the mask's inspection on a DD Form 1574 (Serviceability Tag) or data automated product. When a serviceable C-2 canister is installed, annotate the canister lot number and the date it was installed in the remarks section of the DD Form 1574 or in an area designated on the data automated form.

4.4.4.5. Accessories. The mask also has the following accessories: mask carrier, protective hood, mask outsert, special canteen cap, a waterproofing bag, and spectacles inserts.

4.4.4.6. Care and Use. When the MCU-2A/P series mask is issued, all maintenance is the responsibility of the user. Routine cleaning of the mask between inspections and after use must be accomplished to maximize protective capability.

4.4.4.7. Operational Factors. The MCU-2A/P series mask remains serviceable as long as it meets operational inspection IAW T.O. 14P4-15-1. C2 canister(s) must be replaced after CB contamination or shelf life expiration. Some specific criteria is listed in **Table 4.5.**

Table 4.5. Filter Change Criteria.

When directed by higher authority or a clear indication of chemical use.	Excessive breathing restriction is experienced. Immersed in water or wetted in anyway.
15 days have elapsed after exposure to chemical-biological agents (except blood agent)	Filters have been exposed for 12 months in temperate climates. (Korea, Europe, etc.)
Exposure to BLOOD agent has occurred.	Filters have been exposed for two months in tropical climates. (Panama, Puerto Rico, etc.)
Shows evidence of mechanical damage such as breaks or cuts in material or edge of seal, a bent or split connector, etc.	Filters have been exposed for 24 months in arctic climates. (Alaska, etc.)

4.4.4.8. Hood. To increase operational efficiency, you must make sure certain adjustments to the hood based on temperatures. In moderate temperature (between 30° to 90° degrees Fahrenheit), place the hood over the voicemitter/outlet valve cover. The exhausted air inflates the hood and helps prevent contaminated air from entering the hood. In extreme weather -- cold (below 30° F) or hot (above 90° F), uncover the voicemitter/outlet valve cover. In cold weather, this prevents condensed moisture from freezing inside the hood or from dripping into your clothing. In hot weather, it prevents extreme heat and humidity buildup inside the hood.

4.4.4.9. Cleaning and decontamination. Clean the mask with mild liquid detergent and warm water. Alcohol towelettes may be used for expedient sanitation. Do not place the mask in boiling water. Do not wash the canister. Do not dry wipe the mask lens to avoid scratching. The mask and hood should be decontaminated as soon as practical after CB contamination has occurred. Perform immediate decontamination using the M258A1, M291, or M295 decontamination kits. Perform operational and thorough decontamination in accordance with the T.O.

4.4.4.10. Repair. The mask has no repair parts. All repair is accomplished using replacement parts. Defective parts other than those listed in the T.O. are cause for mask replacement.

4.4.4.11. Operational Safety Tips. Safety is paramount when using any protective equipment. Ensure you have a proper fit on your mask. A leaking mask will not protect against toxic agents.

Don't over tighten the mask. Over tightening may actually cause leaks. Check the mask for leaks every time you put your mask on. Don the mask quickly. Remember it should be on and sealed before you take another breath. It should only take you nine seconds to don, clear, and seal the mask. The MCU-2A/P is not intended for industrial chemical use and is not effective in confined spaces where there is not enough oxygen to support life. When wearing the mask with the hood over the outlet valve, do not loosen the straps of the head harness for comfort. If the straps are loosened, the wearer is in danger of suffocation by carbon dioxide and unprotected against toxic agents. If you become overheated in cold weather, do not remove your mask outdoors until your head cools and sweat has dried. Frostbite may result if the mask is removed while your face is still wet. A serviceable C2 canister must be installed prior to use in a toxic chemical or biological environment.

4.4.5. Mask, M17A2. The M17A2 mask, with serviceable M13A2 filters installed, protects the faces, eyes, and respiratory tract from chemical and biological warfare agents and radioactive dust particles. A properly worn mask provides a gas-tight face seal which prevents unfiltered air from reaching the wearer's respiratory system. T.O. 14P4-9-31 and T.O. 14P4-1-151 provides details on the mask and filter canisters.

4.4.5.1. The M17 series masks were standard issue for the USAF from the early 1960s until the introduction of the MCU-2A/P. The few M17A2s remaining in the USAF inventory are extra smalls for those personnel whom a small MCU-2A/P is too large. The masks are of face seal design with two lenses that provide good vision. Each has twin M13A2 cheek-mounted filter elements, a voicemitter, a self-contained drinking system. The mask is issued with a mask carrier, replacement filters, waterproofing bag, and M6A2 hood.

4.4.5.2. Operational Limitations. This mask is not authorized for use during industrial chemical spills. Chemicals of this nature normally require a self-contained breathing apparatus. For example, the mask would not be effective against chemicals such as ammonia, chlorine, or even carbon monoxide fumes. The mask is not effective in confined spaces when there is insufficient oxygen to support life. The M17A2 mask is simply a filter respirator; it does not supply or produce oxygen.

4.4.5.3. Mask Size. The M17A2 X-small is the only mask of this type still being fielded. The M-41 Protection Assessment Test System (PATS) is required to determine proper fit.

4.4.5.4. Inspection and Documentation. The user must inspect the mask upon issue, every six months during peacetime, and every seven days during wartime. Refer to Table 5.1 in the T.O. Document the mask's inspection on a DD Form 1574 (Serviceability Tag) or data automated product. When serviceable M13A2 filters are installed, annotate the lot number and the date it was installed in the remarks section of the DD Form 1574 or in an area designated on the data automated form.

4.4.5.5. Accessories. The mask also has the following accessories: mask carrier, protective hood, special canteen cap, a waterproofing bag, winterization kit, and spectacles inserts.

4.4.5.6. Care and Use. When the M17A2 mask is issued, all maintenance is the responsibility of the user.

4.4.5.7. Operational Factors. The M17A2 series mask remains serviceable as long as it meets operational inspection IAW T.O. 14P4-9-31. M13A2 filters are the serviceable filters for the M17A2 mask. GREEN colored connector ring can visually identify the M13A2s. Other colors may be used for training, but are not considered serviceable. M13A2 filters must be replaced after CB contamination or shelf life expiration. See **Table 4.5.** for more specific criteria.

4.4.5.8. Hood. To increase operational efficiency, you must make sure certain adjustments to the hood based on temperatures. In moderate temperature (between 30° to 90° degrees Fahrenheit), place the hood over the voicemitter/outlet valve cover. The exhausted air inflates the hood and helps prevent contaminated air from entering the hood. In extreme weather -- cold (below 30° F) or hot (above 90° F), uncover the voicemitter/outlet valve cover. In cold weather, this prevents condensed moisture from freezing inside the hood or from dripping into your clothing. In hot weather, it prevents extreme heat and humidity buildup inside the hood.

4.4.5.9. Repair. The mask has no repair parts. All repair is accomplished using replacement parts. Defective parts other than those listed in the T.O. are cause for mask replacement.

4.4.5.10. Operational Safety Tips. Safety is paramount when using any protective equipment.

Ensure you have a proper fit on your mask. A leaking mask will not protect against toxic agents. Don't over tighten the mask. Over tightening may actually cause leaks. Check the mask for leaks every time you put your mask on. Don the mask quickly. Remember it should be on and sealed before you take another breath. It should only take you nine seconds to don, clear, and seal the mask. The M17A2 is not intended for industrial chemical use and is not effective in confined spaces where there is not enough oxygen to support life. When wearing the mask with the hood over the outlet valve, do not loosen the straps of the head harness for comfort. If the straps are loosened, the wearer is in danger of suffocation by carbon dioxide and unprotected against toxic agents. If you become overheated in cold weather, do not remove your mask outdoors until your head cools and sweat has dried. Frostbite may result if the mask is removed while your face is still wet. Serviceable M13A2 filters must be installed in the M17A2 prior to use in a toxic chemical or biological environment.

4.4.5.11. Cleaning and decontamination. Clean the mask with mild liquid detergent and warm water. Alcohol towelettes may be used for expedient sanitation. Do not place the mask in boiling water. Do not wash the filters. The mask and hood should be decontaminated as soon as practical after CB contamination has occurred. Perform immediate decontamination using the M258A1, M291, or M295 decontamination kits. Perform operational and thorough decontamination in accordance with the T.O.

4.5. Chemical Agent Detection Equipment.

4.5.1. M8 Paper, Chemical Agent Detection. The M8 paper will detect liquid G and V nerve agents and H blister agents. M8 paper provides the user with a manual liquid detection capability. M8 paper provides a simple way of checking exposed surfaces for the presence of liquid G-agent, V-Agent and mustard contamination. It is supplied in booklets of 25 pages of paper containing chemical agent sensitive dyes. The paper is to be blotted, not rubbed, over surfaces suspected of contamination. The appearance of colored blotches on the paper indicates agent presence. G-agents produce yellow, brown, or orange discoloration, V-agents produce blue-green discoloration, and vesicants produce red discoloration. Color changes typically occur within seconds at 70-80°F but may take as long as three minutes to develop at 32°F. M8 paper is intended primarily for detection of surface contamination by liquid chemical agent. The cover shows a color comparison chart and describes general instructions for use. The booklet is four inches by two inches in size. A number of chemical compounds produce false positive responses. T.O. 11H2-14-5-1 is the technical reference.

4.5.1.1. Inspection. Inspect M8 paper prior to use. Discard any M8 paper that shows signs of wetness, wrinkling, dirt, damage, or discoloration. If M8 paper is out of its original plastic package, and the immediate user did not remove it from the package, discard the M8 paper.

4.5.1.2. Operation. When liquid nerve or blister agents contact M8 paper, a color change takes place. This color change is used to make an initial assessment of the presence of liquid nerve or blister agent. Never use the results from M8 paper as the sole indicator that liquid nerve or blister agents are present. **Table 4.6.** summarizes the M8 paper positive indicators.

Table 4.6. Positive M8 Paper Results.

GOLD	RED	GREEN
G-Series Nerve	H-Series Blister	V-Series Nerve
If the paper turns red brown, it is an indication that a certain nerve (G) agent is present. This positive indication is not represented on the color comparison chart inside the cover. Do not check M8 paper with a colored light, because you will not see liquid chemical agent red spots.		

4.5.1.3. Operational Limitations. M8 paper will function in snow, rain, and sleet. However, if the M8 paper becomes saturated with water, false color changes can occur. M8 paper reaction is immediate at temperatures above 32°F. At temperatures below 32°F, reaction time may take up to two minutes.

4.5.2. M9 Chemical Agent Detector Paper. M9 paper, like M8 paper, contains agent sensitive dyes that change color in the presence of liquid chemical agent. M9 paper reacts to traditional nerve agents (G-agents and V-agents) and mustards. The paper is green when issued. Liquid agent droplets produce red spots. Like M8 paper, more time is necessary for color change in cool conditions. Temperatures above 160° F produce false positive readings. M9 paper is intended to be worn on clothing or attached to vehicles or equipment to provide warning of chemical attack. It is supplied in rolls with either smooth or adhesive backs. When worn on protective clothing or attached to equipment, M9 paper provides one rapid assessment of detection. M9 paper comes in a dispenser with one 30-foot roll of 2-inch paper. The dispenser is 2.5 inches long, 3.5 inches wide and 3.25 inches high. Each dispenser comes with a resealable plastic storage bag. The operating range is 32°F to 125°F, with relative humidity between 0 - 99%. T.O. 11H2-2-21 is the technical reference.

4.5.2.1. Operational Life. 1 year in temperate, tropic, and desert regions. 2 years, in frigid zones after removal from the shipping bag. The shelf life is six years from manufacturer's date, non-extendible.

4.5.2.2. Inspection. Inspection is a user responsibility. Inspect equipment to include: shipping bag and dispenser. If shipping bag is torn or open, discard roll. Check for shelf life date that is stamped on the dispenser; discard if shelf life has expired. If dispenser is crushed, wet or cutting edge is missing, discard. Check paper for discoloration, tears, creases, or dirt. If paper comes apart from backing, discard. Detector paper is serviceable unless the paper will not stick or the paper is dirty or greasy. **Note:** Do Not open shipping bag until ready for use; operational life of detector paper will be shortened.

4.5.2.3. M9 paper will turn different colors if liquid agent comes in contact with paper. Color changes to M9 paper identify agent presence, Not Agent Type. Positive indicators of liquid agents include: pink, red, red-brown, red-purple. Blue, yellow, green, gray, or black spots are not from a liquid chemical agent.

4.5.2.4. Operational Limitations. Temperatures above 125°F; brake fluid, hydraulic fluid, gasoline, aircraft and automotive grease; DS-2 decontamination solutions; and insect repellent cause false responses to M9 paper. Refer to T.O. 11H2-2-21 for complete list.

4.5.3. M256A1 Chemical Agent Detector Kit. The M256A1 kit manually detects and classifies nerve, blister, and blood agents in vapor or liquid form. The M256A1 sampler-detectors are capable of detecting and identifying vapors only. The M8 paper provided is to identify liquid agents. The kit contains instruction cards (3), a carrying case, liquid reagents in ampoules, 12 plastic sampler-detectors for vapor detection with separate nerve, blood and blister spot materials, and M8 paper (1 booklet: 25 sheets) for liquid agent detection. The olive drab plastic carrying case is 7 inches wide, 3 inches deep, and 5 inches high. It takes 10-22 minutes to test air for CW agent vapor with an M256A1 kit. The M256A1 operates between -25°F and 120°F. T.O. 11H2-21-1 is the technical reference.

4.5.3.1. **Table 4.7.** identifies the agents detected with an M256A1 kit.

Table 4.7. Agents Detected with An M256A1 Kit.

Cyanogen Chloride	CK	Blood
Mustard	H	Blister
Nitrogen Mustard	HN	Blister
Distilled Mustard	HD	Blister
Phosgene Oxime	CX	Blister
Hydrogen Cyanide	AC	Blood
Nerve Agents	V and G Series	Nerve
Lewisite	L	Blister

4.5.3.2. Operational Limitations. The detector packages are a one-time use item. If any of the following conditions exist, Do Not use: outdated detector packages, discolored detector samples, open detector packages, or water soaked samplers. Avoid direct sunlight on sampler when operating. Avoid sampling in smoke and do not touch individual detector test spots.

4.5.3.3. Inspection: Inspect prior to use and annually. Verify the manufacture's date, stamped on cover of carrying case, prior to use. Currently, M256A1 kits are serviceable for 6 years from manufacture date. Complete inspection procedures identified in T.O. 11H2-21-1.

4.5.3.4. Operational Use. Prior to using the kit assume the proper MOPP level. Testing with the M256A1 takes about 20 minutes and is just one of a number of sources used to determine the presence and extent of chemical contamination. When you conduct testing, it is just as important to provide negative as well as positive results. However, when checking for blood agents, a re-check is necessary if the first results are positive. This is due to mercuric cyanide used in the blister agent testing which could possibly be mistaken for hydrogen cyanide, a type of blood agent. If the blood agent test is positive both times, call in a positive result. When performing chemical testing, one ideal place to monitor is around or above suspected areas of liquid agents. By using a box or can, you can trap the vapors above the liquid for a better concentration.

4.5.3.5. **Table 4.8.** summarize the M256A1 positive test results.

Table 4.8. Positive M256A1 Results.

Lewisite	After ten minutes of exposure time Remember, your first rub mark was a tan color	Positive if the mark is olive drab after rerub. Negative if mark is tan after rerub
Blister	Square test spot (immediately after all ampoules are broken)	Positive for H agent if purple or blue. Positive for CX agent if red or purple. Negative if colorless (if temperature is high it may be faint blue).
Blood	Round test spot (after ten minutes of exposure time)	Positive if pink or blue. Negative if yellow, orange, tan, or colorless.
Nerve	Star test spot (wait about three minutes after exposure)	Positive if colorless (colorless or peach for M256) Negative if blue.

4.5.3.6. Unusual Conditions. There are some special considerations based on weather conditions. The procedures vary when using the kit in cold weather as well as using the kit in a tropical climate. Extend the wait times for the test spot by six minutes when temperatures are between 32° and 50° degrees Fahrenheit or 0° and 10° degrees Celsius. Below 32 degree Fahrenheit (0°C) the reagent solution may freeze. You must thaw it prior to use. Retain a small amount of reagent after crushing ampoule marked "3" in desert conditions, defined as high temperature and low humidity. Rewet the nerve agent test spot after five minutes by squeezing the remaining reagent from the ampoule "3" onto the nerve agent test spot. For tropic conditions, a faint blue color may appear in ABSENCE of blister agents H and HD. Otherwise, operation of the kit is the same as it is for usual conditions. When judging the results, special care must be taken with the Lewisite rub marks. Since changes in color may vary slightly, check the results with a second rub mark before making a decision. Protect the sampler-detector from rain or snow as much as possible. Cover the detector with your body or use it under a roof or cover. You could also use the same can or box that you used to trap vapors.

4.5.4. Automatic Liquid Agent Detector (ALAD). The ALAD provides the user with automatic liquid chemical agent detection. ALADs are intended for use with existing vapor detectors. The AN/PSR-2 is an automatic liquid agent point detector capable of detecting solid or liquid chemical agent droplets as small as 200 microns in diameter within 60 seconds from contact onto the sensor disk. It can operate on internal battery power, or on 110/220 VAC and at 50 Hz line power as well. It is designed for local warning, using an integral horn and warning lamp, or for remote warning using a communications network. The unit provides the communications network with three signals: "operating and OK," "low battery," and "alarm". T.O. 11H2-22-1 is the technical reference for inspection and use.

4.5.4.1. Components. The AN/PSR-2 Detector unit assembly consists of one detector and five sensors. The detector is 12.62 inches long, 8.5 inches wide and weighs 9 pounds without battery. The auxiliary alarm is 15 inches long, 12 inches wide and weighs 23 pounds. The ALAD is compatible with the M42A1 Auxiliary Alarm.

4.5.4.2. Theory of operation. The ALAD theory of operation is divided into five circuit groups: power, controller board, sensor, internal alarms, and external alarms. The ALAD operates on battery or AC power. A non-rechargeable BA-5588/U lithium sulfur dioxide battery provides DC power to the ALAD. It provides power for at least 30 days. A power switch controls both AC and DC power to the detector unit. When the power is set to [ON] the unit starts a self-diagnostic test. A microprocessor controls all functions of the detector unit. The detector unit also has built-in protection from electro-magnetic pulses (EMP). The sensor is a one time use item. When the sensor is placed on the mounting plate, an electrical current is passed from contact to contact through the metallic paint on the grooved surface. If attached to AC power, the system will heat the sensor plate to 70°F if needed. (This occurs when the outside temperature is less than 70°F.) When a 200 micron droplet or more of chemical agent falls on the sensor, it causes the metallic paint in the groove to swell. When the paint swells, the resistance of the sensor changes, and the detector unit recognizes that a chemical agent is present. This sends a signal to the alarm. It detects GD, VX, Mustard, Lewisite, and simulant DEM type chemical agents. The sensor is not sensitive to most flight-line chemicals. The system has an internal horn and lamp alarm. The horn sounds either, when chemicals are present, or when signals faults occur in the system. The lamp alarm provides continuous flashing light when an alarm signal is received from the ALAD. A low battery LED provides continuous warning light when battery voltage is low. The test push-button provides self-test to ensure the horn and lamp are working. The unit is capable of operating with remote auxiliary alarms. Two different auxiliary alarms can be connected to the detector unit, the BZ-90/PSR-2 and the chemical agent automatic alarm unit ABCA-M42. When a chemical agent is detected it sends a signal to these alarms. The ABCA-M42, commonly referred to as the M42 is compatible with the ALAD. External alarms may be connected with field wire up to a distance of 1000 feet from the detector unit assembly. Signal posts on the system provides quick connections between the ALAD detector unit and auxiliary alarms.

4.5.4.3. This unit has operating ranges for the ALAD, auxiliary alarm, as well as the sensor discs. ALAD Operation: -30 to 125°F. Auxiliary Alarm Operation: -30 to 125°F Storage -75 to 165°F. The sensor disc operating range is from -30 to 125°F.

4.5.4.4. The sensor disc service life is 30 days after removal from package if not contaminated. The shelf life is 5 years extendable in two year increments up to nine years from the date of manufacture as long as the outside packaging remains undamaged. Expired sensor discs can be used for training. If they are not available, simulated reading can be obtained by making an electrical connection between the inner and outer posts on the ALAD.

4.5.4.5. Operational Limitations. The sensor discs are a one-time use only item. After removal from packaging, the discs are good for 30 days. The sensor must be replaced if dirt or debris is visible on the sensor surface.

4.5.4.6. Operations and Employment. Prior to operation, the ALAD detector unit assembly must be setup. This includes an inspection of the unit, battery installation, sensor card installation, and connection to AC power.

4.5.5. Chemical Agent Monitor (CAM). The CAM is a hand held point monitor capable of detecting and identifying nerve and mustard agent vapors, giving a rough indication of concentration within 1 minute of agent exposure. CAMs are intended for use to search out clean areas, and to identify contaminated personnel, equipment, aircraft, vehicles, buildings, and terrain. CAMs can help determine the effectiveness of decontamination and can be used in collective protection shelters. T.O. 11H2-20-1 is the technical reference for inspection and use.

4.5.5.1. CAMs can detect GA, GB, GD, VX, HN, and L. CAMs can be powered by an internal battery or an external source. The operating range of this instrument is -13 to 113°F. ***NOTE:*** The CAM contains a beta radiation source. The source is a plated cylinder of 10 millicuries of Nickel-63 radiation. Do Not attempt to open the CAM.

4.5.5.2. Components. The basic CAM comes with the following components: carrying case assembly, CAM, carrying harness assembly, filtered nozzle package assembly, spare battery, large handle strap, small handle strap, confidence sample, spare nozzle protective cap assembly, nozzle protective cap assembly, nozzle assembly, battery, battery cap assembly and environmental cap. Available auxiliary equipment includes an optional battery used for operational check-out and training, and a buzzer to provide audible alarm when the detector reads three bars or more.

4.5.5.3. Power Requirements. The CAM uses one internal 6-volt lithium sulfur dioxide battery (BA-5800/U). The following listed in **Table 4.9.** are benchmarks for temperature versus battery life.

Table 4.9. CAM Battery Life.

113°F	(45°C)	14 hours
68°F	(20°C)	12 hours
32°F	(0°C)	10 hours
-13°F	(-25°C)	2 hours

4.5.5.4. Operational Limitations. The CAM is a monitor, not a detector, and can become contaminated or overloaded (saturated) if not used properly. The CAM can only detect vapors at the inlet nozzle. It will not give the vapor hazard over an area from a single point. The CAM is currently the best fielded device we have to at least approximate the concentrations of chemical agent vapors present at any given time. While it does not provide a digital readout with exact chemical concentrations, the CAM's individual bars do equate to intensity ranges. However, Readiness personnel should use the intensity levels as a guide and must not use a single CAM as an absolute source of information. **Table 4.10.** depicts CAM readings at various concentrations.

Table 4.10. CAM Bar Readings.

AGENT	READINGS [2,3,4]					MIOSIS (.03 mg/m3)
GA (Tabun)	0.043 mg/m3	0.13 mg/m3	0.41 mg/m3	1.4 mg/m3	3.0 mg/m3[1]	4.4
BARS	2 - 3	4	5	6	7 - 8	
GB (Sarin)	0.03 mg/m3	0.1 mg/m3	0.32 mg/m3	1.1 mg/m3	3.0 mg/m3[1]	.04 - 2.5
BARS	1 - 2	3 - 4	5	6	7 - 8	
GD (Soman)	0.035 mg/m3	0.12 mg/m3	0.33 mg/m3	1.2 mg/m3	3.0 mg/m3[1]	.04 - 2.5

AGENT	READINGS [2,3,4]					MIOSIS (.03 mg/m3)
BARS	2 - 3	4	5	6	7 - 8	
VX	0.05 mg/m3	0.16 mg/m3	0.33 mg/m3	0.66 mg/m3	1.0 mg/m3[1]	.1
BARS	3	4 - 5	6	6	7 - 8	
HD (Mustard)	0.11 mg/m3	0.35 mg/m3	1.2 mg/m3	2.6 mg/m3		100
BARS	4	5	6 - 7	8		

NOTES:

1. These figures weren't physically obtained through testing. They are an extrapolation of what they should be if the instruments continue to function in the same manner as tested (with a small safety factor built in).

2. The listed CAM bar readings were generated from scientific testing with new or near new instruments. We don't have sufficient data to ascertain if the same readings hold true for old instruments.

3. Different CAMs may provide slightly different readings. This is especially true if both instruments have not been properly maintained (weekly operational checks with appropriate preventative maintenance).

4. The reliability of the CAM is better the longer it has been operating. Several scientific reports clearly state that, during contingencies, CAMs should be powered up and left running for the duration of the conflict or event. The point is two-fold: there may be a difference between one instrument that has been running for an extended period of time and an instrument that was just powered up, and the same instrument may provide different readings based on how long it has been running.

4.5.5.5. Interpretation of CAM Results. Whenever possible, a CAM footprint should be established in the pre-attack phase. Use the readings as an approximation for the reasons mentioned above. The main point is that the hazard is different for a reading of one (1) bar and a reading of six (6) bars for a given agent. Remember that a specific CAM bar reading does not equate to a specific concentration level. Rather it provides insight into a concentration range. For example, five (5) CAM bars with HD does not equate directly to 0.35 mg/m3. It means the concentration level is somewhere between 0.35 mg/m3 and 1.2 mg/m3. Consequently, Readiness personnel should use the worse case figure when accomplishing hazard analysis calculations. A CAM bar reading of "8" does not equate to the figure listed on the chart for each agent. It means the concentration level is at least that high but we have no idea of what it really is. For example, eight (8) CAM bars with GB does not equate directly to 3.0 mg/m3. The actual concentration may be 3.0 mg/m3, 3.1 mg/m3, 50 mg/m3, 300 mg/m3, etc.

4.5.6. M8A1 Chemical Agent Alarm. The M8A1 Detector provides an automatic detection capability for nerve agent vapors (GA, GB, GD and VX). The M8A1 can be used at fixed sites, hand carried, carried on a backpack, or mounted on a vehicle. The M8A1 System is a fixed-point nerve agent vapor detector capable of detecting low levels of nerve agent vapor within one minute of exposure. M8 systems consist of an M43A1 detector, an M42 remote alarm, and an M10A1 power supply. Line-powered units weigh less than 20 pounds, battery-powered units weigh 25 pounds. They are sufficiently sensitive to detect agent concentrations at miosis level. These systems are intended to be used in several roles. Bases are assigned M-8 systems connected to the Survival Recovery Center (SRC) for early warning. Others are used in collective protection and medical facilities. NOTE: The cell module of the M43A1 Detector contains a radioactive source: Americium-241. The cell module is potentially dangerous if broken. Do Not attempt to remove the cell or pump modules. This unit operates from -40°F to 120°F, 3 to 99% relative humidity. T.O. 11H2-17-1 is the technical reference for inspection and use. The M22 detector will eventually replace this piece of equipment.

4.5.6.1. Components. The following components make up the M8A1 system. The system provides the user the option of deciding what components are needed. They are:

4.5.6.1.1. The M43A1 Detector automatically detects nerve agent vapors. It will alarm and send a signal to a connected M42 Alarm. (weight 7 pounds, length 7 inches, width 7.75 inches, height 10.75 inches). The power requirements are listed in **Table 4.11.**

Table 4.11. M43A1 Power Requirements.

18 volt DC to 36 volt DC
BA3517/U Battery or
BB501/U Battery (M253 Winterization kit) or
M10 Power supply (115/220 volt AC, 50-400 Hz) or
Vehicle Power

4.5.6.1.2. The M42 Alarm Unit provides a warning light and horn at a remote location (up to 400 meters away) when the M43A1 detects nerve agent vapors. It weighs 4 pounds, length 8 inches, width 6 inches, height 2.25 inches. Four 1.5 volt, BA3030/U dry batteries are required to power the alarm unit.

4.5.6.1.3. The M10A1 Power Supply converts power from an AC source to DC power for the M43A1 Detector. It accepts 115 or 220 VAC, 50 to 400 HZ and switches automatically to the standby battery if output drops below 18 VDC. The M10A1 attaches directly to the bottom of the M43A1 Detector (weight 6.5 pounds, length 7.5 inches, width 6.5 inches, height 3.2 inches).

4.5.6.1.4. The M10 Power Supply provides DC power to the M43A1 detector by converting 115/220 volt AC, 50-400 Hz power (weight 18 pounds, length 12 inches, width 6 inches, height 7 inches). BA3517/U batteries supply 36 volt DC power to M43A1 Detector (weight 7.5 pounds, length 6.3 inches, width 7.7 inches, height 5 inches).

4.5.6.1.5. The M273 Maintenance Kit contains 10 air filters and 10 test paddles.

4.5.6.1.6. The Probe Assembly contains 5 probes, 5 rubber bands, and 5 instruction cards. Enables the M43A1 detector to monitor equipment, vehicles and personnel for vapor contamination.

4.5.6.2. Operating The M8A1 In Cold Weather. When the outside temperature reaches 20°F or below, the M8A1 must be operated in a cold weather configuration. To help accomplish this task, an M253 Winterization Kit is available. The M253 Winterization Kit provides DC power when temperature ranges from 20°F to -40°F. The kit contains two BB501/U rechargeable batteries and one M168 cable. The M43A1 can suffer adverse effects if operated unprotected during inclement weather conditions (e.g. constant rainfall, dust, etc.). Furthermore, if the rain cap on the M43A1 is not properly positioned, water can be sucked in the inlet and damage the instrument.

4.5.6.3. M43A1 Detectors may be employed at widespread indoor and outdoor locations around the installation in a DICE 5 pattern. The M10A1 Power Supply should be used whenever possible. Because it is a point source detector, every effort must be made to place a sufficient number of detectors upwind of the air base and mission-critical areas.

4.5.6.3.1. Place M43A1s units no closer than 500 meters apart within the confines of the base. This placement can change due to the prevailing winds, likely attack routes, threat assessment, proximity to major lines of travel, work-area noise levels, etc.

4.5.6.3.2. Place the M43A1 units no closer than 25 feet from any major structure to ensure maximum exposure to prevailing winds and limit interference caused by buildings.

4.5.6.3.3. Be sure to avoid place the M43A1 around smoke, jet fuel vapors, and diesel exhaust. The M43A1 has shown sensitivity to these interferents and will possibly detect them as chemical agents.

4.5.6.3.4. The M43A1 should be at least 3 feet, but no higher than 6 feet, off the ground to ensure maximum exposure to the contaminating environment. Do not place the units in low lying areas where the alarm cannot be seen or heard. Likewise, do not place units on tops of buildings since most chemical warfare agents are heavier than air.

4.5.6.4. M42 Alarms should be installed primarily in work centers (preferably ones with collective protection) to remotely monitor the M43A1s. ***NOTE:*** The M42 alarm may not be heard in high noise areas. Also, the M43A1 may falsely alert to some aftershaves and smokes.

4.5.7. M90 Chemical Agent Detector. ***NOTE:*** The M90 utilizes a small sealed radioactive source, AM-241, as a part of the detection system. The unauthorized repair or disassembly of the M90 may result in Alpha radiation contamination and exposure. The M90 Detector provides the Air Force with stand-alone nerve and blister agent detection. The M90 will detect nerve and blister agent vapors at levels that prevent over exposure to personnel. The M90 can be networked to provide airfield chemical detection and warning, as well as a shelter monitoring device. The M90 is a multi-application instrument which is capable of operating as a point detector to provide early warning of approaching toxic chemicals or as a chemical agent monitor to identify and monitor personnel, vehicles, and equipment for contamination. The M90 uses Ion Mobility Spectrometry (IMS) to determine the presence of toxic vapors. The detector is portable or can be vehicle mounted. Weight with battery is 15 pounds. Dimensions are length 11 inches x width 4 inches x height 11 inches. The M90 will operate in temperatures between -22°F and 131°F with 10 to 95% humidity. No technical order is assigned to this instrument so the M90 Users Manual is the technical reference for inspection and use. The M22 detector will eventually replace this piece of equipment.

4.5.7.1. The M90 does not come in a kit. Various components are available to allow different uses in the field. The M90 is capable of being powered by several different batteries and power supplies. The batteries must be capable of providing at least 11 volts of power. Different power requirements are based on intended usage. **Table 4.12.** provides a complete list of all components and power requirements.

Table 4.12. M90 Components and Power Requirements.

Components	Power Requirements
M90 detector unit M90-RH2 Remote alarm unit M90-BC Battery charger M90-IT2 Inlet tube M90-CC Communications cable M90-CB Carrying bag Battery case M90-MP1 Main power supply M90-VP1 Vehicle power supply M90-FT/S Filter tool Sample kit containing 2 stimulants, nerve and blister	M90-NB NiCd rechargeable D-cell battery, comes standard with detector; 8 hours use. M90-LB Lithium non-rechargeable battery, BA-5598/U; 16 hours use. M90-MB Magnesium non-rechargeable battery, BA-4386; 16 hours use. M90-MP1 Main power supply, 115/240 volt AC, 60Hz. M90-VP1 Vehicle power supply, AC/DC converter 10-32 volt DC. M90-VP2 Vehicle power supply, 24-34 volt DC converter.

4.5.7.1.1. Battery Life. This is dependent on climatic conditions. Cold temperatures degrade battery life and decrease battery voltage. At room temperature, the NiCd battery will last about 8 hours. Operational tests show a realistic battery life of about 4-6 hours for NiCd batteries in the field.

4.5.7.1.2. Battery Recharge. The M90-BC battery charger only recharges one NiCd battery pack at a time. The battery charger requires 6 hours to charge one battery pack. The NiCd batteries will only take a charge when temperatures are between 32°F and 104°F.

4.5.7.2. Inspection. Refer to **Chapter 2** of the M90 Users Manual for complete details. Preventive maintenance checks and services include preparation for operation, starting, testing the detector, alarms, operations under unusual conditions, shutdown procedures, and troubleshooting. The operator must perform certain checks to insure proper operation of the M90 and avoid failure of alarms.

4.5.7.2.1. Inspect both the air inlet and outlet are open and free from blockage.

4.5.7.2.2. Check that the internal air filter and the external pump port caps are tightly closed.

4.5.7.2.3. Visually inspect that a serviceable battery or power supply is connected.

4.5.7.2.4. The detector sensor should be tested with the stimulant after every startup, or if in continuous operation, once a month. The testing is done with the simulant tube once startup is completed. The simulant tub contains nerve agent simulant. The simulant needs to be warmed to at least +50 F(+10 C) to react correctly. Ensure testing is conducted away from strong wind or drafts.

4.5.7.3. Concept of Employment. The M90 should be employed around an air base in a DICE 5 pattern for early detection and warning of chemical agent vapors.

4.5.7.3.1. Because it is a point source detector, every effort must be made to place a sufficient number of detectors upwind of the air base and mission-critical areas.

4.5.7.3.2. Place M90 units no closer than 500 meters apart within the confines of the base. This placement can change due to the prevailing winds, likely attack routes, threat assessment, proximity to major lines of travel, work-area noise levels, etc.

4.5.7.3.3. Place the M90 units no closer than 25 feet from any major structure to ensure maximum exposure to prevailing winds and limit interference caused by buildings.

4.5.7.3.4. Be sure to avoid place the M90 around smoke, jet fuel vapors, and diesel exhaust. The M90 has shown sensitivity to these interferents and will possibly detect them as chemical agents.

4.5.7.3.5. The M90 should be at least 3 feet, but no higher than 6 feet, off the ground to ensure maximum exposure to the contaminating environment.

4.5.7.4. Readings from the M90 are based on the light level: low light lit = lowest detectable level; medium light lit = miosis; high light lit = highest detectable level associated with the M90.

4.5.7.5. Inclement Weather Conditions. To prevent damage to the instrument from inclement weather, place the M90 in a protective cage. The cage should be made out of wood or sheet metal with air slots and a locking, front door.

4.5.7.5.1. The top of the cage should prevent rain or falling particulates from affecting the M90's operation.

4.5.7.5.2. The M90 can suffer adverse effects if operated unprotected during inclement weather conditions (e.g. constant rainfall, dust, etc.)

4.5.7.5.3. If the rain caps on the M90 are not properly positioned, water can be sucked in the inlet valve and damage the instrument.

4.5.7.5.4. Do not place the units in low lying areas where the alarm cannot be seen or heard. Likewise, do not place units on tops of buildings since most chemical warfare agents are heavier than air.

4.5.7.6. Maintenance and decontamination. Refer to **Chapter 3** of the M90 User Manual for complete details. Topics covered include Cleaning, Decontamination (both external and internal), Internal Filter Replacement, External Filter Replacement, and Battery Replacement. The M90 CAD can be decontaminated internally and externally. Before decontaminating the detector check that all air and electric protector caps are tightly closed and the power is turned off.

4.5.7.6.1. If the internal parts have been contaminated two options are possible: use the M90 chemical filter adapter with a charcoal filter fitted to the air inlet port, and operate until the alarm light is extinguished; or use the UIP and run the decontamination option.

4.5.7.6.2. The outside casing and top panel of the detector can be decontaminated by using a decontamination solution of mild soap and water.

4.5.8. M22 Automatic Chemical Agent Detector Alarm. The M22 system will determine the presence of nerve and blister agent vapors. The system provides the user with a stand alone, automatic vapor agent detector. The M88 Detector is the main piece of equipment in the M22 System. The M88 is an automatic air sampling chemical detector for G and H series agents. The M-88 draws air into a port and samples the air for nerve and blister agents. The M-88 provides a visual and audible alarm when chemical agent vapors are present. It can also be attached to the M42 alarm. ***NOTE:*** The sensor assembly inside the M88 detector, a sub-component of the ACADA, contains two Nickel-63 sources of radioactive material. Do Not attempt to open the M88 Detector. T.O. 11H2-23-1 is the technical reference for inspection and use.

4.5.8.1. **Table 4.13.** Provides a list of components for the ACADA.

Table 4.13. ACADA Components and Power Requirements.

M88 DETECTOR	6.5 inches in length, 7.0 inches in width, 10.75 inches in height and 10.63 pounds in weight, without battery
Operating temperature	-22°F to 125°F
Storage temperature	-80°F to 160°F
Operating relative humidity	5 to 99%
Power requirements	24Volt DC at 0.6 amps at 20°C
BATTERY BOX	6 inches in length, 7 inches in width, 3 inches in height and 3.3 pounds in weight, with battery
Operating temperature	-40°F to 125°F
Storage temperature	-80°F to 160°F
Operating relative humidity	5 to 99%
Power requirements	24 volt DC at 7.2 amps
	Holds one BA5590/U non-rechargeable lithium sulfur dioxide battery, weight 2.2 pounds
BATTERY LIFE	Approximately 15 hours at normal temp; in cold temperatures -22°F, 3-4 hours
M42 REMOTE ALARM	8.8 inches in length, 6 inches in width, 6 inches in height and 3.8 pounds in weight, with battery
Operating temperature	-40°F to 125°F
Storage temperature	-80°F to 160°F
Operating relative humidity	5 to 99%
Power requirements	Battery, dry, 1.5 volt, BA3030/U (4 each)
M28 POWER SUPPLY	4.5 inches in length, 7 inches in width, 4.3 inches in height and 12.9 pounds in weight. NSN 6120-01-438-6960
Operating temperature	-40°F to 125°F
Storage temperature	-67°F to 158°F
Operating relative humidity	5 to 99%
Power requirements	96 to 136 volt AC, or 190 to 256 volt AC, 47 to 60 Hz at 200 watts maximum
	M28 will supply 24 volt DC +/- 1 volt DC at 2 Amps
A confidence sample is used to determine the operational state of the M88 detector. The sample was designed to have both agent vapor modules in one device. One end is for blister agents and the other end for nerve agents. Complete procedures for use and care are identified in T.O. 11H2-23-1.	

4.5.8.2. Operational Limitations. The M22 system is limited by both battery power life and airfield interference. Refer to T.O. 11H2-23-1 for guidance.

4.5.8.3. Concept of Employment. The M22 should be employed around an air base in a DICE 5 pattern for early detection and warning of chemical agent vapors.

4.5.8.3.1. Because it is a point source detector, every effort must be made to place a sufficient number of detectors upwind of the air base and mission-critical areas.

4.5.8.3.2. Place M22 units no closer than 500 meters apart within the confines of the base. This placement can change due to the prevailing winds, likely attack routes, threat assessment, proximity to major lines of travel, work-area noise levels, etc.

4.5.8.3.3. Place the M22 units no closer than 25 feet from any major structure to ensure maximum exposure to prevailing winds and limit interference caused by buildings.

4.5.8.3.4. Be sure to avoid placing the M22 around smoke, jet fuel vapors, and diesel exhaust. The M22 has shown sensitivity to these interferents and will possibly detect them as chemical agents.

4.5.8.3.5. The M22 should be at least 3 feet, but no higher than 6 feet, off the ground to ensure maximum exposure to the contaminating environment. Do not place the units in low lying areas where the alarm cannot be seen or heard. Likewise, do not place units on tops of buildings since most chemical warfare agents are heavier than air.

4.5.9. M272 Chemical Agent Water Testing Kit. The M272 is a portable kit for detecting chemical agents in water. The kit can detect harmful levels of hydrogen cyanide (AC), mustard (HD), lewisite (L), and nerve agents. The M272 uses cholinesterase enzyme tickets to detect nerve agents and chemical detection tubes to detect mustard, lewisite, and cyanide. The kit contains supplies to perform 25 tests for each agent. All four tests can be conducted in about 20 minutes.

4.6. Biological Agent Detection Equipment.

4.6.1. Advance Concept Technology Demonstration - Portal Shield. Portal Shield provides the user with a biological detection system with a chemical add-on consisting of the ACADA. The system is hard-wired with comm back up to provide continuous information through a computer terminal located at the command and control centers chosen by the installation. The computer terminal indicates when an agent is detected and can identify the specific biological agent triggered upon in near real time. The Portal Shield Advanced Concept Technology Demonstration provides an interim capability for a limited number of installations until Joint Biological Point Detector System (JPBDS) are developed and fielded. The system is able to detect biological agents in 5 minutes or less, identifies the agent in 20 minutes or less and can currently identify 8 biological agents delivered with wet aerosol or dry powder dissemination systems.

4.6.1.1. Components. The system consists of a Global Positioning System, weather station, particle counter, CPU radio modem, optical immunoassay ticket reader, and cyclone sampler, and most notably, a decontamination unit for sensitive equipment, and hand held assays known as SWUBE's. It is fielded in a quadcon configuration with environmental control unit. The chemical add on is the addition of the M22 ACADA integrated into the system to allow both biological and chemical sampling and notification.

4.6.1.2. Power Requirements. Total power requirements for each quadcon unit (this includes the power to run the ECU and the UPS and sensor) is approximately 3200 watts.

4.6.1.3. Operating Ranges. The sensors normal operating range (without cooling) is 32-80 degrees F. The antibodies in the optical ticket reader (used for ID of the BW agents) needs to be kept at a fairly constant temperature resulting in the need for the ECU.

4.6.1.4. Operational Limitations. The only known limitation is the number of units available for the United States Air Force. Two bases in Korea, a limited number of sites in SWA, and the potential additional sites makes the capability useful, but not available to all required sites.

4.6.2. Joint Biological Remote Early Warning System (JBREWS). The primary objective of the Joint Biological Remote Early Warning System (JBREWS) Advanced Concept Technology Demonstration (ACTD) is to evaluate the military utility of a biological early warning capability that allows an increased decision cycle to warn, report and protect deployed forces; develop operational procedures with that capability; provide the sponsoring Commander-In-Chief (CINC) an interim capability to detect and warn forces who may have been exposed to Biological Warfare (BW) agents; and, support that capability for two (2) years. Additionally, the ACTD will demonstrate the Command and Control (C2) interoperability and connectivity necessary to perform automated warning and reporting of a biological attack. The JBREWS ACTD will provide the first joint service capability for biological remote early warning across the battlespace. This capability will significantly increase the survivability of the soldier/sailor/airman and marine on the battlefield. The conduct of the JBREWS ACTD will establish the capability needed to protect US forces against BW on/off point attacks.

4.6.2.1. The JBREWS will strive to utilize a mix of complementary technologies to provide early warning of BW attacks. The specific and necessarily limited primary mission for the JBREWS ACTD is to detect and warn of the presence of biological agent(s) so that exposure to a ground maneuver force in an assembly area or airbase causes minimal casualties. Other critical functional requirements for the JBREWS ACTD include sampling, identification, and de-warning. The design threat is a BW missile attack targeted on or off the assembly area or airbase. The mission is further defined to cover about a 50-100 square kilometer (km) contiguous area.

4.6.2.2. JBREWS is a system of BW agents sensors. The JBREWS will demonstrate four components - the JBREWS architecture, the Deployable Unit Biological Detection System (DUBDS), the Short Range - Biological Standoff Detection System (SR-BSDS), and the data link from legacy biological detection systems.

4.6.2.3. The JBREWS architecture consists of a series of "control" nodes coupled with an expert system that recognizes biological attacks. Once the JBREWS recognizes that a biological attack has occurred, it will provide the necessary data to the Joint NBC Warning and Reporting Network (JWARN). JWARN will disseminate the biological attack warning using the appropriate NBC message. Additionally, JWARN will predict the hazard area and provide warnings to the units at risk.

4.6.2.4. The DUBDS consists of detection and identification master unit and sentry (trigger) sensors. In its most basic mode of operation, the trigger sensors continually monitor the air for an increase of aerosol particles over background. Once the Sentry network determines a potential BW attack is underway, the network notifies the detection and identification module (master unit). The master unit draws an air sample and analyzes the sample for X specific BW agents. If a BW agent is detected, a message is transmitted to a JBREWS control node. The unit is given a local warning of a possible biological attack. The expert system analyzes the detection report and selects a recognition pattern which indicates which other battlefield biological sensors should begin to report BW agent detection’s.

4.6.2.5. The SR-BSDS is an active standoff detection system. The SR-BSDS can provide standoff detection out to five kilometers. The SR-BSDS can provide near real time detection of a suspect BW attack.

4.7. Decontamination Equipment.

4.7.1. M258A1 Personal Decontamination Kit. The M258A1 kit provides the individual with a portable, expedient, method of decontaminating the skin of liquid nerve and blister agents. The M258A1 Kit consists of a pocket-sized plastic case (2 inches by 4.25 inches) containing six packages of decontamination wipes, three of them marked "1" three marked "2." Each "1" packet contains a gauze wipe soaked with decontaminant to be used to wipe skin, clothing, masks, gloves, personal weapons, and equipment. Packet "1" decontaminant is caustic and toxic. Each "2" packet contains a wipe and a glass vial of a solution to be added to the wipe before use. Packet "2" materials neutralize packet "1" decontaminant. M258A1 kits are being replaced by the less toxic M291 Kit decontaminants. The kit operates in temperatures up to 110°F. T.O. 11D1-1-111 is the technical reference.

4.7.1.1. Operational Limitations. The packets are a one-time use item. Do Not use if any of the following conditions exist: outdated or open packets, seeping or swollen packets, or packets with dried residue. Packets that have been subjected to direct sunlight or temperatures of 110°F should not be used. Discard all defective packets as hazardous waste. Solutions in packets are flammable; Do Not use around open flame.

4.7.1.2. Inspection. Inspection of M258A1 kit is the individual user's responsibility. Follow all procedures to prevent injuries. Inspect the M258A1 prior to use. Wear rubber gloves while inspecting kits. Inspect for holes in packets. Verify glass ampoules in packet 2 are not crushed. Check if the case/packets is deformed, or packets have deteriorated. Minor cracks in case, rubber O-ring missing, or nylon strap missing do not constitute unserviceability.

4.7.1.3. Operational Use. When contamination is found or suspected on skin, act immediately. If chemical protective clothing is not on put on your mask and hood. Do not zip the hood, pull the draw strings, or fasten the shoulder straps. The M258A1 kit may be used to decontaminate small equipment and the protective mask. Refer to the T.O. for complete procedures.

4.7.2. M291 Skin Decontaminating Kit. The M291 Skin Decontaminating Kit provides the user capability to completely decontaminate through physical removal, absorption, and neutralization of chemical agents on the skin. This wallet-sized kit contains six separately packaged laminated pads soaked with the nontoxic decontaminant AMBERGARD XE-555. Ambergard absorbs and neutralizes chemical agent. M291 pads are to be used to wipe skin, clothing, masks, gloves, personal equipment, and weapons. The six pads of an M291 kit should be sufficient for three personal decontaminations. The kit operates in ranges from -50°F to 120°F. T.O. 11D1-1-131 is the technical reference.

4.7.2.1. Inspection. The user must do the following inspection prior to use: inspect kit for loose black powder. If no loose powder is present, the kit is serviceable. If powder is detected, inspect each packet for leaks. Discard all leaking packets. Replace bad packets with new ones. Six total packets make a complete kit.

4.7.2.2. Operational Use. When contamination is found on skin, act immediately. Put on your mask and hood. Do not zip the hood, pull the draw strings, or fasten the shoulder straps. Seek overhead cover or use a poncho for protection against further contamination. Refer to the T.O. for complete procedures.

4.7.3. M295 Individual Equipment Decontamination Kit. The M295 Kit allows the individual to decontaminate their equipment through physical removal and absorption of chemical agents. Each M295 Kit consists of a carrying pouch containing four individual decon packets. Each packet contains a decon mitt filled with decon powder. The packet is designed to fit comfortably in the pocket of the ground crew ensemble. Each individual mitt is comprised of absorbent resin contained within a nonwoven polyester material. The kit operates in ranges from -25°F to 180°F. Technical Manual TM-3-4230-235-10 is the technical reference.

4.7.3.1. Inspection. Inspect kit for loose black decon powder. If no powder is detected, the kit is operational. If powder is detected, inspect each packet for leaks. Discard all leaking packets. A complete kit consists of 4 serviceable packets.

4.7.4. M17/ M17A2 Decontaminating Apparatus. NOTE: The A/E32U-8 Sanator is a variant of this system and is being phased out by attrition. The USAF is converting existing M17s into M17A2s by replacing the engine. The M17A2 Decontamination Apparatus provides the user with a portable decontaminating capability. Decontamination at an airbase is essential to sustain operations once an airbase has been contaminated. Limit fixed site decontamination to mission essential areas. Refer to the T.O. for complete operating procedures.

4.7.4.1. The only difference between the M17 and M17A2 is the engine manufacturer. Both systems have the same capabilities: a portable (165kg), self-contained system capable of supplying up to 24 l/min of superheated (150°C) water at moderate pressure (to 100psi) through two spray wands for equipment decontamination. Alternatively, it can supply up to 80 liters of warm water per minute through 12 shower heads for personnel decontamination. It can draw water from any source and accepts fuel directly from jerry cans for heating and to drive the pump motor. The system consists of a pump/heater assembly, two spray wands, each with 20 meters of high pressure hose, 12 shower points, 10 meters of suction hose with filter, and an injector for chemical decontaminant. T.O. 11D1-3-9-1, 11D1-3-9-2, and 11D1-3-9-1CL-1 are the technical references.

4.7.4.2. General Description. The M17A2 decontamination apparatus is comprised of seven major component systems: engine, engine fuel system, electronic control system, air system, heater system, heater fuel system, and water system. These systems provide a supply of pressurized, temperature controlled water. The apparatus weighs 360 lbs, is 40.2 inches long, 23.2 inches in width, and is 33.9 inches in height.

4.7.4.3. Components. The major components includes the engine, heater, and accessory kit.

4.7.4.3.1. The engine is a single cylinder, two cycle, 197 cc, 7.3 hp, air cooled engine. The fuel mixture is 2 cycle oil and unleaded gas, 1qt of oil to 5 gallons of gas.

4.7.4.3.2. The heater is a convection type, jet fired, igniter plug ignition, and produces 700,000 BTU. It runs on leaded or unleaded gasoline and will run on diesel (DF2), jet fuel (JP4), or kerosene.

4.7.4.3.3. Accessory Kit. Box weighs 143 lbs and is 41.8 inches long, 20.5 inches wide, and 15.4 inches in height. It includes: suction hose, 33 feet long with quick disconnect, branch hose, 3 feet long with quick disconnect; pressure hoses, 50 feet in length quick disconnect; shower sets (2 each), 3-section with 6 jets each, 8 feet in length with quick disconnect; spray wands, 3 foot single sections, trigger actuator with quick disconnect; injector, 80/20 siphon, with cam coupling; water tank, 1580 gallon, collapsible, self-erecting rubberized-nylon, weight 70 lbs (empty) and 5.8 feet in height (full). Stored separately.

4.7.4.4. No external power is required to operate this system. Only a source of water and fuel is needed. There are two operating ranges: usual conditions: above 32°F, refer to Section III of T.O.; unusual conditions: below 32°F, refer to section IV of T.O.

4.7.4.5. Operational Limitations. The M17A2 will operate in all environments; however, extra components must be properly maintained in weather below 32° to prevent failure. The M17A2 is limited only by its water and fuel supply. The unit is heavy and moving it requires at least four people.

4.7.4.6. Inspection. The inspection of the M17A2 requires Preventive Maintenance Checks and Services (PMCS). These procedures are described in detail in section II of T.O. 11D1-3-9-1, which gives user actions for before, during, and after operations. The T.O. outlines unit maintenance and specifies the semi-annual, annual, biennial, and hourly PMCS actions.

4.8. Nuclear Detection Equipment.

4.8.1. Charger CDV-750/750-5/750-6. The charger provides the user with a portable unit designed to provide the necessary voltage to charge, illuminate, and read the IM-143 dosimeter. The CDV-750 charger is approximately 4 inches square, 3 inches high and weighs 1.25 pounds with battery. The charger has two bulbs, one on the circuit card inside and one in the charging pedestal. The charger has one large knob (left side) that is for dosimeter adjustment and one cap (right side), that is for charging and reading the dosimeter. The CDV 750-6 (pistol grip) is also available in the field. The CDV 750-6 is the latest version of dosimeter charger. It's advantages over older models include: easier handling, faster loading, charging, and zeroing, and it uses no batteries. It has a pistol grip handle with rapid dosimeter loading using the short yellow trigger. Instead of battery power, this model uses a magneto to charge the dosimeter. This is done by loading a dosimeter and squeezing the black lever repeatedly until the light located near the top of the pistol grip flashes. To zero the dosimeter, the operator looks through the dosimeter at the scale and squeezes the black lever to move the hairline down to zero. The small black button is used for fine adjustment (moves the hairline upscale in small increments with every press) T.O. 11H4-2-12-1 is the technical reference for inspection and use.

4.8.1.1. Power Requirements. The CDV-750 charger is powered by one 1.5 volt, D-cell battery. Battery life is dependent upon use and freshness of battery.

4.8.1.2. Preventive Maintenance (PM). Accomplish PM every 28 days when charger is in use and 180 days when charger is in storage. Documentation to support PM should accompany charger. The following procedures apply:

4.8.1.2.1. Clean the battery contacts and battery terminals to remove any corrosion. Use denatured alcohol and a soft cloth, no water.

4.8.1.2.2. Check the battery and the two bulbs. Replace the spare bulb if it is missing from its holder.

4.8.1.2.3. If the battery has leaked, remove the case bottom and fill with warm water. The corrosion will be loosened in a short time and can be rinsed out. Dry the case bottom, replace the battery, and check the electrical operation by charging a dosimeter.

4.8.2. Dosimeter, IM 143PD. The dosimeter detects and measures cumulative exposure to X-ray and gamma-ray radiation from 0 - 600 Roentegens (R). The dosimeter can be used for individual or area measurement for total radiation exposure. This survey meter is designed for large area surveying to find the extent and intensity of radioactive contamination. It can also be used for area and personnel monitoring to determine the presence and intensity of residual radiation. The dosimeter is a sealed assembly in a metal barrel. A magnifying optical system is contained within the metal barrel for reading the image on a calibrated scale. The dimensions and weight are approximately 4.5 inches in length, .5 inches in diameter and 1.5 ounces in weight. The dosimeter has two distinct ends, one for charging and one for viewing. The charging end has a metal charging post located in the center of the barrel. A protective rubber dust cap should be mounted over the charging end to protect the charging post. The dosimeter will operate with or without the dust cap. The viewing end has a glass window and does not require a dust cap. T.O. 11H4-6-1-1 is the technical reference.

4.8.2.1. Operation. Two phases of operation are applicable to the dosimeter, preoperational and operational:

4.8.2.1.1. Preoperational: The dosimeter must be charged before use. To charge the dosimeter, a "charger" must be used. The standard charger for the dosimeter is the CDV-750 charger. Operation of the charger is identified in T.O. 11H4-2-12-1. Charging the dosimeter realigns the scale and clears any readings on the scale.

4.8.2.1.2. Operational: Once charged, the dosimeter is worn in clothing (pocket), or attached to clothing (vest), for personal use. If used in a shelter, it is usually placed in occupied rooms. To read the dosimeter, a light source is required. Hold dosimeter in hand and look at a light. Rotate the dosimeter to a horizontal position to align the internal scale. Read the hairline on the scale. The reading obtained is the accumulative amount of radiation received from the time the dosimeter is charged to when it is read.

4.8.2.2. Preventive Maintenance (PM). Charging and leak check must be done prior to annual calibration and operational use. Three phases of maintenance are required for the dosimeter; preventive, verification of leakage rate, and calibration. Refer to T.O. 11H4-6-1-1 for complete procedures. The instrument must be calibrated annually through the Precision Measurement Equipment Laboratory (PMEL).

4.8.3. ADM 300, Multi Functional Radiac Meter (MFR). The ADM-300 RADIAC meter will locate and measure low and high intensity gamma rays or detect beta particles. When used with external probes, it will locate and measure alpha, gamma, x-ray and neutron radiation, and detect the presence of beta. The ADM-300 is a battery operated, self diagnostic, multiple function instrument. The ADM-300 meter has a Liquid Crystal Display (LCD), a programmable meter and is RS-232 serial computer port compatible. The meter has a internal probe and is configured to use optional external probes. The meter can be vehicle powered and mounted and has both audible and visible alarm displays. Meter weight 3 pounds, height 1.88 inches, width 4.38 inches and length 8.5 inches. T.O. 11H2-2-31 is the technical reference for inspection and use.

4.8.3.1. Components. The ADM-300A radiological assessment kit is configured several ways to provide user-specific requirements. **Table 4.14.** list basic pieces; refer to T.O. 11H2-2-31, chapter 5 for itemized components by kit type:

Table 4.14. ADM 300A Components.

ITEM	KIT A	KIT B	KIT C	KIT E
ADM-300A - Multi-function survey meter, part # 702454-001/2	X	X	X	
AP-100A - Alpha probe, part # 801473-001	X		X	
BP-100 - Beta probe, part # 702456	X		X	
KC-100 - Probe cable, part # 702459	X		X	
XP-100 - X-ray probe, part # 702461			X	
CC-100 - Carry Case, part # 702464	X	X	X	
HG-100 - Gun Handle, part # 703231	X	X	X	
EM-100 - Headset, part # 702463	X		X	
TS-100 Test Source				X

4.8.3.2. The ADM-300A will operate on both AC/DC power. AC: 100 to 240 VAC, 50 or 60 Hz. DC: Two standard 9-volt batteries, 100 hours battery life. Vehicle Power: 12-24 volts.

4.8.3.3. The following summarize the unit's operating ranges: altitude operating range -- Up to 15,000 feet above sea level; humidity -- 0 to 95%; operating temperature -- from -22°F to 122°F; and storage temperature – from -40°F to 140°F.

4.8.3.4. Unit of Measurement and Range. The radiation range and units of measurement adjust automatically depending on the MODE selected and the probe attached. The ADM-300A detects, measures, and digitally displays levels of gamma radiation from 10µR/h (micro roentgen per hour) to 10,000 R/h. The analog display is a bar graph which covers 10µR/h to 1,000 R/h. The Alpha and X-ray probes use a different unit of measurement than the basic meter. Three units of measurement are available: Curie/MxM (µCi/MxM); DPM/Cm x Cm (disintegrations per minute/cpm); and C/mn ALPHA (counts per minute). The survey meter will automatically provide and display the proper readings and unit of measurement over its entire operating range as illustrated in **Table 4.15.**

Table 4.15. ADM 300A Components.

Survey Meter. The survey meter will automatically select one of four operating modes (2 low and 2 high)	
The low-range detector in the dose RATE mode	Detects and measures gamma and detects beta radiation. Ranges from 10 µR/h to 5 R/h.
The low-range detector in the accumulated DOSE mode	Measures gamma and detects beta radiation. Ranges from 1 µR/h to 1,000 R.
The high-range detector in the dose RATE mode	Detects and measures gamma radiation only. Ranges from 3 R/h - 10,000 R/h. Note. Detects and measures up to 10,000 R, but only displays 1,000 R.

The high range detector in the accumulated DOSE mode	Detects and measures gamma radiation only. Ranges from 1 µR to 1,000 R.
Alpha Probe. The range of the Alpha probe is 0 - 1,200,000 counts per minute.	

4.8.3.5. Capabilities and Limitations. The instrument will display both a dose rate as well as an accumulated dose amount. With additional auxiliary probes, the ADM-300A has extended capability such as detecting and measuring alpha radiation. In its stand alone configuration it detects and measures gamma and detects beta radiation.

4.8.3.5.1. Highly Resistant. The ADM-300A operates in temperatures from -25° to 50°C (-14° to 122°F) and in humidity up to 100%. It is highly resistant to most harsh environmental conditions. For example, it is engineered to operate even after being accidentally immersed in water. NOTE. The unit will not operate underwater.

4.8.3.5.2. Operates On Two 9 Volt Batteries. The meter primarily operates on two standard 9 volt alkaline batteries and will last about 100 hours at 25°C (76°F).

4.8.3.5.3. Electromagnetic Pulse. The instrument is also electromagnetic pulse (EMP) hardened and will not saturate at a dose rate of up to 100,000 R/h.

4.8.3.6. Principles Of Operation. The ADM-300A is microprocessor-based. This means that the internal electronics control all functions including detection, calculation, compensation, and display. The central processing unit (CPU) control both low range and high range Geiger - Mueller (GM) tubes. The two GM detectors produce electrical signals when exposed to gamma rays and beta particles.

4.8.3.7. Modes of Operation. Press the MODE switch until the desired reading is displayed. The mode is displayed as follows in **Table 4.16.**

Table 4.16. ADM 300A Modes.

MODE	DISPLAY
DOSE Rate	RATE
Dose	DOSE
Dose Rate Alarm	RaAlm
Dose Alarm	DoAlm
Scaler (used for accumulation over a preset period of time)	Scaler
Survey (used for tracking up to 100 pre-designated monitoring points)	Survey

4.8.3.8. Alarm Set Points. To see the current alarm set points, repeatedly press the MODE switch until RaAlm or DoAlm is displayed. The default point for rate alarm is 600 µR/h and the dose alarm default is 100 mR. The unit memory retains the last setting when the power is turned off.

4.8.3.9. Alarm Display. When the survey meter has detected radiation above the preset alarm levels, the audible and flashing visual alarms are activated. The display shows the type of alarm.

4.8.3.10. Gamma Surveying. To perform gamma surveys with the ADM-300A, the beta window on the meter's rear panel must be closed. The survey meter will auto range to detect gamma radiation without interruption. During ground radiological reconnaissance the instrument should be at a consistent angle to the ground to assure accuracy and uniformity of readings.

4.8.3.11. Beta Monitoring. To monitor for beta, hold the ADM-300A in your hand or by the handle, if attached. Open the window cover and point window towards the suspected contaminated area. In the "low range" mode, the beta particles will enter the window if contamination is present. If the reading is 15 or higher with the window cover open, then Beta particles are present. Gamma reading can be observed while the window is closed.

4.8.3.12. External Probe Operation. Both the Alpha and Beta external probes lend themselves to convenient personnel and material contamination checks. The X-ray probe is designed to find gross contamination under cover of dust, snow etc., where alpha detectors would have no sensitivity. When the X-ray probe is attached the internal detectors and alarm set points are de-activated and the accumulation of dose is suspended. The neutron probe is an accessory to the ADM-300A kit and is used to measure neutrons in a nuclear environment. The probe is not a standard component to the kit; it must be ordered as a separate component.

4.8.3.13. Preventive Maintenance. Preventive maintenance or routine checks include a visual inspection, operational check, cleaning, and storing the unit. When turned on, the ADM-300A automatically runs a diagnostic test. It will display any malfunctions if they occur. Any problems other than low batteries will be displayed as FAILURE and then the type of failure. If this occurs, turn unit off, retry unit after 30 seconds. If failure still exists, turn unit off and contact NRC or box unit and return to NRC for repair.

4.8.3.14. Calibration. The ADM-300A requires an annual calibration. A performance test on the instrument and probe accuracy should be accomplished prior to use and every 180 days. Accuracy verification of the meter and probes is done using a test set containing test sources and a fixture to position the test sources.

4.9. Support Equipment.

4.9.1. M41 Protection Assessment Test System. The M41 provides the user with a quantitative device for correctly fitting the protective masks. Mask fit procedures for the M17 series masks greatly differ from the procedures of the MCU2A/P series masks. Variations in training, procedures, and fit equipment will be eliminated, resulting in protective masks that provide proper fit and protection. The M41 refers to the whole system or kit. The test instrument is called the Protection Assessment Test Instrument (PATI). The PATI is 9.5 in. x 7.5 in. x 5.5 in. and weighs 4.2 pounds. Total weight for the M41 with carrying case is 22 pounds. The M41 operator's manual is the technical reference.

4.9.1.1. Power Requirements. 115 VAC to 230 VAC or lithium-sulfur dioxide battery. Hours of operation per battery charge are 8 hours at 70°F.

4.9.1.2. Operational Limitations. Operate inside at ambient temperatures between 35° and 100°F. Inaccurate readings will result if the M41 PATS is operated in temperatures below 35°F and temperatures above 100°F. Do not smoke in the immediate area and within 30 minutes prior to the test. For valid results, the airman should not talk during the mask fit test.

4.9.1.3. Calibration. The PATI should be calibrated every 18 months or 500 hours of operation, whichever comes first. It is the operator's responsibility to track and maintain the usage hours of the device. Refer to Chapter 6 of the Operator's Manual for cleaning and calibration instructions.

4.9.2. NBC Contamination Marking Set. The marking kit provides the user with a lightweight, portable, easy to use marking set to mark the presence of NBC contamination. The marking set is green plastic with two carrying straps for backpack or frontal wear. The set has three individual rollers integrated in the plastic case. Basic weight with components is less than 10 pounds, length is 13.6 inches, width is 9.3 inches, and height is 3.6 inches. Technical Manual 3-9905-001-10 is the technical reference.

4.9.2.1. Components. The marking set consists of a carrying container; 60 marking flags, 20 for each type of NBC hazard; 48 metal stakes each 11.4 inches in length; 2 red marking crayons; and 13 separate rolls (66 feet in length) of yellow marking ribbon.

4.9.3. Multi-Man Intermittent Cooling System (MICS). The MICS provides cooling to alleviate heat stress to personnel performing moderate to high intensity work such as Integrated Combat Turn-arounds (ICTs) and some Base Recovery After Attack (BRAAT) functions while wearing chemical protective clothing. T.O. 35EA4-7-6-1 is the technical reference for inspection and use.

4.9.3.1. MICS consists of two major components:

4.9.3.1.1. Air Distribution Unit (ADU). The ADU is an external adapter to a standard flight line ground air conditioner equipped with an eight-inch duct flange adapter. The ADU receives cool air from the air conditioner, removes CB agents through two gas particulate filters (M-48s), and distributes the air to ten outlets. Each ADU, including filters, hoses and connectors, weighs 360 pounds. Dimensions are 36 inches long x 32 inches wide x 42 inches high.

4.9.3.1.2. Air Cooling Vest (ACV). The ACV is a lightweight (30 oz.) nylon vest with hose attachment to distribute cool, dry air to both the front and rear of the torso. The ACV is worn over the undershirt.

4.9.3.2. Power Requirements. The air conditioning source and power generator will be operated and maintained by aerospace ground equipment (AGE) technicians. A standard flight line generator and any air conditioning unit producing at least 200 cfm of air, with an 8-inch duct flange adapter is necessary to operate the ADU.

4.9.3.3. Three levels of maintenance exist for the ADU: organization, intermediate and depot.

4.9.4. AN/PSN-11 Navigation Set Global Positioning System (GPS). The GPS provides the user with global positioning and siting capabilities. The AN/PSN-11 will provide data for missions such as general navigation, siting/surveying, tactical reconnaissance, close air support, engineer surveying, electronic warfare (EW) operations, and ground-based forward air control. The GPS is a sealed, watertight, hand held receiver. It is less than 9.5 inches long, 4.1 inches wide, and 2.6 inches deep. It weighs 2.75 pounds with batteries. The instrument operates at the following ranges: -4 to 158°F; 0 to 100% relative humidity; and elevations from -1312 to 29,856 feet at mean sea level. T.O. 31R4-2PSN11-1 is the technical reference for this instrument.

4.9.4.1. Configurations. The GPS can be used by itself (internal battery and integral antenna); with an external antenna; remote RA or helmet HA; with external dc power cable, or ac power adapter; with the vehicle mount; or any combination of AN/PSN-11 external antenna, external power cable/adapter, or mount.

4.9.4.2. Power Requirements. The GPS will operate with both battery and external power. The internal power adapter is hardwired for a 110/220 volt ac power source via an external AC power adapter. The following are battery specifications and battery life estimates:

4.9.4.2.1. Lithium (nonrechargeable), BA-5800/U, >10 hours life.

4.9.4.2.2. Nickel Cadmium (rechargeable), Rockwell part# 221-0134-010, >1.5 hours life.

4.9.4.2.3. AA-alkaline (nonrechargeable), WB101, 8 each, >4.0 hours life.

4.9.4.2.4. AA-lithium (nonrechargeable), L-91, 8 each, TBD.

4.9.4.2.5. Lithium (nonrechargeable) (memory battery), LS6 BA, 1 year (change annually)

4.10. Physical Protection. Some permanent USAF air bases in CB high-threat areas (HTAs) are equipped with fixed collective-protection shelters that are staffed, maintained, and stocked for operation. Portable collective protection is not widely available, therefore, protection on host nation bases may be limited to that provided by the host nation or that provided by individual protective ensembles.

4.10.1. There are two types of personnel shelters: emergency operations shelters and rest and relief shelters. Overseas bases equip these shelters with chemical and biological (CB) protection as the threat dictates. CB protected shelters are maintained in a state of positive overpressure by the continuous introduction of filtered air. This assures an outward flow of air, contaminant vapor and contaminant aerosols.

4.10.1.1. Currently, there are three primary types of ColPro systems. The first type is ColPro built into critical work areas such as squadron operations centers, wing command posts, communications centers, hospitals and avionics maintenance facilities. A number of these systems are currently in some CBW threat areas. The second type of ColPro, survivable collective protection systems (SCPS), are underground rest and relief shelters positioned near operational areas. The third type, transportable ColPro, is deployable and has three variations that can protect work areas or rest and relief areas. One variation fits inside of rooms within buildings, another protects deployable shelters, and a third stands alone. These systems are in the early stages of development.

4.10.2. Sealed and closed structures offer some protection. In the absence of dedicated CP systems, the inherent features of some buildings offer protection not otherwise available. Walls, doors, and windows offer physical barriers to the penetration of contamination, while filters in heating, ventilation, and cooling systems can remove certain levels of particulate contamination. Wearing a mask inside such structures increases the protection for the wearer.

4.10.3. Biological warfare defense relies on the same measures for physical protection as chemical defense. However, because of aerosol nature of most BW threats, masks provide a higher level of protection against biological than chemical agents. The nominal BW agent protection factor for the mask is 1/50,000. In other words, the mask is designed to remove 99.998% of the BW agent in inhaled gases. Protective overgarments, hoods, gloves and boots minimize skin contact with biological agent. This protection may be supplemented with medical countermeasures. The need for a well fitting mask is critical

4.11. Medical CBW Countermeasures.

4.11.1. NAAK, MK1 Nerve Agent Antidote Kit. The NAAK consists of one atropine-filled (2 mg) and one 2-PAM Cl (600 mg) filled autoinjector in a single plastic clip. USAF personnel are authorized to carry three NAAK Mk-1 kits each (AFMAN 160-11). Atropine is an antichloinergic preparation. It mitigates many of the effects of nerve agent poisoning. 2-PAM Cl facilitates the reactivation of nerve agent-inactivated acetylcholine. It, like atropine, is supplied in single dose autoinjectors for use after recognition of the symptoms of nerve agent exposure.

4.11.2. NAPP, Nerve Agent Pretreatment, Pyridostigmine. Pyridostigmine tablets are packaged in blister packets of twenty-one 30mg tablets. Pyridostigmine is a nerve agent pretreatment. It is supplied in tablet form for oral ingestion. Pyridostigmine pretreated personnel can survive substantially larger nerve agent exposures than untreated personnel. USAF personnel are usually issued one NAPP packet when chemical protective ensembles are expected to be opened for use (AFMAN 160-11).

4.11.3. CANA, Convulsion Antidote, Nerve Agent. Diazepam is an anticonvulsant issued for personal administration after chemical attack. It is only used in personnel displaying well developed indications of nerve agent poisoning. It is administered as part of buddy-aid by autoinjector. CANA issue is one diazepam-filled autoinjector per person.

4.11.4. Modern biological warfare defense relies heavily on medical countermeasures. These are the responsibility of Health Services of the Individual Services (Joint Publication 4-02).

4.11.5. Medical services provide prophylactic, diagnostic, and therapeutic measures for prevention and management of BW casualties.

4.11.5.1. Prophylaxis against BW agents depends primarily on vaccines and toxoids. Antibiotics, antiviral agents, and antibody preparations (immune serum, antitoxins) can provide short-term prophylaxis.

4.11.5.2. Vaccines and toxoids are available for use against some (B. anthracis, Y. pestis) but not all (ricin, B. suis) BW agents. They often produce high levels of protection and that protection often lasts for years. But it has a delayed onset and can be overwhelmed.

4.11.5.3. Both antibiotics and antibody preparations have been used for prophylaxis. But, the protection they impart is relatively short lived (a few hours from a single dose of antibiotic, a few weeks to a few months from a single dose of antibody preparation). Antibody preparations provide instantaneous protection at a level governed by the administered dose. Antibiotics are available for most bacterial and rickettsial agents. Antiviral agents are effective against some viral infections. Neither is effective against toxins.

Chapter 5

NBC COMMAND AND CONTROL

5.1. Survival Recovery Center. The nucleus of all wing CB defensive communications is the Survival Recovery Center (SRC). The SRC is the focal point for detection, warning and reporting of CB events, damage, and directing mission operations. Control Centers, shelters, detection posts, and automatic detectors all report data.

5.1.1. The Readiness position in the SRC is normally occupied by the Readiness Flight officer or senior NCO. The first preparation to perform in the SRC is ensuring the lines of communication are in place. You must be able to receive information from your teams as quickly as possible. Once you receive this information you must analyze it and give your advice to the correct person or coordinate with the proper agency.

5.1.2. Understandably, the SRC can get pretty chaotic at times, teamwork with all SRC representatives is essential. Every unit on your base is represented in either the SRC or Wing Operation Center (WOC). Part of your preparation is ensuring all representatives are aware of the information you provide and the information you need from them.

5.2. NBCCC. The Nuclear, Biological, Chemical Control Center (NBCCC) is responsible for providing the SRC Commander information pertaining to detected hazards and duration of the hazard. The NBCCC is also responsible for receiving NBC reports from other locations, evaluating, and notifying the SRC of any threat to the base. This control center should be staffed with two Readiness personnel with at least one person being a 3E971 or a 3E991. This job consists of directing and monitoring the specialized teams and running the NBC Warning and Reporting System (NBCWRS). To prepare the NBCCC, ensure the lines of communication with your specialized teams and all UCCs exist. You must also ensure you have communication procedures with each agencies (to include host nation and sister services), both on and off base, in your NBCWRS. As a minimum, you should equip the NBCCC with the items listed in Table 5.1.

Table 5.1. NBCCC Equipment List.

ATP 45 and theater/command directives	Overlays and templates (scaled)
Rulers and protractors	Plotting equipment (i.e. grease pencils, pens, pads, NBC 1-6 report forms)
1:50,000 and 1:250,000 UTM maps of unit area	Base grid map and maps of dispersed unit operating locations
Computer and plotting software as required:	

JWARN will provide near real-time operational capability for joint services to collect, analyze, report and disseminate NBC agent detection, identification, location, and warning information. Within the Air Force, JWARN will be located in the base command and control center and will be operated by NBC defense specialists and other designated personnel.

JWARN is a three-phase program. Phase I, the interim phase, consists of commercial-off-the-shelf (COTS) NBC warning and reporting software and government-off-the-shelf (GOTS) hazard prediction models.

NBC Analyis, EMIS/D2PC, HPAC, and VLSTRACK are four software packages included as part of the phase IA JWARN. Note: the nbc Analysis software being fielded by this phase is an updated version of what some units currently have. Phase IA (NBC Analysis) provides only the software necessary to automate plotting and reporting in accordance with ATP-45a; it does not include any capability to link detectors to the software.

JWARN phase II provides the total JWARN capability by integrating detector systems and NBC information management software modules into the services C4I2 systems.

JWARN phase III, the pre-planned product improvement (P3I) phase, will add to the communications and software functionality to accommodate the next generation of detectors and upgrades to C4I2 systems.

5.3. Establish Information Flow. To have a successful outcome during an operation, the most important thing we must do as a team is to communicate with one another. If our message doesn't make it to the receiver, our mission could fail.

5.3.1. Communications between the SRC and unit control centers or specialized teams provides information for critical decisions affecting the scope of post-attack damage and contamination and its impact on the base's missions. SRC members must disseminate information to and collect information from, UCCs, specialized teams, and shelters. Inputs come into the SRC from control centers or from individual reports.

5.3.2. The flow of information is vital to any contingency or exercise. During any control center operation information flows up and down. Use checklists to ensure all items are covered. The following is some information that will flow through the survival recovery center (SRC) and unit control centers (UCC).

5.3.3. Radio communication will be one of the primary means of passing information. Also, radios could become your primary means of communicating with other base agencies if telephones become inoperative or if you are in a deployed location. It is vital that all Readiness personnel understand how to use radios. Develop telephone/radio frequency (and alternate) communications lists for unit shelters, control centers, reconnaissance team, and contamination control teams.

5.3.4. Information Flow. The SRC has several simultaneous requirements to communicate information and decisions. Communications may include checklists to activate, resources needed, directions to evacuate or take cover, and accomplishment of specific actions associated with states and stages of alert.

5.3.4.1. Upward Flow. Upward flow of information starts with the individual and goes through the UCC to the SRC. The SRC must also communicate with MAJCOM or theater through the wing commander to report any critical shortages or incidents that affect the mission capability of the installation.

5.3.4.2. Downward Flow: The SRC must inform UCCs of the situation when it changes. This includes alert stages, threats, or attack information.

5.4. Duplication Of Information. Because of the levels of input, multitude of sources, and quantities of information channeled through the SRC, reports are inevitably duplicated. The SRC staff needs to coordinate and consolidate all inputs to eliminate duplications.

5.4.1. Reports are unplanned and uncontrolled. Expect individuals to call in when they have damage, fire, lose power etc. Individual reports create the potential for chaos by having lower priority problems choking your lines of communication.

5.4.2. Observation posts use personnel that are dispersed throughout your reporting area who can immediately report on post-attack conditions and damage in their immediate area. Some examples are: security forces ground defense positions and aircraft control tower.

5.4.3. By far the best way for information to flow is through organized reports. During contingencies, the SRC receives reports from several sources. Messages and status updates arrive from headquarters and other installations. Organized reports usually originate from base personnel or designated teams. The reports are funneled to UCCs and passed to the SRC. The advantage of an organized report is that you can quickly get a damage assessment of the entire base. This reduces multiple reports and provides a better system to prioritize damage. Organized reports should contain the following: casualties, fires, facility/utility damage, presence of NBC agents, airfield damage, UXO, indication of impact to mission. Due to the number of incoming reports you will have to prioritize communications. Ensure the teams are aware of the priority of their team and they adhere to it.

5.5. Monitor Passive Defense Measures. Measures taken without engaging enemy forces to reduce the probability of and to minimize the effects of damage caused by hostile action are called passive defense. One of your roles in the NBCCC is to monitor passive defense measures for the base -- beginning in the planning process. Plans must be written to support passive defense measures based on the current threat and implemented in a proper and timely manner.

5.5.1. Camouflage, concealment, and deception (CCD). CCD planning takes a lot of coordination with all units. There are many different types of CCD measures to use. You must make sure the measures used are the most advantageous to your current threat. You must monitor the implementation of the CCD plan ensuring all units are using the proper measures. After attacks monitor the effectiveness of CCD measures and make suggestions to take advantage of your successful measures. For more information on CCD measures see AFI 32-4007, Camouflage, Concealment, and Deception.

5.5.2. Hardening. Balance the level of hardening with the type of protection needed. Use the threat to determine the type of protection required. New construction, revetments, and expedient methods (i.e. sandbags, earth berms, or steel drums filled with earth.) are examples of hardening. For more information see AFPAM 10-219, Vol. II, Preattack and Predisaster Preparations.

5.5.3. Dispersal. Each unit disperses key assets to protect them from enemy attack. When these assets are dispersed, mark their location on a control center map. You must have at least two routes to each dispersal site. You must also ensure dispersed assets are not placed in an unsecured area.

5.5.4. Blackout. Every unit is responsible for blackout procedures to protect their resources. Specific requirements are normally theater specific. A good way to monitor this measure is to perform a blackout exercise for the base to determine which areas need improvement. Blackout should be checked each night and after each attack. Although the unit is responsible for obtaining the supplies to perform this measure, they may call Readiness technicians for assistance.

5.5.5. NBC Defense Training. It is vital the people on the installation know which actions to take in a contaminated environment. NBC Defense Training is used to identify items or procedures particular to your base.

5.6. Direct Activation Of Specialized Teams. One of the duties of the Readiness Flight is directing the activation of specialized teams. It is important to understand when this should occur so as not to hamper mission effectiveness or waste valuable manpower. Just as important as understanding when to activate these teams is realizing when to deactivate, or place them in a standby status. The teams you'll normally be responsible to activate are NBC Reconnaissance teams, Shelter Management Teams, and Contamination Control Teams. Establish procedures to activate these teams – consider: method of notification such as radios or conference calls, call signs, operating locations, communication checks, security, and "comm-out" procedures. Table 5.2. illustrates team manpower needs.

Table 5.2. Sample Specialized Team Manpower Requirements.

SPECIALIZED TEAMS	HOW MANY PER SHIFT	TOTAL
SHELTERS	40	80
NBCC	2	4
RECON	6	12
DECON	20	40
TOTAL SPECIALIZED	68	136

5.6.1. NBC Reconnaissance Teams. These teams are usually activated in the pre-attack phase. During this phase they establish their monitoring route. They ensure all their equipment is available and operational. Their staging or dispersal area must also be prepared. Once these items are accomplished they may be placed in standby status, depending on the threat they may be used in another capacity. When in standby status, keep in contact in case of short notice recall.

5.6.2. Shelter Management Teams (SMT). These teams are usually activated during the pre-attack phase. They prepare their shelters for operation by ensuring measures which were planned for are implemented, for example; shelter stocking, hardening, exposure control procedures, post-attack reporting, and CCA procedures. For more information on SMTs refer to AFMAN 32-4005, *Personnel Protection and Attack Actions.*

5.6.3. Contamination Control Teams (CCT). These teams are also usually activated during the pre-attack phase. They ensure the equipment and supplies they need are on hand and serviceable. Their dispersal or staging area must also be prepared. They can then be placed in standby status until they're needed. Unlike the other two teams, CCTs often report to their Unit Control Center (UCC).

Your plans should direct their activation through either the SRC or UCCs. CCT locations must be identified, and equipped away from priority targets, have alternate routes in and out of the sites, offer contamination avoidance and shrapnel protection.

5.7. Monitor and Direct Readiness of NBC Forces. In order to help your base minimize the loss of operational capability you must ensure all NBC forces are ready. The control center, SRC, or NBCCC is the place where you will monitor and direct all of your NBC forces. When intelligence information indicates the enemy has the ability and willingness to use chemical warfare agents, our ability to detect and identify these agents becomes critical. Under normal conditions the NBCCC will direct monitoring team actions to include those of the NBC reconnaissance teams, shelter teams, contamination control teams, UCCs, damage assessment teams, and members from the base populace to perform monitoring actions. All these other sources help you to quickly obtain a much larger idea of the degree of contaminated areas on your base. You will direct the monitoring teams during three different phases listed in Table 5.3.

Table 5.3. Monitoring Specialized Teams.

Pre-Attack (Alarm Yellow): The more teams can accomplish in this phase directly affect the amount of and speed in which the NBCCC will receive monitoring results.
Trans-Attack (Alarm Red): Teams should try to observe the enemy's attack tactics. Watch for CB munitions employment, listen for low-order detonations, automatic alarm activations, and oberve the M9 Paper attached to ensembles for positive chemical indicators. Perform frequent buddy checks and remain under cover until Alarm Black is declared.
Post-Attack (Alarm Black): Post-attack inspection and damage reporting must be accomplished as quickly as possible using "quick looks" and detailed assessements.

5.7.1. NBC Reconnaissance Teams. Based on projected manning, establish three teams composed of two personnel each per shift. Additional help may be available through trained augmentees. Determining your monitoring route is a major item in the preparation of this team. Establish an integrated NBC detection network based on available equipment.

5.7.2. Shelter/CCA Teams. These teams normally consist of people from the unit owning the shelter, or augmentees in the case of CCA teams. The NBCCC or SRC directs and monitors these teams and must ensure lines of communication are established between the two. For the shelter teams in particular, the unit is responsible for the equipment and supplies needed to perform shelter operations. The NBCCC or SRC still monitors them to ensure they have this equipment. In addition, ensure shelters have current and correct operating procedures primarily for CCA operations and exposure control monitoring. For guidance on shelter operations see AFMAN 32-4005.

5.7.3. CCT. To ensure these forces are ready, Readiness technicians should make sure CCTs have been trained and verify they have all their equipment. The NBCCC or SRC must check with each supporting UCC to make sure their communication line and understanding of how to employ the CCT exists. The NBCCC and NBC reconnaissance teams may be tasked to assist these teams with technical guidance. As an option, CCTs may be used as part of the detection and identification system for the base. Therefore, ensure they have enough equipment to accomplish this task.

5.7.4. Other Teams. Explore every option to incorporate other teams into the base detection and identification system. Some examples are security forces, anti-aircraft attack (AAA) batteries, and damage assessment teams. These teams must be trained and equipped with available resources. You also need to establish the communication chain from these teams or their UCC to your NBCCC.

5.7.5. Base Populace. Ensure the people know the communication chain for post-attack reporting.

5.8. Receive And Consolidate Reports. The NBCCC will receive many reports from sources, such as NBC monitoring teams, shelter teams, contamination control teams, etc. You'll also receive consolidated reports from UCCs. You'll receive reports from off base agencies as well. These reports must be analyzed and consolidated so they can present a clear picture of the effect they have on the base. Consolidating the reports into useable information includes analyzing the information received, extracting the pertinent data, compiling it into concise reports, and forwarding that information to the appropriate agencies. For instance, after an attack SMTs will call in with the status of the shelters, integrity, the monitoring results, etc. The information from each shelter should be consolidated before it is passed on. Table 5.4 is an example of what the shelter status might look like.

Table 5.4. Sample Shelter Status Report.

Bldg. #	Date/Time	Casualties	Integrity	Overpressure	UXO	M8/M9	M256A1
419	22 May 0922	0	Yes	Yes	1	Red M8	Purple Square
422	22 May 0920	3	No	No	2	Red M8	Purple Square
324	22 May 0925	0	Yes	No	0	Red M8	Purple Square
253	22 May 0918	2	Yes	Yes	2	Red M8	Purple Square
Total	22 May 0930	5	1 With No Integrity	2 With No Overpressure	5	All Red M8	All Purple Square

5.8.1. Status Reports: The NBCCC monitors the specialized teams and reports on the status of these teams. As you receive reports from the members of each team, consolidate them into one report per team. For example, the shelter teams provide you with their status, as you receive this information you will consolidate it into one report for all shelter teams. By doing this you can identify common problems making it easier to provide possible solutions.

5.8.2. Damage Assessment Reports: These are reports you'll receive after an attack on the base. By consolidating these reports you'll have a better picture of the overall effect the attack had on your base. As with the status reports, you'll receive these damage assessment reports from your specialized teams and UCCs. The SRC/NBCCC should be in constant contact with the Damage Control Center (DCC). The CE DCC controls damage assessment for the base and directs specific unit actions.

5.8.3. NBC Reports: These are standard reports for use in the NBCWRS. Paragraph **5.10.** goes into more detail on the NBCWRS.

5.9. Relocation. All command and control and facilities should have a relocation checklist and should:

5.9.1. Identify and mark evacuation route.

5.9.2. Identify personnel re-assembly points.

5.9.3. Identify priority classified/essential documents and equipment for evacuation.

5.9.4. Develop destruction/relocation procedures for classified materials/equipment.

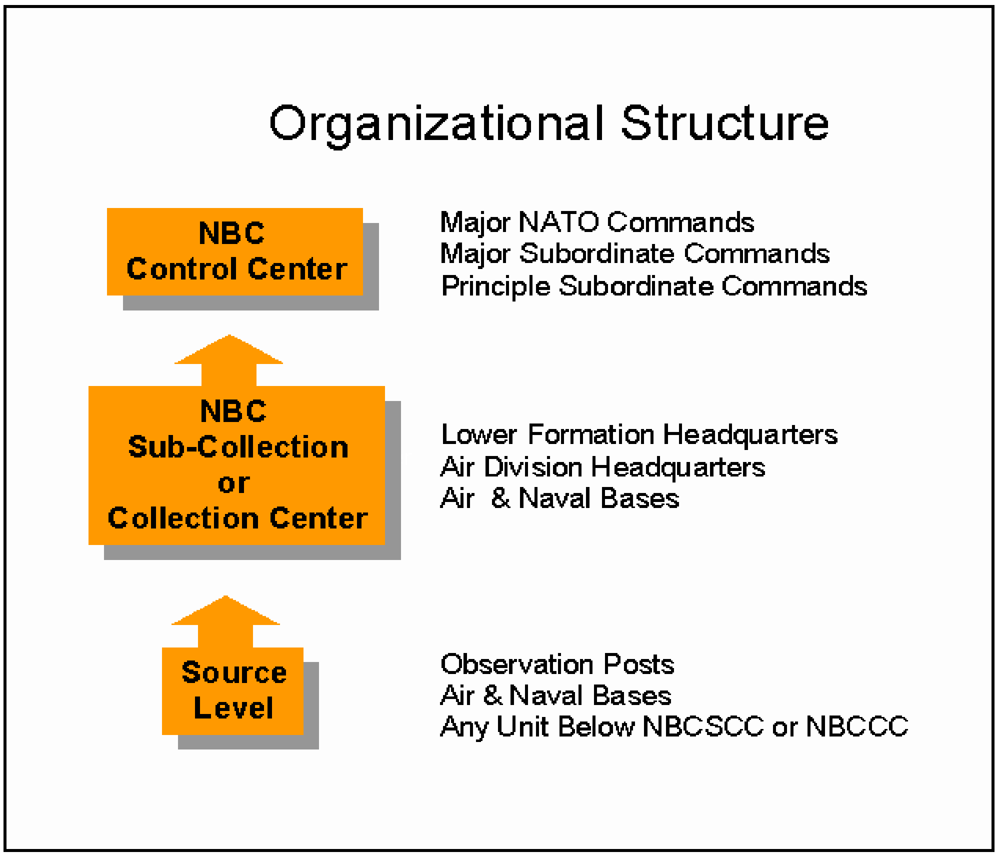
5.9.5. Position vehicle at locations to support evacuation.

5.9.6. Report relocation to SRC.

5.10. NBC Warning and Reporting System (NBCWRS). A system has been developed to provide the most accurate data possible on enemy NBC attacks and resulting hazard areas to the various levels of command within NATO. This system allows you to report the following: nuclear detonations, radioactive contamination, enemy biological or chemical attacks and resulting contamination, predicting and warning of fallout areas, and predicting and warning of chemical hazard areas.

5.10.1. NATO NBC Reporting and Warning System Organizational Structure. The NATO NBC reporting and warning organization is divided into the following categories: source level, NBC sub-collection centers and NBC collection centers, NBC control centers. See **Figure 5.1.**

Figure 5.1. NBC Reporting Structure.



5.10.1.1. Source Level. Observation Posts (OPs) Air and Naval bases, or any agency below NBC or NBC sub-collection centers fall into this category. The responsibilities of the Source Level are:

5.10.1.1.1. Report the initial enemy use of nuclear, biological or chemical weapons by the most expeditious means available. (NBC 1).

5.10.1.1.2. Report immediately any further NBC attacks and subsequent data to the NBC sub-collection or NBC collection center. (NBC 1).

5.10.1.1.3. Disseminate timely warnings of predicted hazard areas to enable forces to increase their NBC state or readiness, to conduct monitoring and to prepare for survey and decontamination. (NBC 3).

5.10.1.1.4. Report monitoring and survey results to the NBC sub-collection or NBC collection center. (NBC 4).

5.10.1.1.5. Submit detailed information on chemical or biological attacks on request. (NBC 6).

5.10.1.2. NBC Sub-Collection Centers and NBC Collection Centers. This is the NBCCC on air bases. Corps or lower formation, headquarters, air division headquarters, sector operation centers fall into this category. Their responsibilities include:

5.10.1.2.1. Report the initial enemy use of nuclear, biological and chemical weapons by the most expeditious means available in accordance with directives and standard operating procedures (SOPs). (NBC 1).

5.10.1.2.2. Clarify, consolidate, and evaluate NBC attack data reported from the source level or other NBC Centers or agencies (NBC 1 and NBC 2).

5.10.1.2.3. Compute fallout predictions and chemical downwind hazards areas based upon processed NBC attack data and pass the appropriate warnings to units likely to be affected (NBC 3).

5.10.1.2.4. Direct survey efforts within its zone of observation.

5.10.1.2.5. Analyze survey and monitoring results and pass actual contaminated areas to units likely to be affected (NBC 4 and NBC 5).

5.10.1.2.6. Request and provide detailed information on chemical and biological attacks as directed (NBC 6).

5.10.1.2.7. Exchange NBC information with appropriate national military and civilian reporting agencies.

5.10.1.3. NBC Control Center Level. Major NATO Commands, Major Subordinate Commands, and forward deployed headquarters such as in SWA fall into this category. Their responsibilities include:

5.10.1.3.1. Report the initial enemy use of nuclear, biological, and chemical weapons by the most expeditious means available in accordance with directives and SOPs (NBC 1).

5.10.1.3.2. Clarify, consolidate, and evaluate NBC attack data reported from the source level or other NBC Centers or agencies (NBC 1, and NBC 2).

5.10.1.3.3. Transmit promptly NBC warnings to adjacent HQ or agencies when predicted hazard areas extend beyond their own area of observation (NBC 3).

5.10.1.3.4. Exchange NBC information with appropriate national military and civilian authorities as arranged by directives and SOPs.

5.10.1.3.5. Organize and coordinate the NBC warning system within its area of observation by contributing to the war plans and issuing a comprehensive directive and/or SOP.

5.10.1.3.6. Submit reports to higher headquarters and adjacent agencies as required (NBC Summary)

5.10.2. Standard NBC Message Formats. Organizations within the NBCWRS should use the standard NBC message formats listed in **Table 5.5.** for reporting nuclear, biological, and chemical attacks and predicted or actual hazard areas following attacks.

Table 5.5. Standard NBC Message Formats.

NBC 1 Observers initial report
NBC 2 Used for passing evaluated data
NBC 3 Used for immediate warning of predicted contamination and hazard areas
NBC 4 Used for passing monitoring and survey results
NBC 5 Used for passing information on areas of actual contamination
NBC 6 Used for passing detailed information on chemical or biological attacks
NBC SITREP Report used for passing information on the NBC situation (**NOTE:** The NBC SITREP is a free text message. Any rules for contents are given by the local national authority or command.)

5.10.2.1. All ground locations given in all NBC standard message formats must, whenever possible be given in Universal Transverse Mercator (UTM) grid coordinates, except in areas to which the UTM grid has not been extended.

5.10.2.2. Classification and precedence. Unless the NBC message contains specific operational information. e.g. effects on troops, all messages should be unclassified. NBC 1 messages reporting the first enemy use of NBC weapons must be given precedence FLASH (Z). All other messages should be given a precedence which reflects the operational value of the contents, normally OPERATIONAL IMMEDIATE (O) would be appropriate. **Figure 5.2.**, **Figure 5.3.**, and **Figure 5.4.** show sample formats that could be used sending NBC 1, 2, 3 reports which are the most common reports utilized by readiness personnel .

5.10.3. Meaning of letter items used in all NBC reports. The NBC standard message system is based on a code system. In the system, each letter has a defined meaning for each type of NBC message. **Table 5.6.** defines the meaning of each letter. **Figure 5.5.** Shows the flow for NBC reports.

Table 5.6. NBC Line Numbers.

LINE	NUCLEAR	CHEMICAL/BIOLOGICAL FORMS
A	Strike serial number **Example: 01**	Strike serial number **Example: 01**
B	Position of observer **Example: NB062634**	Position of observer **Example: NB062634**

LINE	NUCLEAR	CHEMICAL/BIOLOGICAL FORMS
C	Direction measured clockwise from gird north, true north, or magnetic north (state which) of attack from observer (degrees or mils -state which) Example: Grid 270 degrees Note: The Air Force uses degrees for all compass readings	Direction measured clockwise from gird north, true north, or magnetic north (state which) of attack from observer (degrees or mils -state which) **Example: Grid 110 degrees**
D	Date/Time of detonation **Example: 081100ZDEC92**	Date/ Time attack started **Example: 022330ZAPR88**
E	(Not used)	Date/Time attack ended **Example: 022345ZAPR88**
F	Location of attack **Example: LB260300**	Location of area attacked **Example: 260300**
G	Means of delivery **Example: Aircraft**	Means of delivery **Example: Bomblets/Mortar**
H	Type of burst **Example: Surface**	Type of burst Type of agent and persistency, P (persistent) NP (non persistent) **Example: Air burst, Nerve (P)**
I	(Not used)	Quantity of items reported under line GOLF **Example: Approximately 100 rounds**
J	Flash-to-bang-time (seconds) **Example: 45 seconds**	(Not used)
K	Crater present or absent and diameter (meters) **Example: crater 30 meters**	Description of terrain/vegetation **Example: Area flat/sandy 500 ft above sea level**
L	Nuclear burst angular cloud width measured at H+5 minutes (state whether using degrees or mils) **Example: 23 degrees**	(Not used)
M	Stabilized cloud top angle and/or cloud bottom angle (state which) or cloud top height and/or cloud bottom height (state which) measured at H+10 minutes (state whether using degrees or mils, meters or feet) **Example: Top 28 degrees**	Enemy action before and after attack Effect on troops **Example: Heavy artillery fire**
N	Estimated yield (KT) **Example: 100 KT**	(Not used)

LINE	NUCLEAR	CHEMICAL/BIOLOGICAL FORMS
O	Reference date/time for estimated contours when not H+1 hour **Example: 141300ZJUL84**	(Not used)
P	See under PA and PB	(not used)
PA	Coordinates of points to outline external contours of radioactive cloud (For radar observations only)	Coordinates of predicted hazard areas **Note:** If representative downwind speed is 10 km/h (5.41 knots) or less PA of the NBC 3 CHEM will contain only 3 digits, i.e. the radius of a circle around the center of the attacked area, in km **Example: NB 160295 NB 160306 NB 160291 NB 265300 NB 265358 NB 265242**
PB	Downwind direction of radioactive cloud (state whether in degrees or mils) (For radar observations only)	Duration of hazard (days) **Example: Attack area: 2-4 days Hazard area: 1-2 days**
Q	Location of reading **Example: NB 265300**	Location where the sample(s) were taken and details of the sample **Example: NB 160360/Air**
R	Dose rate cGy/h The words “initial” “increasing”, “peak” or “decreasing” may be added. When decay rate is reported the words “decay normal”, “decay fast” or “decay slow” or the actual value of decay constant may be inserted **Example: 40 Increasing**	(Not used)
S	Date/time of reading **Example: 290900ZAUG97**	Date/time contamination detected **Example: 101400ZDEC97**
T	H+1 date/time **Example: 010800ZJUL97**	Date/time of latest survey of contamination in the area. **Example: 021300ZMAY97**
U	1000 cGy/h contour line coordinates (RED)	(Not used)
V	300 cGy/h contour line coordinates (GREEN)	(Not used)
W	100 cGy/h contour line coordinates (BLUE)	(Not used)
X	30 cGy/h contour line coordinates (BLACK)	Area of actual contamination (YELLOW)

LINE	NUCLEAR	CHEMICAL/BIOLOGICAL FORMS
Y	Direction measured clockwise from grid north to the left and then to the right radial lines (state whether using degrees or mils) 4 digits each **Example: 02720312 degrees**	Representative downwind direction, 4 digits (state whether using degrees or mils) Representative wind speed (state whether using km/h or knots) 3 digits **Example: 0270 degrees, 010 km/h**
Z	Effective downwind speed (state whether using km/h or knots) 3 digits; downwind distance to Zone I (state whether using km or nautical miles) 3 digits cloud radius (state whether using km or nautical miles) 2 digits **Example: 019 km/h, 025 km , 05 km** **NOTE:** If the effective downwind speed is less than 8 km/h (4.32 knots) the NBC 3 NUC will contain only 3 digits, i.e. the radius of Zone I	(Not used)
ZA	(Not used)	Information on actual weather conditions: Air stability condition (1digit); Surface temperature (state whether using Celsius or Fahrenheit) (3 digits); humidity (1digit); significant weather phenomena (1digit); cloud cover (1digit); Unknown parameters must be indicated by a (-) for each missing digit. **Example: 410C5-1** **NOTE:** This information is obtained from a valid Chemical Downwind message (CDM). **NOTE:** NBC 1 CHEM- is normally prepared in plain language, but code can be used. NBC 2 and 3 CHEM -is normally prepared using code, but plain language can be used.
ZB	(Not used)	Remarks e.g. information on type and case of chemical attack, maximum downwind hazard distance, half sector angle and verification of chemical attack and agent **Example: Type B, case 2, downwind distance 10km**

LINE	NUCLEAR	CHEMICAL/BIOLOGICAL FORMS
ZI	Used for friendly bursts effective downwind speed (3 digits) Downwind distance of Zone I(in hundreds of meters)(4 digits) Downwind distance of Zone II (in hundreds of meters) (4 digits) Cloud radius (in hundreds of meters (3 digits) **EXAMPLE: ZI 030 0003 0005 005** **NOTE:** If line ZI is used line Z will not be used. ***NOTE:*** If effective downwind speed is less than 8 km/h (4.32 knots), line ZI will contain of Zone I (in hundreds of meters) (4 digits) and the radius of Zone II (in hundreds of meters) (4 digits) **EXAMPLE: ZI 0003 0005**	(Not used)

Figure 5.2. Sample NBC 1 Chemical Message.

NUCLEAR/BIOLOGICAL/CHEMICAL *NBC* MESSAGE

List the type of report: **NBC1**, NBC2, or NBC 3

List the type of message: Nuclear Biological **Chemical**

FROM: **Civil Defense *(Observer)***

TO: **Alpha Air Base**

List Precedence of Message:
R (Routine) *P (Priority)*
O (Immediate) *Z (Flash)*

N = Nuclear Only *C = Chemical Only* *NC = Nuclear or Chemical*

1	2	3	LETTER	MESSAGE CONTENT	EXPLANATION
	NC	NC	ALPHA		Strike Serial Number
N			BRAVO		Position of Observer
N			CHARLIE		Direction Measured Clockwise from Grid North, True North, or Magnetic North *(State Which)* of the Attack from the Observer
NC	NC	NC	DELTA	040725ZJul97	Date - Time Attack Started DTG
C			ECHO		Date - Time Attack Ended
C	NC	NC	FOXTROT	FJ342432 Actual	Location of Attack or Area Attacked *(Coordinates or Place - Actual or Estimated - State Which)*
NC	NC	NC	GOLF	Bombs	Means of Delivery - Kind of Attack
NC	NC	C	HOTEL	Nerve Non-Persistent Ground Burst	(N) Type of Burst, Including Height (C) Type of Agent, Persistency, and Height of Burst
N			JULIET		Flash-to-Bang Time *(Seconds)*
N			LIMA		Nuclear Burst Angular Cloud Width Measured at H+5 Minutes *(Degrees or Mils - State Which)*
N			MIKE		Stabilized Cloud Top Angle and/or Cloud Bottom Angle or Cloud Top Height and/or Cloud Bottom Height Measured at H+10 Minutes
	N	N	NOVEMBER		Estimated Yield
		C	PAPA ALPHA		Predicted Hazard Area *(Coordinates)*
		C	PAPA BRAVO		Duration of Hazard Within Attack Area and Within Hazard Area *(Days)*
C	C	NC	YANKEE		(N) Direction Measured Clockwise from Grid North to the Left then to the Right Radial Lines - 4 Digits Each (C) Representative Downwind Direction - 4 Digits / Representative Wind Speed - 3 Digits
		N	ZULU		Effective Wind Speed - 3 Digits / Downwind Distance of Zone I - 3 Digits / Cloud Radius - 2 Digits
C	C	C	ZULU ALPHA		Air Stability Conditions - 1 Digit / Temperature - 2 Digits / Humidity - 1 Digit / Significant Weather Phenomena - 1 Digit / Cloud Cover - 1 Digit
		C	ZULU BRAVO		Remarks *(Type, Case, Downwind Hazard Distance)*

Figure 5.3. Sample NBC 2 Chemical Message.

NUCLEAR/BIOLOGICAL/CHEMICAL *NBC* MESSAGE

List the type of report: NBC1, **NBC2**, or NBC 3

List the type of message: Nuclear Biological **Chemical**

FROM: **Alpha Air Base**

TO: **ATOC Bravo**

List Precedence of Message:
R (Routine) *P (Priority)*
O (Immediate) *Z (Flash)*

N = Nuclear Only *C = Chemical Only* *NC = Nuclear or Chemical*

1	2	3	LETTER	MESSAGE CONTENT	EXPLANATION
	NC	NC	ALPHA	A001	Strike Serial Number
N			BRAVO		Position of Observer
N			CHARLIE		Direction Measured Clockwise from Grid North, True North, or Magnetic North *(State Which)* of the Attack from the Observer
NC	NC	NC	DELTA	040725ZJul97	Date - Time Attack Started DTG
C			ECHO		Date - Time Attack Ended
C	NC	NC	FOXTROT	FJ342432 Actual	Location of Attack or Area Attacked *(Coordinates or Place - Actual or Estimated - State Which)*
NC	NC	NC	GOLF	Bombs	Means of Delivery - Kind of Attack
NC	NC	C	HOTEL	Nerve Non-Persistent Ground Burst	(N) Type of Burst, Including Height (C) Type of Agent, Persistency, and Height of Burst
N			JULIET		Flash-to-Bang Time *(Seconds)*
N			LIMA		Nuclear Burst Angular Cloud Width Measured at H+5 Minutes *(Degrees or Mils - State Which)*
N			MIKE		Stabilized Cloud Top Angle and/or Cloud Bottom Angle or Cloud Top Height and/or Cloud Bottom Height Measured at H+10 Minutes
	N	N	NOVEMBER		Estimated Yield
		C	PAPA ALPHA		Predicted Hazard Area *(Coordinates)*
		C	PAPA BRAVO		Duration of Hazard Within Attack Area and Within Hazard Area *(Days)*
C	C	NC	YANKEE	0240 DGG/010 KPH	(N) Direction Measured Clockwise from Grid North to the Left then to the Right Radial Lines - 4 Digits Each (C) Representative Downwind Direction - 4 Digits / Representative Wind Speed - 3 Digits
		N	ZULU		Effective Wind Speed - 3 Digits / Downwind Distance of Zone I - 3 Digits / Cloud Radius - 2 Digits
C	C	C	ZULU ALPHA	3/14C/7/-/0	Air Stability Conditions - 1 Digit / Temperature - 2 Digits / Humidity - 1 Digit / Significant Weather Phenomena - 1 Digit / Cloud Cover - 1 Digit
		C	ZULU BRAVO		Remarks *(Type, Case, Downwind Hazard Distance)*

Figure 5.4. Sample NBC 3 Chemical Message.

NUCLEAR/BIOLOGICAL/CHEMICAL *NBC* MESSAGE

List the type of report: NBC1, NBC2, or **NBC 3**

List the type of message: Nuclear Biological **Chemical**

FROM: **Alpha Air Base**

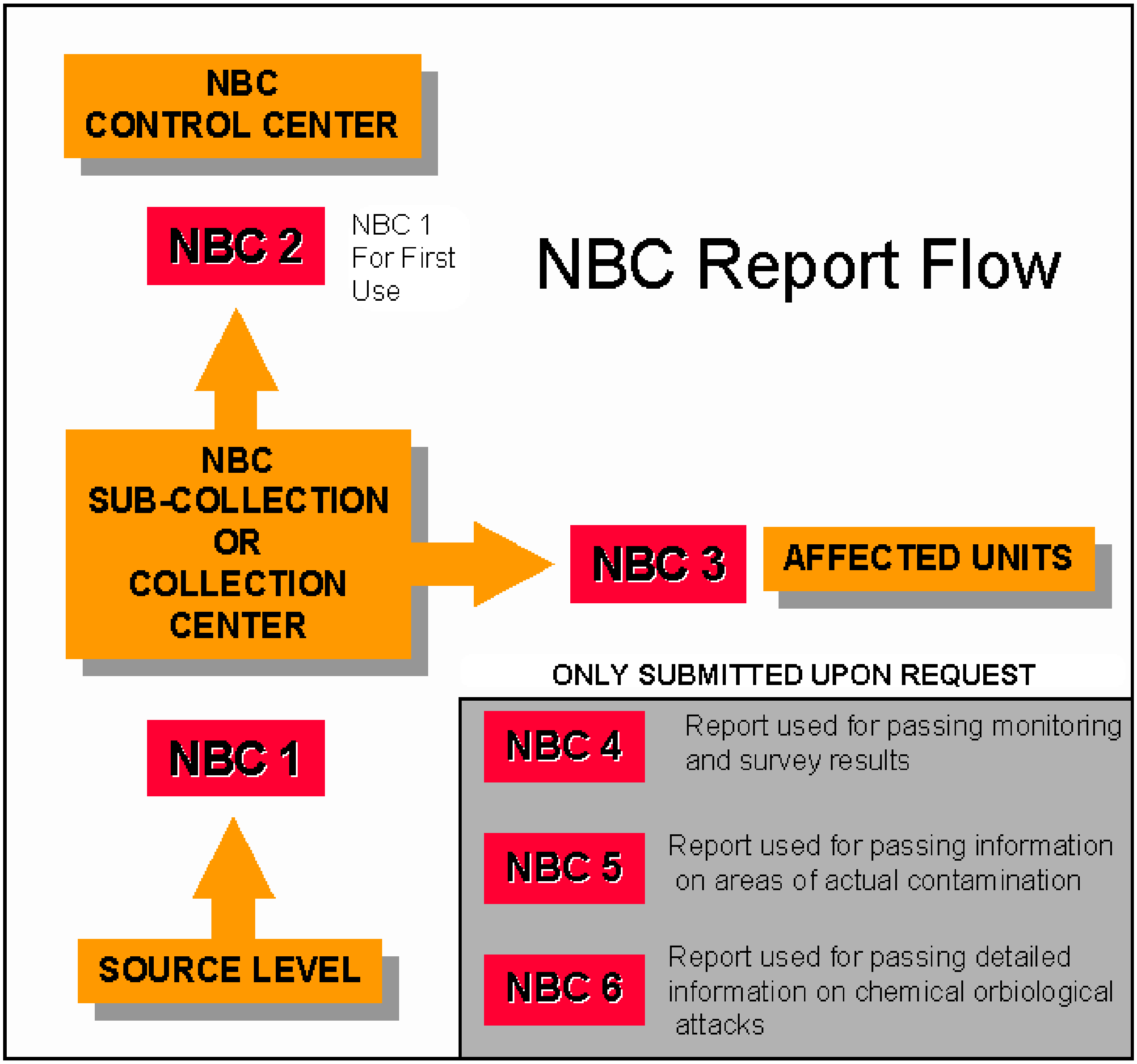
TO: **Affected Unit**

List Precedence of Message:
R (Routine) *P (Priority)*
O (Immediate) *Z (Flash)*

N = Nuclear Only *C = Chemical Only* *NC = Nuclear or Chemical*

1	2	3	LETTER	MESSAGE CONTENT	EXPLANATION
	NC	NC	ALPHA	A001	Strike Serial Number
N			BRAVO		Position of Observer
N			CHARLIE		Direction Measured Clockwise from Grid North, True North, or Magnetic North *(State Which)* of the Attack from the Observer
NC	NC	NC	DELTA	040725ZJul97	Date - Time Attack Started DTG
C			ECHO		Date - Time Attack Ended
C	NC	NC	FOXTROT	FJ342432 Actual	Location of Attack or Area Attacked *(Coordinates or Place - Actual or Estimated - State Which)*
NC	NC	NC	GOLF	Bombs	Means of Delivery - Kind of Attack
NC	NC	C	HOTEL	Nerve Persistent Ground Burst	(N) Type of Burst, Including Height (C) Type of Agent, Persistency, and Height of Burst
N			JULIET		Flash-to-Bang Time *(Seconds)*
N			LIMA		Nuclear Burst Angular Cloud Width Measured at H+5 Minutes *(Degrees or Mils - State Which)*
N			MIKE		Stabilized Cloud Top Angle and/or Cloud Bottom Angle or Cloud Top Height and/or Cloud Bottom Height Measured at H+10 Minutes
	N	N	NOVEMBER		Estimated Yield
		C	PAPA ALPHA	010 KM	Predicted Hazard Area *(Coordinates)*
		C	PAPA BRAVO	Attack Area: 2 to 4 Days Hazard Area: 1 to 2 Days	Duration of Hazard Within Attack Area and Within Hazard Area *(Days)*
C	C	NC	YANKEE	0240 DGG/010 KPH	(N) Direction Measured Clockwise from Grid North to the Left then to the Right Radial Lines - 4 Digits Each (C) Representative Downwind Direction - 4 Digits / Representative Wind Speed - 3 Digits
		N	ZULU		Effective Wind Speed - 3 Digits / Downwind Distance of Zone I - 3 Digits / Cloud Radius - 2 Digits
C	C	C	ZULU ALPHA	3/14C/7/-/0	Air Stability Conditions - 1 Digit / Temperature - 2 Digits / Humidity - 1 Digit / Significant Weather Phenomena - 1 Digit / Cloud Cover - 1 Digit
		C	ZULU BRAVO	Type B Case 3 10KM	Remarks *(Type, Case, Downwind Hazard Distance)*

Figure 5.5. NBC Report Flow.



5.10.4. Interpreting NBC reports. Working in the NBCCC you must have the ability to quickly interpret and prepare NBC reports. These reports are vital during any wartime contingencies which the enemy has the ability to employ Nuclear, Biological or Chemical weapons. The following steps will help interpret NBC reports.

5.10.4.1. Receive and NBC report. An NBC report can come in many formats from a frantic call on the radio or telephone to a detailed message.

5.10.4.2. Interpret the NBC report. Using the line item descriptions in **Table 5.6.** identify the applicable items and determine their meaning. Always look for line Foxtrot, Golf and Hotel on chemical reports and lines Bravo, Charlie, Juliet, and Lima on nuclear reports. These line item provide vital information as to the location and type of attack.

5.10.5. NBC status. Status boards within the SRC and NBCCC allow the personnel working in those area to rapidly update, assess, and brief the current situation. It is your responsibility to ensure all status boards under your control are current and accurate, mission critical decision will be based on your status boards and lives will depend on the accuracy of these boards. The actual procedures used when updating status boards will be determined locally. One base may be "high tech" with a computerized system while another will use simple charts and grease pencils. The following steps are minimum requirements for updating status boards.

5.10.5.1. Determine what type of status boards are needed. Consider the following when determining what types of status boards you may need: threat, enemy capabilities (i.e. nuclear or chemical weapons), teams that need to be tracked, attack information, hazard areas, shelter locations and status, results of damage assessments, specialized team status.

5.10.5.2. Develop status boards. These can be as simple or as elaborate as necessary but they must provide a clear picture of the situation!

5.10.5.3. Update the status boards. All information must be updated continuously kept current 24 hours a day for the duration of the contingency. Note: If you have alternate SRC or NBCCC location, ensure they have the exact same status boards as the primary and are updated when ever the primary is updated.

5.10.6. Simplified Chemical Plots. Chemical plotting is one of the critical tasks performed in the NBCCC. Raw data from NBC 1 reports and current weather information is necessary to construct a chemical plot. Chemical plots are divided into two categories Type A (air contamination) and Type B (ground contamination) attacks. The sole source document for chemical plotting is Allied Tactical Publication (ATP)45A and should always be referenced when constructing a plot.

5.10.6.1. Chemical Downwind Message (CDM): A key element in constructing any type of plot is current surface weather conditions. Base weather provides CDM's to you at six hour intervals (the amount of time one CDM is valid) and is broken into three, two-hour blocks of weather information. The CDM contains, downwind direction and speed, air stability, temperature, humidity, any significant weather and cloud cover. Anytime a CDM is used you must insure that it is valid at the time of use and that it was developed for your location. **Table 5.7.** is an example of a CDM. Note: Wind direction is always plotted to the degrees on the CDM. Refer to ATP 45A to construct a CDM if one is not available.

5.10.6.2. Type A Chemical Plots: Type A chemical plots are constructed after each air contamination attack. There are two distinct plots under Type A which are referred to as "cases" (1 and 2). Determining which case to use is based on wind speed. If the wind speed is 10 kmph or less, then you use case one and if the wind speed is >10 kmph or greater then case two is used. In determining the case always use a current CDM.

5.10.6.2.1. Case one plots are always a circle plot with a one km radius circle around the center of the attack location and a 10 km radius circle around the attack location (**Figure 5.6.**, Case 1).

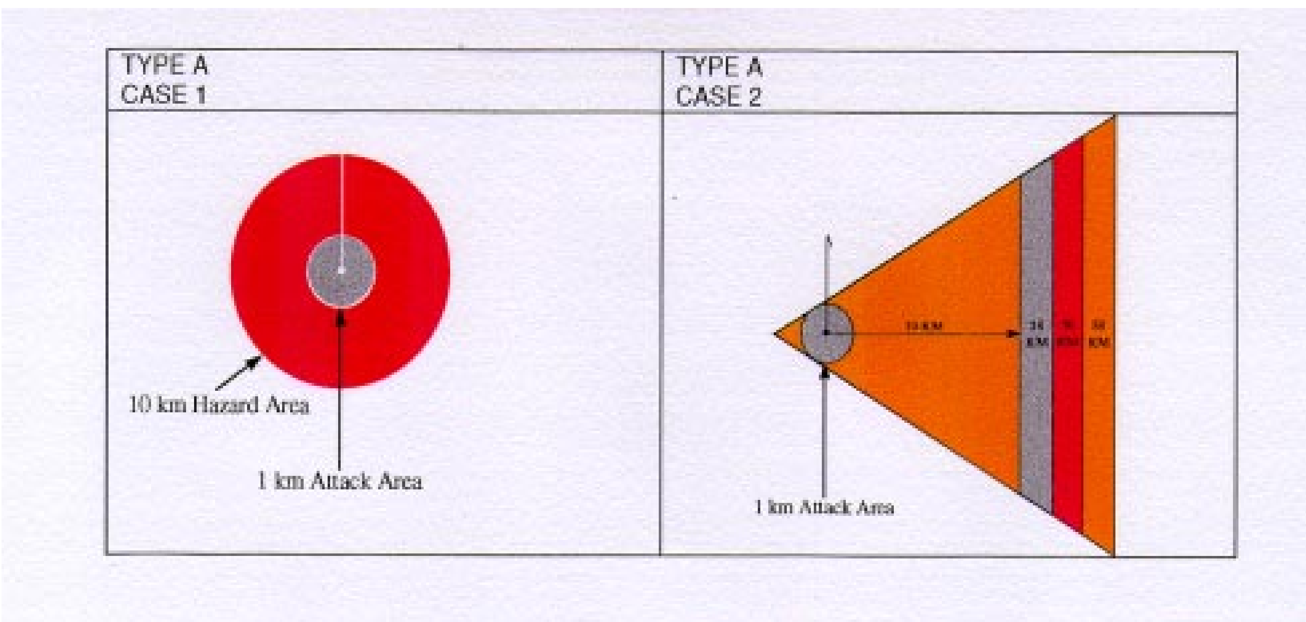
5.10.6.2.2. A case two plot is always constructed with wind speeds >10 kmph or greater. The case two plot has a specific wind direction and 30 degree angles forming on each side of the center line. The downwind distance of a case two plot is determined by the air stability and delivery method (**Figure 5.6.**. Case 2).

Table 5.7. Chemical Down Wind Message.

NBCEVENT/CDM//
AREAM/ECQ4//
ZULUM/011200ZMAY97/011300ZMAY97/011900ZMAY97
UNITM/-/DGG/KPH/C//
WHISKEYM/070/022/6/15/7/-/1//
XRAYM/075/025/4/13/9/6/2//
YANKEEM/080/028/4/12/8/-/2//

0 0 0	0 0 0	0	0 0	0	0	0
Wind Direction	**Wind Speed**	**Stability**	**Temp C°**	**Humidity**	**Weather Phenomena**	**Cloud Cover**

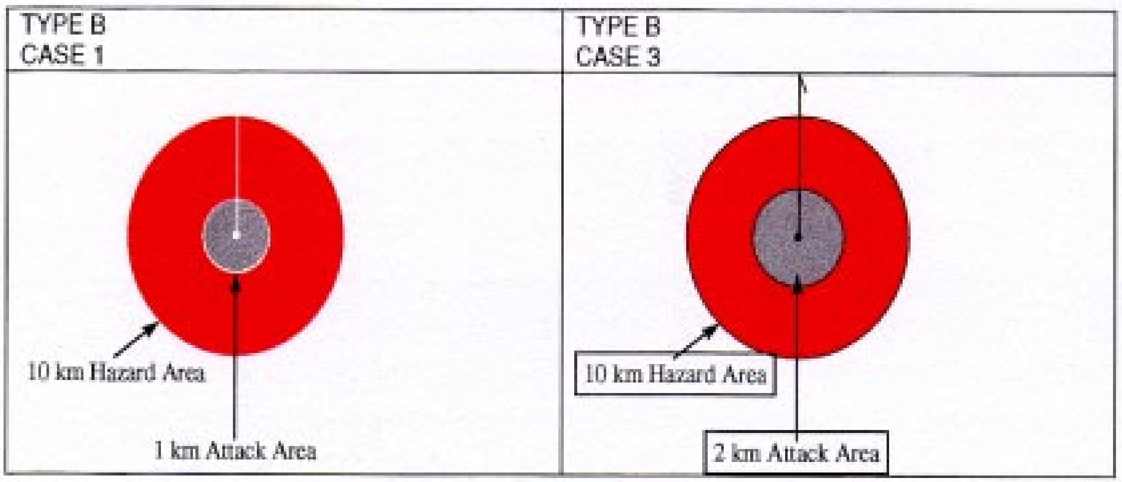
Figure 5.6. Type A Chemical Plots.



5.10.6.3. Type B Chemical Plots: Type B chemical plots are constructed after a confirmed ground contaminating attack. There are six distinct plots which are also referred to as cases. Without exception all Type B plots have a maximum downwind distance of 10 km. Determining which case to use will be based on the wind speed and the size of the attack area.

5.10.6.3.1. Cases 1, 3, and 5 are constructed when the wind speed is 10 kmph or less. (**Figure 5.7.** and **Figure 5.9.**) Case 1 is a one km radius circle around the attack area and a 10 km radius circle around the attack area. Case 3 is a 2 km radius circle around the center of the attack area and a 10 km radius circle around center the center of the attack area. Case 5 is a spray attack with a 1 km radius circle around the start and finish locations of the attack and a 10 km radius circle around this same two points.

Figure 5.7. Type B, Case 1 and 3 Chemical Plots.



5.10.6.3.2. Cases 2, 4, and 6 are constructed when the wind speed is >10 km or greater. (**Figure 5.8.**. and **Figure 5.9.**) Case two is constructed with a one km radius attack area and a 10 downwind hazard. Case four is constructed with a 2 km radius circle attack area and a 10 km downwind hazard. Case 6 is a spray attack with two 1 km radius circles and two 10 km downwind hazard areas.

5.10.6.4. **Figure 5.10.** provides a flowchart for quickly determining the type and case used in simplified chemical plotting.

Figure 5.8. Type B, Case 2 and 4, Chemical Plots.

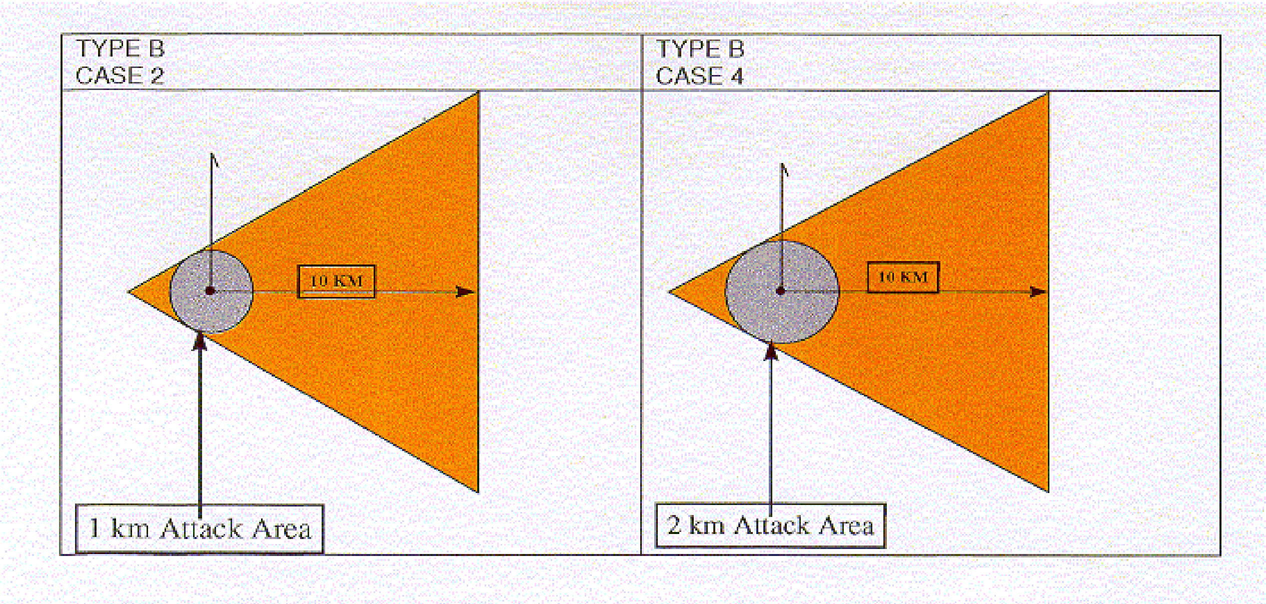


Figure 5.9. Type B, Case 5 and 6, Chemical Plots.

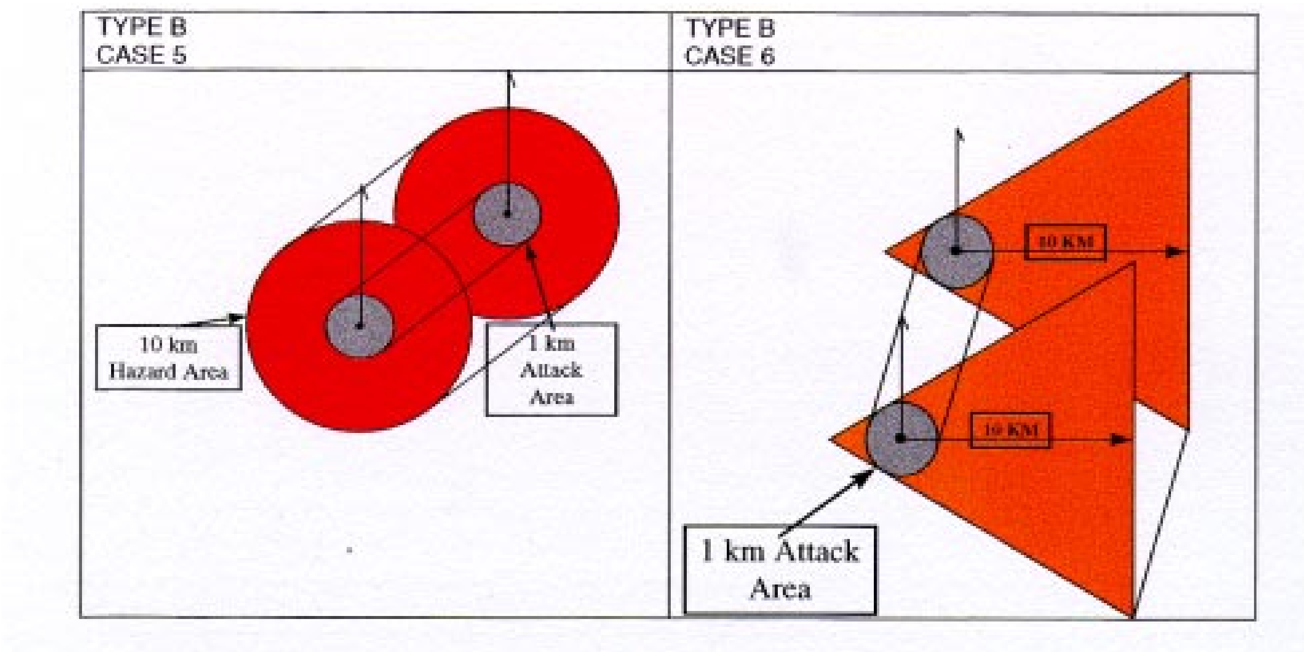
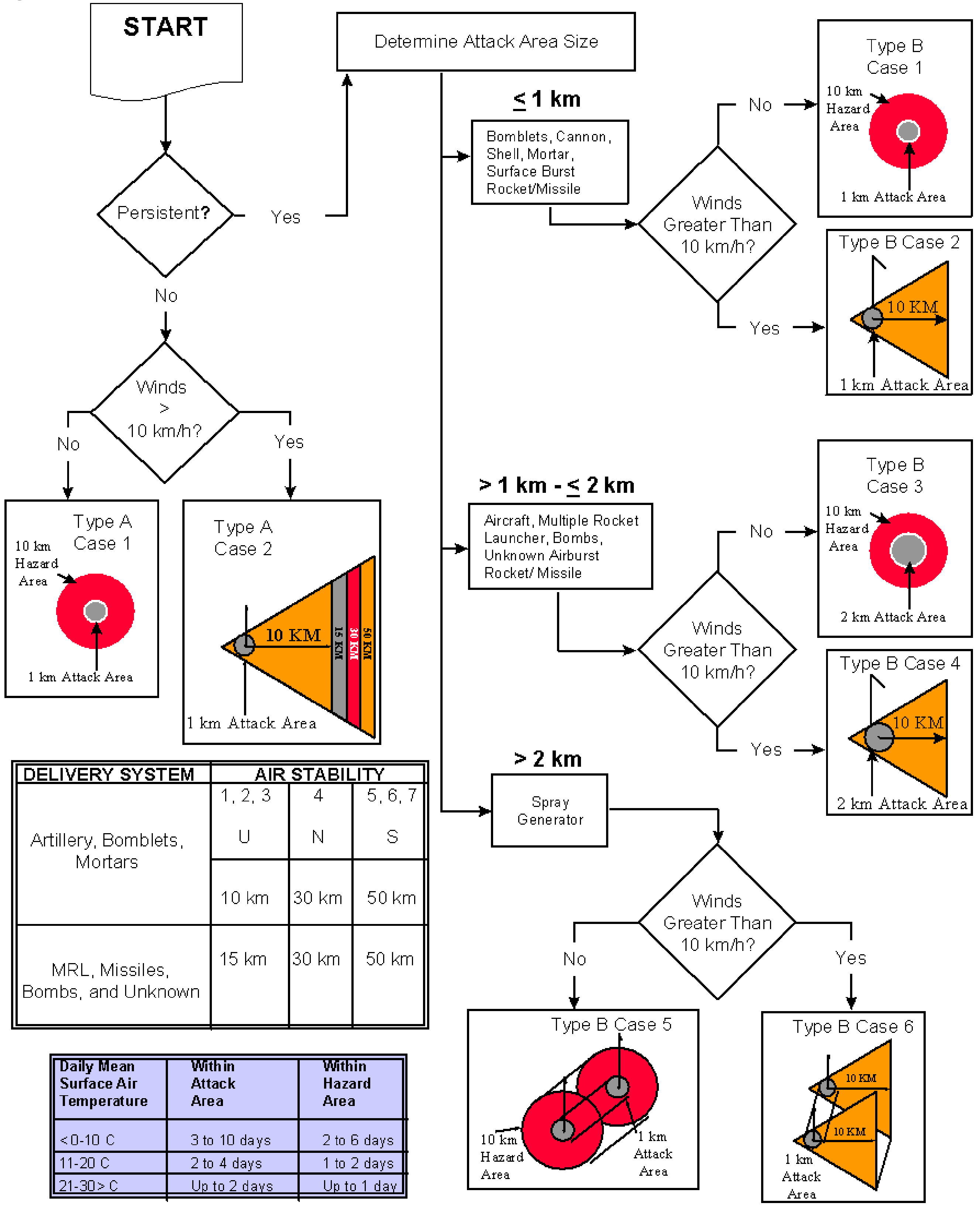


Figure 5.10. NBC Classification Chart.



DELIVERY SYSTEM	AIR STABILITY		
	1, 2, 3 U	4 N	5, 6, 7 S
Artillery, Bomblets, Mortars	10 km	30 km	50 km
MRL, Missiles, Bombs, and Unknown	15 km	30 km	50 km

Daily Mean Surface Air Temperature	Within Attack Area	Within Hazard Area
<0-10 C	3 to 10 days	2 to 6 days
11-20 C	2 to 4 days	1 to 2 days
21-30> C	Up to 2 days	Up to 1 day

5.10.6.5. Recalculation: It may necessary to recalculate an existing plot because of changes in weather conditions. The weather conditions that could cause you to recalculate a plot are:

5.10.6.5.1. Wind direction changes of 30 degrees or more

5.10.6.5.2. A change in air stability category that extends the downwind hazard or a change in wind speed. Note: a new NBC 3 report has to be forwarded.

5.10.6.5.3. There is a change in representative downwind speed of 10 kmph or more, or if the wind increases from $\leq$10 kmph to > 10 kmph or the reverse.

5.10.7. Plotting Biological Agent Attacks. There presently is not a method for manually plotting biological agent attacks that all services and/or allied countries agree upon. This shortfall exists partially because of the extreme complexity of the subject and the different characteristics associated with pathogens as opposed to toxins although both are considered biological agents. For example, computer-generated biological agent plotting models use the following factors (**Table 5.8.**) to develop hazard predictions for a line spray attack. NBC reconnaissance personnel probably won't see evidence of biological contamination unless toxins such as Trichothecene Mycotoxin (T2) are used in a manner consistent with chemical dissemination. This complicating factor occurs because the desired particle size for biological agents is in the 1 - 15 micron range (1000 microns are equal to one millimeter).

Table 5.8. Biological Plotting Factors.

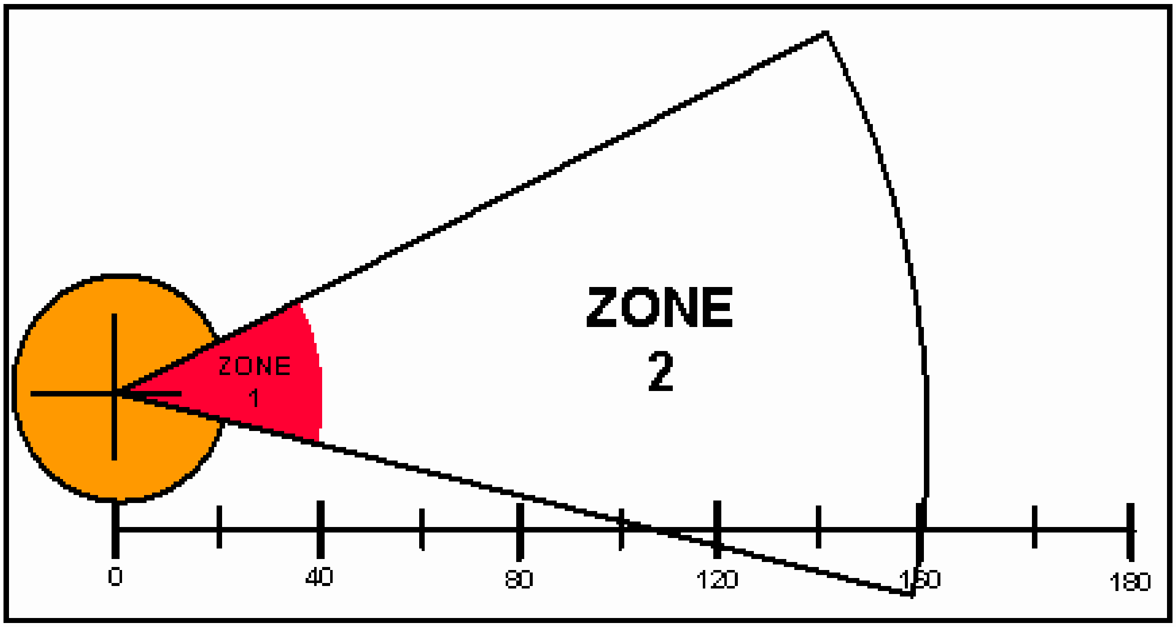
FACTORS FOR BIOLOGICAL PLOTTING		
Specific Type of Agent	Decay Rate	Agent Density
Air Stability Code	Time of Attack	Wind Speed
Volume of Spray Tank	Line Source Strength	Dissemination Efficiency
Release Height Respiratory Dose	Purity of Agent and Concentration	Target Population Breathing Rate

5.10.7.1. Biological plots are broken into two contamination zones: Zone 1. The cloud is expected to produce a casualty rate of at least 20% for exposed, unprotected personnel in Zone 1; Zone 2. The cloud is expected to produce a casualty rate of between 3% and 20% for exposed, unprotected personnel in Zone 2.

5.10.7.2. The hazard distances associated with biological plotting far exceed those associated with chemical plotting. Similar to the concept used with nuclear plotting, there is a relationship between Zone 1 and Zone 2 of a biological agent plot. The Zone 2 distance will always be four times larger than Zone 1 as illustrated in **Figure 5.11.** For example, if the Zone 1 distance (as measured from the attack location) is 40 kilometers, the Zone 2 distance (as measured from the attack location) will be 160 kilometers.

5.10.7.3. Because of the difficulty associated with gathering some of the weather information required for the proposed U.S. Army biological agent plotting technique, and because Dugway Proving Ground reports indicate the Army technique does not adequately encompass the hazard area, the Air Force will use the following simplified, streamlined biological agent plotting techniques until computer programs are distributed to the units. Because of the complexity of the situation, units should make every effort to verify agent travel downwind by contacting sister service or joint/coalition forces who possess biological agent samples.

Figure 5.11. Sample Biological Contamination Zones.



5.10.7.3.1. Point Source Attack (Air Contaminating).

5.10.7.3.1.1. Use the procedure associated with Type A, Case 2 chemical plotting to produce the shape of the hazard plot. Note: If the attack area radius is known to more than 1 kilometer, plot a circle with a radius equal to the radius of the know attack area. At this point, use the concepts imbedded in Type A, Case 2 chemical plotting for the remainder of the plotting procedure. For example, establish the tangent reference point opposite the wind direction line at a spot twice the radius of the circle as measured from the center of the attack area.

5.10.7.3.1.2. The downwind distance of Zone 1 in kilometers is eight times the effective wind speed in kilometers per hour. For example, if the wind speed is 15 km/h, the downwind distance of Zone 1 will be 120 kilometers (as measured from the attack location).

5.10.7.3.1.3. The downwind distance of Zone 2 in kilometers is 32 times the effective wind speed in kilometers per hour. As previously mentioned, this equates to four times the Zone 1 distance. In our example, the Zone 2 distance would be 480 kilometers.

5.10.7.3.2. Line Spray Attack (Air Contaminating)

5.10.7.3.2.1. Use the procedure associated with Type B, Case 6 chemical plotting to produce the shape of the hazard plot.

5.10.7.3.2.2. The downwind distance of Zone 1 in kilometers is eight times the effective wind speed in kilometers per hour. For example, if the wind speed is 12 km/h, the downwind distance of Zone 1 will be 96 kilometers (as measured along the downwind direction line from each end of the spray line).

5.10.7.3.2.3. The downwind distance of Zone 2 in kilometers is 32 times the effective wind speed in kilometers per hour. As previously mentioned, this equates to four times the

Zone 1 distance. In our example, the Zone 2 distance would be 384 kilometers (as measured along the downwind direction line from each end of the spray line).

5.10.7.3.3. Large Liquid Drop Attack (Ground Contaminating). Draw a circle with a 5 kilometer radius around the center of the attack area. If the radius of the attack area is known to be larger than 5 kilometers, draw a circle with a radius equal to the radius of the known attack area.

5.10.7.3.4. The following notes also apply to biological agent plotting.

5.10.7.3.4.1. Movement of the Cloud. After a biological agent release occurs, the cloud will gradually widen and lengthen as it moves downwind. Ultimately, the cloud will obtain a length of approximately one-third the total distance traveled. For example, if the leading edge of the cloud has traveled 30 kilometers, the trailing edge of the cloud will be approximately 10 kilometers behind (at the 20 kilometer point of the downwind hazard line).

5.10.7.3.4.1.1. As the cloud increases in width and length, the actual exposure hazard will increase. This occurs because, although the concentration of the cloud has decreased, the exposure time will be greater due to the increased size of the cloud. Therefore, personnel will be exposed to a lower concentration of agent, but for a loner period of time.

5.10.7.3.4.1.2. Unlike Type A, Case 2 chemical attacks, the cloud arrival time associated with biological agent attacks is determined by dividing the distance the unit is from the attack area by the wind speed (in km/h). For example, if the leading edge of a unit is located 60 kilometers from the attack location, and the wind is moving at 20 km/h toward the unit, the leading edge of the cloud should arrive at the unit three hours after the time of attack. In this example, if the attack took place at 1200 hours, the expected cloud arrival time would be 1500 hours.

5.10.7.3.4.1.3. The length of time personnel can expect to be exposed to the cloud can be determined by dividing the unit's distance from the attack area by three times the wind speed (in km/h). This will provide an answer in hours and fractions of an hour. In the above example where the people are located 60 kilometers from the attack location and the wind speed is 20 km/h, the "cloud exposure time" would be one hour (60 km divided by [30 x 20]). Therefore, we would expect the cloud arrival time for this location to be 1500 hours and the cloud departure time to be 1600 hours.

5.10.7.3.4.2. Time Allotted for Cloud Deposition. There are several factors which affect the time it takes for a biological agent cloud to settle to earth, with its limited contact or resuspension hazard, or be destroyed by weathering effects. However, the default factor for cloud deposition is 8 hours.

5.10.7.3.4.3. Impact of Structures on Cloud Travel. The distances associated with biological hazard plots are based on cloud travel across clear, open land. Heavy forest structure, cities, etc., will limit cloud spread because of increased cloud dispersion and particle contact with surfaces. Installations surrounded by an urban infrastructure are less likely to receive the full power of a remote biological agent release.

5.10.8. Simplified Nuclear Plotting. Simplified nuclear plotting requires nuclear detonation (NUDET) information NBC 1 Reports for a estimated yield of the weapons, type of burst, attack location/ground zero (GZ), current Effective Downwind Message (EDM), ATP 45(A) (sole reference for NBC plotting), and, ideally, a 1-250,000 Universal Transverse Mercator (UTM) map of the area of responsibilities (AOR).

5.10.8.1. Effective Downwind Message (EDM) is produced by the base Weather squadron. It is valid for six hour time periods. EDM consist of seven numbers. The first three numbers are wind direction in degrees, the second set of three numbers are wind speed in knots per hour, and the last digit is the angle of expansion for the plot. See **Table 5.9.** for an example.

Table 5.9. Nuclear Yield Groups.

Effective Downwind Message
NBCEVENT/EDM//
AREAM/ECQ4//
ZULU/011200ZMAY97/011300ZMAY97/011900ZMAY97//
UNITM/-/DGG/KPH//
ALPHAM/200/010/4//
BRAVOM/205/012/4//
CHARLIEM/210/014/4//
DELTAM/220/016/4//
ECHOM/225/020/4//
FOXTROTM/230/030/4//
GOLFM/240/035/4//

5.10.8.2. Types of Burst. Their are four types of nuclear burst. They are the High altitude, Air , Surface, and Sub-surface burst. The high altitude burst takes place at an altitude equal or above 100,000 feet, it produces electromagnetic pulse (takes out all power). The air burst is below 100,000 feet, designed for maximum blast and radiation. The surface burst is where any portion of the fireball touches the surface of the earth, designed for maximum radioactive fallout. Sub-surface bursts were designed for extremely heavy local residual radiation and short range surface shock.

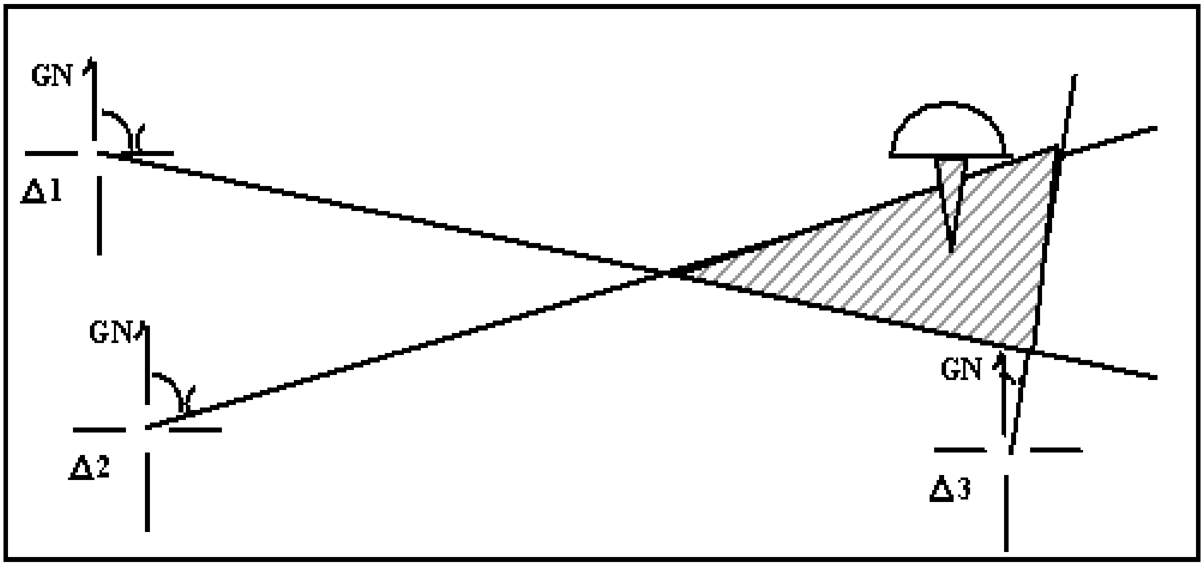
5.10.8.3. To develop a simplified fallout plot, you must accomplish the following steps:

5.10.8.3.1. Find and plot ground zero. Gather Information from NBC 1 Report(s). (Hint: Use lines J, L, and M, from the NBC 1 Report(s) to construct ground zero). Draw/Plot Ground Zero. **Figure 5.12.** illustrates one method of finding GZ.

5.10.8.3.2. Estimate the yield of the NUDET. This may be estimated by using NBC 1 Reports lines J, L, and M) Note: Use the nomograms listed in ATP 45(A).

5.10.8.3.3. Determine type of burst. Determine this from NBC 1 reports. Note: High altitude bursts are not plotted.

Figure 5.12. Intersection Method of Plotting GZ.



5.10.8.3.4. Develop simplified plot: plot/draw downwind direction; determine downwind direction for Zone 1, draw Zone II, and plot yield groups "Alpha" through "Golf" listed in **Table 5.10.**

5.10.8.3.5. Estimate arrival times (eat) of radioactive fallout.

5.10.8.3.6. Label simplified nuclear plot.

5.10.8.3.7. Special Case Note: Use this case if the Effective Downwind Speed (EDS) is < 8 km/h or if the weapon yield is < 4.4 KTs)

Table 5.10. Nuclear Yield Groups.

Alpha	is	2KT or less
Bravo	is more than	2KT to 5 KT
Charlie	is more than	5KT to 30KT
Delta	is more than	30KT to 100KT
Echo	is more than	100KT to 300KT
Foxtrot	is more than	300KT to 1000KT (1 MT)
Golf	is more than	1000KT to 3000KT (3 MT)

Chapter 6

NBC DEFENSE ACTIONS - DEPLOYMENT, EMPLOYMENT (PRE-, TRANS-ATTACK)

6.1. Purpose and Overview. This chapter discusses the actions associated with the employment phase of CB defense. It deals specifically with activities during the pre-, and trans- attack phases of employment operations. **Chapter 7** will address post-attack operations. **Figure 6.1.** summarizes CB defense actions which will be explained throughout Chapters 6 and 7.

Figure 6.1. CB Defense Actions.

DEPLOYMENT
Evaluate Enemy Capability: ☑ Production ☑ Agents ☑ Delivery Systems ☑ Employment Doctrine
Identify Train and Equip Specialized CB Teams ☑ Assessment ☑ Contamination Control ☑ Shelter ☑ Reconnaissance
Establish CB Defense Plans: ☑ Detectors ☑ Communications ☑ Shelters
Obtain Required Immuno/Chemo-Prophylaxis Treatment
Evaluate and Correct Unit Status ☑ Individual Training ☑ Individual Protective Equipment ☑ CB Protective Shelters ☑ Medical Supplies and Equipment ☑ Decontamination Equipment ☑ Detection Equipment ☑ Vaccine Status
Conduct Training Exercises for CB Defense
EMPLOYMENT - PRE - ATTACK
Evaluate and Monitor CB Intelligence ☑ Enemy Defensive Equipment locations ☑ Enemy CB Training and Exercise Status ☑ Enemy Vaccine/Immunity Status ☑ Enemy CB Facility Locations ☑ Enemy Agents
Disperse Pre-positioned Individual CB Equipment
Implement Appropriate MOPP
Activate CB Defense Plan ☑ Deploy Specialized Teams and Equipment ☑ Detectors (arrays & networks) ☑ Communications (Medical/Intelligence Networks Warning & Reporting) ☑ Shelters ☑ Cover All Mission Essential Equipment ☑ Environmental & Medical Baselines ☑ Disease Analysis (non-battle injuries)
Review/Refine Reconstitution and Relocation Plans: ☑ Toxic Free Areas ☑ Contamination Control Areas
Implement Sanitation and Hygiene Measures
Continue Medical Protective Treatments
Conduct Training Exercises for CB Defense
ATTACK
Monitor Warning and Reporting System for Reports of CB Attacks
Monitor Intel/Airborne Radar Data
Issue Base Wide Warning: ☑ Activate Attack Alarm ☑ Implement Appropriate MOPP
Monitor CB Attack Indicators: ☑ Detector Response ☑ Casualty Data ☑ Environmental Data

6.2. Deployment Actions. Readiness Flights should take measures to evaluate the enemy capability, identify and train specialized CB teams, establish CB defense plans, evaluate unit status, and conduct training and exercises for CB defense. Additionally, they should be familiar with procedures for obtaining required immuno/chemo-prophylaxis treatment.

6.3. Preparation Process. Site surveys and vulnerability assessments are cornerstones in the preparation process. They serve as the foundation for unit planning activities. Site surveys provide detailed information concerning available resources and are critical to the force beddown planning process. Vulnerability assessments provide insight into the ability of the unit to mitigate likely threat situations. This insight entails the unit to develop procedures, acquire equipment, and/or take other actions to correct vulnerabilities before the mission is adversely affected and/or people are injured or killed. Knowing the risks and vulnerabilities in a CB environment allows the commander to determine his/her unit's situation and provides options to mitigate those vulnerabilities. The Readiness Technician will often be called upon to advise the commander of these risks.

6.4. CB Risk Assessments. **Figure 6.2.** and **Figure 6.3.** on the following pages illustrate a chemical and biological risk assessment and efforts to mitigate the risks. Particularly in high threat (high risk) areas, the commander must focus on the efforts that he/she has direct control over (i.e. MOPP levels, decon, hygiene, etc.).

6.5. Site Surveys. One of the most important functions Readiness personnel perform is the development and assessment of comprehensive unit planning documents (plans, checklists, etc.). Unit effectiveness during chaotic situations is directly attributable to the preparation and training personnel have received prior to the event. For example, Readiness personnel will be able to establish an effective, integrated NBC detection network much more rapidly if they've already developed a detector array, reporting network, and backup considerations prior to the deployment. Because there's no guarantee of how long a unit will have to prepare itself prior to the onset of hostilities, speed is a valuable asset. Clearly, a well trained and prepared unit will be in much better position to survive attacks and continue the mission in comparison to a unit that waits until they arrive at the employment location to determine requirements, develop procedures and prioritize activities.

6.5.1. Unfortunately, many Readiness personnel are not afforded the opportunity to train at or even physically see their intended wartime employment location prior to the onset of hostilities. This shortfall is made worse when these personnel must either write or review base support plans for these locations. In these cases, personnel must rely entirely on the material contained in past site surveys to establish the foundation for the operational requirements contained in their planning documents.

6.5.2. Because the site survey and subsequent vulnerability assessment process is critical to contingency preparation, it's imperative Readiness personnel spare no effort in attempting to be included as part of the site survey team. In many cases this will be an extremely hard sell because space on the team will be limited and every installation function has a valid site survey requirement. However, as sincere as a non-Readiness person may be, there is no substitute for seeing the location yourself. This experience enables the observer to better evaluate the situation, determine unit strengths and weaknesses, as well as develop and assess the probable effectiveness of proposed work-arounds for identified shortfalls.

6.5.3. Readiness personnel should have a clear idea of what the site survey objectives are before the visit and then ensure those objectives are met before the team leaves the employment location. This preparation will pay large dividends during the post-visit vulnerability assessment and planning activities.

Figure 6.2. CW Risk Assessment Flowchart.

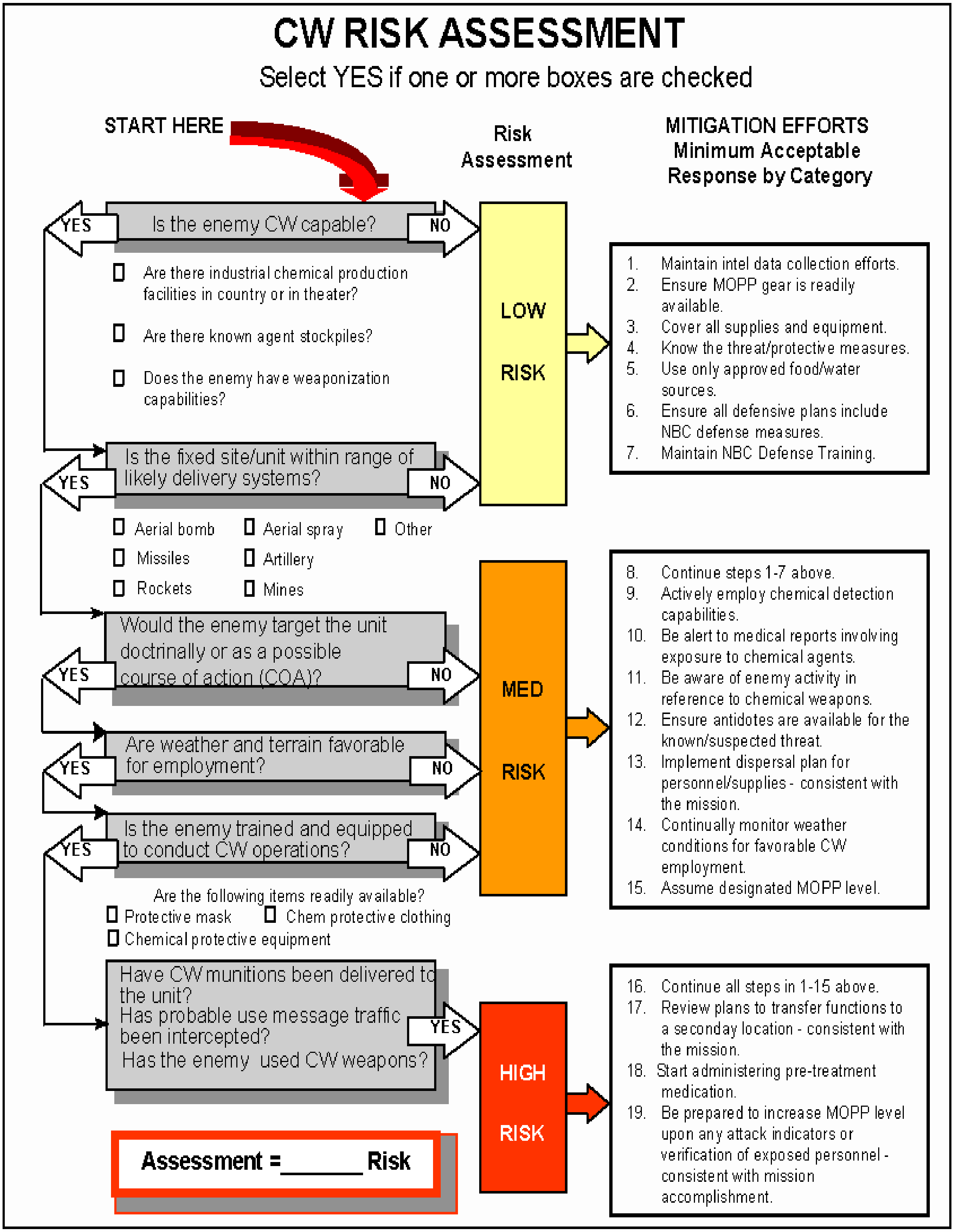
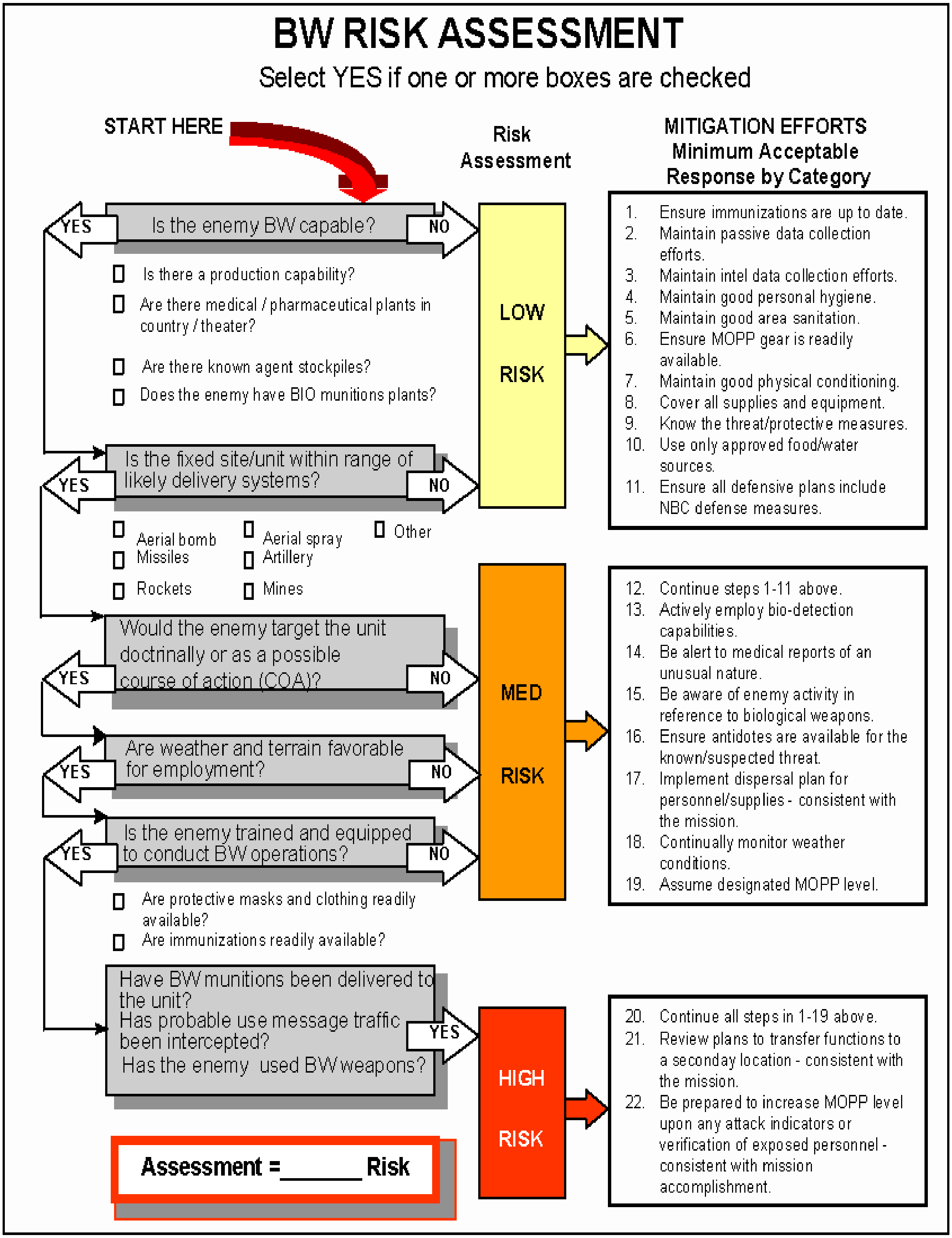


Figure 6.3. BW Risk Assessment Flowchart.



6.5.3.1. If you are fortunate enough to be selected as a site survey member, don't attempt to accomplish the visit preparation entirely by yourself.

6.5.3.1.1. Gather the Readiness Flight together and discuss what specific questions need to be answered. Prioritize the information-gathering tasks so critical items are accomplished first in case time on site is limited.

6.5.3.1.2. Meet with your local Readiness Council to verify you have included all necessary items from the wing survivability perspective. Again, as with your office meeting, prioritize the information-gathering tasks and integrate them with the materials you've already prepared.

6.5.3.1.3. Find out who the other members of the site survey team will be and determine if they can help you gather the information you need. Solicit their help and ensure you clearly explain the impact if the information can't be obtained. For example, the individual checking out the utilities infrastructure can tell you if hard-line power is available at or near your proposed NBC detector employment locations. This piece of information will provide insight as to whether you'll need generators and/or a large supply of batteries to employ your detector array.

6.5.3.1.4. Gather and verify as much of the previously acquired site survey information as possible. This includes talking to in-place personnel at a main operating base, caretakers at a collocated operating base, and past site survey team members. Be sure to look at site survey records from a variety of units (logistics, transportation, operations, other portions of civil engineering, etc.). They may contain valuable information even though it wasn't specifically gathered for Readiness purposes.

6.5.3.2. Use AF Form 2519, **All Purpose Checklist,** and the checklist items contained in **Attachment 5** as a starting point for your site survey operations. Remember that some site survey questions are designed to gather information about existing procedures (main operating base) and are not limited to queries concerning the availability of resources.

6.6. Hazard Analysis. Hazard analysis is a three step decision-making process of collecting and analyzing information on potential threats. It is used to obtain a clear understanding of what hazards exist and the risk posed to people, property, missions, and the environment. The information developed in a hazard analysis provides the basis for notification and reporting requirements, establishes subsequent planning priorities, and provides the documentation to support planning and response efforts. **Table 6.1.** lists the three key steps associated with hazards analysis.

Table 6.1. Hazard Analysis Steps.

HAZARD IDENTIFICATION	VULNERABILITY ANALYSIS	RISK ASSESSMENT
Location Quantity Nature of Hazard	Vulnerable Zone Human Populations Critical Facilities Environment	Likelihood of Disaster Severity of the Consequences

6.6.1. Many aspects of the site survey directly relate to the vulnerability assessment. Keep this in mind as you complete the basic steps associated with the hazard analysis process.

6.6.1.1. Hazard Identification. Gather all available threat information. Ensure this "threat baseline" is agreed upon by all relevant activities. This will prevent follow-on disconnects between Readiness, Security Forces, OSI preparations, etc., and ensure unit commanders have a clear idea of the probable attack situation(s). Include potential major accident and natural disaster events in this "hazard identification".

6.6.1.2. Vulnerability Analysis. Determine the unit's ability to survive and continue effective mission operations in the event the previously identified hazards and attack situation(s) occur. Analyze each individual aspect of the threat in great detail. Readiness personnel must not attempt to accomplish the entire vulnerability analysis themselves. The functional OPR for each aspect of the threat (Security Forces for the ground threat for example) should take the lead in analyzing their area(s) of responsibility. Units will not be vulnerable to all threats or have the same degree of vulnerability to each hazard. For example, a unit might be totally prepared to operate in a tear gas environment, moderately prepared to operate in a non-persistent chemical environment, and basically unprepared to operate in a persistent chemical or biologically contaminated environment.

6.6.1.3. Risk Analysis. Determine the probability of the threat(s) and unit vulnerability.

6.6.2. Develop work-arounds. Prioritize vulnerabilities and balance available resources (time, materials, personnel) to determine work-arounds to mitigate unit shortfalls. Develop specific action items, with established OPRs and estimated times of completion for each item.

6.6.2.1. Do not "close" an item simply because a request for additional materials, equipment, or personnel was submitted to higher headquarters.

6.6.2.2. If the unit can't determine an adequate work around, inform higher headquarters of the situation and solicit their assistance. Use established lines of communications, the LIMFAC reporting network, etc., to keep higher headquarters abreast of unit capabilities and concerns.

6.6.3. Use AF Form 2519, All Purpose Checklist, the checklist contained in **Attachment 6** of this document as a starting point for your vulnerability assessment operations.

6.7. The CBW Vulnerability Assessment Tool. It may not be possible to effectively operate a U.S. air base following a CB attack. The degree to which the CB environment impacts sortie generation depends to a great extent on the defensive capabilities available to the commander and the strategies he employs. The purpose of the CB Vulnerability Assessment Tool (VAT) is to facilitate the air base commander's preparation for the possibility of CB operations by predicting the sortie and casualty levels likely to be realized in a variety of scenarios. These scenarios include a range of expected attack types and intensities as well as the most relevant aspects of a defensive capability. The VAT tables and the checklist to complete the vulnerability assessment is located in **Attachment 7**.

6.7.1. Overview of the VAT Analysis. The operability estimates given in the VAT are based on a detailed simulation and analysis of air base operations in a CB environment, addressing two theaters of operation (Northeast Asia and Southwest Asia), two types of air base ("large" and "small"), and two times of year (summer and winter). The measures of effectiveness are the number of sorties generated (as a percentage of the tasking) and the number of casualties (as a percentage of the base population). In order to make credible predictions, the analysis had to account for a host of relevant variables. These variables can be divided into three main categories: 1) representation of air base operations. 2) representation of the CB environment, and 3) representation of the CB defensive capability.

6.7.1.1. Representation of Air Base Operations. The Theater Simulation of Airbase Resources (TSAR) is a computer model that accounts for the tasks and resources required to generate sorties on a typical fighter/attack base. A later version called Chemical Warfare Theater Simulation of Airbase Resources (CWTSAR) added the effects of the CBW environment on the air base system, including agent exposure, casualty computations, and degradation of task performance. Existing databases describing Hahn AB Germany and Ramstein AB Germany are used in representing the operations of generic "small" and "large" air bases for this analysis. A few details of these two air base descriptions are given in **Table 6.2.**

Table 6.2. Parameters Governing Simulation of Sortie Generation.

	Small Base		**Large Base**	
Aircraft	72 F-16		96 F-16	
Missions	Interdiction, Close Air Support			
Combat loads	Mark 82/84, CBUs			
Flight Size	4			
Sortie length	90 min			
Flying day (hrs)	NE Asia	SW Asia	NE Asia	SW Asia
Summer	15	14	15	14
Winter	10	11	10	11
Tasking See Note 1				
Summer	3.3	3.1	3.7	3.5
Winter	2.7	3.1	3.0	3.4
Attrition Rate See Note 2				
Loss	0.5%			
Damage	1.0%			
Base Population	4,179		10,047	

NOTES:

1. Sorties per aircraft per day.

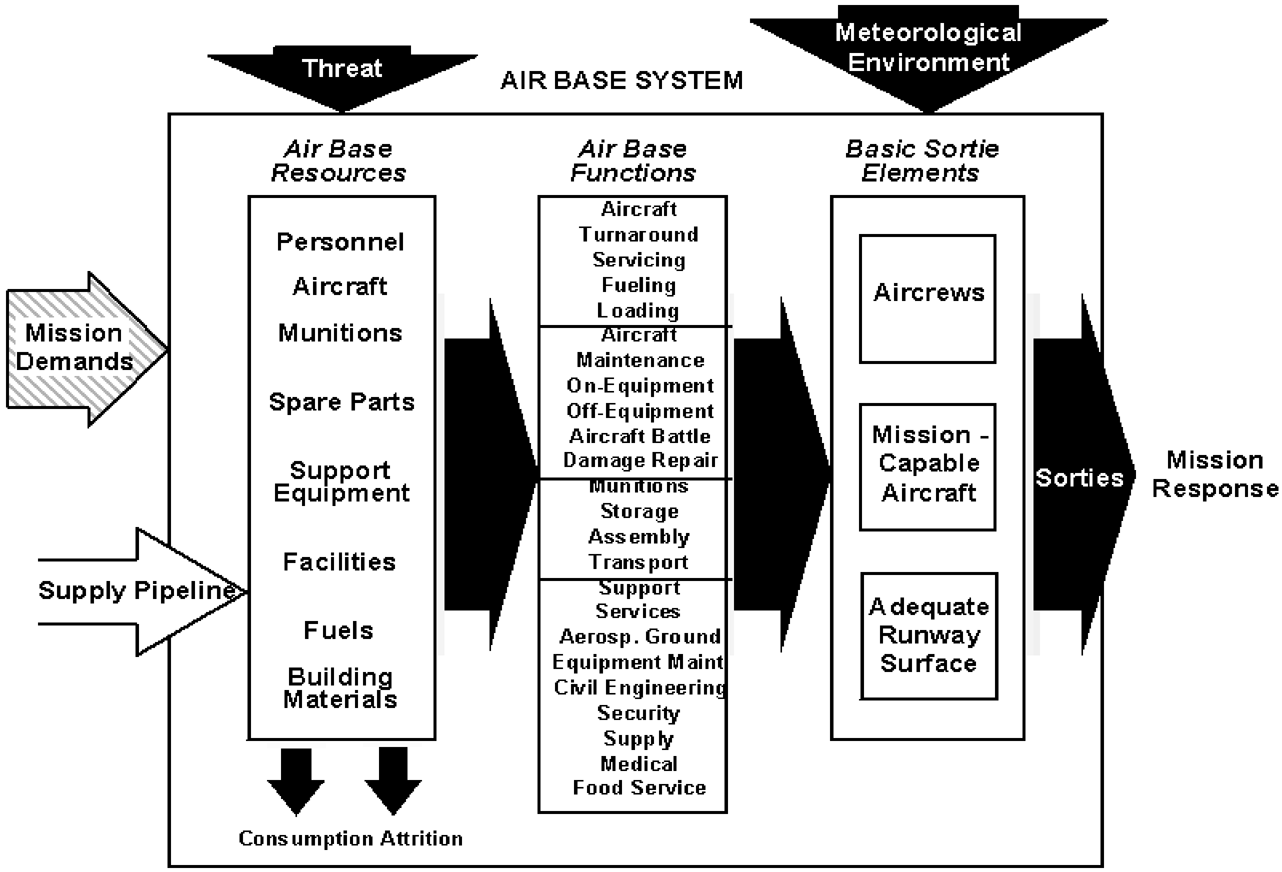
2. Per sortie. Aircraft are housed in semi-hardened shelters. Assume no replacement during scenario.

6.7.1.1.1. CWTSAR represents the air base as a system of functions and resources organized for the purpose of launching aircraft on missions. At the most fundamental level, three assets are required to generate sorties: mission-capable aircraft, aircrews, and an adequate surface for taxi and takeoff (Figure 6.4. box on right). Ensuring the continuing availability of these assets is the goal of the air base functions (Figure 6.4. center box). Performance of the air base functions in turn depends on the availability of air base resources (Figure 6.4. box on left). The air base system as a whole is affected by external events such as attacks, weather conditions, and mission demands.

6.7.1.1.2. Individual task completion times are also determined by random draw in some cases. Some tasks can be performed in parallel while others are performed in series, in which case the initiation of a task depends on the completion of one or more prerequisite tasks.

Resource availability is affected by consumption, attrition, resupply, and allocation to other tasks.

Figure 6.4. Overview of the Air Base System.



6.7.1.1.3. The specific task networks resulting in data bases representing the F-16 wings at Hahn AB and Ramstein AB, Germany, and the F-15 wing at Bitburg AB, Germany, were modeled in the mid-1980s. The Hahn data base has been selected to represent a generic small air base and the Ramstein data base is used to represent a generic large air base.

6.7.1.1.4. The damage to air base resources resulting from conventional attacks is determined by taking into account such variables as the explosive payload and weapon function point. The supply of all affected resources is reduced by an amount appropriate to the damage, and any necessary recovery tasks (such as rapid runway repair and facility reconstruction) are initiated.

6.7.1.2. Representation of the CBW Environment. Several multi-day scenarios have been defined to represent the range of CB attacks most likely to occur on U.S. air bases in each of the two theaters; they include chem-only, bio-only, and combined chem/bio attacks. The combinations of delivery systems, agent types and quantities, attack times, target aimpoints, and meteorological conditions are represented by challenge-prediction models and define the CB environment.

6.7.1.2.1. CBW Challenge Computation. Individual CBW agent levels at each point on the air base (referred to as the challenge) are tracked throughout the simulation, increasing as a result of attacks and decreasing due to natural dissipation. For chemical agents, both residual liquid and ambient vapor (primary and secondary) levels are tracked; only the ambient primary aerosol levels are tracked for biological agents. The companion model TSARDOSE makes these computations by combining the challenge patterns produced by individual weapons according to the time and location of agent release. In the case of tactical ballistic missiles (TBMs) and aircraft-delivered bombs, the weapon function (agent release) point is determined by a random draw based on the specified aimpoint and weapon accuracy. The wind direction, which affects the spread of agent vapor and aerosol across the air base, is also randomly drawn based on the specified variability. Individual weapon challenge patterns are generated using the Non-Uniform Simple Surface Evaporation (NUSSE3) challenge prediction model, which computes the diffusion and downwind transport of droplet and vapor clouds produced upon weapon function.

6.7.1.2.2. Personnel CBW Exposure/Attrition. Cumulative CBW exposure levels are maintained in the simulation for each person in the air base wartime population. The CBW exposure is sub-divided into inhaled vapor, percutaneous vapor, and percutaneous liquid for CW agents and inhaled aerosol for BW agents. Exposures are tracked individually for each agent and each person. The casualty threshold for a given agent varies from person to person.

6.7.1.2.2.1. Vapor or aerosol exposure is computed by dividing the ambient concentration at the person's location by the mask fit factor (for inhaled vapor/aerosol) or the whole-body protection factor (for percutaneous vapor). The liquid exposure for a given time and place is computed by first randomly drawing a "pickup factor". The pickup factor represents the extent to which personnel will pick up liquid CW agent on their (protected or unprotected) body surfaces as a result of their duties. The pickup factor multiplied by the residual CW liquid level results in the amount of agent picked up by a given person in a given time period. This picked-up amount is then divided by the whole-body protection factor for liquid exposure to arrive at the percutaneous liquid CW agent exposure for that time period. The cumulative percutaneous liquid exposure is compared to the casualty threshold for that person/agent combination to determine if the person has become a casualty.

6.7.1.2.2.2. Agent concentrations inside buildings or collective protection facilities are computed using air exchange equations, an air exchange rate and (if collective protection) a filtration factor. Each person's cumulative agent exposure is tracked with time, accounting for changes in personnel location and protective status as well as the change in the challenge levels.

6.7.1.2.3. IPE-Induced Performance Degradation. Task performance degradation increases the time required to complete tasks due to the effects of the IPE. This is modeled using task-time multipliers which reflect the difference in performance times for the same tasks with and without the IPE. The thermal effect is accounted for by simulating work-rest cycles which reduce the amount of time personnel can work under conditions of heat stress. The simulation assumes these work-rest cycles will be strictly observed and will prevent casualties from heat exhaustion, heat stroke, or dehydration.

6.7.1.2.4. Northeast Asia Scenarios (5 days). There are eight scenarios: Chem-only (TBMs Only), Chem-only (TBMs + Aircraft on Day 1), Bio-only (Covert Only), Bio-only (Covert + TBM), and four Chem + Bio scenarios with all possible combinations of the Chem-only and Bio-only scenarios. The three scenarios which include aircraft apply only to the large base cases; it is assumed that the small base will not have penetrating aircraft. The chemical attacks include conventional munitions as well, but these are only significant with the aircraft attacks. Three TBMs filled with nerve agent are delivered at dawn on each day of all but the two bio-only scenarios (a single conventional TBM is also included). Three of the 15 total chemical-filled TBMs contain a highly persistent and toxic nerve agent, 10 contain a medium-persistent nerve agent and two a low-persistent nerve agent. Blister agent-filled bombs are used in the aircraft attacks, along with conventional bombs. A usually non-lethal but potent and fast-acting toxin is used as the biological agent, delivered just past midnight on Day 1 (so as to take effect just before dawn) by backpack sprayers in the case of the covert attacks, and delivered at the same time on Day 3 by a TBM containing a large number of bomblets. Details are given in **Table 6.3.**.

Table 6.3. Northeast Asia Attack Scenarios.

		Chem/Conv		Bio	
Scenario	**Base Type**	**TBM**	**A/C**	**Covert**	**TBM**
A	L	1-5	1	1	3
B	L	1-5	1	1	-
C	L	1-5	1	-	-
D	L, S	1-5	-	1	3
E	L, S	1-5	-	1	-
F	L, S	1-5	-	-	-
G	L, S	-	-	1	3
H	L, S	-	-	1	-
L = Large; S = Small; numbers are scenario days.					

6.7.1.2.5. Southwest Asia Scenarios (7 days). Five scenarios are defined, corresponding to the five NE Asia scenarios with no aircraft attacks but with several differences in the scenario details. Five TBMs are used in the chemical attacks instead of three, but the highly persistent and toxic nerve agent is not used. Three of the five chemical-filled TBMs delivered each day contain a medium-persistent nerve agent and two contain a blister agent. The final difference is that a more potent but slower-acting infectious agent is used as the biological agent. Due to the slow action the Bio-TBM attack is moved up to Day 1. Details are given in **Table 6.4.**

Table 6.4. Southwest Asia Attack Scenarios.

		Chem/Conv		Bio	
Scenario	**Base Type**	**TBM**	**A/C**	**Covert**	**TBM**
D	L, S	1-7	-	1	1
E	L, S	1-7	-	1	-
F	L, S	1-7	-	-	-
G	L, S	-	-	1	1

		Chem/Conv		Bio	
Scenario	**Base Type**	**TBM**	**A/C**	**Covert**	**TBM**
H	L, S	-	-	1	-
L = Large; S = Small; numbers are scenario days.					

6.7.1.2.6. Detailed meteorological data for Northeast Asia and Southwest Asia were used in defining the CBW agent challenge histories and the heat stress conditions for the summer scenarios. The data consisted observations of temperature, humidity, wind speed, wind direction, cloud cover, and Pasquill stability category.

6.7.1.3. Representation of the CBW Defensive Capability. All major areas of CBW defense were considered for representation in the development of the VAT. The defensive components and cases ultimately selected for the VAT are shown in **Table 6.5.** and are briefly explained below.

Table 6.5. CBW Defensive Components.

Component	Cases
Collective protection	Available (Y) Not Available (N)
IPE Type	BDO (B) JSLIST(J)
Cooling	Available (Y) Not available (N)
Dewarning	See **Table 6.6.**
Contamination Control (Expedient decon)	Performed (Y) Not performed (N)

6.7.1.3.1. Collective Protection (ColPro). Collective protection provides a toxic-free environment. Only the long-term rest and relief role is represented in the VAT analysis.

6.7.1.3.1.1. It is understood that in the absence of ColPro, personnel must remain in IPE while off duty. In the simulation cases in which ColPro is not available, personnel are assumed to remain on base. It is further assumed that an open-air collective protection area on base cannot be established. (Note: This is an assumption for the model. It does not mean that open-air collective protection on-base is not an operationally feasible option.) The only remaining option is to continue wear of the IPE during the entire off-duty shift (or as long as Alarm Black conditions are in effect).

6.7.1.3.1.2. In the cases where IPE must be worn around-the-clock, the simulation includes two 30-minute periods of short-term rest and relief each day in order to extend tolerance of the IPE to the full duration of the scenario. This has the effect of increasing casualties, since these breaks will not always occur in clean areas. Two additional effects are some reduction of mask fit factors during sleep and a degradation in next-day performance due to mask-induced sleep disruption. In actual practice, the consequences of the breaks in protection would be mitigated by attempting to find the least contaminated areas to use for this purpose. In the VAT analysis and simulation, however, it was necessary to assume that the breaks occurred wherever personnel happened to be located, although they were scheduled at the times of day with the lowest hazard.

6.7.1.3.1.3. Long Term Wear of IPE (No ColPro). In order to represent the "No ColPro" case, then, it is necessary to assume that tolerance of the IPE can be extended to five days provided there are regular opportunities to remove the gear and attend to personal needs. Two daily 30-minute breaks from the IPE (before and after the duty shift) are postulated for this purpose.

6.7.1.3.2. IPE Type (summer only). Wearing the IPE in warm or hot weather poses the risks of heat stroke and dehydration, requiring the use of work-rest cycles and/or auxiliary cooling. Personnel in the simulation observe work-rest cycles to prevent the occurrence of thermal casualties. The work-rest cycles used depend on the ambient temperature and humidity, as well as the work intensity and the clothing and IPE being worn.

6.7.1.3.3. Personnel Cooling (summer only). Auxiliary personnel cooling is represented by simulating use of the Multi-Man Intermittent Cooling System (MICS). Whatever their protective posture, personnel can attach to a nearby MICS unit to receive cool, filtered air to the torso and face during the rest period of a work-rest cycle, hastening their return to work. This is modeled by shortening the rest periods in the "cooling available" cases to the rest times that would be required at an ambient temperature of 60°F instead of the (warmer) ambient temperature. Although the MICS as currently configured will interface with the BDO only and not the JSLIST, the VAT includes a few JSLIST cases with cooling to show the effect of some type of cooling concept along with the JSLIST.

6.7.1.3.4. Dewarning Strategy. Determining when and where to allow personnel to reduce their individual protection is one of the more difficult decisions associated with operating in a CB environment. Dewarning levels are designated time intervals associated with established MOPP levels. For example, Dewarn 9 is Full IPE (MOPP 4) for 8 hours, then Mask Only. Dewarning too early may result in additional casualties, while erring on the conservative side by waiting too long after the hazard has dissipated can needlessly reduce sortie generation due to the effects of the IPE. The decision process is a complicated one that involves factors such as detector placement strategy, detector responses, meteorological conditions and predictions, and personnel locations. The commander's leadership style and risk tolerance also comes into play. Dewarning strategies do not apply to covert BW attack, for which personnel are considered unprotected at all times. Depending on the agent used and weather conditions, hazardous levels of CB contamination can persist on an air base from less than an hour to several days. The primary outdoor hazard from biological agent attacks remains only as long as it takes for the aerosol cloud to pass beyond the air base or dissipate, usually no longer than 30 minutes. It is generally assumed that chemical attacks on an air base will be made with semi-persistent or non-persistent agents to extend the period of time in which personnel must remain in IPE and suffer its performance-hampering effects. Because of these effects, it is critical to the optimum operation of the air base that personnel not remain in their IPE after all agent has dissipated and a hazard no longer exists.

6.7.1.3.4.1. Options available to the commander include partial reduction of protection, such as from MOPP 4 to mask only, and dewarning certain areas of the base before others.

6.7.1.3.4.2. The objective in representing dewarning for the VAT is to provide insight into the time frames for which IPE will most likely be required and the consequences of dewarning either too early or too late. This is accomplished by presenting 10 different dewarning strategies, in which personnel reduce their protection to a mask-only or BDUs-only posture at the 1-, 8-, or 16-hour point. The simulation makes protective posture reductions without consideration of the CBW hazard present at the time. All personnel in the simulation reduce protection at the same time in accordance with the dewarn case, even if hazardous vapor, aerosol, or liquid agent remain on the air base. Although not entirely realistic, this methodology is consistent with the objective of providing insight to the user. See **Table 6.6.** for dewarn cases modeled in the VAT.

Table 6.6. Protective Posture Changes in Dewarn Cases.

	Hours Post-Attack			
Case No.	< 1	1 - 8	8 - 16	16 -24
9	F	F	F	F
8	F	F	F	M
7	F	F	F	B
6	F	F	M	M
5	F	F	M	B
4	F	F	B	B
3	F	M	M	M
2	F	M	M	B
1	F	M	B	B
0	F	B	B	B
	Protective Posture: F = full IPE M = mask only B = BDUs			

NOTES:

1. Does not apply to the covert BW attack, for which personnel are considered unprotected at all times.

2. At the end of 24 hours, all cases de-warn to BDUs (if not already). This applies only to the BW-only scenario, TBM attack, since CW attacks are repeated every 24 hours.

6.7.1.3.4.3. Three states of individual protection are modeled in CWTSAR: full IPE (MOPP 4), mask-only, and BDUs only. When an individual protection state change is signaled by a dewarning event , three main personnel attributes are affected: CBW protection factors, task-time multipliers, and (if applicable) work-rest cycles.

6.7.1.3.4.4. Effect on CBW Protection Factors. When personnel are in MOPP 4 or mask-only state, the model assigns a mask fit factor for each person from an input fit factor distribution table. With percutaneous protection factors, there is no distribution but a single value which applies to all personnel. Two percutaneous protection factors were specified, one for liquid challenge and one for vapor challenge (in both cases it is the penetration of vapor through the skin which causes casualties).

6.7.1.3.4.5. Effect on Task-Time Multipliers (TTMs). The IPE task-time multipliers are the ratios of the times required to perform tasks while wearing IPE to the task times with no IPE representing the encumbrance effects of the IPE. The actual TTMs used in the VAT differ from those presented in AFMAN 32-4005 because a more robust set of variables (i.e. more weather data points) were used in determining the effect of IPE on work tasks. Furthermore, these numbers do not include rest times. **Table 6.7.** contains the average TTMs for each of the task categories, for the full IPE and mask-only cases.

Table 6.7. Mean Task-Time Multipliers Representing IPE Effects.

Function	Full IPE	Mask only
On-aircraft maintenance	1.42	1.18
Aircraft turnaround	1.30	1.09
Off-aircraft maintenance	1.50	1.25
Ground equipment repair	1.50	1.25
Munitions buildup	1.38	1.15
Civil engineering	1.20	1.10
Aircraft battle damage repair	1.50	1.20

6.7.1.3.5. Contamination Control (immediate decontamination). Contamination control includes both contamination avoidance (either pre- or post-attack) and decontamination. It is assumed that pre-attack contamination avoidance actions will be taken to cover or shelter equipment, but that decontamination will be limited due to time and resource constraints, the effectiveness of the IPE, and natural reduction of the hazard due to evaporation and absorption of the agent by the surface.

6.7.1.3.5.1. Hazard Reduction. The benefit of decon is modeled by eliminating residual CW agent pickup for all personnel whose duties involve using a specific set of equipment which they could systematically decontaminate prior to beginning their duties after the attack. The decon strategy implemented in the simulation is to immediately decontaminate only the equipment which was directly exposed to the attack and only in those areas which may contact personnel. If decontamination is not performed, personnel may pick up residual CW agent which can result in additional casualties. Only security police and personnel performing chemical reconnaissance do not have their pickup eliminated in the cases where decon is performed. Decon does not benefit these functions because by the nature of their duties they are susceptible to pickup from large areas of contaminated ground and other outdoor surfaces and could not feasibly decontaminate these prior to going about their duties. The additional time required for immediate decontamination of exposed equipment is assessed to functions using that equipment.

6.7.1.3.5.2. Following the attack it is presumed that all equipment which had been left uncovered will be identified and then immediately decontaminated. Since all exposed equipment will be decontaminated prior to first use, after this initial period of immediate decontamination there should be no further need to decontaminate; all transferable agent would have been removed from touchable surfaces and transfers from the ground have shown by analysis to be negligible.

6.7.1.3.5.3. Decon Time Penalty. The additional time required to immediately decontaminate all equipment exposed to a CW attack is assessed in CWTSAR. The decon task time multipliers for a given air base function are calculated according to the following procedures and are shown in **Table 6.8.**

Table 6.8. Derivation of Decon Task-Time Multiplier (TTM).

Function[1]	Total Quantity of Items	Percent Exposed	Total Quantity to Decon	Total Decon Time	Total Task Time	Decon TTM[2]
On aircraft maintenance	202	10	20	3.0	1,061	1.00
Turnaround	3,479	5	174	26.1	390	1.07
Munitions buildup	1,467	5	73	11.0	See Note 3	1.03
Civil engineering	137	20	27	4.1	See Note 3	--
Determine the total number of equipment items associated with that function, excluding small items such as hand tools (it is assumed clean substitute items will be available for any small items that are exposed to the attack). Obtain estimates of the percentage of each function's equipment items which will be left exposed during an attack, either inadvertently or because sufficient time or resources were not available to cover/shelter them. Multiply (1) by (2) to obtain the approximate total number of equipment items which would have to be decontaminated. Multiply (3) by an average time estimate for immediate decon, 9 minutes per item, to obtain the additional task time required for decon. (Take total minutes and divide by 60 for the hours) Add the decon task time to the total aggregate task time without decon. Divide (5) by the total task time without decon to obtain the decon TTM.						

NOTES:

1. Effect of decon on off-aircraft maintenance, AGE repair, and aircraft battle damage repair (ABDR) assumed insignificant.

2. Times in hours.

3. Total task time for munitions buildup and CE tasks unknown:

- Assume munitions buildup is equal to turnaround

- CE tasks neglected due to insignificant influence on sortie generation.

6.7.2. CBW Defensive Components Considered But Not Included in VAT. The following are not included in the VAT: CBW hazard warning, medical intervention, and training.

6.7.3. Using the Vulnerability Assessment Tool.

6.7.3.1. Description. There are two closely related purposes for using the VAT. The first is to determine whether effective air base operations are possible in a given situation, one which matches or approximates one of the combinations of operating location, base type, time of year, and defensive capability represented in the tables. The second is to identify situations in which changes to CBW defensive capabilities and strategies will enable effective air base operations to be conducted in the future where that capability does not currently exist.

6.7.3.1.1. The VAT consists of a total of eight tables, one for each combination of operating location, base type, and time of year. The columns of the VAT tables represent the attack scenarios, while the rows contain selected combinations of CBW defensive components/strategies, each such combination representing a different CBW defensive capability. The individual defensive cases are designated by the letters and numbers appearing on the far left-hand side of the table under the heading "Defensive Components." There are five components listed for the summer attack scenarios and three for the winter scenarios. The key to the letters identifying the defensive component cases other than "Dewarn" can be found in **Table 6.5.**, while **Table 6.6.** provides the key to the numbers identifying the "Dewarn" cases. Each row representing a defensive capability is numbered on the far left.

6.7.3.1.2. The air base operability/survivability prediction for a given combination of attack scenario and defensive capability is found in the intersection of the column for that attack scenario and the row for that defensive capability. The attack scenario columns are divided into two sub-columns, headed "S" and "C." The "S" sub-column displays the predicted sortie generation for the entire scenario as a percentage of the air tasking. The sub-column labeled "C" contains the predicted casualty total for the scenario as a percentage of the air base wartime population (casualties reflect those personnel who do not return to duty before the end of the scenario).

6.7.4. Important Considerations for Operability Predictions. The following considerations should be taken into account when conducting operability predictions and assessments.

6.7.4.1. Variability. Since many of the variables affecting CBW air base operations are random in nature, the results of the CWTSAR simulation often fluctuate greatly from one trial or replication to the next. The single result shown in each cell of the VAT tables is actually a median or middle value out of 40 trials; the sortie or casualty levels realized in actual operations could be substantially higher or lower.

6.7.4.2. Aircrew casualties do not affect sortie levels. The simulation methodology does not allow aircrew members to be tracked as separate resources required for the launch of sorties. Casualties among aircrew members are reflected in the casualty totals but do not affect the predicted sortie levels. Aircrews are housed in collective protection facilities between missions but must remain in IPE in the same way as ground crews in the "ColPro Not Available" cases in which casualty levels are higher.

6.7.4.3. Maximum Achievable Sortie Level. The sortie levels reported in the tables in **Attachment 7** are given as percentages of the air tasking. Due to the attrition of some aircraft and the assumption that no aircraft can be replaced during the scenario, the highest sortie level which can be obtained in the simulation, even with no attacks and no IPE wear, is only 90% or slightly higher. The sortie rates given in the tables would consequently be higher if replacement of aircraft were allowed.

6.7.4.4. Personnel are warned and fully protected before the first CBW agent arrives in all but the covert BW attack, which is not detected. It is assumed that a heightened state of readiness precedes all attacks, enemy aircraft and TBMs will be detected shortly after launch, and all attacks are initially considered CBW. Estimates were obtained for the time elapsed from launch detection to notification of the air base and signaling of Alarm Red, from Alarm Red to protection of personnel, from weapon launch to agent release, and from agent release to agent arrival on the air base. It is apparent from this process that most personnel will be protected before the arrival of agent.

6.7.4.5. All aircraft are ready on the morning of Day 1 of the scenario and can be launched despite massive casualties from the covert BW attack. It is assumed that all aircraft will be fully armed, fueled and otherwise mission-ready in light of the heightened state of readiness, that enough aircrews will be available, and that enough ground crew members will be available to perform the final tasks prior to taxi and takeoff.

6.7.4.6. Personnel must remain in IPE around-the-clock if collective protection is not available. It is assumed that logistics and security problems would preclude relocation to an uncontaminated off-base site for relief from the IPE, and that current and near-term detection and hazard prediction capabilities would be inadequate to find "clean" areas on base for this purpose.

6.7.4.7. Sufficient overhead cover and contamination avoidance covering is available to protect the vast majority of air base equipment from falling droplets/aerosols from the CBW attacks. If these assumptions are not valid, the reported sortie levels may be too high in the "Decon Performed" cases, since the time requirement to decontaminate exposed equipment will have been underestimated. Similarly, the reported casualty levels would be too low in the "Decon Not Performed" cases, since more equipment would be contaminated and the risk of agent pickup would be higher if less equipment was covered at the time of the attack.

6.7.4.8. Mechanical disturbances of BW agent particles deposited on ground, equipment, and personnel surfaces following an attack do not result in hazardous levels of reaerosolized agent.

6.7.4.9. Casualty Timing and Duration. The casualty levels shown in the tables in **Attachment 7** represent the percentage of the wartime base population which is removed from action for the duration of the five or seven simulation days. The timing of the casualties is not reflected in the casualty results but would be reflected in the sortie level for that case. Since personnel are not replaced, casualties occurring on Day 1 would reduce the sortie level more than the same number (and type) of casualties happening on Day 5, for example. In addition to the "permanent" or long-term casualties shown in the VAT tables, the BW attacks in the NE Asia scenarios generate a second category of "temporary" or short-term casualties. The toxin SEB has two levels of effect, the lower of which incapacitates exposed personnel but allows for full recovery and return to duty in 24-48 hours without medical treatment. Although not shown in the casualty columns of the VAT tables, the temporary absence from duty of these personnel is reflected in the sortie levels if their duty is directly related to sortie generation.

6.7.5. Selection Of Defensive Cases to Include in the VAT Tables. In order to make the VAT as helpful as possible to its intended user, its total size and hence the number of combinations of attack scenarios and defensive capability cases represented in the VAT tables must be limited. Following is the method used in selecting the cases to appear in the VAT:

6.7.5.1. Sixty defensive cases are represented for the summer scenarios, 30 for winter. Summer is allocated twice as many cases as winter since it has five defensive components versus three for winter.

6.7.5.2. Ten cases are included for dewarning strategy because it had been observed in preliminary trials that variations in this defensive component had the greatest impact on both sortie and casualty levels.

6.7.5.3. All combinations of dewarning strategy (10 cases) and collective protection availability (2 cases) are included for the baseline decon case (decon not performed). After dewarning, the availability of collective protection has the greatest impact on the results.

6.7.5.4. In the winter scenarios, the remaining 10 defensive cases are filled by selecting 5 of the 10 dewarn cases in which to represent the effect of decon, both with and without collective protection. The five dewarn cases selected were those for which decon is most likely to show an effect.

6.7.5.5. In the summer scenarios, there are 40 "slots" for defensive cases remaining in the VAT tables after first taking all combinations of dewarn and collective protection cases for the baseline values of the other three defensive components. These 40 cases were filled by representing the addition of cooling, the JSLIST suit, and decon both with and without collective protection. As is for the winter cases, a limited number of dewarn cases had to be selected for the addition of non-baseline cases of the other defensive components. The dewarn cases chosen were again those judged most likely to show the effect of the other components.

6.8. Training. Initiate CB Defense training programs with assigned personnel. Incorporate local signals and IPE maintenance as heightened subjects of attention. Practice complete processing through the Contamination Control Area (CCA) during local exercises. This is necessary because of the unacceptable consequences to your operations if someone should bring contamination into a TFA. All of your people must practice complete processing--not just a token few. Train your personnel to check suspected surfaces with M8 or M9 paper before touching the surfaces. Everyone should recognize that marked off areas, whether for contamination or unexploded ordnance, must be avoided. The job of decontamination will be easier if we keep equipment from being contaminated.

6.9. Pre-attack Actions--Post-Deployment. Employment operations are broken down into three phases: pre-, trans-, and post-attack. Many of the actions undertaken during predeployment and deployment are considered as pre-attack actions. There is, however, a clear distinction in the trans-attack, and post-attack phases of employment operations.

6.9.1. Reassess CB Threat and Potential Risk. Soon after deployment, the CB assessment team should reassess the CB threat and risk based on any changes in the operational situation during deployment, intelligence updates, and direct access to information at the deployment location. There are no direct means to ascertain whether attacks in progress or about to occur include CB weapons. In very few, if any, cases would there be enough time between warning and occurrence of an attack to adequately consider available information and decide on the likelihood of a CB attack. Accordingly, commanders must continuously monitor intelligence assessments, situation reports, and other related information to prepare themselves to make an informed decision on whether or not to implement CB defense measures upon notification of an attack. Other important factors would include the time of day, weather conditions, mission demands, fitness level, training status, and equipment status.

6.9.2. Implement Coordinated CB Defense Plan. Commanders should direct implementation of the coordinated CB defense plan developed for their unit. The kinds of actions to be implemented include, but are not limited to, dispersing available detectors, designating sampling locations, implementing periodic sampling and analysis, and designating shelters. For example, some critical dispersal pre-attack actions include:

6.9.2.1. Identify locations for dispersal of critical equipment and essential vehicles (RRR, Fire fighting, and Damage assessment).

6.9.2.2. Coordinate security of dispersal site with Security Forces.

6.9.2.3. Identify alternate access routes to each area having dispersed critical resources.

6.9.2.4. Post locations of dispersed assets in SRC/DCC.

6.9.2.5. Conceal dispersed resources.

6.9.2.6. Provide splinter protection for resources if possible.

6.9.2.7. IPE at dispersal sites will require vigilance to ensure protection from weather, contamination, abuse, and theft. Stored IPE should be palletized for easy movement, covered with plastic tarps, and protected from blast damage.

6.9.3. If the Commander has decided during the pre-attack period that the threat of CB attack is sufficient, the base must assume an appropriate defense posture. As the base progresses through various stages of alert, CB attack preparations occur concurrently with preparations for conventional attack. Pre-attack measures include disseminating protective gear, declaring MOPP levels, distributing antidotes and initiating pre-treatments, activating collective protection systems, deploying and activating detection and warning systems, covering supplies and equipment, and readying decontamination systems. Commanders should disperse critical personnel as much as the operational situation permits. Additionally, Commanders should ensure appropriate medical protective measures are initiated or continued.

6.9.4. Prepare to provide primary care for unit casualties. Unit commanders should have their personnel prepare contingency plans for treatment of unit casualties by unit personnel in unit facilities with limited assistance from the medical staff. This may be necessary if casualties exceed the capabilities of the medical staff by themselves, or when response will be delayed. Commanders should receive advice on MOPP levels from the technical experts to include CE Readiness personnel and the medical community.

6.9.5. Monitor intelligence indicators. Intelligence and medical staffs should be monitoring incoming reports for any information concerning enemy CB capability and intentions. Security forces should be alert for the unique indications of covert attacks.

6.9.6. Determine and implement MOPP. Based on the situation, commanders should determine and implement the appropriate MOPP level and variation if appropriate.

6.9.7. Maintain watch for covert attack. Commanders should issue periodic reminders of the need to remain observant for signs of a covert CB attack. These reminders apply to all base personnel but are particularly important for security patrols, air traffic control personnel, water treatment personnel, and personnel responsible for food storage and handling. Maintaining watch for covert CB attack is part of the larger effort to detect covert attacks of all types.

6.9.8. Use only protected food and water. Commanders should ensure personnel consume only protected food and water, to avoid the possibility of ingesting covertly disseminated contamination, no matter how slight the threat may be perceived. Use of packaged foods, bottled water, and protected food preparation equipment and eating utensils are the primary means to meet this requirement.

6.9.9. Minimize skin exposure. Commanders should direct personnel to minimize skin exposure to protect against CB hazards. Although inhalation and ingestion of agent are the primary concerns, many agents can enter the body by penetrating the skin, or through cuts, cracks, or abrasions in the skin. This could be a serious problem with highly infective or toxic agents.

6.9.10. Biological protective measures. Prior to deployment is when the base NBC defense program should already be in place and account for biological defense. Specifics include good health, proper immunizations, and training on BW defense during NBC Defense Training. Vaccines will be administered if deemed appropriate. Some vaccines exist as a preventive measure for biological exposure. (For example Ciprofloxacin is currently recommended as a chemoprophylaxis for anthrax - current CENTCOM guidance is to issue 20 500mg tablets to deploying personnel) These vaccines significantly reduce the likelihood of disease. There are also antibiotics available for use after a potential exposure to biological agents that can reduce or eliminate the agent affects.

6.9.10.1. Continue good hygiene sanitation methods. Commanders should require that their personnel practice proper hygiene and sanitation methods at all times. These measures should include hand washing with soap and water before eating and after using the latrine; protecting and properly storing food; cleaning food preparation equipment and eating utensils after use; eating protected foods and drinking sufficient amounts of protected or treated water; using approved methods for collection, storage and disposal of sewage and other wastes; avoiding direct contact with blood, body fluids, and feces; using insect repellents, and wearing shoes or boots and clothing that protects arms and legs.

6.9.10.2. Deployment measures include an assessment of the biological threat based on capability, delivery systems, known use, and movement from storage to launch facilities. Immunizations are continued during the deployment. Furthermore, IPE is required. AFI 32-4001, Disaster Preparedness Planning and Operations, identifies the required equipment quantities for deployments. If personnel deploying to an area that only has a biological threat, the complete basis of issue for IPE is still required.

6.9.11. Deploy Detectors. Each unit, as part of the installation CB defense plan, should deploy available detectors around their immediate facilities. The Base OPlan 32-1 is the vehicle used to plan these efforts. CE Readiness personnel will deploy specialized detectors to pre-established locations according to the defense plan. These locations will include sites upwind of the base, sites along and at the corners of the base perimeter, and near selected facilities on the base itself. If biological detectors are not available, the MAJCOM should be contacted to develop work-around plans. The bioenvironmental engineer should disperse sampling supplies and equipment, and prepare to conduct sampling, preferably at the same designated detector sites. Pre-attack detector operations should include:

6.9.11.1. Have specialized teams pick up detectors.

6.9.11.2. Operationally check detectors.

6.9.11.3. Deploy detectors, M8/M9 to pre-determined locations.

6.9.11.4. Turn on detectors, field test for background interferents, and report any malfunctions to the SRC.

6.9.11.5. Establish battery replacement , functional check, and maintenance schedules.

6.9.12. Designate and Prepare Shelters. The Commander should direct the Base Civil Engineer, through the CE Readiness Flight, to survey and designate appropriate rest and relief shelters. Protection from CB and conventional weapons effects, such as liquid and vapor contamination, blast, shrapnel, and heat, should determine the suitability of buildings as shelters. In addition the Commander should designate unit responsibility for preparing and operating each shelter, performing CB reconnaissance around the shelter, and considering all Force Protection issues. Force Protection prevents successful hostile actions against our friendly combat power while it is not directly engaged with the enemy. A successful hostile action is one which, if executed, would threaten our ability to accomplish the mission. Units responsible for the shelters will prepare them by sealing cracks and holes, closing all doors and windows, and adding filters to ventilation systems or preparing to turn off nonfiltered ventilation systems, if environmental conditions permit. The innermost rooms in buildings without filters make the best shelter areas in terms of the least amount of aerosol and vapor infiltration.

6.9.12.1. If personnel shelters do not have collective protection then another means must be provided for rest and relief of personnel. Shelter operations should include steps to determine the number of non-mission essential personnel who require toxic-free area sheltering. Also, plan for toxic-free areas which are located well away from liquid and vapor contaminated areas and address logistical, transportation and civil engineer support for the rest and relief of personnel.

6.9.12.2. Specific pre-attack shelter actions should, at a minimum include the items listed in **Table 6.9.**

Table 6.9. Pre-attack Shelter Actions.

1. Identify shelter locations.
2. Identify the assigned shelter locations for all deployed personnel.
3. Assign squadron personnel to shelters.
4. Determine squadron personnel assignments to sealed chemically protected; hardened, semi-hardened shelters, other shelters, or TFA's.
5. Determine shelter staffing requirements.
6. Provide protection for specialized equipment such as AGE, decontamination units, and replacement stores of IPE.
7. Integrate the unit storage requirements with the host base plan.
8. Shelter teams pickup assigned shelter management kit.
9. Dispatch shelter stocking detail to pick up shelter supplies if appropriate.
10. Pick up detection and monitoring equipment.
11. Perform operational checks.
12. Activate the shelter.
13. Set up shelter in accordance with shelter floor plan.
- Establish entry and exit routes
- Establish entry decontamination station
- Establish exit donning station
- Post shelter signs
14. Receive, inventory, and secure supplies.
15. Set up medical buddy care station/ casualty collection points.
Dependent upon shelter type, accomplish the following:
16. Upgrade collective protection configuration from standby to ready.
17. Install serviceable filters as directed by SRC.
18. Shelters with over pressure systems will be operationally checked.

19. Shelters teams without collective protection will seal buildings to the best extent possible.
20. Expedient Protection. - Check condition of bunkers and revetments for personnel outside. - Improve through sand bagging, plywood for windows, 55 gallon drums (filled), fill materials
21. Test standby power and check fuel levels.
22. Inspect area around shelter for unusual conditions.
23. Report shelter activation to SRC & DCC.
24. Shelter staff will return to normal function until Alarm Yellow at which time they will staff the shelter.
25. Check alternate power for collective protective shelters.
- The generators associated with collective shelters require diesel fuel. - Generators must be fueled prior to attack and plans in place for re-supply. - Ensure generators are operational prior to attack and have repair/replacement plans. - Monitor fuel consumption and reorder fuel as required.

6.10. Pre-attack actions--Alarm Yellow. This is a pre-attack alert indicating that attack is probable. The enemy must have the means and intention of attacking your base to make the recommendation to declare Alarm Yellow. Normally, the wing commander will make this decision based on advice given by intelligence reports. The theater commander may also make the declaration. If a CB threat exists, MOPP 1 is the minimum level of protection required.

6.10.1. Assess Likelihood of CB Attack and Inform Unit. The CB assessment team should advise the Commander on the current CB threat. The Commander should initiate unit notification of the possibility of CB attack by declaring Alarm Yellow, at the appropriate time. This tells unit personnel to be observant for signs of a CB attack and to take appropriate precautionary measures.

6.10.2. Determine Protective Equipment Requirements. The SRC commander is going to look at Readiness to make recommendations on the protective equipment to wear. Use your knowledge of chemical and biological agents to determine which protective equipment you need to wear. Use MOPP levels to ensure the base populace is in the appropriate protective posture. With additional information from Intelligence, Emergency Action (EA) cell, other bases, HQ, etc., you can determine if you need to change the protective posture. **Table 6.10.** is a simple example of what chain of events might occur to drive certain protective equipment requirements for the installation. More information should be available through intelligence briefings and general knowledge of the base and its mission. These factors will greatly influence protective equipment requirements.

6.10.3. Command and control centers will be activated and wartime plans will be implemented. Some of these plans to be implemented are the noncombatant evacuation (NEO), survival recovery and reconstitution (SRR), and continuity of operations. The shelter plan must be implemented or at the very least the shelters must be prepared and stocked. Disperse critical assets according to the dispersal plan. If appropriate, CCD should be implemented at this time as well. Additional expedient hardening should be performed if time is available. When an attack is probable all personnel not performing mission essential tasks should report to their shelter. If a CB threat is present, there would be additional measures to implement, such as contamination avoidance and CB monitoring.

Table 6.10. Sample Chemical Attack Scenario.

INPUT 1	Intelligence has briefed the enemy has the capability of delivering nerve and blister agents to your air base. This doesn't mean that you should start wearing the chemical ensemble, but you should ensure base personnel have all their IPE checked and readily available.
INPUT 2	Your NBCCC receives an NBC report. The enemy has just used nonpersistent nerve agents on forward area operating troops. This may drive you to recommend MOPP 2 for the base, but it would depend on many other variables, such as the proximity of the enemy from your base or the likelihood of an attack at your base, to name just a couple.
INPUT 3	The EA cell announces that enemy aircraft are 10-15 minutes from your airspace. If your base is not in MOPP 2, you should assume that protective posture now.
INPUT 4	The EA cell announces that enemy aircraft are 3-5 minutes from your airspace. The Wing Commander puts the base in Alarm Red. At this time you would advise putting the general base populace in MOPP 4.
INPUT 5	Your base is under attack.
INPUT 6	The EA cell announces that enemy aircraft have departed your airspace. The Wing Commander puts the base in Alarm Black. If MOPP 4 was declared, advise keeping personnel at this MOPP until CB reconnaissance has been performed and the results are negative.
INPUT 7	Damage assessment teams start reporting gold color changes on M8 paper. Chemical monitoring teams start reporting findings of persistent G nerve agent on the base. The base must remain in MOPP 4 until they process through a CCA. All operations conducted outside of a CCA must be in MOPP 4 until the nerve agent has dissipated and the test results are negative.

6.10.4. Evaluate Adequacy of Local Alerting System. Every Air Force installation must have a rapid and effective system for dissemination of disaster information. There are many ways to ensure this information is disseminated to include: Giant Voice, radios, telephones, secondary crash phone, word of mouth, visual system such as flags and lights.

6.10.4.1. At some overseas locations, Armed Forces Network (AFN) will usually broadcast emergency information over their television and radio stations. One responsibility of a Readiness technician is to evaluate the adequacy of the local reporting system. Some of the avenues available include:

6.10.4.1.1. COMPATIBILITY: Ensure your base uses signals that are compatible with host nation, local, or theater systems.

6.10.4.1.2. AVAILABILITY: The base warning system should be available to all areas on the installation. Local warning signals should be displayed in all work and rest areas. Forces deploying into your base should be briefed on them, since they might be used to different signals.

6.10.4.1.3. TESTING: The system at your base should be periodically tested. (Normally Communication personnel test the Giant Voice system). Identify areas of the base where the Giant Voice system can not be heard and develop alternate notification procedures. Also, Base Operations normally perform a daily check of the secondary crash phone. Most radios and telephones are also used everyday. In addition, overseas AFN will perform a test of their emergency broadcast periodically.

6.10.4.1.4. EXERCISES: They serve as the best means to test your alerting system. This is the most practical time to evaluate unit control centers on their procedures for disseminating information throughout the unit.

6.10.4.1.5. DEPLOYMENTS: Include deployed alerting capabilities in applicable planning documents. If the deployment location is unknown, evaluate and brief the alerting system to the deployment team upon arrival. For bare base operations, assist with the setup the alerting system. Make sure the alerting system follows MAJCOM or theater guidance.

6.10.5. Advise on Use of Warning Signals. If warning signals are used improperly it can hamper the ability to perform the mission. Understand when these warning signals are to be used and be prepared to advise the commander. AFVA 32-4011, USAF Standardized Alarm Signals, are designed for passive defense, do not use these for active ground defense. For example, if you hear an explosion on your base and declare Alarm "Red", everybody will take cover. If saboteurs caused the explosion they've just been given free run of the base. ***NOTE:*** The following are the standardized alarm signals, however you must consider your host nation or local warning signals. For example, Korea uses Alarm signals Green, Yellow, Blue, and Black. **Figure 6.5.** illustrates AFVA 32-4011, USAF Standard Alarm Signals for Areas Subject to NBCC Attack

6.10.6. Suspend Noncritical Activities and Shelter All Nonmission Essential Personnel. The Commander should initiate sheltering of all non-mission essential personnel in designated shelters, available collective protection systems, or inner rooms of buildings (improvised shelters) which offer the best available degree of protection from contamination when the possibility of attack is imminent. Personnel should remain in these areas when not performing mission essential tasks.

6.10.7. Monitor Health Status/Disease Situation. Preventive medicine personnel should continuously evaluate and assess the unit's health status and environmental situation for indications of a CB attack. They should look for agent symptoms, unusual disease patterns or indications of environmental contamination. Information sources include medical intelligence reports, disease and injury rates, laboratory analysis results, and epidemiological studies.

6.10.8. Watch for Attack Indications. All personnel should be alert for signs of attack. Personnel specifically monitoring air and land approaches to the base, such as active air defense units, security forces, and air traffic control personnel should be particularly alert for indications of attack. Commanders should issue periodic reminders of the need to remain observant for signs of a covert BW attack. Maintaining watch for covert BW attack is part of the larger effort to detect covert attacks of all types.

6.10.9. Activate/Monitor Detectors and Detection Systems. Commanders should direct activation and monitoring of available detectors by shelter teams and CE Readiness personnel, and initiate periodic sampling and analysis performed by the preventive medicine staffs.

Figure 6.5. Alarm Signals For Areas Subjects to NBCCC Attacks.

USAF STANDARDIZED ALARM SIGNALS

FOR AREAS SUBJECT TO NBCC ATTACK

IF YOU	FOR A CONVENTIONAL PROTECTIVE POSTURE YOU MUST	FOR A CHEMICAL/ BIOLOGICAL PROTECTIVE POSTURE YOU MUST
HEAR: "ALARM YELLOW" SEE: A YELLOW FLAG	ATTACK IS PROBABLE (PRE-ATTACK) DON HELMET AND AVAILABLE BODY ARMOR GO TO SHELTER WHEN DIRECTED	ATTACK IS PROBABLE (PRE-ATTACK) DON HELMET AND AVAILABLE BODY ARMOR GO TO SHELTER OR SEEK OVERHEAD PROTECTION WHEN DIRECTED ASSUME MOPP 1 UNLESS OTHERWISE DIRECTED
HEAR: "ALARM RED", A 1 MINUTE WARBLING TONE ON SIREN OR BLASTS ON HORNS, WHISTLES, BUGLES, ETC 3 SECONDS ON - 1 SECOND OFF SEE: A RED FLAG	ATTACK IS IMMINENT OR IN PROGRESS (TRANS-ATTACK) TAKE COVER	ATTACK IS IMMINENT OR IN PROGRESS (TRANS-ATTACK) TAKE COVER ASSUME MOPP 4 UNLESS OTHERWISE DIRECTED
HEAR: "ALARM BLACK", "GAS-GAS-GAS", A BROKEN WARBLING TONE ON SIRENS OR BLASTS ON HORNS, WHISTLES, BUGLES, ETC (1 SECOND ON - 1 SECOND OFF) OR CONTINUOUS BEATING OF METAL ON METAL SEE: A BLACK FLAG	ATTACK IS OVER (POST-ATTACK) GO TO OR STAY IN SHELTER UNLESS OTHERWISE DIRECTED INITIATE POST ATTACK RECONNAISSANCE	NBC CONTAMINATION IS EXPECTED OR PRESENT (POST-ATTACK) GO TO OR STAY IN SHELTER UNLESS OTHERWISE DIRECTED INITIATE POST ATTACK RECONNAISSANCE ASSUME MOPP 4 UNLESS OTHERWISE DIRECTED
HEAR "ALL CLEAR"	ATTACK IS NOT PROBABLE, NOR IS NBC CONTAMINATION PRESENT RESUME NORMAL OPERATIONS OR INITIATE RECOVERY IF APPLICABLE	ATTACK IS NOT PROBABLE, NOR IS NBC CONTAMINATION PRESENT RESUME NORMAL OPERATIONS OR INITIATE RECOVERY IF APPLICABLE

Local Information: Policies and procedures may vary at deployed locations/theaters. For example, the Republic of Korea deviates with Alarm Blue and Alarm Green. Other variations include using lights in addition to flags as visual indicators.

Prescribed by AFI 32-4001
Supersedes AFVA 32-4011, 2 May 1994
Distribution: F

AFVA 32-4011
1 December 1997

6.10.10. Cover Unprotected Mission Essential Equipment. Commanders should direct units to cover mission essential equipment to prevent deposition of contamination on the equipment. This will reduce the need for decontamination and minimize the possibility of personnel contaminating themselves if they have to handle the equipment at a later time. Move mission essential vehicles, equipment, and supplies indoors. Hangar aircraft and close canopies and cargo doors. Shelter refueling vehicles and AGE equipment in empty hangars. Cover the remaining exposed items with tarpaulins, plastic sheets, or anything that's reasonably available to protect them from CW agents. Keep building and vehicle windows and doors closed. Establish a single point of entry/exit for all buildings and restrict ingress/egress to these points.

6.10.11. **Table 6.11.** lists some specific CE Readiness pre-attack actions.

Table 6.11. Specific CE Readiness Flight Pre-Attack Actions.

1. Activate SRC, NBCCC, and DCC and recall support staff.	
2. Staff Alternate SRC, NBCCC, and DCC with a skeleton staff.	
3. Alternate SRC, NBCCC, and DCC mirror all critical information for immediate assumption of operations should the primary center/s fall out of service.	
4. Update maps.	
5. Update weather data.	
6. Establish primary and backup communication with NBCCC.	
7. Establish primary and backup communication with DCC.	
8. Supervise the SRC support staff.	
9. Monitors:	
Recall of personnel.	Activation of CB Detection and Warning Systems.
Issue and operational check of IPE, detection, and decontamination equipment.	Activation of CE specialized teams to prepare CB defense material, facilities, and systems for operation.
Stocking of protective shelters. with protective clothing , water, food, supplies, decontaminates.	CE Units implementation of Non Combatant evacuation plan.
Deployment and activation of CB detection, identification and warning systems.	Upgrade collective protection system configuration from stand by to ready.
Sector sampling for covert attack detection.	Issue of medical pre treatment antidotes and drugs.
Dispersal of CE critical material.	Contamination avoidance measures for unsheltered critical assets.
SRC/NBCC/DCC and Unit control centers review of Alarm Yellow checklists.	MOPP change as necessitated by threat. - - Evaluate MOPP condition. - Announce MOPP condition change based on hazards. - Personnel rotation, rest cycles.
10. Defense Condition status. Be prepared to move to Alarm Yellow.	
11. NBCCC Pre-Attack Actions.	
Maintain all weather data and post maps . Identify friendly forces in the local areas. Verify reporting networks and procedurs Monitor for detected hazards.	Monitor dispersal of the detection and warning network. Monitor reports from other locations for first use of CB agent. Pass information to alternate NBCCC. Integrate host nation and sister service detection and warning network.
12. Additive Forces. CE deploying forces.	

Contact host base CB readiness personnel or host country counterparts for integration of Civil Engineering into their SRC/NBCC/ DCC/Unit Control Center network. Integrate detection system with the host base or setup bare base operations detection systems. Check power supplies and ensure battery change and recharging is initiated.	Receive and inventory CB assets (UTC 4F9D2) packages. Report discrepancies to the SRC immediately. Develop mission task and work schedules for CB warfighters. Deploy detectors to pre-planned sites. Adjust battery maintenance schedules based upon local climate. Obtain from the host Readiness Flight the latest base grid plan, dispersal plans and relocation sites.
13. Reception for Additive Forces. Brief arriving UTC Team Chief on	
Shelter assignments. Beddown locations. Decontamination assignments. Reconnaissance team duties. Current detector placement and plan for integration of UTC detectors.	Local threat. Local attack signals. Local information. Location of SRC/NBCCC/DCC/ Control centers and alternates. In-place communication systems. Telephone numbers current radio calls signs verification codes.
14. Provide additive forces with base and local area maps.	
15. Integrate UTC equipment package with base program.	
16. Report the status/locations of all CB Readiness personnel, equipment, dispersal sites and detector operations to the SRC/DCC/NBCCC	

6.11. Trans-attack Actions--Alarm Red. This trans-attack alert means the attack is imminent or in progress. The Emergency Action (EA) cell will advise the wing commander when to declare Alarm Red. During Alarm Red everyone on the base takes cover. Critical decisions must be made at this time. For example, the commander must decide whether to hangar or launch aircraft. Personnel must decide whether to take immediate cover or reach adequate shelter. If a CB threat exists, assume MOPP 4 unless otherwise directed. There are no direct means to ascertain whether attacks in progress or about to occur include BW weapons. In very few, if any, cases would there be enough time between warning and occurrence of an attack to adequately consider available information and decide on the likelihood of a BW attack. Accordingly, commanders must periodically monitor intelligence assessments, situation reports, and other related information to prepare themselves to make an informed decision on defense measures upon notification of an attack. Other important factors would include the time of day, weather conditions, mission demands, fitness level, training status, and equipment status. NBC reconnaissance teams should evaluate the attack to determine if any spray devices, or other indications of a biological attack occur.

6.11.1. Attack Warning. Trans-attack procedures begin when the attack against the base begins. Detection and warning of the attack are critical to the implementation of protective measures.

6.11.2. Take Cover. Immediately take cover and, if a CB threat exists, assume the appropriate MOPP. If no overhead protection is available, use ponchos, plastic sheets, or any expedient cover to minimize exposure to CW agents. Don't seek overhead protection by crawling under any vehicle, as the risk clearly outweighs any potential benefits you may gain by doing this.

6.11.2.1. Taking cover protects personnel against blast, shrapnel, heat, and liquid and particulate contamination. After taking cover, personnel don their masks and remaining protective gear as appropriate. All but the most mission essential functions cease. Personnel able to safely observe the attack in progress should watch for any unique signs of a CB attack.

6.11.2.2. Use MOPP 4. All personnel should assume MOPP 4 (full IPE) in the absence of any other information, and remain in IPE until directed to reduce the MOPP level. Commanders should consider going with full MOPP until they can gain more information on the type and extent of contamination. MOPP levels may then be reduced accordingly. The ultimate goal is to balance mission continuation with force survivability in order to maximize mission effectiveness. Towards this end, the concept of risk assessment (what risk a Commander is willing to take in relation to the importance of the mission) is an integral part of the equation.

6.11.3. Keep Shelters Closed. Shelter teams or senior personnel in each shelter should ensure shelter doors remain closed as much as possible to limit infiltration of contamination, and control personnel entering and exiting the shelter. Some specific shelter attack actions include:

6.11.3.1. Maintain accountability of shelter occupants.

6.11.3.2. Assume MOPP condition.

6.11.3.3. Shelter personnel away from exterior walls. Use desks and interior rooms for protection.

6.11.3.4. Perform buddy care and report casualties to control centers or shelter staff.

6.11.4. Conduct Wartime Tasks Wearing Personal Protective Equipment. There are many different jobs to perform in wartime requiring the wear of chemical protective equipment. Though the tasks may differ many procedures for wearing the protective equipment will remain the same. An area of primary concern is contamination avoidance. Other areas of concern are the proper wear of the personal protective equipment, proper configuration, serviceability, and the ability to perform the task while wearing the gear.

6.11.4.1. SRC/NBCCC. Although this function is performed inside, operating in MOPP 4 is still difficult. The SRC/NBCCC becomes even more crowded and confusing when everyone dons their GCE. For example, a lot of noise will be generated from everyone working and from all the communication equipment operating. Remember to use the front voicemitter on the mask designed for radios and face to face communication, and the side voicemitter for telephones. When using any kind of communication device be sure to speak loud and clear. Also, it is essential to keep work areas organized – the lack of peripheral vision may cause misplaced paperwork, NBC reports, damage assessments, taskings, etc.

6.11.4.2. NBC Reconnaissance Teams. Naturally, this task is performed outside and proper wear of the GCE is critical. Contamination avoidance procedures are essential for these teams. Again, vision will be reduced while wearing the mask and it may be difficult to identify hazards. It can not be emphasized enough that you must take certain precautions while wearing IPE outdoors

Chapter 7

NBC DEFENSE ACTIONS - POST ATTACK (CONTAMINATION AVOIDANCE AND CONTROL)

7.1. Principle of Avoidance. Avoidance means taking actions to avoid or minimize the impact of an NBC attack and to reduce the effects of the NBC hazard. For the USAF, CB avoidance includes detection and identification, prediction, warning and reporting, marking, and relocation or rerouting. BW detection and identification require procedures and equipment different than those required for chemical and nuclear detection and identification, whereas warning and reporting and marking share common procedures and equipment with chemical and nuclear defense. BW detection and identification involves medical personnel and procedures to a greater extent than chemical or nuclear detection and identification.

7.1.1. Avoidance alone is probably an insufficient response to a representative large-area CB attack, regardless of the type of unit. On one hand, forces operating from fixed locations (e.g., USAF wings) are not capable of relocating quickly enough to avoid contamination, regardless of the type of attack. On the other hand, even highly mobile units (e.g., Army maneuver units) may be unable to move far and quickly enough to avoid contamination when attacks cover such large areas as those possible with typical biological aerosol attacks. Accordingly, for fixed and mobile units alike, avoidance of a CB attack most likely means detecting or learning of the attack in time to take protective and medical actions to prevent or minimize the effects.

7.1.1.1. In general, contamination avoidance includes actions to prevent contamination from getting on mission-essential resources and personnel, whether directly from agent deposition or by transfer from contaminated surfaces. Contamination avoidance actions include the use of protective covers or coatings and removal of these covers or coatings upon entry into uncontaminated areas. Similarly, contamination control area (CCA) processing is a form of contamination avoidance. Additionally, restriction of movement constitutes a form of contamination avoidance.

7.1.1.2. CCAs are essential to sustained operations in a CB environment. They provide controlled entry areas, force personnel to practice effective contamination avoidance procedures, and limit the spread of contamination into toxic free areas (TFAs). TFAs provide personnel the ability to work or obtain rest and relief without wearing IPE. The hostile use of chemical agents against USAF operating locations will almost certainly force the creation of CCAs, regardless of the agent or external factors involved. One or both of the following situations will likely occur after the attack.

7.1.1.2.1. If an air base is attacked with chemical agents it is likely that the agent's persistency will exceed acceptable work/rest cycles. Consequently, the work force will require some form of rest and relief shelter in order to sustain mission operations. Rest and relief will primarily be accomplished by processing people through a CCA into a TFA.

7.1.1.2.2. A very small percentage of the base population will have their chemical protective clothing contaminated at the time of the attack because they could not find adequate overhead protection. Still others will contaminate their protective clothing during post-attack operations. This contaminated clothing must be removed as soon as possible but absolutely within 24 hours. The exchange of contaminated clothing for clean protective clothing will take place at the CCA.

7.1.1.2.2.1. Cautions in post-attack while wearing the GCE. Some jobs that might be considered easy in a conventional environment may seem very difficult in a CB environment. We need to ensure that all wartime tasks can be performed while wearing the GCE. Two primary jobs performed in a chemical-biological environment are SRC/NBCCC duties and CB reconnaissance. Assisting in the processing of personnel through a CCA may also be required.

7.1.1.2.2.2. CCA Teams. CCA teams are unique because they are working in an originally clean environment with the base populace coming to them in a contaminated state. Contamination avoidance and control are essential. Team members may have to work in close quarters with the people processing which creates additional hazards. Attendents should limit contact with processees to only essential assisting. Refer to AFMAN 32-4005, Personnel Protection and Attack Actions, for complete ground crew CCA processing procedures. AFMAN 11-303, Life Support Combat Operations, is currently in draft and will, when published, outline aircrew CCA processing.

7.1.1.3. Contamination avoidance has a direct and significant impact on limiting the spread of contamination by isolating key resources from the need for decontamination. Early detection of missiles or aircraft attacks triggers the use of contamination avoidance procedures and protects personnel through use of individual protective equipment. Post attack detection and marking of contaminated areas decreases the inadvertent spread of contamination, thereby reducing future decontamination operations

7.2. Post-Attack Reconnaissance. Alarm Black is the post-attack alert to indicate the attack is over. Once the EA cell has determined that the enemy aircraft or missiles have departed our airspace they will advise the wing commander to declare Alarm Black. The Installation Commander directs mission oriented protective postures (MOPP) levels and variations, through the advice of the Readiness Flight., based on mission, local situation, intelligence, and higher headquarters requirements. Once in Alarm Black, the SRC commander will look for results of post-attack reconnaissance. This is a base-wide effort with an integrated network of unit control centers, shelters, and specialized teams reporting information to the SRC. **Table 7.1.** provides a list of post-attack inspection items. Hold all non-critical mission activities until hazards are assessed. Base personnel and response teams should report findings on UXO, casualties, and damage to unit control centers who will report the findings to the Survival Recovery Center. Recovery operations, such as firefighting, casualty treatment, UXO safing, rapid runway repair, and facility restoration should begin.

Table 7.1. Post-Attack Inspections.

Type of Inspection	Required Action
Quick-look inspections (Everyone)	Quick-look inspections are performed by individuals designated to go outside as soon as possible once Alarm Black is declared. All quick-look inspections are up-channeled to the SRC through their units UCC. Report both positive and negative findings. Check for casualties. Locate UXO. Identify damaged vehicles, facilities, and equipment. Everyone must check their individual M9 Paper and immediately report any positive indications. Report passive indications such as dead wildlife or personnel showing symptoms of CB exposure.
Quick-look inspections (SMTs and facility owners)	Check for casualties. Check in and around buildings to assess structural damage. Observe pre-positioned M8/M9 Paper or other chemical detectors. Locate UXO. Identify damaged vehicles and equipment. Perform collective protection shelter visual inspections to validate shelter integrity (if applicable). When shelter integrity visual inspections are complete, shelter managers must perform chemical detection tests within the TFA portions of their shelters.
Quick-look inspections (Specialized Teams)	When the alarm condition changes to black start monitoring routes. NBC reconnaissance teams will report their findings to the NBCCC. Verify the status (activation) of all automatic detectors placed along their route and report the findings to NBCCC. Respond, as dispatched, for additional information on specific areas All specialized teams equipped with M256A1 kits must be prepared to perform chemical agent vapor tests if required, to validate automatic detectors, and report the results to the SRC upon completion. DARTs should report visual observations to the SRC. This includes initial runway/taxiway and structural damage, craters, chemical test results, UXO estimates, casualty reports, and any other significant observations.

7.2.1. Base personnel should know their individual post-attack reconnaissance responsibilities. Only critical mission essential activities should continue during post-attack reconnaissance. Non-mission essential personnel should remain indoors until all hazards have been identified, located, and reported.

7.2.1.1. Commanders should direct monitoring teams to begin operations as soon as an attack is over. This must be accomplished immediately but with accuracy to reduce Mission Operational Protective Posture (MOPP), and restore sortie generation. Priorities for hazard assessment should be afforded to critical sortie generation areas, aircraft parking and maintenance facilities, munitions build-up and storage areas, and critical command, control and communications (C^3) facilities. When post-attack reconnaissance is complete, all hazards have been safed or identified, and if NBC testing results prove negative, recommend Alarm "Yellow" to the SRC commander, who will in turn make the recommendation to the wing commander.

7.2.1.2. Base personnel and designated specialized team members (i.e., security, shelter, reconnaissance, UXO, and damage assessment) provide reconnaissance and assessment information for all types of damage and hazards. During initial reconnaissance, personnel should be observant for activated detectors, operating or spent CB delivery systems or devices, such as spray tanks, aerosol generators, and submunitions or bomblets. This information should flow up to the Survival Recovery Center where CE Readiness personnel will report any indications of CB attacks to higher headquarters through established NBC Warning and Reporting systems.

7.2.2. As a minimum, when planning reconnaissance operations consider: location of critical facilities, location of shelters, location of dense populations, placement of detectors, size and shape of the base, weather and terrain conditions, location of CCA, dispersal areas, CCT areas, available transportation and equipment, and capabilities and integration of other reconnaissance teams (i.e. Damage Assessment and Repair Teams (DARTs), UXO teams, etc.) Keep in mind that you will probably be working at a deployment location, so you will want to practice running your reconnaissance routes both at day and night. Part of the team's duties include evaluating attacks to determine attack patterns, probable targets, and effectiveness of passive defense measures.

7.2.3. When conducting post-attack reconnaissance, be cautious when traveling. Make every reasonable effort to avoid crossing through cordoned and contaminated areas. When necessary, perform personal immediate decontamination using dry absorbent powder, M258A1, M291 or M925 decontamination kits. Also, decontaminate vehicle access handles, equipment controls, and other mission essential items before touching them. Don't drive contaminated vehicles near any toxic free area. Before taking a drink in your mask, decontaminate your gloves, mask drinking tube coupling, and M1 canteen cap with the M258A1, M291 or M295 decontamination kit if contamination is suspected. Avoid sitting in, leaning against, or kneeling on any contaminated areas during MOPP 4 or Alarm Black.

7.2.4. Procedures specific to biological defense include:

7.2.4.1. Base medical personnel should review medical intelligence reports, monitor patient diagnoses and symptoms, and conduct epidemiological studies. Medical personnel also perform disease surveillance and report, supply and administer vaccines, antibiotics, and other drugs. Finally, they will treat BW casualties, clinically analyze BW samples, and advise the commander on medical aspects of BW defense.

7.2.4.2. EOD verify the type of ordnance used. This may indicate if biological agents have been used. If chemical agents are used biological agents may also be present. Delivery systems for chemical and biological agents are similar, but the enemy may use different delivery systems. For instance, during the same attack the enemy may deliver chemical agents in bombs and biological agents with a spray device. Do not rely on the means of delivery as the sole indicator of the use of biological agents.

7.2.4.3. Security Forces should look for indications of BW attacks, watch for spray attacks from observation posts and, during patrols, focus on areas upwind of the base which are accessible to hostile forces.

7.2.4.4. All personnel should look for enemy aircraft and missile activity for unusual patterns or characteristics which might indicate the possibility of BW attacks. An example would be single aircraft passes upwind of an air base.

7.3. Shelter Post-Attack Actions. Shelters should report shelter status to SRC, check area outside of shelter for UXO, casualties, contamination and damage and report to the SRC.

7.3.1. Activate/maximize shelter use and restrict nonessential movement. Commanders should ensure personnel continue to use shelters as long as there is residual contamination and employ contamination control measures for shelter entry. Shelter teams should employ contamination control measures to limit the infiltration of contamination. Individuals should take the following actions before entering any facility to reduce the accumulation of liquid chemical agent within the facility: use the boot and glove bath or shuffle box at the entrance; and monitor for liquid contamination (M8 paper or M9 tape) at the entrance, either individually or using the buddy system or by assigned shelter team members. They should continue to do so until it has been determined there is no longer a contamination hazard. Additionally, within shelters or work centers, units should, as a minimum, visually check for: unusual substances, dead animals, holes as opposed to UXO entry sites, night time black-out conditions, and visual warning flags as assigned.

7.4. Detection and Identification. Once the situation permits, the Base Civil Engineer and Bioenvironmental Engineer should focus their detection efforts on determining the extent of residual CB hazards. This information is necessary to determine appropriate contamination containment and decontamination actions. Detection, identification and warning are integral to the successful recovery from a CW attack. Real-time detection requires that detector networks be deployed, activated, and monitored prior to attack. Real-time agent detection can trigger warning, and thus trigger mask, ensemble and collective protection use. It is also vital for verification by national command, surveying for residual contamination, and attack reporting. In order to provide comprehensive and operationally-valid advice to commanders concerning protective postures and hazard assessments, Readiness personnel must have some idea of the type and amount of contamination involved in a post-attack situation. Our recommendations must offer commanders potential solutions of how to balance force survivability and mission continuation. Personnel may be needlessly injured if we recommend too little protection but mission operations will suffer if we recommend more protection than the hazard requires. Validated detection and identification standards and operational requirements are necessary to support current development efforts focusing on point and standoff detection, as well as other future efforts. Assessment of the relationship of air and ground warfare surveillance systems to CB detection and warning is necessary. The tradeoffs between field and clinical BW detection systems require analysis. There are at least five separate CB detection and identification roles or tasks: protection, treatment, verification or confirmation, all clear, and surface contamination. Specific methods, capabilities, and limitations vary according to the detection and identification role or task. In some cases, these tasks may involve the same people, equipment, and procedures, but their purposes are unique. In general, current detection methods for CW are adequate while most BW detection techniques are slow and provide no tactical warning. Prototype detectors provide rudimentary information on the presence of BW contamination.

7.4.1. Detection for protection (standoff detection) provides warning in sufficient time to implement protective measures before exposure to agent contamination occurs. A lack of automatic standoff detectors for CB agents necessitates reliance on available detectors, attack indicators, and preventive medicine sampling and analysis.

7.4.1.1. For attacks upwind of the airbase, detection must occur at sufficient upwind distances to provide a reasonable amount of time for detection, processing and information transmission. Detection of the leading edge of the cloud is preferable, since it can give more warning time.

However, such detection requires greater detector sensitivity, because the concentration of agent at the leading edge of the cloud is less than in the middle of the cloud.

7.4.1.2. Warning of an upwind attack may come from a base's own upwind detectors or from other assets monitoring the area upwind of an airbase, whether purposely or coincidentally. Lacking the necessary point or standoff detectors, commanders must decide when, based on intelligence indications, the possibility of attacks warrants a protective posture. In addition to BW attacks alone, the combined threat of both CW and BW attack warrants this type of protective posture response. Also, reports of an attack from upwind units can provide warning of an attack, assuming the units have the necessary detectors, have observed enemy activities indicative of an attack, or have identified an agent through detection by sampling and analysis.

7.4.1.3. For attacks directly on an airbase (i.e. submunitions released from a TBM) rapid detection of CB agents for warning will be difficult, if not impossible. Donning of IPE in response to a general TBM attack warning, based on the commander's assumption that a CB attack is possible, is the best course of action.

7.4.2. Detection for treatment focuses on identifying the type of agent dispersed in an attack so that the best possible treatment can be rendered as early as possible. Since some aspects of treatment are agent specific, agent discrimination is extremely important. Agent sampling and analysis continue to be the primary means of accomplishing this detection role. Sampling is a local action, while analysis can occur locally or at DoD-designated reference laboratories, depending on capabilities. The preventive medicine staff share responsibility with the medical staff for this type of detection. Medical personnel collect and submit clinical samples from patients and BEE/Readineess personnel perform environmental sampling and detection functions.

7.4.2.1. Laboratory analysis and identification methods include isolation by culture, detection of toxin by mass spectroscopy and animal inoculation, antibody detection, antigen detection by sensitive assay methods, and detection of metabolic products in clinical specimens. Some of the most commonly available of these methods, such as culturing and antibody detection, require one or more days for agent identification. Development of agent-specific sampling and identification kits for field use is ongoing and expanding.

7.4.2.2. Clinical diagnosis of disease, disease surveillance and reporting, and subsequent epidemiological investigations are not likely to be timely enough for treatment of personnel first exposed to a BW agent. However, they may offer some valuable information regarding the scope and other characteristics of an attack or help verify an attack for national security decision-making. Epidemiology will involve both local and theater-wide observations and reports, with base medical personnel observing local disease patterns while also monitoring theater-wide disease outbreaks reported through medical or operational channels.

7.4.3. Detection for verification provides critical information to the national command authority (NCA) to support decisions regarding national strategic direction and integration. The NCA uses such information to determine the need for response and to select options in a timely manner. The capability to detect all agents is necessary, but identification is not. High detection sensitivity for detection of the cloud fringe would help expedite notification of the NCA and implementation of actions to prevent further attacks.

7.4.3.1. Current procedures call for local collection of samples to be forwarded to designated laboratories for analysis and reporting to the NCA. The local medical staff is responsible for sampling, packaging, and shipping samples according to DoD procedures. CE Readiness personnel initiate the necessary NBC warning reports, conduct agent identification, and provides assistance.

7.4.3.2. Environmental protection and continuing accountability for the samples are important considerations for meeting political requirements to verify and notify NCA of offensive agent use.

7.4.4. Detection for all clear (dewarning) means detecting the reduction of contamination to acceptable levels. Detectors for this purpose need to detect and identify all threat agents, and should be able to detect low concentrations of agents early enough to take full advantage of reductions in protective posture. If possible, they should be the same as those used to provide detection for protection. BW field detectors are not yet widely available for this purpose. Instead, most airbases must rely on periodic sampling and laboratory analysis to provide a relatively reliable indication of contamination absence. Comparison with methods and results from earlier detection of agent(s) will be an important aspect of determining contamination reduction. Reductions in protective posture will take much longer than if real time detectors were readily available. Detection for warning is an integrated responsibility of all members of the CB assessment team working together as well as from inputs from the base populace.

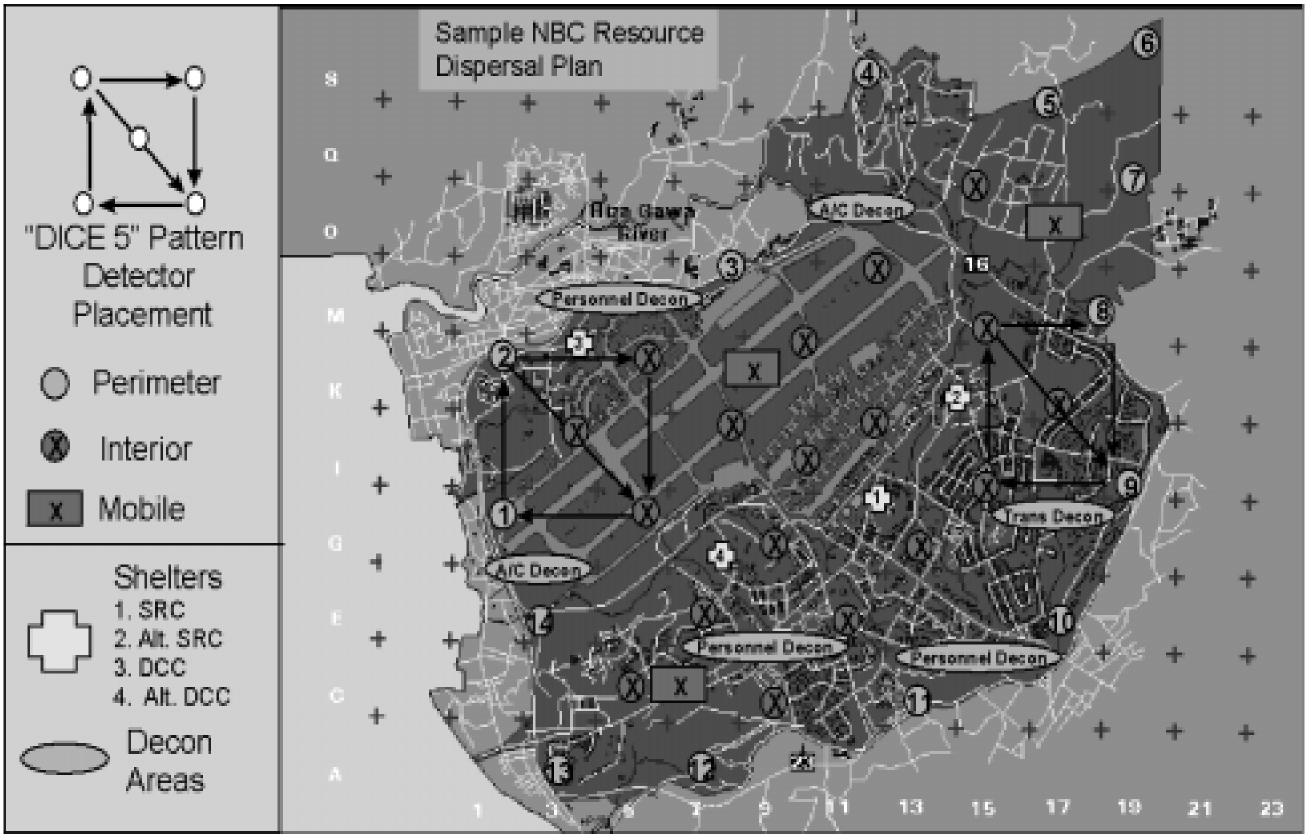
7.4.5. Detection for surface contamination means detecting deposited contamination on surfaces to determine if decontamination is necessary. This detection role has a lower priority than the others, given the current position that reaerosolization of agent in the effective particle size range is difficult to achieve. Nonetheless, there is a risk of contaminating oneself through cross contamination; i.e., by transferring agent from contaminated surfaces to the eyes, broken skin, mucus membranes, or mouth. Detectors for this purpose need real time capabilities and at least minimal quantification capabilities. It would be useful for them to identify the agent, which would aid in the selection of the most effective decontamination method.

7.4.6. Detector Placement. Each installation will develop a plan for deployment and integration of automatic chemical agent detection, identification, and warning systems with individual chemical agent detection systems. Plans must include activation and use of the Nuclear, Biological, and Chemical Warning and Reporting System (NBCWRS) and local communications. Base alert may be achieved with radio communications, Giant Voice, or flags. Manual systems will be used for back-up roles and to expand coverage. The current inventory of detectors sample for chemical agent vapors at the detectors location. Manual networks can give you an indication of a chemical attack in about 12 minutes or less (for specific agents). Post attack determination for the presence or the absence of chemical agents may take 30 minutes or more.

7.4.7. Detector Assets. Determine detector assets at the host base. Survey the host base assigned cantonment area to determine host detector system coverage capability. Determine unit detector compatibility with host base and identify limiting factors (LIMFACs) to the appropriate MAJCOM.

7.4.8. Detector Employment. Develop base procedures to establish a dispersal employment scheme for assigned automatic detectors, as well as M256A1 kits, and M8 and M9 paper. Review Joint support plans to determine UTC equipment sets which will be available to augment the detector plan. Divide the installation into sectors. Disaster response force maps can be overprinted with sectors identified. Size and shape of the sector may vary based on what is located in the sector. The DICE FIVE pattern (a rectangle with five detectors, one in each corner and one in the center) is recommended as the basic pattern. Apply the Dice Five concept to the base as a whole, placing available detectors evenly through out the base and perimeter. See **Figure 7.1.** The prevailing winds for the base should be taken into account. Detectors should always be concentrated on the upwind side of the base. Identify Critical C3 facilities munitions build up and storage areas, aircraft generation and hot turn sites maintenance facilities, POL resources, cantonment, and support areas. Pre-determine M8/M9 paper placement for unit monitoring. At bare bases with responsibility for a small USAF cantonment area, use detection teams in the cantonment area in the Dice Five pattern and provide extended coverage of the perimeter as detectors become available. If detectors are not available, the bio-environmental engineer should disperse any necessary sampling supplies or equipment or otherwise prepare to sample, preferably at the same designated detector sites.

Figure 7.1. Sample CB Resource Dispersal Plan.



7.4.9. Post-Attack Detector Operations. Check , decontaminate, and service detectors as necessary. If decontamination is required, use M295 decontamination kit. See **Chapter 3** for more equipment details.

7.5. Relocate or Reroute. Relocation and rerouting as avoidance options depend on the operational situation. They are more applicable to mobile ground units, but should not be rejected out of hand for aerospace operations. However, they are unlikely to be viable options unless there has been sufficient preplanning to ensure sufficient decontamination and resupply assets, and alternate locations are available and can provide adequate support. **Chapter 6** addresses planning considerations regarding relocation, along with remote basing, dispersal, and redundancy. In addition, **Chapter 6** addresses rerouting as an option in the context of the airlift mission.

7.6. Prediction. When timely and accurate warning occurs, and enough information is available, units can make predictions regarding the arrival of contamination at their location. Necessary information includes type of agent, release point and time, terrain, air stability, and meteorological data. Prediction methods range from simple manual methods to more sophisticated computer models.

7.7. Warning and Reporting. Warning and reporting falls under the DoD's general requirements for NBC warning and reporting. Joint doctrine gives combatant commanders two specific CB warning and reporting responsibilities. The first is to verify enemy first use of CB weapons for the NCA. The second is to inform US forces, allies, and friendly governments of the impending or actual use of CB weapons by an enemy.

7.7.1. The local Commander monitors and evaluates intelligence reports, detection information, medical information, reports of activities suggesting the release of CB agent, and any reports of CB attack from other units or higher headquarters. The Commander consults with CE Readiness personnel, preventive medicine, operations, and intelligence staffs regarding the available information. After weighing all available information, the Commander decides when to disseminate a warning for that base and report the attack to higher headquarters.

7.7.2. If a base obtains positive indications of a CB attack and it is the first use of CB warfare, the Commander will immediately transmit an NBC 1 report, by flash precedence, up to the Theater NBC Control Center. Confirmation should be substantiated with all available information as quickly as possible. Higher headquarters will be seeking verification of the first use of CB agents to notify the NCA.

7.7.3. Through the detection network, the SRC commander determines the presence or absence of chemical agent. Installation commanders are responsible for issuance of warnings and for determination of the MOPP level required. This decision, through advice from the Readiness Flight, is based on mission, local situation, intelligence, and higher headquarters requirements. In CB threat areas commanders should be prepared to respond to every attack as though it were chemical until proven otherwise. The commander's decision to respond to attacks relies heavily on intelligence, enemy capability, previous attacks, etc. The commander should evaluate automatic detector, team and individual detection reports, reports of symptoms in personnel or wildlife, and tactics and weapons used. NBC reconnaissance teams, contamination control teams, and shelter management teams may be used to verify early positive indications and to survey unmonitored areas.

7.7.4. When warning is deemed necessary (chemical or biological attack is detected and satisfactorily verified or indications of impending CB attack are manifest and are assumed to be chemical or biological as doctrine requires), it is to be disseminated by Giant Voice, flags, and radio communications with flight line, shops, and control centers. The NBCWRS must be activated. Be cautious during exercises, Installations can hurt themselves through the exercise artificiality's they perpetuate during local exercises. For example:

7.7.4.1. Installations typically plan exercise "alarm black periods" based on a predetermined time instead of the likely hazard duration associated with a threat agent. The exercise doesn't generally force upper and mid-level supervisors to make the hard decisions associated with long term operations in a CB environment, work-rest cycles aren't considered or implemented, resupply procedures aren't evaluated, etc. The installation doesn't really know if it can sustain mission operations in a CB contaminated environment. Readiness personnel should ensure that portion of the exercise, however short it may be, is not terminated until leadership personnel have developed and implemented work-rest cycles.

7.7.4.2. Installation exercises generally have all the CB contamination from a previous attack magically disappearing all at once; alarm yellow is declared and the hazard is listed as "closed" in the log books. This isn't realistic. The agent(s) will dissipate at different rates throughout the installation because of factors such as exposure to sunlight, varying temperatures (some in shade, some not), differing wind speeds, and the type of surface that was contaminated (concrete versus wood versus plastic versus cloth and so on). Readiness personnel should script inputs in their exercises where isolated cases of post-attack exposure occur (For example, Amn Jones gets nerve agent symptoms while dealing with a pallet or changing a vehicle tire for example). Ultimately, installations should develop a thought out, coordinated response to this situation.

7.7.5. The SRC monitors alarm conditions and changes alarm conditions based on threat. The SRC tests communications out and power out alarm backups. Once presence of contamination has been confirmed, the SRC must make decisions on what to do about areas that are mission critical or essential. The decisions to perform decontamination operations must be based on operational and mission consideration, manpower and resources available. Operations are carried out in a priority order as designated by the installation commander. The SRC must coordinate recovery actions with base security forces to ensure the safety of recovery operations. Reports from Central Security Control to the SRC representative will identify the security posture, readiness and potential perimeter/base threat areas.

7.7.6. Dewarn. Commanders must reduce MOPP levels whenever possible. The operational cost of IPE use makes this a priority decision. But protective measures must continue until there is adequate evidence that agent is no longer present. Negative findings must be verified. A single negative test is not an adequate basis for a decision to dewarn. That decision should be based on repeated detector tests that fail to detect agent, possibly followed by selective unmasking procedures. Refer to AFMAN 32-4005, Personnel Protection and Attack Actions. In the absence of chemical detectors, the decision may be based solely on the selective unmasking procedures.

7.7.7. Verification Procedures.

7.7.7.1. Field Verification. Personnel in MOPP 4 needing access to restricted areas such as the flight line cannot be readily identified while wearing the mask. Using a SSAN authenticator (often referred to as "chem codes") where the wearer is asked a component or components of their SSAN, has been successful. The SRC would normally issue a daily directive -- directing the day's set of SSAN components. EXAMPLE Day 1. Sample SSAN is 123-45-6789. Component is: middle two , first three. Correct answer is 45-123

7.7.7.2. Voice (Telephone/Radio/Intercom) Verification. Determine the daily code from the SRC. Provide control centers/Telephone/Radio operators with copy of current day's verification table and disseminate code to personnel.

7.8. Marking. Marking surface contamination is a possibility with a CB attack, but the odds of having militarily significant amounts of ground deposition with aerosol attacks are small. In the unlikely event there are areas of heavy deposition (e.g., a jettisoned spray tank bursts on the ground and spreads heavy contamination over a small area), marking can help preclude significant cross contamination and identify areas for decontamination. CB contamination should be marked immediately upon recognition to prevent unnecessarily contaminating other personnel, equipment, and materials. Use the NBC Marking Kit to identify equipment items, vehicles and areas that are contaminated. When time permits, these areas should be roped off.

Table 7.2. Code Table Example.

Substitute numbers in table for actual use

SAMPLE C/B

AUTHENTICATION CODE

	1	2	3	4	5	6	7	8	9	0
A	17	34	97	13	61	13	19	16	20	50
B	33	78	02	41	05	55	08	99	24	27
C	65	15	56	93	98	07	22	31	96	80
D	01	45	99	86	12	79	39	59	26	28
E	77	53	44	02	84	36	08	18	95	37
F	98	25	87	49	11	16	55	23	32	30
G	69	03	21	34	06	81	10	82	40	42
H	88	66	09	04	38	60	14	19	71	29

The correct response to challenge C- 4 is 93

7.9. Principle of Contamination Control (Decontamination). By definition, contamination control includes procedures for reducing, removing or rendering harmless, the hazard resulting from the contamination. Although contamination avoidance before an attack is the most effective, cheapest, and easiest to perform, contamination control takes the operation to the next level. From a practical standpoint, BW contamination control is a combination of standard disease prevention measures and traditional CW contamination avoidance and decontamination measures.

7.9.1. In regards to casualty decontamination, thorough patient decontamination will occur at the medical treatment facility. Immediate and operational decontamination might be necessary to minimize the spread of contamination and reduce exposure to the casualty. However, it is imperative that the casualty be entered into the medical treatment system as soon as practical in order to begin definitive care.

7.9.2. Decontamination is a manpower, time, and resource consuming process which should be limited to actions which are absolutely necessary to permit mission accomplishment. Decontamination systems do not offer the capability to rapidly decontaminate large areas to reduce overall hazard levels. Natural decontamination (decay or weathering) is the most cost effective and easiest of the decontamination methods, however, mission needs will not always allow this as an option.

7.9.3. When decontamination of mission essential equipment is necessary, efforts should be consistent with available resources and the contamination's effect on critical mission operations. Limit decontamination operations to those actions necessary to minimize contact hazards and to limit the spread of contamination to both personnel and equipment.

7.9.4. There are limited numbers of equipment items in the inventory specifically identified for decontamination. The USAF has portable decontamination systems for use with equipment and personnel. Individual decontamination kits are issued to all personnel for decontamination of the skin and personal equipment. There are, however, many common materials available for decontamination, to include items such as bleach, disinfectants, soap and water.

7.9.5. Direction and priority of decontamination operations will be established by the SRC and passed to organization control centers tasked to conduct decon operations. SRC coordination of assigned assets is critical during expedient decon operations.

7.9.6. Decontamination cannot restore all assets to usable condition. Some components are uniquely sensitive to CB agents or to decontaminants. The expertise of CB, medical and bioenvironmental personnel can facilitate the restoration of assets to usable forms. However, some contaminated assets will require destruction

7.9.7. BW Decontamination. BW agent decontamination processes are no different than CW agent decontamination processes. Surface contamination with BW agent is to be expected highest near the point of munition function. There will be some surface contamination along the path of cloud travel, just as with CW munition function. BW agents pose some contact hazard. BW infectious agents (anthrax, brucella) are often able to infect through nicks, abrasions or even intact skin. The contact hazards from BW agents are, however, generally less than from comparable CW contamination.

7.9.7.1. The BW inhalation hazard differs significantly from that of CW attack. CW surface contamination evaporates, often producing significant downwind toxic vapor hazard. BW agents do not. It is possible, of course, for BW surface contamination to be reaerosolized to produce a downwind toxic aerosol hazard. But it is difficult to reaerosolize a large fraction of these deposits. The inhalation hazard from burst of a CW agent-filled munition is typically of much longer duration than one that is BW agent-filled.

7.9.7.2. BW agent surface contact hazards spontaneously dissipate with exposure to wind and sunlight just as CW surface contaminant hazards do. Nevertheless, reduction of contact hazard by the cleaning of masks, frequently used tools, and surfaces commonly touched in the execution of duties has merit. Immediate decontamination with the M291 decontamination kits serves this function.

7.9.7.3. Operational and Thorough Decontamination of BW-contaminated surfaces utilize the same processes and equipment as Operational and Thorough CW Decontamination. BW decontamination is manpower, time, and resource intensive. It should be limited to actions directly justified by mission demands.

7.10. Levels of Decontamination. There are four general categories, or levels, of decontamination. **Table 7.3.** summarizes these levels.

7.10.1. Immediate. This level of decontamination is conducted by the individual as soon as possible after they realize that they, their partners, their personal clothing (including ground crew ensemble), or their high-use equipment items have been contaminated. The purpose of this activity is to minimize casualties, extend the serviceability of the overgarment, potentially protect their equipment's serviceability, and limit the spread of contamination.

7.10.2. Operational. This level of decontamination is conducted by individuals or unit personnel as the situation dictates in the post-attack environment. The purpose of this activity is to reduce or minimize the contact hazard associated with contamination located on specific parts of mission essential equipment, materials, or work areas. This is the primary level of decontamination that will be achieved with mission-essential large aircraft operations in the midst of hostilities.

7.10.3. Thorough. The purpose of this decontamination is to reduce contamination to the lowest possible levels and thereby achieve a reduction in MOPP level i.e., permit partial or total removal of individual protective equipment.

7.10.4. Reconstitution. This level of decontamination will primarily be required in a post-contingency environment i.e., the hostilities have ended. The objective is to "eliminate contamination to restore critical resources permitting unrestricted use, handling or operation and release from military control." Because the agent concentration acceptance levels for this degree of decontamination have not been clearly established but will undoubtedly be exceptionally low (how clean is clean?), this will be the most time consuming and difficult of the different categories. This level of decontamination is not currently possible for all items.

Table 7.3. Decontamination Levels.

LEVELS OF DECONTAMINATION	
	IMMEDIATE
AIM	Minimize casualties, save lives, and limit the spread of contamination.
WHO	Individual.
WHAT	Skin, personal clothing, and equipment.
WHEN	As soon as contamination is suspected.
	OPERATIONAL
AIM	Minimize contact or transfer hazard and sustain operations.
WHO	Individuals, crews, teams, units.
WHAT	Specific parts of operationally essential equipment, material, work areas.
WHEN	Conducted when operations require.
	THOROUGH
AIM	Reduce contamination to lowest possible level.
WHO	Units or wings, with or without external support.
WHAT	Personnel, equipment, material or work areas.
WHEN	When operations, manning, and resources permit.
	RECONSTITUTION
AIM	Eliminate contamination to restore mission critical resources permitting unrestricted use.
WHO	Units or wings with external support.
WHAT	Mission critical aircraft, equipment, material, work areas, and terrain.
WHEN	After hostile actions have terminated or directed by higher authority.

7.11. Contamination Control Teams. CCTs are responsible for performing decontamination of critical assets usually at the operational or thorough levels. Team members must wear the suit properly and, because of the nature of the operation, go above and beyond in contamination avoidance. When performing decontamination operations with water, control the runoff and mark it as contaminated if appropriate. This will increase the risk of contact because members are working with or around higher or more concentrated contamination. To counteract this, members should wear rain gear over the GCE. This will provide additional protection from the agents and protect the GCE from water and/or fuel that might be used during the operation. CCTs will respond to taskings based on priorities established by SRC and their unit control center. They must check for and assess the extent of contamination then perform decontamination. When finished, the team must again retest for contamination if required. When there's no contamination detected, they should call the unit control center, report the status, and await further instructions.

7.11.1. Contamination Control Site. Ensure all established tasks are accomplished for establishing decontamination areas for both on and off-base. Locate contamination control sites based upon mission requirements and available assets. Obtain specialized CB detection protection, and decontamination equipment. Disperse sites from priority targets. Locate site off main route with easy access, in/out entry. Identify alternate entry and exit routes. For site set up consider, as a minimum: establishing a contaminated runoff containment area if appropriate; using sandbags and plastic for a contamination leaching area; filling bladder(s) and providing splinter protection, establishing a safe fuel storage site with fire extinguisher/s. Finally, notify unit control centers of the location and notify the SRC of completed activation.

7.11.2. Spot or small area decontamination may be required on equipment to be handled, on mission-essential equipment, and to keep liquid out of aircrew compartments. Deciding whether to decontaminate, how much to decontaminate, and when and where to decontaminate, are tactical decisions that must be weighed in light of mission requirements.

7.11.3. The following is a typical equipment requirements list for each CCT: M17A2 decontamination apparatus, bladder/ water source, fuel for LDA, CAMs, M8 detector paper, M291 or 295 decontamination kits, and wet weather gear. Other available assets that could be considered are: general purpose equipment such as fire-fighting equipment, mops, brooms, deicing equipment, water hoses, as well as support equipment such as cones, engineer tale, signs, NBC marking kit, and sandbags, etc.

7.11.4. Some critical decontamination operations include aircraft aircrew egress, refuel/rearm operations, vehicles, and equipment.

7.12. Large Frame Aircraft (LFA) CB Decontamination and Cargo Movement Procedures. It must be noted that the reconstitution level of decontamination does not significantly affect the majority of military aircraft tactical and strategic operations, i.e., we can accomplish the mission within the framework of immediate, operational, and thorough decontamination. However, it will degrade our capability to use civil contracted aircraft and the Civil Reserve Air Fleet (CRAF) with impunity.

7.12.1. Degree of Concern. In terms of Large Frame Aircraft decontamination, every CB agent does not present the same personal protection or operational requirement. For example, blood agents do not present a viable decontamination problem because they aren't likely to be used to attack air bases, don't present a viable contact hazard, and their persistency is exceptionally short. Further, biological agent pathogens such as Anthrax or Plague are deadliest when inhaled. Towards this end, testing associated with Portal Shield (the Biological Detection Advanced Concept Technology Demonstration) indicates the agents can migrate inside even "closed" LFA but do not pose much of a resuspension hazard once they land on a surface.

7.12.1.1. The specific chemical agents may be released in neat (natural), thickened, or dusty (solid) form. In it's thickened form, the agent's toxicity is not altered but its persistency and ability to stick to whatever it touches are enhanced. In terms of agent removal, dusty agents are easier to remove than liquid agents.

7.12.1.2. The biological agents of greatest concern are likely to be released in aerosol or powder form. An aerosol is a finely divided liquid and/or solid substance suspended in the atmosphere. Airborne aerosols behave in much the same manner as agents in vapor or gaseous form. However, aerosols are generally heavier than vapors and therefore settle out onto surrounding surfaces quicker. Particles may stick to vegetation and other surfaces. The primary hazards associated with aerosols will be in the form of inhalation or ingestion. In it's powder form, biological agents are very similar to chemical agents in "dusty" form, and the primary dangers associated with them will also be from inhalation and/or ingestion.

7.12.2. CB Scenarios. Large frame aircraft will predominantly become contaminated either as a result of being outside, unprotected, at the time of a CB attack or by landing/moving in or around a contaminated airfield.

7.12.2.1. The type of contamination we are concerned with is solid or liquid particles. These particles have the ability to absorb (sink into) or adsorb (stick onto) various surfaces. The particles then potentially present the dual hazards of contact and vapor generation.

7.12.2.2. If the only exposure an aircraft has to contamination is through landing or taking off on a contaminated runway, contamination will primarily be confined to the tires, wheel wells, and perhaps the extreme underbelly of the plane. In other words, it is unlikely that contamination will be "slung" all over the aircraft exterior during the take off or landing process. This is even more likely to be true the longer the agent has to weather and/or absorb into the aircraft operating surface i.e., the threat at 30 minutes after contamination is much greater than the threat at 6 hours after contamination and so on.

7.12.2.3. It is highly unlikely a LFA will become contaminated as a result of flying through a CB cloud as it is released from a missile or other weapons delivery system.

7.12.2.4. Aircraft interiors will primarily become contaminated inside as a result of cross-contamination during the personnel and/or cargo loading process. If even rudimentary pre-attack considerations are followed, it's unlikely LFA interiors will become contaminated with operationally significant levels of CB agents solely as result of an attack.

7.12.3. Primary Hazards. While vapor penetration of some surfaces is possible, with resulting off-gassing, this event is not our primary concern. As of today, we cannot decontaminate the air without the use of extensive filter systems which are impractical in regards to LFA. Our capabilities rest in our ability to remove the vapor generation source, generally liquid or solid particles, and then sufficiently aerate the surface so that any remaining vapors are dispersed.

7.12.4. Assumptions.

7.12.4.1. National, theater, and local command authorities will base LFA decontamination operations on the intelligent balance of mission continuation and force survivability.

7.12.4.2. The primary agents we will concentrate on are Distilled Mustard (HD - sometimes referred to as "Sulfur Mustard"), Lewisite (L), Sarin (GB), VX, Anthrax, and Plague. See Attachment 3 for specific agent characteristics.

7.12.4.3. CB attacks may occur without warning at any stage of air mobility operations.

7.12.4.4. The amount of support/logistical resources required to operate in a CB environment is directly proportional to the type and amount of contamination present.

7.12.4.5. In order to maximize personnel survivability and provide critical insight into the biological contamination issue, an air sampler must be available.

7.12.4.6. Cargo Handling. In order to maximize cargo handling effectiveness in a CB environment, the packaging of the pallets must be accomplished differently than it is today.

7.12.4.6.1. The assumption for today's LFA operations is that cargo will arrive at enroute and theater locations as presently configured. Consequently, the receiver will have to accomplish specific repackaging or decontamination tasks that would not otherwise be required.

7.12.4.6.2. The assumption for the mid and long term outlook concerning LFA operations is that these packaging requirements will be part of the pallet build-up process.

7.12.5. Planning Factors. The planning factor for the amount of liquid/solid contamination on an aircraft after any given attack is 5 g/m2. This equates to approximately one teaspoons of liquid agent per square meter of surface area. The individual droplets will be in the 400 to 900 micron size range for missile air bursts.

7.12.5.1. Effects from CB warfare could be localized (contained to an airfield or parts thereof), regional (some or many theater airfields), or global (enroute, CONUS, and theater airfields) in nature.

7.12.5.2. Because the extent of CB contamination on an operational airfield can't be pre-determined to any certainty, it's imperative force survivability requirements such as collective protection, extra individual protective equipment, and a full array of CB detectors be programmed for each designated decontamination location.

7.12.5.3. In order to maximize our effectiveness in determining if potentially contaminated assets are free from surface deposits of biological agents, hand-held assays will have to be utilized.

7.12.6. Concept of Operations. Every projected LFA landing or operating site within range of projected threat weapon systems will have the capability to conduct at least minimal aircraft load, off-load, and decontamination operations. As part of current post-attack reconnaissance activities, units will concentrate on delineating and quantifying the contamination hazard zone (both contact and vapor) in and around the aircraft staging/loading area(s).

7.12.6.1. Whenever possible, adhere to the overarching concept of exposure control i.e., expose the minimum amount of people to the minimum amount of hazard, for the minimum amount of time.

7.12.6.2. Use combination of mission criticality and existing concentration standards as driving factor for selecting level/type of decontamination operation.

7.12.6.3. Once hostilities begin there are three main environments LFA may operate in:

7.12.6.3.1. Clean and secure. Similar to normal day-to-day operations. In this case, aircraft are working out of sites that are outside the range of projected threat weapon systems.

7.12.6.3.2. Grey. Potential for or actual presence of contamination on the operating location, but the aircraft staging/load area has not been physically contaminated. A vapor hazard may exist.

7.12.6.3.3. Full contamination. The aircraft staging/load area and/or the aircraft themselves have physically been contaminated by CB agents.

7.12.6.4. Within these operating environments, if the mission situation allows, large aircraft and cargo handling operations will take place with the following prioritized methodologies.

7.12.6.4.1. Uncontaminated cargo/passengers transiting to uncontaminated aircraft.

7.12.6.4.2. Contaminated cargo/passengers transiting to contaminated aircraft.

7.12.6.4.3. Uncontaminated cargo/passengers transiting to contaminated aircraft (transload).

7.12.6.4.4. Contaminated cargo/passengers transiting to uncontaminated aircraft (transload).

7.12.6.5. Resources will be transitioned through various locations within the "cargo movement area". The purpose of the cargo movement area is to facilitate airlift by separating cargo according to mission criticality and hazard category level, accomplish whatever decontamination or contamination avoidance techniques are required, and ultimately load the "safest" cargo possible onto the aircraft.

7.12.7. Major Decontamination Locations. Every projected LFA landing or operating site will potentially be used for decontamination-cargo movement activities. This includes having trained personnel and equipment to support standard (totally uncontaminated), dirty (totally contaminated), and transload activities.

7.12.7.1. Because we won't be able to predict which operational airfields will be totally clean, or at least have clean areas suitable for large aircraft areas on them at any given time, we can't guarantee a set amount of "through put" at any given location. However, we do have the ability to input enhanced capabilities into select locations. This will be done through the use of non-standard UTCs with today's TPFDD and will be built into the deliberate planning process for the out years. The designation of these sites will be classified.

7.12.7.2. There will be two categories of sites in regards to the "reconstitution" level of decontamination.

7.12.7.2.1. The first sites will be inside the "grey" area i.e., at locations within the range of projected enemy weapon systems.

7.12.7.2.2. The second set of sites will be outside the range of projected enemy weapon systems.

7.12.7.3. As with the standard, dirty, and transload activities mentioned above, we won't be able to concretely pre-determine which sites within the grey area will be available for use at any given time. However, as with the sites above, we can provide some enhanced capabilities at selected locations (different equipment and decontamination techniques are employed for reconstitution as opposed to operational levels of decontamination).

7.12.7.4. Specific projected reconstitution sites will be classified locations.

7.12.7.5. If reconstitution activities are required during hostilities, the specific site for the reconstitution attempt will be made on a case-by-case basis.

7.12.7.6. In the post hostility environment, reconstitution sites will be selected based on the situation at that time, personnel and equipment will be deployed to those sites to conduct the operation, and contaminated assets will be cycled through the site(s).

7.12.8. Critical Factors And Specific Procedures Associated With LFA Operations. The proper implementation of contamination avoidance and contamination control measures will directly influence the amount and extent of decontamination operations required in a post-attack environment. In simple terms, preventative activities are much easier to accomplish than decontamination activities. These also play a significant role in the individual survival chances of the decontamination team members, load crew, air crew, and reception crew. While the majority of the base populace will be going to great lengths to avoid contact with contaminated materials, these personnel will routinely be coming into contact with CB agents. In fact, the "gathering" of loads awaiting shipment may create an artificial "hot spot".

7.12.8.1. The following measures are recommended during pre-hostility operations and/or at bases that have not yet been contaminated by CB agents in any form. Refer to **Attachment 8** for personnel protection standards associated with operational decontamination activities.

7.12.8.1.1. Keep aircraft doors and hatches closed to the maximum extent possible.

7.12.8.1.2. Attempt to provide aircraft, cargo marshaling and storage areas some sort of overhead cover if at all possible. Any device, system, or location that would stop rain from directly hitting the resource will suffice.

7.12.8.1.3. Ensure each pallet or individually loaded item is double wrapped in plastic; the heavier and more durable the material, the more protection it will provide.

7.12.8.1.4. If an aircraft is scheduled to be used in contaminated zones, fasten a plastic curtain with hook and loop tape between the cockpit and the cargo compartment to minimize vapor concentrations within the cockpit. Next, line the cargo storage and personnel seating areas with plywood, plastic sheeting, tarps, etc., as much as the scheduled load configurations will allow.

7.12.8.1.5. Develop a "CAM footprint" of the aircraft staging and loading area, to include each cargo pallet.

7.12.8.1.6. Create shuffle boxes or troughs for entrance into facilities, aircraft hatches, loading ramps, etc. The boxes or troughs should contain either a readily-available, highly absorbent material or a liquid solution of approximately 5% chlorine (household bleach). The liquid solution should be used if agents in dusty form are a realistic threat. Cover the shuffle pits/troughs. Having the agent "rain" into the shuffle pit during an attack situation does not promote effective contamination removal when personnel use the device later. This technique is more crucial for pits/troughs involving absorbents than it is when liquid solutions are used.

7.12.8.1.7. Contact the installation Survival Recovery Center (SRC) and determine where the designated "contaminated waste disposal area" is sited. The use of this site will prevent undue contamination arising within the aircraft staging/loading areas as a result of haphazard disposal of decontamination materials or unusable contaminated items.

7.12.8.2. Employ the following measures when attack is imminent. Close all aircraft doors and hatches. Depart airfield if time permits, aircraft survivability isn't in question, and sufficient fuel is on board to allow several alternative landing site possibilities. Place everything possible at locations with overhead cover. Ensure plastic, tarps, etc., are covering all cargo that can't be provided overhead cover. Cover all outside assets with one layer of protection and then add a second layer to those assets if time permits. Shut down aircraft and facility environmental control systems (engines, air conditioners, air handlers, etc.). Check the validity of your "CAM footprint" against the reality of the moment (is the same cargo still there?), and update the footprint if time permits.

7.12.8.3. It's imperative the aircraft flight scheduling community be aware of the contamination status of each operating base and potential landing zone within the theater of operations. This status includes: present contamination status i.e., uncontaminated or contaminated. The basic information will be available through theater and/or installation NBC Control Centers. However, the installation NBC Control Center will possess much more detailed information on some of the following aspects. If uncontaminated, has it always been uncontaminated or has an agent from a past attack apparently dissipated? This is important for two reasons. The first is strictly the political factor associated with whether uncontaminated aircraft will typically be allowed to land there. The second is the realistic factor that all areas of the base probably are not uncontaminated, even if the integrated NBC detection network is showing negative results. The probability is that certain pockets of area (ground, shaded areas, porous materials, etc.) still contain at least a localized hazard.

7.12.8.3.1. If contaminated: is the entire installation contaminated? If not, are the aircraft operating surfaces and cargo movement area clean? What type of agent(s) is present? When is the expected agent dissipation time?

7.12.8.3.2. Expected contamination status i.e., has another base been hit and a CB cloud is heading its way? This information will be available through the theater and installation NBC Control Center by means of NBC 3 reports.

7.12.8.4. The airlift allotment community must be keenly aware of the past and present contamination status of each base, the mission requirements of each base and the theater as a whole, and the specific importance of each projected cargo load.

7.12.8.5. Accomplish the following items as soon as possible after an attack.

7.12.8.5.1. Uncover or pull out the shuffle pits/troughs and use them until the absence of CB agents on the installation is verified or the agents dissipate. NOTE: Properly dispose of the contents periodically (sealed containers in contaminated waste disposal area best choice) and replace with fresh, uncontaminated material.

7.12.8.5.2. Check each asset that was outside at the time of attack with M8 paper to determine if it was contaminated with chemical agents in liquid form. If the asset was protected by a single sheet of plastic, tarp, etc., remove and replace the covering within one hour if possible. Testing has shown these materials only provide two to three hours of protection at best. If the asset was protected by a double sheet of plastic, remove the outer covering within one hour and replace it as time permits. If the asset was not protected by a barrier of any type, and it was contaminated, place a chemical contamination sign from the NBC marking kit on it in prominent locations.

7.12.8.5.3. If the aircraft staging/loading area is partially contaminated i.e., one section is and another section isn't, annotate your map of the area (one used for CAM footprint will suffice) to show the contamination zone. Using your map as a guide, ensure uncontaminated materials in close proximity to the contaminated zone are covered in order to minimize cross contamination.

7.12.8.5.4. Contact the SRC to determine what type, if any, CB agents have been detected across the installation or in the local area. In the case of chemical agents, this will allow cargo movement or decontamination personnel to gain insight into the activities that may be required at their location. In the case of biological agents, if the installation air samplers come up positive, use the biological agent hand-held assays to take samples of the cargo items awaiting shipment. If these samples produce positive results, place a biological contamination sign from the NBC marking kit on it in prominent locations.

7.12.8.5.5. From a personnel standpoint, specific procedures associated with the debarking from or loading of aircraft need to be implemented.

7.12.8.5.5.1. The aircrew must be aware of the contamination status at their intended landing site and alternate landing locations. The aircrew and passengers must be using the appropriate individual protective equipment when they touch down at the airfield, regardless of whether their aircraft is contaminated or uncontaminated.

7.12.8.5.5.2. Conversely, the aircrew must report the contamination status of their aircraft/cargo so that the "receiving" location's ground support crew can be properly prepared to handle the situation.

7.12.8.5.5.3. If already in a contaminated environment, consider pre-flight crews, if available, to pre-flight and load the aircraft while the crew is in rest. Aircrew should complete pre-departure preparations to the maximum extent possible prior to leaving shelters.

7.12.8.5.5.4. The loadmaster(s) should be the only aircrew member(s) in the loading area. Other aircrew members should stay on the flight deck. Local ground support personnel should perform actual loading and the loadmaster should not touch contaminated payloads. Cargo handlers should not touch any part of the aircraft and should decontaminate their hands/boots every time before they enter an uncontaminated aircraft with contaminated cargo.

7.12.8.5.5.5. If possible, all contaminated passengers should process through one of the installation's contamination control areas (collective protection or open-air), get back into uncontaminated suits, and return to the aircraft loading area. If this is not possible, all contaminated passengers should remain outside for as long as possible (safety and mission permitting) in order to maximize the weathering effect. These passengers should check each others ground crew ensembles for signs of liquid contamination and use their M295 kits to decontaminate the affected area(s) if contamination is discovered.

7.12.8.5.5.6. If passengers or aircrew must bring aboard individual contaminated items (chocks, engine covers, mission-essential personal equipment), they should seal these items in a plastic bag prior to loading.

7.12.8.5.5.7. All uncontaminated passengers should remain in shelter or vehicles until ready to board the aircraft. If the loading area is contaminated, use plastic sheeting, or decontaminate a footpath for uncontaminated passengers to enter the aircraft. All passengers should decontaminate their hands/boots before they enter the aircraft.

7.12.8.6. Assuming that either the aircraft is contaminated (carrying either contaminated or uncontaminated cargo), or that a previously uncontaminated aircraft is carrying contaminated cargo, aircrew members should:

7.12.8.6.1. Be exceptionally familiar with the internal airflow characteristics of the particular aircraft. For example, testing has shown with the C-130: Air movement in the cargo bay just behind the cockpit bulkhead is very slight even with the rear cargo door open. Thus movement of vapor out of the aircraft from the front portion of the cargo bay is slow, even with the door open. The highest air exchange rate was produced by flying with the forward escape hatch and both paratroop doors open. However, this configuration pulled the agent vapors forward onto the flight deck. Flying with the auxiliary vent open produced nearly the same exchange rate without contaminating the flight deck. Therefore, for the elimination of toxic fumes and vapors, it is recommended that the auxiliary vent be used to keep the flight deck concentrations to a minimum. To eliminate nontoxic fumes and vapors, the forward escape hatch and both paratroop doors should be opened.

7.12.8.6.2. Decide if one of the goals of the flight will be to decontaminate the interior of the aircraft through the use of airflow.

7.12.8.6.2.1. If the goal is to maximize decontamination of the aircraft interior/cargo prior to landing (as might be the case if bringing in contaminated cargo for off loading at a presently uncontaminated location):

7.12.8.6.2.1.1. The best decontamination of the cargo results when cargo bay temperatures are highest and the rear cargo door is open. This condition does produce high, but tolerable cockpit temperatures and high levels of vapor concentration in the cabin and cargo bay.

7.12.8.6.2.1.2. Significant decontamination of palletized cargo requires generation of cargo bay temperatures above 30 degrees Celsius over an extended period of no less than 3 hours. Due to the high vapor levels generated in both the cargo bay and cockpit, it would be necessary for the crew to be in protective ensembles. This could result in heat stress problems for the crew.

7.12.8.6.2.2. If the goal is to minimize vapors within the aircraft (as might be the case if transporting unprotected personnel or attempting lower levels of protection for aircrew):

7.12.8.6.2.2.1. The aircrew should keep the temperatures in the cargo bay at the lowest readings possible, consistent with crew comfort. Even a few degrees makes a difference. For example, testing showed that temperatures of just under 20 degrees Celsius showed much lower vapor concentrations arising from contaminated cargo than temperatures of 25 degrees Celsius.

7.12.8.6.2.2.2. If the aircrew discovers excessive vapor leakage from the cargo, the aircraft should be depressurized and purged by using the auxiliary vent.

7.12.8.6.3. Perform routine air monitoring operations. Since the toxic vapors of CB agents are not visible to the naked eye, the use of air samplers such as the CAM, M90, M256A1, etc., are the only reliable way to determine the quantity and extent of vapors present throughout various sections of the aircraft. As previously stated, these levels should be used to assist in the determination of required protective postures for passengers, emergency aircraft procedures (venting for example), and be reported to the "receiving" location's ground support crew.

7.12.8.7. When it comes to decontaminating the exterior of an aircraft, there are several factors associated with this tasking.

7.12.8.7.1. Regardless of the decontamination technique used, the smooth surfaces will be relatively easy to decontaminate while chemical agents will tend to migrate into crevices, rivet heads, joints, etc.

7.12.8.7.2. Weathering will remove most chemical agents (HD, THD, GB, GD, TGD). The time required to use this process is directly related to the temperature. Higher temperatures will accelerate weathering.

7.12.8.7.3. While weathering should always be considered as the first choice, other methods may be required for colder temperatures or VX contamination.

7.12.8.7.4. If weathering is not feasible, or if an installation wishes to accelerate the aeration process, the use of flight has proven to be an effective decontamination technique. However, as stated above, small pockets of contamination may exist in the cracks or crevices.

7.12.8.7.5. The use of the M295 kit will be effective for decontamination operations involving "routine-use" areas but would be impractical for cleaning entire air frames.

7.12.8.7.6. The use of household bleach is an effective decontamination technique and may be the best choices for greasy areas, rivet heads, cracks, and crevices. If the bleach is continually applied or left in place for 30 minutes it will neutralize all threat agents. This application should be followed by a clear water rinse even though the bleach has not proven to be detrimental to the aircraft components.

7.12.8.7.7. The use of forced hot air for purposes of decontamination has been studied extensively. Studies recommend the use of the AM 32A-60A Start Cart because it is readily available at most flying wings. However, it must be noted that forced hot air decontamination did NOT always result in a contamination-free aircraft. Consequently, follow-up testing is scheduled to finalize recommended procedures.

7.13. Helicopter Contamination Control. Successful helicopter operations in a hostile NBC environment are dependent on how contamination avoidance and control is performed. Commanders must be aware that contamination control and decontamination procedures on helicopters may only reduce the hazard and not eliminate it altogether. Once a helicopter is contaminated, it is very difficult to decontaminate completely due to the various compounds used in its construction and the ability of NBC materials to intrude and penetrate these compounds, and the inner space of the helicopter generally. Contamination avoidance is the best way to deal with this hazard. Helicopter units need to have effective procedures that emphasize contamination avoidance. Should helicopter contamination occur then the priority changes from "avoidance" to "contamination control". The objective of contamination control is to limit the spread of contamination. The final priority should be decontamination. During decontamination operations the primary objective is to reduce the contamination hazard to the lowest possible level to enable a reduction in individual NBC protection and to prevent transfer of contamination. To ensure the least degradation of operational effectiveness, commanders will need to apply risk-taking philosophy to all contamination control procedures. Protective states and measures must be consistent with the hazard facing helicopter operators and those directly affected by helicopter operations.

7.13.1. The aim of this section is to provide commanders with general guidance and procedures on the contamination avoidance, contamination control, and decontamination of helicopters affected by nuclear fallout and biological or chemical agents, and toxic industrial hazards (TIH). It does not replace the guidance available from specialist NBC Technicians.

7.13.2. Threat. Helicopter operations may be threatened directly or indirectly by the use of NBC weapons. In addition to 'conventional' NBC materials, helicopters may be exposed to the hazard of contamination from a release other than attack as a result of the collateral damage of war fighting in the form of TIH such as low level radiation and toxic industrial hazards. Dependent on the substance involved, large areas of terrain and the air immediately above may become contaminated with radioactive fallout dust, biological particles or liquid chemical or vapor and remain so for extended periods of time.

7.13.3. Contamination avoidance is the best method of dealing with this threat/risk. It includes those actions taken before an attack to protect resources from contamination and actions taken after an attack to mark and avoid contamination. Practice contamination avoidance at all times: on the ground, in the air, before NBC attacks, and around suspected contaminated payloads and areas. Contamination avoidance is critical due to the difficulty in decontamination. Aircrews must be aware of the hazards of NBC operations. For instance, an aircraft that hovers or lands in a contaminated area could transfer contamination onto itself. Likewise, contaminated passengers or ground crew pose a danger of transferring contaminants.

7.13.4. Decontamination. During decontamination operations, the primary objective is to reduce the contamination hazard to the lowest possible level. The principles of decontamination are to decontaminate:

7.13.4.1. As soon as possible. The sooner contamination is removed, the sooner you can reduce NBC protection levels through appropriate risk taking measures and begin restoring combat power. This also reduces the sorbing risk. Scientific assessment of modern chemical agents requires that some are removed within 30 minutes to protect materials from their corrosive properties; however, due to the risk of perspex crazing, contamination on perspex should be removed within 10 minutes.

7.13.4.2. Only what is necessary (Operational Decontamination). To survive and win on the contaminated battlefield, it is important not to waste precious resources decontaminating everything. Decontaminate only what is necessary to continue the mission. This will help sustain the combat power.

7.13.4.3. As far forward as possible (limit the spread). Do not transport contaminated personnel and equipment away from the operational area if you can bring decon assets forward safely. This will keep the equipment on location, where it is needed, allow decon to begin earlier, and limit the transfer of contamination to other areas.

7.13.4.4. Equipment and personnel according to operational priorities. Clean mission essential items first and non-essential items last.

7.13.5. There are four possible scenario's by which helicopters may be exposed to contamination:

7.13.5.1. Attack while on the ground. To minimize the effect of an attack, the following pre-attack precautions should be taken, when practicable, whenever the aircraft is shut down on the ground: park close to and downwind of trees and buildings; close doors and windows - if doors and windows have been removed then alternative materials such as chemical resistant material should be considered; cover tires and canopy/window perspex with chemical resistant material.

7.13.5.2. Fly through contamination. Flight through liquid/particles falling to the ground is extremely unlikely but flight through a vapor hazard may take place. Aircrew and passengers should wear individual protection and, when possible, doors and windows should be closed. Close all non-NBC air vents, where this is practicable, as a measure against the ingress of NBC substances. If closure is not possible, some form, of external over-taping may be appropriate.

7.13.5.3. Land on contaminated ground. When landing a helicopter on contaminated ground or hovering close to it, the re-circulation of spoil by the rotor wash will result in a significant spread of contamination to the aircraft, people, and area. It may even penetrate to the interior of the helicopter. Aircrew and passengers should wear individual protection and, when possible, doors and windows should be closed. Close all non-NBC air vents, where this is practicable, as a measure against the ingress of NBC substances. If closure is not possible, some form, of external over-taping may be appropriate.

7.13.5.4. Carry contaminated cargo/personnel. The primary consideration when required to carry contaminated cargo/personnel is to employ contamination avoidance/control procedures to the maximum extent possible. Use of external loads should also be considered, when practical. Flying with doors and windows open will increase the rate of weathering if carrying contaminated troops. When having to carry contaminated personnel or cargo, personnel could undergo a suit change and the cargo could be sealed in chemical agent resistant material. Protecting the floor with covers will aid subsequent decontamination but tears in the fabric could increase the risk of contamination behind floorboards and may present a flight safety hazard.

7.13.6. Planning. As part of the planning process the commander should apply risk-taking philosophy and should assess the likely threat including the risk of exposure to contamination. He will seek to reduce the risk and maximize operational capability by determining levels of aircrew protection and establishing procedures for the decontamination of aircraft and equipment. Commanders should be aware that, depending on the extent of contamination, once any helicopter is contaminated by threat substances, it may take an unacceptable amount of resources, particularly time, to remove all contamination due to the intrusive and penetrative nature of the substances involved. During this decontamination, helicopters would not be supporting ground forces, their major role, which may be unacceptable. Consequently, commanders may have to accept, in the spirit of risk taking philosophy, operating 'dirty' helicopters in the knowledge that the risk to crews and passengers has been reduced to acceptable levels. Personnel will require protection commensurate with the residual hazard. However, it must be recognized that any such 'fight dirty' posture will have a very finite life due to the extremely debilitating nature of operating helicopters in aircrew NBC ensembles. The following factors listed in **Table 7.4.** should be considered:

Table 7.4. Helicopter Decontamination Planning Consideration.

The time for which aircrew must wear protective ensembles.
The type of mission.
The capabilities of unit NBC personnel.
The external support available from NBC units.
The decontamination assistance available from the supported unit.
The support available to detached elements.
The designation of a decontamination site.
Employ hazard avoidance whenever possible within the context of the mission.
Selection of optimum sites and landing techniques minimize airframe and underslung load contamination.
Availability of a toxic free area.
The availability of NBC Warning and Report Information.

7.13.7. Detection and alarm equipment will usually provide adequate warning of many NBC hazards to helicopter sites although it may take some time to assess the precise nature and likely duration of contamination. In the air, visual detection of certain liquid agents is possible using chemical detection paper attached to the windscreen of the aircraft and chemical alarms may also be fitted. Where adequate stand-off NBC detection technologies exist, not interfering with the payload of the aircraft, units should seriously consider their employment as a means of advanced warning of NBC hazard to safeguard aircrews and their passengers.

7.13.7.1. On-board the helicopter, NBC equipment may be used to detect, identify and monitor levels of NBC hazard; however, chemically sensitive papers will only detect and identify liquid chemical agents.

7.13.7.2. On-board NBC detection is unlikely to provide aircrew or passengers sufficient warning time to mask when in flight to protect them against the effects of the threat substance. This is especially the case with nerve agents where equipment would be required to detect minute quantities to prevent the aircrew from suffering from miosis.

7.13.8. Contamination avoidance. Some things that can be done to avoid contamination:

7.13.8.1. Commander should have access to NBC Warning and Reporting information to inform them of hazard areas. NBC reconnaissance and survey will deny or confirm hazard areas. Know these areas and avoid them.

7.13.8.2. If aircraft must land in contaminated areas, consider the tactical situation and, if possible, pick landing zones that will have a reduced transfer effect.

7.13.8.3. Contaminated crews should conduct inspections without touching or shaking items (when possible). Many points can be inspected visually.

7.13.8.4. Increase the use of chemical resistant covers when not flying. Use engine covers, flyaway gear, and hatches. If possible, provide overhead cover for parked aircraft.

7.13.8.5. Apply adhesive M9 detection paper to the landing gear of the aircraft. Groundcrew should monitor the helicopter for contamination before servicing and after sorties, in accordance with unit SOPs. Another piece of M9 detection paper can be placed on the windscreen where the aircrew can see it.

7.13.8.6. During terrain flight, areas of heavy vegetation should be avoided because vapor is dispersed less quickly where the wind is blocked. Open areas or high ground afford the best opportunity to evade this hazard.

7.13.8.7. Artillery impact areas should also be avoided as the enemy may have employed NBC munitions.

7.13.8.8. Ground crews could conduct operations without requiring the aircrew to exit the aircraft.

7.13.8.9. Limit the number of aircraft that must operate in a contaminated area or use aircraft already contaminated.

7.13.8.10. When carrying contaminated personnel or casualties, lining the troop compartment with chemically resistant material is a field expedient way to limit the spread of contamination. A chemically resistant material can be fastened between the troop compartment and the flight compartment with tape to limit contamination transfer. The aircraft's heater can be used in conjunction with the material to create an over pressure in the pilot's compartment but is not a substitute for aircrew NBC ensembles. This will limit vapors from entering the compartment.

7.13.8.11. In addition, any servicing or turn-round of known contaminated helicopters must be accompanied by NBC monitoring.

7.13.9. Levels of decontamination. Once a helicopter is contaminated, it is difficult to decontaminate it completely. The tactical situation and the availability of aircraft will determine the degree of decontamination attempted. The goal of all decontamination efforts will be to reduce the hazard to the lowest possible level. During sustained operations, in order to sustain combat power for as long as possible, commanders must employ risk-taking measures to reduce, as far as practicable, the time personnel spend in NBC protective equipment and thereby reduce the degradation suffered. Commanders should also consider the use of collective protection to provide personnel with rest and relief in a hazard area. Only specialist decontamination units, usually established in the rear area, will be able to conduct thorough decontamination to permit a reduction in MOPP. It may be necessary to continue to operate helicopters in a dirty condition before they too can be subjected to decontamination procedures, but, in this event, all who may come into contact with contaminated helicopters must be suitably attired and made aware of the conditions they face. Routine flight and ground operations with rotors turning help to decontaminate exterior surfaces of the aircraft; however, this could result in the ground contamination being transferred back onto the aircraft in a self-defeating process. The wind and warm temperatures generated by the engines help to dislodge particles and expedite the evaporation of NBC agents. Complete decontamination of surfaces by evaporation however, is not possible because some agents may remain in the paint. Care must be taken not to spread contamination to clean parts of the helicopter. There are three options to be considered: **Table 7.5.** summarized the three options.

7.13.9.1. Immediate decontamination should be concentrated on personnel. For operational decontamination, unit commanders should select sites dedicated to the decontamination of aircraft and organize them to take account of aircraft type, mission, terrain and wind conditions. If necessary, operational decontamination may be accomplished in two stages:

7.13.9.1.1. Stage 1. Selected areas of the aircraft that are likely to be touched by personnel (landing gear, fuel ports, doors, steps, and hand holds) are decontaminated to limit the transfer and spread of contamination. Wash exterior surfaces with decontaminants to flush off contamination. Fuel, surfactant, and water are most commonly used. Insure run-off is contained and disposed of as contaminated waste.

7.13.9.1.2. Stage 2. As soon as time and resources permit, all external and accessible internal surfaces may be decontaminated. The primary concern is to wash contaminants from the aircraft exterior and, as a minimum, the internal cabin floor. Insure run-off is contained, appropriately marked with NBC warning signs, and disposed of as contaminated waste.

7.13.9.2. Thorough decontamination of helicopters are best accomplished at sites in the rear area established by specialist chemical units. Thorough decontamination is a lengthy process, the aim of which is to reduce contamination to the lowest possible levels, thus permitting the partial or total removal of individual protection and the continuation of operations with minimum degradation. After deplaning of personnel and removal of role equipment, all parts of the aircraft including engine, transmission and equipment compartments must be checked and cleansed. Some panels and equipment will have to be removed and the aircraft must, therefore, be shut down.

Table 7.5. Three Types of Helicopter Decontamination.

Type of Decon	When, Who, and Why	What	Examples of Type Decon Agent
Stage 1 (Operational)	1. After immediate decontamination. 2. Decontamination by crew. 3. To allow continued operations.	Essential operating surfaces on the aircraft	decontamination kit (M295), aircraft fuel (Note 1)
Stage 2 (Operational)	1. Within 6-24 hours. 2. By unit CCT. 3. To reduce contact hazard (Note 2)	The entire exterior surface of the aircraft (Notes 3 and 4)	Hot water and surfactant
Throrough Aircraft Decon	1. Mission allows. 2. CCTs 3. To reduce hazard to negligible risk levels.	The entire exterior surface and selected interior surfaces of the aircraft	10 % sodium carbonate solution – 4.5 kilograms (10 pounds) of sodium carbonate to 45.5 liters (12 gallons) of water.

NOTES:

1. Do not use fuel inside the aircraft.

2. This technique is most effective if conducted within one hour of contamination.

3. Perform aircrew spot decon to reduce contact hazard inside the aircraft. Do not spray water inside the aircraft.

4. You must be familiar with the "no direct water pressure" contact areas.

5. Due to the intolerance of modern helicopters to liquid, a helicopter technician should be present during all decontamination operations to advise on aircraft sensitivities.

7.13.10. Equipment will vary by nation but large quantities of water will invariably be required. The most common decontamination procedure is to wash the aircraft with hot water containing a surfactant followed by a clear water rinse, avoiding spraying water on electrical components. Water pressure should be adjusted to avoid damaging the aircraft. Hot air, if available, should be directed onto sensitive components that cannot be washed. Only approved cleaning compounds should be used to decontaminate aircraft. If pressurized water is used all blanking plates should be in position and other vulnerable apertures should be sealed.

7.13.10.1. Standard Decontaminates. No effective chemical compound is available for full aircraft decontamination. Caustic decontaminants such as DS2 and Super Tropical Bleach (STB) are not considered safe. STB corrodes metal components and aircraft skin, and DS2 corrodes rubber, plastic, and Plexiglas. Spot decontamination, may be performed using the M295 decontamination kits.

7.13.10.2. Expedient Decontaminates. Soap and water, kerosene, aircraft fuel and diesel fuels are approved as decontaminants on selected parts of the helicopter. Fuel is effective in removing some agents from aircraft skin and components; however, it does not neutralize the agents. If water is available, personnel should use it to rinse off the fuel. Many parts of the helicopter are delicate and cannot stand high pressure water or extreme hot air.

7.13.11. The decontamination site must be capable of accommodating the appropriate aircraft type in the required numbers. It should be relatively secure but close enough to refueling and rearming points to permit a reasonably quick turn around if required. The site should have sufficient terrain flight routes within 2 to 3 kilometers to facilitate entry and exit. A slight slope to the terrain is desirable but must remain within aircraft limits. It is preferable to sequence groups of aircraft through the decontamination site to prevent arriving or departing aircraft interfering with decon operations. Depending on the personnel and resources available, it may be possible to cleanse several aircraft simultaneously.

7.13.12. NBC hardening is designed to make any equipment easier to decontaminate, withstand the damaging effects of NBC substances and decontamination agents and be compatible with operators wearing full NBC individual protective equipment. Where commanders identify areas of helicopter NBC hardening deficiency, they should bring this to be attention of their appropriate MAJCOM.

7.14. Post-Attack--All Clear. Commanders should revert to an appropriate MOPP level based on the current threat in conjunction with the "All Clear" signal. Personnel engaged in CB defense functions should repair and resupply CB defense equipment in preparation for follow-on attacks. Repair of damaged shelters, detection equipment, and decontamination equipment is essential for surviving any future attacks. All personnel should return their IPE to a ready status in anticipation of the next attack warning. At the first opportunity, they should clean and repair masks and other repairable items, or replace non-repairable using appropriate technical orders.

WILLIAM P. HALLIN, Lt GENERAL, USAF
DCS/Installations & Logistics

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

Abbreviations and Acronyms

AAA Batteries—Anti-Aircraft Attack Batteries

AADC—Area Air Defense Commander

AB—Air Base

ABDR—Aircraft Battle Damage Repair

ABGD—Air Base Ground Defense

ABM—Anti-ballistic Missile

ACADA—Automatic Chemical Agent Detector and Alarm

ACC—Air Combat Command; Air Component Commander

ACDE—Aircrew Chemical Defense Equipment

ACOM—[U.S.] Atlantic Command

ACTD—Advanced Concept Technology Demonstration

ADCP—Air Defense Control Post

ADVON—Advanced Echelon

AEF—Air Expeditionary Force

AERP—Aircrew Eye/Respiratory Protection

AETC—Air Education and Training Command

AF/IL—USAF Deputy Chief of Staff for Installations and Logistics

AFCESA—Air Force Civil Engineer Support Agency

AFDC—Air Force Doctrine Center

AFJMAN—Air Force Joint Manual

AFMS—Air Force Manpower Standard

AFN—Armed Forces Network

AFSC—Air Force Specialty Code

AFSOF—Air Force Special Operations Forces

AGE—Aerospace Ground Equipment

AGL—Above Ground Level

AIM-7M—U.S. Air-to-Air Missile, "Sparrow"

AIM-9—U.S. Air-to-Air Missile, "Sidewinder"

ALAD—Automatic Liquid Agent Detector

ALCM—Air-Launched Cruise Missile

ALICE Pack—All-Purpose Lightweight Individual Carrying Equipment Pack

AMRAAM—Advanced Medium-Range Air-to-Air Missile

AO—Area of Operation

AOR—Area of Responsibility

APOD—Aerial Port of Debarkation

APOE—Aerial Port of Embarkation

ARC—Air Reserve Component (AFR and ANG personnel combined)

ATBM—Anti-tactical Ballistic Missile

ATP—Allied Tactical Publication

ATSO—Ability to Survive and Operate

AWACS—Airborne Warning and Control System

BCE—Base Civil Engineer

BDA—Battle Damage Assessment; Bomb

BDO—Battle Dress Overgarment

BDU—Battledress Uniform

BEE—Bioenvironmental Engineering

BEPO—Base Emergency Preparedness Orientation

BIDS—Biological Integrated Detection System

BM—Ballistic Missile

BRAAT—Base Recovery After Attack

BVO—Black Vinyl Overboot

BW—Biological warfare; biological weapons

BWC—Biological and Toxin Weapons Convention

C2—Command and Control

C3 or C^3—Command, Control, and Communications

C4—Command, Control, Communications, and Computers

C41—Command, Control, Communications, Computers, and Intelligence

CAM—Chemical Agent Monitor

CANA—Convulsion, Antidote, Nerve Agent (Diazepam)

CB—Chemical-Biological

CBD—Chemical and Biological Defense

CBU—Cluster Bomb Unit

CBW—Chemical-Biological Warfare

CBWD—Chemical-Biological Warfare Defense

CBWDE—Chemical-Biological Warfare Defense Equipment

CCA—Contamination Control Areas

CCD—Camouflage, Concealment, and Deception

CCP—Casualty Collection Point

CCT—Contamination Control Team

CDM—Chemical Downwind Message

CERE—Combat Employment Readiness Exercise

CHAMP—Chemically Hardened Air Management Plant

CHATH—Chemically Hardened Air Transportable Hospital

CIEAP—PACAF **C**ommand **I**ntelligence **E**stimate for **A**ir base **O**Perations

CINC—Commander in Chief

CMBCC—Consolidated Mobility Bag Control Center

CMD—Cruise Missile Defense

COA—Course of Action

COB—Collocated Operating Base

COTS—Commercial Off-the-Shelf

CPS—Collective Protection System

ColPro—Collective Protection

CONOPS—Concept of Operations

CPO—Chemical Protection Overgarment

CRAF—Civil Reserve Air Fleet

CSC—Central Security Control

CW—Chemical Warfare; Chemical Weapons

CWC—Chemical Weapons Convention

CWTSAR—Chemical Warfare Theater Simulation of Airbase Resources

DART—Damage Assessment and Repair Team

DAT—Damage Assessment Team

DCC—Damage Control Center

DEFCON—Defense Readiness Conditions

DFP—Defensive Fighting Position

DIW—Detection, Identification, and Warning

DMZ—Demilitarized Zone

DNA—Defense Nuclear Agency (new designation is DSWA);

DNA—deoxyribonucleic acid

DOC Statement—Designed Operational Capability Statement

DS-2—Decontaminant Solution 2

DSWA—Defense Special Weapons Agency (formerly DNA)

DUBDS—Deployable Unit Biological Detection System

EA Cell—Emergency Action Cell

EDM—Effective Downwind Message

EDS—Estimated Downwind Speed

EET—Exercise Evaluation Team

EMP—Electromagnetic Pulse

EOD—Explosive Ordnance Disposal

EOR—Explosive Ordnance Reconnaissance

FM—Field Manual

GBU-26—Guided Glide Bomb Unit used to destroy hardened and deeply buried bunkers

GCC—Gulf Cooperation Council

GCE—Ground Crew Ensemble

GOTS—Government Off-the-Shelf

GPS—Global Positioning System

GVO—Green Vinyl Overboot

GZ—Ground Zero

HTA—High Threat Area

HMMWV—High Mobility Multipurpose Vehicle

IAEA—International Atomic Energy Agency

ICBM—Intercontinental Ballistic Missile

ICBPG—Improved Chemical-Biological Protective Glove

INF—Intermediate Range Nuclear Forces (treaty)

IPE—Individual Protective Equipment

IRBM—Intermediate-range Ballistic Missile

ITAP—Improved Toxicological Agent Protective

JAC—Joint Analysis Center

JBPDS—Joint Biological Point Detection System

JBREWS—Joint Biological Remote Early Warning System

JCAD—Joint Chemical Agent Detector

JFACC—Joint Force Air Component Commander

JFC—Joint Force Commander

JIC—Joint Intelligence Center

JS-LIST OG—Joint Service Lightweight Suit Technology Over Garment

JWARN—Joint Warning and Reporting Network

LDA—Lightweight Decontamination Apparatus

LFA—Large Frame Aircraft

LIMFAC—Limiting Factor

MAOS—Minimum Airfield Operating Surface

MCP—Mobile Command Post

MICS—Multi-Man Intermittent Cooling System

MOA—Memorandum of Agreement

MOA—Memorandum Of Agreement

MOB—Main Operating Base

MOOTW—Military Operations Other Than War

MOPP—Mission Oriented Protective Posture

MRBM—Medium-Range Ballistic Missile

MULO—MULtipurpose **O**verboot

NAIC—National Air Intelligence Center

NAPP—Nerve Agent Pretreatment, Pyridostigmine (9.9.2)

NATO—North American Treaty Organization

NBC—Nuclear, Biological, and Chemical

NBC/M—Nuclear, biological, or chemical weapons delivery means

NBCC—Nuclear, Biological, Chemical, Conventional

NBCCC—Nuclear, Biological, and Chemical Control Center

NBCWRS—Nuclear, Biological and Chemical Warning and Reporting System

NCA—National Command Authority

NEO—Noncombatant Evacuation Operations

NIS—New Independent States

NODONG—North Korean Ballistic Missile

NPT—Nuclear Nonproliferation Treaty (Refers to the 1968 Treaty on the Non-Proliferation of Nuclear Weapons)

NUDET—Nuclear Detonation

NUSSE3—Non-Uniform Simple Space Evaporation

ODS—Operation Desert Storm

ORI—Operational Readiness Inspection

ORM—Operational Risk Management

PAD—Point Air Defense

PB Tabs—Pyridostigmine Bromide Tablets (nerve agent pre-treatment)

PGM—Precision-Guided Munition

PMCS—Preventive Maintenance Checks and Services

PMEL—Precision Measurement Equipment Laboratory

POD—Point of Debarkation

POE—Point of Embarkation; Port of Entry

POL—Petroleum, Oil, and Lubricants

Prime BEEF—Prime Base Engineer Emergency Force

QDR—Quadrennial Defense Review

RADIAC—Radiation Detection, Indication, and Computation

RCA—Riot Control Agents

ROK—Republic of Korea

RRR—Rapid Runway Repair

RTP—Readiness Training Packages

RWMS—Readiness Wartime Manpower Standard

SAM—Surface-to-Air Missile

SCPE—Simplified Collective Protective Equipment

SCPS—Survivable Collective Protection Systems

SCUD—NATO designation for Soviet designed short-range ballistic missile

SITREP—Situation Report

SLBM—Submarine Launched Ballistic Missile

SMT—Shelter Management Teams

SNF—Short-range Nuclear Forces

SOF—Special Operations Forces

SOP—Standard Operating Procedures

SORTS—Status of Resources and Training System

SR BSDS—Short Range Biological Standoff Detection System

SRBM—Short-Range Ballistic Missile

SRC—Survival Recovery Center

SRR—Survival Recovery Reconstitution

START—Strategic Arms Reduction Treaty

STB—Super Tropical Bleach

SWA—Southwest Asia

TAEPO DONG—North Korean Ballistic Missile

TALCE—Tanker Airlift Control Element

TAP—Toxicological Aprons Protective

TBM—Tactical Ballistic Missile

TCPS—Transportable Collective Protection System

TEMPER—Tent, Expandable Modular Personnel (tents)

TFA—Toxic Free Area

THREATCON—Terrorist Threat Conditions

TO—Technical Order

TPFD—Time-Phased Force Deployment

TPFDD—Time-Phased Force and Deployment Data

TPFDDL—Time-Phased Force Deployment Data Listing

TSAR—Theater Simulation of Airbase Resources

TTM—Task Time Multipliers

UAV—Unmanned Aerial Vehicle

UCC—Unit Control Center

UN—United Nations

UNSCOM—United Nations Special Commission

UNSCR 687—United Nations Security Council Resolution, 1991, calling for Iraq to eliminate its NBC weapons and missiles and forbids it from developing, producing, possessing any NBC weapons or missiles with ranges greater than 150km

USACOM—U.S. Atlantic Command

USARIEM—US Army Research Institute of Environmental Medicine

UTC—Unit Type Code

UTM—Universal Transverse Mercator

UV—Ultra-Violet

UXO—Unexploded Ordnance

VAT—Vulnerability Assessment Tool

WHO—World Health Organization

WMD—Weapons Of Mass Destruction

WMD/M—Weapons of Mass Destruction/Missile; Weapons of Mass Destruction and the Means to deliver them

WOC—Wing Operations Center

WRM—War Reserve Material

Terms

Aeromedical Evacuation System—A system which provides: (1) control of patient movement by air transport; (2) specialized medical attendants and equipment for inflight medical care; (3) facilities on or in the vicinity of air strips and air bases for the limited medical care of intransit patients entering, en route, via, or leaving the system; and (4) communication with originating, destination, and en route medical facilities concerning patient transportation.

Agent Defeat Weapon (ADW)—capability to neutralize NBC weapons or materials in order to preclude the spreading of contamination beyond a containment vessel (e.g., storage bunker).

Antibiotic—A substance, as penicillin, that is produced by organisms such as fungi and bacteria, effective in the suppression or destruction of microorganisms, and widely used in the prevention and treatment of diseases.

Antidote—A remedy that counteracts the effects of a poison.

Antigen—A substance that when introduced into the body stimulates the production of an antibody.

Antisera—Human or animalserums having antibodies for at least one antigen.

Antiterrorism (AT)—Defensive measures used to reduce the vulnerability of individuals and property to terrorist acts, to include limited response and containment by local military forces.

Area of Responsibility (AOR)—The geographical area associated with a combatant command within which a combatant commander has authority to plan and conduct operations. (2) In naval usage, a predefined am of enemy terrain for which supporting ships are responsible for covering by fire on known targets or targets of opportunity and by observation.

Arms Control—A concept that connotes: (1) any plan, arrangement, or process, resting upon explicit or implicit international agreement, governing any aspect of the following: the numbers, types, and performance characteristics of weapon systems (including the command and control, logistics support arrangements, and any related intelligence gathering mechanism); and the numerical strength, organization, equipment, deployment, or employment of the Armed Forces retained by the parties (it encompasses disarmament); and (2) on some occasions, those measures taken for the purpose of reducing instability in the military environment.

Bare Base—A base having minimum essential facilities to house, sustain, and support operations to include, if required, a stabilized runway, taxiways, and aircraft parking areas. A bare base must have a source of water that can be made potable. Other requirements to operate under bare base conditions form a necessary part of the force package deployed to the bare base.

Battle Damage Assessment (BDA)—The timely and accurate estimate of damage resulting from the application of military force, either lethal or nonlethal, against a predetermined objective. Battle damage assessment can be applied to the employment of all types of weapon systems (air, ground, naval, and special forces weapon systems) throughout the range of military operations. Battle damage assessment is primarily an intelligence responsibility with required inputs and coordination from the operators. Battle damage assessment is composed of physical damage assessment, functional damage assessment, and target system assessment.

Biological Agent—A microorganism that causes disease in personnel, plants, or animals or causes the deterioration of materiel.

Biological Defense—The methods, plans, and procedures involved in establishing and executing defensive measures against attacks using biological agents.

Biotechnology—The engineering and biological study of relationships between human beings and machines.

Chemical Agent—A chemical substance which is intended for use in military operations to kill, seriously injure, or incapacitate personnel through its physiological effects. The term excludes riot control agents, herbicides, smoke, and flame.

Chemical Defense—The methods, plans, and procedures involved in establishing and executing defensive measures against attack utilizing chemical agents.

Chemical Dose—The amount of chemical agent, expressed in milligrams, that is taken or absorbed by the body.

Chemical Monitoring—The continued or periodic process of determining whether or not a chemical agent is present.

Chemical Survey—The directed effort to determine the nature and degree of chemical hazard in an area and to delineate the perimeter of the hazard area.

Chemical Warfare (CW)—All aspects of military operations involving the employment of lethal and incapacitating munitions/agents and the warning and protective measures associated with such offensive operations. Since riot control agents and herbicides are not considered to be chemical warfare agents, those two items will be referred to separately or under the broader term "chemical." The term "chemical warfare weapons" may be used when it is desired to reflect both lethal and incapacitating munitions/agents of either chemical or biological origin.

Chemoprophylaxis—Use of chemicals in the prevention of infectious diseases.

Coalition—An ad hoc arrangement between two or more nations for common action.

Coalition Force—A force composed of military elements of nations that have formed a temporary alliance for some specific purpose.

Collateral Effect—collateral effects are the physical, psychological, operational, political, and strategic consequences that result from the deliberate or accidental detonation of a WMD or the release of nuclear, chemical, biological, and/or radiological contaminants that are unrelated to the primary target.

Collective Nuclear, Biological, and Chemical Protection—Protection provided to a group of individuals in a nuclear, biological, and chemical environment which permits relaxation of individual nuclear, biological, and chemical protection.

Collective protection (ColPro)—systems protect those inside a building, room, shelter or tent against contamination through the combination of impermeable structural materials, air filtration equipment, air locks, and overpressurization.

Concept Of Operations (CONOPS)—A verbal or graphic statement, in broad outline, of a commander's assumptions or intent in regard to an operation or series of operations. The concept of operations frequently is embodied in campaign plans and operation plans; in the latter case, particularly when the plans cover a series of connected operations to be carried out simultaneously or in succession. The concept is designed to give an overall picture of the operation. it is included primarily for additional clarity of purpose.

Contamination—(I) The deposit, absorption, or adsorption of radioactive material, or of biological or chemical agents on or by structures, areas, personnel, or objects. (2) Food and/or water made unfit for consumption by humans or animals because of the presence of environmental chemicals, radioactive elements, bacteria, or organisms, the byproduct of the growth of bacteria or organisms, the decomposing material (to include the food substance itself), or waste in the food or water.

Contamination Avoidance—Actions to prevent contamination from getting on mission-essential resources and personnel, whether directly from agent deposition or by transfer from contaminated surfaces.

Contamination Control—Procedures to avoid, reduce, remove, or render harmless, temporarily or permanently, nuclear, biological, and chemical contamination for the purpose of maintaining or enhancing the efficient conduct of military operations.

Contamination Control Area—An area in which chemically contaminated individual protective equipment (IPE) is removed; people, equipment, and supplies are decontaminated to allow processing between a toxic environment and a toxic free area; and people exiting a toxic free area may safely don IPE.

Contamination Control—Procedures to avoid, reduce, remove, or render harmless, nuclear, biological, and chemical contamination. Such procedures may be temporary or permanent and are carried out to maintain or enhance the efficient conduct of military operations.

Control Center—A unit command and control function. Control centers monitor unit resources and mission capability and coordinate unit activities during disaster operations.

Conventional Weapon—A weapon which is neither nuclear, biological, nor chemical.

Counterforce (CF)—in the context of fighting an adversary equipped with WMD and the means to deliver it (WMD/M), counterforce means the employment of special operations, strategic air and/or missile forces in an effort to deny, disrupt, tender impotent, or destroy selected WMD-related capabilities during proliferation, production, weaponization, deployment or employment.

Counterproliferation (CP)—The activities of the Department of Defense across the full range of U.S.

Government efforts to - combat proliferation, including the application of military power to protect U.S. forces and interests; intelligence collection and analysis; and support to diplomacy, arms control, export controls; with particular responsibility for ensuring U.S. forces and interests can be protected should they confront an adversary armed with weapons of mass destruction or missiles.

Decontamination—The process of making any person, object or area safe by absorbing, destroying, neutralizing, making harmless, or removing chemical or biological agents or by removing radioactive material clinging to or around it. As a part of the contamination control process, decontamination operations are intended to help sustain or enhance conduct of military operations by preventing or minimizing performance degradation, casualties, or loss of material. See definitions of immediate, operational, thorough and reconstitution decontamination.

Defense readiness conditions (DEFCON)—Uniform system of progressive alert postures for use between the Chairman of the Joint Chiefs of Staff and the commanders of unified and specified commands and for use by the Services. Defense readiness conditions are graduated to match situations of varying military severity (status of alert). Defense readiness conditions are identified by the short title DEFCON (5), (4), (3), (2), and (1), as appropriate.

Deliberate Planning—(1) The Joint Operation Planning and Execution System process involving the development of joint operation plans for contingencies identified in joint strategic planning documents. Conducted principally in peacetime, deliberate planning is accomplished in prescribed cycles that complement other Department of Defense planning cycles in accordance with the formally, established Joint Strategic Planning System. (2) A planning process for the deployment or employment of apportioned forces and resources that occurs in response to a hypothetical situation. Deliberate planners rely heavily on assumptions regarding the circumstances that will exist when the plan is executed.

Deterrence—The prevention from action by fear of the consequences. Deterrence is a state of mind brought about by the existence of a credible threat of unacceptable counteraction.

Dewarning Levels—Designated time intervals associated with established MOPP levels and variations such as MOPP Alpha and "Mask Only" variation.

DICE FIVE Pattern—A rectangle with five detectors, one in each corner; one in the center.

Dispersal—Relocation of forces for the purpose of increasing survivability.

Electromagnetic Pulse (EMP)—The electromagnetic radiation from a nuclear explosion caused by Compton-recoil electrons and photoelectrons from photons scattered in the materials of the nuclear device or in a surrounding medium. The resulting electric and magnetic fields may couple with electrical/ electronic systems to produce damaging current and voltage surges. May also be caused by nonnuclear means.

Emergency Relocation Site—A site located where practicable outside a prime target area to which all or portions of a civilian or military headquarters may be moved. As a minimum, it is manned to provide for the maintenance of the facility, communications, and date base. It should be capable of rapid activation, of supporting the initial requirements of the relocated headquarters for a predetermined period, and of expansion to meet wartime requirements of the relocated headquarters.

Force Protection—Security program designed to protect service members, civilian employees, family members, facilities, and equipment, in all locations and situations, accomplished through planned and integrated application of combating terrorism, physical security, operations security, personal protective services, law enforcement, and supported by intelligence, counterintelligence, and other security programs to ensure combat capability.

Host Nation—A nation which receives the forces and/or supplies of allied nations and/or NATO organizations to be located on, to operate in, or to transit through its territory.

Host-Nation Support—Civil and/or military assistance rendered by a nation to foreign forces within its territory during peacetime, crises, or emergencies, or war based on agreements mutually concluded between nations.

Immediate Decontamination—Decontamination that involves:

Aim - minimize casualties, save lives, and limit the spread of contamination

When - conducted as soon as someone suspects they have been contaminated

Who - individual

What - skin, personal clothing, and equipment

Immunoprophylaxis—Prophylactic immunization is the only means of providing continuous protection against BW threats prior to, as well as during, hostile actions.

Incapacitating Agent—An agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties.

Individual Protective Equipment (IPE)—in nuclear, biological and chemical warfare, the personal clothing and equipment required to protect an individual from biological and chemical hazards and some nuclear effects.

Interoperability—(1) The ability of systems, units or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together. (2) The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases.

Limiting Factor—A factor or condition that, either temporarily or permanently, impedes mission accomplishment. Illustrative examples are transportation network deficiencies, lack of in-place facilities, malpositioned forces or materiel, extreme climatic conditions, distance, transit or overflight rights, political conditions, etc.

Main Operating Base (MOB)—In special operations, a base established by a joint force special operations component commander or a subordinate special operations component commander in friendly territory to provide sustained command and control, administration, and logistical support to special operations activities in designated areas.

Medical Casualty—A general term for a wounded, injured, or sick person who has not yet been admitted to a medical facility for treatment. The term does not include fatalities.

Medical countermeasures—Fall into three basic categories: prophylactic (preventative), therapeutic (post-exposure), and diagnostic.

mg-min/m^3—An expression of the concentration (in milligrams) of an agent in the air breathed in for a specific period (in minutes; usually a 10 minute exposure) contained within a specific volume of air (1 cubic meter)

Military Operations Other Than War (MOOTW)—Operations that encompass the use of military capabilities across the range of military operations short of war. These military actions can be applied to complement any combination of the other instruments of national power and occur before, during, and after war.

National Command Authorities (NCA)—The President and the Secretary of Defense or their duty deputized alternates or successors.

NBC Defense—Nuclear defense, biological defense, areas, and chemical defense, collectively. The term may not be used in the context of U.S. offensive operations.

Nonproliferation—The use of the full range of political economic, international, and military tools to prevent proliferation, reverse it diplomatically, or protect U.S interests against an opponent armed with weapons of mass destruction, should that prove necessary.

Nuclear, Biological-, and Chemical-Capable Nation—A nation that has the capability to produce and employ one or more types of nuclear, biological, and chemical weapons across the full range of military operations and at any level of war in order to achieve political and military objectives.

Operational Decontamination—Decontamination that involves:

Aim - minimize contact or transfer hazard and sustain operations.

When - conducted when operations require.

Who - individual, crews, teams, or units.

What - specific parts of operationally essential equipment, material, work areas and exchange of individual protective equipment.

Planning Documents—Base DP program guidance and policy publications. These include plans, standard publications, host-tenant and inter-service support agreements, memoranda of understanding, and operating instructions and checklists for external activities. The Readiness Flight may be the OPR for all or part of the documents.

Port Of Debarkation (POD)—The geographic point at which cargo or personnel are discharged. May be a seaport or aerial port of debarkation (APOD). For unit requirements, it may or may not coincide with the destination.

Port Of Embarkation (POE)—The geographic point in a routing scheme from which cargo or personnel depart. May be a seaport or aerial port (APOE) from which personnel and equipment flow to port of debarkation. For unit and nonunit requirements, it may or may not coincide with the origin.

Post-attack Phase—In NBCC warfare, the period between termination of the final attack and formal political termination of hostilities. In base recovery after attack actions, it is the period after an attack where the installation assesses damage and repairs mission critical facilities.

Preattack Phase—A term used in planning for general war. It is the period from the present until the first enemy weapon impacts.

Principles Of CB Defense—Avoidance, protection, and contamination control (defined as decontamination in Joint Pub 3-11).

The principle of avoidance includes the elements of detection, identification, prediction, warning, reporting, marking, and relocation or rerouting.

The protection principle includes typical CB defense measures involving use of individual protective equipment, shelters, and specific medical countermeasures.

The contamination control principle includes a variety of contamination containment and avoidance activities as well as decontamination actions.

Proliferant—Any actor (i.e., a state, group of states, state-sponsored organization, or non-state entity) who furnishes, acquires, researches, develops, stores, tests, or deploys WMD in violation to existing international norms.

Proliferation—The process by which one nation after another comes into possession of, or into the right to determine the use of nuclear, biological, or chemical weapons, each potentially able to launch a NBC attack upon another nation.

Prophylactic Vaccinations—Preventive inoculations with a vaccine so as to protect against a given disease.

Radiological Defense—Defensive measures taken against the radiation hazards resulting from the employment of nuclear and radiological weapons.

Readiness—The ability of U S. military forces to fight and meet the demands of the national military strategy. Readiness is the synthesis of two distinct but interrelated levels: (a) unit readiness - The ability to provide capabilities required by the combatant commanders to execute their assigned missions. This is derived from the ability of each unit to deliver the outputs for which it was designed. (b) joint readiness- The combatant commander's ability to integrate and synchronize ready combat and support forces to execute his or her assigned missions.

Reconstitution—Decontamination that involves:

Aim - eliminate contamination to restore mission critical resources to a condition which permits unrestricted use, handling, or operation, and release from military control. (Decontaminate to the national standards of the location to which the resources will be sent. If no national standards are available, use US standards.)

When - conducted after hostile actions have terminated, when the commander determines it is in the unit's best interest, or when directed by higher authority.

Who - units or wings with external support.

What - mission critical aircraft, equipment, material, work areas and terrain.

Relocation—Moving mission-essential functions and personnel from high- to low-risk target areas for survival, recovery, and reconstitution. Relocation is also synonymous with evacuation/dispersal.

Riot Control Agent—A substance which produces temporary irritating or disabling physical effects that disappear within minutes of removal from exposure. There is no significant risk of permanent injury, and medical treatment is rarely required.

Shelf Life—The length of time during which an item of supply, subject to deterioration or having a limited life which cannot . be renewed, is considered serviceable while stored.

Shelters—Structures that protect personnel from exposure to CB contamination. As a minimum, they provide a physical barrier that keeps a portion of the contamination away from the people inside.

Terrorist Threat Conditions (THREATCON)—A Chairman of the Joint Chiefs of Staff-approved program standardizing the Military Services identification' of and recommended responses to terrorist threats against U.S. personnel and facilities. This program facilitates inter-Service coordination and support for antiterrorism activities.

Theater of Operations—A subarea within a theater of war defined by the geographic combatant commander required to conduct or support specific combat operations. Different theaters of operations within the same theater of war will normally be geographically separate and focused on different enemy forces. Theaters of operations are usually of significant size, allowing for operations over extended periods of time.

Theater Of War—Defined by the National Command Authorities or the geographic combatant commander, the area of air, land, and water that is, or may become, directly involved in the conduct of the war. A theater of war does not normally encompass the geographic combatant commanders entire area of responsibility and may contain more that one theater of operations.

Thorough Decontamination—Decontamination that involves:

Aim - reduce contamination to the lowest possible levels, to permit partial or total removal of IPE and maintain operations with minimum degradation.

When - conducted when operations, manning, and resources permit.

Who - units or wings, with or without external support.

What - personnel, equipment, material, or work areas (may include some terrain beyond the scope of operational decontamination.

Time-Phased Force And Deployment Data (TPFD)—The Joint Operation Planning and Execution System data base portion of an operation plan; it contains time-phased force data, non-unit-related cargo and personnel data, and movement data for the operation plan, including: (1) In-place units, (2) Units to be deployed to support the operation plan with a priority indicating the desired sequence for their arrival at the port of debarkation, (3) Routing of forces to be deployed, (4) Movement data associated with deploying forces, (5) Estimates of non-unit-related cargo and personnel movements to be conducted concurrently with the deployment of forces, and (6) Estimate of transportation requirements that must be fulfilled by common-user lift resources as well as those requirements that can be fulfilled by assigned or attached transportation resources.

Toxic Free Areas—Provide personnel the ability to work or obtain rest and relief without wearing IPE.

Toxin Agent—A poison formed as a specific secretion product in the metabolism of a vegetable or animal organism as distinguished from inorganic poisons. Such poisons can also be manufactured by synthetic processes.

Trans-Attack Phase—In NBCC warfare, the period from initiation of the attack to its termination.

Unit—Any organizational element above branch or section level, such as squadron, division, directorate, deputate, or staff agency.

US Air Force Resources—Military and civilian personnel of active and reserve components; facilities, equipment, vehicles, and supplies under the control of the US Air Force; and services the US Air Force performs including airlift and other transportation services.

Weapons Of Mass Destruction (WMD)—Weapons that cause indiscriminate, widespread destruction. Such weapons include nuclear, biological, and chemical weapons in any form, and associated delivery system. These three types of weapons are also referred to as NBC weapons. In arms control usage includes radiological weapons, but excludes the means of transporting or propelling the weapon where such means is a separable and divisible part of the weapon.

Weapons Of Mass Destruction And The Means To Deliver Them (WMD/—M) - The term currently embraces all of nuclear, chemical, biological and radiological weapons and a select set of means of transporting or propelling the weapons to a target. The current select set of means includes ballistic and cruise missiles, UAVs, aircraft and special operations forces.

Attachment 2

CHEMICAL AGENT CHARACTERISTICS

A2.1. CW Agent Classes. Lethal chemical warfare agents are effective in both vapor and liquid phases. They pose liquid contact, vapor contact, and vapor inhalation hazards. Chemical agents are classified according to physical state, physiological action, and use. These agents include: (1) Nerve Agents, (2) Blister Agents, (3) Choking Agents, and (4) Blood Agents. Threats to Air Force operations revolve primarily around the persistent nerve and blister agents. Chemical agents may exist as solids, liquids, or gases. To a certain extent the state in which an agent exists determines its use, duration, effectiveness, and physiological action. The physical state of an agent also contributes to a determination on munitions delivery vehicle and methods used for its dissemination. More detailed information is available in AFJPAM 32-4008, *Technical Aspects of Military Significant Chemical Agents/Compounds*, or the Threat Compendium, Worldwide Threat to Airbases: 1995-2005, NAIC-2660F-265-95, 1 September 1994.

A2.2. Chemical Agent Effectiveness. Several factors determine the time a chemical agent remains effective. These include the method of dissemination, physical properties of the agent, and environmental factors such as weather, terrain, and target conditions.

A2.2.1. The size of the particles disseminated greatly influences the effectiveness of liquid or solid agents. Gaseous (vapors) or aerosols (air-contaminating agents) do not persist as long as liquid or solid agents used to contaminate terrain and materiel. Physical properties of the agent influence the rate of evaporation. Vapor pressure and volatility are especially important in determining the duration of effectiveness of an agent. Gases (vapors), aerosols, and highly volatile liquids tend to disperse rapidly after release. Thus, they present an immediate short-duration hazard. Liquid drops remain a hazard longer than finely divided particles. Also, viscous materials tend to adhere and not spread or flow readily and increase persistency.

A2.2.2. In explosive munitions the degree of division depends on the amount and the type of burster charge and the fuzing of the munition (air or ground burst). Nonexploding types of munitions, such as aerosol generators and spray tanks, can vary the degree of dispersion and thereby influence the duration and effectiveness of agents.

A2.2.3. Many weather factors influence the duration of effectiveness. The most important are temperature, temperature gradient (stability) and wind speed. See Army FM 3-6 for a detailed discussion of the impact of weather on duration. In general, the higher the ground or surface temperature, the quicker a liquid chemical agent will evaporate from it. High winds increase the rate of evaporation of liquid agents and also disperse chemical clouds more rapidly than low winds. Stable (inversion) conditions require less munitions to create the same casualty effects as in neutral or lapse conditions. During an inversion, airborne agents tend to remain near the ground, while unstable conditions disperse and dilute vapors due to increased air mixing.

A2.2.4. The terrain plays an important part in the duration and effectiveness of an agent at the target. Chemical agents cling to vegetation, increasing the area for contact and slowing evaporation. Low wind speeds and reduced temperatures in heavily wooded and jungle areas will retain vapors longer. Liquids quickly soak into porous surfaces and soils which make them evaporate more slowly than nonporous surfaces. This increases the duration of any vapor hazard, although it reduces vapor cloud concentration. Finally, toxic clouds follow the contour of the surface of the terrain. These clouds tend to go around obstacles such as hills and persist in hollows, low ground and buildings.

A2.3. Agent Volatility. In recognition of the importance of agent volatility, agents are further classified as either persistent or nonpersistent compounds. Nonpersistent agents convert to vapor rapidly (usually within a few minutes), and consequently produce high agent density clouds that are quickly blown clear of the target area. Such agents pose brief liquid contact hazards and brief but intense vapor contact and inhalation hazards. Persistent agents pose a longer (hours to days) liquid contact hazard, and longer but less intense vapor contact and vapor inhalation hazards.

A2.4. Dusty Agents. Dry chemical agent aerosols are also practical. These are called dusty agents. They may be produced of finely ground dry agent or agent coated dry aerosol powders. They are not new. They have been investigated since the 1930s. Mustard (HD) and Sarin (GB)-impregnated silica powders are among the more common of these (Joint Pub 3-11 1992).

A2.5. Agent Cocktailing. Agents are not always used in pure form (neat). Additives can be mixed with agent for a variety of reasons. Lewisite/mustard mixes have been recommended for use in some conditions where it is desirable to lower mustard's freezing point. Mixtures of a high and low volatility agents can provide intense initial challenge with the persistence required to force prolonged use of protective posture.

A2.6. Agent Thickeners. Various chemical additives can be mixed with chemicals to alter their flow and, therefore, their droplet breakup properties, and to slow their evaporation. Agent thickeners can provide sufficient control of drop size of agent bulk-released at altitude (1,000-2,000 meters) to keep the loss of agent at or near release altitude within acceptable bounds, can effectively increase agent persistence, and can enhance percutaneous agent uptake. Effective CW agent thickening is feasible. The benefits are widely appreciated.

A2.7. Concentration. To simplify the medical terminology that may sometimes hinder the understanding of what is taking place as exposure to an agent runs its course, keep the following definitions in mind.

A2.7.1. ICt_{50} is the product of concentration of the agent times the length of exposure time to the agent which causes nonlethal casualties in 50% of the exposed population; referring to vapor, aerosol, or gas exposure.

A2.7.2. LCt_{50} is the product of concentration of the agent times the length of exposure time to the agent which causes lethal casualties in 50% of the exposed population; again referring to vapor, aerosol, or gas exposure.

A2.7.3. ID_{50} is that dose which produces incapacitating effects in 50% of the exposed population.

A2.7.4. LD_{50} is that dose which produces death in 50% of the exposed population.

A2.7.5. ED_{50} is that dose that causes an effect in 50% of the exposed population.

A2.8. Nerve Agents. Traditional nerve agents fall into either the G or V agent classes. These are organophosphate compounds whose dominant effect is attributed to interference with acetylcholine mediated nerve-to-nerve or nerve-to-muscle impulse transmission. Two additional types of nerve agent, NOVICHOK and GV agents have recently emerged. The open literature suggests that representatives of both may be suitable for warfare use.

A2.8.1. G, V, GV, and NOVICHOK class agents owe their effectiveness largely to interference with nerve cell-to-nerve cell impulse transmission or to nerve cell-to-muscle cell impulse transmission. They do so by inhibiting an enzyme, acetylcholinesterase (ACHE), that normally removes the neurotransmitter acetylcholine from nerve-to-nerve or nerve-to-muscle junctions at the end of impulse transmission, thereby allowing restitution of the normal, resting cell membrane polarization. Nerve and skeletal muscle cells must repolarize between impulse transmissions.

A2.8.2. Interference with acetylcholine-mediated impulse transmission produces a variety of symptoms. Low doses of ACHE inhibitor cause pupillary constriction with some reduction in near vision and night vision. Higher doses are associated with a runny nose, excessive bronchial, salivary and ocular secretions, sweating, miosis, bronchospasm, bradycardia, weakness, tightness in the chest, eye pain, confusion, nausea, localized muscle twitching, and a generally unpleasant feeling. Still higher doses cause vomiting, unconsciousness, convulsions, and death. Nerve agents may also act on the central nervous system's ion channel complexes.

A2.8.3. Tabun (GA). Tabun was the first of the WW II German nerve agents. It was discovered in the late 1930's by the German firm IG Farben. Tabun was in production by 1940 and became the world's first weaponized nerve agent. GA is a brownish to colorless liquid that gives off a colorless vapor. It enters the body primarily through the respiratory tract, but is also highly toxic when absorbed through the skin and digestive tract. It is approximately 20 times more persistent than GB but not as stable in storage.

Table A2.1. Tabun (GA).

TABUN (GA)	
Physical State	Colorless to brown liquid that gives off colorless vapor.
Odor	Faintly fruity; none when pure.
Skin and Eye Toxicity	Eyes: Very high toxicity; much greater through eyes than through skin. Very low concentration of vapor (estimated 2.5 mg-min/m3) causes pupil of eyes to constrict, resulting in difficulty in seeing in dim light (miosis). Skin: Very toxic. Decontamination of smallest drop of liquid agent is essential. Liquid penetrates skin readily.
Protection Required	Protective mask and protective clothing. Clothing off gasses G-agents for about 30 minutes after contact with vapor; consider this fact before unmasking. Immediately remove all liquid from clothing.
Decontamination	Eyes: Flush eyes with water immediately. Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. Calcium hypochlorite (HTH), supertropical bleach (STB), household bleach, caustic soda, and diluted alkali solutions are effective on equipment. Use steam and ammonia or hot, soapy water in a confined area. Note: GA may react to form Cyanogen chloride (CK) in bleach slurry.
Persistency	Depends on munitions used and the weather. Heavily splashed liquids persist one to two days under average weather conditions. GA evaporates about 20 times more slowly than water. GA in water can persist about one day at 20°C and about six days at 5°C. GA persists about twice as long in sea water.

PROPERTY		**DOSAGE RESPONSE**		
Formula[1,2]	$C_5H_{11}N_2O_2P$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	162.1 g/mol	Inhalation Dosage[2]	Lethal	150 mg•min/m^3
Melting Point[1,2]	-50 °C		Severe Incapacitation	110 mg•min/m^3
Boiling Point[1,2]	247.5 °C		Mild Incapacitation	85 mg•min/m^3
Vapor Pressure[1]	4.83 Pa	Percutaneous Vapor Dosage[2]	Lethal	12,000 mg•min/m^3
Vapor Pressure Constant[1]	7650 K		Severe Incapacitation	8,000 mg•min/m^3
Density[1,2]	1080 kg/m^3		Mild Incapacitation	4,500 mg•min/m3
Surface Tension[1]	0.033 N/m	Percutaneous Liquid Dose[2]	Lethal	2,750 mg/man
Viscosity[1]	0.00256 kg/ms		Severe Incapacitation	1,800 mg/man

TABUN (GA)				
Viscosity Constant[1]	2100 K		Mild Incapacitation	1,100 mg/man
Diffusion Coefficient[1]	5.1 mm^2/s	Ocular Dosage[2]	Incapacitation	4.4 mg-min/m^3
[1]van Beest and Medema 1994 [2]Wells et al. 1993a				

A2.8.4. Sarin (GB). Sarin is also a WWII Nerve agent. The Germans developed GB after they developed GA, hence the designation GB. It is more volatile and more toxic than Tabun. When the U.S. maintained a CW program, it relied on GB and VX as its nerve agents. Sarin is reported to be in more CW arsenals than any other nerve agent. Pure GB is odorless and colorless. The physiological symptoms of GB are essentially the same as those of other nerve agents.

Table A2.2. Sarin (GB).

Sarin (GB)	
Physical State	Colorless liquid.
Odor	Almost none when pure.
Skin and Eye Toxicity	Eyes: Very high toxicity; much greater through eyes than through skin. Very low concentration of vapor (estimated 2.5 mg-min/m^3) causes pupil of eyes to constrict, resulting in difficulty in seeing in dim light (miosis). Skin: Lethal dose (LD) is 1.7 grams per person. Liquid does not injure skin but penetrates it rapidly. Immediate decontamination of smallest drop is essential. Vapor penetrates skin also. Death usually occurs within 15 minutes after absorption of fatal dosage.
Protection Required	Protective mask and protective clothing. Clothing off gasses G-agents for about 30 minutes after contact with vapor; consider this fact before unmasking. Immediately remove all liquid from clothing.
Decontamination	Eyes: Flush eyes with water immediately. Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. Calcium hypochlorite (HTH), supertropical bleach (STB), household bleach, caustic soda, and diluted alkali solutions are effective on equipment. Use steam and ammonia or hot, soapy water in a confined area.
Persistency	Depends on munitions used and the weather. Evaporates at approximately the same rate as water or kerosene. GB is less persistent than GA.

Property		**Dosage Response**		
Formula[1,2]	$C_4H_{10}FO_2P$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	140.1 g/mol	Inhalation Dosage[3]	Lethal	35 mg•min/m^3
Melting Point[1,2]	-56.9 °C		Severe Incapacitation	25 mg•min/m^3
Boiling Point[1,2]	157.7 °C		Mild Incapacitation	15 mg•min/m^3
Vapor Pressure[1]	282 Pa	Percutaneous Vapor Dosage[3]	Lethal	4,000 mg•min/m^3
Vapor Pressure Constant[1]	5650 °K		Severe Incapacitation	2,500 mg•min/m^3
Density[1,2]	1095 kg/m3		Mild Incapacitation	1,500 mg•min/m^3
Surface Tension[1]	0.0255 N/m	Percutaneous Liquid Dose[3]	Lethal	900 mg/man
Viscosity[1]	0.00154 kg/ms		Severe Incapacitation	700 mg/man

Sarin (GB)				
Viscosity Constant[1]	1800 K		Mild Incapacitation	550 mg/man
Diffusion Coefficient[1]	5.9 mm^2/s	Ocular Dosage[3]	Incapacitation	2.5 mg•min/m^3
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008 [3]Wells et al. 1993a				

A2.8.5. Soman (GD). Soman was the last of the nerve agents developed during WW II. Soman is the most poisonous of the G-agents, apparently because of the ease with which it can penetrate into the central nervous system. Soman intoxication is sufficiently different than that of GA, GB, or VX to make it noticeably more difficult to treat (Dunn and Sidell 1989). GD is a colorless liquid that gives off a colorless vapor. The addition of thickeners increases GD persistency and hazard. The usual thickened form of GD is designated TGD. VR-55 is another designation for thickened Soman.

Table A2.3. Soman (GD).

Soman (GD)	
Physical State	Colorless liquid that gives off colorless vapor.
Odor	Fruity; impurities give it the odor of camphor.
Skin and Eye Toxicity	Eyes: Very high toxicity; much greater through eyes than through skin. Vapor causes pupil of eyes to constrict, resulting in difficulty in seeing in dim light (miosis). Skin: Extremely toxic by skin absorption. The estimated LD50 is 0.35 grams per person on bare skin (1.4 grams per person in ordinary clothing). Liquid does not injure skin but penetrates it rapidly. Immediate decontamination of smallest drop is essential. Death usually occurs within 15 minutes after absorption of fatal dosage.
Protection Required	Protective mask and protective clothing. Clothing off gasses G-agents for about 30 minutes after contact with vapor; consider this fact before unmasking. Immediately remove all liquid from clothing.
Decontamination	Eyes: Flush eyes with water immediately. Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. Calcium hypochlorite (HTH), supertropical bleach (STB), household bleach, caustic soda, and diluted alkali solutions are effective on equipment. Use steam and ammonia or hot, soapy water in a confined area.
Persistency	Depends on munitions used and the weather. Heavily splashed liquids persist one to two days under average weather conditions. GD is calculated to evaporate about four times as slowly as water. Addition of agent thickeners can greatly increase persistency.

Property		**Dosage Response**		
Formula[1,2]	$C_7H_{18}FO_2P$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	182.2 g/mol	Inhalation Dosage[3]	Lethal	20 mg•min/m^3
Melting Point[1,2]	-42 °C		Severe Incapacitation	12 mg•min/m^3
Boiling Point[1,2]	197.8 °C		Mild Incapacitation	8 mg•min/m^3
Vapor Pressure[1]	36.4 Pa	Percutaneous Vapor Dosage[3]	Lethal	4,000 mg•min/m^3
Vapor Pressure Constant[1]	6630 °K		Severe Incapacitation	2500 mg•min/m^3
Density[1,2]	1027 kg/m^3		Mild Incapacitation	1500 mg•min/m^3

Soman (GD)				
Surface Tension[1]	0.0251 N/m	Percutaneous Liquid Dose[3]	Lethal	1,100 mg/man
Viscosity[1]	0.00364 kg/ms		Severe Incapacitation	650 mg/man
Viscosity Constant[1]	2,400 K		Mild Incapacitation	350 mg/man
Diffusion Coefficient[1]	4.5 mm2/s	Ocular Dosage[3]	Incapacitation	0.4 mg•min/m^3
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008 [3]Wells et al. 1993a				

A2.8.6. Cyclosarin (GF). Cyclosarin (cyclohexyl methylphosphonofluoridate, CMPF) is also a nerve agent. It is structurally similar to Sarin. GF is the most persistent (least volatile) of the G-agents. It has never been popular, probably because it is less stable than other G-agents and because it is subject to excessive flashing (burning) upon explosive dissemination (Spectral Intelligence 1991). Nevertheless, Iraq produced and weaponized GF prior to the Gulf War (Browder 1993; Gander 1992). GF is a fluoride-containing organophosphate. It is a slightly volatile liquid that is almost insoluble in water. It enters the body primarily through the respiratory tract but is also highly toxic through the skin and digestive tract. It is a strong cholinesterase inhibitor. It is approximately 20 times more persistent than Sarin.

Table A2.4. Cyclosarin (GF).

Cyclosarin GF	
Physical State	Liquid.
Odor	No information given.
Skin and Eye Toxicity	Toxicity information reports LD50 values in mice from 16 to 400 micrograms per kilogram, compared to LD50 of 200 micrograms per kilogram for Sarin (GB).
Protection Required	Protective mask and protective clothing.
Decontamination	Eyes: Flush eyes with water immediately. Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. Calcium hypochlorite (HTH), supertropical bleach (STB), household bleach, caustic soda, and diluted alkali solutions are effective on equipment. Use steam and ammonia or hot, soapy water in a confined area.
Persistency	GF is about as persistent as Tabun (GA). GF evaporates about 20 times more slowly than water. .Heavily splashed liquids persist one to two days under average weather conditions.

Property		**Dosage Response**		
Formula[1,2]	$C_7H_{14}FO_2P$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	180.2 g/mol	Inhalation Dosage[3]	Lethal	75 mg•min/m^3
Melting Point[1,2]	-50 °C		Severe Incapacitation	30 mg•min/m^3
Boiling Point[1,2]	298.4 °C		Mild Incapacitation	20 mg•min/m^3
Vapor Pressure[1]	5.88 Pa	Percutaneous Vapor Dosage[3]	Lethal	15,000 mg•min/m^3
Vapor Pressure Constant[1]	7,860 K		Severe Incapacitation	8,000 mg•min/m^3
Density[1,2]	1,133 kg/m^3		Mild Incapacitation	5,000 mg•min/m^3
Surface Tension[1]	0.0329 N/m	Percutaneous Liquid Dose[3]	Lethal	850 mg/man
Viscosity[1]	0.0064 kg/ms		Severe Incapacitation	500 mg/man
Viscosity Constant[1]	2,550 K		Mild Incapacitation	350 mg/man

Cyclosarin GF				
Diffusion Coefficient1	4.9 mm^2/s	Ocular Dosage[3]	Incapacitation	Unknown

[1]van Beest and Medema 1994
[2]AFJMAN 32-4008
[3]Wells et al. 1993a

A2.8.7. VX (No Common Name). V-series agents were discovered In 1952 by Britain's Imperial Chemical Industries in the course of research into organophosphate insecticides (Spectral Intelligence 1991). VX is the most common of the V-series compounds. It is a persistent (low volatility) agent that is substantially more toxic than any known G-agent. It is a very persistent, odorless, amber-colored liquid, similar in appearance to motor oil. Although VX is many times more persistent than the G-agents, it is very similar to GB in mechanism of action and effects. Because VX has low volatility, liquid droplets on the skin do not evaporate quickly, thereby increasing absorption. VX by this percutaneous route is estimated to be more than 100 times as toxic as GB. VX by inhalation is estimated to be twice as toxic as GB.

Table A2.5. VX.

VX	
Physical State	Amber-colored oily liquid.
Odor	None.
Skin and Eye Toxicity	Extremely toxic by skin and eye absorption; about 100 times as potent as GB. Liquid does not injure the skin or eye but penetrates rapidly. Immediate decontamination of the smallest drop is essential. The rate of action is very rapid. Death usually occurs within 15 minutes after absorption of fatal dosage.
Protection Required	Protective mask and protective clothing.
Decontamination	Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. Calcium hypochlorite (HTH) and supertropical bleach (STB) slurries, and household bleach are effective on equipment.
Persistency	Depends on munitions used and the weather. Heavily splashed liquid persists for long periods under average weather conditions. In very cold weather VX can persist for months. VX is calculated to be approximately 1,500 times slower in evaporating than GB.

Property		**Dosage Response**		
Formula[1,2]	$C_{11}H_{26}NO_2PS$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	267.4 kg/mol	Inhalation Dosage[3]	Lethal	10 mg•min/m^3
Melting Point[1,2]	-50 °C		Severe Incapacitation	8 mg•min/m^3
Boiling Point[1,2]	298.4 °C		Mild Incapacitation	5 mg•min/m$_3$
Vapor Pressure[1]	0.044 Pa	Percutaneous Vapor Dosage[3]	Lethal	100 mg•min/m^3
Vapor Pressure Constant[1]	10900 K		Severe Incapacitation	50 mg•min/m^3
Density[1,2]	1012 kg/m^3		Mild Incapacitation	25 mg•min/m^3
Surface Tension[1]	0.0320 N/m	Percutaneous Liquid Dose[3]	Lethal	20 mg/man
Viscosity[1]	0.0124 kg/ms		Severe Incapacitation	12 mg/man
Viscosity Constant[1]	3400 K		Mild Incapacitation	4 mg/man
Diffusion Coefficient[1]	3.3 mm^2/s	Ocular Dosage[3]	Incapacitation	0.1 mg•min/m^3

VX
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008 [3]Wells et al. 1993a

A2.8.8. Vx. Another V-agent of interest is Vx, called "V sub x". Another designation for Vx is "V gas". The properties of Vx are similar to those of VX. It is nearly ten times more volatile than VX but is very persistent in comparison the G-agents. The physiological action, protection, and decontaminants for Vx are the same as for VX.

A2.8.9. GV Agents. Recent Czech articles describe a family of nerve agent candidates that is new to the west. These are referred to by the authors as GV agents. They are more toxic and more persistent than the G-agents, but less so than V-agents (Matousek and Masek 1994). They are reported to be somewhat unstable, but are suitable for use as a binary agents. They appear to be as resistant to conventional nerve agent therapy as is GD (Bajgar, Fusek, and Vachek 1994). In 1992 Vil Mirzayanov, a scientist who defected from a Russian CW research facility, revealed that the USSR had developed a new family of nerve agents (Clarke 1993). These agents were called NOVICHOK (Newcomer) agents. They are reported to be low volatility agents, several times as toxic VX. Agent characteristic data is not available.

A2.9. Blister Agents. Blister agents are irritants. They act on the eyes, mucous membranes, lungs, skin, and blood forming organs. The primary agents in this category are mustard (H, HD), nitrogen mustards (HN-1, -2, -3), and arsenicals like lewisite (L).

A2.9.1. Blister agents, in either liquid or vapor forms, are severely irritating to the eyes. Mustard exposure causes tearing, conjunctivitis, and ulceration of exposed eye surfaces. Symptoms may not appear for hours. The nitrogen mustards (HN) produce these symptoms more rapidly and often more severely than those of H or HD. Lewisite is primarily a danger to the eyes as a liquid. Exposure to lewisite causes eye pain and irritation. Skin, lung tissue, and conjunctival necrosis are common.

A2.9.2. Blister agent-induced lung inflammation is accompanied by fluid accumulation in irritated tissues and impairment of respiratory gas exchange. Many World War I mustard deaths were from secondary infection of injured lung tissue. Nitrogen mustards and lewisite have similar effects, although the concentrations of lewisite vapor necessary to produce pulmonary damage are not easily achieved. Mustard and lewisite produce painful irritation and blistering of skin. The effect is more pronounced on moist than on dry skin. This explains the predominance of blisters in the crotch and armpits. Lewisite symptoms appear faster and are frequently more severe than those of mustard.

A2.9.3. Malaise, vomiting, and fever are common consequences of vesicant exposure. Circulatory shock also appears with the life-threatening mustard or lewisite exposures. Bone marrow function is often suppressed as well. This compromises the natural defenses against infections. Liver damage is frequent after lewisite exposure.

A2.9.4. Mustard (H and HD). Mustard was the premier WW I war gas. It is a blister agent. It is still widely deployed. H is the designation for mustard made by the Levinstein process. Levinstein Mustard contains a large amount of sulfur (15-20%) as an impurity (Medema 1986). Distilled mustard (HD) is a much purer product. Mustard made by the original German technique, the Meyer method, is sometimes referred to as HS.

A2.9.5. Mustard's high freezing point limits winter mustard usage. To overcome this problem, it can be mixed with other blister agents. Mustard/Lewisite (HL) mixes have freezing points as low as -42 °C. The toxicity of mustard/Lewisite mixes is not greatly different than that of neat mustard (Spectral Intelligence 1991).

A2.9.6. Levinstein Mustard (H). Levinstein mustard is the original mustard (gas) of World War I vintage. It contains about 30% sulfur impurities, which gives it a pronounced odor. These impurities lessen the effectiveness of H but depress its freezing point two to five degrees. Other properties of H are essentially the same as those for distilled mustard which is presented on the next page.

A2.9.7. Distilled Mustard (HD). HD is a colorless to amber-colored liquid with a garlic like odor. It has less odor and a slightly greater blistering power than H and is more stable in storage. It is used as a delayed-action casualty agent. HD is heavier than water, however small droplets will float on water surfaces and present a hazard. HD effects are usually delayed 4-6 hours but latent periods have been observed for up to 24 hours. Wet skin absorbs more mustard than does dry skin. For this reason HD exerts a casualty effect at lower concentrations in hot, humid weather because the body is moist with perspiration.

Table A2.6. Mustard (H and HD).

HD	
Physical State	Oily, colorless to amber liquid.
Odor	Like garlic or horseradish.
Skin and Eye Toxicity	Eyes are very susceptible to low concentration; incapacitating effects by skin absorption require higher concentrations.
Protection Required	Protective mask and permeable protective clothing for vapor and small droplets; impermeable clothing for protection against large droplets, splashes, and smears..
Decontamination	Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. STB and scorching with fire are effective for confined areas.
Persistency	Depends upon the amount of contamination by liquid, the munitions used, the nature of the terrain and the soil, and the weather conditions. Heavily splashed liquid persists for one to two days or more in concentrations that produce casualties of military significance under average weather conditions, and a week to months under very cold conditions. HD on soil remains vesicant for about two weeks. HD is calculated to evaporate about five times more slowly than GB. Persistency in running water is only a few days, while persistency in stagnant water can be several months. HD is about twice as persistent in sea water.

Property		**Dosage Response**		
Formula[1,2]	$C_4H_8Cl_2S$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	159.1 g/mol	Inhalation Dosage[1]	Lethal	750 mg•min/m^3
Melting Point[1,2]	2.4 °C		Incapacitation	100 mg•in/m^3
Boiling Point[1,2]	217.4 °C	Percutaneous Vapor Dosage[1]	Lethal	10,000 mg•min/m^3
Vapor Pressure[1]	9.14 Pa	(Cool/Dry Subjects)	Severe Incapacitation	3,500 mg•in/m^3
Vapor Pressure Constant[1]	7450 K		Mild Incapacitation	1,000 mg•min/m^3
Density[1,2]	1274 kg/m^3	Percutaneous Vapor Dosage[1]	Lethal	10,000 mg•min/m^3
Surface Tension[1]	0.0432 N/m	(Hot/Wet Subjects)	Severe Incapacitation	350 mg•min/m^3
Viscosity[1]	0.00447 kg/ms		Mild Incapacitation	200 mg•min/m^3

HD				
Viscosity Constant[1]	2550 K	Percutaneous Liquid Dose[1]	Lethal	5,000 mg/man
Diffusion Coefficient[1]	4.9 mm^2/s		Incapacitation	2,000 mg/man
		Ocular Dosage[1]	Incapacitation	100 mg-min/m^3
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008 [1]Wells et al. 1993a				

A2.9.8. Nitrogen Mustard 1 (HN-1). HN-1 is a blister agent. It is a colorless liquid with a faint fishy or musty odor. It has similar properties to sulfur mustard (H), but is less toxic via the skin and less stable in storage. The effects on the skin can be delayed by 12 or more hours. HN-1 effects the eyes more rapidly than sulfur mustard.

Table A2.7. Nitrogen Mustard 1 (HN-1).

Property		**Dosage Response**		
Formula[1,2]	$C_6H_{13}Cl_2N$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	170.1 g/mol	Inhalation Dosage[2]	Lethal	1,500 mg•min/m^3
Melting Point[1,2]	-34 °C		Incapacitation	Unknown
Boiling Point[1,2]	194 °C (Decomposes below BP)	Percutaneous Vapor Dosage[2]	Lethal	20,000 mg•min/m^3
Vapor Pressure[1]	32.997 Pa at 25 °C		Incapacitation	9,000 mg-min/m^3
Vapor Pressure Constant[1]	Unknown	Percutaneous Liquid Dose	Lethal	Unknown
Density[1,2]	1,090 kg/m^3		Incapacitation	Unknown
Surface Tension$_1$	Unknown	Ocular Dose[2]	Incapacitation	200 mg•min/m^3
Viscosity[1]	Unknown			
Viscosity Constant[1]	Unknown			
Diffusion Coefficient[1]	Unknown			
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008				

A2.9.9. Nitrogen Mustard 2 (HN-2). HN-2 is a liquid blister agent with a fruity odor. It is more toxic than HN-1. It is not stable and is, therefore, of limited value as a threat agent.

Table A2.8. HN-2.

Property		Dosage Response		
Formula[1,2]	$C_5H_{11}Cl_2N$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	156.07 g/mol	Inhalation Dosage	Lethal	3000 mg•min/m^3
Melting Point[1,2]	-60 °C		Incapacitation	-
Boiling Point[1,2]	(Decomposes)	Percutaneous Vapor Dosage	Lethal	-
Vapor Pressure[1]	0.29 mm Hg @ 20°C		Incapacitation	-
Vapor Pressure Constant[1]		Percutaneous Liquid Dose	Lethal	-
Density[1,2]	1.15 g/cm^3 @ 20°C		Incapacitation	-
Surface Tension[1]		Ocular Dosage	Incapacitation	100 mg•min/m^3
Viscosity[1]				
Viscosity Constant[1]				
Diffusion Coefficient[1]				
[1]AFJMAN 32-4008				

A2.9.10. Nitrogen Mustard 3 (HN-3). Nitrogen mustard 3 is a blister agent. It is structurally similar to sulfur mustard. HN-3 is only marginally stable, but it is the most stable and, therefore, the most useful of the nitrogen mustards for CW use. Its toxicity is very similar to that of sulfur mustard. It is a low volatility agent. Nitrogen Mustard (HN-3).

Table A2.9. Nitrogen Mustard 3 (HN-3).

HN					
Physical State	Oily liquid.				
Odor	None when pure.				
Skin and Eye Toxicity	Similar to HD. Nitrogen mustards are not detoxified by the body, therefore effects are cumulative.				
Protection Required	Protective mask and permeable protective clothing for vapor and small droplets; impermeable clothing for protection against large droplets, splashes, and smears..				
Decontamination	Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. STB and fire are effective for confined areas.				
Persistency	Considerably longer than for HD.				
Property		**Dosage Response**			
Formula[1,2]	$C_6H_{12}Cl_3N$	Route of Exposure	Reaction Type	Dose/Dosage	
Molecular Weight[1,2]	204.5 g/mol	Inhalation Dosage[3,4]	Lethal	1,500 mg•min/m^3	
Melting Point[1,2]	-3.7 °C		Incapacitation	Unknown	
Boiling Point[1,2]	257.2 °C (Decomposes below BP)		Incapacitation	2,500 mg•min/m^3	
Vapor Pressure[1]	0.9 Pa	Percutaneous Vapor Dosage[3,4]	Lethal	mg•min/m^3	
Vapor Pressure Constant[1]	7900 K		Incapacitation	2,500 mg•min/m^3	
Density[1,2]	1240 kg/m^3	Percutaneous Liquid Dose[3,4]	Lethal	700 mg/man	
Surface Tension[1]	0.0415 N/m		Incapacitation	Unknown	
Viscosity[1]	Unknown	Ocular Dosage[3,4]	Incapacitation	200 mg•min/m^3	
Viscosity Constant[1]	Unknown				
Diffusion Coefficient[1]	4.6 mm^2/s				
[1]van Beest and Medema 1994 [2]AFR 355-7 [3]Wells et al. 1993a [4]AFJMAN 32-4008					

A2.9.11. Lewisite (L). Lewisite, or chlorovinyldichloroarsine, is a blister agent developed late in World War I. It was the best of the WW I era arsenicals, and is the only arsenical agent still reported to be in CW Inventories. It is used as a moderately delayed-action casualty agent with a persistency somewhat shorter than that of HD. When humidity is high, L hydrolyzes so rapidly that it is difficult to maintain a concentration sufficient to blister bare skin. It produces effects similar to mustard with the main difference is that L produces immediate pain. Lewisite warns of its presence by irritating the eyes and skin and has a rapid rate of action. Liquid L causes immediate burning sensation in the eyes and permanent loss of sight if not decontaminated within one minute with large amounts of water. Lewisite, like other blister agents, causes irritation and death to any tissue that it contacts. It also has systemic effects.

Table A2.10. Lewisite (L).

LEWISITE (L)	
Physical State	Colorless to brownish liquid.
Odor	Like geraniums. Very little odor when pure.
Skin and Eye Toxicity	Eyes: Even limited concentrations of L vapor cause extreme irritation of the eyes. Burning, pain, sensitivity to light, tearing and swelling of the eyelids result. An exposure of 1,500 mg-min/m3 produces severe and probably permanent corneal damage to the eyes. Liquid L causes severe damage to the eye. Skin: L has about the same blistering action on the skin as HD, even though the lethal dosage for L is much higher.
Protection Required	Protective mask and permeable protective clothing for vapor and small droplets; impermeable clothing for protection against large droplets, splashes, and smears..
Decontamination	Skin: Use skin decontaminating kit for liquid agent on the skin Equipment: Decontaminate individual equipment with the individual equipment decontamination kit. HTH, STB, household bleach, and caustic soda are effective for confined areas.
Persistency	Somewhat shorter than for HD; very short duration under humid conditions.

Property		**Dosage Response**		
Formula[1,2]	$C_2H_2AsCl_3$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	207.3 g/mol	Inhalation Dosage[3]	Lethal	200 mg•min/m^3
Melting Point[1,2]	-1.2 °C		Incapacitation	Unknown
Boiling Point[1,2]	195.5 °C	Percutaneous Vapor Dosage[3]	Lethal	100,000 mg•min/m^3
Vapor Pressure[1]	29.3 Pa		Incapacitation	1,500 mg•min/m$_3$
Vapor Pressure Constant[1]	7450 K	Percutaneous Liquid Dose[3]	Lethal	7000 mg/man
Density[1,2]	1887 kg/m3		Incapacitation	
Surface Tension[1]	0.0418 N/m	Ocular Dosage[3]	Incapacitation	200 mg•min/m^3
Viscosity[1]	0.00226 kg/ms			
Viscosity Constant[1]	1570 K			
Diffusion Coefficient[1]	6.1 mm^2/s			

[1]van Beest and Medema 1994
[2]AFJMAN 32-4008
[3]van Beest and Medema 1994

A2.9.12. Phosgene oxime (CX), another blister agent, is primarily an irritant to the skin and mucous membranes. It differs from mustard in that it produces immediate pain. Skin that comes in contact with phosgene is usually destroyed. Phosgene is extremely irritating to eyes and mucous membranes. Even minute concentrations produce tearing of the eyes.

Table A2.11. Phosgene Oxime (CX).

Property		**Dosage Response**		
Formula[1,2]	$CHCl_2NO$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	113.9 g/mol	Inhalation Dosage[1,2]	Lethal	3,200 mg•min/m^3
Melting Point[1,2]	40 °C		Incapacitation[2]	3 mg•min/m^3 (unbearable irritation)
Boiling Point[1,2]	54 °C	Percutaneous Vapor Dosage	Lethal	Unknown
Vapor Pressure[1]	480 Pa		Incapacitating[1]	1,000 mg•min/m^3
Vapor Pressure Constant[1]	5900 K	Percutaneous Liquid Dose	Lethal	Unknown
Density[1,2]	Unknown		Incapacitation	Unknown
Surface Tension[1]	Unknown	Ocular Dosage	Incapacitation	Unknown
Viscosity[1]	Unknown			
Viscosity Constant[1]	Unknown			
Diffusion Coefficient[1]	Unknown			
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008				

A2.10. Choking Agents. Choking agents are also tissue irritants. Inhalation produces coughing, choking, and tightness of the chest as well as occasional nausea, vomiting, headache, and tearing. Difficulty in breathing and a diminished lung oxygen exchange become evident as fluids accumulate in lungs. Lung fluid accumulation reaches a maximum within 12 to 14 hours of exposure.

A2.10.1. Phosgene (CG) and Diphosgene (DP) are the principal choking agents. Diphosgene spontaneously converts to phosgene in the body, which explains the similarity in the effects of the two.

A2.10.2. Phosgene (CG). Phosgene is a choking agent. It is a colorless gas with an odor of new-mown hay. CG is considered obsolete, but may be encountered as an improvised agent. A few countries are reported to maintain stocks of this agent.

Table A2.12. Phosgene (CG).

Property		Dosage Response		
Formula[1,2]	COCl2	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	98.9 g/mol	Inhalation Dosage[1,2]	Lethal	3,200 mg•min/m^3
Melting Point[1,2]	-128 °C		Incapacitation	1,600 mg•min/m^3
Boiling Point[1,2]	8.2 °C	Percutaneous Vapor Dosage	Lethal	Unknown
Vapor Pressure[1]	155,900 Pa		Incapacitation	Unknown
Vapor Pressure Constant[1]	3000 K	Percutaneous Liquid Dose	Lethal	5,000 mg/man
Density[1,2]	1,373 kg/m^3		Incapacitation	Unknown
Surface Tension[1]	0.0114 N/m	Ocular Dosage	Incapacitation	Unknown
Viscosity[1]	Unknown			
Viscosity Constant[1]	Unknown			
Diffusion Coefficient[1]	10.9 mm^2/s			
[1]van Beest and Medema 1994 [2]AFJMAN 32-4008				

A2.10.3. Diphosgene (DP). Diphosgene is a choking agent. It is a colorless liquid with an odor of new-mown hay. The effects of DP are identical to phosgene (CG) because DP is converted to CG in the body. DP is considered obsolete, but may be encountered as an improvised agent. A few countries are reported to maintain stocks of this agent.

Table A2.13. Diphosgene (DP).

Property		Dosage Response		
Formula[1,2]	$C_2Cl_4O_2$	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	197.85 kg/mol	Inhalation Dosage[1]	Lethal	3,000 mg•min/m^3
Melting Point[1,2]	-57 °C		Incapacitation	1,600 mg•min/m^3
Boiling Point[1,2]	127 °C	Percutaneous Vapor Dosage	Lethal	Unknown
Vapor Pressure[1]	559.95 Pa		Incapacitation	Unknown
Vapor Pressure Constant[1]	Unknown	Percutaneous Liquid Dose	Lethal	Unknown
Density[1,2]	1653 kg/m^3		Incapacitation	Unknown
Surface Tension[1]	Unknown	Ocular Dosage	Incapacitation	Unknown
Viscosity[1]	Unknown			
Viscosity Constant[1]	Unknown			
Diffusion Coefficient[1]	Unknown			
[1]AFJMAN 32-4008				

A2.11. Blood Agents. Blood agents, so called because of their effects on the oxygen carrying capacity of hemoglobin, block the transfer of oxygen to body tissues. The oxygen carrying properties of hemoglobin and tissue cytochrome systems are both degraded. Exposure to blood agents results in headache, dizziness, and nausea which can progress to coma, convulsions, and cessation of breathing.

A2.11.1. Hydrogen Cyanide (AC). Hydrogen cyanide is a highly volatile blood agent. It is reported to be rapidly detoxified (Spectral Intelligence 1991). Toxicity is dependent upon exposure duration.

Table A2.14. Hydrogen Cyanide (AC).

Property		Dosage Response		
Formula[1,2]	HCN	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	27.0 g/mol	Inhalation Dosage[1]	Lethal	2,000 mg•min/m^3
Melting Point[1,2]	-13.2 °C		Incapacitation	800 mg•min/m^3
Boiling Point[1,2]	25.7 °C	Percutaneous Vapor Dosage[1]	Lethal	200,000 mg•min/m^3
Vapor Pressure[1]	81200 Pa		Incapacitation	Unknown
Vapor Pressure Constant[1]	3350 K	Percutaneous Liquid Dose[1]	Lethal	7,500 mg/man
Density[1,2]	687 kg/m^3		Incapacitation	Unknown
Surface Tension[1]	0.0183 N/m	Ocular Dosage[1]	Incapacitation	Unknown
Viscosity[1]	0.0201 kg/ms			
Viscosity Constant[1]	740 K			
Diffusion Coefficient[1]	19.9 mm2/s	[1]van Beest and Medema 1994 [2]AFJMAN 32-4008		

A2.11.2. Cyanogen Chloride (CK). CK is a blood agent. Its effects are short lived which makes its toxicity exposure time dependent (Spectral Intelligence 1991).

Table A2.15. Cyanogen Chloride (CK).

Property		Dosage Response		
Formula[1,2]	CNCl	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight[1,2]	61.48 g/mol	Inhalation Dosage[1]	Lethal	11,000 mg•min/m^3
Melting Point[1,2]	-6.9 °C		Incapacitation	7,000 mg•min/m^3
Boiling Point[1,2]	2.8 °C	Percutaneous Vapor Dosage	Lethal	Unknown
Vapor Pressure[1]	133,322 Pa at 25 °C		Incapacitation	Unknown
Vapor Pressure Constant[1]	Unknown	Percutaneous Liquid Dose	Lethal	Unknown
Density[1,2]	1180 kg/m^3		Severe Incapacitation	Unknown
Surface Tension[1]	Unknown	Ocular Dosage[1]	Incapacitation	Unknown
Viscosity[1]	Unknown			
Viscosity Constant[1]	Unknown			
Diffusion Coefficient[1]	Unknown	[1]AFJMAN 32-4008		

A2.11.3. Arsine (SA). Arsine is primarily a blood agent although it also produces liver and kidney damage. It has a mild, garlic like odor. Low-level exposure causes headache and uneasiness. Greater exposures cause chills, nausea, and vomiting. Severe exposures cause anemia from damage to blood cells. Symptoms are delayed by a few hours to several days.

Table A2.16. Arsine (SA).

Property		Dosage Response		
Formula	AsH_3	Route of Exposure	Reaction Type	Dose/Dosage
Molecular Weight	77.93 g/mol	Inhalation Dosage	Lethal	5000 mg•min/m^3
Melting Point	-116 °C		Incapacitation	2500 mg•min/m^3
Boiling Point	-62.5 °C	Percutaneous Vapor Dosage[1]	Lethal	-
Vapor Pressure	11,000 mm Hg @ 20°C		Incapacitation	-
Vapor Pressure Constant		Percutaneous Liquid Dose[1]	Lethal	-
Density	1.34 g/cm^3 @ 20°C		Incapacitation	-
Surface Tension		Ocular Dosage[1]	Incapacitation	-
Viscosity				
Viscosity Constant				
Diffusion Coefficient				
Ref: AFJMAN 32-4008 [1]Arsine is considered to be no danger by cutaneous or ocular routes				

A2.12. Vomiting Agents. Vomiting agents (adamsite, diphenylchloroarsine, diphenylcyanoarsine), as the class name implies, produce nausea and vomiting. They are also eye and respiratory tract irritants and produce headache and cold-like symptoms.

A2.13. Tearing Agents. Tearing gases, such as chloracetophenone, are short acting, rapid-onset irritants. They produce eye irritation, tearing, and mild skin irritation.

A2.14. 3-Quinuclidinyl Benzilate (BZ). BZ is a psychotropic agent.. It has anticholerginic properties that are in many ways similar to those of atropine. BZ affects memory, problem solving ability, and concentration. High dose exposures produce excitement, delusions, and hallucinations. Symptom onset usually occurs within two hours of exposure. Symptoms may last for three to four days.

Table A2.17. Individual Characteristics of Primary Threat Agents.

AGENT		EARLY SYMPTOMS
HD	EYES	More susceptible than respiratory tract or skin. Inflammation of inner eyelid may occur after exposure of about 1 hr to a concentration barely perceptible by odor. Mild exposure will result in symptoms (crying and sensation of grit in eyes) 4 - 12 hours later. Heavy exposure irritates the eyes after 1 - 3 hours and produces some severe lesions. Temporary blindness may occur but permanent blindness is very rare. Recovery from mild exposure may take 1 - 2 weeks. Severe eye damage may require several months of convalescence.
	SKIN	Warm, moist skin most susceptible. Vapor exposures sually don't display symptoms (sunburn, itching, and then blisters) until 2 to 48 hours after exposure. Liquid contamination of the skin usually results in a ring of blisters surrounding a gray-white area of skin; symptoms (sunburn, itching, mild burning) don't appear until hours after the exposure. Blisters of the face heal in 1 - 2 weeks. Other areas may take 2 - 4 weeks to heal.
	RESPIRATORY TRACT	Lesions develop slowly and do not reach maximum severity for several days. Symptoms begin with hoarseness, cough (worse at night), labored breathing and fever. Pneumonia may develop. Milder symptoms, like hoarseness, last only 1 - 2 weeks.
	INGESTION	Ingestion of food or water contaminated by liquid mustard produces nausea and vomiting, pain, diarrhea, and inability to stand.
L	EYES	Pain and spasms occur instantly. Inflammation of the eye lids follows rapidly and closes the eye within an hour. Mild symptoms heal in a few days without treatment. Severe exposure may cause permanent injury or blindness.
	SKIN	Stinging pain is usually felt within 10 to 20 seconds after contact with liquid. The pain increases in severity with penetration and in a few minutes becomes a deep, aching pain. After about 5 minutes of contact, there appears a gray area of dead skin (upper layers) resembling that seen in corrosive burns.
	RESPIRATORY TRACT	Vapors are so irritating to the respiratory tract that conscious personnel will immediately put on a mask to avoid the vapor. While there hasn't been a known human case of poisoning by vapors of L, the prognosis is probably similar to that for respiratory injury by HD.

AGENT		EARLY SYMPTOMS
GB/VX	EYES	Miosis, eye pain, frontal headache will occur from one to several minutes after exposure to a vapor. The symptoms will be immediate if caused by contact with liquid. Miosis will be present for 24 hours following mild exposure and will last 2 to 3 days after a severe exposure.
	SKIN	Following exposure to agent in liquid form, local sweating and muscular twitching will occur from 3 minutes to 2 hours. The effects will last for up to 3 days following mild exposure and up to 5 days following a more severe exposure.
	RESPIRATORY TRACT	Unexplained runny nose, tightness in chest, wheezing, and general weakness will appear within one to several minutes after exposure. These effects will be felt for a few hours after a mild exposure and may exist for 1 - 2 days after a more severe exposure.
	INGESTION	Initial symptoms include abdominal cramps, vomiting, and diarrhea. These will occur about 30 minutes after ingestion. The recovery period may take from several hours to 5 days.
	NOTE:	The recovery periods stated for the nerve agents above refer to the casualty NOT receiving a lethal dose and NOT receiving medical treatment. If untreated, exposure to lethal concentrations of nerve agents can result in death 5 minutes after appearance of symptoms.

Table A2.18. Effects on Chemical Agents.

FREEZING POINT (C)	DECOMP TEMP (C)	RATE OF[1] DETOXIFICATION	PRESENT[2] DETECTION METHODS
HD 2.45	149	Very low	M8/M9 paper (liquids), M256A1, CAM, M90, M22, ALAD (liquids)
L 18	Above 100	None	M8 paper (liquids), M256A1, ALAD (liquids)
GB - 56	150	Low, essentially cumulative	M8/M9 paper (liquids), M256A1, CAM, M8A1, M90, M22, ALAD (liquids)
VX - 39	150	Low, essentially cumulative	M8/M9 paper (liquids), M256A1, CAM, M8A1, M90, M22, ALAD (liquids)
[1]Figures concerning the agent's freezing point, decomposition temperature, and rate of detoxification (within the body) were obtained from AFR 355-7 (Dec 90) [2]While the ALAD technical order only specifies the instrument was tested against GD and VX, it is believed to function in the presence of GB			

Table A2.19. Chemical Agent Advantages and Disadvantages.

ADVANTAGES	DISADVANTAGES
HD - Doesn't produce immediate symptoms - Normal UTC array of pre-positioned detectors (M8/M9 paper, M8A1, ALAD) doesn't detect agent in dusty form - Without CAM, demasking drill is dangerous because M256A1 threshold is too high. - Ideally suited for hot, humid conditions; percutaneous ICT 50 of 200 mg-min/m3 may be significant problem - Barely soluble in water. HD may persist in water for long periods of time	- Casualties will be "walking wounded" (able to accomplish parts of the mission) as opposed to significant amounts of fatalities - High freezing point limits effective use (other than by people dragging it inside for vapor release) - Normal BDU with underwear provides significant amount of protection
L - Contains arsenic and may result in systemic poisoning - Skin burns are much deeper than those of HD - High freezing point limits effective use (other than by people dragging it inside for vapor release)	- Immediate sensation of pain will warn people of agent's presence and will drive individual decon actions - When humidity is high, L hydrolyzes so rapidly it is difficult to maintain a concentration large enough to blister the skin

ADVANTAGES	DISADVANTAGES
GB - Most volatile (vapor producing) of the nerve agents; best agent for creating immediate casualties (especially miosis) among unmasked and/or incompetent	- Very short persistency, not suitable for keeping an air base "down" - Virtually any detector will work
VX - Most persistent of all traditional chemical agents - Possesses the deadliest contact hazard of all traditional chemical agents	- Exceptionally low volatility results in little, if any, vapor concentration

A2.15. Chemical Persistency (Persist2). Persist2 is a computer program that implements the chemical agent surface evaporation model developed by Monaghan and McPherson (STP 386, A Mathematical Model for Predicting Vapour Dosages On and Downwind of Contaminated Areas of Grasslands, AD889764). This model predicts the rate of evaporation of chemical agents deposited on grass covered surfaces. The model is derived from a combination of field experiments and knowledge about the physics of agent evaporation, diffusion, and transport. The model includes the effects of agent volatility, temperature, wind speed, droplet size, and surface effects such as the distribution of liquid agent within the grass layer and adsorption of nerve agents by the grass. Given suitable input values for these effects, the model computes the droplet evaporation rate. From this value the model predicts the time for various levels of residual deposition to be reached (persistence).

A2.15.1. Chemical persistency is a complex subject that has a tremendous impact on installation operations. Unfortunately, Readiness personnel do not have a lot of tools to assist their efforts in this area. For example: Even the definitions involved are vague. There is no time line associated with an agent that is "non persistent" as compared to an agent that is "persistent". In other words, it is not established that everything with a persistency of XX minutes or hours or less is non-persistent while all others are persistent.

A2.15.2. Some reference materials are misleading as they possess statements such as "All blister agents are considered to be persistent." This blanket statement leads to confusion. For example: every agent can come in gaseous (vapor), liquid, or solid form. In actual fact, a blister agent in vapor form will disappear before other agents that are in liquid or solid form, even if the blister agent would typically last much longer if both agents were in the same physical form.

A2.15.3. ATP 45A possesses the only wide spread persistency chart in so far as the U.S. military services are concerned. However, this chart provides only exceptionally broad categories such as "3 to 10 days in the attack area" and "2 - 4 days in the downwind hazard area". The disadvantage of using these charts is that it does not consider critical persistency-affecting factors such as wind speed and the type of agent itself. Furthermore, vague as it is, its operational effectiveness is further degraded because it's based on a 10 g/m2 agent disposition, a concentration level double what we expect the worst case to be at most Air Force locations. It does not come close to approximating the persistency of any agent, except VX in some cases, whose hazard duration was calculated through the variety of "detailed" scientific studies or methods. In terms of likely threat agents to Air Force installations, the worst example of this would be GB. While ATP 45A might give a "3 to 10 days" answer, most detailed persistency calculations show the probable persistency to be less than an hour or two. Certainly, different response procedures are required for a situation in which the hazard will rapidly disappear as opposed to a hazard situation that will continue for an extended period of time.

A2.15.4. The "Persist 2" chemical persistency program is the preferred program for Readiness personnel to use when preparing detailed chemical persistency calculations. The following information explains baseline calculations.

A2.15.4.1. The times given in the program are guidelines and not absolute values. Readiness personnel must verify the absence and/or specific remaining agent concentration levels prior to recommending lower mission oriented protective postures (MOPP).

A2.15.4.2. The persistency calculations are based on a surface composition of dry grass. Readiness personnel should use a correction factor of "2.5" for sand and "0.8" for concrete or asphalt surfaces. In other words, if the program lists a persistency time of 100 minutes for a given situation, the estimation would be that the agent would dissipate in 250 minutes in the sand and in 80 minutes on the installation's roadways.

A2.15.4.3. The program provides persistency calculations for GB, GD, TGD, HD, VX, and GF. The other choices for projected calculations are for simulants.

A2.15.4.4. The program calls for an input concerning wind speed in "meters per second (MPS)". The conversion factor Readiness personnel can easily gather information for and use is "MPS x 2 = Knots" or "Knots divided by 2 = MPS". In other words, 3 MPS = 6 knots or 10 knots = 5 MPS.

A2.15.4.5. The program calls for an input concerning agent droplet diameter in "microns". One millimeter equals 1000 microns. Most attack situations involving missile air bursts will result in droplet diameters in the 400 to 900 micron range. Therefore, if you're unsure of the droplet diameter to use, default to a choice of 900 microns. ***NOTE:*** Because of the Army's different threat and safe-sided policy, most of the persistency information in Army publications are based on droplet diameters of 2500 microns.

A2.15.4.6. The program calls for an input concerning "percent of agent loss". The program will then display the persistency time for this value (90% for example) and the persistency time for 100% agent dissipation. These times can be substantially different, even when the answers listed are for 95% and 100%. Simply put, the bulk of the agent dissipates rapidly in comparison to the final traces. If Readiness personnel use 95% as their input, this level will generally mean that the agent has dissipated to a point below miosis level. However, it must be stressed that Readiness personnel must verify remaining agent concentration levels and explain the potential harm cumulative agent effects can have prior to recommending reductions in MOPP.

A2.15.4.7. The program can only perform one persistency calculation at a time. If another agent or set up value (temperature, wind speed, droplet size, percentage dissipated) is desired, a separate calculation must be calculated for each configuration. It typically takes less than one minute per calculation.

A2.15.4.8. The program is not infallible. There are persistency calculations on the "edges" of the program (low or high wind speeds or temperatures) in which the difference between answers might not be as great as the operator would think. Again, the program offers a tremendous capability in relation to ATP 45 but is only a guideline.

A2.15.5. The specific operating instructions for Persist 2 (if the program is on a disk) are:

A2.15.5.1. Insert the disk in the appropriate drive of the computer (generally "A:").

A2.15.5.2. Go to the DOS A prompt [A:\]

A2.15.5.3. When [A:\] appears, type in [PERSIST2] and press [ENTER].

A2.15.5.4. Select the numerical designator associated with the desired agent and press [ENTER]. The numeral 1 is used for GB, 2 for GD, 3 for TGD, 4 for HD, 5 for VX, and 8 for GF. For an example, using a GB attack use "1".

A2.15.5.5. Input the average temperature reading (in Celsius) for the projected time period and press [ENTER]. Use "10" in your GB attack scenario.

A2.15.5.6. Input the average wind speed in meters per second and press [ENTER]. In this example use "5".

A2.15.5.7. Input the average agent droplet diameter in microns and press [ENTER]. Use "900" in this case.

A2.15.5.8. Input the desired figure for percent of agent loss and press [ENTER]. Use "95" as the desired figure.

A2.15.5.9. The screen will display the persistency time for 100% agent dissipation and for the percentage of agent dissipation that the operator selected. In the example, 100% loss was projected at 1 hour, 30 minutes, and 6 seconds while 95% loss was projected at 19 minutes and 56 seconds.

A2.15.6. The following charts are derived from Persist 2 and provide representative calculations (95% agent loss) for likely threat agents.

Table A2.20. Representative Chemical Persistency Table.

PERSISTENCY (HOURS)[1]									
AGENT	5C 1KNOT	5C 3KNOT	5C 6 KNOT	10C 1KNOT	10C 3KNOT	10C 6 KNOT	20C 1KNOT	20C 3KNOT	20C 6 KNOT
HD	111	65	42	68	40	26	28	16	10
GB	1.2	0.85	0.6	0.85	0.6	0.45	0.45	0.3	0.25
GD	8.2	5.85	4.25	5.4	3.85	2.8	2.45	1.75	1.25
TGD	14	10	7.2	9.1	6.5	4.7	4.1	2.9	2.1
GF	77	55	40	45	32	24	17	12	8.8
VX	855	810	757	415	393	368	110	104	97
AGENT	25C 1KNOT	25C 3KNOT	25C 6 KNOT	35C 1KNOT	35C 3KNOT	35C 6 KNOT	45C 1KNOT	45C 3KNOT	45C 6 KNOT
HD	18	11	7	8.25	4.9	3.1	4	2.35	1.5
GB	0.3	0.2	0.15	0.15	0.1	0.1	0.1	0.05	0.05
GD	1.7	1.2	0.85	0.85	0.6	0.45	0.45	0.3	0.2
TGD	2.9	2	1.5	1.4	1	0.7	0.8	0.5	0.4
GF	11	7.55	5.6	4.65	3.3	2.4	2.15	1.55	1.1
VX	59	56	53	19	18	17	6.75	6.4	5.95

[1] Persistency data derived from Persist 2 program. Figures represent 900 micron-sized droplets and a 95% evaporation rate of the agent (which should adequately address worst case scenarios for operational purposes). Results over 10 hours are rounded to the nearest hour and figures less than 10 hours are broken down into fractions of an hour. Since the Persist 2 program doesn't address "L", and the detailed charts from the 1993-2003 version of the Worldwide Chemical Biological Threat to Air Bases is based on 90% agent evaporation (versus 95), the author extrapolated the data from the two sources by establishing the relationship between HD and L persistency times from the charts and then applying that relationship to the Persist 2 figures for HD.

A2.16. Chemical Agent Delivery and Dissemination.

A2.16.1. Chemical Artillery Munitions. Artillery was the most common method of delivering chemical agents during WW I. Mortars, tube artillery and rocket artillery have all been used. Artillery, with its modest range, is suitable for chemical agent delivery in tactical roles.

A2.16.2. Chemical Bulk-Filled Missiles. Tactical ballistic missiles (TBM) offer longer range delivery for CW agents. TBMs can deliver bulk-filled (unitary) or submunition-filled warheads. Bulk-filled munitions delivering persistent agent, if triggered to detonate 1,000 or more meters above ground level, can efficiently achieve wide area coverage. The amount of agent lost before reaching ground level argues against high altitude release of nonpersistent agents. Near ground-level burst of nonpersistent agent-filled warheads provides more efficient agent delivery, but can be difficult to achieve. The warhead must function before impact, but within a few meters of ground level to achieve its potential.

A2.16.3. Chemical Submunition-Filled Missiles. Wide dissemination of missile-borne nonpersistent chemical agent can be achieved by use of submunitions. A submunition is a small munition designed to be released at altitude and function on impact. A missile typically carries hundreds of submunitions. Some submunitions have been designed to be scattered by free-fall. Others incorporate aerodynamic features to achieve wider distribution. In either case the submunitions are capable of dispersion over a wide area. Ground-level functioning assures maximum vapor concentration at ground level. Agent release can be by explosive or spray dissemination.

A2.16.4. Chemical Aircraft Bombs. Aircraft bombs are also an effective means of delivery of chemical agents. Unitary (bulk-filled) bombs can effectively deliver volatile or nonvolatile agent. Cluster bombs (submunition clusters) typically deliver less agent per ton of munition than unitary bombs, but provide broader agent dissemination. Modern air defenses can make aircraft bombing of high priority targets costly.

A2.17. Other Delivery Methods. Various other CW delivery methods have been developed since WW I. Aircraft spray tanks and CW land mines were developed by both the United States and the Soviet Union (Stoessel et al. 1985; DIA 1985). Spray tanks for high performance aircraft have proven useful for delivery of lines of agent at low level. Aircraft survival considerations can impede this type of delivery near high priority targets. CW land mines are possible but are not likely to be encountered. They are seldom, if ever, reported to be included in contemporary arsenals..

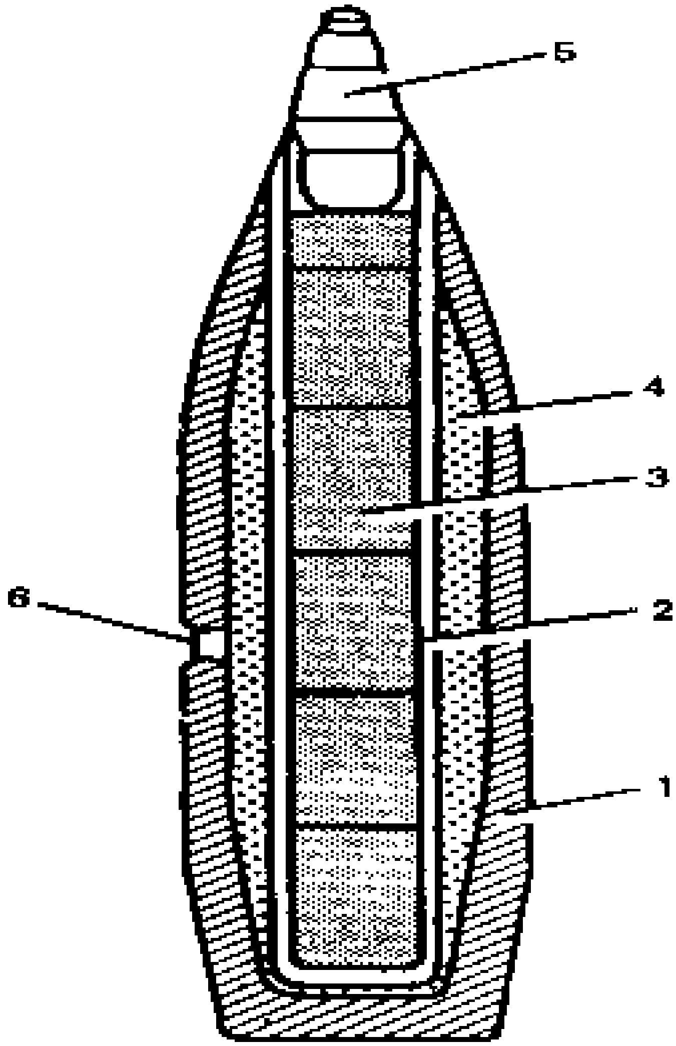
A2.17.1. Unmanned Aerial Vehicles (UAVs) and Cruise missiles provide new and promising ways of delivering CW agent. Cruise missiles and UAVs have the potential to penetrate heavy air defenses and deliver chemical agent with great precision. However, the payloads tend to be small and delivery costs high.

A2.18. A Representative CW Arsenal. The US chemical arsenal was shelved more than a quarter century ago. What is known about it can hardly be considered representative of a modern CW arsenal. It was instructive to western observers, therefore, to be allowed to examine the Russian CW munitions at Shikhany military facility in 1987 (Dugway 1988).

Table A2.21. Standard Soviet Chemical Military Munitions.

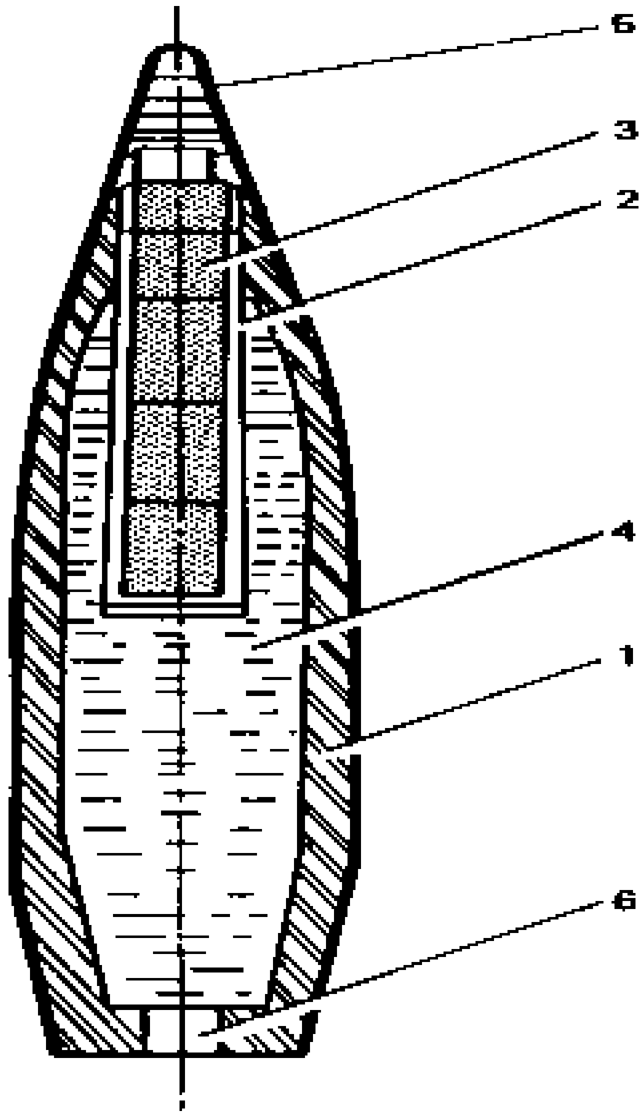
Type/Caliber	Toxin	Weight (kg)	Weight of Agent (kg)
Tube Artillery			
122 mm	Sarin	22.2	1.3
122 mm	Viscous lewisite	23.1	3.3
130 mm	Sarin	33.4	1.6
130 mm	Vx	33.4	1.4
152 mm	Sarin	40.0	2.8
152 mm	Viscous lewisite	42.5	5.4
Rocket Artillery			
122 mm	Sarin	19.3	3.1
122 mm	Vx	19.3	2.9
140 mm	Sarin	18.3	2.2
240 mm	Sarin	44.3	8.0
Tactical Missile Warheads			
540 mm	Vx	436.0	216.0
884 mm	Viscous Vx	985.0	555.0
Chemical Aerial Bombs (impact fuzed)			
100 kg	Mustard/lewisite	80.0	28.0
100 kg	Mustard/lewisite	100.0	39.0
250 kg	Sarin	233.0	49.0
Chemical Aerial Bombs (airburst)			
250 kg	Viscous soman	130.0	45.0
500 kg	Mustard/lewisite	280.0	164.0
1500 kg	Mustard/lewisite	963.0	630.0
Chemical Grenades			
Hand grenade	Cs	0.25	0.17

Figure A2.1. 122 mm Chemical Artillery Shell, 22.2 kg, 1.3 kg GB Fill, Percussion Fuzed.



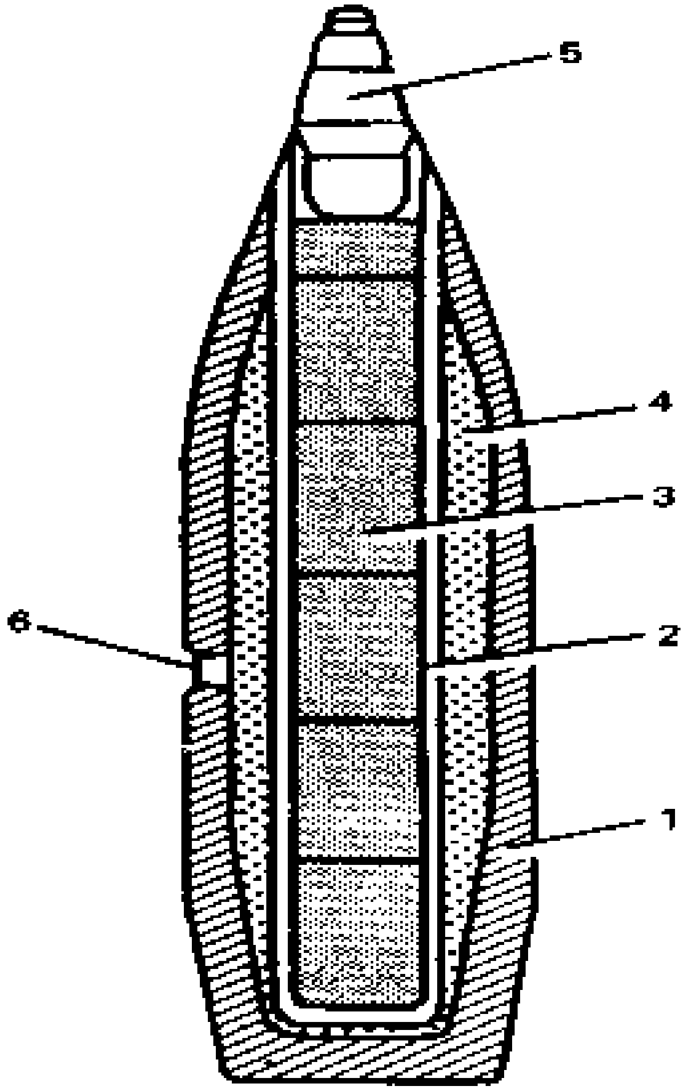
1. CASING
2. BURSTER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FUZE
6. FILLER HOLE

Figure A2.2. 152 mm Chemical Artillery Shell, 40.0 kg, 2.8 kg GB fill, Percussion Fuzed.



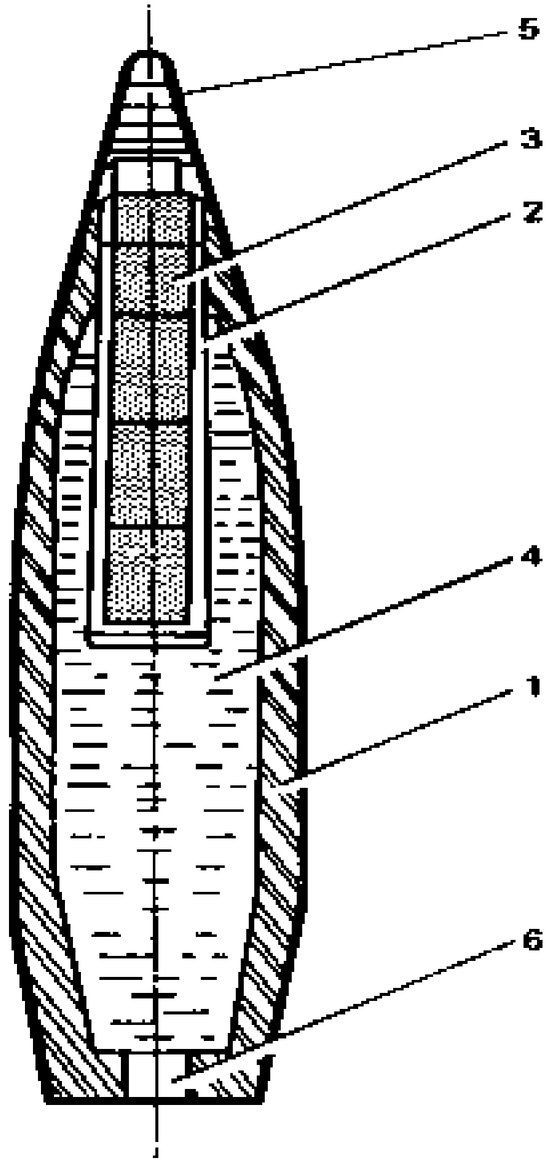
1. CASING
2. BURSTING TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FUZE
6. FILLER HOLE

Figure A2.3. 130 mm Chemical Artillery Shell, 33.4 kg, 1.6 kg GB Fill, Precussion Fuzed.



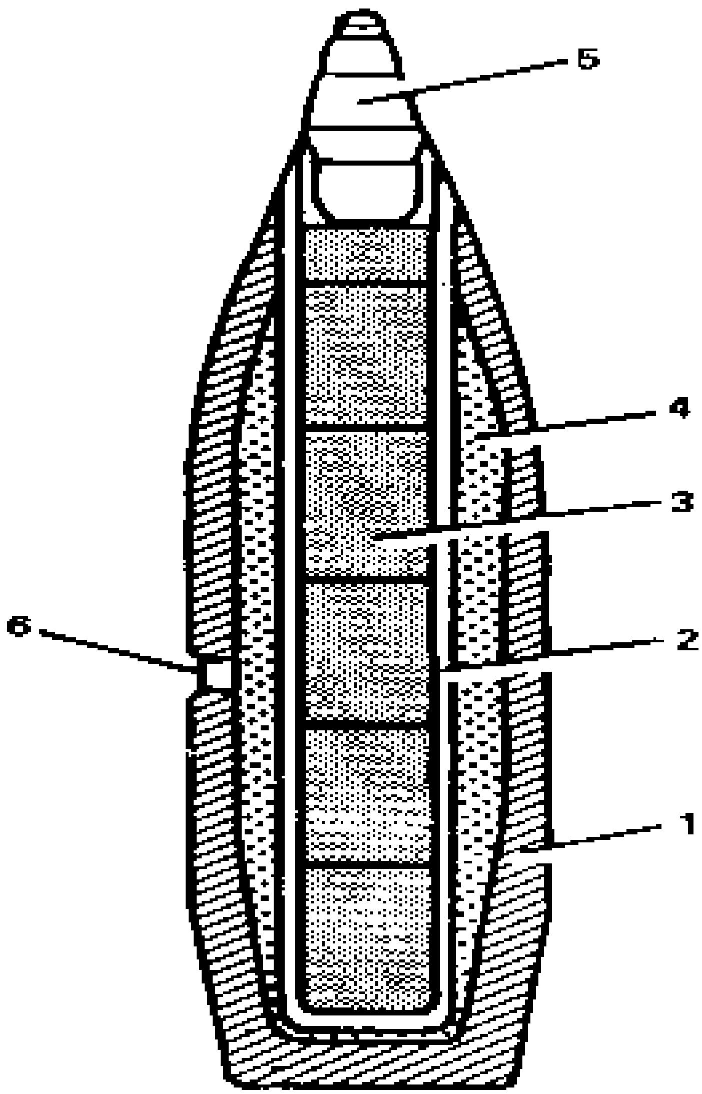
1. CASING
2. BURSTER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FUZE
6. FILLER HOLE

Figure A2.4. 122 mm Chemical Artillery Shell, 23.1 kg, 3.3 kg Thickened Lewisite Fill, Time Fuzed.



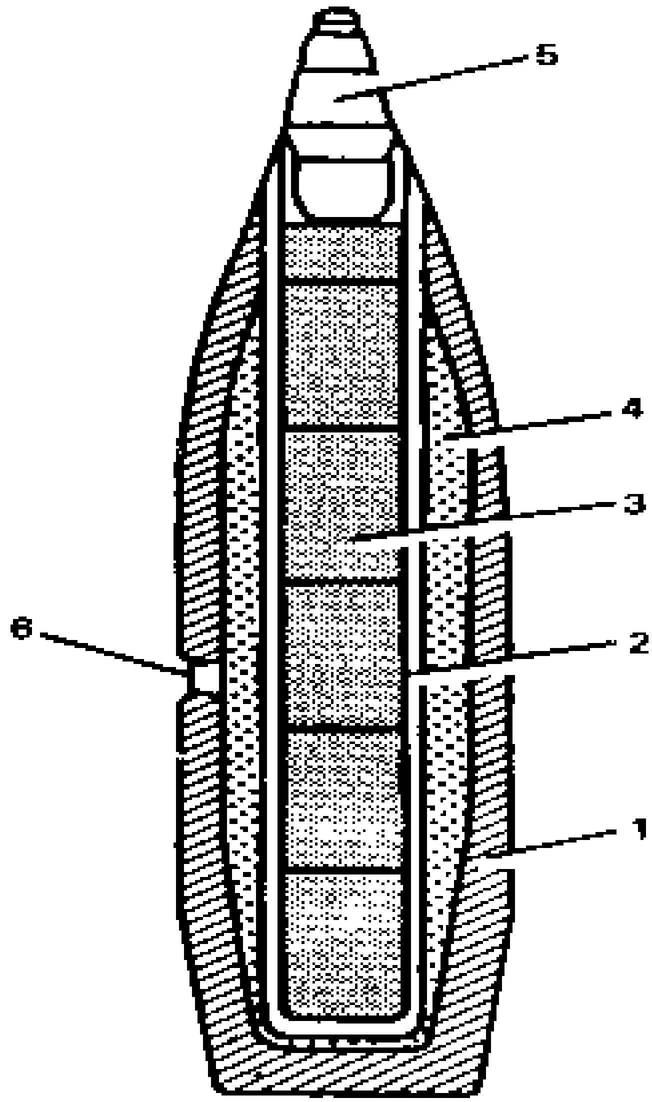
1. CASING
2. BURSTING TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FUZE
6. FILLER HOLE

Figure A2.5. 152 mm Chemical Artillery Shell, 42.5 kg, 5.4 kg Thickened Lewisite Fill, Time Fuzed.



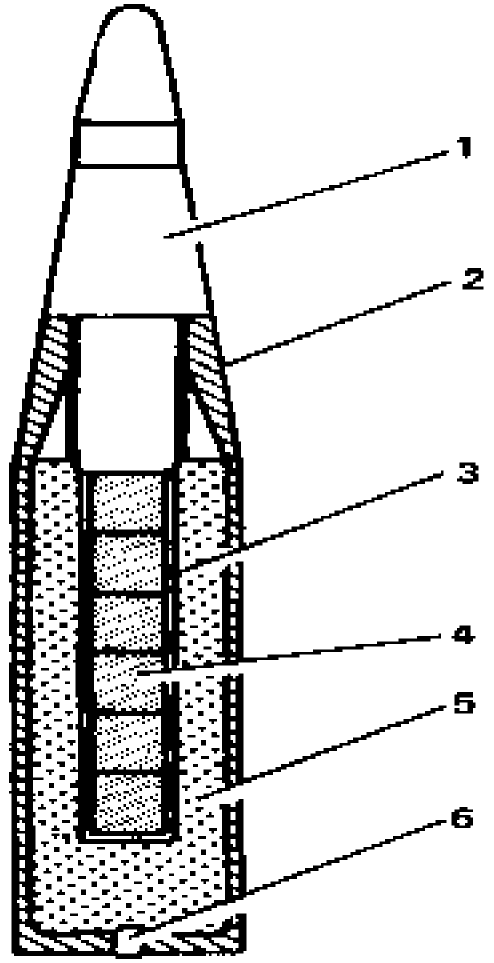
1. CASING
2. BURSTER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FUZE
6. FILLER HOLE

Figure A2.6. 130 mm Chemical Artillery Shell, 33.4 kg, 1.4 kg VX Fill, Proximity Fuzed.



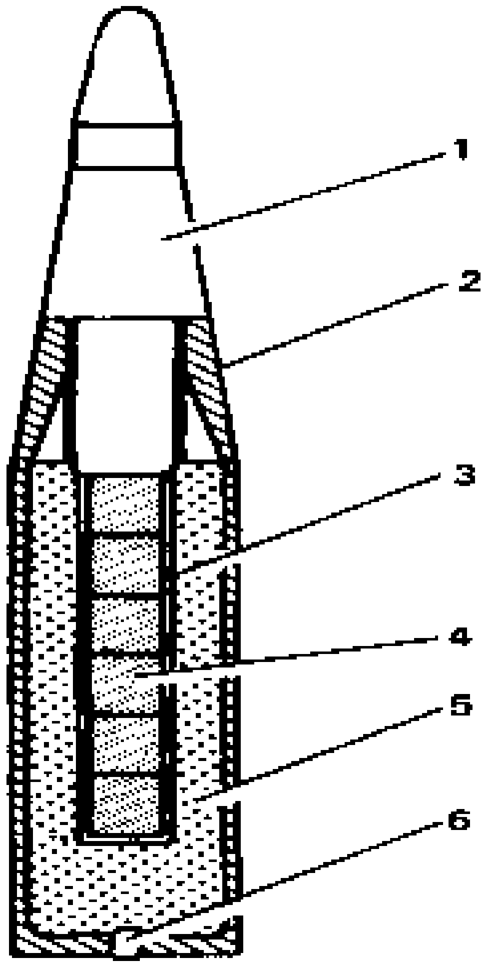
1. CASING
2. BURSTER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FUZE
6. FILLER HOLE

Figure A2.7. 122 mm Chemical Rocket Warhead, 19.3 kg, 2.9 kg VX Fill, Proximity Fuzed.



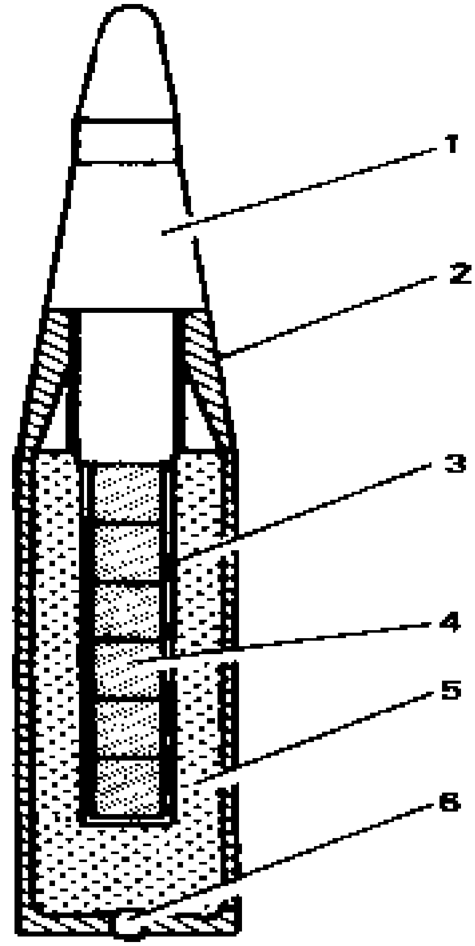
1. FUZE
2. BODY
3. PRIMER TUBE
4. BURSTING CHARGE
5. CW AGENT
6. FILLER HOLE

Figure A2.8. 122 mm Chemical Rocket Warhead, 19.3 kg, 3.1 kg GB Fill, Percussion Fuzed.



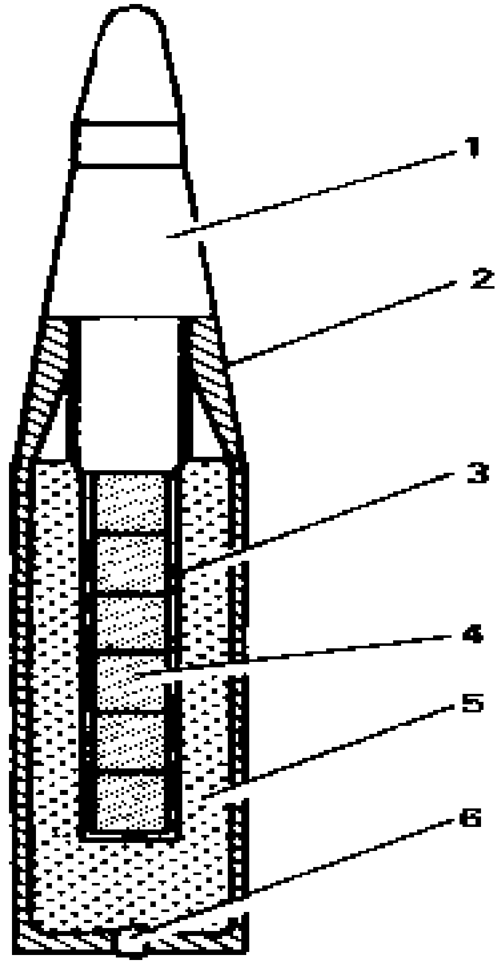
1. FUZE
2. BODY
3. PRIMER TUBE
4. BURSTING CHARGE
5. CW AGENT
6. FILLER HOLE

Figure A2.9. 140 mm Chemical Rocket Warhead, 18.3 kg, 2.2 kg GB Fill, Percussion Fuzed.



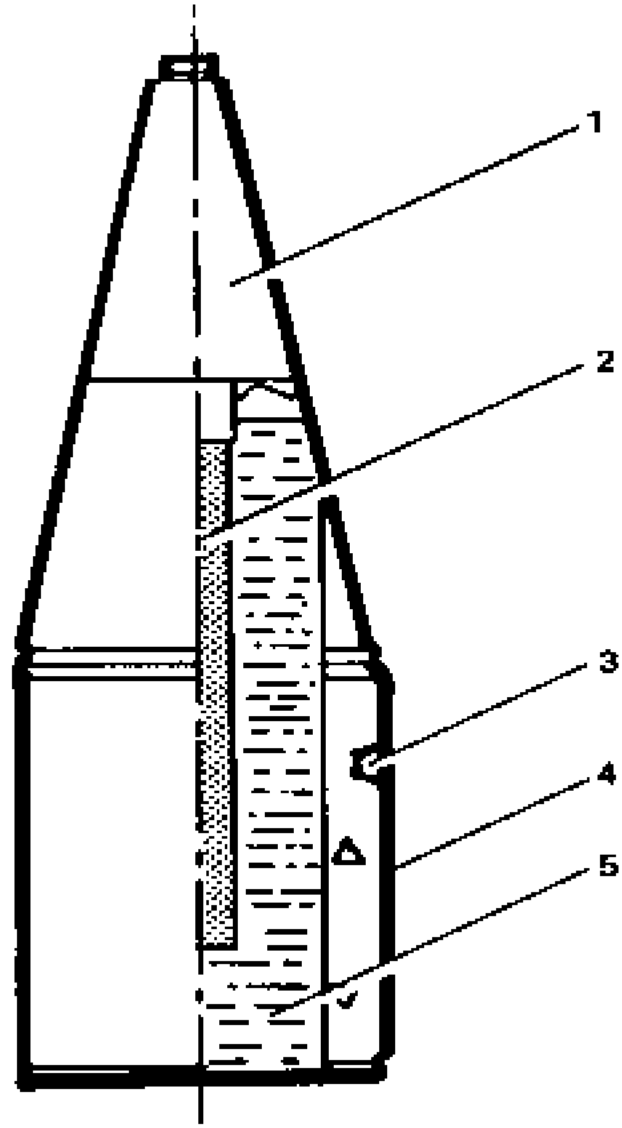
1. FUZE
2. BODY
3. PRIMER TUBE
4. BURSTING CHARGE
5. CW AGENT
6. FILLER HOLE

Figure A2.10. 240 mm Chemical Rocket Warhead, 44.3 kg, 8.0 kg GB Fill, Percussion Fuzed.



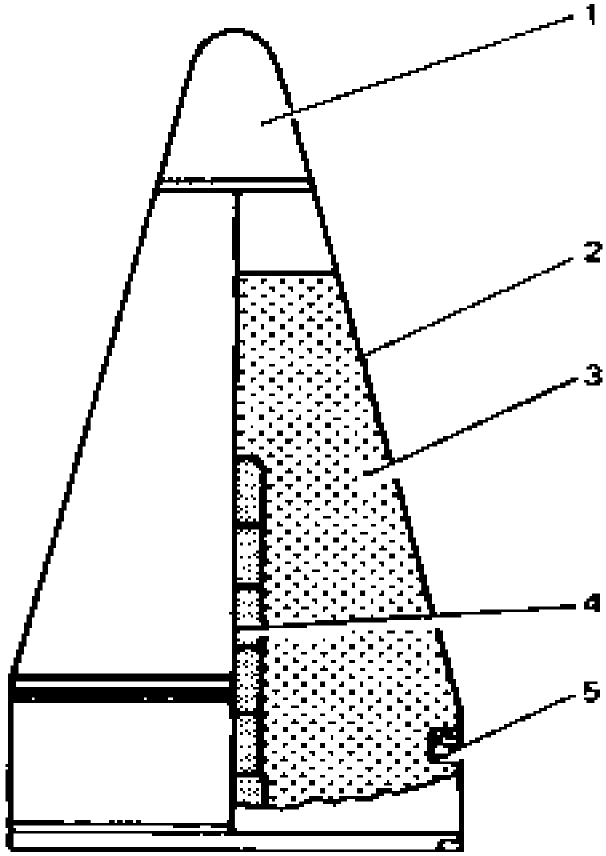
1. FUZE
2. BODY
3. PRIMER TUBE
4. BURSTING CHARGE
5. CW AGENT
6. FILLER HOLE

Figure A2.11. 540 mm Chemical Missile Warhead, 436 kg, 216 kg VX Fill, VT Fuzed.



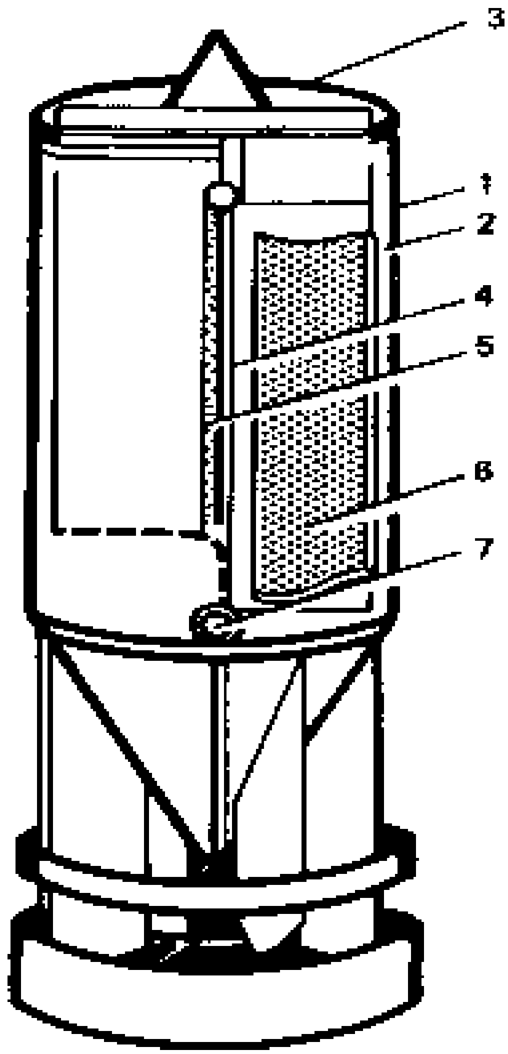
1. VT FUZE
2. BURSTING CHARGE
3. FILLER HOLE
4. CASING
5. CW AGENT

Figure A2.12. 884 mm Chemical Missile Warhead, 985 kg, 555 kg Thickened VX Fill, VT Fuzed.



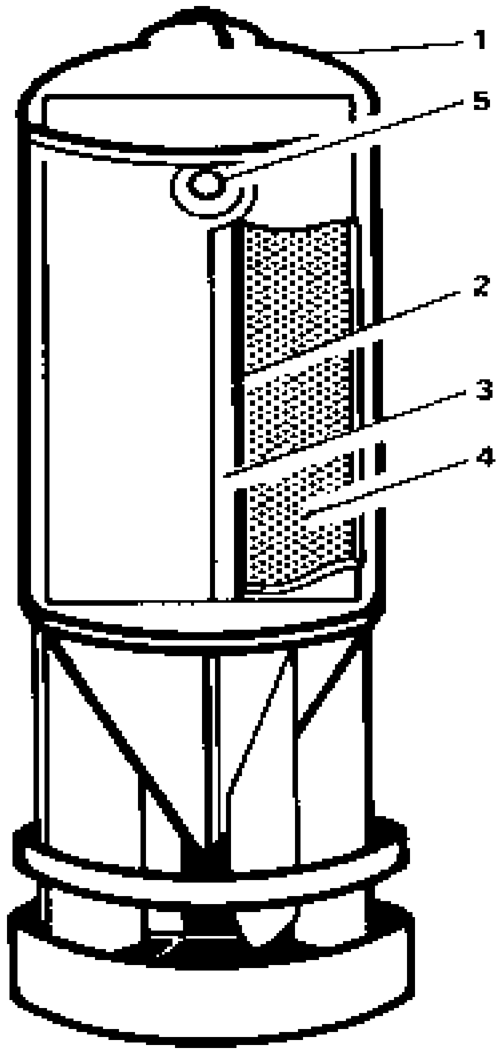
1. VT FUZE
2. CASING
3. CW AGENT
4. BURSTING CHARGE
5. FILLER HOLE

Figure A2.13. 100 kg Chemical Bomb, 100 kg, 39 kg HL Fill, Percussion Fuzed.



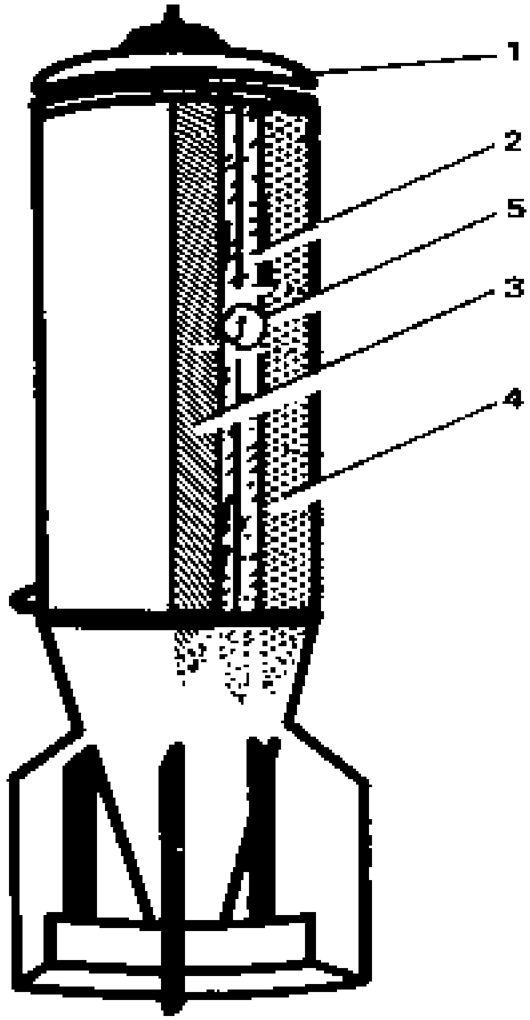
1. EXTERNAL CASING
2. SHELL
3. PROPELLING CHARGE
4. PRIMER TUBE
5. BURSTING CHARGE
6. CW AGENT
7. FILLER HOLE

Figure A2.14. 100 kg Chemical Bomb, 80 kg, 28 kg HL Fill, Percussion Fuzed.



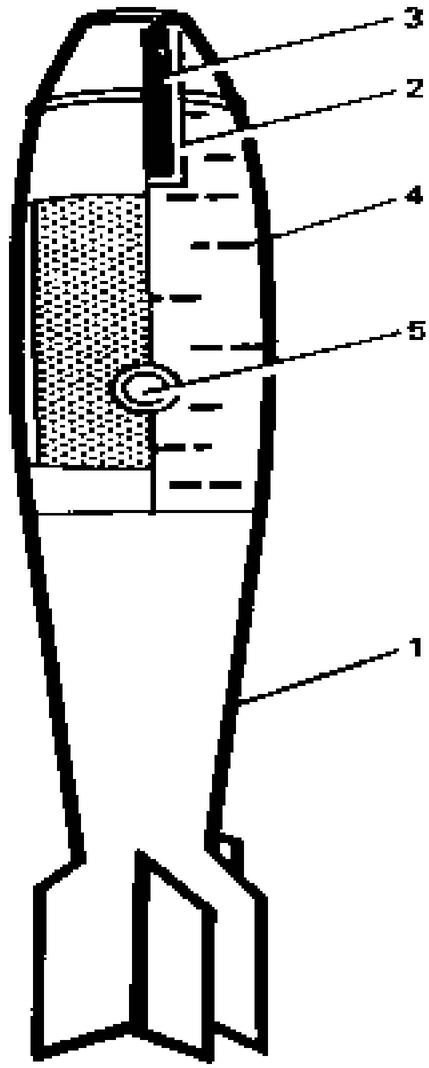
1. SHELL
2. PRIMER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FILLER HOLE

Figure A2.15. 250 kg Chemical Bomb, 233 kg, 49 kg GB Fill, Percussion Fuzed.



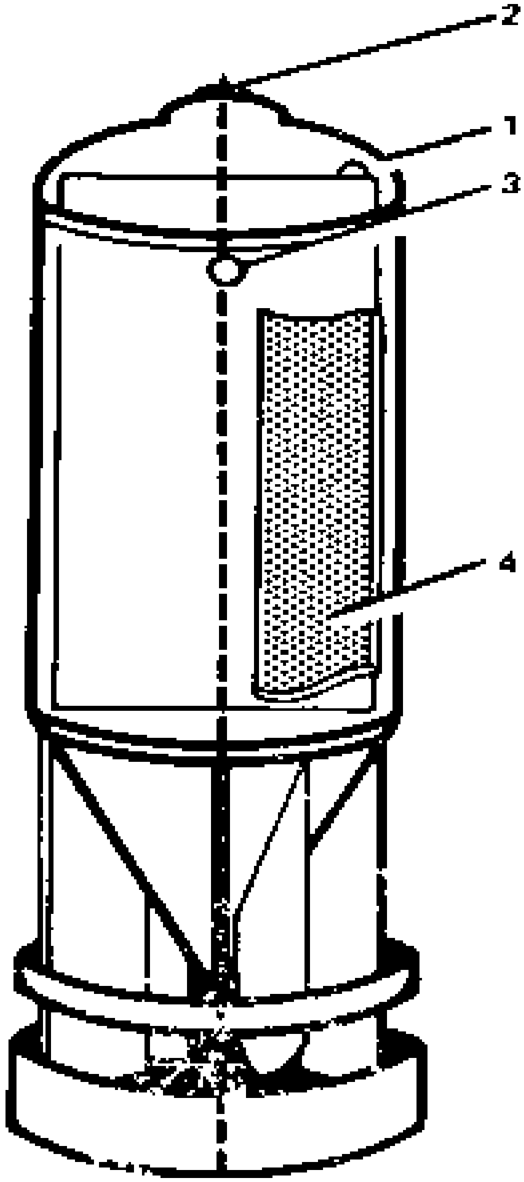
1. SHELL
2. PRIMER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FILLER HOLE

Figure A2.16. 250 kg Chemical Bomb, 130 kg, 45 kg TGD Fill, Time Fuzed.



1. CASING
2. PRIMER TUBE
3. BURSTING CHARGE
4. CW AGENT
5. FILLER HOLE

Figure A2.17. 500 kg Chemical Bomb, 280 kg, 164 kg HL Fill, Time Fuzed.



1. CASING
2. BURSTING CHARGE
3. FILLER HOLE
4. CW AGENT

Figure A2.18. 1500 kg Chemical Bomb, 963 kg, 630 kg HL Fill, Time Fuzed.

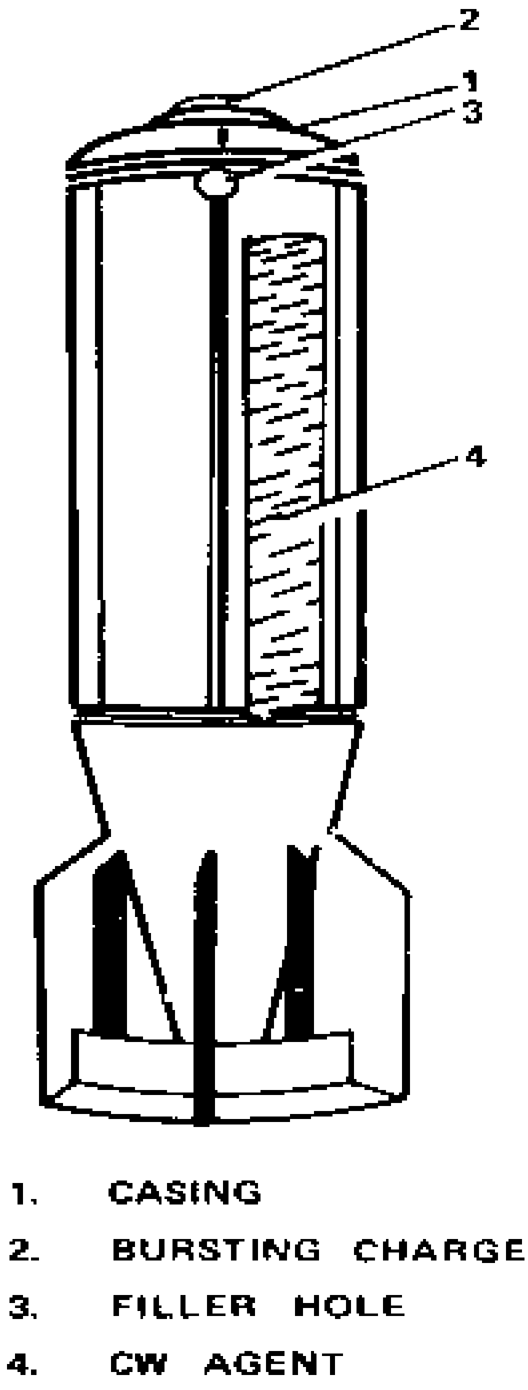
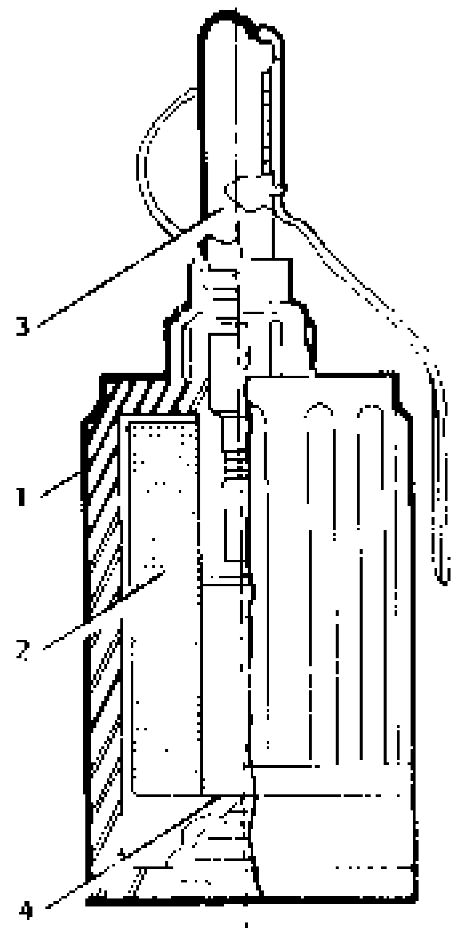


Figure A2.19. Chemical Hand Grenade, 02.5 kg, 0.17 kg CS-Pyrotechnic Mix.



1 BODY

2 PYROTECHNICAL MIXTURE CONTAINING CW AGENT

3. IGNITER SET

4. OUTLET HOLE

Attachment 3

BIOLOGICAL WARFARE AGENTS

A3.1. Consequences of BW Attack. Biological attack can produce varied results. Toxins (e.g., saxitoxin, tetrodotoxin, ricin) are suitable for use in assassination or other highly focused attacks. Pathogens are capable of producing a high level of threat over enormous areas (e.g., anthrax, C. burnetii). These are often true weapons of mass destruction. Munition lethal area coverages can approach those of nuclear weapons.

A3.2. Communicate. The key to determining the appropriate biological protective measure is to communicate with the other agencies on and off base. The threat of biological agents being used in a contingency is the same, if not greater, than chemicals. AFJMAN 32-4009, Technical Aspects of Biological Warfare Agents, and AFH 32-4014 Volume 2, USAF Operations in a Chemical Biological Warfare Environment, CB Hazards, provides more detailed information on BW agents.

A3.3. VAT. Sortie degradation and casualty expectations from representative biological warfare attacks are presented in the Vulnerability Assessment Tool section of **Chapter 6**.

A3.4. Threat. Terrorist release of agent upwind of the installation and missile-delivered BW submunition attacks on air bases, either to degrade operations or weaken national resolve are obvious possibilities with potentially devastating consequences. Terrorist releases may be of relatively modest size. They may evade timely detection. Personnel may therefore be unprotected. Missile-delivered attacks will be detected and personnel should be in full MOPP by the time of agent arrival. But one missile can easily cover an entire base with BW agent. In almost all cases, the only IPE required is the mask.

A3.5. Biological Agent Classes. BW has been defined by the Biological Weapons Convention of 1972 as the use of infectious agents or biological toxins in warfare. A variety of bacteria, viruses, rickettsia and toxins are suitable for warfare uses. The sources previously cited suggest that close to a dozen have found their way into one or another of the world's arsenals. However there is every indication that anthrax and botulinum toxins alone make up the backbone of the vast majority of the world's current arsenals.

A3.5.1. Agent delivery and dissemination can take many forms. However, BW agent dissemination as a wind-borne inhalation hazard is clearly preferred. BW munitions generally contain slurries of liquid agent or dry agent in the form of fine compacted powders. This agent must be converted into an atmospheric aerosol in order to become an effective atmospheric inhalation hazard. Agent aerosolization is commonly achieved by explosive dissemination, or spray. Explosive dissemination is easier to accomplish. But spray typically converts a greater percentage of the munition's agent into usable aerosol.

A3.5.2. The inhalation hazard posed by BW aerosols is derived almost entirely from its one to five micron particles. Particles of this size are readily taken up by the lungs. Inhaled particles of less than one micron are also readily inhaled, but tend to remain suspended in the inhaled air and are subsequently exhaled with it. Particles larger than five microns generally settle out on upper airway surfaces and are subsequently expelled by ciliary action. Few ever make their way into the lung.

A3.5.3. Infectious or toxin agents in contact with skin cause fewer, and generally less severe, consequences than those inhaled. But skin contact with BW agent is not totally without risk. Some toxins are skin irritants and infections can result from skin contact with infectious BW agents. According to Soviet reports, a significant fraction of the infections resulting from the accidental aerosol release of anthrax at Sverdlovsk in 1979 were cutaneous. These could only have resulted from skin contact with agent derived from the anthrax aerosol cloud.

A3.5.4. Water-borne biological warfare hazards should also be considered. Effective reservoir contamination in developed nations is difficult because of the amounts of agent required and the effects of subsequent water treatment. But the possibilities for agent introduction downstream of treatment facilities are endless.

A3.5.5. Since the primary biological warfare hazard is from inhalation of aerosolized wind-borne particles the magnitude of the hazard depends on the amount of agent released, on dissemination efficiency, on agent infectivity or toxicity, on agent persistence in the aerosol state, and on such meteorologic variables as wind speed and atmospheric stability.

A3.5.6. Most aerosolized biological agents survive longer at night than in sunlight. Nighttime use of biological agent is favored whenever attack objectives permit. It is important to recognize that an effective dose of infectious agent is typically tens to hundreds of times smaller than that of toxins. This results in larger dissemination patterns and longer downwind travel for infectious agents than toxins.

A3.6. Classification of Biological Agents. Biological agents can be classified according to their biological type, uses, operational effects, and physiological action. Operationally, biological agents are best thought of as either pathogens or toxins. Pathogens “bugs” are living organisms. As such they require certain conditions of temperature, humidity, protection from sunlight, and a susceptible host population in order to wreck havoc. They must overcome host natural defenses and essentially “set up housekeeping” before illness occurs. This takes time. Therefore, the most likely use of these pathogens will be in SOF, covert, terrorist or other “non-conventional” attack. That way, the target population isn’t alerted to the release immediately, the bug has time to spread through a larger population, and identification of the pathogen becomes much more difficult. Toxins are really no different than familiar GA, GD, VX etc. chemical agents. They are chemical compounds produced by some living organism. Specifically:

A3.6.1. Pathogens are disease-producing microorganisms, such as bacteria, mycoplasma, rickettsia, fungi, or viruses. Pathogens are either naturally occurring or altered by random mutation or recombinant deoxyribonucleic acid (DNA) techniques.

A3.6.2. Toxins are poisons naturally produced through the metabolic activities of living organisms such as proteins, polypeptides, and alkaloids, that come from microorganisms and various plants and animals. Although toxins were initially isolated from living organic sources, manufacture of some by chemical synthesis or other biochemical process is feasible. Industrial fermentation processes can obtain large amounts of highly concentrated bacterial toxins.

A3.7. Biological Agent Characteristics. Aerosol dissemination is the preferred method for biological agent delivery. The aerosol characteristics of biological organisms are dependent upon production details, upon the presence or absence of chemical additives, upon temperature, humidity, and the level of UV radiation (sunlight), upon the strain of organism, and the time in storage (Anderson and Cox 1967). There are many infectious diseases other than the identified threat agents that could be adapted for biological warfare use. Some viral agents such as Rift Valley Fever and Yellow Fever are highly infective by inhalation and survive well in aerosol (Miller et al. 1963). There is neither prophylaxis nor specific therapy for many of these. **Table A3.1.** Lists some possible infectious BW agents.

Table A3.1. Some Possible Infectious BW Agents.

Viral	Rickettsial	Bacterial	Fungal
Yellow Fever	Typhus	Plague	Coccidioidomycosis
Tick-borne Encephalitis	Rocky Mountain Spotted Fever	Anthrax	
Japanese Encephalitis	Q Fever	Tularemia	
Dengue		Brucellosis	
Venezuelan Equine Encephalitis		Typhoid Fever	
Chikungunya			
O'nyong-nyong			
Rift Valley Fever			
Influenza			
Smallpox			
World Health Organization 1970			

A3.8. BW Delivery and Dissemination Systems. Biological agents may be disseminated as aerosols, liquid droplets (toxins only), or dry powders. To a certain extent the state in which an agent normally exists determines its delivery state, use, duration of effectiveness, and physiological action. It also determines the type of system used for its dissemination. Live microorganisms usually grow in a moist environment. Therefore, these agents lend themselves to dissemination in a liquid medium as wet aerosols. However, technology exists to store microbiological materials as a powder. Dissemination of spores and certain toxins as dry powders is likely. Many toxins are water soluble, and dissemination could be as sprays or wet aerosols. In general, agents disseminated as a dry powder will survive longer than those disseminated as wet aerosols. There are many possible methods to deliver biological agents. These include such methods as aerosol delivery, water and food contamination, and use of insect vectors. However, the method best suited to large area coverage is aerosol delivery (Crozier 1963). This method of delivery, especially with aircraft spray systems, can cover thousands of square kilometers. This report concentrates on aerosol delivery of biological agents.

A3.8.1. Another method that has apparently been adopted is water contamination. This is evidenced by the presence of water-borne diseases such as cholera in threat assessments (see BW Threat section). This method of delivery is probably of little threat to modern military and civilian populations because of advanced water treatment facilities (Lamoureux 1951; Montgomery 1985). However, it may be a significant threat to less developed nations.

A3.8.2. While a variety of BW munitions are possible, a few generalities can be made. Biological weapons systems operate as either point sources or line sources. Point sources operate at a single-fixed point and line sources disseminate the agent along a long line perpendicular to the wind direction.

A3.8.2.1. Point Sources. Point source munitions include bombs, unitary missile warheads, submunition systems, and fixed generators. Submunition delivery by missile is a particularly attractive possibility for BW agent delivery. It provides wide coverage of fixed targets in a short period of time. And it is less dependent upon weather effects than single point delivery or line dissemination.

A3.8.2.1.1. The United States reportedly developed 500 lb. aircraft bombs with 106 four-pound bomblets for the dissemination of anthrax in World War II (Bernstein 1987). The BW delivery system designed for the Honest John rocket carried 740 E134 bomblets. However, the U.S. no longer has an offensive BW capability.

A3.8.2.1.2. Backpack sprayers, are frequently cited terrorist or special operations BW agent delivery possibilities. Their use requires that personnel be on the ground near to the target.

A3.8.2.2. Line Sources. Line source dissemination allows extreme area coverage. This can put its use into the realm of strategic, rather than tactical weapons. The most commonly mentioned weapon system of this type is the aircraft spray tank. One example is the Aero 14B aerial spray tank with a capacity 91.6 gallons of liquid agent (Chemical Corps 1960). Any vehicle capable of mounting a spray device from a cruise missile to a ship could be used.

A3.8.2.2.1. Field trials conducted by the US Army with simulants show the possibilities for wide area coverage. In one test, a two-mile long line was disseminated from a ship. Significant doses (100-1000 spores of B. globigii for 15 l/min breathing rate) were achieved up to 23 miles downwind (onshore) from the source (Fothergill 1960).

A3.8.2.2.2. Delivery is most effective if release is close to ground level. Nighttime release prevents sunlight-induced agent decay. And favorable night-time atmospheric inversion conditions are common.

A3.9. Biological Agent Effectiveness. The duration of effectiveness of a biological agent refers to the persistency of the agent in the environment. It depends on the characteristics of the agent, the influence of environmental factors, and any residual hazard generated through resuspension of settled biological particles by the movement of wind, vehicles or personnel in the affected area. Solar (UV) radiation, relative humidity, wind speed and temperature gradient are the most important weather factors in determining duration of effectiveness. UV light affects most biological pathogens and some toxins.

A3.9.1. Pathogens: Because pathogens are living organisms (exhibiting feeding, excretory, respiratory, reproductive, and defensive functions) any factors that reduce their viability will reduce the duration of effectiveness.

A3.9.2. Toxins: The duration of effectiveness of a toxin relates to its physical properties, however vapor pressure or volatility are not as significant factors for biological agents as for the more familiar chemical agents. Some toxins(for example, Staphylococcus enterotoxin, Type B) are stable in the environment and are more resistant to heat, hydrolysis, or vaporization than G or V nerve agents. The chemical structure of toxins can strongly influence the stability of the agent to environmental factors. High-molecular-weight toxins, such as proteins, are usually more sensitive to ultraviolet (UV) light, heat and oxidation than low-molecular-weight, nonprotein toxins. Many toxins are water soluble. Impurities in crude toxin cultures can stabilize the toxins and/or enhance toxicity.

A3.10. Selected Biological Warfare Agents. The following pages provide a thumbnail sketch of selected biological warfare agents that present a likely threat to airbase operations. More detailed information is available in AFJMAN 32-4009, Technical Aspects of Biological Warfare Agents.

A3.10.1. Pathogens:

A3.10.1.1. Anthrax, a bacteria is primarily a disease of cattle and sheep caused by the spore-forming bacteria Bacillus anthracis. Respiratory anthrax, caused by inhalation of air-borne anthrax spores is the dominant biological warfare threat. Remarkably little anthrax is necessary to infect. Anthrax spores are destroyed in a matter of hours by sunlight, but air-borne spores are remarkably stable at night. Spores in soil survive for years. Anthrax has a primary military potential as an anti-personnel agents.

Table A3.2. Anthrax.

Anthrax	
Physical State	Biological warfare agent anthrax can be liquid slurry or dry powder. In either case it will be converted into air-borne particles for BW attack. These will seldom be visible
Effects	The symptoms of respiratory anthrax appear as soon as two days after exposure, or possibly as late as 30 to 60 days after exposure. Early symptoms are flu-like. Once symptoms appear breathing becomes more difficult, fever and weakness worsen over the next 2 days. Coma can develop. Victims usually die within three to four days of symptom development.
Protection Required	Vaccination produces a substantial level of immunity to anthrax. Individual Protective Ensembles provide physical protection against biological agents. Biological weapons produce ground-level clouds of air-borne BW agent particles that move with the wind. IPE protection requires that you be in it before the agent cloud arrives, and stay in it until the cloud has completely cleared the area. Good mask fit and careful mask donning are imperative. Early treatment with antibiotics can cure respiratory anthrax. Well developed cases respond less favorably.
Decontamination	Personal decontamination with towelettes is required at the time of removal of the IPE. Anthrax deposition near the point of munition function is substantial, justifying thorough decontamination. Further downwind deposition is minimal. Skin contact with low level anthrax contamination is not highly dangerous. Because they are proteins, heat, acids, or alkalies can be used for detoxification. Chlorine can be used.

A3.10.1.2. Brucellosis is produced by any of several variants of the bacterium Brucella (Brucella suis, Brucella melitensis, Brucella abortis). These Brucellas are primarily diseases of domesticated animals. Biological warfare infection with the agent is designed to result from inhalation of air-borne Brucella organisms. Very little Brucella needs be inhaled to produce an infection, but Brucella does not survive exceptionally long when air-borne. Nighttime dissemination is therefore preferred. Brucella is expected to soon be part of a number of BW arsenals.

Table A3.3. Brucellosis.

Brucellosis	
Physical State	Brucella can be prepared for Biological warfare use as dry powders or liquid slurries
Effects	A period of weeks is common between exposure to Brucella and the first onset of symptoms. The symptoms are nonspecific. Fever, chills, listlessness, sweats, weakness, joint and muscle pain are usually reported. The symptoms last for months, even with treatment. Brucella are highly infective, but do not withstand the rigors of air-borne transmission and environmental exposure well.
Protection Required	Although there is no US vaccine for Brucellosis, the organisms respond to a number of antibiotics. The disease is not communicable from man to man. The primary means of infection is through inhalation of air-borne organisms, therefore mask protection is of critical importance. Other means of transmission is through ingestion of unpasteurized dairy products and uncooked meats.
Decontamination	Contaminated materials are easily sterilized or disinfected by common methods such as Chlorine. Pasteurization and proper food preparation is effective for contaminated meats and dairy products..

A3.10.1.3. Plague, or Black Plague, is a disease caused by the bacteria Pasteurelia pestis. It occurs as three primary types in man: bubonic, septicemic, and pneumonic. Plague is transmissible to man by the bite of an infected flea, or from man to man by the respiratory route. Like other common BW agents, it relies on inhalation of air-borne organisms for infection. The disease naturally occurs in many parts of the world. The plague is moderately infective by inhalation, but not very hearty once released into the environment, nor does it seem to penetrate intact skin easily. Antibiotic resistant strains are possible.

Table A3.4. Plague.

Plague	
Physical State	Biological warfare agent preparations can be in the form of water-based slurrys, or possibly dry powder. Dry forms are more efficient, but more difficult to prepare.
Effects	Inhalation (pneumonic) plague symptoms typically appear two to three days after inhalation of the organism. The onset is abrupt, with fever, chills, headache, cough and rapid heart rate. Sputum is blood-flecked, later pink to red. Most untreated patients die within 48 hours of symptom onset.
Protection Required	USAF personnel have, for some time been vaccinated against Plague, not so much as a biological warfare defense as a defense against exposure to the organism during deployment to naturally plague-ridden areas. IPE provides physical protection against the organism. Since large amounts of the agent are released from typical BW munitions, good mask fit is essential. Antibiotics provide a third tier of protection against this agent. Antibiotic use within a few hours of symptom development reduces the fatality rate to less than 5%.
Decontamination	The organism is killed by exposure to heat at 130° F for 15 minutes. Decontamination can be effected by boiling, dry heat above 130° F, steam, or treatment with lysol or chlorine.

A3.10.1.4. Tularemia is also known as rabbit fever. It is produced by the bacterium Francisella tularensis. Like most BW agents F. tularensis is typically prepared for air-borne dissemination. F. tularensis is not a spore forming organism, and is not extremely stable when released into the environment. But it is highly infective. It is best released at nighttime. Some isolates produce few enough fatalities to be considered incapacitating agents.

Table A3.5. Tularemia.

Tularemia	
Physical State	BW Tularemia preparations can be either wet slurries or dry powders
Effects	Symptoms appear within 4 to 7 days of inhalation of airborne F.tularensis. They include the sudden onset of fever, chills, cough, headache, with a tendency for pneumonio do develop.. Untreated, the disease has a fatality rate of approximately 30%, and may last for months. When treated with antibiotics the fatality rate is less than 1%.
Protection Required	F. tularensis responds to any of several antibiotics. And although the Department of Defense has an experimental vaccine that has been successfully used with several thousand subjects there are no immediate plans for its widespread use. As with other BW agents, IPE, most notably the protective offers considerable physical protection against airborne agent.
Decontamination	F. tularensis is easily killed by heat at 113°F or above for a few minutes or by 0.5 percent phenol in 15 minutes. Chlorine can be used as a decontaminant.

A3.10.1.5. Smallpox is an infective human disease caused by the virus Variola. The virus ranges from 0.15 to 0.2 micron in size and can pass through most filters. It has been eradicated in nature.

The last natural case occurred in Somalia in October 1977. The virus has no known animal reservoirs. It survives in various laboratories, and presumably in biological warfare arsenals. There are many related animal pox viruses; however, it is unlikely that these will cause severe effects in man.

Table A3.6. Smallpox.

Smallpox	
Physical State	Biological warfare preparations of variola virus can, presumably, be prepared in liquid slurry or fine dry powder.
Effects	Smallpox is a highly contagious disease. Fever, headache, backache, and prostration the first symptoms of the disorder, appear seven to seventeen days after exposure. A rash typically appears within two days of the onset of fever. Over the next few days the rash converts to pus-filled blisters (Pustules), scab over, and the scabs separate in weeks two and three of the disease. The rash is easily identifiable as smallpox. Case fatality rates of 30-35% are common for the more virulent of the variola strains.
Protection Required	Vaccination provides an effective, long-lasting protection against small pox. However few people born since the mid 1970s have been vaccinated (the disease was eradicated in 1977). IPE provides a significant level of physical protection. Biological warfare uses of smallpox are expected to rely on respiration of air-borne virus particles, implying that mask protection is of particular importance.
Decontamination	Decontamination can be accomplished by exposure of the organism to alcohol and acetone for 1 hour at room temperature, or chlorine, but the virus is resistant to some other disinfectants. Moist heat above 140°F and dry heat above 212°F are effective in 10 minutes.

A3.10.1.6. Viral encephalitis is caused by any of several viruses. Some common encephalitis viruses are Venezuelan, Eastern and Western Equine Encephalitis viruses, St.Louis Encephalitis, and Japanese Encephalitis. Many infections by these viruses result in relatively mild illness. However, a percentage of infected people develop central nervous system involvement (encephalitis and/or meningitis). These cases are severe and may be fatal.

Table A3.7. Viral Encephalitides.

Viral Encephalitides	
Physical State	Viral Encephalitides can be prepared as either a liquid slurry or as a dry powder. These agents will likely be dispersed as an aerosol to create an inhalation hazard. Use of infected insects is another possible means of disseminating these viruses.
Effects	Headache, drowsiness, fever, vomiting, and muscle pain are the usual initial symptoms for these viruses. Tremors, mental confusion, convulsions, and coma may develop rapidly in cases of CNS involvement. Paralysis of the extremities occurs occasionally. Fatality rates depend upon specific strain of virus, but are usually low. The incubation period for Venezuelan Equine Encephalitis, a typical member of this group, is 2 to 4 days with the acute phase of the disease lasting 2 to 6 days.
Protection Required	Vaccines for several of the viral encephalitides are available on a limited experimental basis. The IPE provides effective protection against aerosols of these agents. As these agents are likely to be disseminated as an aerosol, good mask fit is important.
Decontamination	Personal decontamination of individual equipment should be performed after De-Warn. Standard decontaminants and methods are effective with these viruses. Contact with low level contamination is not generally considered a great hazard unless the agent is re-aerosolized.

A3.10.1.7. Q Fever is the disease caused by the rickettsia Coxiella burnetti. It is maintained in nature as inapparent infections in domestic animals such as cattle and sheep. Transmission is usually by infective aerosols. The disease can also be spread by ticks.

Table A3.8. Q Fever.

Q Fever	
Physical State	Q Fever may be prepared as either a dry powder or as a liquid slurry. It will be dispersed as an aerosol to create an inhalation hazard.
Effects	Q Fever has an incubation period of 2-3 weeks. Onset of symptoms is abrupt with acute fever, headache, chills, weakness, and profuse perspiration. A non-productive cough is common. Acute phase of the disease may last 1 to 3 weeks. Mortality rate is less than 1% even in untreated patients. Acute Q Fever responds well to antibiotic treatment. Chronic forms of the disease may respond poorly to antibiotics.
Protection Required	An experimental vaccine effective against Q Fever is available on a limited basis. Acute forms of Q Fever respond well to antibiotics. Antibiotic treatment will usually shorten or eliminate period of incapacitation in infected personnel. The IPE provides effective protection against aerosols of Q Fever. As Q Fever is highly infective by inhalation, good mask fit is imperative.
Decontamination	Q Fever organisms are very persistent in the environment and are hard to kill. They can survive for months in soil. Standard decontamination methods may not be entirely effective in disinfecting Q Fever, but can at least remove the organisms. Personal decontamination of individual equipment should be performed after De-Warn. Thorough decontamination should be performed as soon as feasible.

A3.10.2. Toxins:

A3.10.2.1. Botulinum toxins, the cause of botulism food poisoning, are a family of high molecular weight neurotoxins produced by the bacteria Clostridium botulinum. Botulinum toxins are lethal, considerably more poisonous than nerve gases, and are among the most toxic substances known to man. The type A toxin is the most potent of the toxins produced by this organism. BTA is the dominant toxin threat agent and would likely be used as an aerosol to create an inhalation hazard.

Table A3.9. Botulinum Toxins.

Botulinum Toxins	
Physical State	Botulinum toxins can be prepared as either a dry white powder or as a liquid slurry. It is stable in solution up to seven days when protected from heat and light.
Effects	Botulinum toxins act by preventing the release of acetylcholine, a neuromuscular transmitter chemical. This results in extreme muscular weakness, malaise, dilation of the pupils, blurred vision, and dizziness. Respiratory paralysis and cardiac arrest occur in lethal cases. Symptom onset occurs in 12 to 72 hours. Recovery in survivors may take months.
Protection Required	An experimental vaccine effective against Botulinum toxins type A, B, C, D, and E is available and was used on limited basis during Operation Desert Storm. There is a polyvalent antitoxin available for treatment of botulinal intoxication. It may not be available in quantity, however, and needs to used very soon after intoxication. The individual Protective Ensemble (IPE) provides effective protection against toxins disseminated as an aerosol. As Botulinum will probably be dispersed as an aerosol, good mask fit and careful mask donning are imperative.
Decontamination	Basic skills decontamination for personnel would prove effective on neutralizing this toxin. The toxin can withstand acids, but chlorine or other alkaline solutions can destroy it. This toxin is sensitive to heat. Boiling for 15 minutes or, when in food, cooking for 30 minutes at 175°F will destroy it.

A3.10.2.2. Staphylococcal Enterotoxin, Type B (SEB). Various bacteria produce toxins that induce fever, vomiting, and diarrhea. These toxins, called enterotoxins, are a common cause of food poisoning. They are militarily important as they cause incapacitating effects at very low doses. One of the most potent of the bacterial enterotoxins is Staphylococcal Enterotoxin type B (SEB). This toxin is produced by certain strains of the bacteria Staphylococcus aureus.

Table A3.10. Staphylococcal Enterotoxin, Type B (SEB).

Staphylococcal Enterotoxin, Type B (SEB)	
Physical State	SEB can be prepared as either a dry powder or as a liquid slurry.
Effects	Intoxication by SEB causes fever, nausea, vomiting, abdominal pain, and watery diarrhea. While SEB is generally considered an incapacitating agent, fatalities will occur in cases of high doses. Symptoms usually occur within one-half to six hours (average three hours) after ingestion. Symptoms cn appear within a few minutes after exposure to large doses by aerosol. Incapacitation is brief, usually one day or less.
Protection Required	There is no specific treatment for SEB intoxication, therefore physical protection is imperative. As SEB will likely be disseminated as an inhalable aerosol, good mask fit important.
Decontamination	Use large amounts of soap and water to decontaminate personnel, equipment, and supplies. SEB is difficult to decontaminate with active chlorine (STB, HTH). Formaldehyde detoxifies SEB.

A3.10.2.3. Ricin is a lethal, delayed-action cytotoxin. The toxic properties of the castor bean have long been known. The active toxin in castor beans is the toxin ricin. This is a high molecular weight protein toxin that is highly toxic. Forms of ricin that could be used as a warfare agent range from crude castor bean cake to a highly purified extract.

Table A3.11. Ricin.

Ricin	
Physical State	Ricin can be prepared as either a dry powder or as a liquid slurry.
Effects	Inhalation of ricin causes a severe hemorrhagic pneumonia. Initial symptoms usually appear between six to ten hours and three days. The first symptoms are nause, vomiting, bloody diarrhea, abdominal cramps, breathing difficulty, renal failure, and circulatory collapse. In survivors of serious exposures, hospitalization of 10 or more days may be required. Death in may occur a few days after exposure.
Protection Required	Antitoxin is available; its early administration is necessary to prevent severe tissue damage, therefore physical protection is imperative. IPE provides effective protection as ricin will likely be disseminated as an inhalable aerosol, good mask fit is important.
Decontamination	Personal decontamination of individual equipment should be performed after De-Warn. Use soap and water to remove contamination from personnel, equipment, and supplies. Chlorine can be used as a decontaminant.

Attachment 4

RECOMMENDED READINESS BEDDOWN OPERATION PRIORITIES

This attachment provides a recommended Readiness priority list for beddown operations. The BCE will implement beddown operations and determine the actual priorities based upon guidance from the commander. These operations will normally be prioritized and directed from the WOC, the SRC, and the DCC and will require the coordination and support of the other CE flights and several other functional organizations (possibly including other services or national forces). Although aimed primarily at preparing the base for combat, several of these operations serve an equally vital peacetime function.

A4.1. Develop warning and notification systems.

A4.1.1. Attack warning and notification.

A4.1.1.1. Aircraft and Tactical Ballistic Missile.

A4.1.1.2. Conventional and NBC weapons.

A4.1.2. Natural disaster and major accident.

A4.1.2.1. Base and local community.

A4.1.2.2. DCG and DP specialized team recall.

A4.2. Develop attack response plans and checklists.

A4.2.1. Pre-Attack Actions.

A4.2.1.1. Dispersal and sheltering of assets.

A4.2.1.2. Hardening or splinter protecting of assets.

A4.2.1.3. CCD operations.

A4.2.1.4. Preparation for NBC contamination detection, protection, avoidance, and control.

A4.2.2. Trans-Attack Actions.

A4.2.2.1. Activation of warning and notification.

A4.2.2.2. Sheltering personnel and equipment.

A4.2.3. Post-Attack (BRAAT) Actions.

A4.2.3.1. Reconnaissance operations.

A4.2.3.2. Repair, recovery, and contamination control operations.

A4.3. Recommend dispersal and shelter strategies for vital assets.

A4.3.1. Aircraft/weapons systems.

A4.3.2. Wing command and control centers.

A4.3.3. Command, control, communication, and computer systems.

A4.3.4. Squadron operations and intelligence support.

A4.3.5. Critical maintenance facilities.

A4.3.6. Collective protection facilities/areas.

A4.3.7. Critical POL storage and distribution assets.

A4.3.8. Munition storage, assembly, loading assets.

A4.3.9. Critical utility generation and distribution systems.

A4.3.10. Critical supply storage.

A4.3.11. Fire/crash facilities and assets.

A4.4. Implement sheltering or relocation of non-vital assets.

A4.4.1. Medical facilities.

A4.4.2. Non-critical maintenance facilities.

A4.4.3. Non-critical POL facilities.

A4.4.4. Non-critical utility generation and distribution systems.

A4.4.5. Non-critical supply storage.

A4.4.6. Dining facilities.

A4.4.7. Living areas.

A4.4.8. Other facilities and assets.

A4.5. Train for attack response and recovery actions.

A4.5.1. WOC, SRC, DCC, and NBCCC combined operations.

A4.5.2. Base-wide BRAAT operations.

A4.5.2.1. Reconnaissance and reporting of damage, unexploded ordnance, and NBC contamination.

A4.5.2.2. NBC avoidance and contamination control.

A4.5.3. CE BRAAT operations.

A4.5.3.1. EOD operations.

A4.5.3.2. Damage assessment team (DAT) operations.

A4.5.3.2.1. Airfield DAT.

A4.5.3.2.2. Building and facility DAT.

A4.5.3.3. Fire fighting operations.

A4.5.3.4. NBC reconnaissance, plotting and reporting.

A4.5.3.5. NBC contamination control operations.

A4.5.3.6. Post-attack evaluation and modification of passive defense measures.

A4.6. Recommend hardening or splinter protection strategies for vital assets.

A4.6.1. Steel bin revetments.

A4.6.2. Earth berms.

A4.6.3. Pre-cast concrete revetments.

A4.6.4. Sand bags.

A4.6.5. Other expedient methods.

A4.7. Implement CCD plan.

A4.7.1. Smoke and obscuration.

A4.7.2. Camouflage netting.

A4.7.3. Tonedown.

A4.7.4. Decoys.

A4.7.5. Radar corner reflectors.

A4.7.6. Other systems and methods.

A4.8. Establish mutual support agreements with host and allies.

A4.8.1. Agreements not already in force to clarify major accident, natural disaster, and combat-related response and recovery support, facilities, communications, etc.

A4.9. Train NBC specialists.

A4.9.1. NBC control center.

A4.9.2. NBC reconnaissance.

A4.9.3. Decontamination teams.

A4.9.4. Open air contamination control teams.

A4.9.5. Personnel protective shelter teams.

A4.10. Establish NBC plotting/reporting system.

A4.10.1. NBC control center.

A4.10.2. NBC reconnaissance.

A4.11. Develop major accident/disaster plans and checklists.

A4.11.1. Natural disaster mitigation, response, and recovery.

A4.11.2. Major accident response and recovery.

A4.12. Train for major accident and natural disaster response and recovery operations.

A4.12.1. Base-wide major accident operations.

A4.12.1.1. CE major accident response and recovery operations.

A4.12.2. Base-wide natural disaster operations.

A4.12.2.1. CE natural disaster response and recovery operations.

Attachment 5

READINESS SITE SURVEY CHECKLIST ITEMS

A5.1. Introduction. Use AF Form 2519, **All Purpose Checklist**, and the checklist item contained in this attachment as a starting point for your site survey operations. Remember that some site survey questions are designed to gather information about existing procedures (main operating base) and are not limited to queries concerning the availability of resources. Many existing procedures will be found in the host base planning documents such as the base support plan, OPlan 32-1, CE Contingency Response Plan, etc.

A5.2. Threat. Determine the threat.

A5.2.1. What is the actual threat at the location as agreed upon by the Readiness Flight, Security Forces, OSI, and Intelligence? Use all available documents (PACAF Command Intelligence Estimate for Air Base Operations {CIEAP}, Peninsula Intelligence Estimate {PIE}, Worldwide CB Threat to Air Bases, etc.) and specific discussions with intelligence personnel during this evaluation.

A5.2.2. What is the likelihood of enemy use of:

A5.2.2.1. Nuclear, chemical, or biological agents?

A5.2.2.2. Conventional weapons, terrorism, and special forces operations?

A5.2.3. If NBC weapons are likely to be used:

A5.2.3.1. How are the agents likely to be delivered?

A5.2.3.2. How many weapon systems will probably be used in any given attack?

A5.2.3.3. What is the range, payload, accuracy, and likely burst characteristics (air, ground) of the weapon system(s)?

A5.2.3.4. What specific agents are likely to be used?

A5.2.3.5. What physical form (liquid, dusty, aerosol) will the agents probably be in?

A5.2.3.6. When is the enemy likely to employ NBC weapons (early on, nighttime, etc.)?

A5.2.3.7. What contamination levels (g/m2, mg/m3, spores/m3, etc.) will probably exist at your location after an attack?

A5.2.3.8. What is the purity of the enemy's agents:

A5.2.3.8.1. Is there a shelf-life associated with their agent production i.e., the agent(s) must be used within six months of production in order to be effective.

A5.2.3.8.2. Are the characteristics of their agent the same as an American-made agent i.e., does the enemy's VX have the same volatility rate, color change on M8 paper, etc.

A5.2.4. In terms of conventional weapons, what are the probable weapons delivery systems i.e., mortars, rockets, surface-to-surface missiles, and man portable surface-to-air missiles?

A5.2.5. What is the "hazard ring" associated with critical operating locations of the installation (to include typical aircraft take off and landing patterns)? This "ring" provides insight into the amount of area around the installation that must be secured from ground forces - the installation's perimeter fence has no tactical significance. Develop the hazard ring by drawing a line equaling threat weapon system ranges from the critical airfield operating locations. In most cases, the “ring” will actually take the shape of a large dog bone.

A5.2.6. If a realistic threat, what is the range and accuracy of enemy sniper activities?

A5.3. Communications. Determine communication requirements.

A5.3.1. What communications capabilities currently exist at the location?

A5.3.2. Is there an installation-wide warning system?

A5.3.2.1. Does a Giant Voice System exist and what are the areas of coverage?

A5.3.2.2. Are there tapes for Giant Voice in all applicable languages?

A5.3.2.3. Does the warning system have the capability to broadcast the siren sequences the base populace is used to hearing?

A5.3.2.4. Is the system set up so that a power loss or other problem in one sector does not adversely affect other sectors?

A5.3.2.5. Does the system have back up power or uninterrupted power supply capabilities?

A5.3.3. How many tactical and non-tactical radios will Readiness personnel have access to at the employment location?

A5.3.3.1. Have radio frequencies been pre-identified within the theater for various functions (EOD has XXX, Readiness has XXX, etc. across the entire theater)?

A5.3.3.2. If so, do Civil Engineer radio’s have the required frequency and/or programmable capability?

A5.3.3.3. If not, are unit radio frequencies in conflict with another user?

A5.3.3.4. What is the range of the radio’s (with and without repeaters)?

A5.3.3.5. Are there any “black holes” on the base (no or poor quality radio contact)?

A5.3.3.6. Do Readiness personnel and/or the NBC Control Center have the capability to talk to joint service forces (Army Patriot and/or Fox vehicle operators for example) via radio?

A5.3.4. Will available radios reach the proposed installation open-air CCA/TFA complex?

A5.3.5. Are communications available, both primary and backup, from the NBC Control Center to all planned billeting and personnel protection locations to include shelters, collective protection facilities, and tent cities?

A5.3.6. If a collocated operating base (COB), does a hot line exist between host and tenant NBC Control Centers?

A5.3.7. Are cellular phones a possible alternative to established landline communications needs?

A5.3.8. If not available immediately, when will critical communications assets be available?

A5.3.9. Are there Wing Initial Communications Packages (WICP) packages scheduled to deploy with the unit, and if so, what type and how many WICP assets can Readiness personnel expect to use?

A5.3.10. Is phone service readily available at the site?

A5.3.10.1. If so, does a secure voice capability exist at the deployed location?

A5.3.10.2. If so, does a DSN capability exist?

A5.3.10.3. If so, are there adequate numbers of lines to support mission operations?

A5.3.11. Does a message center exist with the following capabilities:

A5.3.11.1. Transmittal and receipt of hard copy unclassified messages? If so, does the system require a specific format (SARA Lite for instance)?

A5.3.11.2. Transmittal and receipt of hard copy classified messages? If so, does the system require a specific format?

A5.3.11.3. Secure voice

A5.3.11.4. Transmittal and receipt of unclassified and classified facsimile

A5.3.12. Does the site have designated phone lines for automated NBC plotting and reporting hook ups?

A5.3.13. Does the site and/or expected UTCs have sufficient computer workstations (with appropriate software) to effectively conduct mission operations?

A5.3.14. Are there any known communication's choke points i.e., a single cable

or switchboard that holds the wiring for the majority of installation communication lines?

A5.3.15. If appropriate, what communications lines will be used to pass or receive hazard information from local civil defense, air defense, or security notification systems?

A5.3.16. Are global positioning systems (GPS) coded?

A5.4. Facilities. Determine facility requirements.

A5.4.1. Are facilities available to house the Survival Recovery Center (SRC), alternate SRC, Damage Control Center (DCC), and alternate DCC?

A5.4.1.1. Will the SRC be collocated with the Wing Operations Center (WOC)?

A5.4.1.2. Will the NBC Cell be collocated with the SRC?

A5.4.1.3. Do these facilities provide semi-hardened and/or filtration capabilities?

A5.4.1.3.1. If so, how will deploying personnel learn how to operate the system(s)?

A5.4.1.3.2. If so, are the filters operational and how many spares exist?

A5.4.1.3.3. Do these facilities have an emergency escape capability?

A5.4.2. Are adequate storage facilities available for BCE equipment, CCA supplies, bulk stored CWDE, and CCD materials?

A5.4.3. Are sufficient facilities available to beddown deploying forces? If not, does the installation terrain allow the rapid establishment of tent compounds (soil stability is key i.e., not swamp land)?

A5.4.4. Have facilities been identified for use by Readiness personnel?

A5.4.5. Do sufficient personnel protection facilites (buildings, bunkers, etc., with splinter protection and overhead cover) exist in the main work and rest and relief areas?

A5.4.6. Do sufficient collective protection facilities exist for the entire base populace? If not, has available collective protection space been allocated on a prioritized basis i.e., direct sortie generators before support personnel?

A5.5. Utilities. Determine utility requirements.

A5.5.1. What power sources (110/220 VAC, etc.) are available at the deployed location?

A5.5.2. Which facilities have serviceable, fixed-generator systems as their source of backup power? Are appropriate unit personnel trained in generator maintenance, start up, and refueling requirements?

A5.5.3. Does every section of the installation have adequate commercial power?

A5.5.4. Are there main switches for turning on/off the utilities within each grid (quadrant) of the base?

A5.5.5. Is the source of electrical power contained within the base perimeter or does it originate from an external location (power station 3 miles away for example)?

A5.5.6. Which facilities have emergency lights?

A5.5.7. Do adequate water supplies exist (for drinking)?

A5.5.7.1. If so, where is the “purification” plant located?

A5.5.7.2. If not, will the deployed water purification capability support operations?

A5.5.8. Do adequate water supplies exist for contamination control and fire fighting activities?

A5.5.8.1. Are water hydrants readily available and functional? If so, do our forces possess the tool(s) to use them?

A5.5.8.2. Is the available water for contamination control operations primarily saltwater?

A5.5.9. Does a sufficient water-heating capability exist to support food preparation and personal cleanliness?

A5.5.10. What water storage capabilities exist (tanks, flexible bladders, water buffalos, etc.)?

A5.5.11. Are sewer lines available and functional?

A5.5.12. Do Readiness personnel require additional generators in order to support critical mission operations?

A5.6. Air Defense. Determine air defense requirements.

A5.6.1. Does the unit have an organic point air defense capability (host nation force with systems such as the Chaparral, Avenger and/or Stinger)?

A5.6.1.1. If not, is there another air defense unit (Army, Host Nation) scheduled to deploy and assigned to protect the installation?

A5.6.1.2. Does the air defense unit possess both an anti-aircraft and anti-missile capability?

A5.6.2. Does the installation have a direct communication’s link with the Sector Operations Center (SOC)?

A5.6.2.1. What air defense sector is the installation located in?

A5.6.2.2. Is the sector the same for the tactical ballistic missile warning system?

A5.6.3. Is the Air Defense Control Post (ADCP) collocated with the WOC?

A5.6.4. Does a tenant or joint unit possess former-Soviet aircraft? If so, does the air defense unit have procedures for "interrogating" aircraft in order to determine friend or foe?

A5.6.5. Where and how do tactical ballistic missile warnings come into the installation?

A5.6.6. Does the installation commander have ready access (within 15 seconds) to tactical ballistic missile warning system information?

A5.7. Transportation. Determine transportation requirements.

A5.7.1. Do Readiness personnel have sufficient vehicles designated for their use at the employment location? If not, how many additional vehicles are required?

A5.7.2. Does the BCE have sufficient vehicles to conduct airfield damage assessment, building damage assessment, rapid runway repair, explosive ordnance disposal, bomb removal, fire fighting, and facility repair activities?

A5.7.3. Are the installation's vehicles (to include host nation and/or contract) toned down?

A5.7.4. If appropriate for the threat, does the installation have sufficient vehicle and trailer support to effectively conduct smoke and false operating strip activities?

A5.7.5. Does the installation have the maintenance capability, to include acceptance of the responsibility, to repair power-driven decontamination equipment and the smoke **generators?**

A5.8. Legal Considerations. Determine legal requirements.

A5.8.1. Are there any status of forces agreements that require deviation from normal Readiness operations? If so, what are they?

A5.8.2. Are there any memorandum of agreements (MOA's) in existence or that are required?

A5.8.3. Are there any unique local customs that might affect mission operations? If so, what are they?

A5.8.4. Are there any unique local laws or customs that Readiness personnel might unwittingly violate? If so, what are they?

A5.8.5. What is the availability of civilian assets and services in the local area that are necessary to effective mission operations and could be procured through contracting?

A5.8.6. Are all personnel familiar with the Geneva Convention rules of engagement?

A5.9. Air Base Defense. Determine air base defense requirements.

A5.9.1. Does the installation already have defensive fighting positions (DFP's) around its perimeter and around critical resource areas?

A5.9.2. Are DFP's sited in such a manner as to complement rather than disrupt dispersal operations?

A5.9.3. Do the DFP's possess adequate splinter protection and overhead cover?

A5.9.4. Who is responsible for providing security outside of the perimeter?

A5.9.5. Are there any non-USAF forces tasked for security inside the perimeter? If so, who and where are they?

A5.9.6. Are clear lines of communications available to warn ground defense personnel of impending hazards i.e., missile attack or approaching NBC contamination?

A5.9.7. Does the unit utilize a specific, easily recognizable signal to warn the base populace of harassment activities i.e., sniper fire or limited mortar attack?

A5.9.8. Are air defense sites and personnel incorporated into the installation's ground defense protective network?

A5.10. Command and Control. Determine command and control requirements.

A5.10.1. Are sufficient base grid maps and local area maps available for unit control centers and reconnaissance personnel?

A5.10.2. Does a detailed map of the airfield operating surfaces exist (to support minimum airfield operating surface {MAOS} selection)?

A5.10.3. Do appropriate personnel in the wing operations center (WOC) have direct access to the installation-wide warning network?

A5.10.4. Which OSI detachment is responsible for area coverage?

A5.10.5. Have operational procedures been developed for CB contaminated remains?

A5.10.6. Are facilities available to house all required primary and alternate control centers?

A5.10.7. Have Readiness personnel reviewed all existing wartime plans for the employment location and discussed applicable items with other players?

A5.11. Munitions Storage. Determine munitions storage requirements.

A5.11.1. Is the munitions storage area protected (igloo's, berms, revetments, etc.)?

A5.11.2. Is the munitions storage area located away from other critical assets?

A5.11.3. Is there more than one entrance/exit from the munitions storage area?

A5.11.4. Are munitions build areas sufficiently dispersed so that if one is damaged at least one other site is available?

A5.12. Medical Facilities. Determine medical facility requirements.

A5.12.1. Does the installation possess "fixed" medical facilities?

A5.12.1.1. If yes, what is the bed capacity?

A5.12.1.2. If yes, are portions of the facility afforded "filtered" protection?

A5.12.1.3. If no, are there facilities that could be transformed into medical operating areas or is an air transportable hospital scheduled to be deployed to the employment location?

A5.12.2. Are there medical facilities in the local community? If yes, does an MOA exist between the host nation and the local medical facility?

A5.13. Fire Fighting Capability. Determine fire fighting requirements.

A5.13.1. Does the installation have automatic fire suppression systems in critical facilities?

A5.13.2. Does the host nation have an MOA with the local community concerning fire fighting activities?

A5.13.3. Does the installation have dedicated fire fighting facilities?

A5.13.4. Has an agreement been established with fire fighters to assist in water production should the capability be needed for decontamination operations?

A5.14. Repair and Operation of Airfield Operating Surfaces. Determine airfield requirements.

A5.14.1. What is the status of the runway(s) i.e., is it operational, capable of handling unit aircraft, etc?

A5.14.2. Are there any rapid runway repair materials presently available at the installation (crushed stone, folded fiberglass mats, etc.)?

A5.14.3. What is the runway redundancy factor?

A5.14.4. Does the runway(s) have aircraft arresting systems permanently installed?

A5.14.5. Does the runway have an adequate lighting system and does an alternate lighting capability exist?

A5.14.6. Does adequate aircraft parking space exist? If not, is the parking area capable of being easily expanded (based on soil stability and use of AM-2 matting for example)?

A5.15. Equipment. Determine equipment requirements.

A5.15.1. Is there an NBC equipment repair capability available in the local area (RADIACS, chemical detection, etc.)?

A5.15.2. Will there be equipment standardization issues with host nation or other U.S. military service personnel (filter element swaps, batteries, etc.)?

A5.15.3. Will there be equipment interoperability issues with host nation or other U.S. military service personnel (suit removal, detection instrument units of measurement, etc.)?

A5.15.4. Are there any restrictions on bringing air base operability assets into the country; i.e., heavy equipment can't operate on the highways without special convoy arrangements?

A5.15.5. Are "pre positioned" assets available? If so, what are they and are they serviceable?

A5.15.6. What will individuals do with their hand carried CB individual protective equipment (IPE)?

A5.15.7. If appropriate, when is CB IPE scheduled to arrive from the Consolidated Mobility Bag Control Center (CMBCC)? What will the unit do with the CB IPE once it arrives from the CMBCC?

A5.15.8. How will CB IPE be issued to hospital and CCA/TFA locations for resupply purposes?

A5.15.9. How will disposal of contaminated IPE be handled?

A5.15.10. Does the host country possess enough IPE for their personnel? If not, is IPE available for at least those host nation personnel that are critical to the unit's mission operations i.e., air base defense and emergency essential civilians?

A5.16. Contamination Control Operations. Determine contamination control requirements.

A5.16.1. What command and control structure will govern contamination control operations?

A5.16.2. How many contamination control units will exist and from which units will they be formed?

A5.16.3. What is the concept of operations for decontamination; i.e., weathering except when mission critical or decon everything?

A5.16.4. What decontamination equipment is currently available on site?

A5.16.5. What decontaminants exist at the location (DS2, STB, solid chlorine, etc.)?

A5.16.6. Where are decontamination equipment and decontaminants stored, how do you gain access to them, and are they it maintained properly?

A5.16.7. Do facilities exist for aircraft decontamination (wash racks, spray system, etc.)?

A5.16.8. Is water available for decontamination and is it other than salt water?

A5.16.9. Are assets available to cover equipment when overhead cover is unavailable?

A5.17. NBC Detection. Determine NBC detection requirements.

A5.17.1. What NBC detection equipment is currently on site?

A5.17.2. Exactly where are these assets stored?

A5.17.3. Who has access to these assets and how do you contact them?

A5.17.4. What NBC detection equipment is projected to deploy to the site?

A5.17.5. Are there restrictions on bringing NBC detection assets into the country?

A5.17.6. Where are deploying equipment assets coming from?

A5.17.7. When are equipment packages due in?

A5.17.8. Will sufficient NBC detection instruments be present to ensure total mission coverage i.e., stationary sites, mobile reconnaissance teams, decontamination teams, instruments for CCA and TFA operations, and instruments to place between contaminated and clean areas of the installation?

A5.17.9. If a COB, what type and amounts of NBC detection equipment does the host nation possess?

A5.17.9.1. What are the host nation's NBC detection equipment capabilities and limitations?

A5.17.9.2. How does the host nation plan on utilizing assigned NBC detection equipment assets?

A5.17.9.3. What integration of host nation and unit plans must be accomplished in relation to stationary NBC detection equipment utilization to ensure 100% coverage?

A5.17.9.4. How many decontamination teams does the host have; how many do you have?

A5.17.9.5. Does each decontamination team possess sufficient NBC detection equipment?

A5.17.9.6. How many people will be on each host nation reconnaissance team?

A5.17.9.7. What is the host nation's concept of operations for reconnaissance teams and does it conflict with your reconnaissance concept of operations?

A5.17.9.8. Do host nation reconnaissance teams possess the types and amounts of NBC detection equipment to effectively implement the appropriate concept of operations? assets?

A5.17.10. What communications capabilities exists for reconnaissance teams and with whom will they communicate?

How will NBC contamination be reported; i.e., positive, negative, or identification of specific agents, category, and concentration level when known?

How will reconnaissance teams be dispatched; automatic dispatch upon declaration of alarm black or only when notified by command and control?

A5.17.11. What PMEL support exists for NBC detection equipment?

A5.17.12. Are sufficient quantities of batteries available for NBC detection equipment?

A5.18. NBC Cell. Determine NBC Cell requirements.

A5.18.1. Do sufficient quantities of appropriate maps exist for primary and alternate NBC Cell operations? Are digitized maps available?

A5.18.2. If a COB, who has primary and alternate responsibility for NBC Cell operations and is there a tasking for the exchange of NBC Cell personnel?

A5.18.3. What is the reporting channel for NBC Cell reports?

A5.18.4. What sub collection centers will exist in the surrounding area?

A5.18.5. Who will provide weather information to the NBC Control Center and/or NBC Cell functions?

A5.18.6. Does the unit possess information that will enable NBC Cell personnel to provide detailed CB plotting and persistency calculations?

A5.18.7. Does the unit have the proper forms for NBC warning and reporting?

A5.19. Sister Services. Determine sister service requirements.

A5.19.1. What sister services are presently assigned or scheduled to be deployed within your area of operations?

A5.19.2. Do these sister services have NBC specialists assigned and if so, how many?

A5.19.3. What are or will be these sister service NBC roles and missions in the area?

A5.19.4. Do any of the sister services have a capability you can use but do not possess such as biological detection through the BIDS system, enhanced chemical detection through the use of the Fox, etc.,?

A5.19.5. Do the sister services possess sufficient personnel and equipment to fulfill their mission requirements in relation to how they directly impact your unit operations?

A5.20. Contamination Control Area(s)/Toxic Free Area(s). Determine CCA/TFA requirements.

A5.20.1. If sufficient collective protection facilities do not exist, are unit procedures set up so to utilize an on-base CCA/TFA complex if possible before venturing off-base?

A5.20.2. What are the likely drawbacks to off-base CCA/TFA operations at the employment location?

A5.20.3. At least for planning purposes, are suitable CCA/TFA locations in the surrounding area pre-identified, surveyed, and available at each major compass direction?

A5.20.4. What installation facilities, complete with capacities, possess CB filtration systems?

A5.20.5. Are there areas within the confines of the installation perimeter that could serve as an on-base CCA/TFA?

A5.20.5.1. If yes, are these areas already spoken for?

A5.20.5.2. If yes, will logistical, communications, and transportation problems be insurmountable?

A5.20.5.3. Do these sites have land line communications available?

A5.20.5.4. Do these sites have multiple access routes?

A5.20.6. Can security of the proposed TFA sites be reasonably assured to include security for routes to and from TFA ?

A5.20.7. Are required signs and equipment available for installation CCA/TFA operations?

A5.20.8. How will required equipment, to include replacement CB IPE, be transported to the CCA/TFA once the site is selected and/or activated?

A5.20.9. How will personnel be transported to the TFA? What are the security provisions for off-base CCAs.

A5.20.10. Who will provide food, water, and other critical supplies to the CCA/TFA sites?

A5.20.11. Where will the people required for installation CCA/TFA operations originate from - how and when will they be trained, will they be permanently assigned or simply report at a specified time?

A5.20.12. Has the unit considered the requirement for CB IPE aeration and contaminated waste disposal sites as part of its CCA/TFA planning activities?

A5.21. Explosive Ordnance Disposal. Determine EOD requirements.

A5.21.1. If so requested by EOD, will there be a problem involved with digging trenches along the entire length of the runway-taxiway network?

A5.21.2. Does sufficient space (100 yards on each side of a square) exist for EOD to establish a conventional weapons holding area and a separate chemical-biological weapons holding area (following render safe procedures)? If so, where are these areas scheduled to be sited?

A5.21.3. Are installation facilities adequate for the physical security requirements associated with EOD materials?

A5.22. Alarm Signals/Unique Procedures. Determine alarm signal requirements.

A5.22.1. Does the host country utilize warning signals that are contradictory to ours (yellow means attack is imminent for example)?

A5.22.2. Does the host country or main operating base possess warning signals that the deploying forces are not used to practicing with (a special alarm for attacking ground forces, alarm blue versus red {Korea}, and alarm green {Korea}for instance)?

A5.23. Shelters and Tent Cities. Determine shelter requirements.

A5.23.1. Are sufficient facilities available to beddown deploying forces? If not, is a tent city planned to shelter personnel? If so:

A5.23.1.1. Are available Harvest Falcon and Harvest Bare assets available to meet construction taskings? Have people been identified and trained to erect these assets?

A5.23.1.2. What additional construction will be required to facilitate completion of the tent city?

A5.23.1.3. Is the site identified in a potential flood, avalanche, or falling rock area?

A5.23.1.4. Is the soil stable enough to support the tent city and is sufficient drainage available?

A5.23.1.5. Have assigned security forces incorporated the personnel housing area(s) into their protective ground defense network?

A5.23.1.6. Does the unit possess sufficient transportation support to get people to and from the tent city?

A5.23.1.7. Was Geneva Convention rules taken into consideration when selecting location for the tent city?

A5.23.2. Will CCD activities and techniques be required to increase the survivability of personnel housing areas?

A5.23.3. Do personnel housing areas possess sufficient blast/splinter protection and overhead cover?

A5.23.4. Are the personnel shelters located in a “target rich” environment i.e., are they next to critical mission operation centers?

A5.23.5. Will Readiness personnel have housing arrangements when they arrive at the employment location i.e., are they arriving ahead of the main engineering force?

A5.23.6. Has the host engineering force made arrangements to ensure the base population has adequate housing arrangements in a timely manner (in relation to when the bulk of the population arrives in the TPFDD flow?)

A5.23.7. Do sufficient hardened aircraft shelters exist at the deployed location to protect unit and transient aircraft? If not, are there sufficient “revetted” aircraft parking spaces for unit and transient aircraft?

A5.24. Expedient Hardening Capabilities. Determine hardening requirements.

A5.24.1. What percentage of required hardening has been accomplished?

A5.24.2. What expedient hardening is still required to be accomplished and are expedient hardening materials available (sandbags, bunkers, revetments, etc.) to rapidly accomplish this task?

A5.24.3. If necessary, can the installation rapidly get additional expedient hardening supplies i.e., revetment kits and/or “Bitburg” revetments?

A5.24.4. Are critical facilities sited in such a manner that earth could be easily pushed up along the sides of the building?

A5.24.5. Have engineers evaluated planned expedient hardening techniques to ensure the facilities can withstand the activity i.e., the roof won’t collapse?

A5.25. Camouflage, Concealment, and Deception. Determine CCD requirements.

A5.25.1. What are the specific types of sensor systems used in the enemy’s primary threat weapon systems for target acquisition (visual, thermal, radar, etc.)?

A5.25.2. What CCD measures will be effective against the specific threat and does the unit possess the capability (resources, training, planning) to effectively possess them?

A5.25.3. If appropriate to the threat, what employment technique(s) will allow available CCD assets to be best utilized?

A5.25.4. How and when will CCD assets be dispersed to units?

A5.25.5. Are natural foliage or ground terrain features (ravines, stream beds, etc.) available at likely dispersal locations?

A5.25.6. Will the buildings and/or aircraft operating surfaces require tone down (reflectivity too high)?

A5.25.7. If attacking aircraft are a probable threat, does available foliage look natural or does it lead attacking aircrews to critical resource areas (trees in lines down main streets, etc.)?

A5.25.8. Are there any terrain features around the installation that would allow us to predict likely aircraft or ground attack corridors? If so, what and where are they?

A5.25.9. Does the terrain of the installation allow for pockets of “naturally” camouflaged areas?

A5.25.10. If necessary to combat air or ground threats, has the installation considered what actions can be implemented for light deception? Are sufficient quantities of blackout materials available?

A5.25.11. What support will Readiness personnel provide to units in CCD planning and operations?

A5.25.12. Are smoke generators to be used for CCD?

A5.25.12.1. If so by whom?

A5.25.12.2. Remotely activated from where?

A5.25.12.3. Who will authorize their use?

A5.25.12.4. Are Readiness personnel qualified to plan smoke missions?

A5.25.12.5. Do Readiness personnel have access to required fuel and fog oil supplies?

A5.26. POL Operations. Determine POL requirements.

A5.26.1. Are the main POL storage tanks:

A5.26.1.1. Isolated from other critical resource areas?

A5.26.1.2. Toned down (if necessary in relation to the threat)?

A5.26.1.3. Afforded some degree of splinter protection?

A5.26.2. Does the capability exist to disperse POL assets (bladders, fuel trucks, etc.)?

A5.27. Host Nation Considerations. Determine host nation requirements.

A5.27.1. Are there any host nation forces in the area who can support installation air base operability operations? If so, where are they and what do we expect them to do?

A5.27.2. If host nation forces are used for any purpose on the installation or in the surrounding area, do they understand the unit's alarm signals?

A5.27.3. Are interpreters available if necessary for interaction between host nation and Readiness personnel?

Attachment 6

HAZARD ASSESSMENT CHECKLIST ITEMS

A6.1. Introduction. As principle advisors to the commander on NBC issues, the readiness technician should be able to address the following indicators. Make plans to improve or develop work-arounds for the deficient areas. If the unit is counting on host nation resources (especially services such as fire fighting or medical) ensure written support agreements exist.

A6.2. NBC Detection and Warning. The unit's integrated NBC detection network should detect all of the enemy's CB agents, in all of the likely agent delivery forms (liquid, dusty, aerosol). If not, develop a method that will/can be used for agent identification.

A6.2.1. The unit's integrated NBC detection network should be positioned in such a manner that personnel will receive sufficient warning to completely avoid agent exposure.

A6.2.1.1. If this is not possible, what specific types and concentrations of CB agents will personnel likely be exposed to before they receive warning?

A6.2.1.2. Will this exposure be sufficient to cause injuries and/or fatalities? If so, what percentage of personnel are expected to be incapacitated or killed?

A6.2.1.3. Does the unit possess the capability to provide virtually instantaneous warning and critical amplification instructions to the entire base populace?

A6.2.1.4. Are all personnel in and around the installation familiar with the alarm signals and amplification instructions that will be used? This includes host nation, sister service, and additive forces.

A6.2.2. The installation should have a course of action once a launch has been detected i.e., transition immediately to alarm red or wait until the missile trajectory has been defined?

A6.2.2.1. How much warning do you expect the installation to receive in relation to air threats i.e., aircraft or incoming missiles?

A6.2.2.2. When all things have been considered (flight time in relation to installation warning, installation alarm signal declaration procedures, adequacy of installation notification network, etc.), will the base populace receive adequate warning in regards to impending air threats?

A6.3. Specific BW Concerns. The unit should have sufficient materials, and an executable plan, to vaccinate installation personnel prior to deployment. Especially if one or more of the unit shortcomings (i.e. detection and warning) are in the biological agent area (pathogens). Does the unit possess sufficient medical treatment materials (ciproflaxin or other antibotics for anthrax for example) to effectively handle large population exposures?

A6.4. NBC Assessments. The unit should possess the training and support materials necessary to provide detailed assessments for commanders concerning NBC agent identification, characteristics, associated hazards, and persistency? If necessary in relation to the threat, does the unit have a realistic chance (equipment, training, and past exercise performance) of sustaining mission operations in a NBC contaminated environment for an extended time?

A6.5. “Hazard Ring”. Air base defense, sister service, and/or host nation forces should have control throughout the employment location’s “hazard ring”, especially in terms of man-portable surface-to-air systems?

A6.6. NBC Force Protection. If necessary in relation to the threat, critical Readiness items such as chemical and biological detectors should be afforded protection from sniper activities.

A6.6.1. The base population should have adequate splinter protected bunkers (with overhead cover) or other protective structure in the immediate vicinity of their work area.

A6.6.1.1. What percentage of direct sortie generators don’t have this protection?

A6.6.1.2. Has the unit determined exactly what resources it will need to conduct expedient protection if appropriate for the threat (200,000 sandbags for instance)? If so, does the unit possess the required assets and do they have a specific construction plan?

A6.6.1.3. Are off-site utility sources such as electrical power stations and water filtration plants afforded adequate security? If not, what is the probability of their being sabotaged and what will be the impact if sabotage does occur?

A6.6.1.4. Have critical work areas and functions, to include defensive systems such as Patriot batteries, been afforded adequate security?

A6.6.1.5. Are aircraft and other critical resources (fuel trucks, munitions trailers, etc.) afforded the alignment and separation distances necessary to prevent a chain reaction of explosions and damage if one asset explodes?

A6.6.1.6. Do unit billeting plans erroneously call for the housing of like AFSCs in the same location(s)? For example, are all aircrew, munitions personnel, fire fighters, or Readiness personnel housed together?

A6.7. Communications. Readiness personnel and NBC teams should possess sufficient radios and/or other communications methods.

A6.7.1. Can Readiness personnel easily contact all NBC reconnaissance teams, sister service NBC specialists, and related installation functions (shelter teams, decontamination teams, etc.)?

A6.7.2. Will the installation possess sufficient communications to completely control open-air CCA/TFA operations i.e., communications between the contact hazard area, vapor hazard area, TFA, SRC, and NBC Control Center?

A6.7.3. Can the NBC Cell rapidly transmit and receive NBC reports to/from subordinate, lateral, and higher headquarters units?

A6.7.4. If appropriate to the threat and situation, what is the probability that an enemy could seriously degrade installation communications by destroying critical circuits at one or more communications chokepoints?

A6.7.5. If the NBC Cell is not collocated with the SRC, is the communications system such that Readiness personnel can still provide rapid, accurate hazard updates and personnel protective posture advice to the commander?

A6.8. NBC Response Procedures. All Readiness personnel employed are expected to be familiar with existing procedures and aware of their specific mission task(s), regardless of their originating home station. Installation response procedures should be such that the wing does not respond to all threats (sniper, ground forces, mortars, missile and/or aircraft attacks) in the same manner. This will cause unnecessary degradation and possibly prevent the unit from accomplishing its assigned mission(s).

A6.8.1. Does the unit possess "cookie cutter" (one-size fits all) procedures such as automatic evacuation distances in relation to unexploded ordnance (same for bomblet as for missile regardless of facility structure or mission criticality)? If so, examine these procedures and determine the potential impact they will have on mission operations.

A6.8.2. Does the unit possess sufficient medical capability to handle the expected amounts and types of injuries?

A6.8.3. Does the unit possess sufficient RRR and associated airfield maintenance capabilities to keep airfield operating surfaces open if the runway redundancy factor is low? This may be a factor even if the enemy threat is low because of the possibility of major accidents causing surface damage.

A6.8.4. Does the unit possess a clear concept of operations for decontamination, contamination avoidance, and cargo movement activities? Does the unit possess the dedicated personnel, checklists, equipment, and training to effectively execute the concept of operations?

A6.8.5. Does the unit possess a clear concept of operations for CCA/TFA activities be it open-air, collective protection, or a combination of both? Does the unit possess the dedicated personnel, checklists, equipment, and training to effectively execute the concept of operations?

A6.9. Reconnaissance and Transportation. Critical post-attack functions such as damage assessment, explosive ordnance disposal, fire fighting, NBC reconnaissance, etc., should possess sufficient vehicles and equipment to accomplish their mission. Are there locations on munitions routes or elsewhere on the installation where, if a major accident occurred, the majority of installation mission activities would be shut down because of resulting evacuation and response procedures?

A6.10. CCD. If appropriate to the threat, the unit should possess sufficient CCD materials and have a specific employment scheme for these materials.

A6.10.1. What will be the impact on unit survivability if one or more CCD assets (smoke generator for instance) are damaged and aren't likely to be repaired?

A6.10.2. Has each unit assigned with CCD or blackout materials accepted the responsibility to employ, reposition, and maintain its materials?

A6.11. NBC Equipment. The unit should possess plans for the protection and distribution of CB individual protective equipment (IPE).

A6.11.1. Are all personnel familiar with the plans?

A6.11.2. Does the unit possess sufficient IPE to conduct operations in an extended NBC contaminated environment? This includes IPE for critical host nation and/or sister service personnel such as air defense, security forces, and cargo handlers.

A6.11.3. Is a clear resupply route for IPE established and are sufficient resources available through this method?

Attachment 7

CB VULNERABILITY ASSESSMENT TABLES

A7.1. VAT Instructions. This worksheet should be used in conjunction with the Vulnerability Assessment Tool (VAT) data tables to quantify airbase vulnerability to chemical and biological attacks.. Chapter 6 should be consulted for detailed explanation of the VAT variables and components.

A7.1.1. Step 1 - Identify Correct Set of Look Up Tables. The first step in conducting the vulnerability assessment is to determine the region of the world that is of interest. After the correct set of tables is located, find the meteorology condition that applies and then find the correct airbase size. The VAT data tables contain assessments for Southwest Asia (SWA-Middle East) and Northeast Asia (NEA-Korea) attack scenarios. Each region is further broken down by meteorology condition (summer and winter) and by size of airbase (large and small). **Table A7.1.** provides an index to the VAT Tables.

Table A7.1. VAT Index.

Vat Table	Attack Scenario	Base Size	Climate	Case Numbers
A7.2.	NE Asia	Small	Summer	1-30
A7.3.	NE Asia	Small	Summer	31-60
A7.4.	NE Asia	Small	Winter	1-30
A7.5.	NE Asia	Large	Summer	1-30
A7.6.	NE Asia	Large	Summer	31-60
A7.7.	NE Asia	Large	Summer	61-90
A7.8.	NE Asia	Large	Summer	91-120
A7.9.	NE Asia	Large	Winter	1-30
A7.10.	NE Asia	Large	Winter	31-60
A7.11.	SW Asia	Small	Summer	1-30
A7.12.	SW Asia	Small	Summer	31-60
A7.13.	SW Asia	Small	Winter	1-30
A7.14.	SW Asia	Large	Summer	1-30
A7.15.	SW Asia	Large	Summer	31-60
A7.16.	SW Asia	Large	Winter	1-30

A7.1.2. Step 2 - Evaluate Defensive Components of the Airbase. The second step in conducting the assessment is to find the appropriate columns that match the “fixed” defensive components. The defensive components that are used in the assessment are: (1) ColPro (Collective Protection or rest and relief shelters), (2) IPE (Individual Protective Equipment which is either the BDO or the new JSLIST), (3) Cooling (body cooling which is MICS or any other system), (4) Dewarn (dewarning or the time after attack when MOPP is reduced), and (5) Decon (whether or not decontamination will be performed). ColPro, IPE, and Cooling columns under the defensive components are "fixed", which means your base either has ColPro or doesn't, personnel have either a BDO or a JSLIST suit, and your base has cooling systems or it doesn't. Dewarn and Decon are variables, depending on when you want personnel to reduce MOPP or perform decontamination operations. This will be done in step 3.

A7.1.3. Step 3 - Determine when MOPP will be reduced and if Decon will be performed. This final step is done by matching the time which you plan on reducing MOPP (Dewarn) determining if decon will be accomplished. Reducing MOPP too early may result in increased casualties while waiting too long may reduce sortie generation capability. Likewise, decontamination operations may reduce casualties at the expense of a lower sortie generation capability. Once this is done, read across the different attack scenarios listed at the top of the table to determine your airbase vulnerability to CB attacks.

A7.2. Sortie Generation Capability and Casualties. The "S" sub-column displays the predicted sortie generation for the entire five-day scenario as a percentage of air taskings. The "C" sub-colum contains the predicted casualty total for the five days as a percentage of the air base wartime population (casaulties reflect those personnel who do not return to duty before the end of the scenerio. This information, when applied to your operation should be SECRET WHEN FILLED IN.

Table A7.2. NE Asia, Small Base, Summer Cases 1 - 30.

	NE ASIA							SMALL BASE				SUMMER			
	Defensive Components					CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warm	Decon	S	C	S	C	S	C	S	C	S	C
1	N	B	N	9	N	41	1	25	52	60	11	15	34	29	19
2	N	B	N	8	N	47	4	26	52	60	11	21	35	33	20
3	N	B	N	8	Y	46	2	26	51	60	11	20	35	33	19
4	N	B	N	7	N	41	12	25	57	60	11	16	89	26	39
5	N	B	N	6	N	59	6	30	52	60	11	30	35	45	19
6	N	B	N	6	Y	61	3	29	52	60	11	30	35	45	19
7	N	B	N	5	N	57	14	27	58	60	11	18	89	37	40
8	N	B	N	4	N	57	33	26	63	60	11	12	95	23	54
9	N	B	N	3	N	73	8	28	52	60	11	33	35	50	20
10	N	B	N	3	Y	75	4	28	52	60	11	34	34	50	19
11	N	B	N	2	N	73	17	28	57	60	11	20	89	41	39
12	N	B	N	1	N	71	34	28	64	60	11	13	94	30	55
13	N	B	N	0	N	51	53	27	65	60	11	9	96	22	72
14	N	B	Y	9	N	61	1	26	52	60	10	27	34	43	19
15	N	B	Y	8	N	66	3	27	52	60	10	32	35	46	19
16	N	B	Y	8	Y	66	2	28	52	60	10	29	34	45	19
17	N	B	Y	7	N	64	12	27	57	60	10	19	89	38	39
18	N	B	Y	6	N	73	6	29	52	60	10	32	35	49	19
19	N	B	Y	6	Y	72	3	30	51	60	10	32	34	49	20
20	N	B	Y	5	N	71	14	28	57	60	10	21	89	41	39
21	N	B	Y	3	N	76	8	29	51	60	10	31	35	50	21
22	N	B	Y	3	Y	77	4	28	52	60	10	35	34	50	20
23	N	J	N	9	N	50	1	29	52	60	11	20	34	35	19
24	N	J	N	8	N	55	4	28	52	60	11	25	36	38	21
25	N	J	N	8	Y	55	2	27	52	60	11	22	35	39	21
26	N	J	N	7	N	52	12	26	58	60	11	16	89	30	39
27	N	J	Y	9	N	63	1	30	52	60	10	27	33	41	19
28	N	J	Y	8	N	66	4	27	52	60	10	30	36	45	21

	NE ASIA							SMALL BASE				SUMMER			
	Defensive Components					**CW Only**		**BW Only (Covert +TBM)**		**BW Only (Covert Only)**		**CW + BW (Covert +TBM)**		**CW + BW (Covert Only)**	
#	ColPro	IPE Type	Cooling	De-Warm	Decon	**S**	**C**	**S**	**C**	**S**	**C**	**S**	**C**	**S**	**C**
29	N	J	Y	8	Y	67	2	27	52	60	10	31	36	47	20
30	N	J	Y	7	N	65	12	29	57	60	10	18	89	36	38

Table A7.3. NE Asia, Small Base, Summer Cases 31-60.

	NE ASIA							SMALL BASE				SUMMER			
Defensive Components						CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
31	Y	B	N	9	N	42	0	75	8	86	4	37	7	36	5
32	Y	B	N	8	N	48	2	79	8	86	4	41	8	41	6
33	Y	B	N	8	Y	47	1	75	8	86	4	41	7	41	5
34	Y	B	N	7	N	47	10	75	9	86	4	30	32	41	19
35	Y	B	N	6	N	65	5	81	8	86	4	54	11	59	8
36	Y	B	N	6	Y	65	2	80	8	86	4	57	8	59	6
37	Y	B	N	5	N	63	13	82	8	86	4	39	34	55	19
38	Y	B	N	4	N	65	28	84	9	86	4	36	48	50	34
39	Y	B	N	3	N	79	7	83	8	86	4	69	12	70	8
40	Y	B	N	3	Y	80	3	84	8	86	4	70	9	76	8
41	Y	B	N	2	N	78	14	84	8	86	4	52	35	68	20
42	Y	B	N	1	N	79	29	83	10	86	4	44	49	64	34
43	Y	B	N	0	N	64	44	83	10	86	4	34	67	49	48
44	Y	B	Y	9	N	67	0	81	8	85	5	58	7	61	5
45	Y	B	Y	8	N	70	2	81	8	85	5	61	9	64	6
46	Y	B	Y	8	Y	71	1	80	8	85	5	62	7	65	5
47	Y	B	Y	7	N	70	10	81	8	85	5	47	33	62	18
48	Y	B	Y	6	N	77	4	83	8	85	5	68	11	70	8
49	Y	B	Y	6	Y	79	2	84	8	85	5	67	8	70	6
50	Y	B	Y	5	N	77	13	81	8	85	5	52	33	68	19
51	Y	B	Y	3	N	80	6	83	8	85	5	72	12	76	9
52	Y	B	Y	3	Y	81	3	85	8	85	5	75	9	79	8
53	Y	J	N	9	N	52	0	79	8	86	4	47	7	47	5
54	Y	J	N	8	N	57	2	81	8	86	4	51	8	51	6
55	Y	J	N	8	Y	58	1	80	8	86	4	51	7	52	5
56	Y	J	N	7	N	59	10	80	9	86	4	39	33	51	19
57	Y	J	Y	9	N	69	0	80	8	85	5	62	7	62	5
58	Y	J	Y	8	N	71	2	82	8	85	5	63	8	65	6
59	Y	J	Y	8	Y	71	1	81	8	85	5	64	7	68	5
60	Y	J	Y	7	N	72	10	81	9	85	5	49	32	61	18

Table A7.4. NE Asia, Small Base, Summer Cases 31-60.

NE ASIA						SMALL BASE				WINTER			
Defensive Components				CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
1	N	9	N	71	17	43	38	43	15	41	35	53	22
2	N	9	Y	72	16	44	38	43	15	39	35	52	21
3	N	8	N	70	22	44	38	43	15	40	34	55	29
4	N	8	Y	73	19	44	38	43	15	42	35	58	24
5	N	7	N	65	49	42	42	43	15	24	83	47	40
6	N	6	N	73	25	44	37	43	15	46	35	55	32
7	N	6	Y	76	19	44	38	43	15	43	35	55	27
8	N	5	N	65	51	41	43	43	15	26	83	51	43
9	N	4	N	54	85	41	47	43	15	22	91	44	75
10	N	3	N	75	27	44	38	43	15	45	38	54	34
11	N	3	Y	78	21	44	38	43	15	45	34	59	29
12	N	2	N	67	54	41	42	43	15	24	84	44	44
13	N	2	Y	71	51	42	42	43	15	26	84	52	39
14	N	1	N	51	85	40	46	43	15	26	91	44	74
15	N	0	N	39	89	39	49	43	15	18	93	34	85
16	Y	9	N	79	1	81	5	87	7	73	8	75	5
17	Y	9	Y	79	1	82	5	87	7	71	8	75	5
18	Y	8	N	79	6	82	5	87	7	72	11	73	10
19	Y	8	Y	80	3	83	5	87	7	73	8	76	8
20	Y	7	N	73	38	81	7	87	7	65	39	72	22
21	Y	6	N	80	8	84	5	87	7	74	12	77	11
22	Y	6	Y	82	4	85	5	87	7	75	9	77	10
23	Y	5	N	75	41	82	6	87	7	65	39	75	23
24	Y	4	N	64	61	82	8	87	7	62	48	71	43
25	Y	3	N	85	9	84	5	87	7	77	15	76	13
26	Y	3	Y	86	5	84	5	87	7	80	9	81	10
27	Y	2	N	74	43	83	6	87	7	67	39	75	25
28	Y	2	Y	80	38	84	6	87	7	70	39	80	23
29	Y	1	N	63	62	83	8	87	7	63	48	73	43
30	Y	0	N	49	70	80	8	87	7	52	61	62	55

Table A7.5. NE Asia, Large Base, Summer Cases 1-30.

NE ASIA						LARGE BASE				SUMMER			
Defensive Components						CW (TBMs +A/C) BW (Covert +TBM)		CW (TBMs +A/C) BW (Covert Only)		CW (TBMs Only) BW (Covert +TBM)		CW (TBMs Only) BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C
1	N	B	N	9	N	25	19	30	15	29	18	32	16
2	N	B	N	8	N	27	20	33	15	32	19	35	16
3	N	B	N	8	Y	28	19	34	14	34	18	37	15
4	N	B	N	7	N	23	54	31	26	22	76	31	31
5	N	B	N	6	N	35	20	42	15	41	19	45	17
6	N	B	N	6	Y	35	19	43	14	42	18	46	15
7	N	B	N	5	N	30	54	41	26	28	76	42	30
8	N	B	N	4	N	24	77	37	45	25	88	36	52
9	N	B	N	3	N	47	20	55	16	56	20	57	17
10	N	B	N	3	Y	45	19	55	14	55	18	56	16
11	N	B	N	2	N	39	54	51	26	34	76	54	31
12	N	B	N	1	N	30	78	50	45	32	88	49	52
13	N	B	N	0	N	19	91	30	66	27	93	35	71
14	N	B	Y	9	N	40	19	45	14	46	18	49	15
15	N	B	Y	8	N	41	20	48	15	46	18	52	16
16	N	B	Y	8	Y	39	19	49	14	48	18	51	15
17	N	B	Y	7	N	36	54	45	25	31	76	47	31
18	N	B	Y	6	N	45	20	53	16	53	19	57	16
19	N	B	Y	6	Y	44	19	53	14	53	18	55	15
20	N	B	Y	5	N	37	54	50	26	34	76	52	31
21	N	B	Y	3	N	49	21	57	16	58	21	60	17
22	N	B	Y	3	Y	48	19	57	14	58	18	60	15
23	N	J	N	9	N	31	19	37	14	37	18	39	15
24	N	J	N	8	N	26	58	38	16	39	20	42	16
25	N	J	N	8	Y	25	58	39	14	39	19	42	16
26	N	J	N	7	N	29	53	38	26	26	76	38	31
27	N	J	Y	9	N	41	19	48	14	48	18	50	15
28	N	J	Y	8	N	30	58	49	16	48	19	52	16
29	N	J	Y	8	Y	30	58	48	15	49	19	52	16
30	N	J	Y	7	N	34	54	47	26	31	76	48	30

Table A7.6. NE Asia, Large Base, Summer Cases 31-60.

NE ASIA						LARGE BASE				SUMMER			
Defensive Components						CW (TBMs+A/C) BW (Covert+TBM)		CW (TBMs+A/C) BW (Covert Only)		CW (TBMs Only) BW (Covert+TBM)		CW (TBMs Only) BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C
31	Y	B	N	9	N	38	7	37	6	39	6	39	6
32	Y	B	N	8	N	41	7	41	6	42	8	44	6
33	Y	B	N	8	Y	42	7	41	6	43	6	44	6
34	Y	B	N	7	N	38	22	41	9	39	30	41	11
35	Y	B	N	6	N	55	8	54	7	57	8	57	7
36	Y	B	N	6	Y	55	6	54	6	57	6	56	6
37	Y	B	N	5	N	49	22	53	9	47	30	57	11
38	Y	B	N	4	N	43	31	54	17	44	36	53	22
39	Y	B	N	3	N	71	9	69	7	73	9	73	7
40	Y	B	N	3	Y	72	7	70	6	73	6	74	6
41	Y	B	N	2	N	65	22	71	10	63	31	73	12
42	Y	B	N	1	N	57	31	72	18	58	37	72	22
43	Y	B	N	0	N	41	42	52	33	49	40	54	38
44	Y	B	Y	9	N	62	7	60	6	63	7	62	6
45	Y	B	Y	8	N	63	7	63	7	65	8	65	6
46	Y	B	Y	8	Y	63	7	61	6	65	6	64	6
47	Y	B	Y	7	N	57	22	61	9	57	30	64	11
48	Y	B	Y	6	N	68	8	66	7	72	8	69	7
49	Y	B	Y	6	Y	69	7	69	6	72	6	70	6
50	Y	B	Y	5	N	62	22	67	9	61	30	70	11
51	Y	B	Y	3	N	74	9	73	7	76	9	74	7
52	Y	B	Y	3	Y	73	7	74	6	76	6	77	6
53	Y	J	N	9	N	49	7	47	6	49	7	48	6
54	Y	J	N	8	N	51	7	50	6	53	8	53	6
55	Y	J	N	8	Y	52	7	49	6	52	6	53	6
56	Y	J	N	7	N	46	22	50	9	45	29	52	11
57	Y	J	Y	9	N	64	7	62	6	65	6	63	6
58	Y	J	Y	8	N	64	7	64	7	65	8	65	6
59	Y	J	Y	8	Y	64	7	62	6	66	6	66	6
60	Y	J	Y	7	N	58	22	64	9	58	30	66	11

Table A7.7. NE Asia, Large Base, Summer Cases 61-90.

NE ASIA						LARGE BASE				SUMMER			
Defensive Components						CW Only (TBMs + A/C)		CW Only (TBMs Only)		BW Only (Covert + TBMs)		BW Only (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C
61	N	B	N	9	N	39	3	42	2	43	28	66	5
62	N	B	N	8	N	43	4	46	3	45	28	66	5
63	N	B	N	8	Y	44	3	46	2	47	28	66	5
64	N	B	N	7	N	39	13	42	13	45	30	66	5
65	N	B	N	6	N	55	5	58	4	47	28	66	5
66	N	B	N	6	Y	55	3	58	2	48	28	66	5
67	N	B	N	5	N	54	13	56	14	47	29	66	5
68	N	B	N	4	N	48	38	53	35	48	30	66	5
69	N	B	N	3	N	70	6	71	5	50	28	66	5
70	N	B	N	3	Y	70	3	72	2	49	28	66	5
71	N	B	N	2	N	68	14	69	15	47	30	66	5
72	N	B	N	1	N	63	39	68	35	49	30	66	5
73	N	B	N	0	N	36	65	53	61	46	30	66	5
74	N	B	Y	9	N	60	3	63	2	47	28	66	5
75	N	B	Y	8	N	63	4	64	3	48	28	66	5
76	N	B	Y	8	Y	63	3	65	2	49	28	66	5
77	N	B	Y	7	N	61	13	63	12	47	30	66	5
78	N	B	Y	6	N	68	5	69	4	50	28	66	5
79	N	B	Y	6	Y	67	3	70	2	47	28	66	5
80	N	B	Y	5	N	67	13	69	14	47	29	66	5
81	N	B	Y	3	N	72	6	73	5	50	28	66	5
82	N	B	Y	3	Y	72	3	74	2	49	28	66	5
83	N	J	N	9	N	50	3	50	2	46	28	66	5
84	N	J	N	8	N	52	4	55	4	48	28	66	5
85	N	J	N	8	Y	51	3	53	2	47	28	66	5
86	N	J	N	7	N	49	13	54	12	46	30	66	5
87	N	J	Y	9	N	62	3	64	2	47	28	66	5
88	N	J	Y	8	N	64	4	64	4	47	28	66	5
89	N	J	Y	8	Y	64	3	65	2	46	28	66	5
90	N	J	Y	7	N	62	13	64	12	49	30	66	5

Table A7.8. NE Asia, Large Base, Summer Cases 91-120.

NE ASIA						LARGE BASE				SUMMER			
Defensive Components						CW Only (TBMs + A/C)		CW Only (TBMs Only)		BW Only (Covert + TBMs)		BW Only (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C
91	Y	B	N	9	N	42	1	42	0	70	13	79	3
92	Y	B	N	8	N	45	1	47	1	71	13	79	3
93	Y	B	N	8	Y	44	1	46	0	70	13	79	3
94	Y	B	N	7	N	45	4	48	4	72	13	79	3
95	Y	B	N	6	N	59	2	62	2	76	13	79	3
96	Y	B	N	6	Y	59	1	63	0	76	13	79	3
97	Y	B	N	5	N	61	5	62	4	76	13	79	3
98	Y	B	N	4	N	63	13	66	12	77	13	79	3
99	Y	B	N	3	N	75	3	76	3	77	12	79	3
100	Y	B	N	3	Y	75	0	77	0	76	13	79	3
101	Y	B	N	2	N	75	6	77	6	78	13	79	3
102	Y	B	N	1	N	80	14	81	13	80	13	79	3
103	Y	B	N	0	N	61	29	74	29	78	13	79	3
104	Y	B	Y	9	N	64	1	66	0	74	13	80	3
105	Y	B	Y	8	N	67	1	69	1	76	13	80	3
106	Y	B	Y	8	Y	68	1	68	0	75	13	80	3
107	Y	B	Y	7	N	67	4	69	3	77	13	80	3
108	Y	B	Y	6	N	74	2	76	2	77	13	80	3
109	Y	B	Y	6	Y	74	1	75	0	77	13	80	3
110	Y	B	Y	5	N	73	5	75	5	79	13	80	3
111	Y	B	Y	3	N	77	3	78	3	77	13	80	3
112	Y	B	Y	3	Y	78	1	80	0	78	13	80	3
113	Y	J	N	9	N	51	1	53	0	71	13	79	3
114	Y	J	N	8	N	56	1	57	1	72	13	79	3
115	Y	J	N	8	Y	56	1	58	0	72	13	79	3
116	Y	J	N	7	N	56	4	59	3	73	13	79	3
117	Y	J	Y	9	N	67	1	69	0	74	13	80	3
118	Y	J	Y	8	N	68	1	70	1	75	13	80	3
119	Y	J	Y	8	Y	68	1	69	0	76	13	80	3
120	Y	J	Y	7	N	69	4	70	3	75	13	80	3

Table A7.9. NE Asia, Large Base, Winter Cases 1-30.

NE ASIA				LARGE BASE				WINTER			
Defensive Components				CW (TBMs + A/C) BW (Covert+TBM)		CW (TBMs+A/C) BW (Covert Only)		CW (TBMs Only) BW (Covert +TBM)		CW (TBMs Only) BW (Covert Only)	
#	ColPro	De-Warn	Decon	S	C	S	C	S	C	S	C
1	N	9	N	52	23	58	17	53	23	60	18
2	N	9	Y	52	23	58	17	53	22	59	18
3	N	8	N	53	23	59	17	53	24	60	18
4	N	8	Y	51	23	59	17	54	23	59	18
5	N	7	N	47	43	54	37	36	72	56	36
6	N	6	N	53	24	61	17	54	24	62	18
7	N	6	Y	54	23	60	17	54	22	63	18
8	N	5	N	49	43	54	37	35	73	59	36
9	N	4	N	43	68	51	54	33	82	53	64
10	N	3	N	57	24	64	17	56	24	66	19
11	N	3	Y	58	23	65	17	57	22	66	18
12	N	2	N	50	43	57	37	36	72	58	37
13	N	2	Y	50	42	56	36	38	72	59	36
14	N	1	N	46	69	54	54	35	82	56	64
15	N	0	N	33	84	42	71	32	89	44	74
16	Y	9	N	73	8	72	5	73	8	74	6
17	Y	9	Y	72	8	71	5	73	8	73	6
18	Y	8	N	73	8	72	6	74	9	75	7
19	Y	8	Y	72	8	73	5	74	8	74	6
20	Y	7	N	71	17	73	15	69	30	73	15
21	Y	6	N	75	9	75	7	77	9	76	7
22	Y	6	Y	75	8	75	5	75	8	76	6
23	Y	5	N	73	18	74	15	71	30	75	16
24	Y	4	N	70	28	71	28	70	39	74	31
25	Y	3	N	78	10	79	6	79	9	79	8
26	Y	3	Y	79	8	79	5	79	8	80	6
27	Y	2	N	77	18	76	15	74	31	78	15
28	Y	2	Y	76	18	77	14	75	29	78	14
29	Y	1	N	74	27	75	28	73	39	77	32
30	Y	0	N	52	37	61	43	56	45	63	45

Table A7.10. NE Asia, Large Base, Winter Cases 31-60.

NE ASIA				LARGE BASE				WINTER			
Defensive Components				CW Only (TBMs+A/C)		CW Only (TBMs Only)		BW Only (Covert+TBM)		BW Only (Covert Only)	
#	ColPro	De-Warn	Decon	S	C	S	C	S	C	S	C
31	N	9	N	69	16	70	14	57	26	65	13
32	N	9	Y	68	16	68	13	58	26	65	13
33	N	8	N	69	19	70	16	56	26	65	13
34	N	8	Y	68	16	70	14	57	25	65	13
35	N	7	N	61	50	63	43	55	27	65	13
36	N	6	N	71	20	72	18	59	26	65	13
37	N	6	Y	71	16	72	13	59	26	65	13
38	N	5	N	63	50	64	43	58	27	65	13
39	N	4	N	49	74	56	66	56	28	65	13
40	N	3	N	74	22	75	20	59	26	65	13
41	N	3	Y	74	16	75	13	58	26	65	13
42	N	2	N	65	50	67	44	58	27	65	13
43	N	2	Y	66	49	68	42	57	27	65	13
44	N	1	N	49	74	58	66	56	27	65	13
45	N	0	N	30	84	43	77	55	28	65	13
46	Y	9	N	75	1	75	0	82	6	86	5
47	Y	9	Y	74	1	76	0	82	6	86	5
48	Y	8	N	75	2	77	2	82	6	86	5
49	Y	8	Y	75	1	76	0	82	6	86	5
50	Y	7	N	73	19	75	16	82	6	86	5
51	Y	6	N	77	3	78	3	84	6	86	5
52	Y	6	Y	76	1	78	0	83	6	86	5
53	Y	5	N	75	20	76	17	83	6	86	5
54	Y	4	N	68	37	73	31	83	7	86	5
55	Y	3	N	80	4	81	4	82	6	86	5
56	Y	3	Y	80	1	82	0	82	6	86	5
57	Y	2	N	78	22	79	18	82	7	86	5
58	Y	2	Y	79	18	81	14	83	6	86	5
59	Y	1	N	70	38	76	32	84	7	86	5
60	Y	0	N	46	53	55	42	84	8	86	5

Table A7.11. SW Asia, Small Base, Summer Cases 1-30.

SW ASIA						SMALL BASE						SUMMER			
Defensive Components						CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
1	N	B	N	9	N	16	8	20	95	28	60	15	72	11	40
2	N	B	N	8	N	20	9	22	95	28	60	18	72	14	41
3	N	B	N	8	Y	20	10	21	95	28	60	18	71	13	41
4	N	B	N	7	N	19	43	18	95	28	60	15	90	12	77
5	N	B	N	6	N	35	12	26	95	28	60	27	72	24	43
6	N	B	N	6	Y	34	12	25	95	28	60	28	72	24	43
7	N	B	N	5	N	35	46	23	95	28	60	25	90	20	77
8	N	B	N	4	N	30	85	22	96	28	60	19	96	14	92
9	N	B	N	3	N	46	14	27	95	28	60	38	72	28	45
10	N	B	N	3	Y	45	14	27	95	28	60	37	72	29	45
11	N	B	N	2	N	45	47	25	95	28	60	32	91	25	78
12	N	B	N	1	N	40	86	23	96	28	60	25	96	17	92
13	N	B	N	0	N	35	94	20	96	28	60	23	96	16	96
14	N	B	Y	9	N	45	8	28	95	30	59	35	72	25	41
15	N	B	Y	8	N	49	9	28	95	30	59	37	72	28	42
16	N	B	Y	8	Y	49	9	27	95	30	59	37	72	29	41
17	N	B	Y	7	N	45	43	25	95	30	59	31	91	27	77
18	N	B	Y	6	N	58	13	29	95	30	59	44	72	36	43
19	N	B	Y	6	Y	59	12	29	95	30	59	42	72	36	43
20	N	B	Y	5	N	52	44	27	95	30	59	34	91	29	77
21	N	B	Y	3	N	66	14	29	95	30	59	47	72	36	45
22	N	B	Y	3	Y	66	13	29	95	30	59	44	72	38	44
23	N	J	N	9	N	29	8	24	95	28	60	26	72	18	40
24	N	J	N	8	N	33	9	25	95	28	60	28	72	22	42
25	N	J	N	8	Y	32	10	24	95	28	60	28	72	21	42
26	N	J	N	7	N	33	44	22	95	28	60	26	91	19	76
27	N	J	Y	9	N	54	8	28	95	30	59	40	72	32	41
28	N	J	Y	8	N	58	9	29	95	30	59	43	72	32	42
29	N	J	Y	8	Y	56	9	28	95	30	59	42	72	32	42
30	N	J	Y	7	N	52	43	26	95	30	59	35	91	29	77

Table A7.12. SW Asia, Small Base, Summer Cases 31-60.

SW ASIA						SMALL BASE						SUMMER			
Defensive Components						CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
31	Y	B	N	9	N	19	0	46	55	76	20	22	1	18	8
32	Y	B	N	8	N	22	0	46	54	76	20	26	1	22	8
33	Y	B	N	8	Y	22	0	45	54	76	20	26	1	22	8
34	Y	B	N	7	N	24	17	43	55	76	20	24	58	22	29
35	Y	B	N	6	N	41	0	51	55	76	20	44	1	38	8
36	Y	B	N	6	Y	41	0	50	54	76	20	44	1	38	8
37	Y	B	N	5	N	41	16	51	55	76	20	36	58	34	29
38	Y	B	N	4	N	39	47	50	59	76	20	31	82	29	57
39	Y	B	N	3	N	54	1	52	54	76	20	61	2	53	9
40	Y	B	N	3	Y	54	1	51	55	76	20	61	2	52	9
41	Y	B	N	2	N	55	17	51	56	76	20	49	59	47	29
42	Y	B	N	1	N	50	46	49	58	76	20	42	83	43	58
43	Y	B	N	0	N	43	67	48	59	76	20	35	85	30	71
44	Y	B	Y	9	N	51	0	56	55	81	20	52	1	51	8
45	Y	B	Y	8	N	58	0	55	55	81	20	59	1	53	8
46	Y	B	Y	8	Y	58	0	52	55	81	20	58	1	55	8
47	Y	B	Y	7	N	56	16	54	56	81	20	49	58	48	29
48	Y	B	Y	6	N	66	1	56	54	81	20	67	1	63	8
49	Y	B	Y	6	Y	67	0	56	55	81	20	67	2	64	8
50	Y	B	Y	5	N	65	16	55	56	81	20	56	59	57	30
51	Y	B	Y	3	N	75	1	56	55	81	20	76	2	71	8
52	Y	B	Y	3	Y	75	1	56	54	81	20	74	2	71	8
53	Y	J	N	9	N	33	0	48	54	76	20	40	1	31	8
54	Y	J	N	8	N	38	0	50	55	76	20	43	1	36	8
55	Y	J	N	8	Y	39	0	49	55	76	20	43	1	37	8
56	Y	J	N	7	N	38	16	49	55	76	20	38	58	33	28
57	Y	J	Y	9	N	60	0	56	54	81	20	64	1	59	8
58	Y	J	Y	8	N	64	0	55	54	81	20	65	1	61	8
59	Y	J	Y	8	Y	63	0	56	55	81	20	66	1	60	8
60	Y	J	Y	7	N	64	16	54	56	81	20	57	59	58	28

Table A7.13. SW Asia, Small Base, Winter Cases 1-30.

SW ASIA				SMALL BASE						WINTER			
Defensive Components				CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
1	N	9	N	65	2	32	87	27	59	51	72	37	29
2	N	9	Y	65	3	33	87	27	59	50	73	37	29
3	N	8	N	67	4	32	88	27	59	51	73	36	31
4	N	8	Y	66	4	33	87	27	59	52	73	36	31
5	N	7	N	61	40	30	89	27	59	38	92	32	75
6	N	6	N	69	7	34	88	27	59	53	73	39	33
7	N	6	Y	70	7	34	87	27	59	54	73	38	33
8	N	5	N	63	43	31	89	27	59	42	93	35	76
9	N	4	N	49	87	26	90	27	59	30	95	25	93
10	N	3	N	73	9	34	88	27	59	55	74	41	34
11	N	3	Y	71	10	34	88	27	59	56	74	40	34
12	N	2	N	65	44	31	88	27	59	40	93	34	77
13	N	2	Y	65	43	31	88	27	59	42	93	36	77
14	N	1	N	51	87	27	90	27	59	32	96	26	93
15	N	0	N	38	95	24	90	27	59	23	96	19	96
16	Y	9	N	72	0	77	34	80	22	69	1	67	9
17	Y	9	Y	72	0	78	34	80	22	70	1	68	9
18	Y	8	N	73	0	77	34	80	22	72	1	71	9
19	Y	8	Y	72	0	78	34	80	22	72	1	70	9
20	Y	7	N	73	15	79	35	80	22	60	67	66	25
21	Y	6	N	77	0	80	34	80	22	76	1	72	9
22	Y	6	Y	75	0	78	34	80	22	75	1	74	9
23	Y	5	N	76	15	78	35	80	22	62	67	68	25
24	Y	4	N	73	46	79	37	80	22	52	81	65	51
25	Y	3	N	80	0	80	34	80	22	77	1	78	9
26	Y	3	Y	80	0	79	34	80	22	79	1	76	9
27	Y	2	N	80	15	79	35	80	22	66	67	74	26
28	Y	2	Y	79	15	79	35	80	22	68	67	73	27
29	Y	1	N	76	45	77	38	80	22	57	81	67	52
30	Y	0	N	58	72	78	39	80	22	38	87	43	79

Table A7.14. SW Asia, Large Base, Summer Cases 1-30.

SW ASIA						LARGE BASE						SUMMER			
Defensive Components						CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
1	N	B	N	9	N	17	6	28	85	40	51	12	85	13	44
2	N	B	N	8	N	20	7	28	85	40	51	14	85	15	45
3	N	B	N	8	Y	21	7	28	85	40	51	15	85	15	45
4	N	B	N	7	N	20	39	26	87	40	51	15	92	15	67
5	N	B	N	6	N	35	8	33	85	40	51	21	85	23	46
6	N	B	N	6	Y	34	8	33	85	40	51	21	84	23	45
7	N	B	N	5	N	33	40	29	87	40	51	21	92	23	67
8	N	B	N	4	N	30	67	28	88	40	51	20	96	22	81
9	N	B	N	3	N	47	10	33	85	40	51	30	85	32	47
10	N	B	N	3	Y	46	10	34	85	40	51	31	85	32	47
11	N	B	N	2	N	47	42	30	87	40	51	28	93	31	68
12	N	B	N	1	N	41	67	30	88	40	51	28	96	29	81
13	N	B	N	0	N	38	86	27	89	40	51	28	98	25	90
14	N	B	Y	9	N	45	6	36	85	40	51	27	84	30	44
15	N	B	Y	8	N	49	7	35	85	40	51	30	84	34	44
16	N	B	Y	8	Y	50	7	35	85	40	51	28	85	32	44
17	N	B	Y	7	N	46	39	32	87	40	51	28	92	30	67
18	N	B	Y	6	N	57	8	38	85	40	51	33	85	38	46
19	N	B	Y	6	Y	57	9	36	85	40	51	33	85	39	45
20	N	B	Y	5	N	54	40	33	87	40	51	31	92	34	67
21	N	B	Y	3	N	65	10	34	85	40	51	37	85	44	47
22	N	B	Y	3	Y	66	10	37	85	40	51	37	85	44	47
23	N	J	N	9	N	30	6	31	85	40	51	21	84	21	44
24	N	J	N	8	N	33	7	31	85	40	51	23	84	24	44
25	N	J	N	8	Y	33	7	30	85	40	51	22	85	24	44
26	N	J	N	7	N	32	39	30	87	40	51	23	92	24	67
27	N	J	Y	9	N	55	6	35	85	40	51	31	85	36	45
28	N	J	Y	8	N	57	7	36	85	40	51	33	84	38	45
29	N	J	Y	8	Y	57	7	36	85	40	51	32	85	38	45
30	N	J	Y	7	N	52	40	34	87	40	51	31	92	35	67

Table A7.15. SW Asia, Large Base, Summer Cases 31-60.

SW ASIA						LARGE BASE						SUMMER			
Defensive Components						CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	IPE Type	Cooling	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
31	Y	B	N	9	N	19	0	47	52	65	27	20	34	20	12
32	Y	B	N	8	N	22	0	47	51	65	27	23	34	22	12
33	Y	B	N	8	Y	23	0	49	51	65	27	23	34	21	12
34	Y	B	N	7	N	24	18	44	53	65	27	23	58	23	35
35	Y	B	N	6	N	38	0	51	52	65	27	33	35	33	13
36	Y	B	N	6	Y	39	0	52	52	65	27	33	35	34	12
37	Y	B	N	5	N	39	19	50	53	65	27	30	58	33	36
38	Y	B	N	4	N	42	36	47	55	65	27	29	69	33	51
39	Y	B	N	3	N	55	0	51	52	65	27	50	35	50	13
40	Y	B	N	3	Y	55	0	53	51	65	27	50	35	50	13
41	Y	B	N	2	N	56	19	50	54	65	27	47	58	50	36
42	Y	B	N	1	N	58	36	49	55	65	27	45	69	53	51
43	Y	B	N	0	N	55	55	45	57	65	27	40	74	42	63
44	Y	B	Y	9	N	51	0	54	52	69	27	45	34	48	12
45	Y	B	Y	8	N	55	0	52	52	69	27	48	34	51	12
46	Y	B	Y	8	Y	55	0	55	52	69	27	48	34	50	12
47	Y	B	Y	7	N	56	19	53	54	69	27	46	58	50	36
48	Y	B	Y	6	N	65	0	54	52	69	27	54	35	58	12
49	Y	B	Y	6	Y	64	0	54	52	69	27	55	35	58	13
50	Y	B	Y	5	N	64	19	55	54	69	27	51	58	56	36
51	Y	B	Y	3	N	72	0	55	52	69	27	64	35	67	13
52	Y	B	Y	3	Y	72	0	56	52	69	27	66	35	67	13
53	Y	J	N	9	N	33	0	47	52	65	27	34	34	33	12
54	Y	J	N	8	N	36	0	50	52	65	27	37	34	36	12
55	Y	J	N	8	Y	37	0	51	52	65	27	38	34	35	12
56	Y	J	N	7	N	38	18	47	54	65	27	35	58	36	36
57	Y	J	Y	9	N	61	0	53	52	69	27	53	34	56	12
58	Y	J	Y	8	N	62	0	53	52	69	27	54	34	57	12
59	Y	J	Y	8	Y	63	0	53	52	69	27	55	34	57	12
60	Y	J	Y	7	N	62	18	52	54	69	27	50	58	55	35

Table A7.16. SW Asia, Large Base, Winter Cases 1-30.

SW ASIA				LARGE BASE						WINTER			
Defensive Components				CW Only		BW Only (Covert +TBM)		BW Only (Covert Only)		CW + BW (Covert +TBM)		CW + BW (Covert Only)	
#	ColPro	De-Warn	Decon	S	C	S	C	S	C	S	C	S	C
1	N	9	N	64	2	40	73	41	44	42	86	44	31
2	N	9	Y	64	2	41	73	41	44	43	86	45	31
3	N	8	N	64	3	41	73	41	44	43	86	45	32
4	N	8	Y	65	3	41	73	41	44	43	86	46	31
5	N	7	N	63	37	39	75	41	44	40	93	41	59
6	N	6	N	66	5	42	73	41	44	45	86	45	32
7	N	6	Y	67	5	42	72	41	44	45	86	44	32
8	N	5	N	65	38	39	75	41	44	41	94	43	59
9	N	4	N	58	76	37	77	41	44	34	97	35	86
10	N	3	N	70	7	42	72	41	44	46	87	48	34
11	N	3	Y	70	7	42	72	41	44	46	86	47	34
12	N	2	N	68	39	39	75	41	44	43	94	43	60
13	N	2	Y	67	39	39	75	41	44	42	94	43	60
14	N	1	N	60	77	36	77	41	44	37	97	37	86
15	N	0	N	47	92	34	78	41	44	30	98	31	95
16	Y	9	N	70	0	68	45	62	25	61	34	63	7
17	Y	9	Y	70	0	68	44	62	25	61	34	64	7
18	Y	8	N	70	0	65	44	62	25	62	34	64	7
19	Y	8	Y	70	0	68	45	62	25	62	34	65	7
20	Y	7	N	70	10	68	47	62	25	58	60	64	23
21	Y	6	N	72	0	69	44	62	25	64	34	67	7
22	Y	6	Y	72	0	69	44	62	25	64	34	67	7
23	Y	5	N	73	10	69	47	62	25	60	61	66	23
24	Y	4	N	74	35	68	49	62	25	53	72	64	47
25	Y	3	N	75	0	69	45	62	25	67	34	69	7
26	Y	3	Y	76	0	68	44	62	25	67	34	69	7
27	Y	2	N	76	10	68	47	62	25	62	61	70	24
28	Y	2	Y	75	10	67	47	62	25	62	61	70	23
29	Y	1	N	77	35	65	49	62	25	56	72	70	47
30	Y	0	N	70	60	66	51	62	25	40	76	56	65

Attachment 8

PROTECTION STANDARDS ASSOCIATED WITH OPERATIONAL DECON ACTIVITIES

A8.1. Introduction. The chart in **Table A8.1.**. is designed to provide recommended levels of protection for personnel associated with the decontamination process, passengers and crew of aircraft containing contaminated cargo, and personnel receiving contaminated cargo.

A8.1.1. The “recommended protection level” is a protective posture configuration that balances mission continuation with force survivability. It recognizes that many critical missions can’t be accomplished if the work force remains in MOPP 4 for extended periods of time. However, units should not use protective postures less than MOPP 4 if the current and projected (several days worth in advance) tasking is such that full mission operations can be easily completed in MOPP 4. Further, units should attempt to “step down” the protective postures as much as possible until they reach either the “recommended” or “minimum” protection levels (as required for mission accomplishment). For example, the recommended protection level might call for mask, gloves and boots (as necessary). In this case, if MOPP 4 is not a viable option, the unit should consider whether or not the mission could be accomplished with either a MOPP 4-ventillation option or with a MOPP 4-jacket removed option prior to dropping to the mask/gloves/boots configuration.

A8.1.2. The recommended and minimum protection levels are also safe sided in regards to many situations, NEO for example. As another note explains, the probable dosages were calculated based on 360 minutes of exposure. Readiness and medical personnel will have to calculate and assess these situations on a case-by-case basis. For instance, even if the interior of the aircraft was showing relatively high contamination levels of HD such as between .35 and 2.6 mg/m3 (6-7 CAM Bars), NEO people would only be expected to receive 26 mg-min/m3 for a 10 hour exposure time. This figure is well below the agent’s incapacitation levels (see Attachment 2) and may be worth the risk given the fact the people may be, or are expected to be in a contaminated environment at their present location.

A8.2. The “Maximum Probable Dosage”. This was calculated given a scenario where individuals would be exposed to the given dosage 60 minutes an hour for 6 continuos hours.

A8.2.1. The chart is safe-sided to a degree because we don’t have a fielded capability which allows us to quantify the surface contamination in the same way we can quantify the vapor concentrations. Consequently, the charts call for a reasonable degree of skin protection even though the actual threat may be negligible. However, in order to make it a useful operational tool, the author factored in two items. The first was the protection afforded by our BDUs as outlined in the Dugway Report, DPG/JCP-95/006, Chemical Protection Afforded By Standard Uniforms (Feb 95). The second was a belief that the amount of vapor present is related to a degree to the amount of surface contamination. In other words, the larger the source, surface contamination, the greater the vapor readings will be. The only agents which this methodology didn’t really apply to were VX (because of its extreme toxicity) and the biological agents (because their skin penetration capabilities are negligible).

A8.3. Category Definitions. The basic definition of each category is:

A8.3.1. Category 1: Actual or suspected anthrax/plague surface deposition.

A8.3.2. Category 2: HD, L, or GB vapor present without contact hazard.

A8.3.3. Category 3: VX, L contact hazard present without measurable vapor hazard

A8.3.4. Category 4: HD, GB contact hazard combined with medium level of danger associated with vapor concentrations.

A8.3.5. Category 5: HD, L, GB, VX contact hazard combined with high level of danger associated with vapor concentrations. (***NOTE:*** In the case of GB, high vapor hazard alone can drive this designation)

A8.4. The relationship between the CAM readings and intensity levels originates from the U.S. Army's Chemical, Research, Development and Engineering Center (CRDEC), Aberdeen Proving Ground, trip report to the United Kingdom's Chemical Defense Establishment and Graseby Ionics (dated 16 Dec 86). We realize there are problems associated with putting too fine a line on CAM bar readings (age of the instrument, comparison of one instrument to another, etc.). However, the CAM, with its capability is the best fielded instrument we have for this purpose at the present time. As more information becomes available on the individual readings associated with the M22 Automatic Chemical Agent Detector and Alarm (ACADA), this information will be incorporated.

A8.5. Negative M8 paper readings do not guarantee no contact hazard exists. If the agent is in dusty form, the M8 paper will be negative but the vapor detectors will be positive. If the agent is in a frozen state, the M8 paper and the vapor detectors will be negative. Personnel will have to use their personal observations to augment the detector arrays.

A8.6. Ref the Medical Management of Biological Casualties Handbook (US Army Medical Research Institute of Infectious Diseases), dated Mar 96. The severity of cutaneous anthrax is far less than inhalational forms. However, it is possible for the local infection caused by the agent's introduction to the body through skin abrasions to result in systemic poisoning.

A8.7. Ref the Medical Management of Biological Casualties Handbook (US Army Medical Research Institute of Infectious Diseases), dated Mar 96. The primary operational concern with plague is resuspension of the particles. This is a low probability threat as discussed earlier in this document. People do not typically get plague through skin abrasions, as can happen with anthrax.

A8.8. Unless we position a Bio ACTD sampler directly next to each contaminated item, it is presently impossible for us (in field conditions) to determine if agent is being resuspended. Further, even if we did place the Bio ACTD next to the item(s), the results would not necessarily be conclusive.

A8.9. Per the Joint Program Office for Biological Warfare (JPO-BIO), a shortfall with the hand-held assays is that a negative test does not guarantee a contamination-free asset.

A8.10. Biological air samplers can be the Bio ACTD, Biological Integrated Detection System (BIDS), Interim Biological Agent Detector (IBAD), or other similar system.

Table A8.1. Personnel Protection Standards Associated with Operational Decon Activities.

Category	Agent(s)	Contact Hazard	Vapor Hazard	VAPOR CONCENTRATION LEVEL	INDICATOR	MAXIMUM PROBABLE DOSAGE	RECOMMENDED PROTECTION LEVEL	MINIMUM PROTECTION LEVEL
4	HD	YES	YES	Less than .11 mg/m3	Positive "Red" on M8 paper and 1-3 CAM bars	Unknown contact and 39.6 mg-min/m3	Mask, Gloves and Boots (as necessary)	Gloves and boots (as necessary)
4	HD	YES	YES	Between .11 and .35 mg/m3	Positive "Red" on M8 paper and 4-5 CAM bars	Unknown contact and 126 mg-min/m3	Mask, Gloves and Boots (as necessary)	Mask, Gloves and Boots (as necessary)
5	HD	YES	YES	Between .35 and 2.6 mg/m3	Positive "Red" on M8 paper and 6-7 CAM bars	Unknown contact and 936 mg-min/m3	MOPP 4	Mask, Gloves and Boots (as necessary)
5	HD	YES	YES	Greater than 2.6 mg/m3	Positive "Red" on M8 paper and 8 CAM bars	Unknown contact and vapor concentration exceeding 936 mg-min/m3	MOPP 4	MOPP 4
4	HD	YES	NO	N/A	Positive "Red" on M8 paper and 0 CAM bars	Unknown contact and vapor concentration less than 39.6 mg-min/m3	Mask, Gloves and Boots (as necessary)	Gloves and boots (as necessary)
2	HD	NO OR UNK	YES	Utilize mask protection levels as specified with above levels	Negative blister reading with M8 paper but positive vapor indicators (CAM, M256A1, M90, etc)	See inhalation figures (mg-min/m3) above	See above	See above
5	L	YES	YES	N/A	Positive "Red" on M8 paper combined with positive "L" tab on M256A1 with corresponding negative "square" on M256A1	Unknown contact and unquantifiable vapor concentration (M256A1 sensitivity level for "L" is 9 mg/m3 +/- 4 mg/m3)	MOPP 4	MOPP 4
3	L	YES	NO	N/A	Positive "Red" on M8 paper combined with negative "L" tab and "square" on M256A1; people experiencing "immediate pain on contact" with agent	Unknown contact with possible vapor concentration below M256A1 sensitivity level	Gloves and boots (as necessary)	Gloves and boots (as necessary)
2	L	NO OR UNK	YES	N/A	Negative blister reading with M8 paper but positive "L" tab on M256A1 with corresponding negative "square" on M256A1	Unknown vapor concentration	Mask, Gloves and Boots (as necessary)	Mask and Gloves

Category	Agent(s)	Contact Hazard	Vapor Hazard	VAPOR CONCENTRATION LEVEL	INDICATOR	MAXIMUM PROBABLE DOSAGE	RECOMMENDED PROTECTION LEVEL	MINIMUM PROTECTION LEVEL
4	GB	YES	YES	Between .03 and 1.1 mg/m3	Positive M8 paper and 1-6 CAM Bars	Unknown contact and 396 mg-min/m3	Mask, Gloves and Boots (as necessary)	Mask, Gloves and Boots (as necessary)
5	GB	YES	YES	Greater than 1.1 mg/m3	Positive M8 paper and 7-8 CAM Bars	Unknown contact and vapor concentration exceeding 396 mg-min/m3	MOPP 4	MOPP 4
2	GB	NO OR UNK	YES	Between .03 and 1.1 mg/m3	Negative M8 paper and 1-6 CAM Bars	396 mg-min/m3	Mask, Gloves and Boots (as necessary)	Mask
5	GB	NO OR UNK	YES	Greater than 1.1 mg/m3	Negative M8 paper and 7-8 CAM Bars	Vapor concentration exceeding 396 mg-min/m3	MOPP 4	MOPP 4
5	VX	YES	YES	Greater than .05 mg/m3	Positive M8 paper and 3-6 CAM Bars	Unknown contact and vapor concentration exceeding 360 mg-min/m3	MOPP 4	MOPP 4
3	VX	YES	NO	N/A	Positive M8 paper and 0 CAM Bars	Unknown contact and vapor concentration below sensitivity of CAM	MOPP IV, ventilation option, with people removing mask for break periods as necessary	Gloves and boots (as necessary)
1	Anthrax	YES	UNK	N/A	Positive Hand-Held Assay but negative Bio Air Sampler	N/A	Mask and Gloves	Gloves
1	Plague	YES	UNK	N/A	Positive Hand-Held Assay but negative Bio Air Sampler	N/A	Mask and Gloves	No IPE
1	Anthrax	UNK	Positive in Area	N/A	Bio Air Sampler Positive	N/A	Mask and Gloves	Mask and Gloves
1	Plague	UNK	Positive in Area	N/A	Bio Air Sampler Positive	N/A	Mask and Gloves	Mask and Gloves