



DEPARTMENT OF DEFENSE NUCLEAR/BIOLOGICAL/CHEMICAL (NBC) DEFENSE

ANNUAL REPORT TO CONGRESS FEBRUARY 1998



To order additional copies of this report, contact:

Defense Technical Information Center
Attn: DTIC-E (Electronic Document Project Officer)
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6218

or visit the DTIC web site for further information at:
<http://www.dtic.mil>

Cleared for public release.
Unlimited distribution.

EXECUTIVE SUMMARY

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE

ANNUAL REPORT TO CONGRESS

(INTENTIONALLY BLANK)

EXECUTIVE SUMMARY

The National Defense Authorization Act for Fiscal Year 1994, Public Law No. 103-160, Section 1703 (50 USC 1522), mandates the coordination and integration of all Department of Defense chemical and biological (CB) defense programs. As part of this coordination and integration, the Secretary of Defense is directed to submit an assessment and a description of plans to improve readiness to survive, fight and win in a nuclear, biological and chemical (NBC) contaminated environment. This report contains modernization plan summaries that highlight the Department's approach to improve current NBC defense equipment and resolve current shortcomings in the program. *50 USC 1522 has been a critical tool for ensuring the elimination of redundant programs, focusing funds on program priorities, and enhancing readiness.*

Medical and non-medical research, development and acquisition organizations for NBC defense, including the consolidation of all research, development, test and evaluation, and procurement funds for NBC defense have been consolidated. There has been significant progress in the development of Joint training, doctrine development, and requirements generation. Modernization and technology plans have been developed that have begun to show real savings and true consolidation of efforts among the Services. The fruits of these plans will be realized over the next few years as the public law has time to take effect and will result in the increased readiness of U.S. forces.

The objective of the Department of Defense (DoD) NBC defense program is to enable our forces to survive, fight, and win in NBC warfare environments. Numerous rapidly changing factors continually influence the program and its management. These factors include declining DoD resources, planning for warfighting support to numerous regional threat contingencies, the evolving geopolitical environment resulting from the breakup of the Soviet Union, the entry into force of the Chemical Weapons Convention, and continuing proliferation of NBC weapons. To minimize the impact of use of NBC weapons on our forces, we will require improved NBC defensive capabilities. The DoD NBC defense program continues to work towards increasing the defensive capabilities of Joint Forces to survive and continue the mission during conflicts that involve the use of NBC weapons. NBC defense programs are managed jointly under the oversight of a single office within DoD. However, the unique physical, toxicological, destructive and other properties of each threat require operational and technological responses tailored to the threat.

For our forces to survive, fight and win in an NBC-contaminated environment, an integrated and balanced program is essential. Our forces must have aggressive, realistic training, and defensive equipment that allows them to avoid contamination, if possible, and to protect and decontaminate personnel and equipment, and sustain operations throughout the non-linear battlespace. We must also have the capability to provide medical casualty management. Programs are in place to equip and train our forces to accomplish their missions in an NBC environment. The goal of the program is to equip U.S. forces with the finest available equipment for conducting their missions in the face of NBC threats from potential adversaries around the world.

OVERVIEW OF REPORT

The *INTRODUCTION* of this report provides a detailed background of the rationale and purpose for the DoD Chemical and Biological Defense Program. A more detailed report on the threat from the proliferation of NBC weapons was also published by the Department of Defense in the November 1997 entitled, *Proliferation: Threat and Response*. Intelligence documents tailored to the threat are essential for developing and updating requirements for NBC defense programs. Every NBC defense research, development, and acquisition effort funded within the program responds to a defined or validated threat. The vast variations among the chemical and biological threats and the unique physical, toxicological, destructive and other properties of these threats require operational and technological responses tailored to the threat. Intelligence efforts continue to emphasize collection and analysis of nations' "dual-use" nuclear, chemical and biological industrial capabilities and develop the indications and warning of adversarial use of dual-use capabilities.

CHAPTER 1 describes the accomplishments, processes, and issues related to DoD Chemical And Biological Defense Program management and oversight. Since the program's inception, DoD has made significant progress in improving the overall joint management and coordination of the NBC defense program. *50 USC 1522 has been a critical tool for ensuring the elimination of redundant programs, focusing funds on program priorities, and enhancing readiness.* (This report does not address ongoing plans to reorganize the Office of the Secretary of Defense, as outlined in the Defense Reform Initiative, nor potential impacts on the DoD Chemical and Biological Defense Program.) Chapter 1 also includes a detailed response to a special Congressional request for information made in HNSC H. Rpt 105-132 (pp. 236-237)—specifically information on Defense Advanced Research Projects Agency (DARPA) Biological Warfare Defense program coordination with the DoD Chemical and Biological Defense program (Section 1.4).

CHAPTER 2 provides information on non-medical NBC defense requirements and on research and development programs. Requirements and the status of research and development assessments are described within the framework of the functional areas of NBC defense. Chapter 2 also includes detailed responses to special Congressional request for information made in HNSC H. Rpt 105-132 (pp. 236-237)—specifically information on (1) problems with the Army's M-40 Mask program (Section 2.7), and (2) Equipment for Chem/Bio Quick Reaction Force (CBQRF) (Section 2.6). An overview of the structure and function of elements of the CBQRF are provided in Chapter 5.

CHAPTER 3 provides information on medical NBC defense requirements and on research and development programs. Medical technologies are an integral part of providing individual protection both prior to, during and after a chemical or biological attack. Chapter 3 also includes detailed responses to special Congressional request for information made in HNSC

H. Rpt 105-132 (pp. 236-237)—specifically information on (1) anthrax vaccine production & stockpile issues (Section 3.6), and (2) vaccine development issues (Section 3.3).

CHAPTER 4 provides an analysis of NBC defense logistics posture. The analysis reviews the status of quantities, characteristics, and capabilities of all fielded NBC defense equipment, industrial base requirements, procurement schedules, and problems encountered. Much of the information is based on the recently completed (though not officially validated) model of Joint Chemical Defense Equipment Consumption Rates (JCHEMRATES IV). Additional information is derived for the Joint NBC Defense Logistics Support Plan.

CHAPTER 5 assesses the status of NBC defense training and readiness conducted by the Services. Each of the Services' training standards and programs is reviewed. In accordance with Section 1702 of Pub. L. 103-160 (50 USC 1522) all chemical and biological warfare defense training activities of the Department of Defense have been consolidated at the United States Army Chemical School.

CHAPTER 6 provides information on the status of DoD efforts to implement the Chemical Weapons Convention (CWC), which was ratified by the United States and entered into force during 1997. This chapter also includes a summary of plans and activities to provide assistance to other countries in response to an appeal by another State Party to the CWC, pursuant to Article X of the CWC.

Finally, there are several **ANNEXES** to this report. **Annexes A through D** provide detailed information on Joint and Service-unique NBC defense equipment, including contamination avoidance, protection, decontamination, and medical programs. Detailed descriptions are provided for systems and equipment that have been fielded, are in production, or under development. **Annex E** provides a summary of funds appropriated, budgeted, and expended by the DoD Chemical and Biological Defense Program. One of the successes of the DoD NBC Defense Program has been the consolidation of all DoD NBC Defense RDT&E program funds under six program elements, rather than throughout numerous Service accounts. **Annex F** provides a statement regarding chemical and biological defense programs involving human subjects as required by 50 USC 1522. As detailed in the annex, no such testing has been conducted in over two decades and none is planned.

(INTENTIONALLY BLANK.)

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	<i>i</i>
INTRODUCTION	<i>xiii</i>
<u>CHAPTERS</u>	
1 CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM MANAGEMENT AND OVERSIGHT	1-1
1.1 Management Implementation Efforts.....	1-3
1.1.1 Management Reviews.....	1-3
1.1.2 Coordination and Integration of the Program	1-3
1.2 Organizational Relationships	1-3
1.3 Technology Base Review and Assessment.....	1-6
1.4 DARPA Biological Warfare Defense Program Management	1-6
1.5 Funds Management	1-6
1.6 NBC Defense Program Management Assessment	1-8
2 NON-MEDICAL NBC WARFARE DEFENSE REQUIREMENTS AND R&D PROGRAM STATUS	2-1
2.1 Introduction	2-3
2.2 NBC Defense Mission Area Requirements and RDA Summary.....	2-4
2.3 Contamination Avoidance (Detection, Identification and Warning)	2-4
2.3.1 Contamination Avoidance Science and Technology Efforts.....	2-5
2.3.1.1 Goals and Timeframes	2-5
2.3.1.2 Potential Payoffs and Transition Opportunities.....	2-5
2.3.1.3 Major Technical Challenges	2-5
2.3.2 Contamination Avoidance Modernization Strategy.....	2-6
2.3.3 Joint Service Contamination Avoidance Programs	2-9
2.3.4 Warning and Reporting.....	2-10
2.3.5 Other Contamination Avoidance Programs	2-11
2.3.6 Defense Advanced Research Projects Agency (DARPA) Programs	2-11
2.4 Protection	2-11
2.4.1 Protection Science and Technology Efforts.....	2-12
2.4.1.1 Goals and Timeframes	2-12
2.4.1.2 Potential Payoffs and Transition Opportunities.....	2-12
2.4.1.3 Major Technical Challenges	2-13
2.4.2 Protection Modernization Strategy	2-13
2.4.3 Joint Service Protection Programs	2-16
2.4.4 Other Protection Programs	2-19
2.5 Decontamination	2-19
2.5.1 Decontamination Science and Technology Efforts.....	2-20
2.5.1.1 Goals and Timeframes	2-20
2.5.1.2 Potential Payoffs and Transition Opportunities.....	2-20
2.5.1.3 Major Technical Challenges	2-20
2.5.1.4 Chem War 2000.....	2-21
2.5.2 Decontamination Modernization Strategy	2-21
2.5.3 Joint Service Decontamination Programs	2-23

	Page
2.5.4 Other Decontamination Programs	2-23
2.6 Equipment for the Chemical/Biological Rapid Response Team	2-23
2.7 Non-Medical CB Defense Requirements Assessment.....	2-24
3 MEDICAL NBC WARFARE DEFENSE REQUIREMENTS AND R&D PROGRAM STATUS.....	3-1
3.1 Requirements	3-3
3.1.1 Introduction	3-3
3.1.2 Challenges in the Medical NBC Warfare Defense Programs.....	3-4
3.1.3 Reducing Reliance on Research Animals.....	3-6
3.1.4 Medical Program Organization	3-6
3.2 Medical Chemical Defense Research Program	3-7
3.2.1 Goals.....	3-7
3.2.2 Objectives.....	3-8
3.2.3 Threats, Countermeasures, Technical Barriers, Status, and Accomplishments	3-8
3.3 Medical Biological Defense Research Program.....	3-8
3.3.1 Goals.....	3-9
3.3.2 Objectives.....	3-9
3.3.3 Threats, Countermeasures, and Technical Barriers	3-10
3.3.4 DARPA Programs	3-12
3.4 Medical Nuclear (Radiological) Defense Research Program.....	3-13
3.4.1 Goals.....	3-13
3.4.2 Objectives.....	3-14
3.4.3 Threats, Countermeasures, Technical Barriers, and Accomplishments	3-14
3.5 Medical NBC Research Projection	3-17
3.6 Medical R&D Requirements Assessment.....	3-18
4 NBC WARFARE DEFENSE LOGISTICS STATUS	4-1
4.1 Introduction	4-3
4.2 NBC Defense Logistics Management	4-4
4.3 Quantities, Characteristics, and Capabilities	4-6
4.4 Logistics Status.....	4-7
4.5 Peacetime Requirement	4-10
4.6 Funding.....	4-11
4.7 Industrial Base	4-12
4.8 NBC Defense Logistics Support Assessment.....	4-13
Appendix 1: Breakout of Service War Requirements, Stocks On-Hand, and Planned Acquisitions	4-15
Appendix 2: Fielded NBC Defense Items – Issues and Concerns	4-30
1. Contamination Avoidance	4-30
2. Individual Protection.....	4-30
3. Collective Protection.....	4-33
4. Decontamination.....	4-34
5. Medical.....	4-35

	Page
5 NBC DEFENSE READINESS AND TRAINING	5-1
5.1 Introduction	5-3
5.2 Joint NBC Defense Doctrine	5-3
5.2.1 Joint NBC Defense Doctrine Program Management.....	5-3
5.2.2 Joint NBC Defense Doctrine Development Program	5-4
5.2.3 Army Medical Doctrine Development Program.....	5-4
5.2.4 Air Force Medical Doctrine Development Program.....	5-5
5.3 Standards/Proficiency and Currency	5-5
5.3.1 Army	5-5
5.3.2 Air Force	5-9
5.3.3 Navy.....	5-10
5.3.4 Marine Corps.....	5-10
5.4 NBC Defense Professional Training.....	5-12
5.4.1 Joint NBC Defense Professional Training.....	5-13
5.4.2 Army NBC Defense Professional Training	5-13
5.4.3 Air Force NBC Defense Professional Training	5-15
5.4.4 Navy NBC Defense Professional Training	5-15
5.4.5 Marine Corps NBC Defense Professional Training.....	5-16
5.5 Training in a Toxic Chemical Environment	5-17
5.6 Integration of Realism/Wargames/Exercises	5-18
5.6.1 Simulations and Wargames	5-18
5.6.2 Joint NBC Training/Joint and Combined Exercises.....	5-19
5.7 Initiatives	5-22
5.7.1 Joint	5-22
5.7.2 Army	5-23
5.7.3 Air Force	5-23
5.7.4 Navy.....	5-24
5.7.5 Marine Corps.....	5-24
5.7.6 Emergency Response: Army Medical Response	5-26
5.8 Readiness Reporting System.....	5-28
5.9 NBC Defense Training and Readiness Assessment.....	5-29
6 STATUS OF DOD EFFORTS TO IMPLEMENT THE CHEMICAL WEAPONS CONVENTION	6-1
6.0 Introduction	6-3
6.1 Department of Defense Preparations and Implementation	6-3
6.2 Training for Inspectors	6-4
6.3 Preparation of Defense Installations.....	6-4
6.4 Defense Treaty Inspection Readiness Program	6-5
6.5 Article X Assistance and Other Assistance.....	6-6
6.6 Verification Technology	6-6

ANNEXES

Page

A Contamination Avoidance Programs A-1
 I. Fielded and Production Items A-3
 II. RDTE Items..... A-12
B Non-Medical Protection Programs B-1
 I. Fielded and Production Items B-3
 II. RDTE Items..... B-15
C Decontamination Programs C-1
 I. Fielded and Production Items C-3
 II. RDTE Items..... C-6
D Joint Medical Chemical and Biological Defense Research Programs D-1
 D.1 Medical Chemical Defense Research Program D-3
 D.2 Medical Biological Defense Research Program D-13
 D.3 Medical Nuclear (Radiological) Defense Research Program..... D-27
E Summary of FY96 RDT&E Funds for the CBD Program E-1
F Statement Regarding Chemical and Biological Defense Programs
 Involving Human Subjects F-1
G Congressional Reporting Requirement: 50 USC 1523 G-1
H NBC Defense on the Internet H-1
I Acronyms and Abbreviations..... I-1

TABLES AND FIGURES

TABLES	Page
2-1 Contamination Avoidance Science and Technology Strategy	2-5
2-2 Contamination Avoidance Modernization Strategy	2-6
2-3 Contamination Avoidance RDA Efforts.....	2-7
2-4 Protection Science and Technology Strategy	2-12
2-5 Protection Modernization Strategy	2-14
2-6 Protection RDA Efforts.....	2-15
2-7 Decontamination Science and Technology Strategy	2-20
2-8 Decontamination Modernization Strategy	2-22
2-9 Decontamination RDA Efforts	2-22
3-1 Medical Biological Defense Countermeasures and Diagnostic Techniques	3-13
3-2 Medical Nuclear Defense Countermeasures	3-15
3-3 Medical NBC Defense Programs and Modernization Strategy	3-17
4-1 Logistic Risk Assessments: 46 NBC Defense Items	4-9
4-2a Army Logistics Readiness Data - Nonconsumables.....	4-17
4-2b Army Logistics Readiness Data - Consumables.....	4-18
4-3a Air Force Logistics Readiness Data - Nonconsumables.....	4-20
4-3b Air Force Logistics Readiness Data - Consumables	4-21
4-4a Navy Logistics Readiness Data - Nonconsumables	4-23
4-4b Navy Logistics Readiness Data - Consumables	4-24
4-5a Marine Corps Logistics Readiness Data - Nonconsumables	4-26
4-5b Marine Corps Logistics Readiness Data - Consumables	4-27
4-6 Defense Logistics Agency Logistics Readiness Data - Consumables	4-29
 FIGURES	
1-1 Chemical and Biological Defense Program Management Structure	1-4
1-2 Chemical and Biological Defense Funds Management Process.....	1-7
2-1 Letter to Congress regarding M-40 Mask Issue	2-26
3-1 Standard FDA Approval Process for Biological Defense Medical Products.....	3-5
4-1 War Reserve Requirements and Planning.....	4-5
4-2 Fielded Chemical and Biological Defense Items Data Assessment.....	4-8
5-1 USMC Individual NBC Training	5-11
5-2 USMC Collective Training, NBC Requirements	5-12
5-3 USMC Individual Training (Enlisted NBC Specialists)	5-16
5-4 USMC Individual Training (Training for NBC Officers)	5-17
5-5 Chemical/Biological Incident Response Force (CBIRF) Role in Training	5-25

(INTENTIONALLY BLANK.)

INTRODUCTION

DEPARTMENT OF DEFENSE CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM

ANNUAL REPORT TO CONGRESS

(INTENTIONALLY BLANK)

I. PURPOSE

This report provides Congress with an assessment of the overall readiness of the Armed Forces to fight in a nuclear, biological, and chemical (NBC) warfare environment in accordance with 50 USC 1523. This is the fifth report submitted under 50 USC 1523.*

The objective of the Department of Defense (DoD) NBC defense program is to enable our forces to survive, fight and win in NBC-contaminated environments. In addition to the continuing requirement to respond to two simultaneous Major Theater Wars, numerous rapidly changing factors influence the program and its management. These factors include a new defense strategy, an era of declining DoD resources to include force structure reductions, planning for warfighting support to regional threat contingencies, the effects of the breakup of the Soviet Union, the entry into force of the Chemical Weapons Convention (CWC), and continued proliferation of NBC weapons.

The President's 1997 report, *The National Security Strategy of Engagement and Enlargement*, emphasizes the three key elements of the executive branch's strategy as "(1) to enhance our security with effective diplomacy and with military forces that are ready to fight and win; (2) to bolster America's economic prosperity; (3) to promote democracy abroad." U.S. forces must have numerous capabilities in order to respond and deploy quickly to various worldwide needs. Counterproliferation capabilities are required by forces to meet worldwide needs, and NBC defense is integral to counterproliferation capabilities. The Commanders-in-Chief have identified their priorities for counterproliferation capabilities. These priorities are shown in Table I-1. NBC defense related items are highlighted in **bold**.

Table I-1. Required CINC Counterproliferation Capabilities

1. CP Intelligence Cycle
2. Conventional Response (Precision Munitions) with minimum collateral effects
3. SOF Response and Intel Collection/Analysis Targeting Covert/Paramilitary/Terrorist Threat
4. **Battlefield NBC Detection and Warning**
5. TMD with minimum collateral effects
6. Defeat underground targets
7. Target Planning/Analysis including Collateral Effects Prediction and Post-Strike Assessment
8. **Individual Protection**
9. Proliferation Pathway Analysis
10. CMD/Aircraft Defense with minimum collateral effects
11. **Collective Protection**
12. Mobile Target Defeat
13. Offensive Information Warfare
14. CP Consequence Logistics Capability
15. **Decontamination**
16. **NBC Medical Treatment**

The response to the threat of NBC weapons must be based on the nature of this threat, not just where the threat occurs. A key part of DoD's strategy is to stem the proliferation of

* The text of 50 USC 1523, *Annual report on chemical and biological warfare defense*, (implemented as part of Public Law 103-160, the FY94 National Defense Authorization Act) is included at Annex G.

such weapons and to develop an effective capability to deal with these threats. To focus the response to the threat, DoD and the intelligence community have completed several classified reports providing threat assessments on chemical and biological threats to U.S. forces. To minimize the effect of these threats to our forces, we need to demonstrate the capability to deter their use through continuing improvements in our NBC defensive capabilities. The DoD NBC defense program continues to work towards increasing the capabilities of Joint Forces to survive and continue their mission during conflicts which may involve the use of NBC weapons.

The number of nations with CBW capabilities is increasing. Similarly, the sophistication of CBW capabilities is increasing. Proliferation of weapons technology, precision navigation technology, nuclear (medical, power, and industrial applications), and CBW technology to developing nations presents the United States with a complicated national security challenge. Intelligence efforts include collection and analysis of nations' "dual-use" nuclear, chemical and biological industrial capabilities and develop the indications and warning of adversarial use of dual-use capabilities. Tailored intelligence documents are essential for developing and updating requirements for CB defense programs. Numerous threat documents tailored to the CB threat have been produced and are updated periodically. The Intelligence Community continues to review U.S. chemical and biological warfare intelligence requirements and assess the adequacy of those assets to execute the required intelligence program.

The DoD NBC defense program invests in technologies to provide improved capabilities that have minimal adverse impact on our war fighting potential. Our goals are to provide:

- improved capabilities to detect NBC agents in order to avoid their effects;
- lighter, less burdensome protection;
- decontamination systems with reduced logistical burden;
- decontaminants that are less toxic and environmentally safe;
- integrated, balanced system of force protection; and
- medical casualty care and management.

All of the capabilities integrated together as a system-of-systems are essential to avoid contamination and to sustain operational tempo on an asymmetric battlefield. Sound Joint doctrine and realistic training remain fundamental to our defense against NBC weapons.

II. THREAT ASSESSMENT

Nuclear Weapons Threat: The threat posed to the United States and its allies by the proliferation of nuclear weapons is real and growing. While there is no current, direct Inter-Continental Ballistic Missile (ICBM) threat against the United States by nations other than Russia and China, the threat from theater ballistic missiles is of growing concern. More than two dozen countries have operational ballistic missiles, and more have programs in place to develop them. North Korea has sold Syria and Iran extended-range Scud Cs and has apparently agreed to sell missiles to Libya. Egypt, Israel, and Pakistan are developing and producing missiles, and several Persian Gulf states have purchased whole systems as well as production technology from China and

North Korea. Some have equipped these missiles with NBC warheads, and others are striving to do so.

North Korea has developed and tested an indigenous ballistic missile with a range of about 1,000 kilometers. This missile is capable of carrying the full range of NBC weapons. North Korea's continued efforts to sell the missile abroad—particularly to dangerous and potentially hostile countries such as Iran—is of greatest concern. With this missile, North Korea could reach Japan; Iran could reach Israel, and Libya could reach US bases and allied capitals in the Mediterranean region.

Two countries that could engage in warfare using nuclear weapons are India and Pakistan. Both nations have nuclear weapon development programs. In other areas such as the Mid-East and Far-East there is the potential for similar activity. The nuclear threat posed by North Korea is of major concern not only to South Korea and Japan but also to China. As long as nations perceive nuclear weapons as enhancing their security, and others are willing to sell the technology, required production equipment, or finished weapons, the threat from nuclear proliferation will grow.

Chemical and Biological Weapons (CBW) Threat

Despite the end of the Cold War, the United States still faces serious national security issues. At the forefront of these issues are the proliferation of CBW and related technologies and the desire of numerous Third World countries to acquire a chemical and/or biological warfare capability to augment their conventional military arsenals. Moreover, of the nations currently believed to have active CBW efforts underway, a majority also have parallel programs to develop ballistic missiles as a possible means for agent delivery.

Protecting against CBW attacks can make it difficult to carry out military missions because protective measures restrict vision and mobility, add weight, and increase heat stress. Further, logistic burdens are added by the need for decontamination chemicals and equipment, detection gear, and specialized reconnaissance devices and vehicles. Threatened or actual use of CBW places significant stress on troop morale.

Many of the future scenarios for CBW use are not expected to differ from those envisioned historically. However, because U.S. forces have fewer assets pre-positioned in areas of potential conflict, those assets associated with power projection into those theaters such as ports, airfields and logistical depots are the subject of increased attention. Infectious agents may be most effective against the first category (I) from the following list of targets, since these agents have a relatively slow onset of effect but larger area coverage. A wide variety of CB agents may be employed against targets in the second and third categories. Chemical and toxin agents may be most effective against targets in the fourth category (IV) from the following list of targets, since these agents have a relatively rapid onset of effect but smaller area coverage per unit weight of agent than infectious agents.

- I. High-value, large-area facilities/targets within or outside of theater: leadership, diplomatic, military headquarters, industrial, commercial, population centers.
- II. Theater support military facilities: command and control, troop barracks, air bases, missile launch sites, naval ports, logistical transfer/storage facilities.
- III. Military assets near engagement areas: troop convoys, staging areas, drop zones, air strips, air defense systems, artillery support bases, naval task forces.
- IV. Forces in engagement: infantry, amphibious, mechanized/armor.

CBW known to have been designed in conjunction with offensive programs have taken a wide variety of forms. Probable means of weapons employment for optimal agent effect are summarized below.

- *Off-target (upwind) attacks using agent aerosol disseminators moved along paths perpendicular to wind direction.* Means of delivery could include aircraft, UAVs, cruise missiles, boats/submersibles, or ground vehicles. Such attacks also could be achieved with multiple source detonation/spray devices covertly emplaced upwind from the target or employed by SOF or triggered remotely or by timing devices.
- *On-target attacks using various forms of agent containing fused munitions that explosively disseminate or spray agent at or near ground level.* Among these munitions are ballistic and cruise missile warheads, aircraft ordnance, tube and rocket artillery, and naval gunfire.
- *Area-denial attack using persistent (generally chemical) agents laid down in a heavy pattern with the intention of contaminating ground areas and water-crossing points that enemy forces may attempt to traverse.* Means of delivery could include aircraft ordnance, artillery, and mines.

CBW aimed at certain critical nodes in the military infrastructure of the United States—either domestically or abroad—could disrupt the execution of military objectives. Therefore, it is imperative that the United States have an ability to operate effectively in a contaminated environment while simultaneously being able to identify threat agents, treat injured personnel, and remediate the contaminated area.

Another less well defined threat in the realm of chemical warfare or terrorism is the potential for a Bhopal-like event resulting from deliberate targeting of industry or commerce in population centers. A current example of this situation may be found in the operations in Bosnia. Chemical plants in Bosnia are designed to produce large quantities of chemicals for the manufacture of common products, such as plastics. During WWI, some of these chemicals were used as warfare agents. These chemicals, such as phosgene and chlorine, have become staples of the modern chemical industry; yet their potential for use during conflict is as great today as ever. Moreover, the political situation and the restraints on the use of such chemicals as weapons, restraints which have precluded their use in warfare among the industrialized nations over the past 80 years, may no longer exist in these regions of ethnic and religious conflict.

U.S. forces that have to operate in these regions face, therefore, the combined threats of both historical chemical agents and weapons and the potential for exposure to chemicals produced as an

element of the regions chemical industry. Scale of operation is the main discriminator between military uses of weapons and chemicals released from chemical plants by saboteurs or collateral damage resulting from military operations. The chemical plant at Tuzla is a prime example. The chemical storage tanks there have a capacity to hold more than twice as much chlorine as was released by Germany in their first ever chemical attack, which killed or injured over 5,000 people in a span of 15 minutes. If released in an area like Tuzla, such a catastrophic release could have a significant effect on military operations, as well as affecting future humanitarian, political, and economic considerations locally and internationally.

The Regional Chemical and Biological Warfare Threat

Northeast Asia

North Korea has pursued research and development related to biological warfare since the 1960s. Pyongyang's resources presently include a rudimentary (by Western standards) biotechnology infrastructure, which is sufficient to support the production of limited quantities of toxins, viral, and bacterial biological warfare agents. In the early 1990s, an open press release by a foreign government further pointed to applied military biotechnology work at numerous North Korean medical institutes and universities dealing with the anthrax, cholera, plague, and smallpox pathogens. This press release also mentioned the testing of unspecified biological warfare agents on North Korean island territories.

By comparison, North Korea is believed to have a more robust chemical warfare effort, which includes the capability since 1989 to independently produce bulk quantities of both chemical agents and munitions. Since that period, this program has matured to now include a sizable stockpile of chemical weapons and the capability to manufacture nerve, blister, choking and blood agents. North Korea has also devoted considerable scarce resources to defensive measures aimed at protecting its civilian population and military forces from the effects of chemical weapons. Such measures include extensive training in the use of protective masks, suits, detectors, and decontamination systems. Though these measures are ostensibly focused on a perceived threat from U.S. and South Korean forces, they could also support the offensive use of chemical weapons by the North during combat. North Korea has yet to sign the Chemical Weapons Convention (CWC) and is not expected to do so in the near-term because of the intrusive inspection and verification requirements mandated by the agreement.

China possesses an advanced biotechnology infrastructure and requisite biocontainment facilities necessary to perform research and development on lethal pathogens. Although China has consistently claimed that it has never researched or produced biological weapons, it is nonetheless believed to likely retain a biological warfare capability begun before acceding to the Biological Weapons Convention (BWC).

China is believed to have an advanced chemical warfare capability that includes not only a research and development program, but also production and weaponization capabilities. Its current inventory includes the full range of traditional agents and may, in the future, include more advanced chemical agent compounds. It has a wide variety of delivery systems for

chemical agents, including artillery rockets, aerial bombs, sprayers, and short-range ballistic missiles. Chinese forces, like those of North Korea, have conducted defensive CW training and are prepared to operate in a contaminated environment. As China's program is further integrated into overall military operations, its doctrine, which is believed to be based in part on Soviet-era thinking, may reflect the incorporation of more advanced munitions for CW agent delivery.

South Asia

India has a well-developed biotechnology infrastructure which includes numerous pharmaceutical production facilities and secure biocontainment laboratories for working with lethal pathogens. It also has qualified scientists with experience in infectious diseases. At least some of India's facilities are being used to support research and development for biological defense work. India has ratified the BWC of 1972

India has an advanced commercial chemical industry and infrastructure. It produces the bulk of its own chemicals for domestic consumption. After New Delhi ratified the CWC in 1996, it subsequently acknowledged the existence of a chemical warfare program and indicated that all facilities related to this program will be open for inspection. India is believed to have numerous munitions and delivery vehicles that could be used to deliver CW agents, including artillery, aerial bombs, and missiles.

Pakistan has a capable but less well-developed biotechnology infrastructure than India. Its facilities, while fewer in number, could nonetheless support work on hazardous biological pathogens. Moreover, Pakistan is believed to have the resources and capabilities necessary to support a limited biological warfare research and development effort. Like India, Pakistan has ratified the BWC.

Pakistan has a less-well developed commercial chemical industry but is expected to eventually have the capability to produce all precursor chemicals needed to support a chemical weapons stockpile. Like India, Pakistan has numerous munitions delivery vehicles that could be used to deliver CW agent, including artillery, aerial bombs, and missiles. Pakistan has ratified the CWC.

The Middle East and North Africa

Iran's biological warfare program, which began during the Iran-Iraq War, is generally believed to be in the research and development phase. Iran has qualified, highly-trained scientists and considerable expertise with pharmaceuticals. It also possesses the commercial and military infrastructure needed to produce basic biological warfare agents and may have produced pilot quantities of usable agent. Although Iran is a signatory to the BWC, this agreement does not now contain on-site inspection protocols to verify compliance.

Although Iran had a chemical weapons program underway early in the Iran-Iraq War, it has, since the early 1990s, placed a high priority on furthering this effort, to include expanding both the chemical production infrastructure and munitions arsenal. Iran currently manufactures

weapons for blister, blood, and choking agents and is believed to be conducting research on nerve agents. It has the capability to deliver CW agents using artillery shells and aerial bombs. Iran has ratified the CWC.

Prior to the Gulf War, Iraq developed the largest and most advanced biological warfare program in the Middle East. Though a variety of agents were studied, Iraq actually declared anthrax, botulinum toxin and aflatoxin to have completed the weaponization cycle. During the Gulf War, coalition bombing destroyed or damaged many key facilities associated with BW activity. However, it is suspected that a key portion of Iraq's BW capability, in the form of agent-filled munitions, was hidden and may have subsequently escaped damage. Nonetheless, Iraq declared after the war that all BW agent stockpile and munitions were unilaterally destroyed. UNSCOM activity has, however, revealed this assertion as well as many others related to BW activity to be inaccurate and misleading. As with its chemical program, there are indications that Iraq intends to re-establish its BW capabilities if afforded the opportunity by the relaxation or cessation of UNSCOM inspection activity.

Iraq had a mature chemical weapons program prior to the Gulf War, which included a variety of nerve agents, including tabun and sarin, as well as the blister agent mustard, available for offensive use. Iraq also undertook a program, begun in 1985, to develop the nerve agent VX. This activity continued uninterrupted until December 1990. Although Iraq's chemical warfare program suffered extensive damage during the Gulf War and subsequently from UNSCOM activity, Iraq retains a limited capability to reconstitute key parts of its chemical warfare program. Information released from Hussein Kamel, a senior Iraqi defector, revealed that Iraq had hidden from UN inspectors sophisticated chemical warfare capabilities heretofore unknown. These included a program to develop binary sarin-filled artillery rounds, as well as rockets and aerial bombs in quantities beyond the prototype level. Also revealed was a precursor production capability sufficient to produce 400 tons of VX per year. The comprehensive nature of Iraq's previous chemical warfare activity and the consistent pattern of denial and deception employed by Iraqi authorities indicate an intent to rebuild this capability, should Iraq be given the opportunity.

Syria has an adequate biotechnology infrastructure which could support a limited biological warfare effort. Though Syria is believed to be pursuing the development of biological weapons, it is not believed to have progressed much beyond the research and development phase and may have produced only pilot quantities of usable agent. Syria has signed the BWC.

Syria has a mature chemical weapons program, begun in the 1970s, incorporating nerve agents, such as sarin, which have completed the weaponization cycle. Future activity will likely focus on CW infrastructure enhancements for agent production and storage as well as possible research and development on advanced nerve agents. Munitions available for CW agent delivery likely include aerial bombs as well as SCUD missile warheads. Syria has not signed the CWC.

Libya's biological warfare program is believed to remain in the early research and development phase. Progress has been slow due in part to an inadequate scientific and technical base. Though Libya may be able to produce small quantities of usable agent, it is unlikely to

transition from laboratory work to production of militarily significant quantities until well after the year 2000. Libya acceded to the BWC in 1982.

Libya retains a chemical warfare production capability even though efforts to develop CW agents were stymied, in part, by the intense public scrutiny afforded to its Rabta facility in the late 1980s. Prior to this time, however, Libya succeeded in producing up to 100 tons of blister and nerve agent at the site. Although Rabta was closed in 1990, it subsequently re-opened in 1995 ostensibly as a pharmaceutical plant, though the facility is still believed capable of producing CW agents. Libya is not a signatory to the CWC.

Independent States of the Former Soviet Union

The former Soviet offensive biological warfare program was the world's largest and consisted of both military facilities and non-military research and development institutes. Non-military activity was centrally coordinated and performed largely through a consortium of institutes known as Biopreparat. This network of facilities was created in 1973 as a cover for activity related to biological warfare. This huge organization at one time employed up to 25,000 people and involved nearly 20 research, development and production facilities. The Russian government has committed to ending the former Soviet BW program, although serious questions about offensive BW capabilities remain. Key components of the former program remain largely intact and may support a possible future mobilization capability for the production of biological warfare agents and delivery systems. Moreover, work outside the scope of legitimate biological defense activity may be occurring at selected facilities within Russia. Such activity, if offensive in nature, would contravene the BWC of 1972, to which the former Soviet government is a party. It would also contradict statements by top Russian political leaders that offensive activity has ceased.

While former Soviet biological warfare facilities existed in Ukraine, Kazakhstan, and Uzbekistan, none are currently active. Moreover, the governments in these new republics are not believed to have plans to establish any future BW capability. Also, Belarus has no program and no intention of establishing one. Ukraine, Belarus, and Uzbekistan have ratified the BWC, while Kazakhstan has not yet signed it.

Russia has acknowledged the world's largest stockpile of chemical agents, amounting to approximately 40,000 metric tons. This stockpile, consisting mostly of weaponized agent, includes artillery, aerial bombs, rockets, and missile warhead munitions. Actual agents include a variety of nerve and blister agents. Additionally, some Russian chemical weapons incorporate agent mixtures, while others have added thickening agents to increase agent persistence. Russian officials do not deny that CW research has continued but claim that it is for defensive purposes and therefore not proscribed by the CWC. Many of the components for new binary agents developed under the former-Soviet program have legitimate civilian applications and are not on the CWC's schedule of chemicals.

Although remnants of the former Soviet chemical program remain in Ukraine, the country has signed the CWC and has no chemical warfare program. Kazakhstan also inherited

facilities from the former Soviet program, though these have been demilitarized and are being converted to peaceful purposes. Uzbekistan inherited a former Soviet chemical test range, which has since been abandoned. Both Kazakhstan and Ukraine have signed but not ratified the CWC. Uzbekistan has ratified the treaty.

Proliferation

U.S. forces face a number of regional proliferation challenges. Iran continues with a concerted effort to acquire an independent production capability for all aspects of its chemical weapons program. Nonetheless, for the time being, it remains dependent on foreign sources for many chemical warfare-related technologies. China, as a key supplier of technologies and equipment for Iran's chemical warfare program, will play a pivotal role in determining whether Iran attains its long term goal of independent production for these weapons.

Proliferation of CBW technology in South Asia also raises several important issues. India has exported a wide array of chemical products, including Australia Group-controlled items, to numerous countries of proliferation concern in the Middle East. The controlled items include specific chemical agent precursors, pathogens with biological warfare applications, and dual-use equipment which can be used in both chemical and biological warfare programs. Pakistan, on the other hand, may be seeking to upgrade key parts of its biotechnology infrastructure with dual-use equipment and expertise. Such acquisition efforts would reflect Pakistan's less-well developed biotechnology infrastructure.

The proliferation of CBW-related technology remains a critical threat to peace and stability throughout the world. One mechanism through which industrialized countries have agreed to control the proliferation of key chemical and biological warfare-related technologies is the Australia Group. The Australia Group (AG) is a consortium of countries organized to slow the proliferation of chemical and biological warfare programs through the imposition of multilateral export controls. Initial efforts of this group began in June 1985 and focused on precursor chemicals used in the manufacture of chemical agents. However, convinced of the threat posed from biological weapons, AG countries subsequently agreed in December 1992 to also control the sale of items that most likely could be used to develop biological agents and weaponry. The AG adopted a list of human pathogens consisting of 37 organisms, 10 toxins and associated genetically-modified organisms, and a seven-item BW dual-use equipment list. In addition, the AG later adopted animal and plant pathogen lists in recognition of the threat posed from anti-crop and anti-animal biological warfare.

In North Africa, Libyan efforts to acquire foreign equipment and expertise related to biological warfare have been dealt a severe blow, largely because of UN sanctions. Due to the international community's encompassing restrictions on exports to Libya, efforts to proceed beyond laboratory-scale research and development related to biological warfare will be difficult.

(INTENTIONALLY BLANK.)

CHAPTER 1

DOD CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM MANAGEMENT AND OVERSIGHT

(INTENTIONALLY BLANK)

1.1 MANAGEMENT IMPLEMENTATION EFFORTS

During FY96, the Department of Defense (DoD) completed implementation of the process to consolidate, coordinate, and integrate the chemical and biological (CB) defense requirements of all Services into a single DoD CB defense program. Additionally, DoD completed the final steps to ensure close and continuous coordination between the Chemical Biological Warfare Defense program and the Medical Chemical Biological Defense program. Refinement of that process continued during FY97.

1.1.1 Management Reviews

DoD has continued to use the Defense Acquisition Board (DAB) process to conduct oversight of the consolidated CB defense program. Integrated product team working groups and overarching integrated product team meetings are conducted throughout the process to review progress concerning current actions, discuss new management issues, and develop recommendations for DAB decision.

As part of the Program Objectives Memorandum (POM) process, the OSD Director for Program Analysis and Evaluation conducted a major front end assessment of DoD counterproliferation programs, including CB defense. The Defense Resources Board (DRB) reviewed and approved the results of the assessments. A Program Decision Memorandum incorporated the DRB decisions into the development of the FY98 budget request.

1.1.2 Coordination and Integration of the Program

Through the Joint Service Agreement on NBC Defense, the Military Services have established a viable structure which ensures that Service operational needs are integrated and coordinated from their inception and that duplication of effort is eliminated from NBC defense research, development, and acquisition. The series of reviews conducted by the Joint Service Integration Group and the Joint Service Materiel Group, both separately and together, have proved to be an appropriate organizational method to accomplish the coordinating and integrating function.

1.2 ORGANIZATIONAL RELATIONSHIPS

The overall CB defense program management structure, portrayed in Figure 1-1, helps facilitate coordination and integration of the program. This management and oversight structure was developed in late 1996 to provide integration of medical and non-medical CB defense efforts at the Service level. Integration of CB defense efforts continued in 1997.

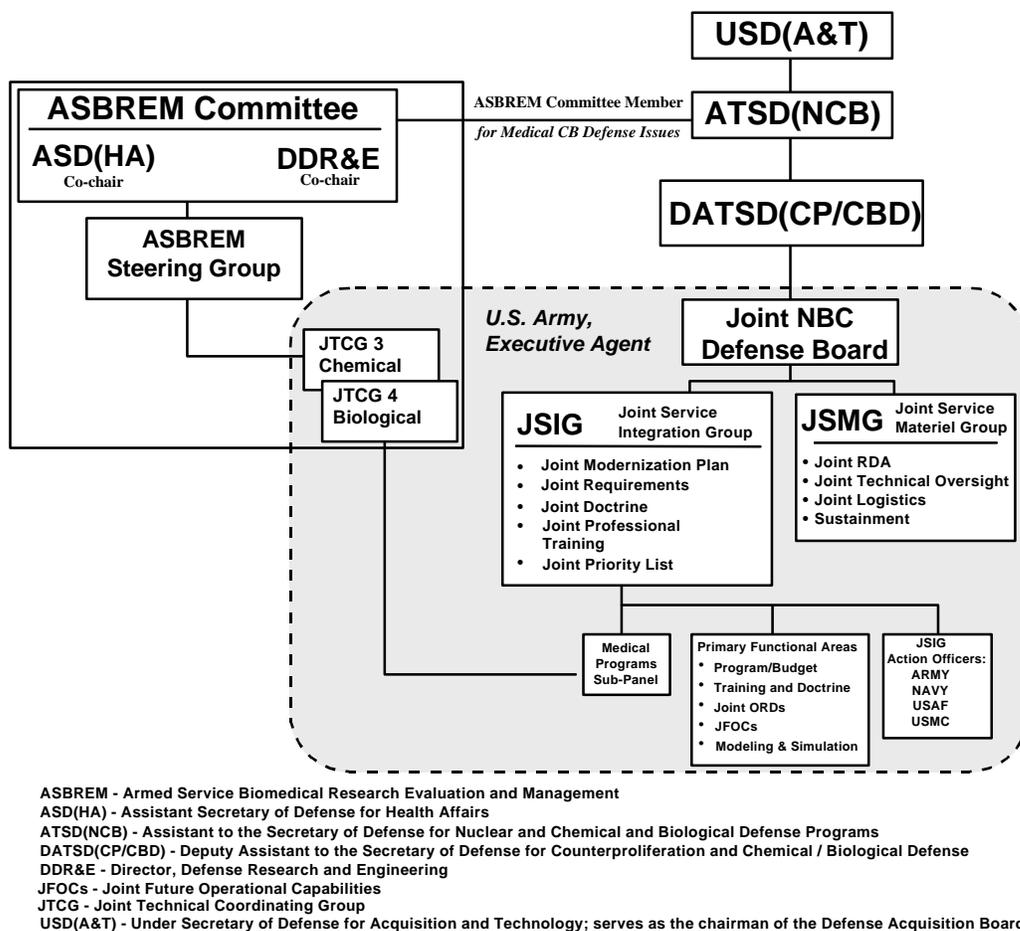


Figure 1-1. Chemical and Biological Defense Program Management Structure

ATSD(NCB) is the single office within OSD responsible for oversight of the DoD CB defense program.¹ ATSD(NCB) promulgates the DoD CB Defense Program Management Plan which specifies the relationships and responsibilities among the coordinating agencies.

ATSD(NCB) provides the fiscal and programming guidance to the Joint NBC Defense Board (JNBCDB) to develop the POM. The Joint NBC Defense Board issues POM Preparation Instructions to the subordinate groups which review the validated requirements and build the POM strategy recommendations. The CB defense program is divided into the following commodity areas: contamination avoidance, individual protection, collective protection, decontamination, medical chemical defense, and medical biological defense. These commodity areas correspond to the projects under the budget program elements. There is also a program budget element to support program management and oversight in accordance with the Joint Service Agreement and in compliance with 50 USC 1522. The JSIG is the principal steering group

¹ In November 1997, DoD published *The Defense Reform Initiative*, which among other things, proposed the elimination of ATSD(NCB). ATSD(NCB)'s responsibilities are proposed to be transferred to Defense Agencies, the Services, and other offices within OSD. During FY98 this issue is being addressed by the Defense Management Council. The changes within OSD should have no impact on the Joint Service Chemical and Biological Defense Program management structure, though it may change the structure within OSD for oversight of the program.

which oversees the coordination and integration of Service and CINC requirements and priorities for RDT&E and initial procurement. The JSMG is the principal steering group that manages execution of RDT&E materiel development efforts to ensure that the program risk is mitigated across commodity areas, and the ongoing efforts are complementary but not duplicative.

A Medical Program Sub-Panel (MPSP) has been proposed as part of the JSIG (as indicated in Figure 1-1). The first Multi-Service action officer meeting for the MPSP was held on 6 January 1998 and was chaired by the Senior Clinical Consultant for the Army Medical Department Center and School (AMEDDC&S). A draft charter for the implementation of the MPSP was presented for action officer review and ultimate approval by the Joint NBC Defense Board. The proposal for the MPSP is to have the sub-panel chaired by the Commander, AMEDDC&S, in accordance with current practices. However, it will be the responsibility of the Army, as the Executive Agent for the Joint NBC Defense Board, in consultation with the JSIG staff, AMEDDC&S, and other interested organizations, to determine and implement optimal arrangements for executing integration of MPSP into the JSIG. The purpose of this panel would be to identify medical program needs and requirements as developed by the AMEDDC&S, CINCs, Services, Joint Staff, the ASBREM Committee, and other users. The MPSP would have the primary responsibility for prioritizing medical CB defense requirements. The users and Joint Technology Coordinating Group (JTCG) 3 (MCDRP) and JTCG 4 (MBDRP) would provide input of medical requirements (separate from non-medical requirements) to the MPSP. The MPSP would coordinate, integrate, and prioritize all of the user requirements input. It would provide the consolidated, integrated, and prioritized list of medical CB defense requirements to the JSIG. The JSIG would submit the medical requirements list along with the non-medical requirements list to the JNBCDB. The JSIG may provide comments but would make no changes to the list when submitting the medical requirements to the JNBCDB. The JNBCDB and DATSD(CP/CBD) may make changes to the medical or the non-medical requirements and priorities list.

The Deputy Assistant to the Secretary of Defense for Counterproliferation and Chemical/Biological Defense, DATSD(CP/CBD), is a deputy to ATSD(NCB) and is responsible for the overall coordination and integration of all CB defense research, development, and acquisition (RDA) efforts. DATSD(CP/CBD) provides the overall guidance for planning, programming, budgeting, and executing the CB defense program. DATSD(CP/CBD) also retains approval authority for all planning, programming, and budgeting documents. DATSD(CP/CBD) is responsible for ensuring coordination between the medical programs and the non-medical CB defense efforts, and management oversight of the DoD CBDP in accordance with 50 USC 1522.

The Secretary of the Army is the Executive Agent responsible to coordinate, integrate, and review all Services' CB defense requirements and programs. The Secretary has delegated this responsibility to the Assistant Secretary of the Army for Research, Development and Acquisition, ASA(RDA), who along with the Vice Chief of Staff of the Army, co-chairs the Joint NBC Defense Board. The military departments' acquisition organizations execute the individual CB defense programs according to Service and DoD directives.

1.3 TECHNOLOGY BASE REVIEW AND ASSESSMENT

The Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs, ATSD(NCB), in coordination with the Director, Defense Research & Engineering (DDR&E), provides technical oversight of all Service and Defense Agency chemical and biological defense science and technology base (S&T) programs and reviews these programs at least annually. By March of each year, ATSD(NCB) prepares the relevant NBC defense portions of three key documents detailing DoD S&T efforts:

- the Joint Warfighting S&T Plan (JWSTP)
- the Defense Technology Area Plan (DTAP), and
- the Basic Research Plan (BRP).

These plans are issued with the Defense Planning Guidance to guide preparation of the CB Defense Program S&T budget and programming efforts. Copies of these plans are submitted to Congress separately in accordance with public law.

1.4 DARPA BIOLOGICAL WARFARE DEFENSE PROGRAM MANAGEMENT

The Defense Advanced Research Projects Agency (DARPA) is charged with seeking breakthrough concepts and technologies. DARPA's Defense Sciences Office (DSO) manages its Biological Warfare (BW) Defense Program, which is intended to complement the DoD CB Defense Program by anticipating threats and developing novel defenses against them, and pursues the development of technologies with broad applicability against classes of threats. DARPA invests primarily in the early, technology development phases of programs, with rapidly decreasing involvement in the succeeding stages that lead to system development.

The FY98 National Defense Authorization Act directed the Secretary of Defense to ensure that the DARPA biological warfare defense program is coordinated and integrated under the program management and oversight of the DoD CBD program. The DARPA BW Defense Program coordinates its efforts with DATSD(CP/CBD) through briefings to DATSD(CP/CBD). The Advanced Diagnostics portion of the DARPA BW Defense Program is closely coordinated with the U.S. Army Medical Research and Materiel Command (MRMC) and maintains representation on the recently formed Common Medical Diagnostic Systems Executive Committee. A panel of chemical/biological defense experts is routinely consulted by DARPA to evaluate programs and to ensure that National Institutes of Health (NIH) efforts are not being duplicated. The DARPA BW Defense office also maintains representation at CBD Program committee meetings, such as ASBREM sub-committee meetings. Additionally, DARPA participates in the BW Seniors Group which provides Government coordination outside of DoD.

1.5 FUNDS MANAGEMENT

Figure 1-2 describes the funds management and execution process for the CB defense program and the coordination between funding and executing organizations. The key organizations in this process are: DATSD(CP/CBD) as the OSD focal point; the JNBCDB Secretariat

representing the Executive Agent; the Ballistic Missile Defense Office (BMDO) as the funds manager; the JSMG as coordinator and interface between the participating organizations; and the operating agencies and performers which execute the programs. For budget distribution, the JNBCDB Secretariat provides funds distribution information to DATSD(CP/CBD) based on the appropriated budget. The DATSD(CP/CBD) prepares funds suballocation instructions and submits them to the BMDO to distribute the funds to the operating agencies.

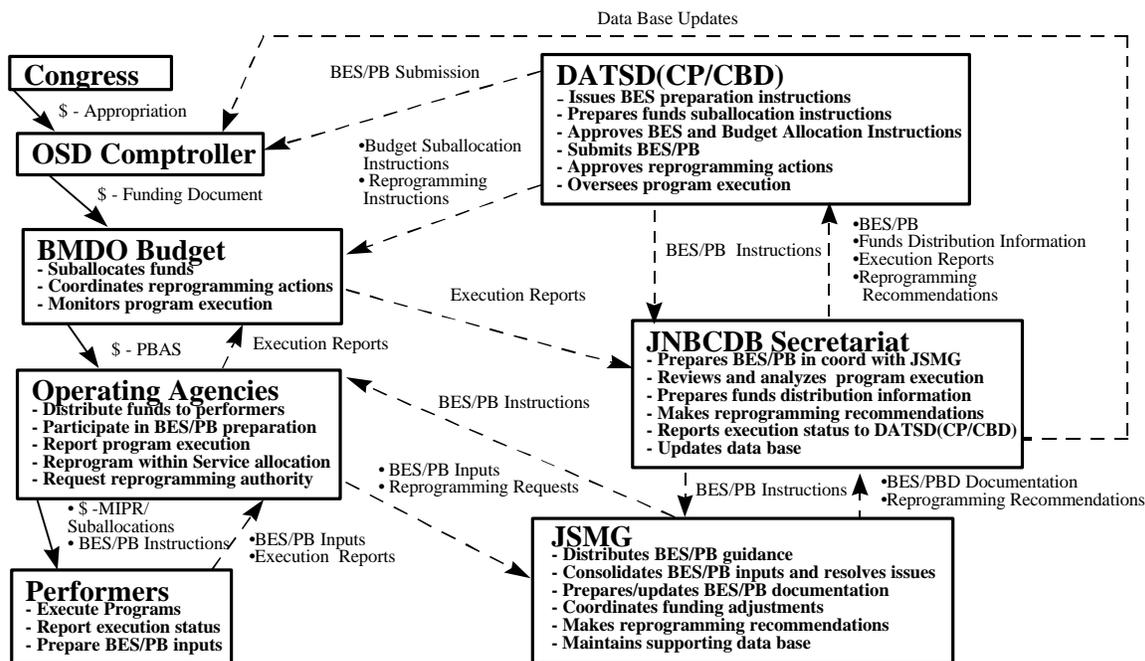


Figure 1-2. Chemical and Biological Defense Funds Management Process

The lead components or operating agencies provide notification of all funding adjustments to the JSMG Executive Office. The JSMG Executive Office, in turn notifies the other components/agencies and the JNBCDB Secretariat (to update the database). For minor adjustments other than reprogramming actions, this is the only necessary action. The JSMG Executive Office forwards to the JNBCDB Secretariat the reprogramming requests with recommendations and any concerns raised by the other components and operating agencies. The JNBCDB Secretariat reviews the reprogramming actions and forwards its recommendations to DATSD(CP/CBD). Once approved, DATSD(CP/CBD) authorizes BMDO to execute the reprogramming. During the execution year for medical programs, the Headquarters, U.S. Army Medical Research and Materiel Command (USAMRMC) staffs all actions resulting from the requirement to reallocate funds between the Services.

DATSD(CP/CBD) instructs BMDO to issue execution and program status reporting instructions. The lead components report execution status to BMDO on a monthly basis. BMDO forwards all reports to the JNBCDB Secretariat for analysis. The JNBCDB Secretariat reports execution status to DATSD(CP/CBD) on a quarterly basis. It is the JNBCDB

Secretariat's responsibility to notify the DATSD(CP/CBD) when programs deviate from or are in danger of not meeting obligation and execution goals.

BMDO serves as the funds manager for the CB defense program. They issue funding documents, per DATSD(CP/CBD) direction, and perform all required accounting functions, with the assistance of the Army staff which represents the Executive Agent. The JNBCDB Secretariat updates the OSD comptroller databases as necessary after the POM, Budget Estimate Submission (BES), and President's Budget (PB). DATSD(CP/CBD) ensures that the JNBCDB Secretariat is kept informed of all OSD comptroller guidance, directives, and schedules.

1.6 NBC DEFENSE PROGRAM MANAGEMENT ASSESSMENT

ISSUE: Oversight and management of the DoD NBC defense program continues to mature. It is imperative that the management system produces joint NBC defense requirements and NBC defense equipment that can be used by all forces. Public Law 103-160 (50 USC 1522) has provided a key tool for ensuring a jointly focused NBC defense program. The continued support of Congress and implementation of current plans will continue to improve jointness and readiness.

SOLUTION: DoD has completed implementation of 50 USC 1522:

- An organizational structure ensuring close and continuous coordination of CB warfare defense and CB medical defense programs.
- The DoD CB Defense Program is fully integrated and coordinated and is based on validated Service requirements generated in response to defined threats. In addition, the Services now jointly prepare (i) Modernization Plans, (ii) Research, Development and Acquisition (RDA) Plans, and (iii) Joint Logistics Support Plans for NBC defense programs.
- Responsibility for the CB Defense Program is vested in a single office in OSD and oversight is conducted using the DAB process.
- DoD has responded to all recommendations provided in the General Accounting Office (GAO) report NSIAD-96-103. DoD-planned actions in response to the GAO report were provided to the GAO in a letter from the ATSD(NCB), dated 11 October 1996, Subject: Follow-up on GAO Report NSIAD-96-103 (OSD Case 1099), "Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems" March 29, 1996.
- A key DoD action in response to the GAO report was the development of an immunization program for biological warfare defense. A description of this program is provided in Chapter 3 (p. 3-18).

Continuing Process Improvements

Improvements to the Joint Requirements Document process need to be made in order to shorten the processing time and establish joint standards for other than Major Defense Acquisition Programs. The JSIG has requested that the JCS J-8 include process improvements in the next update to the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01,

dated 13 June 1997, entitled "Requirements Generation System" (formerly, CJCS Memorandum of Policy 77 (MOP 77)).

Standardization of a DoD wide equipment funding and acquisition policy is another process improvement being investigated to improve efficiency and economy.

Modeling and Simulation

The use of modeling and simulation (M&S) is an essential aspect of the current and future NBC Defense program. The NBC Defense program is enhanced by modeling and simulation in the assessment of NBC threats, survivability, and training, and provides commanders with decision aids based on the integration and interpretation of real-time data. Transport models, toxicity models, point and standoff detector data models, and meteorological models are being integrated in warfighter simulations. This will allow soldiers to experience the operational impact and consequences of nuclear, biological, and chemical weapons in a computer-generated combat environment. Simulation of existing and proposed CB defense equipment will demonstrate their value on the battlefield and enable optimization of their performance requirements for more shrewd procurement. The development and validation of standard CB warfare hazard model for the Services is a critical part of this effort. Interoperability of models in the common forum of the Distributed Interactive Simulation (DIS) network is also a goal.

The Joint Service Integration Group (JSIG) is pursuing establishment of a commodity area manager to integrate and coordinate all NBC modeling and simulation efforts across the Joint Services, Joint Staff, and Defense Agencies. A draft charter for this commodity area is under development and a manager from the lead Service will be assigned after its completion. Concurrently, the JSIG is developing a Model and Simulation Master Plan that will outline costs, schedule, and management responsibilities to implement the findings of the CB Modeling Process Action Team (PAT) which has been tasked with providing OSD with a consolidated and integrated CB modeling program.

Over the past three years, the U.S. Army Chemical and Biological Defense Command (CBDCOM) has developed a suite of advanced Distributed Simulation (DS) models and simulators representing all aspects of the CB battlefield, including CB agent threat environment; Chemical and Biological Defense Equipment (CBDE) such as the FOX and BIDS vehicles, CB point and standoff detectors; individual and collective protection systems; and performance degradation effects on personnel due to agent exposure and protective equipment. These simulation tools form the backbone of the Simulation Based Acquisition (SBA) process for CBDE. SBA involves the use of simulation technology that is integrated across all acquisition phases and programs from concept development through sustainment. These tools have been developed primarily for the Research, Development and Acquisition (RDA) M&S domain and will be used for the design, optimization and integration of CB Defense Equipment and systems. In addition, these same tools are being adapted by the Dugway Proving Ground for their "Virtual Proving Ground." Thus, the same simulation tools can be used for both Research and Development as well as for Test and Evaluation. Further, while envisioned as an RDA activity, the

tools are also being applied to the TRADOC community's Advanced Concepts and Requirements and Training and Exercises of Military Operations, M&S domains.

These tools are currently being used to support various on-going development programs at CBDCOM such as the Integrated Biodetection Advanced Technology Demonstration (ATD); Long Range-Biological Standoff Detection System (LR-BSDS) Tactics Study; Light NBC Reconnaissance System (LNBCRS), Light Standoff Chemical Agent Detector (LSCAD); Chemical Biological, Distributed Infantry (CBDI); Joint Warning and Reporting Network (JWARN); FOX/MM1 Training Suite Enhancement at the U.S. Army Chemical School; Backtrack System and Synthetic Theater Of War-1997 (STOW 97) ACTD. In addition, they have supported several military exercises such as Joint Warfighting Interoperability Demonstration for 1997 (JWID-97), Pacific Joint Task Force Exercise (PAC/JTFEX-97), Atlantic Joint Task Force Exercise (ATL/JTFEX-97), Roving Sands 97, and Unified Endeavor 97.

CHAPTER 2

NON-MEDICAL NUCLEAR, BIOLOGICAL, AND CHEMICAL WARFARE DEFENSE REQUIREMENTS AND RESEARCH AND DEVELOPMENT PROGRAM STATUS

(INTENTIONALLY BLANK)

2.1 INTRODUCTION

This chapter describes the consolidation of Joint Service non-medical NBC defense requirements and assesses how these programs meet the needs of the Force. The discussion of requirements and the status of research and development assessments is conducted within the framework of the three principles of NBC defense doctrine for the mission area:

- Contamination avoidance
- Protection
- Decontamination

As defined in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical Defense*, contamination avoidance includes detecting, avoiding, and bypassing contaminated areas. Protection consists of individual and collective protection. Decontamination restores combat power and is essential for sustaining operations in a contaminated environment. Medical programs support these areas and are discussed in Chapter 3.

The threat from the continued proliferation of NBC weapons—as described in the Introduction—creates a continuous need to ensure that U.S. forces can survive, fight, and win in an NBC threat environment. The increasing danger from these weapons demands that we look for every opportunity to avoid technological surprises. Evolving operational requirements demand that the joint program progressively capture and leverage advances in technology to provide the best in NBC defense equipment for the forces.

The key to the successful implementation of research, development, and acquisition (RDA) strategy is the concept of continuous incremental investment. Our RDA goal is to equip the Force with sufficient quantities of world-class equipment and in the shortest time possible in order to win decisively, quickly, and with minimal casualties. As authorized under the Joint Service Agreement for non-medical programs and in cooperation with the Armed Services Biomedical Research, Evaluation and Management (ASBREM) Committee for medical programs, the Army as executive agent coordinates, integrates, and reviews the DoD NBC Defense Program. The results of these reviews, conducted with all Services participating, are documented in the Joint Service Modernization and Joint Service RDA Plans. These documents form the basis for the consolidated NBC defense Program Objectives Memorandum (POM).

The Services in coordination with the Commanders-in-Chief (CINCs) decide if a material solution is needed to satisfy a requirement for a war fighting capability. They first look at doctrinal, training, or organizational solutions (non-material solutions), and when these cannot be found, they seek equipment solutions through the materiel acquisition cycle. If a valid need exists, then the research and development modernization process will identify technology approaches which may provide a new system or upgrade an existing system.

During FY97 the Joint Service Integration Group instituted an initiative to coordinate the development of Joint Future Operational Capabilities (JFOC). The goal of the JFOC effort is to identify and prioritize Joint User (Services and CINCs) far-term future operational capabil-

ities as expressed in the emerging Joint NBC Defense Concept. The overall intent is to provide enhanced User guidance to the Joint NBC Defense Science and Technology (S&T) community to assist in the NBC S&T program formulation and program execution process. The JFOC effort will also support the development of new NBC Defense Joint Mission Needs Statements (JMNSs) and future Joint Operational Requirement Documents (JORDs). During FY98 the draft JFOCs will be finalized and will be prioritized. The result will be a prioritized list of JFOCs which will establish a clearer link between near and long term Joint NBC Defense research and development efforts and User needs. The final prioritized list will become an integral part of the Joint Service NBC Defense Modernization Plan and related science and technology plans, including the Joint Warfighting Science and Technology Plan and the Defense Technology Area Plan.

In accordance with our national strategy of achieving and applying technological superiority, several underlying concepts form the foundation of acquisition modernization. The first is the need to reduce cycle time in the acquisition of new systems or the integration of emerging technologies into existing systems. The use of Advanced Concept Technology Demonstrations (ACTDs), open systems and architectures, along with the new emphasis on commercial standards and practices, allow us to shorten the acquisition cycle time. Our program acquisition process reduces overall costs through practices such as design-to-cost and concurrent engineering to ensure that equipment is easy to maintain and repair even with the inherent complexity in most new systems.

2.2 NBC DEFENSE MISSION AREA REQUIREMENTS AND RDA SUMMARY

The NBC Defense programs are categorized broadly under three operationally oriented areas: contamination avoidance, protection, and decontamination. Over the past two years, the Services have been working closely together to increase jointness in ongoing programs for each of these areas. This report highlights improvements during FY97 and discusses cooperative efforts for further Joint development of requirements. This section summarizes the requirements in each of the mission commodity areas. Tables 2-1 through 2-9 display requirements and acquisition strategies. Since the focus of this chapter is on research and development efforts, fielded items are not included in these tables. Descriptions of fielded equipment can be found in Annexes A-C at the end of this report.

2.3 CONTAMINATION AVOIDANCE (Detection, Identification and Warning)

The operational concept of contamination avoidance includes NBC reconnaissance, detection, identification, warning and reporting. Earliest possible warning is the key to avoiding NBC contamination. For fixed sites where contamination cannot readily be avoided and for missions requiring operations in a contaminated environment, detection, identification, and warning are equally critical to ensure that forces assume the optimal protective posture so that they can continue to sustain operations. Sensors for the individual soldier and systems capable of detecting multiple agents and characterizing new agents are being developed. Advances in technology are being pursued in chemical and biological standoff, remote/early warning detection, miniaturization, improved detection sensitivity, improved logistics supportability, and

affordability. The following sections detail contamination avoidance science and technology efforts, modernization strategy, and Joint Service programs.

2.3.1 Contamination Avoidance Science and Technology Efforts

2.3.1.1 Goals and Timeframes. The goal of contamination avoidance is to provide near real-time capability to detect, identify, characterize, locate, and warn against all CB warfare agent threats below threshold effects levels (see Table 2-1). Far-term science and technology efforts focus on multi-agent sensors for biological agent detection and remote/early warning CB detection. These far-term objective technologies seek to integrate chemical and biological point and remote/early warning detection modules into a single system. To meet near-term needs, a number of sensor technologies are being optimized while alternative detection technologies mature. R&D efforts seek to optimize system sensitivity, size/weight, cost, power consumption, signature and false alarm rate. Ultimately the goal is direct integration of CB detectors into various platforms, and command, control, communication, computer, and intelligence (C⁴I) networks.

Table 2-1. Contamination Avoidance Science and Technology Strategy

By 1998	By 2003	By 2008
<ul style="list-style-type: none"> • Complete fabrication of tunable, eye safe laser for standoff aerosol cloud detection • Joint Chemical Agent Detector (JCAD) transition to Engineering & Manufacturing Development (EMD) • Complete Air Base/Port Bio Detection ACTD • Demonstrate integrated point biodetection capability (Advanced Technology Demonstration) 	<ul style="list-style-type: none"> • Field upgrade (eye safe) Long Range Bio Stand-off Detector in FY99–01. • Complete development of CB water monitor • Joint Biological Remote/Early Warning System (JBREWS) ACTD with fielding of ACTD systems to selected CINCs by FY01 • Complete development of Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) • JBREWS production in FY02, and first unit equipped (FUE) in FY02 	<ul style="list-style-type: none"> • Demonstrate integration of chemical and biological agent detection modules into a single sensor suite • Transition hand-held equipment chemical contamination scanner to EMD

2.3.1.2 Potential Payoffs and Transition Opportunities. The future CB detection system will provide the capability to detect, identify, map, and track all CB contamination in a theater of operations. This will enable commanders to avoid CB contamination or to assume the appropriate protection required to continue fighting and sustain their mission with minimal performance degradation and casualties. The program seeks to develop small, lightweight chemical detectors that can be incorporated into clothing ensembles to provide an individual chemical detection capability. CB detection technologies have dual use potential in monitoring air pollution, noxious fumes inside enclosed areas, and municipal water supplies.

2.3.1.3 Major Technical Challenges. The major technical challenges are in the areas of biological detection and identification, including remote/early warning sensing, improved agent discrimination and quantification, sampling efficiency, interferent and ambient biological background rejection, and genetic probe development. Size reduction of detectors, development of integrated biological and chemical detection systems, and the fusion of sensor data with mapping, imagery, and other data for near real-time display of events are other areas of challenge.

2.3.2 Contamination Avoidance Modernization Strategy

The increased lethality and heightened operational tempo of the future battlefield demand responsive NBC detection and warning capabilities in order to reduce force degradation caused by contamination. These capabilities—which also encompass NBC reconnaissance, identification, and reporting—have the strongest urgency for force readiness and will continue to be emphasized by the DoD community in the near and distant future. Table 2-2 shows the roadmap of DoD requirements for contamination avoidance.

Table 2-2. Contamination Avoidance Modernization Strategy

	NEAR (FY98-01)	MID (FY 02-06)	FAR (FY 07-12)
Chemical Point	<ul style="list-style-type: none"> • Surface sampling capability (ICAM) • Automatic point detection of nerve and blister agents (ACADA) • <i>Navy-Ship based improved automatic point detection of nerve/mustard (IPDS)</i> • <i>Navy-Automatically detect liquid agent (SALAD)</i> 	<ul style="list-style-type: none"> • Improved, all-agent programmable automatic point detection; portable monitor, miniature detectors for aircraft interiors; interior ship spaces; individual soldiers (JCAD) • Detection of CB contamination in water (Joint Service Agent Water Monitor) 	<ul style="list-style-type: none"> • Improved surface contamination monitor • Low dosage miniature detector; specific identification; personal monitor
Biological Point	<ul style="list-style-type: none"> • Automatic point/mobile biodetection to detect and identify bio-agents; programmable (JBPDS Block I) • <i>Navy-Ship based Interim Biological Agent Detector (IBAD)</i> • <i>Army-Biological Integrated Detection System (BIDS)</i> 	<ul style="list-style-type: none"> • Automatic point biodetection, to detect and identify; programmable (JBPDS Block II) • Biological Remote Early Warning System - A distributed network of fully automated lightweight sensors. 	<ul style="list-style-type: none"> • Automated detection of all validated biological threat agents (Joint Biological Universal Detector, JBUD)
NBC Reconnaissance and CB Remote and Stand-off Detection	<ul style="list-style-type: none"> • Improved NBC Reconnaissance Vehicle with remote/early warning and data infusion capabilities (JSNBCRS) • <i>Army - Long Range Stand-off detection and mapping of aerosol clouds (LR-BSDS)</i> 	<ul style="list-style-type: none"> • Biological remote detection and early warning capabilities (JBREWS) • Lightweight passive stand-off detection for chemical agent vapors (JSLSCAD) • Addition of biological detection and identification capabilities (JSNBCRS P3I) • Light reconnaissance vehicle (JSLNBCRS) 	<ul style="list-style-type: none"> • Stand-off detection, ranging, and mapping of chemical vapors and aerosols (JSCWILD) • Wide area detection
Warning and Reporting	<ul style="list-style-type: none"> • Initial automated warning and reporting interoperable with all Services, C4I (JWARN) 	<ul style="list-style-type: none"> • Integrated and automatic NBC warning and reporting; mission management (JWARN P3I) 	
Radiation Detection	<ul style="list-style-type: none"> • <i>Army-Compact, digital whole body radiation measurement (AN/UDR-13)</i> 		<ul style="list-style-type: none"> • Stand-off radiation detection and measurement • Portable radiation meter

1. Joint Service programs are highlighted in **BOLD**; Service unique efforts are *italicized*.
2. Where applicable, systems which meet requirements are listed following the entry.

Early detection and warning is the key to avoiding NBC contamination. As a result, DoD is concentrating RDA efforts on providing its warfighters real-time capabilities to detect,

Over the past four years, JPO-BD has managed several single service and joint biological detection programs. Three single service biodetection programs fielded in the past year, in which JPO-BD has managed include:

- the Navy's Interim Biological Agent Detector (IBAD); 25 detectors are being fielded throughout FY96-99,
- the Army's Biological Integrated Detection System - Non-Developmental Item (BIDS NDI), which has been type classified limited procurement, and fielded to the 310th Chemical Company (USAR), and
- the Army's Long Range Biological Standoff Detection System (LR-BSDS NDI), which has been type classified standard, and fielded this year to the 310th Chemical Company (3 systems).

Key joint systems JPO-BD manages include:

- The Army's Biological Integrated Detection System, Pre-Planned Product Improvement. This program provides increased automation, doubles the number of agents detected and identified (4 vs. 8) and reduces identification time (<30 min).
- The Joint Biological Point Detection System (JBPDS) which entered Engineering and Manufacturing Development (EMD) phase in FY97. The JBPDS will be the first truly joint biological detection acquisition program that is built on an approved Joint Operational Requirements Document (JORD).
- The Air Base/Port Bio Detection (Portal Shield) Advanced Concept Technology Demonstration (ACTD) which has undergone two major field trials, completed drafting of a Concept of Operations (CONOPS), and will be deployed in late FY98.
- The Joint Biological Remote/Early Warning System (JBREWS) ACTD which starts development in FY98. The JBREWS ACTD is also funded through the Counterproliferation Support Program.

Over the past three years, the JSMG and JSIG, through the Contamination Avoidance Commodity Area Manager, with assistance from JPO-BD transformed and consolidated 44 separate contamination avoidance developmental efforts into nine fully coordinated joint projects. The Joint Programs are:

- Automatic Chemical Agent Detector Alarm (ACADA)
- Joint Chemical Agent Detector (JCAD)
- Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)
- Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD)
- Joint Biological Point Detection System (JBPDS)
- Joint Biological Remote Early Warning System (JBREWS)
- Joint Service Light NBC Reconnaissance System (JSLNBCRS)
- Joint Warning and Reporting Network (JWARN)
- Joint Service Agent Water Monitor (JSAWM)

2.3.3 Joint Service Contamination Avoidance Programs

The consolidation of Joint Service contamination avoidance programs has been completed. All detection programs have been restructured to meet current multi-Service needs. Bolded entries in Table 2-2 highlight Joint programs. Detailed descriptions of Joint contamination avoidance programs are provided in Annex A.

Chemical Warfare Agent Contamination Avoidance

A non-developmental item (NDI) Automatic Chemical Agent Detector (ACADA) is being purchased for point detection of low level chemical agent vapors. ACADA is suitable for many vehicle-mounted and man-portable applications. The Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) for passive standoff, on-the-move detection of chemical agent vapor is in Phase II (Engineering and Manufacturing Development, EMD) of the acquisition cycle. The basic system (detector, scanner and electronics module) of JSLSCAD will weigh approximately 30 pounds and occupy approximately 1 cubic foot. The system may be modified to accommodate a variety of requirements. To date, a 360° x 60° scanner was developed for Armored Systems Modernization applications (tracked and wheeled vehicles), and the system was integrated into a gimbal for Marine Corps helicopters and unmanned aerial vehicle (UAV) contamination avoidance roles. This system is also being considered by the Navy for shipboard use and by the Air Force for use at air bases.

In the near-term, the four Services are focusing on the development of the Joint Chemical Agent Detector (JCAD). The JCAD will function as a chemical point detection system in order to accomplish a variety of mission requirements on multiple service platforms. This system will be considerably smaller and lighter than the ACADA and can be configured for a variety of applications such as individual soldier detectors, shipboard chemical agent monitoring, special operations forces (SOF) applications, and aircraft interior detection. The JSMG selected the Air Force as lead service for the JCAD. The Army, Air Force, and Marine Corps have also agreed to focus upon the development of a Joint Service Light NBC Reconnaissance System (JSLNBCRS). The proposed system will consist of a suite of detectors required for a specific mission which could be easily integrated into the platform of choice. Currently two configurations are proposed: a light and a medium version, to fulfill expeditionary and armored mission profiles, respectively. The FOX NBCRS would fulfill heavy requirements. The FOX NBCRS is being upgraded to include a chemical stand-off detection capability and other electronic improvements including data fusion.

In the mid- to far-term, the Army and Air Force have agreed to a Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD). JSCWILD is a laser-based standoff detection system being developed to meet the requirements for the detection of chemical liquids, aerosols, and vapors. Although this system is much heavier than its passive counterpart (JSLSCAD), it does provide the ability to detect chemical agents in all forms—liquids, vapors, aerosols—as well as mapping and ranging information. The JSLSCAD program is a joint program with an ORD being approved by all Services. The Air Force's primary use for this system will be air base defense. The Navy will install JSLSCAD on shipboard and airborne

platforms and at high priority oversea installations. A requirement for an agent water monitor has been identified by the Army, Air Force, and Marines. Joint program plans are being developed.

Biological Warfare Agent Contamination Avoidance

Currently, there are six biological detection efforts being conducted under the Joint Program Office for Biological Defense (JPO-BD):

- (1) Interim Biological Agent Detector (IBAD);
- (2) Joint Biological Point Detection System (JBPDS);
- (3) Biological Integrated Detection System (BIDS);
- (4) Long Range Biological Stand-off Detection System (LR-BSDS);
- (5) Air Base/Port Biological Detection Advanced Concept Technology Demonstration (ACTD); and
- (6) Joint Biological Remote/Early Warning System (JBREWS) ACTD.

Currently fielded systems include the Navy's shipboard detection system (IBAD) and the Army's land-based system (BIDS-NDI). The Army's LR-BSDS is a helicopter mounted infrared LIDAR system for the detection, ranging and tracking of aerosol clouds that may indicate a biological warfare (BW) attack. In the near-term, the Air Base/Port Biological Detection (Portal Shield) ACTD will develop and demonstrate the capability of networked sensors to protect high value fixed sites against BW attacks. The Joint Biological Point Detection System (JBPDS) will meet each of the four Services' needs for a biological point detector. This system will be integrated on Service designated platforms.

In the mid-term, the JPO-BD will develop the Joint Biological Remote Early Warning System. This distributed network of lightweight, automated sensors will provide enhanced detection, identification, and advanced warning of BW attacks.

In the far-term, JPO-BD's concept for the ultimate, joint service biological detector is the Joint Biological Universal Detector (JBUD). JBUD is envisioned to be a miniaturized, multi-technology, automatic system that may be manned or unmanned, capable of detecting all BW agents, and able to automatically warn troops and report pertinent data relative to a BW attack.

2.3.4 Warning and Reporting

Warning and reporting is a critical capability in contamination avoidance. The Services have agreed to expedite development of this capability by integrating ongoing hardware and software into a Joint Warning and Reporting Network (JWARN). This network will be compatible with, but not duplicate, all C⁴I equipment both current and developmental. Initial urgent requirements of software will be fielded. In FY99 a Warning and Reporting Network of hardware and software will be fielded. This system will be integrated on Service designated platforms and installed at fixed sites.

2.3.5 Other Contamination Avoidance Programs

Various detection and warning requirements have unique mission profiles and technical specifications. While in some instances the development effort may leverage off the technical achievements of a closely related detection and warning project, the application beyond its intended mission is limited and accordingly supports a specific requirement. Starting in first quarter FY97, the Navy is producing the Improved (chemical agent) Point Detection System (IPDS), an upgrade for the existing shipboard Chemical Agent Point Detection System (CAPDS). IPDS, which offers continuous operation and advanced detection sensitivities that do not respond to shipboard interferences, is not adversely affected by the high electromagnetic environment around ships. IPDS improves detection thresholds, response time, and adds the capability to detect mustard agents. Installation of the IPDS will begin in FY98. The Navy is also developing the Shipboard Automatic Liquid Agent Detector (SALAD). This shipboard system will be used to automatically detect and alarm in the presence of liquid chemical agents. By detecting automatically, it will minimize the sailor's exposure to contamination. As with the IPDS, it will offer continuous operation and advanced detection sensitivities that do not respond to shipboard interferences and are not affected by naval electromagnetic interference (EMI).

2.3.6 Defense Advanced Research Projects Agency (DARPA) Programs

DARPA is pursuing breakthrough technologies in biological detection in their sensor program in the Defense Sciences Office. DARPA is developing technologies that will allow for the multiplexing capability of bioagent identification. Using up-converting phosphor technology, detection sensitivity and enhanced multiplexing is being developed in a hand-held biological sensor. Small biochips using ribosomal RNA are also being developed which can reveal family, genus, and species on a single chip. The mass spectrometer is being miniaturized and ruggedized for battlefield use in identification of biological agents and contaminants without the use of liquids. These systems will be automated so that they can be operated in an unattended fashion. Detection technologies that provide information on pathogenicity and viability are being developed under the DARPA biological detection program.

2.4 PROTECTION

When early warning is not possible or units are forced to occupy or traverse contaminated environments, protection provides life sustainment and continued operational capability in the NBC environment. The two types of non-medical protection are individual and collective.

- ***Individual protective equipment*** (IPE) includes protective masks and clothing. Protective masks that reduce respiratory stress on the user while improving compatibility with weapon sighting systems and reduce weight and cost are being developed. Technology advances are being pursued to produce mask systems that provide fully compatible vision capabilities, laser/ballistic protection, and further reduction in logistics burden. Protective clothing is being developed that will present less weight and heat stress burden than present equipment.

- **Collective protection equipment (CPE)** consists of shelters that provide a contamination-free, environmentally-controlled environment for soldiers to perform their mission, and generic NBC protective filters and air movement devices that provide filtered air. Collective protection, *i.e.*, overpressure, can be applied to mobile and fixed command posts, medical facilities, rest and relief shelters, buildings/fixed sites, vehicles, aircraft, and ships. Lightweight shelters integrated with NBC filtration, environmental control and power generation facilities for medical treatment facilities have been developed and are in production. Technology improvements are being pursued to reduce weight, volume, and cost and improve deployability. Technology improvements that reduce logistic and manpower requirements; *e.g.*, filter change frequency and shelter assembly and disassembly time are also being pursued.

2.4.1 Protection Science and Technology Efforts

2.4.1.1 Goals and Timeframes. The goals of the protection subarea are (1) to maintain a high level of protection against CB warfare agents and radiological particles while reducing the physiological burden associated with wearing protective equipment; (2) to integrate CB protection with protection from environmental, ballistic and other threats; and (3) to provide a protective environment for personnel to complete their mission and to provide rest and relief while operating in aircraft, armored vehicles, ships, shelters, and other large-area enclosures (see Table 2-4). To achieve these goals, physiological performance requirements key to the design and evaluation of clothing and respirators are being established. New barrier and filtration materials and permeable fabrics to accommodate these performance requirements, are being developed and evaluated. In addition, advances in collective protection are being explored that will developed filtration systems that can be used by multiple platforms and shelters and will be transitioned into several acquisition programs. Regenerative filtration materials and techniques that would virtually eliminate the need to replace collective protection filters are being explored.

Table 2-4. Protection Science and Technology Strategy

By 1998	By 2003	By 2008
<ul style="list-style-type: none"> • Prototype mask with 50% reduced breathing resistance and 50% improved field of vision • Joint Service Lightweight Suit Technology (JSLIST Component) 	<ul style="list-style-type: none"> • Demonstrate regenerative filtration prototype for collective protection applications • Demonstrate advanced adsorbents to enhance or replace carbon • New chemical protective clothing, gloves and footwear materials 	<ul style="list-style-type: none"> • Continuous operations filter technology • Lightweight materials available

2.4.1.2 Potential Payoffs and Transition Opportunities. Individual protection investments will result in improved respiratory and percutaneous (skin) protection with reduced physiological and psychological burden to the individual soldier. Improved air purification systems for collective protection applications will allow for extended operations in enclosures in a CB contaminated environment and reduce the logistics burden associated with filter replacement. Filtration technology has commercial application to the chemical industry and for automotive applications.

2.4.1.3 Major Technical Challenges. Integrating CB protection into future warrior systems necessitates tradeoffs between performance requirements and limitations of materials and designs. Integral respiratory protection requires tradeoffs between physiological performance parameters such as pulmonary function, field of view, speech intelligibility and anthropometric sizing against cost, size/weight, protection time, and interfacing with other equipment. Integral CB protective clothing requires tradeoffs between minimizing thermal stress and moisture buildup against agent resistance, weight/bulk, and power requirements of cooling systems. Air purification systems require tradeoffs with respect to size, weight and power requirements, as well as longer life and minimal environmental impact.

2.4.2 Protection Modernization Strategy

Forces cannot always avoid NBC hazards, therefore, individual warfighting units must be provided materiel to protect them from the effects of these lethal agents. Protection must be effective against all known threats with minimal degradation to the performance of personnel, weapons, or equipment. Total NBC protective measures, which consist of individual and collective protection, allow our forces to maintain combat superiority in contaminated environments. A summary of protection modernization requirements is provided in Table 2-5.

The goal of the protection RDA area is to provide equipment that allows U.S. forces to operate in a NBC contaminated environment with minimal degradation of the warfighters' performance. The near-, mid-, and far-term project efforts are aimed at maintaining current protection levels while reducing physiological and logistical burdens. Table 2-6 provides an overview of individual and collective protection RDA efforts and Service involvement.

Individual protection equipment (IPE) consists of eye/respiratory and percutaneous protection: a mask, protective garments with hood, boots, and gloves. The IPE issued to U.S. forces protects against all threat chemical and biological agents. Its chemical defense capabilities are routinely demonstrated with actual chemical agents in the Chemical Defense Training Facility (CDTF), U.S. Army Chemical School, Ft. McClellan, Alabama.

Protective masks will be improved to provide greater user comfort and to reduce the breathing resistance currently encountered. Mask systems will require increased NBC survivability and compatibility with combat or personal equipment. Future respiratory systems, such as the A/P23P-14(V)N, the M45, and the mid-term Joint Service Aviation Mask (JSAM) and Joint Service General Purpose Mask (JSGPM) will require enhanced compatibility with life support equipment, tactical systems, and fixed and rotary wing aircraft. In the future, the focus will be on integrated respiratory protective ensembles which offer optimal compatibility with personal, tactical, and crew support systems.

Table 2-5. Protection Modernization Strategy

	NEAR (FY98-01)	MID (FY02-06)	FAR (FY07-12)
Individual Eye/Respiratory	<ul style="list-style-type: none"> • Voice amplification; laser/ballistic eye protection; improved decontaminability, better comfort (M40A1/M42A1) • Army - <i>Aircrew mask compatible with Apache helicopter systems with a significantly lighter motor/blower unit (M48/M49)</i> • Army - <i>Improved compatibility with aviation sighting/night vision systems; reduced logistics burden using non-blower systems, selected for Land Warrior (M45)</i> 	<ul style="list-style-type: none"> • Reduced physiological burden, improved comfort, enhanced optical and communications, improved compatibility • New mask systems for general purpose and aviation masks (JSGPM, JSAM) • Navy - <i>Improved complete protection for all aircrews (A/P 23P-14(V)N)</i> 	<ul style="list-style-type: none"> • Advanced Integrated Individual Soldier Protection system (Future Soldier System) • Improved multiple agent protection
Individual Clothing	<ul style="list-style-type: none"> • Advanced protective suit technology; lighter, improved agent and flame protection; reduced heat stress integrated with all respiratory systems. - Improved foot protection (MULO) • Improved protection, less burdensome, protective suits; Improved foot and hand protection/less burdensome (JSLIST P3I) • Improved protection for short term use for special purposes (ITAP) • Army - <i>Improved protection with self contained breathing capability for special purposes (STEPO)</i> 	<ul style="list-style-type: none"> • Improved protection (Joint Service Chemical Ensemble) 	<ul style="list-style-type: none"> • Integrated multiple threat modular protection (chemical, biological, environmental, ballistic direct energy and flame) • Improved protection for aviators (JPACE)
Collective Protection	<ul style="list-style-type: none"> • Improved filters to extend filter life, reduce maintenance and reduce logistical burden • Chemically Protected Deployable Medical Systems (CP DEPMEDS) • Chemically Hardened Air Transportable Hospital (CHATH) • Navy - <i>Backfit ships with contamination free protected zones - (Selected Area Collective Protection System, SACPS), Integrate CP system into V-22</i> • Marine Corps - <i>Protection for all combat vehicles and unit shelters</i> • Army - <i>NBC protection for tactical Medical units (CB Protective Shelter, CBPS),</i> - <i>Apply regenerable filter to Comanche,</i> - <i>Apply CP to advanced vehicle concepts.</i> - <i>Modular, reduced size, weight and power for vehicle/ shelter collective protection - Advanced Integrated Collective Protection Shelter (AICPS)</i> • Air Force - <i>Upgrade/install CP into existing rest/relief shelters.</i> 	<ul style="list-style-type: none"> • Regenerable protective filtration for vehicles/vans; reduces logistics burden, size, weight, power needs protects against future threat agents • Lighter, more mobile, more affordable shelters and equipment (JCPI) • Support medical treatment in a CB environment for Airborne, Air Assault, and Heavy Divisions (CBPS) 	<ul style="list-style-type: none"> • Family of advanced lightweight protective filtration systems for vehicles, shelters, ships, light forces

1. Joint Service programs are highlighted in **BOLD**. Service unique efforts are *italicized*.
 2. Where applicable, systems which meet requirements are listed following the entry.

Table 2-6. Protection RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Integrated	<u>INDIVIDUAL PROTECTION:</u> - Force XXI Land Warrior	RDTE	Rqmt	Interest	Interest	Interest
Eye/ Respiratory Protective Masks	- MBU-19/P Aircrew Eye/respiratory Protection (AERP) - M48/49 Aircraft Mask - CB Respiratory System (A/P 23P-14(V)N) - M45 Aircrew Protective Mask (ACPM) - M40A1/M42A1 - MCU-2A/P - Joint Service Aviation Mask (JSAM) - Joint Service General Purpose Mask (JSGPM)	Production Production Production Production Production RDTE RDTE	Interest Rqmt Rqmt Rqmt Rqmt Rqmt Rqmt	Fielded Fielded Rqmt Rqmt	Interest Rqmt Interest Rqmt Rqmt	 Rqmt Rqmt Rqmt
Ancillary Equipment	- Protection Assessment Test System (PATS) - Voice Communication Adapter	Production Production	Rqmt Rqmt	Fielding Rqmt	Fielded Fielded	Interest Fielded
Battlefield Protective Suits	- CB Protective Overgarment Saratoga - Chemical Protective Undergarment (CPU) - Joint Service Lightweight Integrated Suit Technology (JSLIST/JSLIST P3I) -- Overgarment -- Undergarment (P3I) -- Duty Uniform (P3I) -- Boots (MULO) -- Gloves (P3I)	Fielded Fielded Prod.* RDTE RDTE MS III* RDTE	Interest Rqmt Rqmt Rqmt Rqmt Rqmt Rqmt	 Rqmt Interest Rqmt Rqmt Rqmt	Fielded Int-NIR Rqmt Interest Rqmt Rqmt Rqmt	Interest Rqmt
Specialty Suits	-Self-Contained Toxic Environment Protective Outfit (STEPO-I) Interim - STEPO - EOD Ensemble - Improved Toxicological Agent Protective (ITAP)	Fielded MS III Production RDTE	Rqmt Rqmt Rqmt Rqmt	 Rqmt	 Interest	 Interest
Tentage and Shelter Systems	<u>COLLECTIVE PROTECTION</u> - M20A1/M28 Simplified CPE - CBPS (Medical) - SACPS - CP DEPMEDS/CHATH	Production Production Production Production	Rqmt Rqmt Rqmt	Interest Rqmt	Interest Interest	* Rqmt
CP Systems	- Shipboard Collective Protection System (CPS) - Shipboard CPE - Modular Collective Protection System (MCPE) - AICPS for Vehicle, Vans, and Shelters - Portable Collective Protection System (PCPS) - M8A3 GPFU - M13A1 GPFU	Production RDTE Fielded RDTE Fielded Fielded Fielded	Interest Rqmt Rqmt Rqmt Rqmt	Interest Interest 	Interest Rqmt	Rqmt Rqmt Interest
Generic Filters	- M48/M48A1 - M56 - Fixed Installation Filters	Fielded Fielded Fielded	Rqmt Rqmt Rqmt	 Rqmt Rqmt	Rqmt Interest	Rqmt

Rqmt = Product requirement
Interest = Product Interest
Int-NIR = Product Interest, No Imminent Requirement

* - Sub-Product(s) of a Consolidated Joint Service Project
Rqmt, Interest = Sub-Product requirement or Interest

Future protective clothing ensembles will be required for land, sea, air, and marine forces to achieve reductions in bulk and weight without any loss of protection or durability. To satisfy these needs, the four Services have consolidated their mission specific requirements into a first truly joint evaluation program for the next generation chemical garments—the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. The JSLIST program developed

and field the JSLIST Overgarment and Multi-purpose Overboots (MULO). The JSLIST Pre-Planned Product Improvement (P3I) will develop improved chemical protective overgarments, duty uniforms, undergarments, gloves, and socks that will increase protection, reduce physiological burden, and have increased durability beyond those items fielded in the JSLIST program. New accessories, such as gloves and footwear, are required to execute missions and tasks which require greater tactility and traction. The Joint Protective Aircrew Ensemble (JPACE) will be developed to provide aviators the same advantages and improved protection as JSLIST provides to other warfighters. Similarly, clothing systems for Explosive Ordnance Disposal (EOD) personnel are required to enhance existing chemical protection systems without undue physiological burdens.

Collective protection equipment (CPE) development efforts are focused on NBC protection systems at the crew, unit, and platform level. New CPE systems will be smaller, lighter, less costly, and more easily supported logistically. New systems are required to make “clean” environments more available for critical operations (*i.e.*, where IPE otherwise places an unacceptable burden upon the Service member in performing duties) and for essential rest and relief. Modernization concentrates on: (1) improved air filtration and environmental control methodologies and integration, (2) advanced technologies integrated into power and ventilation for systems that offer a significant improvement in logistics, (3) applications on essential vehicles, vans, and shelters, and (4) improvements to current vapor and particulate filtration media to extend filter life. Efforts are in place to support major weapons systems developments, such as the V-22 Osprey, the Comanche, the Crusader, USMC Advanced Amphibious Assault Vehicle (AAAV), aircraft, and advanced armored vehicles.

2.4.3 Joint Service Protection Programs

Joint programs are shown in Table 2-5 as bolded entries. A detailed description of Joint IPE and CPE programs is provided in Annex B.

Individual Protection

Eye/Respiratory. The M40 and M42 masks (for individuals and armored vehicle crewmen, respectively) are undergoing the final stages of fielding to replace their M17 and M25 series counterparts. The new masks offer increased protection, improved fit and comfort, ease of filter change, better compatibility with weapon sights, and a second skin which is compatible with Army and Marine Corps protective ensembles. The second skin design also is being reviewed by the Navy and Air Force for potential adoption. The Army, Marines, and Air Force are also fielding the Protection Assessment Test Systems (PATS) to provide users of the M40, M42, and MCU-2/P masks with a rapid and simple means for validating the fit and function of the mask to ensure readiness. The Navy is evaluating the use of PATS with its MCU-2/P series mask.

The Navy, in coordination with the Marine Corps, is leading an effort to equip all forward deployed fixed and rotary wing aircrew with improved chemical, biological, and radiological (CBR) protection. The CBR ensembles will feature off-the-shelf items, such as the

A/P23P-14(V)N respiratory system. The Army, in cooperation with the Marine Corps, recently completed a product improvement program for the M40 series mask that allows ground crew to aircrew communication. The Air Force continues to field Aircrew Eye-Respiratory Protection (AERP) systems to protect aircrews from CB hazards. This system complements the recently fielded lighter weight aircrew ensemble.

Mid- and far-term research is focused on improved vapor and particulate filtration technology, as well as improved masks for light and special operations forces (SOF). Far-term plans include the Joint Service Aviation Mask and Joint Service General Purpose Mask, which will provide improved eye, respiratory, and face protection against current and future agents. It will maximize compatibility with future weapon systems, be lightweight, and offer modular facepieces to accommodate a variety of mission profiles. Protective mask efforts will focus on supporting specific needs of the Joint Services and integrated warrior programs (Land Warrior, Air Warrior, Mounted Warrior, and Force XXI).

Clothing. In the area of full body protection, the JSLIST program is underway to coordinate the selection of advanced technology chemical protective materials and prototype materials. The JSLIST Overgarment was adopted by all four services, and the Multipurpose Overboot (MULO) was adopted jointly by the Army, Air Force, and Marines. The JSLIST Overgarment is a 45 day garment that provides 24 hours of chemical protection. It is launderable and lighter weight than the Battle Dress Overgarment (BDO). The MULO will replace the current black vinyl overboot/green vinyl overboot (BVO/GVO). The MULO is a 60 day boot that provides 24 hours of chemical protection. The boot has increased traction, improved durability, POL and flame resistance, and better chemical protection than the BVO/GVO.

The JSLIST Pre-Planned Product Improvement (P3I) will address requirements not met through the JSLIST program. This program will obtain new material technologies for overgarments and duty uniforms using the existing JSLIST design. Fabric technologies for a chemical protective undergarment and materials and designs for chemical protective gloves and socks will also be addressed. This program will develop a 60 day overgarment with desired flame resistance (FR), a 30 day overgarment with required FR, a 30 day duty uniform with desired FR, a 7 day overgarment with desired FR, a 7 day undergarment with desired FR, general purpose gloves, high tactile gloves and socks. Materials that meet Service's requirements will be placed on a qualified materials list to encourage multi-source competition and to provide surge capability.

In the near to mid-term, the Army is developing an Improved Toxicological Agent Protective (ITAP) ensemble for EOD and depot operations in Immediate Danger to Life and Health (IDLH) contamination concentrations. The ITAP ensemble will incorporate improvements in material and design. It includes a one-hour supplied air bottle system, which can be switched to a filtered air respirator when operators exit the area of high contamination. A Personal Ice Cooling System (PICS) is being developed for use with the ITAP and STEPO. In addition, the Army is working with the Air Force on a chemical protective firefighter's ensemble, leveraging the technology from the JSLIST program.

In the far-term, efforts will focus on integrated protection for the Force XXI Land Warrior System. This next generation technology will be directed toward integrating CB protection into a system which will also provide environmental, ballistic, directed energy, and flame protection, as well as reduced physiological burden. A strong emphasis on supporting technologies must continue. Materials that detoxify a broad range of chemical and biological agents on contact, which can be incorporated into fibers, fabrics, and semi-permeable membranes are being developed using biotechnology, as well as more conventional approaches.

Collective Protection

The Army has produced the M20A1 and the M28 Simplified CPE to provide CP protection and environmental control to existing structures. The new CPE provides liquid agent resistance and allows expansion of protection area. The M20A1 has been fielded. The M28 Simplified CPE is integrated into CP DEPMEDS and CHATH field hospital.

CHATH and CP DEPMEDS are joint programs to integrate environmentally controlled collective protection into already fielded Army and Air Force field hospitals into order to sustain medical operations in a CP environment for 72 hours. Chemical protection is integrated into existing medical tents and shelters through addition of M28 Simplified CPE, chemically protected heaters, air conditioners, water distribution and latrine systems and alarms. CP DEPMEDS successfully completed an Operational Test 4Q97, with type classification scheduled for 4Q98 and fielding in FY99.

The Chemically and Biologically Protected Shelter (CBPS) is a highly mobile, rapidly deployable shelter system designed to be used for Echelon I and II forward area medical treatment facilities. The system is self contained/self-sustaining. It is permanently mounted onto a HMMWV with a Lightweight Multipurpose Shelter with a towed trailer and generator set. It transports a CB protected airbeam supported soft shelter, self-contained environmental support and power generation system, a crew of four and gear, and medical equipment. The system is presently in production with fielding scheduled to initiate 1Q99 following completion of an Operational Test in 2Q98. Mid-term objectives are to initiate development of CBPS to support medical treatment for Airborne, Air Assault and Heavy Divisions.

Other near-term collective protection efforts, such as the Advanced Integrated Collective Protection System (AICPS) will provide a compact, integrated package for power, filtration, and environmental control (heating/cooling). The AICPS will provide transportability and maintainability enhancements and decrease system set-up times. The Portable Collective Protection System (PCPS) provides an agent-free enclosure, eliminating the requirement to wear protective masks and clothing that inhibit performance. Improved shelters and equipment that are lighter, more affordable and more mobile are major products of the Joint Collective Protection Improvement (JCPI) Program. JCPI initiates engineering development in FY00. Redesign and concept tradeoff assistance regarding advanced filtration technologies, such as Pressure Swing Adsorption (PSA) and Catalytic Oxidation (CatOx) has been provided to the Comanche, Crusader, USMC AAV, and U.S. Army advanced vehicle efforts. The USAF is currently upgrading their CP fixed site capabilities.

2.4.4 Other Protection Programs

Program supporting requirements of a single service are shown in Table 2-5 as italicized entries. A detailed description of IPE and CPE projects is presented in Annex B.

Individual Protection

Eye/Respiratory. The Army is developing the M48/49 protective masks to replace the M43 series masks. The M48 will be for Apache pilots and the M49 for general aviator use. They will be lighter and offer enhanced protection and compatibility with night vision and aircrew systems.

In the near-term, the Army will replace the M43 mask for the general aviator with the Aircrew Protective Mask, M45. The M45 is lighter and less expensive than the M43 and features CB protection without the aid of force ventilated air.

Clothing. The Army has approved fielding of the Self-Contained Toxic Environment Protective Outfit (STEPO). The STEPO is introduced for limited EOD and depot operations in contamination concentrations which are of Immediate Danger to Life and Health (IDLH). STEPO will replace the Interim STEPO (STEPO-I).

Collective Protection

The Navy now includes the Collective Protection System (CPS) on all new construction ships. Currently the DDG-51, LHD-1, AOE-6, and LSD-41 ship classes are being built with CPS. The Navy also has the capability to backfit CPS on ships already in Service. The Selected Area Collective Protective System (SACPS) has been installed on selected LHA-1 class ships. Air inside the zone is maintained at a higher pressure than the outside air to prevent leakage of contaminants into the protected zone. In the mid-term, the Navy is designing the V-22 Osprey to be the first Naval aircraft to incorporate CBR protection for both aircrew and passengers. The ability to provide a pressurized, contamination free environment is a design requirement. The Navy Shipboard Collective Protection Equipment (CPE) effort will increase the shipboard particulate filter life (from the current one or two years) to at least a three year service life, through the use of new particulate pre-filter materials and the use of a new HEPA filter media. The Shipboard CPE will thus provide millions of dollars of savings in life cycle costs by reducing shipboard maintenance requirements and providing energy efficient fans.

2.5 DECONTAMINATION

When contamination cannot be avoided, personnel and equipment must be decontaminated to reduce or eliminate hazards after NBC weapons employment. Decontamination systems provide a force regeneration capability for units that become contaminated. Modular decontamination systems are being developed to provide decontamination units with the capability to tailor their equipment to specific missions. Technology advances in sorbents,

coatings, catalysis, and physical removal will reduce logistics burden, manpower requirements, and lost operational capability associated with decontamination operations. The following sections detail CB decontamination science and technology efforts, modernization strategy, and Joint Service programs.

2.5.1 Decontamination Science and Technology Efforts

2.5.1.1 Goals and Timeframes. The goal of decontamination research and development is to develop technologies that will eliminate toxic materials without performance degradation to the contaminated object and be environmentally safe (see Table 2-7). This area includes decontamination of personnel, individual equipment, tactical combat vehicles, aircraft, facilities, and fixed sites. Decontamination technologies currently being pursued include enzymes, catalysts that improve reactivity, decontaminants that are effective in both fresh and brackish water, and improved reactive sorbents. Supercritical fluid technology and non-ozone depleting fluoro-carbons are being investigated for sensitive equipment decontamination, while gaseous ozone is being evaluated as a reactive decontaminant for interior spaces of vehicles such as aircraft. Contamination control involves investigating procedures that minimize the extent of contamination pickup and transfer, and maximize the ability to eliminate the contamination pickup on-the-move as well as during decontamination operations.

Table 2-7. Decontamination Science and Technology Strategy

By 1998	By 2003	By 2008
<ul style="list-style-type: none"> • Demo improved sorbent delivery systems • Aircraft Interior Decon procedures (non-system) 	<ul style="list-style-type: none"> • Sensitive Equipment Decon Systems • Demonstrate enzymatic decon • Fixed Site decon systems 	<ul style="list-style-type: none"> • Demonstrate environmentally safe, sensitive equipment decon materials • New self-decontaminating materials • Improved decon material to replace DS 2 • Aircraft and other vehicle interior decontamination

2.5.1.2 Potential Payoffs and Transition Opportunities. The payoff from enhanced decontaminants and decontamination systems will be new non-corrosive, non-toxic, non-flammable, and environmentally safe decontamination systems suitable for a timely elimination of CB agents from all materials and surfaces. This ability will allow the forces to reconstitute personnel and equipment more quickly to increase combat efficiency and lessen the logistic burdens. In the future, reactive coatings may allow the continuation of combat operations without the need to disengage for decontamination. Dual use potential for environmental remediation, especially those dealing with pesticide contamination, is being exploited.

2.5.1.3 Major Technical Challenges. There are two principle technical difficulties associated with this effort. The first is the development of decontaminants which are reactive, non-aqueous, non-corrosive, safe to use on sensitive equipment, decontaminate a broad spectrum of chemical and biological agents, and environmentally safe. The second technical difficulty is the development of decontamination systems that effectively clean all surfaces and materials, while at the same time reduce the manpower and logistics burden. Also, new concepts or technologies for decontamination of fixed sites are needed.

2.5.1.4 Chem War 2000. To help guide future combat and material development efforts in the area of Fixed Site decontamination (and related activities) the Deputy Assistant to the Secretary of Defense for Counterproliferation and Chemical and Biological Defense, DATSD (CP/CBD), the Joint Staff (J-5) and the Joint Service Integration Group (JSIG) cosponsored a two-day simulation exercise during FY97 entitled Chem War 2000. The main objective of Chem War 2000 was to determine those equipment, doctrinal and operational solutions required for mitigating the effects of chemical warfare on the operations of rear area fixed sites, *e.g.*, aerial ports of debarkation (APODS), seaports of debarkation (SPODS), or logistic nodes. Chem War 2000 was attended by the Commanders-in-Chiefs' (CINCs) staffs, Service representatives (Combat and Material Developers), the medical community, and decontamination subject matter experts. Issues related to decontamination for two scenarios were addressed: a Major Theater of War (MTW) scenario, and a Small Scale Contingency (SSC) operation. During FY98 the results and recommendations from Chem War 2000 will be analyzed and staffed with the major participants. Road Maps to address the key issues (policy, doctrine, training, material, and resources) will then be developed and will form the basis for future exercises, demonstrations, studies, *etc.* required to firm up requirements and research and development programs.

2.5.2 Decontamination Modernization Strategy

Decontamination systems provide a force regeneration capability for units that become contaminated. Existing capabilities rely upon the physical application and rinse down of decontaminants on contaminated surfaces. Existing systems are effective against a wide variety of threat agents, yet are slow and labor intensive and present logistical, environmental, material, and safety burdens. To improve capabilities in this functional area, the Joint Services place emphasis upon new decontaminating technologies which reduce existing manpower and logistics requirements. They are safer on the environment, the warfighter, and equipment. Table 2-8 shows the roadmap for modernizing decontamination systems in DoD.

The goal of the NBC decontamination program area is to provide technology that removes and detoxifies contaminated material without damaging combat equipment, personnel, or the environment. Research and development of non-corrosive, all-agent multipurpose decontaminants and decontaminating systems for combat equipment, aircraft, personal gear, and skin remains a priority. Alternative technologies, such as sensitive equipment decontamination methods and large scale decontamination systems attract interest across the four Services. Table 2-9 provides an overview of Joint Service RDA efforts and Service involvement.

Table 2-8. Decontamination Modernization Strategy

	NEAR (FY98-01)	MID (FY02-06)	FAR (FY07-12)
Personal Equipment Decontaminants	<ul style="list-style-type: none"> • More reactive, high capacity adsorbent (M291/M295) 	<ul style="list-style-type: none"> • Non-caustic, non-corrosive decontaminant for personnel and equipment • <i>Army-Higher efficiency decon methods (Sorbent Decon)</i> 	
Bulk Decontaminants	<ul style="list-style-type: none"> • Non-caustic, non-corrosive, easy to store and manufacture multipurpose decontaminants 	<ul style="list-style-type: none"> • Decontaminants for fixed facilities • <i>Army -Environmentally acceptable replacement for DS-2</i> • <i>Army -Enzymes for chemical agent decontamination</i> • <i>Navy -Less caustic capability</i> 	<ul style="list-style-type: none"> • Mission tailored decontaminants • <i>Navy -Contamination resistant shipboard materials</i>
Expedient Delivery Systems		<ul style="list-style-type: none"> • Auto-releasing coatings; reduces skin contact hazard & labor requirements 	<ul style="list-style-type: none"> • Self-decontaminating auto releasing coatings; reduces manpower and logistic requirements eliminates skin contact hazard
Deliberate Delivery Systems	<ul style="list-style-type: none"> • High pressure water wash; mechanical scrubber; improved decontaminant dispenser (increased vehicle throughput) • <i>Army -High pressure hot water washing and decontaminate scrubber capability; reduced water, labor, and logistic burden (M21/M22 Modular Decon System)</i> 	<ul style="list-style-type: none"> • Rapid large scale decon capability for fixed sites; reduced manpower and logistic burden • Non-aqueous capability for electronics, avionics and other sensitive equipment • <i>Air Force - Sensitive equipment decontamination system for aircraft interiors</i> 	<ul style="list-style-type: none"> • Vehicle interior decon capability • Supercritical fluid decontamination apparatus • <i>Army -Waterless decon capability for electronics and avionics</i>

1. Joint Service programs are highlighted in **BOLD** while Service unique are *italicized*.
2. Where applicable, systems which meet requirements are listed following the entry.

Table 2-9 Decontamination RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Personnel	- M295 Individual Equipment Decontaminating Kit - M291 Skin Decontaminating Kit	Production Production	Fielded	Interest	Interest Fielded	Interest
Combat Equipment, Vehicles, and Aircraft	- M17A2/A3 Lightweight Decontamination System - M21/M22 Modular Decontamination System (MDS) - M17 Diesel Lightweight Decontamination System - Sensitive Equipment Decon	Production RDTE RDTE RDTE	Fielded Rqmt	Interest Int-NIR Int-NIR Rqmt	Fielded Int-NIR Rqmt Rqmt	Interest Int-NIR Interest Rqmt
Decontaminant Solutions and Coatings	- Sorbent Decontamination System - Solution Decontaminants	RDTE	Rqmt	Interest	Rqmt	Interest

Rqmt = Product Requirement
Interest = Product Interest
Int-NIR = Product Interest, No Imminent Requirement

* = sub-Product(s) of a Consolidated Joint Service Project
Rqmt, Interest = Sub-Product Requirement or Interest

2.5.3 Joint Service Decontamination Programs

The Army has developed the M291 skin decontamination kit as a replacement to the M258A1 decontamination kit for all Services, and is currently introducing the M295 for improved personal equipment decontamination. The M295 provides the warfighter a fast and non-caustic decontamination system for personal gear. A new adsorbent which is more reactive and has higher capacity is being developed to improve the performance of the M295 kit.

In the near- and mid- term, DoD continues to research new multi-purpose decontaminants as a replacement for bulk caustic Decontamination Solution 2 (DS2) and corrosive Super Tropical Bleach (STB). New technologies, such as sorbents, enzymatic foams, and reactive decontaminating systems are being explored and may offer operational, logistics, cost, safety, and environmental advantages over current decontaminants. It should be noted that present ship-board chlorine-based decontaminant solutions pose an unacceptable corrosion risk to Naval aircraft. Current procedures require the use of fresh water and normal aircraft detergent solutions.

In the far-term, the Services are seeking non-aqueous decontamination systems to provide for sensitive equipment decontamination at mobile and fixed sites. Additionally, there is interest and research in coatings which can reduce or eliminate the necessity of manual decontamination. A detailed description of the decontamination projects is provided in Annex C.

2.5.4 Other Decontamination Programs

In the near- and mid-term, the Army is developing the Modular Decontamination System (MDS) to enhance vehicle and crew weapon decontamination. The MDS will support deliberate decontamination for ground forces and possess mechanical scrubbing and improved decontaminant dispensing capabilities. It will also offer a reduction in size, weight, logistics burden, and workload requirements over existing decontamination systems. Similarly, the Marine Corps is exploring alternative man-portable decontamination systems and is assessing the feasibility of converting the gasoline powered M17 Lightweight Decontamination System (LDS) with a lightweight diesel engine.

2.6 EQUIPMENT FOR THE CHEMICAL/BIOLOGICAL RAPID RESPONSE TEAM

The Chemical-Biological Quick Response Force (CBQRF) concept has been re-defined as a focused Chemical/Biological Rapid Response Team (C/B-RRT) which is tasked with assisting emergency responders to chemical and biological crisis situations. The C/B-RRT is intended to coordinate with and integrate itself with the local emergency responder incident command structure in the event of a crisis. A major element of the C/B-RRT is the U.S. Army Technical Escort Unit's Chemical Biological Response Team (CBRT). Additional support would be provided by U.S. Army and U.S. Navy medical, analytical, and response assets. This coordinated team would use the equipment normally available to the first responders. In addition, it would use specialized equipment organic to DoD organizations not available to the first responders. This capability is supplemented by a pre-positioned package of specialized

NBC defense equipment that would be delivered within hours of notification to the contingency. (The equipment packages will be in an alert status, ready to deploy in four hours). The pre-positioned package consists of a suite of equipment for hazard containment, detection, personal protection, decontamination, and medical treatments and accessories. The packages include military items, such as those described in Annexes A-D, and non-military items. There will be five packages placed at five sites across the U.S., which include enhanced (“special event”) packages at Pine Bluff Arsenal, AR, and in Alaska and Hawaii. The current concept for the quantities of equipment to be included in the pre-positioned packages is still evolving.

Given the potential involvement of other DoD and non-DoD responders, every effort is being made to ensure a commonality of equipment and capabilities among the responder groups. The development of methods that ensure coordination and communication among the emergency responder groups and the various elements of the C/B-RRT are also being given high developmental priority. Particular attention is being paid to coordination and integration of equipment requirements between the C/B-RRT and the U.S. Marine Corps’ Chemical-Biological Incident Response Force (CBIRF). Additional information on CBIRF and emergency medical response is provided in Section 5.7.5 and 5.7.6 of this report.

2.7 NON-MEDICAL CB DEFENSE REQUIREMENTS ASSESSMENT

***ISSUE:* Advanced technologies and new methods are currently being examined for fixed site decontamination. Follow-up investigations are planned over the next year to determine the requirements necessary to perform decontamination of large areas, including cleaning area to sustain cargo handling operations. Over the past year, the Services have worked together to improve the Joint orientation of NBC defense requirements. The work being accomplished will improve the equipment fielded in the near future. More emphasis needs to be placed on the Warfighting CINCs’ requirements as input for equipment research and development. This is necessary to ensure that future equipment meets the needs of the Joint battlespace environment.**

SOLUTION: Areas of concern which are addressed under the management improvement initiatives include the following:

- Focusing and prioritizing chemical and biological detector programs to ensure that resources are leveraging the most promising technologies and are not diluted by excessive Service unique requirements.
- Developing advanced individual protection ensembles which minimally degrade an individual’s performance for all tasks performed in contaminated environments.
- Identifying requirements for collective protection programs to ensure that enough assets are available to complete missions in a CB environment.
- Developing advanced detection capabilities for the purpose of directing decontamination efforts and monitoring the effectiveness of those efforts.

- Identifying an environmentally safe decontaminant and development of a capability to accomplish fixed site and sensitive equipment decontamination.

ISSUE: The M-40 mask program was reviewed to assess the impact of reported problems in the manufacture and qualification of new masks on meeting the acquisition objectives for the mask and to identify corrective actions.

SOLUTION: A letter dated October 23, 1997—see Figure 2-1 below—addressing issues related to the M40 mask program was delivered to Congress as requested. Following is an extract from that letter addressing M40 mask issues:

- A multiyear, best value contract which combined all known service requirements was competed between the two mobilization base suppliers for the M40/M42 CB Protective Masks, Mine Safety Appliances of Esmond, Rhode Island, and ILC Dover of Frederica, Delaware. The contract was awarded to ILC Dover on November 4, 1996. The proposals were evaluated in accordance with the criteria set forth in the request for proposals.
- A technical issue regarding definition of requirements and dimensions for the mask lens in the government furnished technical data resulted in a four month delay for the contractor in finalizing the mask lens tooling. Resolution of the issues was conducted in a partnering environment between the Army and ILC Dover, resulting in no additional contract costs. ILC Dover has completed the First Article Testing requirements of the contract and is currently in production and delivering masks. To preclude any future mask lens technical data clarifications, a performance specification is being prepared to better define the lens requirements and to eliminate the need for detailed dimensional drawings. This performance specification will be completed by the end of Jan 98. The four month delay in mask deliveries will be made up through increased production from Oct 97-Jan 99. All deliveries of masks will be completed within the time frame of the original contract.
- There was no impact to Army readiness during the lead time into production. The Army will reach its acquisition objectives for the M40/M42 CB Protective Masks with completion of deliveries from ILC Dover from the last year of production on the contract.

Figure 2-1. Letter to Congress regarding M-40 Mask Issue



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH DEVELOPMENT AND ACQUISITION
103 ARMY PENTAGON
WASHINGTON DC 20310-0103

23 OCT 1997

REPLY TO
ATTENTION OF

The Honorable Floyd D. Spence
Chairman
Committee on National Security
U.S. House of Representatives
Washington, D.C. 20515-6035

Dear Mr. Chairman:

This is in response to your request in the National Defense Authorization Act for FY 98; Committee on National Security, House of Representatives, HR 1119, which stated: "The committee has been advised of problems and qualification of new production M40 protective masks and is concerned about the impacts of these problems on the ability to meet acquisition objectives for the mask. The committee directs the Secretary of the Army to review the M40 mask procurement program and provide a report to the Congressional defense committee by October 30, 1997, which addresses the results of that review and the actions to be taken to correct any problems discovered."

I have conducted a review of the program and concluded the following:

(1) A multiyear, best value contract which combined all known service requirements was competed between the two mobilization base suppliers for the M40/M42 CB Protective Masks, Mine Safety Appliances of Esmond, Rhode Island, and ILC Dover of Frederica, Delaware. The contract was awarded to ILC Dover on November 4, 1996. The proposals were evaluated in accordance with the criteria set forth in the request for proposals.

(2) No new technical problems were noted during my review. A previous technical issue regarding definition of requirements and dimensions for the mask lens in the government furnished technical data resulted in a four month delay for the contractor in finalizing the mask lens tooling. Resolution of the issues was conducted in a partnering environment between the Army and ILC Dover, resulting in no additional contract costs. ILC Dover has completed the First Article Testing requirements of the contract and is currently in production and delivering masks. To preclude any future mask lens technical data issues, a performance specification is being prepared to define the lens requirements and to eliminate the need for detailed dimensional drawings. The four month delay in mask deliveries will be made up through increased production from October 97 through January 1999. Final delivery of masks will be completed within the timeframe of the original contract.

Printed on  Recycled Paper

(3) There was no impact to Army readiness during the lead time into production. The Army will reach its acquisition objectives for the M40/M42 CB Protective Masks with completion of deliveries from ILC Dover from the last year of production on the contract.

Thank you for your interest in the M40/M42 CB Protective Mask program. The Army will continue to do all it can to provide the best possible equipment to the men and women of our armed forces. The Army will continue to monitor and manage the ongoing production at ILC Dover to assure that the best interests of the Army are met.

Sincerely,

Kenneth J. Oscar
Acting Assistant Secretary of the Army
(Research, Development and Acquisition)

CHAPTER 3

MEDICAL NUCLEAR, BIOLOGICAL, AND CHEMICAL WARFARE DEFENSE REQUIREMENTS AND RESEARCH AND DEVELOPMENT PROGRAM STATUS

(INTENTIONALLY BLANK.)

3.1 REQUIREMENTS

3.1.1 Introduction

The Gulf War, the Tokyo subway nerve gas (sarin) attack in March of 1995, the threatened release of radiocesium in Moscow's Izmailovo Park, and recently released reports^{1, 2, 3} illustrate that many countries and terrorist groups have acquired the means for both producing chemical, biological and radiological weapons and delivering them. Nuclear, biological, and chemical (NBC) proliferation increases the threat to deployed U.S. forces. The May 1997 *Report of the Quadrennial Defense Review (QDR)* concluded that the threat or use of NBC weapons is a "likely condition of future warfare." In response, the mission of our medical chemical, biological, and radiological defense research program (MCBRDRP) is to preserve combat effectiveness by timely provision of medical countermeasures. The MCBRDRP has three goals:

- (1) Provide individual level protection and prevention to preserve fighting strength;
- (2) Maintain technological capabilities to meet present requirements and counter future threats; and
- (3) Provide medical management of chemical, biological, and radiological weapons casualties to enhance survivability, and expedite and maximize return to duty.

Chemical warfare agents are available worldwide and include vesicants (blister agents), nerve, blood, and respiratory agents. Biological threat agents include bacteria, viruses, rickettsia and toxins, which can be produced by any group with access to a scientific laboratory or a pharmaceutical industry. The radiological threat is from the use of conventional explosives to spread nuclear contamination over a limited area or strategic terrain (including usage against reactors or industrial radiation sources) and potentially from the use of a single or a small number of crude, Hiroshima-type nuclear weapons. Exposure to multiple threats may result in synergistic effects. Medical treatment strategies reduce the performance decrement, injury, and death of military personnel in the field, thereby enabling them to accomplish their missions, as well as reducing the need for medical resources.

DoD medical NBC defense research and development has resulted in the fielding of numerous products to protect and treat service members against the effects of NBC weapons. The DoD program to stockpile biological defense products has been smaller than the chemical defense effort, but has received greater emphasis in recent years.

¹ Proliferation: Threat and Response, November 1997, DoD Report.

² *Report to Congress on Response to Threats of Terrorist Use of Weapons of Mass Destruction*, January 31, 1997, prepared as requested by Public Law 104-201, National Defense Authorization Act for Fiscal Year 1997. SEC. 1411. Response to Threats of Terrorist use of Weapons of Mass Destruction.

³ *Report to Congress on Response to Threats of Terrorist Use of Weapons of Mass Destruction*, May 1, 1997. Prepared by the Department of Defense as requested by Public Law 104-201, National Defense Authorization Act for Fiscal Year 1997, Title XIV: Defense Against Weapons of Mass Destruction (WMD). Subtitle A: Domestic Preparedness.

Specific initiatives programmed to improve NBC medical readiness include:

- Continued emphasis on NBC medical countermeasures research.
- Medical collective protection.
- Identification and testing of medications and therapeutic regimens which reduce the effect of radiation on both bone marrow and the intestinal tract.
- A biological defense immunization policy.
- The award of a prime contract to develop, license, produce, and store biological defense vaccines.
- Enhanced medical diagnostic capability for disease caused by all agents.
- Definition of low dose radiation interaction on susceptibility to biological and chemical agents.

3.1.2 Challenges in the Medical NBC Warfare Defense Programs

Medical prophylaxes, pretreatments, and therapies are necessary to protect personnel from the toxic or lethal effects of exposure to all validated threat agents, as well as other anticipated threats. DoD has fielded a number of medical countermeasures, which greatly improve individual medical protection, treatment, and diagnoses.

DoD complies with all Food, Drug and Cosmetic Act requirements. The Food and Drug Administration (FDA) requires large-scale field trials in human subjects to demonstrate efficacy of drugs and biologicals prior to licensure. There are, however, legal and ethical constraints that preclude such efficacy studies for NBC countermeasures. While demonstration of a drug or vaccine's safety in humans is no different than any "civilian" pharmaceutical product, field studies of efficacy cannot be performed, since exposure to most NBC agents does not usually occur naturally. Moreover, the high lethality and/or toxicity of NBC agents makes it unethical to expose human subjects in the controlled efficacy studies usually required by the FDA for product licensure (*e.g.*, tests of effectiveness of the product against the threat in humans). DoD continues to work with the FDA to seek alternative methods for demonstrating efficacy of NBC medical countermeasures and to obtain their licensure. DoD has also begun the exploration of strategies with the FDA to address the challenges of using investigational products for force protection in deployment.

Contrary to many media reports⁴, medical NBC defense products are thoroughly evaluated and tested for their safety in accordance with FDA guidelines (for example, see Figure 3-1 for biological products) before being administered to *any* personnel. All NBC defense medical products must be safe to use and not degrade operational performance. In cases where adverse effects are known or are possible, a decision must be made—and a risk accepted—of the real or potential effects of a medical product versus the catastrophic effects of unprotected exposure to NBC weapons. Even though efficacy may not be fully understood, safety (including

⁴ See for example, Arthur Brice, "Sneaky use of drugs on GIs sparks debate," *The Atlanta Journal-the Atlanta Constitution*, December 4, 1997, p. D8.; Victor Sidel quoted in Dave Parks, "Military tries to plug chem defense gaps," *Birmingham News*, p.1; "Gulf War Syndrome," by Ed Bradley on *60 Minutes*, CBS-TV, September 29, 1996; "In general, a sickening syndrome," *New York Daily News*, December 7, 1996, p. 11; Thomas Tiedt quoted in David Ballingrud, "Ex-researcher: Gulf 'vaccine' was a poison," *St. Petersburg Times*, December 2, 1996, p. 1.

adverse effects) is understood extensively. In many cases, the safety is well understood because the medical products have been widely used to treat other medical conditions. (For example, pyridostigmine bromide, the investigational nerve agent pretreatment, has been in use since the 1950s to treat myasthenia gravis, a neuromuscular disorder. The anthrax vaccine is licensed and has been used since the 1970s to vaccinate veterinarians, textile workers, and others. Various anti-emetics to protect against radiological threats have been used to treat cancer patients undergoing radiation therapy.)

The acquisition life cycle of medical products developed by DoD is normally managed in accordance with the guidelines found in DoD Regulation DoD 5000.2-R. However, since DoD complies with FDA requirements, it must also follow the requirements of Title 21, Food & Drugs, Code of Federal Regulations (CFR). The following chart illustrates the correlation of events for each DoD 5000.2-R life cycle phase to the requirements of 21 CFR:

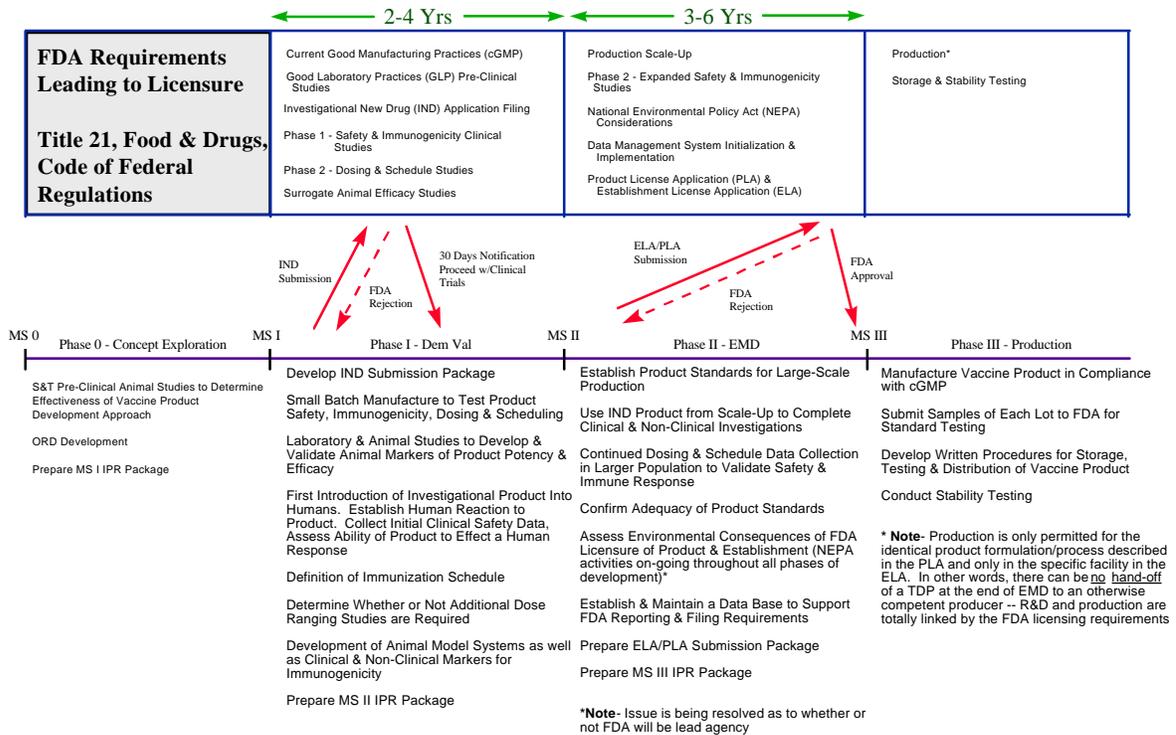


Figure 3-1. Standard FDA Approval Process for Biological Defense Medical Products

The medical NBC defense research programs discussed in this section are divided into three areas of research: chemical, biological, and nuclear. Table 3-3 (on page 3-16) provides a summary of the medical NBC defense programs and the planned modernization strategy over the next fifteen years.

3.1.3 Reducing Reliance on Research Animals

The FY95 National Defense Authorization Act directed DoD to establish aggressive

programs to reduce, refine, or replace the use of research animals. In April 1995, DoD issued Directive 3216.1, "Use of Laboratory Animals in DoD Programs," which mandated standardization of all DoD animal use protocols. Therefore, an objective of the MCBRDRP is to utilize and develop technologies that will reduce reliance on animal research. In FY97, the MCBRDRP utilized computerized molecular modeling, computer predictions, *in vitro* cell cultures, a cell-free reaction system, and a lipid bilayer system to replace the use of animals when possible. All research proposals that use animals are evaluated by a statistician to ensure that only the minimum number of animals required to obtain scientific validity are used. Animals lower on the phylogenetic scale (or the least sentient species) are used if the selection will permit attainment of the scientific objective. Additionally, all procedures which would cause pain or distress in laboratory animals are reviewed by a veterinarian with expertise in laboratory animal medicine to determine the procedural modifications, analgesics and/or anesthetic regimens to be incorporated to minimize pain or distress.

It is the policy of DoD that animal utilization will be conducted in full compliance with the Animal Welfare Act and that animals are used in research only when scientifically acceptable alternatives are not available.

3.1.4 Medical Program Organization

Chemical/Biological. The U.S. Army is the Executive Agent for the MCBRDRP as prescribed in DoD Directive 5160.5 and, as such, is the lead requirements coordinator. The programs integrate DoD in-house and external efforts. Joint Technology Coordinating Group (JTCG) 3 (Medical CW Agent Defense) and JTCG 4 (Medical BW Agent Defense) of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee are responsible for the programs' joint consolidation, coordination, and integration. The ASBREM Committee maximizes efficiency by coordinated planning, and minimizing unnecessary program overlaps and costly materiel retrofits. (The integration of program management and oversight of medical and non-medical NBC defense programs are described in Chapter 1.) The Army Technology Base Master Plan and the Medical Science and Technology Master Plan are the program drivers for the chemical and biological research programs. The science and technology base is managed through the development and execution of Defense Technology Objectives (DTO) and Army Science and Technology Objectives (STO). The predevelopment program (basic research; exploratory development; and concept exploration and definition) is directed by the U.S. Army Medical Research and Materiel Command (USAMRMC). The advanced development program (Program Definition and Risk Reduction [PDRR]); and Engineering and Manufacturing Development (EMD) for medical *chemical* defense products is directed by the U.S. Army Medical Materiel Development Activity (a USAMRMC asset). The advanced development program (PDRR and EMD) for medical *biological* defense products, including the joint vaccine acquisition program, is directed by the Joint Program Office for Biological Defense (JPO-BD).

Nuclear. The study of the medical and biological effects of ionizing nuclear radiation is performed by the tri-service Armed Forces Radiobiology Research Institute (AFRRI). AFRRI programs are integrated into other DoD in-house and external efforts under the coordination of

the ASBREM. Specific requirements and tasking for AFRRI research is not included in the funding or management structure of the DoD Chemical and Biological Defense program. A summary of AFRRI activities and accomplishments, however, are included in this chapter and in Annex D.

3.2 MEDICAL CHEMICAL DEFENSE RESEARCH PROGRAM

The mission of the Medical Chemical Defense Research Program (MCDRP) is to preserve combat effectiveness by timely provision of medical countermeasures in response to joint service chemical warfare defense requirements.

3.2.1 Goals

The goals of the MCDRP are:

- Maintain technological capabilities to meet present requirements and counter future threats:
 - Determine sites, mechanisms of action, and effects of exposure to chemical warfare agents with emphasis on exploitation of neuroscience technology and dermal pathophysiology.
 - Identify sites and biochemical mechanisms of action of medical countermeasures.
 - Exploit molecular biology and biotechnology to develop new approaches for medical countermeasures.
 - Exploit molecular modeling and quantitative structure-activity relationships supporting drug discovery and design.
- Provide individual prevention and protection to preserve fighting strength:
 - Develop improved prophylaxes, pretreatments, antidotes, and therapeutic countermeasures.
 - Develop skin protectants and decontaminants.
 - Identify factors that influence safety and efficacy properties of candidate countermeasures.
 - Develop and maintain preformulation, formulation, and radiolabeling capabilities.
- Provide medical management of chemical casualties to enhance survival, and expedite and maximize return to duty:
 - Develop concepts and recommend therapeutic regimens and procedures for the management of chemical casualties.
 - Develop diagnostic and prognostic indicators for chemical casualties.
 - Develop life-support equipment for definitive care.

3.2.2 Objectives

The objectives of the MCDRP differ with the varying threats:

- For vesicant (or blister) agents, the objective is to develop a pathophysiological database on vesicant chemical agents and develop a working hypothesis on how damage occurs at the cellular level. Used with associated technologies, this approach will enable the formulation of definitive pretreatment and treatment strategies and is expected to produce a realistic concept for medical prophylaxis, immediate post exposure therapy and topical protection.
- For nerve agents, the objectives are to field a safe and effective advanced anticonvulsant nerve agent antidote, and to field an advanced pretreatment based on biological scavengers, such as human enzyme butyrylcholinesterase (BuChE). Like acetylcholinesterase, the target enzyme for nerve agents, native BuChE is also inhibited by nerve agents. Through bioengineering efforts in the technology base, human BuChE has been mutated to a form that catalyzes the breakdown of nerve agent. The concept of using a catalytic BuChE to protect against large doses of nerve agent has been established in laboratory animals, indicating that this approach is feasible in humans. The enzyme pretreatment offers the potential advantage over the present pretreatment, pyridostigmine bromide (PB). The enzyme pretreatment affords long-term protection from a single dose rather than requiring three daily doses, as does PB.
- For blood agents, the objective is to develop and field a safe and effective cyanide pretreatment.
- For respiratory agents, the objective is to develop approaches to prophylaxis and therapy by understanding pathophysiological changes after agent exposure.

3.2.3 Threats, Countermeasures, Technical Barriers, and Accomplishments

The chemical warfare threats and countermeasures, as well as chemical defense research and development technical barriers and accomplishments, are outlined in Annex D (Section D.1).

3.3 MEDICAL BIOLOGICAL DEFENSE RESEARCH PROGRAM

The mission of the Medical Biological Defense Research Program (MBDRP) is to develop medical countermeasures to protect U.S. forces and thereby deter, constrain, and defeat the use of biological agents against them (DoD Directive 5160.5, May 1985). The program is directed against agents of biological origin that are validated military threats. A primary concern is the development of vaccines, drug therapies, diagnostic tools, and other medical products that are effective against agents of biological origin (see Table 3-1).

3.3.1 Goals

Goals of the MBDRP include the following:

- Protecting U.S. forces' war fighting capability during a biological attack.
- Reducing vulnerability to validated and novel threats by maintaining a strong technology base.
- Providing education on medical management of biological warfare casualties.

3.3.2 Objectives

In accomplishing the goals of the MBDRP, efforts are focused on three objectives:

- Prevent morbidity and mortality through the use of vaccines, drugs, and other medical pretreatments.
- Diagnose disease through the use of forward deployable diagnostic kits and confirmation assays.
- Treat casualties to maximize the number of warfighters that return to duty through the use of antitoxins, drugs, and other medical treatments.

The MBDRP responds to requirements from the DoD as identified in DoD Directive 6205.3, "Biological Defense Immunization Program," the Joint Service Agreement on Biological Defense, the Joint Warfighting Science and Technology (S&T) Plan, the Defense Technology Assessment Plan, and the Defense S&T Strategy.

Highly sophisticated technology base efforts for medical biological defense hold the promise of yielding important new products to protect our troops against a wide range of biological weapons. These products include multi-agent vaccines, which will reduce costs of vaccine production and simplify immunization schedules, and a common diagnostic kit, a hand-held device that can be deployed at forward sites to rapidly analyze clinical samples for the presence of biological warfare. The development of these products is also being supported by the Defense Advanced Research Projects Agency (see also section 3.3.4 below).

The measles-mumps-rubella (MMR) vaccine administered to children is an example of a licensed multi-agent vaccine. However, the technologies being explored for producing these new vaccines are more advanced, relying on bioengineering technologies such as naked DNA and the replicon-based delivery systems. In the naked DNA approach, DNA coding for protein antigens of the organism is injected with a "gene gun"; the DNA directs the synthesis of the antigens, which then stimulate the development of immunity. In the replicon approach, selected genes from biological warfare agents are introduced into an attenuated virus, which cannot produce disease. The virus directs the synthesis of the foreign proteins, inducing immunity. Research in both the naked DNA and replicon approaches is advancing rapidly, and transition of a multi-agent vaccine to advanced development is scheduled for FY 02.

Bioengineering techniques are also being used to prepare a variety of recombinant vaccines against single threat agents that will be produced without the need to grow the threat agent during the vaccine production process. Several recombinant vaccines are scheduled to be fielded over the next 10 years.

Development of a common diagnostic kit is proceeding with two state-of-the-art technologies. In the antibody based system, which is scheduled to be transitioned to advanced development in FY 99, a membrane platform will detect biological warfare threat agents in biological specimens. The second system relies on detecting the DNA of a variety of biological warfare threat agents or natural infectious diseases by a hand held polymerase chain reaction (PCR) technique and is scheduled to reach advanced development in FY 02. With these tools, clinical diagnoses will be made much faster (less than 30 minutes) and farther forward than is possible now.

The MBDRP includes the following areas of research:

- Bacterial studies – Identify virulence factors and protective antigens and the specific genes for these factors/antigens in bacterial threat agents. Determine the role of these factors in stimulating cellular and humoral immunity. Use this knowledge in the development of second generation recombinant vaccines. Evaluate modern antibiotics for effectiveness in the treatment and/or post-exposure prophylaxis of bacterial threat agents.
- Toxin research – Conduct basic and developmental research to discover methods of prevention and treatment against broad classes of toxins to include use of site-directed mutagenesis and protein engineering of recombinant vaccine candidates. Study mechanisms of action of high priority toxins in order to identify promising sites for drug intervention.
- Viral and Rickettsial studies – Identify and characterize threat organisms, conduct molecular antigenic analysis, and investigate pathogenesis, immunology, and epidemiology that will allow decisions regarding the optimal approach to disease prevention and control. Develop vaccine candidates and immunological and drug treatment strategies for viral and rickettsial threat agents.
- Diagnosis – Investigate and evaluate sensitive and specific methods for detection of infectious organisms, toxins, antigens and antibodies in biological materials including the application of nucleic acid probes or synthetic antigens. Develop rapid identification and diagnostic methods for the assay of toxins, metabolites, and analogs in clinical specimens.

3.3.3 Threats, Countermeasures, Technical Barriers, and Accomplishments

A biological threat agent is defined as an intentionally disseminated living microorganism or toxin that can cause disease or death in humans, animals, or plants. Threat agents include a broad range of microorganisms (bacteria, rickettsia, and viruses) and toxins of biological origin. Biological weapons are easy to make, difficult to detect and can be very effective. Defense against this class of weapon is difficult, particularly since biological agents can produce casualties for thousands of square kilometers. Biological agents can also be combined with nuclear, chemical, or conventional weapons and used with devastating effect.

Countermeasures and diagnostic techniques for biological weapons are shown in Table 3-1. Critical elements of medical biological defense include the ability to protect U.S. forces from BW agents, to rapidly diagnose (in biological specimens) infection or intoxication

from agents, and to treat casualties. Currently, the most effective countermeasure is pre-deployment active immunization. Future threats could involve genetically engineered biological weapons that may be easily produced, highly lethal, difficult to detect, and resistant to conventional therapies.⁵

The current MBDRP includes the following research areas for the development of medical countermeasures:

- Characterize the biochemistry, molecular biology, physiology, and morphology of biological warfare threat agents;
- Investigate the pathogenesis and immunology of the disease;
- Determine the mechanism of action of the threat agent in an animal model system;
- Select antigen(s) for candidate vaccines;
- Develop and compare potential vaccine candidates and characterize their effects in animal models;
- Establish safety and efficacy data for candidate vaccines;
- Develop medical diagnostics, including far forward, confirmatory, and reference lab;
- Develop chemo/immunotherapeutic agents and preparations.

Technical shortcomings in the private sector include the lack of high level biological containment (BL-3 and BL-4) laboratory facilities to support in-house biological defense research and scientific expertise in biological defense. This has become a critical issue in light of current personnel and program downsizing initiatives and the additional emphasis that is being placed on out-sourcing MBDRP work. The technological and scientific expertise for biological defense can therefore be eroded quickly.

Details of the biological warfare threats and countermeasures, as well as biological defense research and development technical barriers and accomplishments, are presented in Annex D (Section D.2).

⁵ A detailed assessment of the potential impact of new or genetically engineered biological weapons is included in a report prepared by the Department of Defense entitled *Advances in Biotechnology and Genetic Engineering: Implications for the Development of New Biological Warfare Agents*. This report was submitted to Congress in June 1996.

Table 3-1. Medical Biological Defense Countermeasures and Diagnostic Techniques

<p style="text-align: center;">VACCINES</p> <ul style="list-style-type: none">• <i>Killed</i> – killed or inactivated microorganism that is incapable of replicating, yet stimulates immunity.• <i>Live, attenuated</i> – live organism, genetically selected not to cause disease, yet able to stimulate immunity.• <i>Toxoid</i> - toxin protein treated to inactivate its toxicity, yet retains its ability to stimulate immunity.• <i>Recombinant</i> – gene coding for a protein that stimulates specific immunity to a BW agent is inserted into biological vector for production. Protein may be produced in high yields through bioengineering.• <i>Deoxyribonucleic Acid (DNA)</i> – section of DNA that codes for protein that stimulates specific immunity to a BW agent. DNA produces the desired protein in recipient which stimulates immunity.• <i>Polyvalent</i> – mixture of antigens that protect against a number of different BW agents.• <i>Vectored</i> – carrier organism bioengineered to confer immunity against an unrelated BW agent or multiple agents. <p style="text-align: center;">ANTIBODY (ANTISERUM, ANTITOXIN)</p> <ul style="list-style-type: none">• <i>Heterologous</i> – antibodies collected from animals (<i>i.e.</i>, different species than the recipient) repeatedly immunized against the BW threat. These antibodies must be treated to reduce the human immune response to them (serum sickness).• <i>Homologous</i> – antibodies of human origin (<i>i.e.</i>, same species as the recipient) that provide protective immunity against the BW threat. These antibodies are not prone to stimulating serum sickness.• <i>Monoclonal</i> – a cell culture technique for producing highly specific antibodies against a disease agent.• <i>Bioengineered</i> – antigen binding site on the variable portion of an antibody elicited in a non-human system is combined with the non-variable portion of a human antibody to produce a “humanized” antibody. <p style="text-align: center;">DRUGS</p> <ul style="list-style-type: none">• <i>Antibiotics</i> – very effective against bacteria, but are ineffective against viruses and toxins.• <i>Others</i> – compounds that offer new possibilities for protecting against and treating exposure to BW agents (such as antiviral compounds). <p style="text-align: center;">DIAGNOSTIC TECHNOLOGIES</p> <ul style="list-style-type: none">• <i>Immunological technologies</i> – tests relying on antibodies for detecting the presence of proteins associated with the BW agent. They are easy to use, compact, rapid (minutes), and require little logistic support. These tests are currently used in out-patient clinics and doctor’s offices.• <i>Nucleic acid technologies</i> – nucleic acid tests, specifically the polymerase chain reaction (PCR), rely on segments of genes unique to BW agents to detect the presence of those agents. These technologies are extremely sensitive and specific, but currently require more support to perform.
--

3.3.4 Defense Advanced Research Projects Agency (DARPA) Programs

As one of the major program areas conducted under its Defense Sciences Office, DARPA is pursuing the demonstration and development of new biological warfare defense capabilities. Major thrusts include medical countermeasures (developing barriers to prevent entry of pathogens into the human body, pathogen countermeasures to block pathogen virulence

and to modulate host immune response); a new emphasis in advanced medical diagnostics for the most virulent pathogens and their molecular mechanisms; and consequence management tools.

Medical countermeasures to be developed include: (1) multi-agent therapeutics against known, specific agents, and (2) therapeutics against virulence pathways (mechanisms of disease) shared by broad classes of pathogens. Specific approaches include modified red blood cells to sequester and destroy pathogens, modified stem cells to detect pathogens and to induce immunity or produce appropriate therapeutics within the body, identification of virulence mechanisms shared by pathogens, development of novel therapeutics targeting these mechanisms, and efficacy testing in cell cultures and animals.

Early diagnosis is key to providing effective therapy against BW agents since many of these agents cause early nonspecific flu-like symptoms. The ultimate goal of the DARPA advanced medical diagnostics thrust is to develop the capability to detect the presence of infection by biological threat agents, differentiate from other significant pathogens, and identify the pathogen, even in the absence of recognizable signs and symptoms (when the pathogen numbers are low).

Mission effectiveness requires rapid, correct medical responses to biological weapon threats. The objective of the consequence management thrust is to provide comprehensive protocols to protect or treat combatants using current and emerging biological countermeasures. It will provide accelerated situational awareness for biological warfare events by detecting exposure to agents through an analysis of casualty electronic theater medical records, and will locate and determine the most effective logistical support for providing appropriate treatment and pathogen-specific resources required to mitigate effects of the attack. Current plans envision transitioning these software tools to service customers beginning in FY 99.

3.4 MEDICAL NUCLEAR (RADIOLOGICAL) DEFENSE RESEARCH PROGRAM

The mission of the Medical Nuclear Defense Research Program (MNDRP) is to conduct research in the field of radiobiology and related matters essential to the support of the Department of Defense and the Military Services. The sole repository of defense radiobiology research expertise is AFRRI.

3.4.1 Goals

The goals of the MNDRP are the following:

- Develop medical countermeasures for the acute, delayed and chronic effects of radiation.
- Identify and quantify hazards of depleted uranium munitions to military and civilian casualties, both female and male.
- Develop rapid bioassay for radiation injury suitable for field deployment
- Produce improved chelating agents for use in treating internal contamination by radioactive heavy metals.

- Sustain combat capability, increase survival, and minimize short- and long-term health problems associated with ionizing radiation alone, and when radiation is combined with other weapons of mass destruction.
- Respond to immediate operational requirements that obligate expertise in either radiation medicine, health physics or radiobiology.
- Maintain core of scientific expertise necessary to meet current research requirements and to counter current and future radiological threats.
- Provide nuclear radiation weapon effects medical training for DoD medical personnel.

3.4.2 Objectives

The primary objective of this research group is to address the major aspects of military operational requirements for dealing with radiation injuries. A nuclear threat agent is any weapon which causes detrimental medical effects by either direct external irradiation or by internal contamination with radioactive material. These agents include radiation dispersal weapons, which scatter radioactive material with conventional explosives, deliberate area contamination, destruction of a nuclear power plant, improvised nuclear devices, and traditional nuclear weapons. Operational requirements include programs in casualty management, medical radioprotectants to diminish radiation injury, medical therapeutic regimens, maintenance of performance, and radiation hazards assessment.

3.4.3 Threats, Countermeasures, Technical Barriers, and Accomplishments

The deployment of a relatively low-yield nuclear device or Hiroshima-type weapon is increasingly possible by a terrorist or third-world country. Such a device could be utilized against either a military installation or a political target (e.g., the seat of government, large population center, or commercial port city). In such a scenario, citizens outside the immediate lethal area could be exposed to the prompt radiation of the initial explosion as well as to chronic exposures resulting from the residual radioactive fallout.

Early radiation injury diminishes the soldier's ability to fight and survive. Effective radiation countermeasures must protect the soldier from performance decrement and simultaneously diminish lethality and the long-term effects of radiation injury. Therapeutic measures will increase the survival and diminish the morbidity of individual soldiers who are wounded by radiation. A research program to understand molecular and cellular damage induced by radiation is needed to determine the best medical countermeasures for new radiogenic wounding agents on the modern battlefield. Table 3-2 presents an overview of various medical approaches to prevent or counter the various threats of radiological exposure. Program accomplishments are detailed in Annex D.

Table 3-2. Medical Nuclear Defense Countermeasures

PRETREATMENTS

Multidrug combinations: Animal research has demonstrated certain radioprotectant drug combinations administered at nontoxic levels interact synergistically to markedly increase mammalian resistance to radiation.

Antiemetics: Granisatron (KytrilR) has been adopted as the NATO standard pretreatment antiemetic medication to significantly block performance degrading early symptoms of radiation injury. This allows mission completion and consequently diminishes the overall casualty rate.

DEPLETED URANIUM TOXICITY

Metabolism of metallic uranium fragments: Prior to the wounding of soldiers in Desert Storm, very little was known about the toxicity of implanted metallic uranium fragments. Previous uranium toxicity studies had been limited to inhaled uranium oxides in uranium workers. Preliminary aspects of animal studies indicate distribution to depot sites throughout the body and potential risks of late effects. Adequate chelation therapy does not exist at this time to increase excretion of this material.

Fetal metabolism of depleted uranium: Young female soldiers may be wounded by depleted uranium weapons. No knowledge exists of the effects of this material on subsequent pregnancies.

MEDICAL THERAPIES

Specific Cell Line Stimulants: Granulocyte-Macrophage Colony Stimulating Factor has been demonstrated to be highly effective in restoring the immune competence of bone marrow and allowing survival from radiation injuries previously considered lethal. The cytokine thrombopoietin has been developed as a therapeutic agent and is undergoing further trials as a platelet-formation stimulant.

Broad Range Cellular Recovery Stimulants: Research continues into biologically stable compounds which stimulate recovery of multiple hematopoietic cell lines.

Susceptibility to Infectious Agents and Efficacious Therapy: Research continues to assess susceptibility and resistance to infectious agents in conjunction with use of prompt and chronic sublethal irradiation, and to develop combined modality therapies that attack microorganisms and enhance innate immune response in irradiated personnel.

Internal Contamination Chelation Agents: Currently available chelation agents capable of removing internal radioisotopes are investigational drugs which have been utilized with limited success. More effective ligand-type compounds have been identified and are undergoing evaluation. Other modalities being investigated include seaweed based Alginates, which appear to be promising.

DIAGNOSTIC TECHNIQUES

Biodosimetry and Dose Assessment: No dose assessment method, other than individual physical dosimeters can be currently made available to deployed soldiers. Automated chromosome dicentric analysis has been developed and can be made deployable to the Echelon 3 medical care level. Other, more rapid, methods are being evaluated.

CHEMICAL AND BIOLOGICAL WARFARE INTERACTIONS WITH RADIATION

Increased lethality of biological weapons after low level irradiation: Ongoing studies indicate even low levels of radiation exposure will markedly increase the infectivity of biological weapons. Existing data suggest synergistic interactions of mustard and nerve agents with ionizing radiation.

Significant progress has been made in prophylactic and therapeutic measures that will reduce mortality and morbidity in high dose radiation environments. During the Cold War, the numbers of casualties resulting from the large scale deployment of nuclear weapons would have easily overwhelmed the medical assets of NATO forces. In the current threat environment, adequate planning for medical response to a very limited nuclear attack is mandatory. While casualty numbers from a nuclear detonation will still be large, countermeasures have been developed which will significantly limit the morbidity and the secondary mortality. These modalities will be particularly important in the likely scenario of terrorist use of radiation weapons. If the attack is limited to one or, at worst, a small number of events, the ability to provide intensive, sophisticated medical and other support is highly credible because of the availability of uncompromised treatment/research centers and medical evacuation capabilities.

Details of the radiological threats and countermeasures, as well as nuclear defense research and development technical barriers and accomplishments, are presented in Annex D (Section D.3).

3.5 MEDICAL NBC RESEARCH PROJECTION

Table 3-3 presents a projection of the medical NBC defense programs and modernization strategy for the next 15 years.

Table 3-3. Medical NBC Defense Programs and Modernization Strategy

	NEAR (FY98-00)	MID (FY01-05)	FAR (FY06-12)
Medical - Chemical Defense	Licensed Topical Skin Protectant	Licensed Advanced Anticonvulsant Licensed Cyanide Pretreatment Licensed Multi-chambered Autoinjector	Licensed Reactive Topical Skin Protectant Licensed Advanced Prophylaxis for Chemical Warfare Agents Licensed Specific Protection and Treatment for Blister Agents (vesicant agent countermeasures) Licensed Vesicant Agent Prophylaxis
Medical - Biological Defense	Anthrax vaccine Relicensure	Licensed Q fever chloroform-methanol residue (CMR) vaccine Licensed Tularemia vaccine Licensed Vaccinia, cell culture derived vaccine Licensed Botulinum A/B/E/F monovalent vaccines Rapid Diagnostic Kit for Biological Warfare Threat Agents Licensed Botulinum Tetravalent vaccine Licensed Botulinum C vaccine Licensed Botulinum D vaccine Licensed Botulinum G vaccine Licensed Ricin vaccine Licensed Brucellosis vaccine Licensed new Anthrax vaccine	Licensed Staphylococcal Enterotoxin B (SEB) vaccine Licensed new Plague vaccine Licensed new Venezuelan Equine Encephalomyelitis (VEE) vaccine Licensed combined VEE, Western Equine Encephalomyelitis (WEE), & Eastern Equine Encephalomyelitis (EEE) vaccine Multi Agent vaccine delivery system Hand Held Common Diagnostic System
Medical - Nuclear Defense	Depleted uranium fragments toxicity assessment Evaluation of new chelation agents (ligands and Alginates) Multidrug radioprotectants validated Combination cytokine therapy validated Echelon 3 fieldable biodosimetry Licensed novel drug-delivery systems Risk Assessment for low-dose, low-dose rate radiation effect	Licensed treatment modalities for depleted uranium fragments casualties Radioprotectant transdermal patches New generation prophylactic and therapeutic immunomodulators for multi-organ injuries Computer models to understand effects resulting from combined NBC attacks	Licensed Radiation-induced cancer/mutation preventive techniques Licensed Countermeasure for Chem-Bio-Radiation interaction

3.6 MEDICAL R&D REQUIREMENTS ASSESSMENT

ISSUE: DoD lacks FDA licensed vaccines against BW threat agents.

SOLUTION: DoD has established a prime systems contract for the Joint Vaccine Acquisition Program. The program establishes a single entity to develop, procure, and stockpile vaccines for protection against BW agents. The contractor will be required to obtain and maintain FDA licensure and will also be responsible for clinical trials.

The prime systems contract was awarded in November 1997 and begins with a base contract for the licensure of three Biological Defense vaccine products: Q fever, Tularemia, and Vaccinia, and the storage of the current contingency BD vaccine stockpile (IND products). There are options for the development and licensure of fifteen other BD vaccines, with production options for all eighteen. The period of performance for this contract is ten (10) years.

ISSUE: Anthrax vaccine issues. Anthrax vaccination currently requires a primary series, six dose regimen spaced out over the course of 18 months, with an annual booster to maintain immunity. The timetable for the vaccination series makes it difficult to complete before deployment of forces or to ensure that mobile forces, once deployed, are administered the proper regimen.

SOLUTION: On December 15, 1997, the Secretary of Defense announced the decision to systematically vaccinate all U.S. military personnel against anthrax. Vaccinations would start only after the following conditions are met:

- Supplemental testing be performed, consistent with FDA standards, to assure sterility, potency, and purity of the vaccine
- Implementation of a system for fully tracking personnel who receive the vaccinations
- Approval of operational plans to administer the immunizations and communications plans to inform military personnel of the program
- Review of health and medical issues of the program by an independent expert.

Current plans call for personnel serving in high threat regions to receive vaccinations beginning in summer 1998. Total force vaccination will follow according to a schedule to be developed. This decision is crucial for developing a strategy to maintain the industrial base capability for vaccine production.

Currently, the sole FDA-licensed producer of anthrax vaccine for DoD is Michigan Biologic Products Institute (MBPI) in East Lansing, Michigan. The State of Michigan plans to divest itself from MBPI by February 18, 1998. The State intends to privatize the facility, and some commercial companies have expressed interest. (MBPI produces other medical products in addition to anthrax vaccine.) A condition of the sale includes

conveying current DoD contracts to the new owner.

However, a recent FDA audit found MBPI deficient in some areas of regulatory compliance, jeopardizing its FDA-licensure. Due to the evolution of stringent regulations, licensure of a new facility for anthrax vaccine production would delay the program prohibitively. Therefore, JPO-BD worked with the manufacturer to develop a strategic plan that would ensure its continued capability to produce anthrax vaccine and to maintain FDA licensure.

ISSUE: The effects on humans resulting from exposure to low doses of chemical agents, particularly organophosphate (nerve) agents, are not clearly understood.

SOLUTION: Beginning in FY96, DoD, in association with the Research Working Group of the Interagency Persian Gulf Veterans' Coordinating Board, dedicated \$5 million to evaluate the chronic effects of low-dose level exposure to chemical agents. Studies have been under way since 1QFY97 to develop highly specific and sensitive assays, preferably forward deployable, to detect, and potentially quantify, low-level exposure to chemical agents. These ongoing studies may also identify any long-lasting and toxic metabolites of chemical agents which could account for delayed and long-term health consequences. In addition, studies to look at the impact of possible genetic polymorphisms of cholinesterase enzymes upon individual response to nerve agents are under way. Additional funds have been committed and contracts are being awarded to evaluate potential chronic health complaints resulting from exposure to nerve agents. These contracts will begin in 1QFY98.

ISSUE: Radiation exposures below a level that causes acute effects predispose military personnel to injury from other battlefield agents. The magnitude of this interaction has not been fully evaluated.

SOLUTION: Definitive assessment of NBC threat interactions and NBC agent modeling will support the strategic design and development of specific preventative and treatment countermeasures.

(INTENTIONALLY BLANK.)

CHAPTER 4

NUCLEAR, BIOLOGICAL AND CHEMICAL DEFENSE LOGISTICS STATUS

(INTENTIONALLY BLANK.)

4.1 INTRODUCTION

Since Operation Desert Shield/Storm, the logistical readiness of NBC defense equipment has improved. The Services have increased stockage of most NBC defense equipment, and the overall requirements have decreased as a result of a smaller force. Both factors have improved the overall DoD readiness and sustainment status. Asset visibility initiatives continue to increase the ability to manage what is becoming an increasingly joint collection of NBC defense end items and consumables. A number of items continue to pose a moderate to high risk challenge due to low inventories and continued modernization efforts.

The DoD Chemical and Biological Defense Program jointly manages the research, development, and procurement of major items of NBC defense equipment. Consumable NBC defense items are managed by the Services and the Defense Logistics Agency (DLA) in accordance with Title X responsibilities of the Services, and the desire of the Services to manage their own operations and maintenance funds. Under the provisions of Title X of the FY95 Defense Authorization Act, Service Secretaries are responsible for, and have the authority to conduct, all affairs of their respective departments including supplying, researching, developing, training, and maintaining equipment. Research, development, and procurement of NBC defense items are funded through defense-wide funding accounts. The existence of defense-wide (rather than Service-specific) funding accounts has ensured the joint integration of NBC defense programs. However, no defense-wide (that is, joint) funding mechanism exists for the NBC defense logistics area. Because of this, the *joint* NBC defense community is limited to tracking the status of DoD NBC defense logistics sustainment and making recommendations to correct funding shortfalls.

The Joint Service Materiel Group (JSMG) coordinates logistics issues. The JSMG, established by the Joint Service Agreement (JSA), works to ensure a smooth transition through the phases of NBC defense equipment life cycles. It is also charged with developing and maintaining an annual Joint Service NBC Defense Logistics Support Plan (LSP). This LSP forms the basis for the analysis found later in this chapter.

Perhaps the most influential effort undertaken in FY97 was the Joint Chemical Defense Equipment Consumption Rates (JCHEMRATES) IV study. This study is being sponsored by the Army's Office of the Deputy Chief of Staff for Logistics (ODCSLOG) and executed through the U.S. Army Concepts Analysis Agency (CAA). The goal of the JCHEMRATES study is to define the parameters of future chemical warfare scenarios and determine the consumption rates for consumable DoD chemical defense equipment. Using the current Defense Planning Guidance and Quadrennial Defense Report, the JCHEMRATES study is developing consumption rates for the two Major Theater War (MTW) scenario. These consumption rates will include both medical and non-medical chemical defense items for each Service and overall DoD roll-ups for both scenarios. Once validated by the Services, these rates will form an important basis for determining future Service purchases and their readiness to go to war. As of the writing of this document, the JCHEMRATES IV study results are still draft.

Three problems remain from last year regarding the accountability and management of NBC defense item inventories:

- The Services continue to have very limited asset visibility of consumable NBC defense items below the wholesale level. This has the full attention of the senior NBC defense managers. The completion of this effort is based on the progress of the DoD Total Asset Visibility (TAV) project.
- While the Defense Acquisition Board (DAB) tasked the Joint NBC Defense Board to recommend a secondary item procurement policy, the Services still procure consumable NBC defense items through multiple, separate, and distinct funding authorizations, as discussed in Section 4.6 of this chapter. There continues to be a shortfall of specific NBC items when measured against DoD requirements of a two MTW scenario.
- The process by which the Services and DLA fund and store war reserve materiel has been hampered by differing definitions, different deployment strategies, and a lack of validated requirements for jointly managed items. JCHEMRATES IV, once validated, will create a solid foundation for providing a basis for the common planning of future requirements.

The JSMG developed its second Joint Service NBC Defense Logistics Support Plan during 1997. This report focused on identifying the current on-hand stores of the Services' and DLA's NBC defense equipment, and matching these numbers against the requirements generated from the recently completed draft JCHEMRATES IV study. The LSP's aim is to identify the Services' readiness and sustainment capability, maintenance sustainment, and industrial base issues in the area of NBC defense. The Service/DLA data call conducted for the LSP was used to support the findings in this chapter.

4.2 NBC DEFENSE LOGISTICS MANAGEMENT

NBC defense logistics management remains in transition. The Joint NBC Defense Board has begun to exercise full authority in this area, and the JSMG, which reports to the Joint NBC Defense Board, has been charged with coordinating and integrating logistics readiness. The JSMG's role is to identify current readiness and sustainment quantities in the DoD NBC logistics status, with respect to the two MTW scenario outlined in the Quadrennial Defense Review.

As currently planned, all Services retain "starter stocks" of NBC defense equipment that will support immediate deployments and initial operations. The length of time that these stocks will last each unit depends on the respective parent Service. Air Force units deploy with 30 days of NBC defense consumables. Army divisions use a planning figure of 45 days, while Marine Corps forces and Navy shore units use 60 days as the basis for their plans. Navy ships store up to 90 days of starter stocks. In most cases, the Services will first redistribute any available uncommitted assets to provide sustainment before sourcing elsewhere. Once these starter stocks are depleted, the military force turns to the DoD NBC defense item managers for "swing stocks," also known as "sustainment stocks."

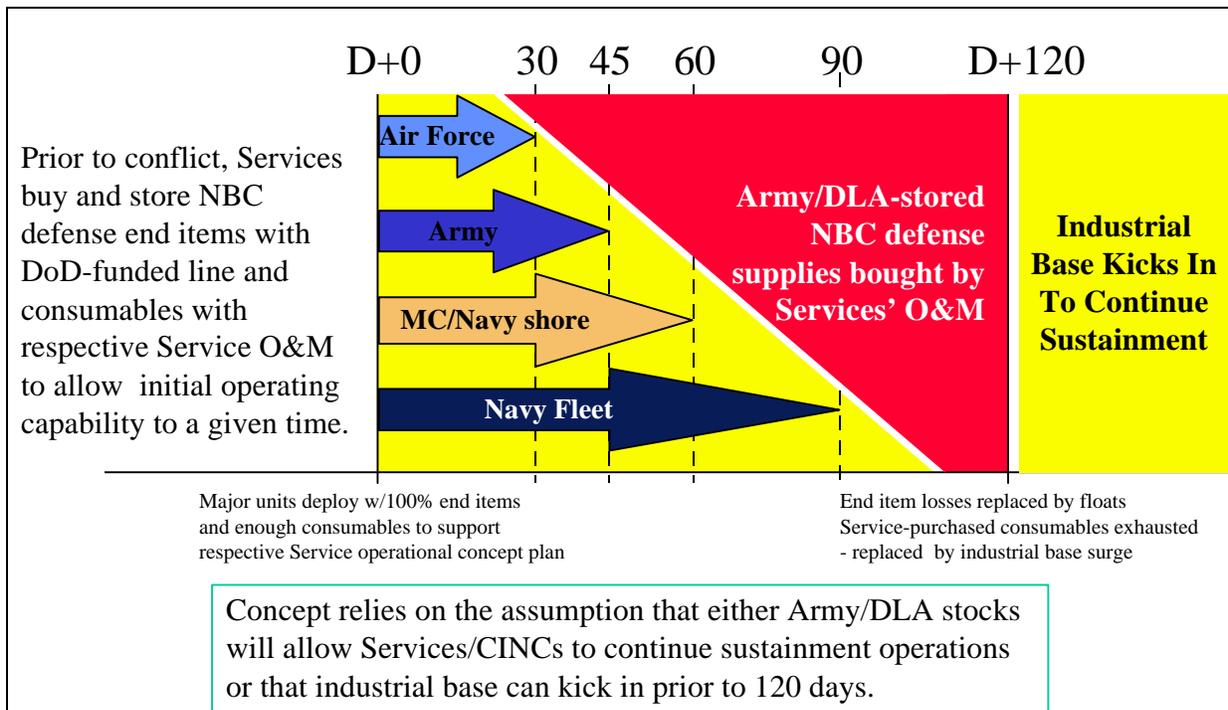


Figure 4-1. War Reserve Requirements and Planning

DLA and the Army Materiel Command (AMC) are the items managers, or National Inventory Control Points (NICP), for the vast majority of NBC defense items in all four Services. They are responsible for industrial base development, acquisition, and storage of wholesale peacetime and sustainment wartime stocks. They buy (process procurement actions) and, if requested, store NBC defense materiel (swing stocks) for the Services. However, the Services must provide funding to DLA and AMC for the procurements.

Currently, only Army owned sustainment stocks are stored in DLA and AMC depots, providing limited back-up for deployed forces during a contingency. Because of a lack of visibility of NBC defense items, unclear wartime requirements (given the post-Cold War environment), scarce Operations and Maintenance funds, and low priorities given to NBC defense stocks, the current quantity of DLA and AMC NBC defense war reserves have been reduced and will not support sustainment requirements during a full two MTW scenario. These numbers are reflected in the tables of this chapter.

Service inventories of NBC defense items maintained at unit level use either manual records or a semi-automated tracking system. Stocks held at wholesale level are maintained using a separate automated system. Currently, there is little connectivity between the two systems. For example, the Air Force established the Mobility Automated Inventory Tracking System (MAITS) to provide a semi-automated tracking system for chemical warfare defense equipment (CDE) items. MAITS has provided for increased Air Force staff asset visibility for installation CDE stocks, but it does not provide information flow directly into the wholesale

databases. This system will, however, provide an interim Air Force CDE logistics tracking net until current Air Force automated databases are linked under the DoD Total Asset Visibility (TAV) program. While other Services' sub-automated databases have different names, their problems are similar. As a result, there is limited Service level asset visibility for NBC defense items. The Services are addressing this deficiency under the auspices of TAV, a long-term initiative which will link existing DoD logistics automated systems.

Both DLA and AMC will remain key players in the future NBC defense logistics management system. The Joint NBC Defense Board, through the JSMG, provides coordination and integration based upon the input of all Services' and commanders-in-chief's (CINCs'). DLA and AMC will continue to provide services such as raw data collection, inventory control, and a distribution infrastructure. Upon the validation of JCHEMRATES IV, the Services and DLA can immediately begin plans to improve their readiness and sustainment status based on a common understanding of post-Cold War requirements.

4.3 QUANTITIES, CHARACTERISTICS, AND CAPABILITIES

The results of the data collection efforts are compiled in Tables 4-2 through 4-5 in Appendix 1, Logistics Readiness NBC Report Data, located at the end of this chapter. A table is included for each of the four Services and DLA.

The items listed under "Nomenclature" in Tables 4-2 through 4-5 of Appendix 1 are the currently fielded NBC defense items in the Services. "Total Service Requirements" include the quantity required for the entire Service, and includes peacetime replacements (wear and tear) and training. The two MTW requirement quantities are those computed by the draft JCHEMRATES IV study. This number represents an average expenditure calculated among four scenarios: chemical defense equipment expenditures under low chemical weapons use during favorable and marginal weather conditions; and of chemical defense equipment expenditures of high chemical weapons use during favorable and marginal weather conditions. All sets of conditions were run for the North-East Asia and South-West Asia scenarios. Wartime requirements for all four Services include materiel requirements to support active duty, reserve, and National Guard forces. Materiel requirements for training and peacetime replacements are *not* included in the wartime requirements.

The "Stocks On-Hand" represent the total of all serviceable NBC defense materiel available in each of the Services (stocks positioned with troops, stocks in the supply system and stocks stored in depots/facilities). This number includes quantities for which a Service or agency has submitted a funded requisition or purchase order in FY97, but has not received the requisitioned items. Finally, the quantities depicted as "Projected Due-Ins" are quantities the Services plan to buy to replace peacetime consumption of NBC defense assets (to include training use and shelf-life expiration), and to buy wartime sustainment stocks. It must be emphasized that these numbers are based on major command estimates of requirements. Actual procurements will be based on available funding.

4.4 LOGISTICS STATUS

During data collection for the FY97 report, information on the inventory status of fielded NBC defense equipment was compiled. From this data, we requested data for 108 fielded items. NBC defense items such as batteries, spare parts, and sub-components were considered a subset of the primary item for risk assessments, and hence not reviewed separately. Trainers were not included in the assessment process, since they do not reflect wartime service requirements. We then compared quantities required for wartime needs to quantities currently on-hand. Characteristics and capabilities of selected fielded NBC defense items are discussed in detail in Annexes A-D of this report. The following items have been added to the FY97 report:

- Chemical Protective Undergarment (CPU)
- M45, M48 and M49 Protective Masks
- Biological Integrated Detection Suite (BIDS)
- M90 Chemical Warfare Agent (CWA) Detector
- Chemical-Biological Protective Shelter (CBPS)
- M51 Shelter System

Of the 108 items extensively reviewed, we developed risk assessments for 46 items based on data gathered as of 30 September 1997 (see Table 4-1). These items were singled out because of their critical role or their ability to represent the general state of their respective commodity area. While some of the items assessed changed from the previous year's report due to obsolescence, assessed items remained as constant as possible to provide for a trend analysis. These were rated as being in a low, moderate, or high risk category. "Risk" is defined as the probability that a shortage in the wartime requirement would exist, severely impacting DoD's ability to respond to a contingency. Shortages were calculated by comparing wartime requirements (draft JCHEMRATES IV average requirements) to on-hand quantities, as shown in Tables 4-2 through 4-5.

RISK ASSESSMENT:

Low –	Services have at least 85 percent of wartime requirement on-hand to support two nearly simultaneous major theater wars
Moderate –	Services have between 70 to 84 percent of wartime requirement on-hand to support two nearly simultaneous major theater wars
High –	Services have less than 70 percent of wartime requirement on-hand to support two nearly simultaneous major theater wars

Table 4-1 provides the results of the assessment. Programs rated as high or moderate risk are discussed in greater detail in Appendix 2. A three-year comparison of data assessments is shown in Figure 4-2. In comparison to FY96 report data, the percentage of the FY97 report's items in the low risk category increased from 56% to 61%. The percentage of items in moderate risk increased from 9% to 17%, while the percentage of items in the high risk category decreased from 35% to 22%.

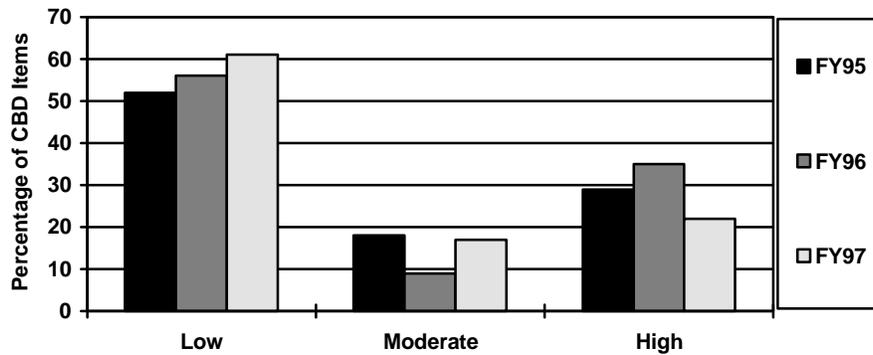


Figure 4-2. Logistic Risk Assessments: 46 NBC Defense Items

While there are only minor changes overall, the following items are highlighted:

- The status of M8A1 chemical agent detectors remains at high risk. Its successor, the M22 ACADA, is not being procured in quantities to supplement the shortage to a degree that would permit a moderate risk assessment in the short term.
- The M272A1 Water Testing Kit and M274 Marking Kit are in short supplies (high and moderate risk respectively). Both these items are not often used in peacetime.
- While quantities of BDOs appear adequate, the shelf life of much of the BDO inventory is reaching its end. The recent plus-up of procurement funds for protective suits has aided in plans to transition to the JSLIST program. As a result, the BDO risk has been re-assessed as low.
- CWU 66/77P remains the only Air Force capability for air crew ensembles with the end of the CP undercoverall procurement, and are assessed at high risk. Inadequate funds and the lack of an established procurement contract hamper the ability to correct this assessment in the short term.
- The collective protection area is assessed as high risk at this time, in part due to the continued emphasis on contamination avoidance and individual protection which overshadows this area. As the procurement cycle in these two latter areas matures, the risk assessment of collective protection systems will lessen slightly.
- While the M291 and M295 Decontamination Kits are assessed as posing a moderate risk, the inventory shortage of the M291 kits are offset by inventory of M258A1 Decontamination Kits. This resulted in a low risk assessment. The status of the M295 kits will improve as procurement funds are released.
- The risk status of medical chemical defense materiel has improved due to lower calculated wartime requirements (JCHEMRATES IV) and planned procurements increasing the past inventory. The shortage of NAAKs can be supplemented with existing supplies of atropine and 2-PAM autoinjectors, reducing its risk from moderate to low.
- The recent award of a prime systems contract for the Joint Vaccine Acquisition Program (JVAP), combined with adequate stores of vaccine for the major BW threats, resulted in a lowering of the risk category from high to moderate risk. Continued vigilance is necessary to ensure that the contractors retain a FDA-approved capability to produce and store vaccines in quantities required to protect the force.

Table 4-1. Logistic Risk Assessments: 46 NBC Defense Items

CONTAMINATION AVOIDANCE/DETECTION EQUIPMENT

Items	Risk Assessment	Remarks
M256A1 Chemical Agent Detector Kit	Low	Shelf life expiration may reduce stocks sharply Procurement curtailed. M22 ACADA will supplement Low inventory; still fielding
M8 Detection Paper	Low	
M8A1 Automatic Chemical Agent Alarm	High	
M1 Chemical Agent Monitor (CAM)/Improved CAM	Moderate	
Chemical Agent Point Detection System (CAPDS)	Low	
AN/KAS-1 Chemical Warfare Directional Detector	Low	
M21 Remote Sensing Chemical Agent Alarm (RSCAAL)	High	
M93A1 NBC Reconnaissance System "Fox"	High	
M272A1 Water Testing Kit	High	
M274 NBC Marking Set	Moderate	
Biological Integrated Detection System (BIDS)	High	Low inventory; still fielding

INDIVIDUAL PROTECTION

Items	Risk Assessment	Remarks
<i>Masks</i>		
MCU-2/P-series Mask	Low	USAF/USN mask
M40-series General Purpose Mask	Low	USA/USMC mask
M42-series Tank Mask	Moderate	Replaces M25A1 mask; still fielding
M48 Apache Mask	Moderate	Replaces the M43A1 mask; still fielding
MBU-19/9 Aircrew Eye/Resp. Protection (AERP)	Low	Replaces MBU-13/P; still fielding
<i>Suits</i>		
JSLIST (Adv. BDO)	Moderate	In process of fielding to all Services
Battle Dress Overgarment (BDO)	Low	Being replaced by JSLIST
Saratoga Suit	Low	No further production - being replaced by JSLIST
CWU 66/77P	High	Low inventory; augmented by USAF CPU
Chemical Protective Undercoverall	Low	
Mark III Suit, CP, OG	Low	No further production - being replaced by JSLIST
Aircrewman Cape	Low	
<i>Gloves/Overboots</i>		
Chemical Protective Gloves (7/14/25-mil)	Low	
Green/Black Vinyl Overshoes (GVO/BVO)	Low	Risk lowered due to CP footwear cover stocks
Chemical Protective Footwear Covers	Low	Replaced by GVO/BVO
Disposable CP Footwear Covers	Low	
CP Socks	Low	Phase-out item

Note - Only selected Low Risk programs are displayed for information purposes.

COLLECTIVE PROTECTION

Items	Risk Assessment	Remarks
M20A1 Simplified Collective Protective Equipment (SCPE)	High	Low inventory
Portable Collective Protective System (PCPS)	Moderate	Low inventory
M48A1 General Purpose Filter	High	Low inventory
Filter For (M59, M56, Shipboard)	High	Low inventory

Table 4-1. Logistic Risk Assessments: 46 NBC Defense Items (continued)

DECONTAMINATION EQUIPMENT

Items	Risk Assessment	Remarks
M258A1 Skin Decontamination Kit	Low	Replaced by M291
M291 Skin Decontamination Kit	Low	Risk lowered based on M258A1 stocks Low inventory
M295 Individual Equipment Decontamination Kit	High	
M11 Decontaminating Apparatus	Low	
M13 Decontaminating Apparatus	Low	
M17A3 Lightweight Decontamination System	Low	
M12A1 Power Driven Decontamination Apparatus	Moderate	Risk increased due to maintenance rqmts
A/E32U-8 Decontamination System	Low	

MEDICAL DEFENSE

Items	Risk Assessment	Remarks
Mark 1 Nerve Agent Antidote Kit (NAAK)	Low	Risk lowered based on autoinjector stocks
Atropine Autoinjector	Low	
2-PAM Chloride Autoinjector	Low	
Nerve Agent Preventative Pyridostigmine (NAPP) Tablet	Low	
Convulsant Antidote Nerve Agent (CANA) Autoinjector	Low	
Biological Warfare Vaccines	Moderate	Prime contract awarded for development, production, FDA licensure, and storage

Note - Only selected Low Risk programs are displayed for information purposes.

Based on the average two MTW requirements identified in the draft JCHEMRATES IV study, the Services continue to exhibit shortages in certain critical areas. Shortages of chemical and biological agent detection systems, collective protection shelters and their respective filters, and biological warfare vaccines may have a serious impact on the joint force’s ability to survive and sustain combat operations under NBC warfare conditions operating in two nearly simultaneous MTWs. The extent of the operational impact of NBC defense equipment shortages is under review in several classified studies.

4.5 PEACETIME REQUIREMENT

In peacetime, quantities of NBC defense equipment are necessary to train personnel in NBC defense and to build confidence that NBC equipment will provide the necessary protection when used correctly. The two most critical areas of peacetime stocks are individual protective equipment and medical chemical defense materiel.

Individual protection equipment is maintained at the unit level. Generally, items used in peacetime for training are drawn from wholesale stocks, requiring units to maintain both training and contingency stocks. For selected items, such as protective clothing, contingency utility is lost when the item is used (or consumed) for training. Because peacetime training requirements are met in this manner, major commands do not track training equipment in their estimates of on-hand requirements. The Services, however, have indicated that adequate NBC defense equipment is on-hand to conduct training.

Individual medical chemical defense materials [*i.e.*, Nerve Agent Antidote Kits (NAAK), Convulsant Antidote Nerve Agent (CANA), Nerve Agent Pyridostigmine Pretreatment (NAPP) tablets, or more commonly Pyridostigmine Bromide (PB) Tablets] are no longer stored at the unit level (with the exception of those items in sets, kits, and outfits). The Army Medical Department centrally funds and manages these items for units in Division Ready Brigade (DRB) sets. To date, 20 DRB sets have been strategically fielded worldwide. In addition, six DRBs are maintained by the manufacturer (three sets for contingencies and three sets for training. The DRB set contains 15,000 each of NAAK, 5,000 each of CANA, and 1,000 packages of PB tablets. These sets will be issued to deploying units at the direction of the Office of the Surgeon General/Department of the Army Office of the Deputy Chief of Staff for Logistics. One DRB set contains the appropriate individual medical chemical defense materiel for 5,000 personnel. Components of the DRB sets are stored separately since PB tablets must be refrigerated and CANA requires secured storage. Due to the current “investigational new drug” status of the PB tablets, this component will not be issued to units without prior approval from Headquarters, Department of the Army.

4.6 FUNDING

In accordance with the NBC defense management initiatives outlined in Chapter 1, funding of RDT&E and procurement was centralized in a DoD defense-wide account beginning in FY96. However, operations and maintenance (O&M) funding for NBC defense materiel is not consolidated at the DoD level. Therefore, for non-major (secondary) end items (*e.g.*, consumables such as decontamination kits, detection kits, and filters), each Service continues to separately fund replenishment and sustainment of NBC defense equipment. Depot maintenance and contractor logistics support for some low density major items are also O&M funded. These appropriations are not included in the joint NBC defense program.

Funding of NBC defense items classified as war reserves secondary items (WRSI) remains a significant issue. The Services are responsible for developing the requirements and funding items in war reserve stocks. Funding of WRSI comes from Congressional appropriations made into the Working Capital Fund (WCF) from the transfer of Services’ O&M funds. For example, replenishment of NBC defense items in Army war reserves will require substantial funding from 1999 through 2006 as these items reach their maximum extended shelf lives. Funding will be required to replace the Army’s current inventory of BDOs with the Joint Service Lightweight Integrated Suit Technology (JSLIST). The Marine Corps, through its normal requirements generation and acquisition process, was able to obtain 100% war reserve of Saratogas for initial projected war reserves requirement. However, when basing their war requirements on JCHEMRATES III, the Marine Corps has a shortage of 500,000 suits (JCHEMRATES III calculations were used as JCHEMRATES IV is not formally accepted as of this report). The recent plus-up of funds for protective suits will assist in building an initial stockage and minimum sustainment (war reserve) stock to meet the current defense planning guidance.

Under the current acquisition procedures and DoD guidance to minimize wholesale stockpiles, procurements are based only on funded Service requisitions. The Services remain responsible for program funding to replace NBC defense equipment wartime stocks. Procurement is usually based on economic buy quantities (a consolidation of all Service requisitions) to provide the best value to the government. Some procurements, however, suffer significant delays in delivery because of the time required to accumulate sufficient requisitions to produce economic buy quantities. This situation occurs when item managers try to plan purchases of consumable items that have a low peacetime consumption but high wartime consumption (such as decontamination kits, large collective protection filters and M256A1 detector kits). The result is a low purchasing history with a small industry production capability, which in turn causes a very low war reserve status with minimal industry surge capability. The draft JCHEMRATES IV model will identify more accurate requirements on which the Services can base their planning, once the study is validated and approved.

4.7 INDUSTRIAL BASE

While the sector is improving, vulnerabilities still exist. Operation Desert Storm highlighted a case in which the industrial base did its best to keep spares and repair parts available yet, there were critical shortages in protective clothing, filters, medical supplies, and batteries for chemical defense equipment. Collective protection systems (filters in particular) continue to be the most critical subsector in the NBC defense area. Additionally, protective clothing procurement continues to receive intense scrutiny due to the possibility of industrial base shortfalls in satisfying requirements during a contingency. The reluctance of pharmaceutical industries to support DoD CB defense medical programs, coupled with a lack of government vaccine production, represents a serious medical industrial base shortcoming.

These assessments indicate that the NBC defense industrial base sector is primarily supported by small- to medium-sized highly specialized companies dedicated to producing military unique products with little or no commercial utility. These companies have become dependent on Service demands and sales for their financial survival. Selected NBC defense items (BDOs, chemical gloves, and nerve agent autoinjectors) have been designated as critical to combat operations because of low peacetime demand, high wartime use, and the fragile supporting industrial base. As a result, DLA established, with OSD approval, a “War Stopper” program to sustain key industrial base capabilities, utilizing industrial preparedness funding under PE 07080110.

The Quadrennial Defense Review (QDR), *Proliferation: Threat and Response*, and other reports and studies highlight the continued threat of NBC warfare. Despite the end of the Cold War, a smaller DoD force, and subsequently reduced requirements for NBC defense items, low purchases of NBC defense consumables continue to threaten the industrial viability of this sector. Currently a Joint Service Industrial Base Integrated Product Team (IPT), consisting of DLA, AMC, DoD, and the Services, is developing approaches to sustain key and critical manufacturing processes and capabilities to ensure that the industrial base can produce sufficient quantities of NBC defense items prior to or during a major theater war. Specifically, the IPT is conducting assessments on thirty fielded consumable items, and determining whether sufficient

technological and industrial capabilities will be available to meet planned DoD developmental and production requirements.

4.8 NBC DEFENSE LOGISTICS SUPPORT ASSESSMENT

ISSUE: DoD lacks a joint, integrated system to maintain asset visibility of NBC defense equipment below wholesale level, and lacks a standardized war reserve program for NBC defense equipment. Resourcing the procurement and sustainment of wartime stocks of individual protective equipment, decontamination kits, and detector kits remains the responsibility of the Services.

SOLUTION: DoD established the requirement for asset visibility and reviewed existing systems and procedures, both for peacetime reporting and war time reporting. The Services and DLA are addressing the NBC defense asset visibility deficiency under the auspices of the Total Asset Visibility initiative.

During 1997, all four Services participated in the development of the JCHEMRATES IV study, which is providing a more accurate prediction of the initial issue and sustainment quantities required for each Service. The use of this common methodology will allow the presentation of Joint Service requirements in future reports and facilitate improved joint logistics management.

The Department of Defense continues to pursue innovative strategies to maintain a responsive industrial base, especially those strategies that decrease industry reliance on DoD procurement for industrial base survival. Strategies may include tapping into independent research and development (IR&D) conducted by universities and corporations, increasing reliance on dual-use technologies, and pursuing strategies that will encourage companies to decrease dependency on DoD requirements for their survival.

(INTENTIONALLY BLANK.)

APPENDIX 1.
**BREAKOUT OF SERVICE WAR REQUIREMENTS, STOCKS ON-HAND,
AND PLANNED ACQUISITIONS**

The following tables display NBC defense equipment wartime requirements, stocks on-hand quantities to include FY97 quantities on contract, and FY98–99 planned procurements for each of the four Services and Defense Logistics Agency. As mentioned earlier in this chapter, the two MTW requirements are based on the average requirements developed under the draft JCHEMRATES IV study. This study has not yet been approved, but is anticipated in April 1998.

Portions of these charts remain blank. There are cases where the Services elect not to track certain items of NBC defense equipment (especially low-cost high-volume consumables), and therefore it is difficult to identify precise on-hand quantities. This asset visibility issue has been discussed earlier in this chapter. In the case of end items, the JCHEMRATES study did not develop end item wartime requirements; if the Services knew a wartime estimate of end items, that number was used. In the case of consumables, some Services chose not to indicate total service requirements as this figure is highly dependent upon major subordinate commands' annual peacetime requirements. The Services continually update these data call sheets on a frequent basis and consider these fluid worksheets rather than a static set of figures. The Services and DLA are working through the FY98 Joint Service NBC Defense Logistics Support Plan to update all figures and to provide 100% of the information required for logistics readiness and sustainment assessments.

(INTENTIONALLY BLANK.)

Table 4-2a. Army Logistics Readiness Data - Nonconsumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS					
					FY98	FY99	FY00	FY01	FY02	FY03
INDIVIDUAL PROTECTION COMMODITY AREA										
<i>CB MASK</i>										
MASK, CB, M17A2	4240-01-143-2017-20	32,0214	0	806,211	0	0	0	0	0	0
MASK, CB, M40/M40A1	4240-01-258-0061-63	796,547	588,854	309,663	48,000	46,076	0	0	0	0
MASK, M24, AVIATOR	4240-00-776-4384	11,166	0	22,593	0	0	0	0	0	0
MASK, M25A1, TANK	4240-00-994-8751-52	19,494	0	93,635	0	0	0	0	0	0
MASK, M42, TANK	4240-01-258-0064-66	95,774	64,060	48,833	105,089	119,987	48,443	0	0	0
MASK, M43, APACHE	4240-01-208-6966-69	3,500	2,215	2,340	0	0	0	0	0	0
MASK, M45, AVIATOR	4240-01-141-4034-52	22,591	13,454	13,043	9768	3500	0	0	0	0
MASK, M48, APACHE	4240-01-386-0198	2,215	1,836	0	2,215	0	0	0	0	0
MASK, M49	4240-01-413-4095-99	1,003	0	16	1,003	0	0	0	0	0
<i>MISC PROTECTION</i>										
PATS, M41	4240-01-365-8241	6,273	3,334	1,875	912	896	949	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
<i>BIOLOGICAL DETECTION EQUIPMENT</i>										
BIDS, M31	6665-01-392-6191	210	85	45	14	28	21	20	0	0
LR-BSDS, M34	6665-00-422-6605	12	10	4	0	0	4	4	3	0
<i>CHEMICAL DETECTION EQUIPMENT</i>										
ACADA, M22	6665-01-348-6963	28,839	28,839	0	1,722	2,151	3,269	3,599	0	0
ALARM, CAA, M8A1	6665-01-105-5623	37,247	28,000	25,215	0	0	0	0	0	0
CAM/ICAM	6665-01-357-8502	15,636	12,000	9,532	2,020	1,047	1,571	1,518	0	0
M21 RSCAAL	6665-01-334-6637	195	156	162	0	0	0	0	0	0
NBC RECON SYS, M93A1	6665-01-372-1303	211	195	57	12	11	0	0	0	0
DECONTAMINATION COMMODITY AREA										
DECON APPAR, M11	4230-00-720-1618	118,000	118,000	108,870	0	0	0	0	0	0
DECON APPAR, M13	4230-01-133-4124	136,150	136,150	178,532	0	0	0	0	0	0
DECON APPAR, PDDA, M12A1	4230-00-926-9488	804	804	1,000	0	0	0	0	0	0
L/WT DEC SYS, M17A1	4230-01-303-5225	2,511	2,511	2,149	30	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
SHELTER, CB PROTECT	5410-01-441-8054	1,253	792	9	83	37	34	36	40	40
SHELTER, CP, M20/M20A1	4240-01-166-2254	1,747	1,747	687	3	0	0	0	0	0
SHELTER, M51	4240-00-854-4144	337	337	161	0	0	0	0	0	0

Table 4-2b. Army Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
INDIVIDUAL PROTECTION COMMODITY AREA						
<i>OVERGARMENTS</i>						
CHEM PROT UNDERGARMENT	8415-01-363-(8692-8700) 8415-01-363-(8683-8691)		262,149	150,062	0	0
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902		2,962,127	0	113,500	76,125
SCALP (TAN AND GREEN)	8415-01-364-(3320-3322) 8415-01-364-(3458-3460)		80,385		0	0
SUIT, CP CAMO (BDOs)	8415-01-137-1700-07		0	3,350,396	0	0
<i>OVERBOOTS/GLOVES</i>						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85		3,480,192	1,518,501	0	0
CP FOOTWEAR COVERS	8430-01-021-5978		0	410,470	0	0
CP GLOVES 7 MIL	8415-01-138-2501-04		171,546	123,509	0	0
CP GLOVES 14 MIL	8415-01-138-2497-00		686,184	240,120	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20		4,354,078	5,867,799	0	0
<i>MISC PROTECTION</i>						
2D SKIN, M40 SERIES	4240-01-413-1540		193,938	0	0	0
CP HELMET COVER	8415-01-111-9028		1,884,458	2,568,799	0	0
FILTER CAN, C2A1	4240-01-361-1319		325,108	1,355,690	409,021	0
FILTER CAN, M10A1	4240-00-127-7186		0	101,120	0	0
FILTER ELEMENT, M13A2	4240-00-165-5026		0	549,554	0	0
HOOD, M40	4240-01-376-3152		1,987,571	2,020,283	46,055	0
HOOD, M5 (FOR M25A1)	4240-00-860-8987		0	36,177	0	0
HOOD, M6A2 (FOR M17)	4240-00-999-0420		0	526,647	0	0
HOOD, M7 (FOR M24)	4240-00-021-8695		0	41,384	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
<i>CHEMICAL DETECTION EQUIPMENT</i>						
DET KIT, M256A1	6665-01-133-4964		33,261	85,089	18,345	0
DET PAPER, M8	6665-00-050-8529		905,141	1,601,190	0	0
DET PAPER, M9	6665-01-226-5589		1,098,158	676,629	275,522	0
MAINT KITS, M293/M273	5180-01-379-6409 5180-01-108-1729		397,995	2,141	0	0
NBC MARK SET, M274	9905-12-124-5955		6,244	5,209		0
WATER TEST KIT, M272A1	6665-01-134-0885		12,054	6,673		0
DECONTAMINATION COMMODITY AREA						
DECON KIT, M258A1	4230-01-101-3984		0	250,727	0	0
DECON KIT, M291	4230-01-276-1905		181,175	46,325	32,168	0
DECON KIT, M295	4230-01-357-8456		181,148	3,976	6,225	0
DS2, 1 1/3 QT	6850-00-753-4827		29,864	207,073	0	0
DS2, 5 GAL	6850-00-753-4870		343,051	315,490	0	0
DS2, M13 CAN	4230-01-136-8888		83,529	35,000	0	0
STB	6850-00-297-6653		16,834	47,380	0	0
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, CP M12A2 (M14 GPFU)	4240-01-365-0981		1,326		0	0

Table 4-2b. Army Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
FILTER, CP M13 SERIES (M14 GPFU)	4240-00-368-6291		1,326	4,733	0	0
FILTER, CP M18A1	4240-00-365-0982		6,136	11	0	0
FILTER, CP M19	4240-00-866-1825		3,627	11,289	0	0
FILTER, GP M48A1	4240-01-363-1311	9,600	936	208	9600	0
FILTER SET FOR (M59, M56, SHIPBOARD)	4240-01-369-6533		177	86	0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	293,173	385,339	1,109,549	0	0
ATROPINE AUTOINJ	6505-00-926-9083	994,541	385,339	663,700	0	0
CANA AUTOINJ	6505-00-274-0951	847,927	95,044	361,651	153,314	348,536
NAAK, MKI	6705-01-174-9919	2,784,711	456,328	384,184	311,525	0
PYRIDOSTIGIMINE TAB	6505-01-178-7903	326,522	36	171,742	293,243	0

Table 4-3a. Air Force Logistics Readiness Data - Non-Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS					
					FY98	FY99	FY00	FY01	FY02	FY03
INDIVIDUAL PROTECTION COMMODITY AREA										
CB MASK										
MASK, AERP	8475-01-339-9782(S)	29,879	15,243	20,542	6,628	212	0	0	0	0
MASK, CB, M17A2	4240-01-143-2017-20	1,525	1,520	2,450	0	0	0	0	0	0
MASK, MCU-2/P, MASK, MCU-2A/P AND MASK, MCU-2A/P (WR) USAF	4240-01-415-4239-41 4240-01-284-3615-17 4240-01-327-3299-01	345,856	30,583	311,655	20,464	3,647	0	0	0	0
MISC PROTECTION										
PATS, M41	4240-01-365-8241	1,208	1,160	316	3	889	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
CHEMICAL DETECT EQUIP										
ACADA, M22	6665-01-348-6963	405	405	113	231	1	0	0	0	0
ALARM, CAA, M8A1	6665-01-105-5623	343	331	218	38	4	0	0	0	0
CAM/ICAM	6665-01-357-8502	104	108	75	4	4	0	0	0	0
CHEM AGENT MONITOR/ICAM	6665-01-199-4153	935	910	417	447	37	0	0	0	0
M90 CWA	6665-01-408-5108	58	58	54	0	0	0	0	0	0
DECONTAMINATION COMMODITY AREA										
A/E32U-8 DECON SYS	4230-01-153-8660	94	94	81	1	0	0	0	0	0
L/WT DEC SYS, M17	4230-01-251-8702	280	266	324	9	0	0	0	0	0
L/WT DEC SYS, M17A1	4230-01-303-5225	39	32	35	0	0	0	0	0	0
L/WT DEC SYS, M17A3	4230-01-346-3122	5	5	0	0	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
KMU-450 SHEL MOD KIT	4240-01-044-7659	16	16	16	0	0	0	0	0	0

Table 4-3b. Air Force Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
AIRCREWMAN CAPE	8415-01-040-9018	221,379	41,178	222,487	4,613	10,801
CHEMICAL OUTFIT	8415-00-782-3245	4,554		4,546	0	0
CLOTHING TEST KIT	6630-00-783-8192	170		3	0	0
CP UNDERCOVERALL	8415-01-040-3141	70,188		92,939	474	452
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902		389,090			
SUIT, AIRCREW, CWU-66/77P	8475-01-328-3454(S)	87,673	128,675	58,591	25,701	2,775
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	996,098	0	876,696	48,938	15,819
SUIT, CP CAMO-DESERT 3 clr	8415-00-327-5347-53	13,878	0	27,255	270	0
SUIT, CP CAMO-DESERT 6 clr	8415-01-324-3084-91	23,716	0	42,598	0	2,223
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	970,472	599,238	990,588	70,700	48,671
CP FOOTWEAR COVERS	8430-01-021-5978	106,612		179,458	1,760	4,054
CP GLOVES 7 MIL	8415-01-138-2501-04	217,682	74,994	326,397	26,044	5,681
CP GLOVES 14 MIL	8415-01-138-2497-00	1,730,025	156,990	1,603,500	442,319	71,062
CP GLOVES 25 MIL	8415-01-033-3517-20	81,511	577,263	115,207	2,160	17
CP SOCKS	8415-01-040-3169	186,222		187,565	3,720	400
DISP FOOTWEAR COVER	8430-00-580-1205	197,847		221,895	13,216	1,820
GLOVE INSERTS	8415-00-782-2809 (S)	2,025,992		1,586,075	391,576	66,256
MISC PROTECTION						
FILTER CAN, C2/C2A1	4240-01-119-2315	1,971,054	88,669	1,972,801	342,555	55,837
FILTER, GP	4240-01-161-3110	1,750		2,258	0	0
HOOD, M6A2 (FOR M17)	4240-00-999-0420	76,767	0	56,852	0	0
HOOD, MCU-2/P	4240-01-189-9423	1,881,061	153,930	2,212,425	79,414	10,715
MICS (COOL SYSTEM)	4240-01-298-4140YR	33	556	42	0	0
MICS VEST	8415-01-217-5634	1,110	1,015	1,410	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECT EQUIP						
DET KIT, M256A1	6665-01-133-4964	38,385	162	17,601	390	75
DET PAPER, M8	6665-00-050-8529	374,408	217,006	672,667	8,941	6,209
DET PAPER, M9	6665-01-049-8982	43,580		54,787	6,877	7,106
DET PAPER, M9	6665-01-226-5589	289,515	261,067	272,813	27,466	8,583
DET UNIT, CHEMICAL AGENT (ALAD SENSR DISK)	6665-01-381-6890	1,181		526	120	85
M18A2 KIT	6665-00-110-9492	41		26	13	0
MAINTENANCE KIT, M293	5180-01-379-6409	41	35,969	30	45	0
NBC MARK SET, M274	9905-12-124-5955	671	16	655	47	24
WATER TEST KIT, M272A1	6665-01-134-0885	60	111	65	5	3

Table 4-3b. Air Force Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
DECONTAMINATION COMMODITY AREA						
CALCIUM HYPOCHLORITE	6810-00-255-0471	41		41	0	0
DECON KIT, M258A1	4230-01-101-3984	698,024	0	390,317	188,379	146,214
DECON KIT, M291	4230-01-276-1905	52,493	58,225	68,023	4,547	6,464
DECON KIT, M295	4230-01-357-8456	27,254	58,245	161	6,701	10,550
DRY SORBENT POWDER	4230-01-262-0484	1,043		43	1,000	0
SODIUM HYPOCHLORITE	6810-00-589-7316	92		92	0	0
STB	6850-00-297-6653	310	79	260	0	0
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, CP M13 SERIES (M14 GPFU)	4240-00-368-6291	1,672	1,318	1,055	0	0
FILTER, GP M48A1	4240-01-363-1311		132			
FILTER SET, GP, FOR M56	4240-01-067-5605	792		555	300	0
PART FILTER, GP, FOR M56	4240-01-066-3266					
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	800,453	4,481	830,842		
ATROPINE AUTOINJ	6505-00-926-9083	815,197	4,481	824,158		
CANA AUTOINJ	6505-00-274-0951	263,882	940	257,797	153,314	348,536
PYRIDOSTIGIMINE TAB	6505-01-178-7903	27,236	102	30,103	293,243	
TETRACYCLINE	6505-00-655-8356	44,311		40,275	311,525	

Table 4-4a. Navy Logistics Readiness Data - Non-Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS					
					FY98	FY99	FY00	FY01	FY02	FY03
INDIVIDUAL PROTECTION COMMODITY AREA										
<i>CB MASK</i>										
MASK, MCU-2/P	4240-01-173-3443	117,770	7,413	131,841	0	0	0	0	0	0
MASK, MCU-2A/P	4240-01-284-3615/17	17,667		18,453	0	0	0	0	0	0
MASK, MCU-2A/P (WR) USN	4240-00-327-4148-50	71,585		79,320	0	0	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
<i>BIOLOGICAL DETECT EQUIP</i>										
IBAD	NOT ASSIGNED	25	25	0	0	0	0	0	0	0
<i>CHEMICAL DETECT EQUIP</i>										
ACADA, M22	6665-01-348-6963	300	300	0	142	80	78	0	0	0
ALARM, CAA, M8A1	6665-01-105-5623	128	128	154	0	0	0	0	0	0
CAPDS	6665-01-294-2556	304	304	301	0	0	0	0	0	0
CHEM AGENT MONITOR/ICAM	6665-01-199-4153	259	259	0	0	0	0	0	0	0
CWDD, AN/KAS-1	5855-01-147-4362	401	401	387	0	0	0	0	0	0
ICAD	6665-01-340-1693	384	384	0	0	0	0	0	0	0
IPDS	NOT ASSIGNED	234	234	32	28	28	45	43	40	38
M21 RSCAAL	6665-01-334-6637	98	98	0	0	0	0	0	0	0
DECONTAMINATION COMMODITY AREA										
DECON APPAR, M11	4230-00-720-1618	1,250	1,250	820	0	0	0	0	0	0
L/WT DEC SYS M17A3 DIESEL	4230-01-346-3122	96	96	0	0	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
SHELTER, CP, M20/M20A1	4240-01-166-2254	40	40	0	40	0	0	0	0	0
SHELTER, CP, PORTABLE	4240-01-105-5521	58	58	0	0	0	0	0	0	0

Table 4-4b. Navy Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE-INS	
					FY98	FY99
INDIVIDUAL PROTECTION COMMODITY AREA						
<i>OVERGARMENTS</i>						
IMPREG UNDERGARMENT	8415-00-782-3243	240		214	0	0
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902		67,601	63,136	33,968	39,100
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	939	0	612	0	0
SUIT, CP, OG MK3	8415-00-214-8289-92	280,225	0	363,795	0	0
<i>OVERBOOTS/GLOVES</i>						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	109,519		120,770	0	0
CP FOOTWEAR COVERS	8430-01-021-5978	153,681		212,950	0	0
CP GLOVES 7 MIL	8415-01-138-2501-04		38,777		0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	287,988	38,630	338,063	0	0
CP SOCKS	8415-01-040-3169		111,315		0	0
CPO FOOT COVERS	8430-01-118-8172	617		160	0	0
DISP FOOTWEAR COVER	8430-00-580-1205		111,315		0	0
GLOVE INSERTS	8415-00-782-2809	330,098		254,739	0	0
<i>MISC PROTECTION</i>						
CP HELMET COVER	8415-01-111-9028		20,243		0	0
FILTER CAN, C2/C2A1	4240-01-119-2315	428,010	15,272	440,067	0	0
HOOD, MCU-2/P	4240-01-189-9423	261	25,258	462	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
<i>CHEMICAL DETECT EQUIP</i>						
DET KIT, M256A1	6665-01-133-4964	10,968	0	8,934	0	0
DET PAPER, M8	6665-00-050-8529	13,368	36,220	12,195	0	0
DET PAPER, M9	6665-01-226-5589	30,802	54,188	25,241	0	0
NBC MARK SET, M274	9905-12-124-5955	5	66	5	0	0
TUBE PHOSGENE	6665-01-010-7965	1,596		2,031	0	0
WATER TEST KIT, M272A1	6665-01-134-0885	220	0	141	0	0
DECONTAMINATION COMMODITY AREA						
CALCIUM HYPOCHLORITE	6810-00-255-0471	9,001		6,512	0	0
DECON KIT, M258A1	4230-01-101-3984	45,685	0	58,057	0	0
DECON KIT, M291 (20 PER)	4230-01-276-1905	129,711	9,684	147,227	0	0
DECON KIT, M295 (20 PER)	4230-01-357-8456		9,684		0	0
DS2, 5 GAL	6850-00-753-4870		36		0	0
SODIUM HYPOCHLORITE	6810-00-598-7316	613		583	0	0
STB	6850-00-297-6653		1,239			
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, GP M48A1	4240-01-363-1311		64		0	0
FILTER SET, GP, FOR M56	4240-01-067-5605				0	0
PART FILTER FOR M56	4240-01-066-3266				0	0

Table 4-4b. Navy Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE-INS	
					FY98	FY99
FILTER SET FOR (M59, M56, SHIPBOARD)	4240-01-369-6533				0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	421,461	1,212	419,052	0	0
ATROPINE AUTOINJ	6505-00-926-9083	571,150	1,212	546,854	0	0
CANA AUTOINJ	6505-00-274-0951	2,635	243	2,318	0	0
PYRIDOSTIGIMINE TAB	6505-01-178-7903	93,662		93,775	0	0
TETRACYCLINE	6505-00-655-8356	4,041	3,271		0	0

4.5a. Marine Corps Logistics Readiness Data - Non-Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS					
					FY98	FY99	FY00	FY01	FY02	FY03
INDIVIDUAL PROTECTION COMMODITY AREA										
<i>CB MASK</i>										
MASK, CB, M40/M40A1	4240-01-258-0061-63	227,069 (total roll-up of mask rqmts)	50,116	199,137	0	0	0	0	0	0
MASK, CB, M17A2	4240-01-143-2017-20		0	19,737	0	0	0	0	0	0
MASK, M24, AVIATOR	4240-00-776-4384		0	4,307	0	0	0	0	0	0
MASK, M25A1, TANK	4240-00-994-8750-52		0	612	0	0	0	0	0	0
MASK, M42, TANK	4240-01-258-0064-66		2,706	5,214	0	0	0	0	0	0
MASK, MCU-2/P	4240-01-415-4239-41		0	98	0	0	0	0	0	0
<i>MISC PROTECTION</i>										
MASK COMM ADAPTOR	5996-01-377-9695	50,000		21,393	0	0	0	0	0	0
PATS, M41	4240-01-365-8241	258	258	258	0	0	0	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA										
<i>CHEMICAL DETECT EQUIP</i>										
ACADA, M22	6665-01-348-6963	689	689	0	12	245	120	312	0	0
ALARM, CAA, M8A1	6665-01-105-5623	28	28	20	0	0	0	0	0	0
CAM/ICAM 1.5	6665-01-359-9006	1,854	1,854	1,854	0	0	0	0	0	0
CAM/ICAM 2.0	6665-99-725-9996	875	875	875	0	0	0	0	0	0
ICAD	6665-01-340-1693	12,399	324,389	9,462	0	0	0	0	0	0
M21 RSCAAL	6665-01-334-6637	197	534	125	0	0	0	0	0	0
NBC RECON SYS, M93	6665-01-323-3582	10	10	10	0	0	0	0	0	0
DECONTAMINATION COMMODITY AREA										
DECON APPAR, M11	4230-00-720-1618	21,050	21,050	43,271	0	0	0	0	0	0
DECON APPAR, M13	4230-01-133-4124	1,600	1,600	17,555	0	0	0	0	0	0
DECON APPAR, PDDA, M12A1	4230-00-926-9488	0	0	70	0	0	0	0	0	0
L/WT DEC SYS, M17A1	4230-01-303-5225	344	344	344	0	0	0	0	0	0
L/WT DEC SYS, M17A3	4230-01-346-3122	884	884	884	0	0	0	0	0	0
COLLECTIVE PROTECTION COMMODITY AREA										
SHELTER, CP, PORTABLE	4240-01-346-2564	230	230	217	0	0	0	0	0	0

Table 4-5b. Marine Corps Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
CP, UNDERCOVERALL	8415-01-040-3141	1,093,497 (total roll-up of suit rqmts)		0	0	0
JSLIST (ABDO) 45 DAYS	8415-01-444-1163 8415-01-444-5902		726,513	23,905	13,015	16,680
SUIT, CP CAMO (BDO)	8415-01-137-1700-07		0	174,020	0	0
SUIT, CP CAMO DESERT 6 clr	8415-00-324-3087		0	0	0	0
SUIT, CP CAMO-DESERT 3 clr	8415-00-327-5347-53		0	0	0	0
SUIT, CP, SARATOGA	8415-01-333-7573-76		0	629,776	0	0
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	654,000	1,037,393	273,846	0	0
CP FOOTWEAR COVERS	8430-01-021-5978			368,825	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	654,000	1,278,838	715,125	0	0
MISC PROTECTION						
2D SKIN, M40 SERIES	4240-01-413-1540	277,069	52,822	23,696	0	0
CP HELMET COVER	8415-01-111-9028	0	873,633	0	0	0
FILTER CAN, C2/C2A1	4240-01-119-2315 4240-01-361-1319	554,246	73,027	206,845	0	0
FITLER CAN, M10A1	4240-00-127-7186	2,468	0	2,468	0	0
FILTER ELEMENT, M13A2	4240-00-165-5026	27,766	0	27,766	0	0
HOOD, M40	4240-01-376-3152		502,529	199,137	0	0
HOOD, M5 FOR M25A1	4240-00-860-8987	867	0	867	0	0
HOOD, M6A2 FOR M17	4240-00-999-0420	29,753	0	29,753	0	0
HOOD, M7 (FOR M24)	4240-01-021-8699	323	0	323	0	0
HOOD, MCU-2/P	4240-01-189-9423	0	288,871	0	0	0
CONTAMINATION AVOIDANCE COMMODITY AREA						
CHEMICAL DETECT EQUIP						
DET KIT, M256A1	6665-01-133-4964	6,324	23,859	4,841	0	0
DET PAPER, M8	6665-00-050-8529	12,654	341,956	12,654	0	0
DET PAPER, M9	6665-01-049-8982 6665-01-226-5589	189,747	389,802	10,565	0	0
MAINTENANCE KIT, M293	5180-01-379-6409	0	220,920	0	0	0
NBC MARK SET, M274	9905-12-124-5955	2,286	2,236	209	0	0
WATER TEST KIT, M272A1	6665-01-134-0885	3,159	1,328	776	0	0
DECONTAMINATION COMMODITY AREA						
DECON KIT , M258A1	4230-01-101-3984	201,568	0	88,627	0	0
DECON KIT, M291	4230-01-276-1905	408,220	37,696	340,876	0	0
DECON KIT, M295	4230-01-357-8456	0	37,696	0	0	0
DS2, 1 1/3 QT	6850-00-753-4827	4,453	2,223	13,648	0	0
DS2, 5 GAL	6850-00-753-4870	7,252	16,207	5359	0	0
DS2, M13 CAN	4230-01-136-8888		2,299		0	0

Table 4-5b. Marine Corps Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMT	NUMBER REQUIRED FOR 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
NITROGEN CYLINDERS	4230-00-775-7541	2,316	4,026	13,081	0	0
STB	6850-00-297-6653	7,410	6,368	401	0	0
COLLECTIVE PROTECTION COMMODITY AREA						
FILTER, CP M12A2 (M14 GPFU)	4240-01-365-0981		216		0	0
FILTER, CP M13 SERIES (M14 GPFU)	4240-00-368-6291		222		0	0
FILTER, CP M18A1	4240-00-365-0982		832		0	0
FILTER, GP M48A1	4240-01-363-1311		454		0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE AUTOINJ	6505-01-125-3248	291,216	98,494	291,216	0	0
ATROPINE AUTOINJ	6505-00-926-9083	205,344	98,494	205,344	0	0
CANA AUTOINJ	6505-00-274-0951	93,336	28,663	93,336	0	0
NAAK, MKI	6705-01-174-9919		93,193		0	0
PYRIDOSTIGIMINE TAB	6505-01-178-7903	93,336	145	93,336	0	0

Table 4-6. Defense Logistics Agency Logistics Readiness Data - Consumables

NOMENCLATURE	NSN	TOTAL SERVICE RQMTS	REQUIRED TO SUSTAIN TO 120 DAYS - 2MTW	STOCKS ON HAND TO INCLUDE FY97 DUE INS	PROJECTED DUE INS	
					FY98	FY99
INDIVIDUAL PROTECTION COMMODITY AREA						
OVERGARMENTS						
AIRCROWMAN CAPE	8415-01-040-9018	N/A	N/A	10,074	14,300	0
CP UNDERCOVERALL	8415-01-040-3141	N/A	N/A	0	0	0
SCALP (TAN AND GREEN)	8415-01-364-3320-22 8415-01-364-3458-60	N/A	N/A	2,086	0	0
SUIT, AIRCREW, CWU-66/77P	8475-01-328-3454(S)	N/A	N/A	0	0	0
SUIT, CP CAMO (BDO)	8415-01-137-1700-07	N/A	N/A	228,758	0	0
SUIT, CP CAMO-DESERT - 3 color	8415-00-327-5347-53	N/A	N/A	45,538	0	0
SUIT, CP CAMO-DESERT - 6 color	8415-01-324-3084-91	N/A	N/A	2	0	0
SUIT, CP, OG MK3	8415-00-214-8289-92	N/A	N/A	0	0	0
SUIT, CP, SARATOGA	8415-01-333-7573-76	N/A	N/A	0	0	0
OVERBOOTS/GLOVES						
BLK/GRN VINYL O/BOOTS	8430-01-317-3374-85	N/A	N/A	0	61,920	102,441
CP FOOTWEAR COVERS	8430-01-021-5978	N/A	N/A	171,087	0	0
CP GLOVES 7 MIL	8415-01-138-2501-04	N/A	N/A	162,000	0	0
CP GLOVES 14 MIL	8415-01-138-2497-00	N/A	N/A	670,146	0	0
CP GLOVES 25 MIL	8415-01-033-3517-20	N/A	N/A	1,326,291	0	0
CP HELMET COVER	8415-01-111-9028	N/A	N/A	347,750	0	0
MEDICAL COMMODITY AREA						
2-PAM CHLORIDE, AUT	6505-01-125-3248	N/A	N/A	208,384	900,000	900,000
ATROPINE AUTOINJ	6505-00-926-9083	N/A	N/A	310,860	850,000	850,000
CANA	6505-00-274-0951	N/A	N/A	173,290	174,000	174,000
DIAZEPAM	6505-00-137-5891	N/A	N/A	5,580	0	0
NAAK, MKI	6705-01-174-9919	N/A	N/A	5,000	470,000	470,000
PYRIDOSTIGIMINE TABLETS	6505-01-178-7903	N/A	N/A	257,000	0	0

APPENDIX 2
FIELDDED NBC DEFENSE ITEMS - ISSUES AND CONCERNS

NBC defense items are generally used in combination to form a system or subsystem for a particular function. Therefore, this report will address items used as a system. These systems are categorized into five functional areas:

- Contamination Avoidance
- Individual Protection
- Collective Protection
- Decontamination
- Medical

1. CONTAMINATION AVOIDANCE

Contamination avoidance programs generally include equipment that is used to conduct NBC agent reconnaissance, detection, and identification. This area represents approximately half of the annual DoD NBC defense RDT&E budget. Due to recent type-classification of several programs that are intended to modernize contamination avoidance programs, this area has an unusually high number of developmental programs. Many programs will complete their fielding beyond FY03.

The combined total of chemical agent detection systems remains at high risk with only a 63.7 percent total fill, even with the M22 Automatic Chemical Agent Detector (ACADA) supplementing the M8A1 Automatic Chemical Agent Alarm. The M21 Remote Sensing Chemical Agent Alarm (RSCAAL) is at moderate risk with 82 percent two MTW fill projected by FY03. Technology from this system is expected to be rolled into the JSLSCAD, now under development.

The M93A1 NBCRS is only 41 percent of its projected requirements. This system adds improved mass spectrometer sampling system along with stand-off chemical vapor detection. Several units continue to use trained reconnaissance personnel in HMMWVs and APCs, thus moderating this risk as continued fielding and developmental systems enter the inventory.

Traditional consumables in this commodity area (M8 and M9 detection paper, M256A1 kits and M272A1 water test kits) are available in sufficient quantities to meet wartime requirements. Some shortages exist in individual Services, but overall there is little risk. Shelf life concerns may change this projection; this area remains under review.

2. INDIVIDUAL PROTECTION

Currently fielded NBC defense equipment items were primarily designed for use in the European environment against a Soviet threat. Equipment in this area provides protection against all known CB threat agents. Past Service-unique requirements led to Service-specific procurements and some duplication in capability resulting in the procurement of six different

chemical protective suits and six different masks. This has caused difficulties in meeting current needs and exacerbated logistics planning. The introduction of the JSLIST protective suits should begin to resolve many of these past difficulties.

2.1 Protective Ensembles

The Services have initiated buys for the Joint Services Lightweight Integrated Suit Technology (JSLIST) suits as a replacement for the BDO and other chemical protective suits. As such, the protective suits should be viewed as a system with the older suits providing readiness stocks until the end of their service life. Contracts placed for the JSLIST program will begin delivery in early FY98, equating to about 260,000 suits. These contracts did not include surge option clauses. When Defense Personnel Support Center (DPSC) takes management of JSLIST in FY98, new solicitations will include this requirement. By examining the year-by-year status of protective suits, we added the number of older suits still within service life to the number of JSLIST suits purchased by that year and matched the total against the requirements. In FY03, the services have sufficient protective suits to meet requirements as projected for the average two MTW requirements. However, beginning in FY04, the number of suits on hand will be below Service requirements, as the service life of older protective suits expires in large quantities. These calculations include the approximately \$58 million plus-up per year allocated to purchasing protective suits beginning in FY98 (average plus-up between FY98-03).

The Battle Dress Overgarment (BDO) is reaching its maximum extended shelf life limit (fourteen years), and the Services plan no new production. There are no companies currently manufacturing the BDO. The Defense Logistics Agency's largest customer, the Army, has 2.9 million suits on hand in war reserves to sustain its requirements until 1999. Duro, Inc. is the sole source for the inner layer of the BDO's charcoal slurry impregnated fabric (a key capability) used within the BDO suit. Chemical Protective Overgarments (CPOGs), the older generation of BDOs, have not been in production for several years. The Saratoga suit, purchased by DPSC for the Marine Corps, is also out of production.

Armor crews and aircrews require special protective ensembles to integrate with their weapon systems. Services have sufficient numbers of aircrew suits to meet requirements, given the small number of suits required for aircrews. The only exception is the Chemical Protective Underoverall, which supplements the CWU-66/77. The services have only 64 percent of requirements on hand, resulting in a high risk rating. To protect armor crewmen when they exit their vehicles, the Services have developed the Suit Contamination Avoidance Liquid Protection (SCALP). This suit is rated as high risk because the Services will have only 25 percent of FY03 requirements on hand by that date.

The Services have adequate stocks of 7, 14, and 25-mil chemical protective gloves on-hand for contingency use. Recent DoD surveillance tests have validated the protective qualities of the existing butyl rubber glove stocks. The results from calculating the number projected to be on hand for FY03 exceeds the projected average MTW requirement. The status of the Services on-hand inventories has allowed DLA to pursue an Industrial Base Maintenance

Contract (IBMC) with both current manufacturers (Siebe North, Inc., Charleston, SC, and Guardian Corp., Willard, Ohio) to sustain the industrial base with “War Stopper” funding.

Chemical Protective Footwear Covers, also known as the “fishtail” boot, have been out of production for several years. The Green Vinyl Overboot (GVO) is the interim chemical protective footwear until the JSLIST MULO boots have been fielded (FUE expected in FY99). Because the GVO’s primary purpose is not chemical protection, current contracts do not include surge option clauses. Again one should view protective footwear as a system with older GVOs providing readiness stocks until the MULO is fielded in sufficient quantities. Currently the Services have 87 percent of required protective footwear, resulting in low risk assessment. The USMC is the only service reporting a shortage of footwear.

2.2 Eye/Respiratory Protection

The Services continue modernizing their chemical protective mask inventories. Different versions of the protective mask were developed to meet the requirements of different military occupational specialties (*e.g.*, air crew, tank crew, *etc.*). For the Army and Marine Corps, the M40 (for generic use) and M42 (for armor crew members) series masks are replacing the M17 and M25-series masks, respectively. Some Army aviation units are still equipped with the old M24 mask, which will be replaced by the M45 mask. The M43-series mask, designed to be used by Apache equipped units, was in fact issued to all types of aviation units. It is being replaced by the M48 (Apache) and M49 (general aviation) series mask. The M45 will replace the M49 as the general aviation mask. All of these masks are at no risk, as the number on hand exceeds the requirement. These newer masks provide increased protection, improved fit and comfort, and compatibility with most Services’ weapons systems’ optics and sights.

The MCU-2A/P is designed to meet the needs of the Air Force ground crews, Navy shipboard and shore-based support missions, and Marine Corps rotary wing forces. The number of these masks on hand exceeds the requirement. It will continue to be the mainstay of these units until the Joint Service General Purpose Mask is fielded (which will also replace the M40/42 masks). The Aircrew Eye/Respiratory Protection (AERP) Mask is specially designed to enable pilots of high performance aircraft to conduct mission in a contaminated environment. There are sufficient numbers of this mask to meet requirements.

In order to provide complete protection to our warriors on the contaminated battlefield, particularly from liquid chemical agents, protective hoods and helmet covers are required as part of the warrior’s ensemble. The protective hood for the M40 is rated as high risk, with only 56 percent of FY03 requirements on hand by FY03. The second skin for the M40 series mask is a high risk area with only 7 percent of requirements on hand by that date. The MCU-2P hood will be at 96 percent of FY03 requirements and is low risk. Protective hoods for the M17-series, M24, and M25A1 masks are not a readiness problem, as these masks are leaving the inventory. The Chemical Protective Helmet Cover is a moderate risk with 77 percent of FY03 requirements expected to be on hand.

Filters and canisters provide the active ingredients that absorb the chemical and biological agents and provide the essential protection required. The C2/C2A1 canister is used with the M40, M42, M43, M45, M48, M49 and MCU-2/P masks. The number on hand exceeds requirements now through FY03. The M13A2 filter element also exceeds requirements. The M10A1 filter canister used on the M24/25 is short of the requirement, but these masks will leave the inventory and will not be a readiness problem.

3. COLLECTIVE PROTECTION

There are two general categories of collective protection: stand-alone shelters and integrated systems. Integrated collective protection equipment is component equipment designed to provide protection against CB agents through the use of filtered air under positive pressure to a variety of facilities, vans, vehicles, aircraft and ships. Filters for these integrated collective protection systems (CPS) are in short supply due to low peacetime demand and low production quantities. The increased emphasis on procuring individual protection and contamination avoidance equipment has resulted in a corresponding decrease in procurements of shelters and large CP filters. The Air Force has expressed interest in a larger collective protective shelter capability; combined with the Navy's increasing shipboard collective protection filter requirements and the Army and Marine Corps traditional integrated vehicular systems and tactical shelter requirements, the near-term MTW requirements for large carbon-based filters have outpaced current inventories even aided by industrial surge capability. As a result, much of this sector is assessed as high risk, though the risk is primarily due to the level of funding rather than technical shortfalls. One notable exception is progress made in providing shipboard collective protection. By the year 2000, most Naval ships that have close-in support roles (including amphibious ships, gunfire support combatants, and new logistics support ships) will contain significant CPS capabilities.

In the near term, the M51 shelter will be replaced by the new Chemical and Biological Protective Shelter (CBPS). Both Army and Air Force field hospitals are being integrated with environmentally controlled collective protection. The Army's Chemically Protected Deployable Medical Systems (CP DEPMEDS) achieves collective protection through the integration of the M28 Simplified CPE, chemically protected air conditioner, heaters, water distribution and latrine and alarm systems. The M28 Simplified CPE is in production and chemically protected heaters and air conditioners will initiate production before FY99. However, M28 components produced will not be enough to field 18 complete hospitals as required immediately and all these components are not funded to meet Force Package I requirements. Funding for the completion of development and production of chemically protected latrine and water distribution systems and alarms remains unfunded.

The M20-series Simplified CPE is to be used to provide a contamination-free, environmentally controlled work space for Echelon I and II forward area medical treatment facilities. Current funding levels, however, only will meet Force Package I requirements and do not support the fielding of Force Package II that can be deployed into high threat regions. This leads to an assessment as high risk. Current policy is that the M20/M20A1 Simplified CPE is a free issue item with no requirement to stock other than spares replenishment; yet this is the only

modern CP shelter in the inventory until the CBPS arrives in sufficient quantities to moderate this risk. The CBPS is presently in production with fielding to initiate in 1QFY99. The Marine Corps Portable Collective Protection System (PCPS) is at moderate risk due to low quantities on hand. Continued difficulties in obtaining a strong industry leader in this field compound these issues.

Collective protection filters for integrated systems (such as armored vehicles, ships and planes) continue to suffer from low stocks. While the Services have been proactive in selecting more capable industrial sources, actual procurement and storage of these filters to MTW requirements has not yet been initiated. As a result, stocks of filters (in particular those associated with the 200 CFM Particulate Filter Set for Shipboard Collective Protection Systems) remain at a critically low level.

4. DECONTAMINATION

Current decontaminants are highly effective against all CB agents, but most present environmental hazards and are manpower intensive. The services are attempting to find environmentally safe decontaminants which are less labor intensive.

Basic soldier skills for decontamination of vehicle and crew-served weapons rely on the M11 Decontamination Apparatus, Portable (DAP) and M13 DAP. The Army is replacing its 1½ quart M11s with the 14-liter M13 DAPs. They are assessed as posing low risk. The M17-series Lightweight Decontamination System (LDS) is used to provide operational equipment decontamination in many battalion-level units and dual-purpose (smoke/decontamination) chemical companies. It is assessed as moderate risk due to a low inventory and high demand. There is still a large mix of different models in the inventory, forcing the Services to retain a large number of differing spare parts to maintain the different models. Based on projected inventory, should spare parts become difficult to obtain for the different models, the risk may become high. Overall, this risk should drop as more systems are produced and the older models are upgraded or replaced. The Marine Corps is upgrading all of their LDS to the diesel engine.

In the Army, the M12A1 Power-Driven Decontamination Apparatus (PDDA) and the M17A3 Light Weight Decontamination System (LDS) are the primary pieces of equipment used to decontaminate vehicles, crew-served equipment and large areas of terrain. The M12A1 is assessed as moderate risk. Although the quantities on-hand of the M12A1 would normally result in a low risk assessment, the maintenance requirements, due to the age of this item, limit its full utilization. The M21/M22 Modular Decontamination System will replace the M12A1 PDDA over the POM period, resulting in a high-low mix of technology until all M12A1s are replaced. By FY02, the on-hand quantities of the M21/M22 MDS alone should satisfy the two MTW requirement. Additionally, the Marine Corps is replacing the M12A1 PDDA with the M17 series Lightweight Decontamination Apparatus.

The M258A1 Skin Decontamination Kit is the primary item used in personnel decontamination. The replacements for the M258A1 are the M291 Skin Decontamination Kit and the M295 Equipment Decontamination Kit. Although the M291 would be assessed as high

risk, the availability of M258A1 decontamination kits still in the inventory helps steady overall readiness stocks. The projected stockage of the M295 Decontamination Kit, however, puts it in a high risk category when compared with 2 MTW requirements.

The M295 Decontamination Kit began delivery in December 1997. Rohm & Haas, Co., the sole supplier of the resin, sold the mixing and packaging equipment they used to manufacture the M291 Decontamination Kit. Pine Bluff Arsenal, Arkansas, set up a production line and began to manufacture the M291 Kit in October 1996. Rohm & Haas continues to provide the XE-555 resin components. True Tech Inc. is blending the components to make the XE-555 resin. Alternatives to producing a kit that does not use the XE-555 resin are being studied. There are a number of options being explored to retain this "at risk" technology.

While less hazardous replacement decontaminants are being developed, the quantities and packaging of current decontaminants present some risk. The projected stockage of STB falls far below the requirements and is therefore considered in the high risk category. Calcium hypochlorite is also high risk. Both these items remain a high risk until alternative decontaminants are developed. Slight shortages in sodium hypochlorite can be made up by the industrial base. Although sufficient quantities of bulk of DS-2 are available, the Marine Corps plans for stocking containers of DS-2 (5-GAL and M13 Can). Other Services will have adequate supplies of those containers and can ameliorate that shortage.

5. MEDICAL

Medical NBC defense items are used to counteract the effects of exposure to chemical or biological agents through pre-treatments, vaccines, or post-treatments. Quantities of Nerve Agent Antidote Kits (NAAK), Convulsant Antidote Nerve Agent (CANA), and Nerve Agent Pyridostigmine Pretreatment (NAPP) tablets now support two MTW requirements. Active duty Army units are assumed to have their Set-Kit-Outfit components on hand, as required by Army regulations. Changes in previous inventory figures and FY96 figures were based on a year-end reconciliation of stocks at depots, the disposal of stocks located at Meridian Medical Technologies (formerly Survival Technology, Incorporated (STI)) that failed extension approval by the Food and Drug Administration (FDA), and increase in stocks due-in to the Army-owned account as a result of year-end buys.

The sole supplier to DoD for nerve agent antidote kits is Meridian Medical Technologies whose manufacturing plant is located in St. Louis, Missouri. Although Meridian is a U.S. company, both the atropine and pralidoxime chloride drugs used to fill autoinjectors are obtained from German suppliers. Currently, there are no domestic sources for these drugs.

The U.S. Army Medical Materiel Development Activity (USAMMDA) added Meridian to their New Drug Application (NDA) for producing the CANA autoinjector. The Army continues to requisition CANA from the Defense Personnel Support Center (DPSC) to replenish and maintain stocks, and to support the industrial base. Meridian's nerve agent antidote production line is being maintained with an IBMC. USAMMDA's centralized management initiative for medical chemical defense materiel should also aid in maintaining the health of

Meridian's line. The shelf-life extension for nerve agent antidote kits is part of this initiative and will help keep Meridian viable. Current projections for the NAAK, CANA, PB Tablets, and autoinjectors (pralidoxime chloride, atropine and multi-chambered) indicate that sufficient quantities should be on hand through the POM years and present low risk as long as the constituent drugs continue to be available from the foreign sources.

Medical research continues to explore medical countermeasures to deter, constrain, and defeat the use of biological warfare agents against U.S. forces. JPO-BD has recently awarded a prime systems integration contract for the development, FDA licensure, and production of vaccines. They are also assisting the sole domestic supplier of anthrax vaccine to maintain FDA licensure and to transition its production facility to a new owner in FY98. The new owner would then continue to fulfill the current contract.

CHAPTER 5

NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE READINESS AND TRAINING

(INTENTIONALLY BLANK.)

5.1 INTRODUCTION

The Services' vision for Joint NBC Defense Management is: *America's Armed Forces trained and ready for the 21st Century, protecting our nation and its forces against nuclear, biological and chemical threats.* The Joint NBC Defense Program build on the Service successes to develop a viable Joint orientation to NBC defense capabilities which includes Joint requirements documents; Joint doctrine and tactics, techniques, and procedures; Joint modeling, simulation and wargaming; and Joint professional training.

5.2 JOINT NBC DEFENSE DOCTRINE

Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*, provides guidelines for the planning and execution of NBC defensive operations. Its focus is on the NBC threat; national policy; and considerations peculiar to the preparation and conduct of NBC defense. These considerations include principles of theater NBC defense, logistics support, medical support, training, and readiness. Although NBC defense doctrine is briefly addressed in 29 other joint doctrine publications further details are required, particularly in the area of joint tactics, techniques, and procedures. The U.S. Army Chemical School has been tasked by the Joint Staff to revise the publication. In the meantime, Joint Pub 3-11, in conjunction with CJCS CONPLAN 0400-96, provides a foundation for combatant commands to train and evaluate their forces. The U.S. Army Nuclear and Chemical Agency (USANCA) is the DoD lead for international standardization of NBC operational matters. USANCA has involvement in the following NATO groups:

- NBC Defense Interservice Operations Working Party (NBCWP) under the Military Agency for Standardization,
- Land Group 7 (LG. 7)—NBC equipment—under the NATO Army Armaments Group (NAAG),
- Working Group 2 (LG. 7)—Low Level Radiation in Military Environments,
- Challenge Subgroup (LG. 7)—chemical/biological toxicity challenge levels,
- Technical Subgroup (LG. 7)—nuclear weapons defense, and
- ATP-45 (NBCWP) NBC warning/reporting.

USANCA also has a lead in the ABCA quadripartite alliance (US,UK, Canada, Australia) in the Quadripartite Working Group (QWG) for NBC Defense. In that group, USANCA also participates in the RADIAC Information Exchange Group (IEG).

5.2.1 Joint NBC Defense Doctrine Program Management

The NBC defense program management strategy described in Chapter 1 provides the mechanism to assist the Joint Staff in the further development of Joint NBC defense doctrine program. The Joint Service Integration Group (JSIG) coordinates with the Services to ensure the program is realistic and meets the needs of the Joint community.

5.2.2 Joint NBC Defense Doctrine Development Program

Following the formation of a Joint Doctrine Development Cell within the U.S. Army Chemical School (USACMLS) in FY96, a number of joint and multi-service projects commenced. Using special funding a "Way Ahead" document was prepared which provided an indicator of service strengths and weaknesses in providing the necessary tactics, techniques, and procedures for operating in an NBC environment. Following recommendations from a GAO Report and Joint Staff Assessments, their first product was a rewrite of FM 3-4-1, *Fixed Site Protection* (published in 1989) as *NBC Defense of Fixed Sites, Ports, and Airfields* with multi-service staffing and CINC input from its inception. Other publications in development during FY97 included operational level doctrine for biological detection and warning; revisions of decontamination procedures for operational decontamination and fixed site procedures; and proposals for the Joint Warfighting Center to sponsor a rewrite of Joint Pub 3-11, *NBC Defense* for the Joint Force. After an assessment by the CINCs, and review by the Joint Staff, a directive to rewrite this Joint Pub was passed from DoD to the Department of the Army (DA) and then through the Training & Doctrine Command (TRADOC) to the USACMLS for action at the end of FY97.

The Joint Doctrine Cell provided exercise and training support to numerous organizations throughout the year. Subject Matter Experts were provided to the Army War College for their Crisis Action Exercises, the Naval War College for their Global Exercise, to the Atlantic Command (ACOM) for Joint Task Force (JTF) training, and the Chem War 2000 Exercise. Future funding is programmed for FY99 and support for our efforts in FY98 has been identified. This Doctrine Cell will not be able to increase the level of effort without additional resources, but all projects currently underway should be completed in the first quarter, FY99.

5.2.3 Army Medical Doctrine Development Program

The FY97 effort consisted of initiatives to develop new AMEDD NBC defense doctrine products and provide input to multinational medical NBC procedures. One AMEDD doctrine field manual is under development and one is proposed for development. They are FM 8-284, *Treatment of Biological Warfare Agent Casualties* and FM 8-283, *Treatment of Nuclear Warfare Casualties and Low-Level Radiation Exposure*. The two manuals will be developed as multiservice publications. The initial draft of the FM 8-284 is under development. FM 8-284 will provide protection, prevention, and medical management and treatment procedures for biological warfare agents. Development of FM 8-283 will begin after work on FM 8-284 is in advanced stages of completion. Doctrine for nuclear, biological, and chemical-environment (NBC-E) will be developed and incorporated into current and new manuals as the technology allows. The area of NBC-E is not new, but emphases is being increased on the effects of long-term exposure to low-levels (subclinical levels) of NBC agents and industrial radiation, biological and chemical hazards.

The AMEDD participated in numerous NATO medical NBC procedural products updates and development, resulting in several NATO Standardization Agreements (STANAGs) being updated. Further, the AMEDD participated in a Quadripartite Working Group to develop

and update additional medical NBC procedural product agreements (QSTAGs). STANAGs and QSTAGs are reviewed for integration of these agreements into Army-specific doctrine literature products as well as multiservice medical doctrine products for which the AMEDD is proponent.

5.2.4 Air Force Medical Doctrine Development Program

HQ USAF/SGXR intends to participate with the Army in development of two doctrine field manuals that are proposed for development. These are Treatment of Biological Warfare Agent Casualties and Treatment of Nuclear Warfare Casualties and Low-level Radiation Exposure. HQ USAF/SGXR also intends to undertake development of a manual standardizing war-time medical contamination control operations. During FY97 SGXR has also participated in the review of numerous NATO Standardization Agreements that were updated during the year.

5.3 STANDARDS/PROFICIENCY AND CURRENCY

Each service establishes standards of proficiency and currency for NBC defense training. The U.S. Army Chemical School (USACMLS) as the DoD Executive Agent for joint NBC defense training, has initiated several actions to counter NBC threats. These include (1) assisting CINCs, MACOMS and their staffs assessing and providing reference materials regarding the NBC threat and recommend actions to reduce the NBC threat in their areas of operations; (2) providing broad-based joint NBC defense doctrine and joint doctrine development support; (3) introducing and upgrading instructional aids and training support material for war colleges and command and staff colleges for all services; and (4) developing, evaluating, and fielding advanced distributed instructional capabilities for both resident and nonresident instruction.

5.3.1 Army

Army Regulation 350-41, *Training in Units*, establishes Army standards for proficiency for NBC defense training. NBC defense training is conducted at schools and in units.

Individual Training

At the initial training level, NBC defense tasks are taught to students wearing Mission Oriented Protective Posture (MOPP) gear during Basic Soldier Training and Warrant Officer Candidate Training to satisfy Initial Entry Training Requirements. Common core qualification is achieved from NBC tasks training during Officer (basic and advanced) and Warrant Officer (basic) training. NCOs train on leader NBC skills during their NCO development courses. Other Officer and NCO courses require training in NBC as a condition which effects the performance of branch specific tasks. At the company level each unit has an NBC NCO specialist and at the battalion or higher level each unit has an NBC Officer and Senior NCO.

Unit Training

The Army is constantly challenged to improve its training of NBC battlefield hazards by integrating such training into unit mission training as well as individual and leader training. It is

required that the NBC protective mask be worn during weapons qualification training up to twice a year, depending on the unit category within the Standards in Training Commission (STRAC). Additionally, essential Army civilians are trained in NBC survival skills. Because of today's battlefield complexities, the Army takes a systems approach to its training. NBC tasks for individuals are published in Soldiers' Training Publications and trained in the Army School System. Sustainment training occurs in the unit. NBC collective tasks are published in ARTEP Mission Training Plans. The highest level of NBC training recognizes NBC as a battlefield condition and units train to execute their mission-essential task list (METL) while under NBC conditions.

Mobilization Training

Fort McClellan was a major Reserve Component mobilization center for chemical units. As part of the mobilization process, these units received individual and unit NBC defense refresher training. During Operation Desert Shield/Storm, instructor personnel from the U.S. Army Chemical School trained numerous units to ensure currency in NBC tasks prior to deployment. As of 1 October 1997, Fort McClellan no longer is a mobilization center. All mobilization will be performed at Power Projection Platforms.

Medical Training

The U.S. Army Medical Department Center and School (AMEDDC&S) conducts Medical NBC Defense Professional Training at Fort Sam Houston, Texas consisting of four Soldier/Noncommissioned Officer (NCO) courses, two Officer courses and various related professional short courses.

AMEDD sergeants attend a 17 week Basic NCO Course (BNCOC) where NCOs with the MOS 91B (combat medic) are trained to be medical platoon treatment/evacuation team leaders. AMEDD BNCOC provides the NCO with the technical and tactical skills to conduct medical operations in a NBC environment, to manage and treat contaminated casualties, and to train non-medical soldiers in casualty decontamination procedures. In FY97, more than 387 junior NCOs were trained in this course.

All AMEDD officers begin training in the Officer Basic Course (OBC). This 11 week course prepares them with the fundamental knowledge to conduct medical operations in an NBC environment and to advise company, battalion, and medical treatment facility commanders in NBC contamination avoidance and the medical implication of NBC exposures. This experience includes a mixture of 39 hours of classroom instruction and 12 hours in their, field training exercises stressing and confidence building, hands-on equipment training and management of contaminated casualties. There are six courses for active Army components and five courses for Reserve/National Guard components annually. In FY976, over 1,700 officers were trained in these courses.

The AMEDD Officer Advance Course (OAC) is designed to provide advanced military education for officers with 3-9 years of time in service. This course provides the AMEDD

officer with skills necessary for command, leadership, and staff positions of greater responsibility in both peacetime and times of hostility. Redesigned this FY to a small group format, the AMEDD officer participates in a group of 12-18 officers lead by one experienced officer. Discussions and assignments are facilitated by the small group leader with emphasis on sharing individual experiences for the collective good of the group. NBC subject matter expertise is provided when requested by the NBC Sciences Branch, with emphasis on in the supervision of medical operations in NBC-contaminated environments with a capstone, Corps level, field training exercise, Medical Unit Staffs in Operations. In FY97, over 550 officers were trained in this course.

The Management of Chemical and Biological Casualties (MCBC) Course provides DoD personnel, primarily physicians and nurses, with a working knowledge of the potential threat of chemical and biological weapons and the status and scope of medical defense strategies. It combines classroom instruction and a field experience to establish essential skills, install confidence and define limitations in therapeutic modalities with each type of medical setting. The course also instructs on the use of specialized equipment and skills required for safe, long-distance evacuation. First-hand experience in triage, decontamination and medical operations on the integrated battlefield is stressed. This course is offered four times annually at the U.S. Army Medical Research Institute for Chemical Defense (MRICD), Aberdeen Proving Grounds, Maryland and the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Ft. Detrick, Maryland, along with a shorter “road” course provided on-site for individual units or posts. During the 36 courses taught in FY97, there were 1,405 Army, 107 Navy, 507 Air Force, 107 Civilians and 23 Foreign Nationals for a total of 2,149 personnel trained. In FY97, on September 16, 18, 19, 1997, USAMRIID broadcast a live, interactive satellite distance learning version of the Medical Management of Biological Casualties Course to 5,632 military health professionals at 249 sites across the United States. This 3-day course proved to be very cost-effective. This course cost \$210 per military student trained, whereas it costs an estimated \$1,000 to train a health care provider at USAMRIID’s resident in-house course. The satellite distance learning course with the first iteration trained more students than USAMRIID has trained in the entire history of the Medical Management of Biological Casualties in-house course. Additionally, MCBC was presented to the Medical Corps specific OBC class as part of their initial training to the AMEDD.

Specific nuclear training is addressed through the Medical Effects of Ionizing Radiation (MEIR) course. This one week course is designed to provide military health care providers and operational planners with background material relating to human injury and combat effectiveness in a nuclear weapons detonation or accident scenario. The course introduces the physical principles of nuclear weapons and ionizing radiation and the effects of nuclear weapons, effects and investigates the medical problems associated with radiation, including external exposure and internal contamination. This course is offered twice annually at the Armed Forces Radiology Research Institute (AFRRI), Bethesda, Maryland along with shorter “road” courses provided on-site for individual units or posts. In FY97, 355 Army, 81 Navy, 12 Air Force, and 123 DoD Civilian personnel trained in this course, for a total of 571 personnel.

The Medical NBC Professional Filler (PROFIS) Course is a ten-day two-week, Joint Service, course for the Medical NBC Officer (Nuclear Medical Science Officer or Preventive Medicine Officer) which stresses advanced instruction on the medical implications of NBC and directed energy environments. This year the course's theme stressed the importance of assessing the topics ranging from the medical NBC threat, determining the risk to US service members, and effectively communicating the risks of NBC to the structure of the Wartime AMEDD. Subject matter experts from various DoD and Civilian agencies, such as the USACMLS, AFRRI, Defense Intelligence Agency, and contractors provided presentations. Emphasis is placed on contingency operations, lessons learned from previous deployments, and domestic response exercises. and responsibilities of PROFIS Officers to their wartime units. In addition, each officer receives a "Battle Chest". This chest contains a notebook computer with modem, color printer, and digital references. The Battle Chest gives each officer the ability to perform their medical NBC duties in any deployable region. Of the 25 Battle Chests issued, three have been deployed with Preventive Medicine Officers to Bosnia in support of Operation Joint Endeavor and one was used during the anti-terrorism Exercise "Measured Response" at U.S. Army garrison, Fitzsimmons, Denver, Colorado.

The Medical NBC Defense Training and Education Network provides distributed learning and digital references via the Internet. The focus of this web site is to improve the overall awareness of medical NBC issues and to enhance sustainment training capabilities. The "home page" [<http://www.nbc-med.org/>] provides doctrinal publications that are interconnected by keywords to allow for quick searches of topics. For training purposes, the user can download these documents. In addition to the internal search capability, this site has a state of the art internet search engine which allows the user to explore all electronic information in support of medical or NBC training. Training using multimedia technology is also being developed for use with this network. Currently, the Management of Chemical Warfare Injuries interactive training package and Medical Management of Biological Casualties Manual is accessible through the site with nuclear training to be added as they become available. Future improvements to this network include: expanding connectivity to other military, governmental and private agencies; scheduling interactive training and education events; and adding related video, video conferences and training seminars to enhance training.

The Center for Health Promotion and Preventive Medicine sponsors a *Transportation of Biomedical Materials (TBM)* course and a *Refresher TBM* course. The purpose of these course is to certify personnel or to package infectious samples and specimens for transport IAW with requirements of 49 CFR Transportation, Air Force Regulation 71-4, and 42 CFR Centers for Disease Control. The course is interactive and practical exercises are used throughout. The course objectives are as follows:

- Identify and classify infectious substances, diagnostic specimens, biological products, and regulated medical waste (Department of Transportation).
- Use of hazardous materials table (49 CFR Part 172, 101) to prepare these items for transport.
- Package infectious substances, diagnostic specimens, biological products, and medical waste.

5.3.2 Air Force

Air Force policy is to provide annual refresher training to equip personnel in or deployable to NBC high threat areas. The Air Force standards of proficiency are based on two international standardization agreements: NATO Standardization Agreement 2150 (NATO Standards of Proficiency for NBC Defense), and Air Standardization Coordinating Committee (ASCC) Air Standard 84/8 (Initial, Continuation and Unit NBC Standards). Both agreements are implemented through Air Force Instruction 32-4001, Disaster Preparedness Planning and Operations. The Air Force ensures proficiencies and currency of NBC warfare defense training through classroom training, unit level training, and exercises. NBC Defense Training (NBCDT) is required only for military personnel and emergency essential civilians in or deployable to NBC high threat areas. Major Commands (MAJCOMs), the Air Reserve Component, and Direct Reporting Units may tailor their NBCDT programs to meet their specific mission requirements. The subjects presented in the classroom follow the three principles of NBC defense (avoidance, protection and decontamination) as identified in Joint Pub 3-11. The classroom training is followed by unit level training on wartime mission critical tasks. Supervisors train personnel to complete mission critical tasks while the workers are wearing their full complement of individual protective equipment. Exercises are used for training and evaluation purposes. Instructors at unit level receive their professional training through Air Force courses at Ft. McClellan, Alabama.

Individual Training

There are two types of individual training. The first is general equipment and procedures training that enables personnel to recognize and protect themselves and others from NBC hazards. The second is individual proficiency training that enables personnel to perform their wartime tasks in a NBC-contaminated environment. Detailed training comes with assignment to a threat area or to a deployable unit. Personnel receive six hours of initial equipment and procedures training to include mask confidence training within 30 days after arrival in an NBC high threat area or 90 days after assignment to a mobility position. NBC refresher training is at the discretion of the MAJCOMs, with the majority opting for annual refresher training through classroom training and exercise participation. Individual NBC proficiency training occurs through on-the-job-training and exercise participation.

Unit Training

Units in or deployable to NBC high threat areas must conduct at least two attack response exercises per year; overseas units often conduct graded attack response exercises more frequently. Air Force major commands have reported significant increases over the last three years in the number of people receiving equipment and procedures training as well as the number of hours spent for that training. The Air Force requires installations to conduct graded attack response exercises, consistent with the threat, at least:

- twice annually at installations in NBC high threat areas
- once annually at installations in other areas

- An additional exercise for units with a mobility commitment based on the threat within the deployment area.

5.3.3 Navy

The Navy's standards of proficiency are contained in several publications:

NWP 62.1	Surface Ship Survivability (Series)
NSTM 470	Shipboard BW/CW Defense
NSTM 070	Radiological Recovery of Ships After Nuclear Weapons Explosion
NSTM 077	Personnel Protection Equipment
FXP-4	Mobility, Logistics, Fleet Support Operations, Non-Combat Operations and Explosive Ordinance Disposal Exercises
S 5080	US Navy Chemical/Biological Defense AA-HBK-010 Handbook

Individual Training

The Navy provides initial entry level CBR defense training to all officers and enlisted personnel in the accession programs. Enlisted personnel receive three hours of training (two hours in the classroom; one hour in the lab) focused on the use of personal protection equipment and survival skills, including a CBR-D "confidence" chamber exposure. Officers receive two hours of class time focused on personal protection equipment and survival skills. Navy medical providers attend the Management of Chemical and Biological Casualties Course at the U.S. Army Medical Research Institute for Chemical Defense, Aberdeen Proving Grounds, Maryland and the U.S. Army Medical Research Institute of Infectious Diseases, Ft. Detrick, Maryland.

Unit Training

Proficiency training is conducted at the unit level by Navy instructors who are graduates of the NBC Defense course conducted by the Navy at Fort McClellan, Alabama. Navy units receive formal training prior to and during deployment. In addition to training, graded exercises are conducted semi-annually.

5.3.4 Marine Corps

The Marine Corps' NBC training focuses on the ability to conduct operations throughout the battlespace with particular emphasis on amphibious deployment, littoral, and air/ground operations. The Marine Corps views NBC as an environment, similar to daylight/darkness, cold/heat.

Training requirements are derived from the Force Commander's Mission Essential Task Lists, Joint Universal Lessons Learned, Marine Corps Lessons Learned, Mission Need Statements and Fleet Operational Needs Statements. Once validated, the training requirements are introduced into the Systems Approach to Training (SAT) Process.

One of the results of the SAT process is the development of Training Tasks and Standards that will fulfill the training requirements. These tasks lists and standards are incorporated into Individual Training Standards (ITSS) for individual Marines and Mission Performance Standards (MPS) for Marine units. These ITSS and MPSs are published as Marine Corps Orders for standardization and compliance throughout the Marine Corps.

The Marine Corps breaks training down into two categories: Individual Training based on ITSS and Collective (unit) Training based on MPS. Figure 5-1 shows the individual NBC training provided to all Marines.

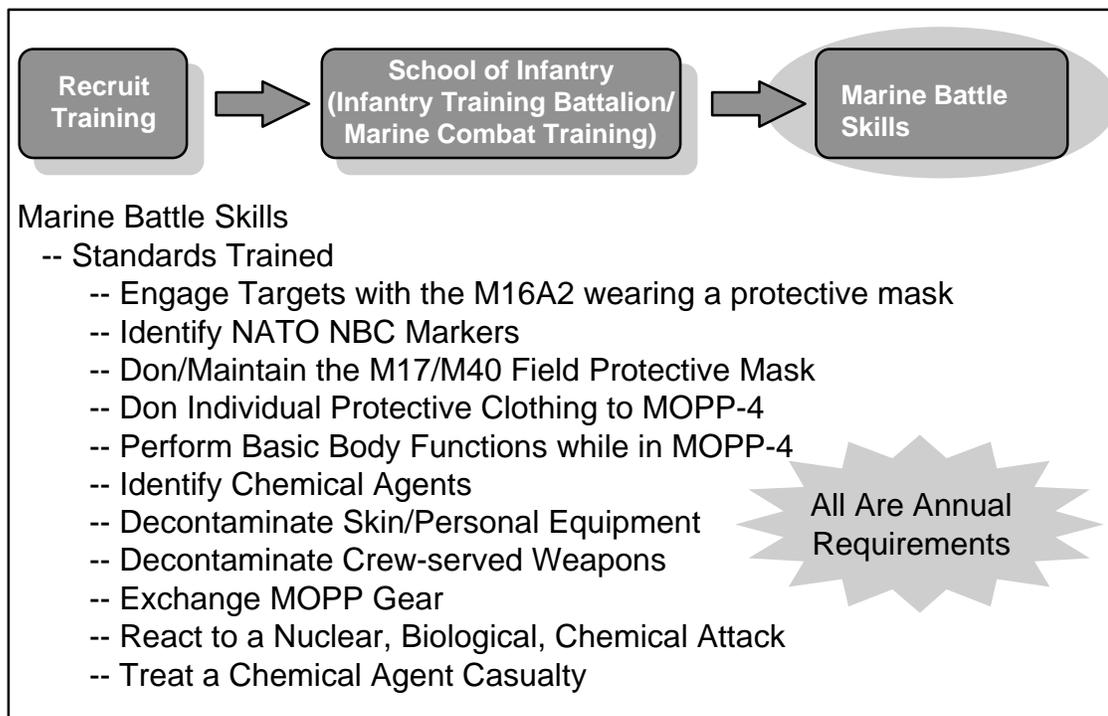


Figure 5-1. USMC Individual NBC Training

Individual Training

Enlisted entry level training begins at recruit training or “Boot Camp” where marines are introduced to the field protective mask and the gas chamber. All enlisted Marines then proceed to the School of Infantry (SOI). NBC training is identical for all personnel. The training focus is surviving under NBC conditions. Training has transitioned from a classroom/academic environment to practical application/field environment to provide students more hands-on experience.

Once Marines reach their units they begin the Marine Battle Skills program. Marine Battle Skills is a set of tasks which all Marines are required to be proficient in and are evaluated on annually. Marine Battle Skills NBC training focuses on providing Marines the capability to survive as well as function under NBC conditions.

Unit Training

Unit level (or collective) training includes classroom and field training and is included in unit training exercises and plans. (See figure 5-2.) Just as individuals are required to meet ITSs, units are also required to meet very specific training standards. These requirements take the form of Mission Performance Standards (MPSs). Each type of unit in the Marine Corps has a set of MPS assigned to it. These MPSs are published as 3500 Series Marine Corps Orders.

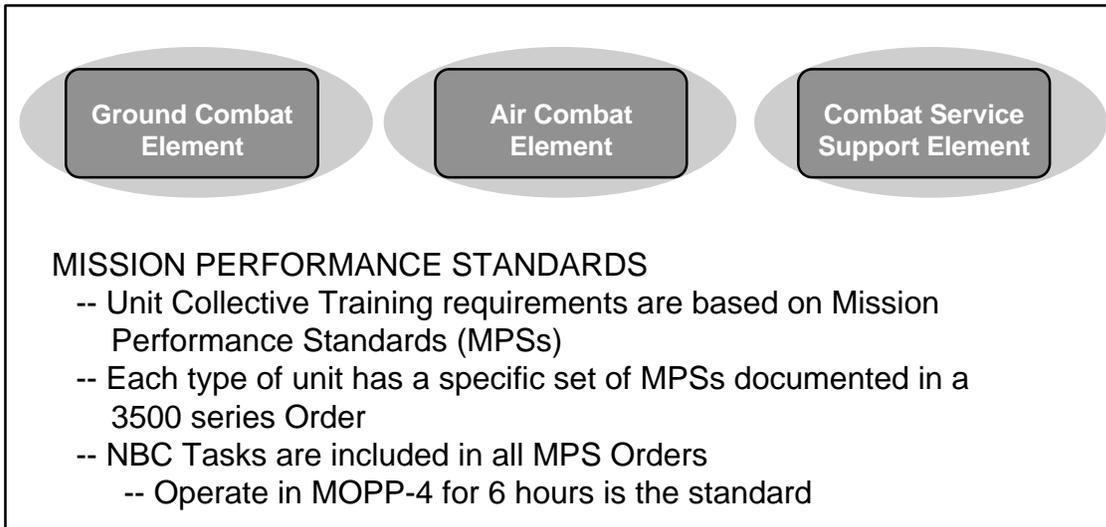


Figure 5-2. USMC Collective Training, NBC Requirements

Each MPS Order includes NBC Tasks which the unit must accomplish. However, each set of requirements varies from unit to unit. For example, a Tank Battalion must be able to utilize the vehicle's NBC filtration system, decontaminate tanks, and operate tanks under NBC conditions. An Infantry Battalion on the other hand has no requirement to decontaminate tanks, but does have to decontaminate crew served weapons. NBC evaluations are conducted annually for all Marine Corps units. Those units that are part of the Marine Corps' Unit Deployment Program and designated Marine Expeditionary Units are required to undergo an NBC evaluation prior to deployment.

5.4 NBC DEFENSE PROFESSIONAL TRAINING

Public Law 103-160 requires all Services to conduct NBC defense professional training at the same location. Currently, all Service training is co-located at the U.S. Army Chemical School, Fort McClellan, Alabama. Fort McClellan is scheduled for closure in FY99 and new training facilities are planned to be opened at Fort Leonard Wood, Missouri. Each Service conducts their training with their own Service instructors. The experts who graduate from the Service's technical training and the Army's Chemical Defense Training Facility become instructors for their Service's unit training. The Defense Weapons School attached to the Field Command, DSWA at Kirkland AFB, New Mexico, conducts a nuclear hazards training course.

5.4.1 Joint NBC Defense Professional Training

The Joint Service Integration Group has established a Joint Training Council (JTC) as a forum to discuss issues that pertain to facilities and range scheduling and any other training issues that impact the ability of the Services to conduct effective training.

Information exchanges between the Services were facilitated by the JSIG and plans put in place to review future doctrine and new equipment training plans. Discussion concerning a Joint instructor pool was shelved due to the planned transfer of training to Fort Leonard Wood, Missouri. The Army plans to consolidate common and shared (Chemical, Military Police, and Engineer) training. During consolidation training sessions, students from professional development courses conducted by all three schools will start at the same time, straining classroom and billeting resources. There are no further plans for migration to Joint instructional topics and/or Joint instructor pool.

Within the joint medical arena, the US Army Medical Department sponsors the Chemical and Biological Casualties (MCBC) course which provides training to DoD personnel further information on this course can be found in Section 5.3.1. Based on guidance contained in DoD Directive 6025.3, Clinical Quality Management Program in the Military Health Services (signed 20 July 1995), this directive requires that health care providers receive certification that documents preparation for assignments during military operations. This includes NBC defense training and provider courses where applicable. Certification will be reviewed by the medical commander annually. In addition, on 20 December 1995 the DoD completed DoD Instruction 1322.24 "Military Medical Readiness Skill Training," which implements policy, assigns responsibility, and prescribes procedures for developing and sustaining comprehensive systems for providing, assessing, and monitoring military medical skills training essential for all military personnel, health care personnel, and medical units. NBC defense training, to include chemical and biological warfare defense measures and medical specialty training such as casualty management, are specifically articulated in the instruction.

All Medical Nuclear Casualty Training has been consolidated under the Armed Forces Radiobiology Research Institute in Bethesda, Maryland, where radiobiology education is made available in a Tri-Service format.

5.4.2 Army NBC Defense Professional Training

US Army NBC Defense Professional Training at Fort McClellan, Alabama consists of three enlisted/noncommissioned officer courses and two officer courses. Initial entry enlisted soldiers receive training in chemical and biological agent characteristics and hazards, smoke and decontamination operations, chemical and radiological survey procedures and individual protective clothing and equipment. This one station unit training program provides 18 weeks of intensive training. It culminates with live/toxic agent training in the Chemical Defense Training Facility. Toxic agent training is an integral, mandatory component of all professional courses.

Chemical Corps sergeants attend the 15 week Chemical Basic Noncommissioned Officer Course (BNCOC) where they are trained to be an NBC company squad leader and a non-chemical company or battalion NBC NCO. Chemical BNCOC provides the NCO with the technical and tactical skills needed to advise company/battalion commanders in NBC operations and procedures, to train non-chemical soldiers in NBC avoidance, decontamination and protective measures and to lead smoke/decontamination squads.

Chemical Corps staff sergeants and sergeants first class attend the 13 week Chemical Advanced NCO Course (ANCOC) where they are trained to be an NBC platoon sergeant, an NBC NCO at brigade level, and an NBC NCO in a division or Corps level NBC element. They receive advanced technical operations, hazard estimates, logistics and maintenance management, combined arms operations, smoke and flame support, and training management.

Chemical Corps lieutenants attend a 19-week officer basic course, which prepares them to serve either as a Chemical Corps smoke or decontamination platoon leader or as a non-chemical battalion chemical staff officer/assistant operations officer. This course provides them with a fundamental knowledge of NBC agent characteristics and hazards, NBC recon (non-FOX), decon and smoke operations, NBC staff functions, individual/unit tactical operations, and biological detection operations. The course includes classroom instruction, hands-on equipment training, and field exercises. Completion of live/toxic agent training is a prerequisite for graduation.

Chemical Corps captains attend the 20-week officer advanced course where they are trained to serve as the commander of an NBC defense company and as NBC staff officers at the brigade and division level. Instruction focuses on leadership, Army operations, hazard prediction, planning and conducting NBC reconnaissance, decontamination, biological detection operations, and smoke and flame operations in support of maneuver units. Additionally, officers receive training in nuclear target analysis/vulnerability analysis, operational radiological safety, and environmental management. Extensive use is made of computer simulations to reinforce the application of NBC assets in support of tactical operations.

Specialized professional training is conducted in stand-alone courses attended by DoD, Allied, and international students. These courses include:

NBC Reconnaissance Operations (FOX)	(5 weeks)
Radiological Safety (Installation level)	(3 weeks)
Chemical Weapons Inspector/Escort (OSIA)	(1 week)
Chemical Weapons Convention Module II	(6 weeks)
Decon Procedures (Non-US) (GE, UK, NE)	(1 week)
RADIAC Calibrator Custodian	(1 week)
Biological Detection Specialist (BIDS)	(5 weeks)
Master Fox Scout	(2 weeks)
Long Range Biological Standoff Detection	(2 weeks)

5.4.3 Air Force NBC Defense Professional Training

The Air Force training detachment at Ft. McClellan offers seven separate in-residence courses designed to enhance the NBC proficiency of primary-duty AF Civil Engineer Readiness Flight personnel. These courses fulfill the differing needs of the total force, including Active Duty, Air National Guard, and Air Force Reserve. Further, the Air Force administers an exportable course designed to prepare people for in-residence training, a career development course taken through correspondence, and two mobile courses in airbase operability and NBC cell operations.

Each course contains a wide range of materials; covering critical aspects of Readiness Flight operations in situations ranging from peacetime, military operations other than war, through wartime. The following is a synopsis of the NBC aspects of these courses.

Training for personnel being assigned primary readiness duties includes comprehensive coverage of agent characteristics and hazards (to include determination of incapacitation/ lethality levels); nuclear weapons effects and other specific hazards associated with ionizing radiation; NBC detection and decontamination; contamination control and avoidance techniques; plotting and reporting procedures; detailed NBC persistency and duration of hazard calculations; the inter-relationship between NBC defense and other passive defense activities (*e.g.*, camouflage, concealment, and deception, (CCD), dispersal, and hardening, *etc.*); and systematic analysis procedures for assessing the hazard and providing credible advice to commanders.

Air Force learning theory emphasizes hands-on training and the school makes extensive use of available training ranges and equipment. The school includes CDTF live agent training in most of their courses. Training is provided on every major piece of equipment available in the field today, including state-of-the-art items to be fielded in the near future.

The CE Readiness Flight Officer and 7-level Craftsman courses provide flight leaders and mid-level NCOs with the background and technical information that is necessary for effective management of the CE Readiness Flight and contingency response operations.

Readiness is the key to successful Air Force operations. Consequently, the various aspects of CE Readiness Flight operations, including NBC defense, are also topics of instruction at briefings for Air War College, Air Force Institute of Technology, or Joint Senior Leaders Course.

5.4.4 Navy CBR Defense Professional Training

The Navy Training Center Detachment at Fort McClellan offers two courses of instruction for Navy Chemical, Biological and Radiological Defense (CBR-D) specialists. The courses are open to Navy, Coast Guard, Military Sealift Command and foreign personnel, E-5 and above. Courses are designed to provide both afloat and ashore commands with individuals who can successfully perform their requisite duties in a CBR contaminated environment. In addition, the training enables CBR-D specialists to act as the primary CBR-D trainers for their respective commands.

The training capitalizes on the unique capabilities of the Army Chemical School. In addition to classroom instruction, the Navy Detachment utilizes the CDTF for live agent training and the Bradley Radiological/Laser Laboratory for training in theory and equipment operation for radiological defense. Approximately 500 students graduate annually from the Detachment's courses. In addition to being fully qualified to conduct training using the Army's facilities, the Navy Detachment actively participates as part of the Joint Training Steering Group.

CBR-D training is incorporated into other courses such as the Senior Enlisted DC Program Management and Training, Damage Control Assistant, Repair Party Leader, and Explosive Ordnance Disposal.

5.4.5 Marine Corps NBC Defense Professional Training

The Marine Corps NBC Defense School at Ft. McClellan consists of an Enlisted Basic NBC Defense Course, and an Officer Basic NBC Defense Course. In addition to the courses conducted by the Marine Corps NBC Defense School, Marines attend three other functional courses (Chemical Officer Advanced Course, NBC Reconnaissance Course, and the Radiological Safety Officer Course) conducted by the Army Chemical School.

The USMC Enlisted Basic NBC Defense Course trains approximately 200 NBC specialists in a comprehensive 10 week program covering all the Individual Training Standards specified in MCO 1510.71. The curriculum includes 108 hours of instruction on how to conduct NBC training. This training provides Marines with the tools they will need on a daily basis as they perform their primary peacetime mission of conducting NBC Defense training to their units. The course is divided into six blocks of instruction as shown in Figure 5-3.

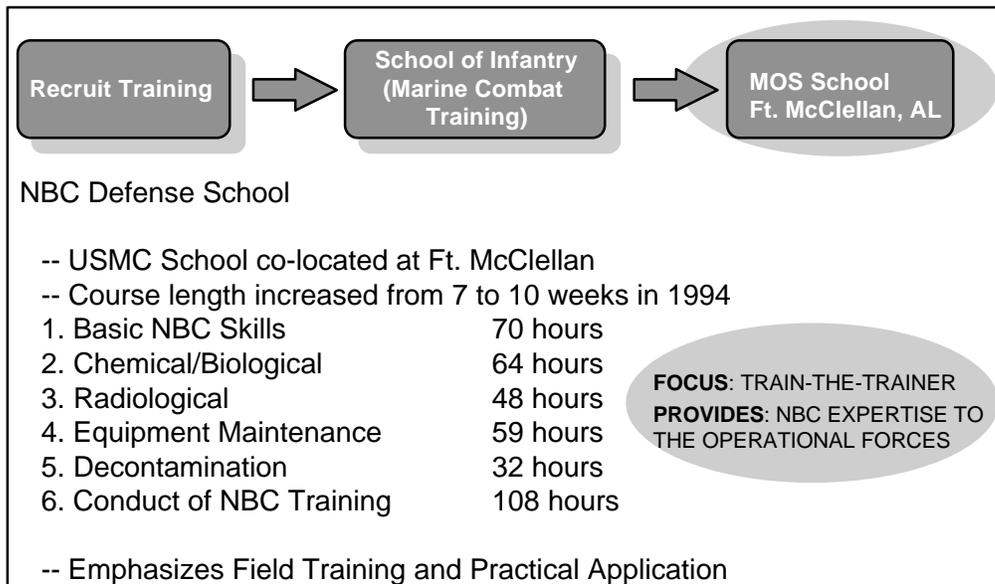


Figure 5-3. USMC Individual Training (Enlisted NBC Specialists)

Training For NBC Officers. Establishment of a Marine Corps Basic NBC Officer Course is complete. This course, shown in Figure 5-4, provides the requisite NBC skills to

newly selected Marine Corps NBC Defense Officers. The first course will begin began in June 1997. All Marine NBC Officers are Warrant Officers, usually selected from NBC Defense specialist enlisted ranks. As Warrant Officers, they focus entirely on technical expertise, NBC Defense training, and supervision of enlisted NBC Defense specialists. In the past, Warrant Officers relied on the training they had received as enlisted NBC Defense Specialists and on-the-job training. However, the new NBC Defense Officers Course will be geared specifically towards Warrant Officers and will build on previous training received. The NBC Officers course is geared toward Warrant Officers and builds on previous training and experience. NBC Officers also attend the Army's Chemical Officer Advanced Course and Joint NBC courses as part of advanced Military Occupational Specialist (MOS) training.

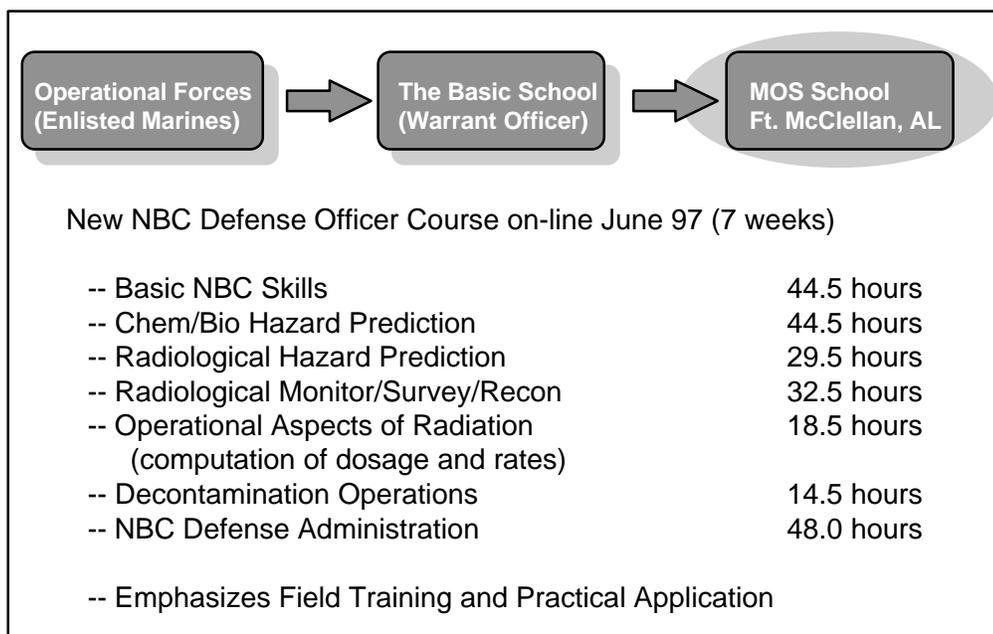


Figure 5-4. USMC Individual Training (Training for NBC Officers)

5.5 TRAINING IN A TOXIC CHEMICAL ENVIRONMENT

In 1987 the Army established the Chemical Defense Training Facility (CDTF) at Fort McClellan, Alabama. The CDTF allows personnel to train in a real toxic agent environment. Since its opening, the Army has used this valuable resource to train over 41,000 U.S. and Allied members from all Services. Training philosophy demands that the military train the way it fights. The CDTF promotes readiness by providing realistic training in the areas of detection, identification, and decontamination of chemical agents. The training develops confidence in chemical defense tactics, techniques, procedures, and chemical defense equipment. Instructors ensure that trainees can adequately perform selected tasks on a chemically contaminated battlefield. To date, the CDTF has maintained a perfect safety and environmental record.

Enrollment at the Joint Senior Leaders Course and the Toxic Agent Leader Training Course at Fort McClellan continues to be in demand. Over 1,200 active and reserve commanders, service leaders, and toxic agent handlers from each of the services have attended.

These experts become instructors for the Services for unit training. In addition to this training opportunity, toxic chemical environment training provides senior officers, commanders and future specialists confidence in their doctrine, warfighting techniques, and the equipment they fight with in the face of challenges presented by NBC contamination.

There is growing international interest in CDTF training participation. Germany has been taking advantage of this training opportunity for about six years. The United Kingdom now uses this facility for training. Law enforcement agencies have also participated in the training.

5.6 INTEGRATION OF REALISM/WARGAMES/EXERCISES

5.6.1 Simulations and Wargames

Incorporation of NBC features into relevant simulations, including portrayal of NBC weapons effects is essential. Currently, there are several engineering level models available that represent the fluid dynamics of NBC contamination. However, relatively few robust representations of NBC effects have been fully implemented in wargames and analytical models used by DoD. The Concepts Evaluation Model (CEM), used by the Army Concepts Analysis Agency, captures NBC effects off-line. Corps level models such as Vector-In-Command (VIC) and Division models such as Combined Arms and Support Task Force Evaluation Model (CASTFOREM) have some NBC capabilities that must be continually improved. JANUS, a division BDE level model, also has some NBC capabilities. that are being improved and updated. Force Evaluation Model (FORCEM) has been modified for theater level play. The configuration controlled version of Tactical Warfare (TACWAR) has had within it a chemical module for theater level chemical play that is under examination by the Joint Staff, and OSD for its ability to accurately model the effects of chemicals on a theater level warfight.

Incorporation of NBC features in relevant models, including faithful portrayal of CB aerosolization and electromagnetic pulse (EMP) effects is essential. The incorporation of CB weapons into the base cases of the computer wargame Louisiana Maneuvers (LAM) versions of the combat development and training model Janus-A and the ongoing iteration of the Army's Total Army Analysis (TAA) process using FORCEM, mark the first time major decisions have considered CB weapons as a part of the standard battlefield. For the LAM Janus-A (CB), the next step is to adopt the CB improvements into the Army Standard Janus-A model. This will put CB effects into a widely used training simulation and provide a Janus-A training audience the opportunity to understand the impacts of CB weapons. ACES, an Air Force Command Exercise System is a family of joint wargames which currently has robust nuclear simulations with chemical and biological planned for the near future. All existing models need to be modified in the biological area. To date, there has been limited model modification for biological play except for the current modifications ongoing to Janus.

Each of the services conducts wargames, which incorporate NBC in the scenarios, in their respective senior level service schools. The Joint Land, Aerospace, and Sea Simulation (JLAS), a joint exercise with all the senior service schools participating, hosted by the Air Force Wargaming Center at Maxwell AFB, Alabama, incorporates electronic simulation of the NBC

environment. EUCOM conducted AGILE LION 97 exercise in a Marine led JTF that dealt with a nuclear reactor accident humanitarian assistance operation in Lithuania. The Navy has conducted a Naval Battle Analysis to provide a tool to analyze the effects of CB agents on Naval operations and permit the incorporation of realistic assessments of CB warfare effects into Naval wargames. As a result, the Vapor, Liquid, and Solid Tracking (VLSTRACK) Model has been integrated into selected wargames and demonstrated to participants. In conjunction with the U.S. Army Concepts and Analysis Agency (CAA), USANCA sponsored ATOMIUM 97, a NATO Partnership for Peace (PfP) political military game involving low-level radiation which included the participation of PfP nations and Russia.

Current training exercise gaming simulations do not sufficiently challenge commanders and staffs to apply NBC defense training doctrine and leader-development training strategies to prepare their forces to maintain operational continuity and achieve mission success in an NBC and smoke/obscurant environment. To be an effective training mechanism, these simulations must challenge training audiences to understand adversaries' NBC intent and capabilities. Simulations must also allow players to visualize how NBC capabilities affect the battlespace, friendly courses of action, and operation plans. Additionally, effective simulations must allow players to apply NBC defense principles and capabilities to set conditions for mission success against NBC capable threats. Gaming simulations (Joint Simulation, Warfighter Simulation 2000, and Combined Arms Tactical Trainer) are being developed that will accurately replicate the NBC hazards and smoke conditions of future battlefields and their effects on friendly systems. Only then can commanders and staffs train and develop required high order battlefield cognitive skills that will allow full integration of enemy intent and capabilities, NBC environment effects, and friendly force capabilities into the development of a winning plan.

There is currently no standardized instrumentation system (IS) that can realistically portray all facets of Nuclear, Biological and Chemical training to train the total force. The U.S. Army Chemical School is developing NBC Recon training devices for the detection and tracking of simulated NBC contamination at Maneuver Combat Training Centers (CTCs) and home station training areas. Proposed training IS will retrieve, process and calculate digital contamination data for maneuver units, and will also include AAR feedback in the areas of NBC casualties, change of custody, and reaction procedures during NBC attacks and operations. This IS would provide a realistic replication of NBC contamination as portrayed on the Battlefield. Resourcing will be pursued to field proposed training devices at CTCs and other locations.

5.6.2 Joint NBC Training/Joint and Combined Exercises

Chairman of the Joint Chiefs of Staff (CJCS) Exercise Program

Joint NBC defense training objectives have been incorporated into the CJCS Exercise Program. This program includes three different types of exercises

- (1) **Positive Force (PF)** exercises are large scale Command Post Exercises that normally consider national level issues such as mobilization and deployment. During PF 98 (Mobilization) and PF 99 (Deployment), Atlantic Command (ACOM), in its role as

the force provider, ensures that deploying units and personnel are certified as combat ready. An integral part of this certification procedure is determining unit, personnel, and equipment operational readiness under NBC conditions.

(2) **Positive Response (PR)** exercises normally consider strategic level nuclear issues. In addition to considering command and control of nuclear forces, these exercises deploy, and backup national command and control personnel and systems annually. Capabilities of these redundant systems are equally applicable during chemical and biological scenarios as they are during nuclear scenarios.

(3) The **No-Notice Interoperability Exercise (NIEX)** program continues to focus on our ability to interdict the proliferation of nuclear, chemical, and biological weapons. In 1995, the NIEX required the interagency process to respond to a foreign nation's request to interdict and recover three stolen nuclear weapons. National level forces were deployed in response to this crisis. The 1996 NIEX tested our nation's ability to respond to a crisis involving biological weapons.

Joint Vision 2010 provides the operational based templates for the evolution of our Armed Forces to meet NBC challenges posed by our enemies. JV 2010 serves as the Doctrine, Training, Leader-development, Organization, and Material requirements (DTLOM) benchmark for Service and Unified Command visions. The NBC defense cornerstone resource for this vision of future warfighting embodies three required operational imperatives.

First, and most important, CJCS and Service leader recognition that NBC strategic and operational level of war expertise is an essential resource requirement in the Joint Warfighting Center (JWFC) and USACOM Joint Training and Analysis Center (JTASC). Success for Joint Vision 2010, a strategy centered on capabilities-based forces, requires these organizations to successfully accomplish their respective joint NBC defense doctrine, training, and leader development roles, and for USACOM to accomplish its NBC defense mission as force provider, force trainer, and force integrator. NBC expertise at all levels and from all Services is paramount.

Second, Unified Commands that are appropriately staffed with the right NBC expertise to meet current and future requirements to shape and respond to threat NBC challenges.

Third, doctrine, training, and leader-development training strategies that facilitate sophisticated battlefield visualization and situational awareness proficiency, allowing commanders and staffs to conduct service, joint, and combined operations in an NBC environment.

Army

The Army emphasizes integration of NBC defense training in unit rotations at the Combat Training Centers (CTCs). These centers include the National Training Center (NTC), Joint Readiness Training Center (JRTC), the Combat Maneuver Training Center (CMTC), and the Battle Command Training Program (BCTP).

The Army continues to see positive results in training based on external evaluation of unit Army Training and Evaluation Programs (ARTEPs) conducted at the NTC, JRTC, and other training locations world-wide. These results clearly show and emphasize that through continued training, soldiers can increase their ability to perform combat missions despite degradation caused by wearing a protective ensemble. Units which (1) have the necessary command support and equipment, (2) balance NBC within their overall training requirements, and (3) execute according to approved training plans, perform their overall mission better in a simulated NBC environment. However, increasingly constrained training resources limit training to fundamentals; often this means training for operating in an NBC environment is not funded.

Air Force

NBC warfare defense preparedness is an integral part of periodic Operational Readiness Inspections conducted by MAJCOM Inspectors General. Realism is injected into these scenarios using a simulated wartime environment including the use of bomb simulators, smoke and attacking aircraft. Personnel are tasked to perform war skills while in their full complement of protective equipment. Additionally, Air Force units participate in major joint and combined exercises which incorporate realistic NBC situations. Following are examples from the Pacific Air Forces (PACAF) that describe exercises incorporating NBC situations:

- TEAM SPIRIT - Joint/combined large scale air, sea, land exercise to demonstrate US resolve in South Korea.
- ULCHI FOCUS LENS - Joint/combined command and control exercise conducted in conjunction with the Republic of Korea's national mobilization exercise "ULCHI."
- FOAL EAGLE - Joint/combined rear area battle and special operations field training exercise.

Navy

Due to the unique nature of Naval vessels, CBR defense training is conducted similarly whether platforms are operating independently or in a group. Even in a battle group scenario, the task force would still continue with the mission while each unit would conduct NBC defense against certain attacks. Therefore, formal training is conducted by Afloat Training Groups while platforms are operating independently. Required training exercises are conducted by each unit every three months in order to maintain their readiness rating. During scheduled NBC defense training periods, realism is stressed. NBC defense equipment is used extensively. Protective masks and suits are worn by required personnel.

Inter-Deployment Training Cycle (IDTC) are notional cycles which have at least four full scale CBR-D exercises conducted prior to the predeployment readiness evaluation. Exercises incorporate all personnel and demonstrate all CBR-D equipment. Also, readiness standards require that at least two full-scale graded CBR-D exercises be conducted every six months.

Marine Corps

The Marine Corps incorporates NBC training into combined arms exercises at the Marine Corps Air Ground Combat Center in Twenty Nine Palms, California. Battalion level unit exercises are also conducted during Korea and Thailand Incremental Training Programs where units deploy and exercise various tasks. Like the Air Force and Army, the Marine Corps also participated in major joint/combined exercises. The level is determined by mission, threat, and task organization. During FY97, the Marine Corps incorporated NBC defense training into such exercises as JTF Exercise UNITED ENDEAVOR, ULCHI FOCUS LENS 96, FOAL EAGLE and IMEFEX. It should be noted that all Marine Corps units must also conduct quarterly NBC exercises. Evaluations include operational, administrative, and logistical functional areas. These exercises incorporate realistic NBC defense training into the exercise scenario to enhance the value of the exercise.

5.7 INITIATIVES

5.7.1 Joint

Doctrine

Initiatives in Joint NBC defense doctrine are detailed in section 5.2.

Modeling

The Deputy Assistant Secretary of Defense for Counterproliferation and Chemical and Biological Defense, DATSD(CP/CBD), and the Deputy Under Secretary of the Army for Operations Research (DUSA-OR) have initiated a CB Modeling Process Action Team whose purpose is to “provide OSD with a consolidated and integrated CB modeling program, where possible, harmonizing individual Service and Agency work into joint programs and eliminating duplication and overlapping projects.”

In response to a Joint Requirement Oversight Council (JROC) question concerning the impact of weapons of mass destruction (WMD) on medical force structure, the Joint Staff is currently conducting a “Joint WMD Analysis” to evaluate the effects of chemical and biological agents on theater level warfighters. Among the many issues related to use of WMD, potential casualties of WMD will be used to review medical force structures.

Training

5.7.2 Army

In an effort to refine doctrine and training, the Army is quantifying the impact of NBC environments on combat operations. Two programs have been executed to achieve this goal: (1) Combined Arms in a Nuclear/Chemical Environment (CANE), and (2) Physiological and Psychological Effects of the NBC Environment and Sustained Operations on Systems in Combat

(P2NBC2). These Force Development Testing and Experimentation (FDTE) evaluations have improved our understanding of individual and unit operations and performance degradation while in MOPP. The CANE FDTE evaluations quantified field data that commanders can use for planning, training and decision making to respond to the threat.

The Army, as proponent for CANE tests, has completed five field evaluations (mechanized infantry squad/platoon in 1983, tank company team in 1985, armor heavy battalion task force in 1988, light infantry forces in 1992, and air defense artillery in 1993). The Army has established the Chemical Vision Implementation Plan (CVIP) a systematic review process to ensure identified deficiencies are addressed and corrected. The Commandant of the Army's Chemical School reviews the CVIP annually. Army field manuals are then revised to address deficiencies identified in CANE tests.

Before CANE FDTEs were conducted, commanders' training in a simulated NBC environment had an indication of the degradation that MOPP places on their operations. They were aware that training could maximize proficiency, but they lacked the feedback to direct that training. Consequently, training was often sporadic and incomplete.

The Army is now implementing several training guidance improvements by:

- Providing heightened command emphasis to unit commanders on NBC threat with attention to Third World countries;
- Simulating NBC environments in training;
- Continuing emphasis and effort to integrate safe, realistic NBC defense in all training.

5.7.3 Air Force

The Air Force currently has three training and readiness initiatives underway and continues to improve its professional training.

The Civil Engineer Readiness Technical School implemented an advanced course at the CDTF. The training is scenario driven, versus lockstep, and revolves around a terrorism incident involving chemical munitions. Air Force instructors are qualified to conduct joint classes at the CDTE and are fully integrated into CDTF operations. Readiness personnel lead every Air Force class through the training and also assist the other services with their training requirements.

The school is in the process of revising its courses of instruction in order to meet the requirements of the Specialty Training Standard (STS) approved in October 1996. The new STS requires Readiness personnel be much more qualified in biological warfare operations, to include the use of emerging detection and plotting technologies.

Air Force Readiness personnel in the field who are enrolled in correspondence courses for upgrade training to the five skill level will have the opportunity to elect to receive the course on fully interactive CD-ROM with full motion-video and sound. The course is presently

available only in a paperback version, which will continue to remain available after the CD-ROM release. Interactive courseware will begin development in fiscal year 1997.

5.7.4 Navy

The Navy's main initiative is integration of CBR-D requirements in the tactical training strategy. These requirements are executed via the interdeployment training cycle's aggressive training and material readiness program. Additionally, the funds made available from the FY96 National Defense Authorization bill are being utilized to upgrade existing training aids and delivery of training support ADP equipment to all units. Navy is also investigating required preparations and training associated with large area decontamination. The Naval Facilities Engineering Command is currently conducting a study in this area with the results expected in 2QFY97.

Additionally, the Navy's basic NBC defense course has been incorporated in both officer and enlisted accession training curriculums. In conjunction with this initiative, the same course taught at the fleet training centers has been restructured to improve throughput. The Navy Environmental Health Center, Norfolk, Virginia, is in the process of implementing a training and consultation team at the Navy Environmental and Preventive Medicine Unit (NEPMU) #2 in Norfolk, Virginia and NEPMU#5 in San Diego, California. These teams will provide Navy Medical Department personnel with the training and consultation necessary to ensure effective medical management of casualties caused by chemical, biological, radiological, and environmental (CBRE) exposures.

5.7.5 Marine Corps

During FY97 the Marine Corps Chemical Biological Incident Response Force (CBIRF) continued to refine its tactics, techniques, and procedures to respond to the growing biological and chemical terrorist threat. The CBIRF was activated April 1, 1996 and has deployed to the Olympics in Atlanta, the Republican National Convention, the Presidential Inauguration, the Summit of Nine Conference in Denver, Colorado, and numerous other exercises to include Agile Lion, Bold Endeavor, and Ill Wind. The CBIRF was a primary participant in both the BIO-911 Advanced Concept Technology Demonstration (ACTD), and the Port and Airfield ACTD during FY97.

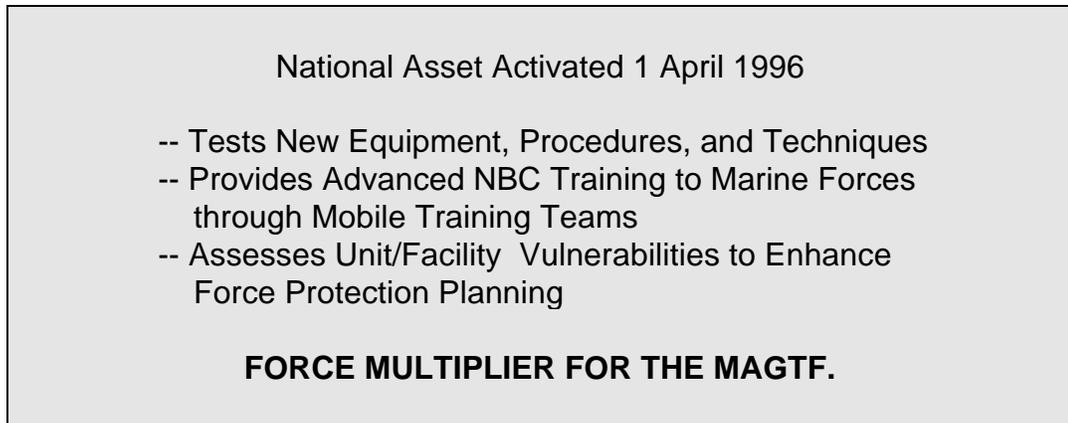


Figure 5-5. Chemical/Biological Incident Response Force (CBIRF) Role in Training

The CBIRF focuses on consequence management to terrorist-initiated NBC incidents. The CBIRF is a national asset, to be globally sourced to Marine Force Commanders and National Command Authority for duties as the President may direct. The CBIRF consists of 380 skilled and trained personnel, including civilian experts. The organization consists of six sections: Command (including a Reach-Back Advisory Group), Security, Service Support, NBC Reconnaissance, Decontamination, and Medical. The CBIRF is equipped with state-of-the-art detection, monitoring, and decontamination equipment and is prepared for operations in a wide range of military-civilian contingencies. The Commanding General, Marine Corps Combat Development Command will continue to refine concepts, doctrine, and tactics, techniques and procedures for this CBIRF. In addition to the CBIRF's capabilities to respond to chem/bio incidents it serves as a training asset to the operational forces. The CBIRF will provide mobile training teams to various units to provide advanced NBC training to unit NBC specialists (train-the-trainer). This will provide operational forces with the most up-to-date NBC techniques, tactics, and procedures developed by the CBIRF. CBIRF will also conduct Unit/Facilities Vulnerability Assessments to enhance force protection. The bottom line is that the CBIRF will serve as a force multiplier to the MAGTF.

Marine Corps initiatives for FY98 will include:

- Integration of NBC defense procedures in Mission Oriented Tasks (Garrison and Field).
- Publish revised MCO 1510.71, Marine Corps NBC Specialist Individual Training Standards (ITS).
- Conduct USMC NBC Defense Course Content Reviews based on revise ITS's and emerging NBC equipment requirements.
- Conduct USMC Table of Equipment and Table of Organization Reviews.
- Complete implementation of USMC NBC Staff Planning follow-on course, a training course to prepare NBC defense officers and NCOs to assist in the staff planning process.
- Establishment of combat training package for ISMs for reserve forces and follow-on forces in the event of hostilities involving an NBC threat.
- Continued Annual Joint Marine Corps and Navy shipboard decontamination exercises with 7th Fleet.

- Continue participation in a bilateral exchange program with the Republic of Korea (ROK) Chemical Corps.
- Conduct Front End Analysis for an NBC SNCO Advanced Course.
- Develop/initiate CBIRF training packages for Marine Expeditionary Units (MEUs).
- Establish a “First Responder” capability in MEUs.

5.7.6 Emergency Response: Army Medical Response

The AMEDD has been increasingly involved in supporting DoD and federal counterterrorism initiatives and contingency operations related to NBC threat agents over the past several years, mainly with elements of the Medical Research and Materiel Command (MRMC). The following offices and agencies have recently required AMEDD assistance: DoD SO/LIC, J4 Medical Readiness, U.S. Army Technical Escort Unit, US Department of State, Federal Bureau of Investigation, Department of Health and Human Services, Office of Emergency Preparedness, and the U.S. Marine Corps CBIRF. Specific examples of AMEDD support include training civilian healthcare providers for the Atlanta Summer Olympics, participation in overseas counterterrorism training exercises, training the USMC CBRIF medical personnel upon unit stand-up, and medical evaluation of biological threat incidents with analytical support for the FBI.

The AMEDD has formed Specialty Response Teams (SRTs). These teams provide a rapidly available asset to complement the need to cover the full spectrum of military medical response—locally, nationally, and internationally. These teams are organized by USAMEDCOM subordinate commands; they are not intended to supplant TOE units assigned to Forces Command or other major commands. The regional medical commands (RMCs), USACHPPM, and the US Army Medical Research and Materiel Command (USAMRMC) commanders organize SRTs using their table of distribution and allowances (TDA) assets. These teams enable the commander to field standardized modules in each of the SRT areas to meet the requirements of the mission. Members of the US Army Reserve (USAR) may be relied upon to provide a variety of functions in support of the various SRT missions. All SRTs will be capable of deploying within 18 hours of notification. The two SRTs which can support NBC are the *Preventive Medicine Threat Assessment SRT* and the *Chemical/Biological SRT*.

The mission of the *Preventive Medicine Threat Assessment SRT* is to provide initial disease and environmental health threat assessments. This is accomplished prior to or in the initial stages of a contingency operation, or during the early or continuing assistance stages of a disaster. This SRT can:

- Perform on-site initial health threat assessments, limited and rapid hazard sampling, monitoring, and analysis, health risk characterization, and needs assessment for follow-on PVNTMED specialty or other medical treatment support in the AO.
- Prepare PVNTMED estimates.
- Perform analysis of, but not limited to--
 - Endemic and epidemic disease indicators within the AO.

- Environmental toxins related to laboratories, production and manufacturing facilities, nuclear reactors, or other industrial operations.
- Potential NBC hazards.
- Provide medical threat information and characterize the health risk to deployed forces or civilian populations.
- Provide guidance to local health authorities on surveying, monitoring, evaluating, and controlling health hazards relative to naturally occurring and man-made disasters.
- Assist local health authorities in surveying, monitoring, evaluating, and controlling health hazards relative to naturally occurring and man-made disasters.

The *Chemical/Biological SRTs* include the following USAMEDCOM staffed assets: the National Medical Chem-Bio Advisory Team (MCBAT) at the USAMRMC, and the RMC Chemical/Biological SRTs. The National MCBAT is comprised of USAMRMC elements from the US Army Medical Research Institute of Infectious Diseases (USAMRIID) and the US Army Medical Research Institute of Chemical Defense (USAMRICD). These assets are Tier 1 elements of the DoD Chemical Biological Quick Response Force (CBQRF) and are ready to deploy worldwide within 4 hours after receiving their orders. The RMC Chemical/Biological SRTs are trained medical teams located at the RMCs that can deploy in response to a chemical, biological, or radiological incident. Examples of incidents which may require a rapid response include:

- An accident involving the transport or storage of NBC weapons.
- The release of CW or BW agents or radiological material.
- A leak of an industrial chemical, infectious material, or radioactive material.

The National Chem-Bio Advisory Team is the principal DoD medical advisor to the Commander, CBQRF and the Interagency Response Task Force. Both the National MCBAT and regional Chemical/Biological SRT can provide medical advice and consultation to commanders or local medical and political authorities for preparation of a response to a threat or actual incident. They can also provide medical advice to commanders or local authorities on protection of first responders and other health care personnel, casualty decontamination procedures, first aid (for non-medical personnel) and initial medical treatment, and casualty handling. The initial advice includes identifying signs and symptoms of NBC exposure, first aid (self-aid, buddy aid, combat lifesaver aid for military personnel), and initial treatment when an incident has occurred. The NCBAT also assists in facilitating the procurement of needed resources.

The RMC Chemical/Biological SRT will conduct the initial response, and upon arriving at the incident site will determine the types and number of other responders required. The RMC Chemical/Biological SRT may, after initial assessment of the situation, elect to use telemedicine reach back or to call in domestic or foreign response assets organized at the national level. These response assets include the National MCBAT and the Aeromedical Isolation Team (AIT) from USAMRIID. The AIT is a highly specialized medical evacuation asset for the evacuation of limited numbers of contagious casualties with lethal infectious diseases, or for consultation on appropriate management of such casualties in place in the event of a mass casualty situation.

The US Army Medical Research Institute of Chemical Defense (USAMRICD) has developed a Chemical Casualty Site Team (CSST) with the capability of rapid deployment in support of DoD, the Foreign Emergency Response Team (FEST), or the Domestic Emergency Response Team (DEST). The team is task organized to support each specific mission. Personnel available for deployment consist of physicians, a nurse, toxicologists, veterinarians, and laboratory specialists. These personnel, when coupled with their supporting capabilities, are knowledgeable of medical effects of a specific chemical warfare agent, identification of chemical agents or their metabolites in biological samples, determination of blood cholinesterase levels, technical and biomedical expertise required to enable protection of personnel responding to chemical incidents or to guide decontamination of personnel and casualties, technical expertise to accomplish mission planning.

The AMEDD also provides assets to support the Chemical Biological Augmentation Team (CBAT), a 5-person chem/bio plug-in to the FEST or the DEST. We also provide two medical advisors as part of the CBDCOM Tier I CB Rapid Response Team (CBRRT) package. The AMEDD provides advisors to the CBRIF Reachback Scientific Advisory Group.

The US Army Medical Research Institute of Infectious Diseases (USAMRIID) has developed the capability to deploy an AIT consisting of physicians, nurses, medical assistants, and laboratory technicians who are specially trained to provide care to and transport patients with disease caused by biological warfare agents or by infectious diseases requiring high containment. USAMRIID's teams are deployable worldwide on a 12 hour notice using USAF transportation assets. The AIT uses specialized isolation units which maintain a contained environment under negative pressure to safely transport such patients and to provide medical care to them while in transit. Quarterly training missions are flown with the West Virginia Air National Guard.

As a supporting capability, USAMRIID has a 16-bed ward with the capability of isolating (up to Biosafety Level 3) patients with infectious diseases in a contingency situation. USAMRIID also has a special Biosafety Level 4 (highest level of containment) patient care area designed for a maximum of 4 patients requiring this level of containment. These patient care areas are capable of providing intensive care for critically ill patients with specialized personnel and equipment augmentation from Walter Reed Army Medical Center. An additional supporting capability at USAMRIID is its capacity for medical diagnostic assays for recognized biological agents.

5.8 READINESS REPORTING SYSTEM

CJCS MOP 11, the policy document for the Status of Resources and Training System (SORTS) requires units from all Services to independently assess their equipment on hand and training status for operations in a chemical and biological environment. This is a change to previous SORTS reporting requirements, and provides more visibility to NBC defense related issues.

The Services individually monitor their SORTS data to determine the type of equipment and training needing attention. Units routinely report their equipment on hand and training status for operations in a chemical or biological environment. Commanders combine this information with other factors, including wartime mission, to provide an overall assessment of a unit's readiness to go to war.

Additionally, the Commanders-in-Chief (CINCs) of the Unified Commands submit readiness assessments at each Joint Monthly Readiness Review (JMRR). In the JMRR, CINCs assess the readiness and capabilities of their command to integrate and synchronize forces in executing assigned missions. As needed, CINCs address NBC defense readiness and deficiencies as part of the JMRR.

5.9 NBC DEFENSE TRAINING AND READINESS ASSESSMENT

***ISSUE:* DoD lacks a mechanism to provide adequate information on the current status of training, equipment, and readiness. It needs adequate information to assess operational force capabilities from the Department and the warfighting CINCs' perspectives.**

SOLUTION: Assign consistent and higher priority to NBC defense, especially by the Joint Chiefs of Staff and the warfighting CINCs, in order to maintain an adequate state of readiness and to ensure NBC defense reporting information is accomplished in a timely and adequate manner. Existing reporting systems may provide an adequate mechanism for assessing readiness.

***ISSUE:* Joint NBC defense doctrine needs to be continually developed and include joint tactics, techniques, and procedures.**

SOLUTION: Initiatives began in 1987 to develop joint NBC defense doctrine which resulted in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense*. In FY95 efforts were initiated to update this document. The Joint Service Integration Group, assisted by the U.S. Army Chemical School Joint Doctrine Cell, is responsible for assisting the U.S. Army in the development of this doctrine under sponsorship of the Joint Staff. Continued Service interaction and cooperation facilitated by these organizations will produce the next generation of Joint NBC Defense Doctrine.

***ISSUE:* There are limited chemical and biological features in wargaming and planning models.**

SOLUTION: Funding to add chemical and biological warfare to exercise scenarios has been received for FY96. Efforts are underway in the current DoD programming cycle to establish long term support. The CB Modeling Process Action Team is also addressing this issue.

ISSUE: The March 1996 GAO Report, “Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems,” identified many readiness shortfalls among the Services.

SOLUTION: In response to the March 1996 GAO Report, “Chemical and Biological Defense: Emphasis Remains Insufficient to Resolve Continuing Problems,” Congress added funds in the FY97 Appropriation Act to Army and Air Force Operations and Maintenance (O&M) accounts to improve readiness. As part of the FY97 Appropriations legislation, Congress provided Army Operations and Maintenance (O&M) with a \$10.2M plus-up for chemical-biological equipment maintenance support. With this plus-up, 9,600 M48A1 Filter Units, which are used to outfit and sustain select combat vehicles and collective protection systems, were procured at a cost of \$540 each (totaling \$5.184M). In addition, 3,436 M295 Decontamination Kits were procured at a cost of \$529.92 (totaling \$1.821M). The remaining part of the \$10.2M plus-up was used by AMC to partially offset over \$300M Congressional and HQDA reductions in the their FY97 Operation and Maintenance Army program, and not applied against the HQDA provided priority list. Actions are ongoing to have AMC restore the remaining funding in FY98.

As part of the same legislation, Congress provided Air Force Operations and Maintenance (O&M) with a \$2.0 million plus-up for chemical-biological equipment maintenance support. With this plus-up, the Air Force supported an NBC program in the U.S. Air Force European Command (\$1.067M); procured MCU-2/P protective masks, M28 simplified collective protection equipment, and related equipment and training for U.S. Air Force Pacific Command (\$0.382M); procured spare parts for masks, decontamination training kits, and related equipment for the Air Combat Command (\$0.278M); purchased training equipment for the Air Mobility Command (\$0.200M); and funded CB defense program management support within the U.S. Force Civil Engineering Squadron, Readiness Flight Division (\$0.073M).

CHAPTER 6

STATUS OF DOD EFFORTS TO IMPLEMENT THE CHEMICAL WEAPONS CONVENTION

(INTENTIONALLY BLANK.)

6.0 INTRODUCTION

The Chemical Weapons Convention (CWC) was opened for signature on January 13, 1993. On October 31, 1996, Hungary became the 65th country to ratify the treaty, thus initiating proceedings for entry into force. Entry into force (EIF) took place on April 29, 1997—180 days after the 65th ratification. As of January 3, 1998, 168 countries have signed the CWC, of which 106 have ratified the treaty, including the United States.

6.1 DEPARTMENT OF DEFENSE PREPARATIONS AND IMPLEMENTATION

The Department of Defense conducts an Implementation Working Group (IWG) to implement the Chemical Weapons Convention (CWC). Through regularly recurring meetings, representatives of the Office of the Secretary of Defense (OSD), the Joint Staff, the Military Services, and DoD agencies and activities coordinate planning efforts to ensure successful implementation of the CWC and related CW agreements. Formal meetings of the CWIWG are scheduled approximately monthly and small group meetings are held as needed to address requirements that impact selected members of the CWIWG. A Compliance Review Group (CRG) was established within DoD to meet as needed to address ongoing compliance concerns.

The Military Services and the On-Site Inspection Agency (OSIA) have developed individual implementation and compliance plans to provide guidance for their commands and activities under the CWC. As outlined in their plans, the Services and OSIA have conducted assistance visits and formal exercises to ensure that all elements are prepared to comply with the agreements.

The Military Services have individually established implementation support offices which participate actively at the DoD CWIWG, provide Service policy direction, and conduct ongoing liaison with their major commands to ensure that all military elements are fully prepared for inspections under the CWC and related CW agreements.

OSD, the Joint Staff, the Military Services, OSIA and the Defense Special Weapons Agency (DSWA) provide technical experts to support activity at the U.S. Delegation to the Organization for the Prohibition of Chemical Weapons (OPCW) in The Hague, The Netherlands. The OPCW is charged with overseeing worldwide implementation of the CWC.

Since EIF, DoD has been actively implementing the Convention. From June until November 1997, DoD and the Military Services (primarily the Army, which is most affected) successfully hosted 34 initial visits and inspections at chemical weapons storage, former production, and destruction facilities. The Army and OSIA continue to host and escort OPCW inspectors who conduct continuous monitoring at DoD CW destruction facilities. DoD continues to prepare for possible challenge inspections which can impact any facility, any place, anywhere, and anytime.

6.2 TRAINING FOR INSPECTORS

The only training provided by the United States is safety orientation for inspectors. OPCW inspectors who conduct continuous monitoring at U.S. chemical weapons demilitarization facilities have attended a 32-hour class—broken down into two sections—on hazardous waste operations (HAZWOPR) and demilitarization protective ensemble (DPE) procedures. The class is conducted at the Chemical Demilitarization Training Facility in Edgewood, Maryland. A total of 122 inspectors have attended HAZWOPR training; 31 of the 122 inspectors have taken the 8-hour DPE portion of the class. This classroom instruction is a U.S. Government requirement for all personnel who work at U.S. chemical demilitarization facilities.

6.3 PREPARATION OF DEFENSE INSTALLATIONS

OSIA has been coordinating actively with the Military Services in preparing DoD installations for inspections under the CWC. All defense installations which are subject to declarations under the requirements of the CWC, and many which are subject to challenge even though not declared, have been visited by OSIA technical experts and Military Service representatives. A series of staff assistance visits, joint training exercises, and mock inspections have been carried out at installations identified by the Military Services as being potentially vulnerable. Furthermore, the Military Services have initiated efforts to ensure that affected commands take timely and appropriate measures to reduce vulnerability.

OSIA successfully trained for and escorted initial OPCW inspections to all DoD CW related facilities during the initial inspection period. Prior to each inspection OSIA participated in a site assistance visit to each location. OSIA will continue to participate in site assistance visits and quarterly meetings with Army Treaty Compliance Officers sponsored by the Army, which is the Executive Agent for Chemical Treaty Compliance to ensure all U.S. DoD facilities are in full compliance with CWC provisions.

6.4 DEFENSE TREATY INSPECTION READINESS PROGRAM

The Defense Treaty Inspection Readiness Program, for which OSIA is the executive agent, has implemented an extensive outreach program to provide information about the CWC, security countermeasures, facility preparation, to both government and DoD industry. DTIRP provides training and awareness services through such fora as industry seminars, mobile training teams, industry associations, national conventions and symposia. DTIRP speakers participated in more than 70 outreach events during the last fiscal year. DTIRP also publishes various educational products (printed and video) and administers electronic bulletin boards to provide information concerning the CWC to government and industry.

Through DTIRP, OSIA maintains an operational capability to deploy counterintelligence personnel and specialized equipment to support assistance teams at facilities which undergo challenge inspections. DTIRP is an integral support element to the Military Services, Department of Energy, and others for CW challenge inspections at their undeclared, as well as

their declared, facilities. This capability continues to be available to support DoD and government contractors during implementation of the CWC.

6.5 ARTICLE X ASSISTANCE AND OTHER ASSISTANCE

Under Article X of the CWC, a State Party to the treaty may make an appeal for assistance to the Director-General of the OPCW. In accordance with a condition of U.S. Senate ratification of the CWC, the United States will provide “no assistance...other than medical antidotes and treatment,” which the U.S. Government deems are necessary, to those CWC States Parties that have requested assistance under Article X of the CWC.

Under the CWC, DoD has not provided any chemical weapons detection equipment, or assistance in the safe transportation, storage, and destruction of chemical weapons to other signatory nations. Such assistance, however, is being provided to Russia under DoD’s Cooperative Threat Reduction (CTR) program.

6.6 VERIFICATION TECHNOLOGY

The Defense Special Weapons Agency (DSWA) Chemical Biological (CB) Arms Control Technology (ACT) Office conducts RDT&E to support U.S. roles in global CB arms control initiatives by developing technologies and procedures for DoD identified implementation, verification, monitoring and inspection needs as required by CB arms control agreements. The CB ACT program is directed towards protecting national security interests, improving the effectiveness of verification efforts, assisting the United States to meet legal obligations imposed by treaty provisions, supporting development of US policy, minimizing inspection and implementation costs, and enhancing the safety of treaty inspections.

The current DSWA CB ACT Program continues to support DoD’s efforts to implement the CWC by focusing on the following:

- Support to the Office of the Secretary of Defense and the U.S. Delegation to the OPCW
- Compliance support/ data management
- Off-site monitoring
- Non-destructive evaluation
- On-site analysis.

(INTENTIONALLY BLANK.)

ANNEX A

**CONTAMINATION AVOIDANCE
PROGRAMS**

(INTENTIONALLY BLANK.)

SECTION 1: FIELDED AND PRODUCTION ITEMS

DETECTORS AND MONITORS

Chemical Agent Monitor (CAM) and Improved Chemical Agent Monitor (ICAM)

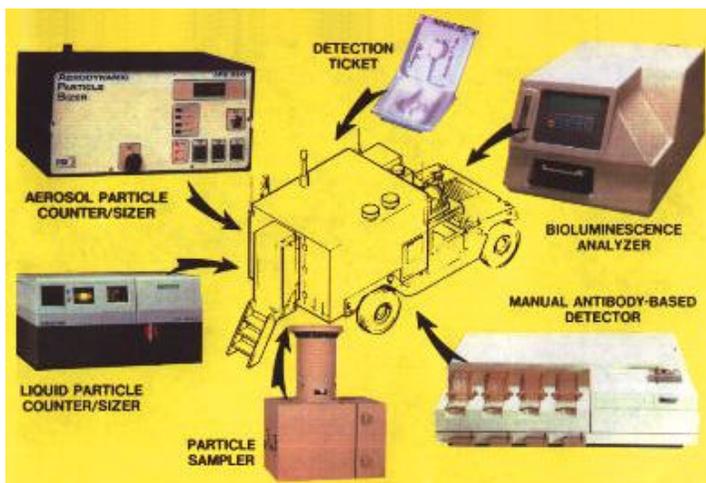
The CAM is a hand held instrument capable of detecting, identifying, and providing relative vapor concentration readouts for G and V type nerve agents and H type blister agents. The CAM uses ion mobility spectrometry (IMS) to detect and identify agents within 1 minute of agent exposure. A weak radioactive source ionizes air drawn into the system and the CAM then measures the speed of the ions' movement. Agent identification is based on characteristic ion mobility,



and relative concentrations based on the number of ions detected. The four pound, 15" long CAM can be powered either by an internal battery, or by an external source through the CAM's combination power/fault diagnosis plug. The CAM may be used for a variety of missions, to include area reconnaissance and area surveillance, and monitoring of decontamination operations. The improved ICAM significantly reduces the level and frequency of maintenance without affecting performance. The ICAM sieve pack has double the capacity of the two CAM sieve packs, which results in twice the operational life of the ICAM over the CAM. This fielding will significantly reduce operating and sustainment costs associated with the CAM.

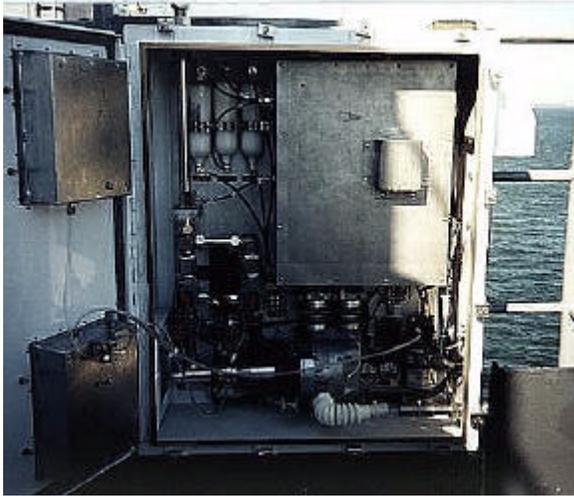
M31 Biological Integrated Detection System (BIDS) NDI

BIDS uses a multiple technology approach, both developmental and off-the-shelf materiel, to detect biological agents with maximum accuracy. BIDS is a vehicle-mounted, fully integrated biological detection system. The system, which is a collectively-protected, HMMWV-mounted S788 shelter, is modular to allow component replacement and exploitation of "leap ahead" technologies. Thirty-eight BIDS (NDI versions) have been fielded to the first ever biological detection company, the 310th Chemical Company (U.S. Reserve) during FY96. This gives the Department of Defense its first credible, rapidly deployable biological detection capability. The BIDS is a Corps level asset. The BIDS program includes a P³I development effort which will increase automation and integrate the CB Mass Spectrometer (CBMS) with the Biological Detector as sub-components. Each sub-component may also be used as stand-alone systems to meet other service needs.



Each sub-component may also be used as stand-alone systems to meet other service needs.

Interim Biological Agent Detector (IBAD) -Rapid Prototype

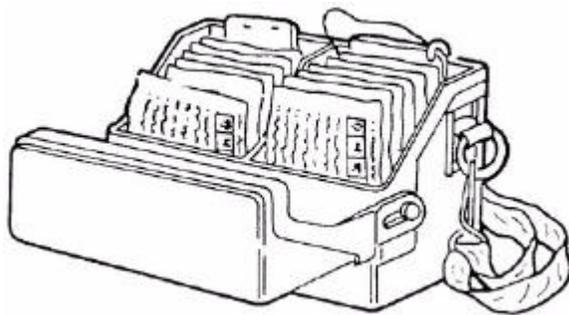


IBAD provides a near term solution to a deficiency in shipboard detection of biological warfare agents. IBAD consists of a particle sizer/ counter, particle wet wall cyclone sampler and hand held colorimetric, immunochemical assay tickets for identification of suspect aerosol particles (flow through assay). The IBAD is capable of detecting an increase in the particulate background, which may indicate a man-made biological attack is underway, and sampling the air for identification analysis. The IBAD can detect a change in background within 15 minutes, and can identify biological agents within an additional 30 minutes.

It is a rapid prototype system that started service

with the fleet in FY96. Fielding will continue through the first part of FY98. A total of 25 IBAD devices are being fielded. A design based on the basic IBAD system has been chosen as the sensor piece of the Airbase/Port Biological Detection Advanced Concept Technology Demonstration (ACTD).

M256A1 Chemical Agent Detector Kit



The M256A1 kit can detect and identify field concentrations of nerve agents (sarin, tabun, soman, and VX), blister agents (mustard, phosgene oxime, and lewisite), and blood agents (hydrogen cyanide and cyanogen chloride) in about 15–20 minutes. The kit consists of a carrying case containing 12 individually wrapped detector tickets, a book of M8 chemical agent detector paper, and a set of instructions. Each detector ticket has pretreated test

spots and glass ampoules containing chemical reagents. In use, the glass ampoules are crushed to release a reagent, which runs down pre-formed channels to the appropriate test spots. The presence or absence of chemical agents is indicated through specific color changes on the test spots. The kit may be used to determine when it is safe to unmask, to locate and identify chemical hazards (reconnaissance), and to monitor decontamination effectiveness.

ABC-M8 VGH, AND M9 Chemical Agent Detector Paper



M8 Paper

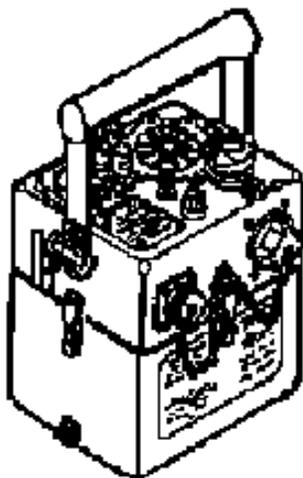
M8 and M9 paper are dye impregnated papers that change color when exposed to liquid chemical agent. These papers cannot detect chemical agents in vapor form. M8 paper comes in 4" by 2 1/2" booklets. Each booklet contains 25 sheets of detector paper that are capable of detecting G series nerve agents (sarin, tabun, soman), V type nerve agents, and H (mustard) type blister agents. M8 paper can identify agents through distinctive color changes from its original off-white: yellow-orange for G, blue-green for V, and red for H. M8 paper is typically used to identify unknown liquid droplets during chemical reconnaissance/surveillance missions. M9 paper is issued as a 33 foot long, adhesive backed strip that is rolled into a 3" 2 1/3" roll. M9 paper can detect G and V nerve agents, and H and L (lewisite) blister agents. It cannot distinguish the identity of agents. It turns red, red-purple, or red-brown when in contact with liquid chemical nerve and blister agents. M9 paper is typically placed on the BDO, equipment, and vehicle exteriors to warn personnel of the presence of a liquid chemical agent.

M8 and M9 paper are dye impregnated papers that change color when exposed to liquid chemical agent. These papers cannot detect chemical agents in vapor form. M8 paper comes in 4" by 2 1/2" booklets. Each booklet contains 25 sheets of detector paper that are capable of detecting G series nerve agents



M9 Paper

M8A1 Automatic Chemical Agent Alarm (ACAA)



M43A1 Detector Unit

The M43A1 detector unit will alarm within about 1-2 minutes from exposure to agent. The M42 alarm unit is a remote visual and audible alarm that measures 7" x 4" x 2 1/3." The M42 alarm unit may be placed up to 400 meters from the M43A1 detector unit to give users warning of an approaching agent cloud.

The M8A1 ACAA is a system that continuously samples the air to detect the presence of dangerous concentrations of G and V type nerve agent vapors. The M8A1 ACAA may be employed in a number of configurations, but all configurations are built around the M43A1 detector unit, and the M42 alarm unit. The configurations differ primarily in their mountings and power supplies: ground mounted and battery operated, or mounted on a vehicle and powered by the vehicle's electrical system. The M43A1 detector unit measures 6 1/2" x 5 1/2" x 11" with the battery used in ground mounted operations adding another 7 3/4" in height. The M43A1 detector unit uses a radio-isotope to ionize molecules in the air that is pumped through the system, and detects electrical current changes that occur in the presence of nerve agents. The



M42 Alarm Unit



M-90 Automatic Agent Detector (AMAD)

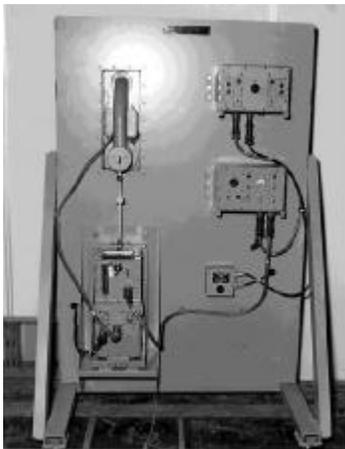
The AMAD is an automatic nerve and mustard agent detector that detects agents in vapor form. This system is currently in use by the Air Force. It transmits an alarm by radio to a central alarm unit.

Automatic Liquid Agent Alarm (ALAD)

The ALAD is a liquid agent detector that can detect droplets of GD, VX, HD, and L as well as thickened agents. It transmits its alarm by radio to a central alarm unit. Although the remote transmission is useful, the device only detects droplets of liquid agent. It must be used in conjunction with other point and/or stand-off vapor agent detectors to afford a complete detection capability.



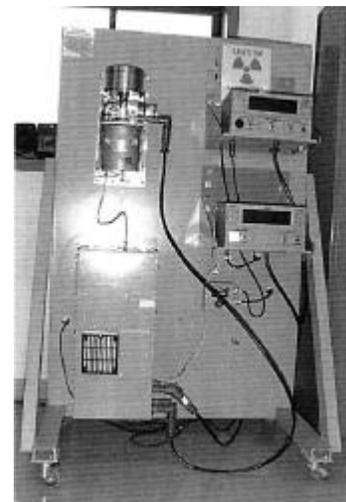
Chemical Agent Point Detection System (CAPDS), MK21, MOD1



This is a fixed system capable of detecting nerve agents in vapor form, using a simple baffle tube ionization spectrometer. Installed in a ship's upper superstructure level, CAPDS obtains a sample of external air, ionizes airborne vapor molecules, and collects them on a charged plate after eliminating lighter molecules via the baffle structure. When a sufficient mass of ions is collected, a pre-set potential is achieved, and an alarm signal is generated and sent to both Damage Control Central and the bridge. The system has been installed on essentially all surface ships.

Improved (Chemical Agent) Point Detection System (IPDS) - Production

The IPDS is a new shipboard point detector and alarm that replaces the existing shipboard CAPDS. IPDS uses special elongated ion mobility cells to achieve the resolution necessary to counter false alarms caused by interferent vapors. IPDS can detect nerve and blister agents at low levels, and automatically provide an alarm to the ship. The unit is built to survive the harsh sea environment and the extreme electromagnetic effects of a Navy ship.



M22 Automatic Chemical Agent Detector and Alarm (ACADA)



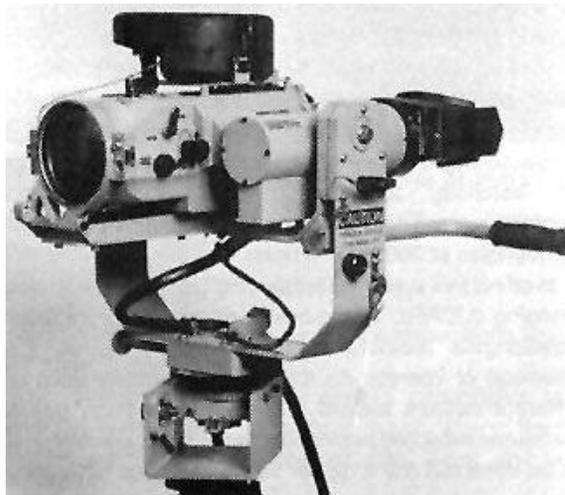
ACADA is a man-portable, point sampling alarm system that provides significant improvement over current capabilities; it detects, and identifies all nerve agents, mustard, and lewisite, by class. ACADA provides concurrent nerve and blister agent detection, improved sensitivity and response time, agent identification capability, improved interference rejection, extensive built-in test, a data communications interface, and the capability to be programmed for new threat agents. It replaces the M8A1 Alarm as an automatic point detector and

augments the CAM as a survey instrument. The ACADA consists of an off-the-shelf non-developmental item (NDI)—the GID-3 chemical agent alarm.

STAND-OFF DETECTION AND REMOTE/EARLY WARNING

AN/KAS-1 Chemical Warfare Directional Detector (CWDD)

This is a semi-portable system designed to detect nerve agent vapor clouds at ranges up to 5 kilometers. The AN/KAS-1 must be removed from its stowage case and set up on a pre-installed pedestal for operation. Because the detector provides information for analysis of the infrared light emission characteristics of distant, manually acquired vapor clouds, it requires a trained, diligent operator to be effective. A new version of this system includes a remote video display providing enhanced capability for vapor cloud analysis, and a remote relative bearing indicator useful in guiding the ship to a man overboard or other surface target with a thermal signature.



M21 Remote Sensing Chemical Agent Alarm (RSCAAL)



The M21 RSCAAL is an automatic scanning, passive infrared sensor that detects nerve and blister agent vapor clouds based on changes on the infrared spectrum caused by the agent cloud. It is effective at line-of-sight distances of up to five kilometers. The alarm is used for surveillance and reconnaissance missions in both vehicle-mounted and tripod-mounted modes.

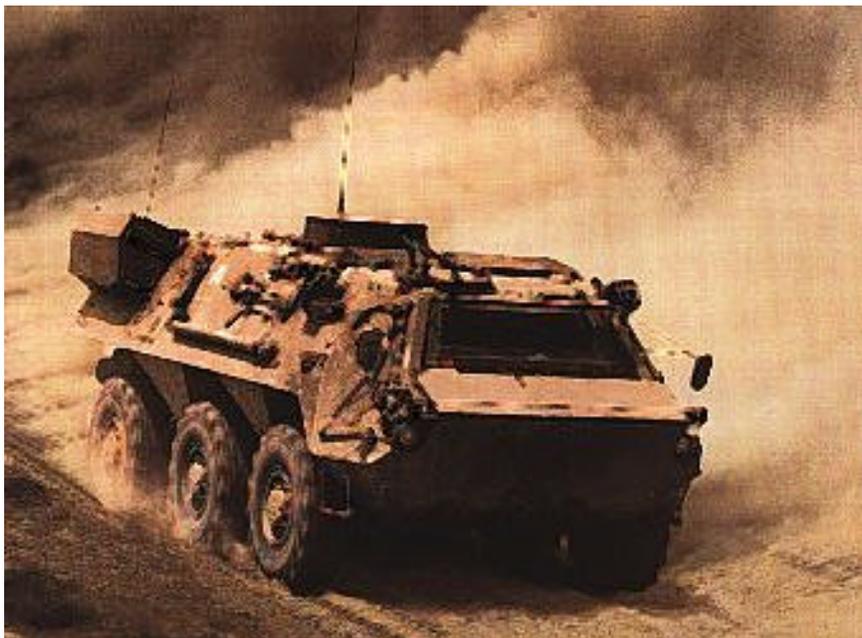
Long Range Biological Stand-off Detector System (LRBSDS) - NDI

LRBSDS utilizes elastic back scatter and infrared light detection and ranging (IR-LIDAR) technology to detect, range and track particulate clouds that are indicative of a BW attack; the LR-BSDS cannot discriminate biological from non-biological clouds. The system, which is approximately 800 pounds and three cubic meters, has three major components: a pulsed laser transmitter operating at IR wavelengths; a receiver and telescope; and an information processor and display. This program, like the BIDS, has been designed in two phases; an NDI phase designed to rapidly field an interim capability, and a pre-planned product improvement (P3I) phase. The three NDI LR-BSDSs have been fielded to the 310th Chemical Company (USAR). The NDI system is able to detect and track man-made aerosols out to 30 km, but is non-eyesafe out to about 5 km. The P3I will provide an eye safe laser system at all ranges, an automated cloud detection and tracking capability, and an increased detection range (50 km minimum).



NBC RECONNAISSANCE

M93 NBC Reconnaissance System (NBCRS)



The M93 is a dedicated system for NBC detection, warning, and sampling equipment integrated into a high speed, high mobility armored carrier capable of performing NBC reconnaissance on primary, secondary, or cross-country routes throughout the battlefield. The M93 can find and mark chemical and nuclear contamination. Through a secure communications system, it provides warnings to follow-on forces. The crew is protected by an on-board

overpressure system. This interim system has been fielded worldwide to Army and Marine Corps forces.

M93A1 NBC Reconnaissance System (NBCRS) - Production



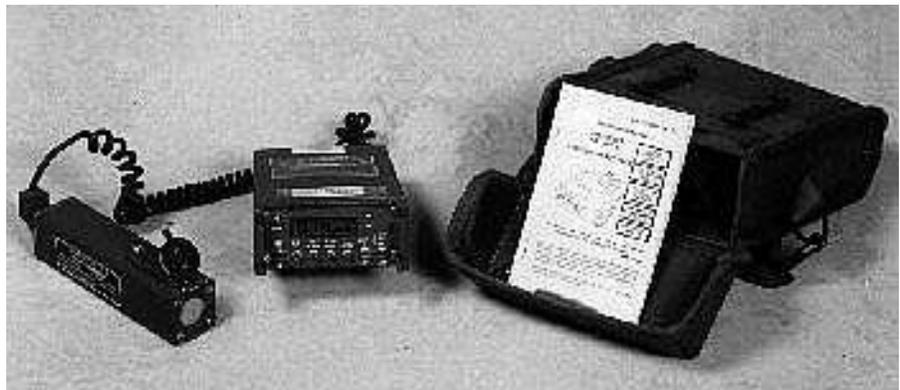
The M93A1 is a block modification program to upgrade the M93 to detect chemical contamination vapors within 5 km using the M21 RSCAAL stand-off detector. It will automatically integrate contamination information from sensors with input from on-board navigation and meteorological systems. It rapidly transmits hazard warning via a central data processor and integrated digital jam-resistant communications. The M93A1 central data processing and manprint changes permit reducing the crew from four to three individuals. For the first time, this program

also develops and fields organic supply and maintenance for the FOX NBCRS. When the Block I modification is completed, the system will save more than \$12M annually in operating and support costs.

RADIACS

AN/VDR-2

The AN/VDR-2 measures gamma dose rates from 0.01 $\mu\text{Gy/hr}$ (micro-Grays per hour) to 100 Gy/hr and beta dose rates from 0.01 $\mu\text{Gy/hr}$ to 5 cGy/hr. The unit functions simultaneously as a dose rate meter and dose meter with independent ad-



justable alarms that can be set at any level over the entire range. Dosage data is independently stored in non-destructive memory for display on command and may be retained when the unit is turned off. The unit is powered by three 9 volt batteries.

AN/PDR-75 Radiac Set



The AN/PDR-75 measures dose from 0 to 999 cGy (centi-Gray). The Radiac Set provides the capability to monitor and record the exposure of individual personnel to gamma and neutron radiation. Each individual will be issued a DT-236/PDR-75 dosimeter. This device, worn on the wrist, contains a neutron diode and a phosphate glass gamma detector. When a determination of exposure is required, the dosimeter is inserted into a CP-696/PDR-75 reader, which then displays the cumulative neutron and gamma dose. The reader is issued at the company level and the dosimeters are issued to all combat, combat support, and combat service support personnel. The reader can be powered by a BA-

5590 lithium battery, vehicle battery, or external power supply via adapter cables provided.

AN/PDR-77 Radiac Set

The AN/PDR-77 Radiac Set is a set of portable radiation detection equipment for detecting alpha, beta, gamma, and x-ray radiation. The set consists of a radiacmeter to which one of three radiation probes can be attached for measuring particular types of radiation. The probes are part of the set. The set includes accessories and basic test and repair parts for unit maintenance including a carrying pouch with shoulder straps capable of holding the radiacmeter, alpha probe and beta/gamma probe for field use. The entire set is contained in a carrying case (large briefcase) for easy portability and storage.



AN/UDR-13 Pocket RADIAC (Platoon Radiac) - Production (FUE FY98)



The AN/UDR-13 Pocket RADIAC is a compact, hand-held, tactical device capable of measuring the gamma dose-rate and gamma and neutron cumulative dose in a battlefield environment. Its pocket size permits convenient use by troops on foot. Alarm pre-sets are provided for both the dose-rate and total dose modes. A push-button pad enables mode selection and functional control. Data readout is by liquid crystal display. It will replace the obsolete IM-93 quartz fiber dosimeter.

Multi-Function Radiation (MFR) Detector -Production

This program will develop improved radiation detection equipment to replace the current suite of logistically unsupportable assets. Present detectors (PAC-1S, AN/PDR-43 and AN/PDR-56F) have exceeded maintainability standards. Original manufacturers have either discontinued production or are no longer in business. An improved capability is required to support both wartime and peacetime nuclear accident response operations. A production contract was awarded in March 1995. First deliveries were made in 1997.

ADM-300A Multifunction Survey Meter

The ADM300A is a battery-operated, self-diagnostic, multiple functional instrument. It is used alone to locate and measure low and high intensity radioactivity in the form of gamma rays or beta particles. It is used with external probes to locate and measure alpha, beta, gamma, and x-rays, and neutron radiation.



SECTION 2. RDTE ITEMS

AUTOMATIC DETECTORS AND MONITORS

Agent Water Monitors

The Agent Water Monitor is a cooperative RDTE effort, chartered to develop a detection system which will detect chemical and biological agents in water. The detector will feature multi-agent capabilities, and operate automatically, improving both ease and response time of existing system. The project will accommodate the four services' requirements for the following:

*In-line CB Detector (IL CBDWS)
Chemical Agent Water Monitor (CAWM)
CB Agent Water Monitor (CBAWM)*

Rationale:

Army, Air Force, Marine Corps (Requirement)
Navy (Interest)

Key Requirements:

- Detect and identify chemical agents and agents of biological origin in water
- Perform monitoring automatically with continuous and batch sampling capabilities
- Easy to operate and support in forward areas, austere environments, and limited lighting

Description:

The Agent Water system will improve current water monitoring and purifying capabilities. It will automatically detect CB agents at or below harmful levels in water and not false alarm to common interferents. The system will be compact, man-portable and easy to use, and be decontaminated to a negligible risk level.

Joint Chemical Agent Detector (JCAD)

The JCAD is a fully cooperative RDTE effort, chartered to develop a chemical agent detector for a variety of mission requirements and service platforms. The detector will provide warfighters near-real time information on the presence of chemical agents so that miosis or more severe effects can be avoided and not subvert the mission. The project will accommodate the four services' requirements for the following:

*Individual Soldier Detector (ISD)
Special Operation Force Chemical Agent Detector (SOF-CAS)
Individual Vapor Detector (IVD)
Aircraft Interior Detector (AIDET)
Shipboard Chemical Agent Monitor Portable (SCAMP)
CW Interior Compartment System (CWICS)
Improved Chemical Detection System (ICDS)*

Rationale:

Army, Navy, Air Force, Marine Corps (Requirement)

Key Requirements:

- Small, lightweight detector capable of detecting presence of chemical agent vapors
- Capable of de-warning, allowing for rapid reduction of protective postures
- Detect, identify, quantify and warn of presence of even low levels of nerve, blister, and blood agents in vapor form in aircraft and shipboard interiors
- Operated/maintained by ship's force; operate in a shipboard environment

Description:

JCAD will provide a detector or a network of detectors capable of automatically detecting, identifying, and quantifying chemical agents (nerve, blister, and blood) inside aircraft and shipboard interiors. (See Figure A.) The device must be sufficiently sensitive to warn aircrews before accumulation, over the entire mission, of a levels of agent that may cause miosis or more severe effects. JCAD will also provide hand-held monitoring capabilities to protecting the individual soldier, sailor, airman, and marine through the use of pocket-sized detection and alarm. (See Figure B.)

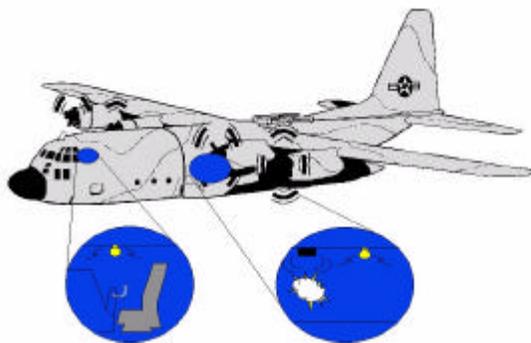


Figure A. AIDET Concept



Figure B. Individual Detector Concept

Shipboard Automatic Liquid Agent Detector (SALAD)

Rationale:

Navy (Service-Unique Requirement)

Key Requirements:

- Automatic detection of liquid chemical agents
- Operated/maintained by ship's force
- Operate in a shipboard environment and detect while the ship is underway

Description:

SALAD is an exterior, liquid agent point detection and monitoring system that will detect and alarm in the presence of liquid nerve and blister agents. SALAD will consist of a detector unit that uses chemically treated paper, optical scanners, a central processing unit and alarms (visual and audible) on the bridge and Damage Control Central.



BIOLOGICAL LONG LINE SOURCE RELEASE AND POINT DETECTION

Biological Point Detection is a fully cooperative acquisition effort chartered to develop new biological point detectors and detection systems for quad-services. The BIDS P3I effort will encompass development of an integrated system as well as several stand-alone biological detectors. In addition, a Joint Biological Point Detection System (JBPDS) is under development. JBPDS will be a system that can stand alone, or be used in a suite of systems.

Biological Integrated Detection System (BIDS) -P3I

Rationale:

Army (Requirement)

Navy, Air Force, Marine Corps (Interest in BIDS' sub-components)

Key Requirements:

- Detect and identify 5 to 25 agent-containing particles/liter of air (ACPLA) in the 2–10 micron range in 15–30 minutes
- Provide agent detection and simultaneous identification of 8 agents
- Provide collective protection with environmental controls (BIDS)
- Knowledge-based system to process detector information (BIDS)
- FM/HF radios to communicate (BIDS)
- Automatically identify biological pathogens and toxins (BD)
- Reject common battlefield interferences and be re-programmable to detect new agents (BD)
- Be data-linked with a centralized hazard information data collection center (BD)
- Characterize new agents; detect, identify, and semi-quantitative CB agents (CBMS)
- Respond to agent vapors, aerosols or liquid droplets (CBMS)
- Have chemical detection thresholds at or below human response levels (CBMS)
- Possess modules to accommodate future advances in technology and CB threat (CBMS)

Description:

BIDS uses a multiple technology approach, both developmental and off-the-shelf materiel, to detect and presumptively identify biological agents with maximum accuracy. The BIDS P³I system will integrate the CB Mass Spectrometer (CBMS) and the Biological Detector (BD) as sub-components.

The Biological Detector is an antibody based, device capable of identifying specific biological agents. It consists of electronics processing equipment, fluid processing modules, reservoirs for antibody reagents, and a light addressable potentiometric sensor to provide biological agent identification. The total processing time, from insertion of sample to data readout, will be approximately 15 minutes at threshold concentrations. The biodetector

includes an operator display which will provide identification and relative concentration of the biological agent detected. Built-in tests will also be provided to identify system malfunctions.



CBMS

CBMS detects and characterizes all known chemical and biological threat agents. It continuously and automatically detects threat agents via a mass analyzer chassis, a biological aerosol sampling probe, a surface sampling probe and sample identification device. The mass analyzer chassis houses the mass analyzer, pumps, control electronics, and computers. With the aerosol probe attached, the CBMS detects biological agent aerosols and chemical agents as aerosols and/or vapors in the air. With the ground probe attached, the CBMS detects chemical agents whether they exist as airborne vapors or aerosols, or as liquid droplets on surfaces. The CBMS will replace the MM1 and be mounted within the NBC Recon System to search for areas of CB agent contamination.

Air Base/Port Biological Detection Advanced Concept Technology Demonstration (ACTD)

Rationale:

Requirements identified by the Commander-in-Chief Central Command (CINCCENT) and Commander-in-Chief Pacific Command (CINCPAC)

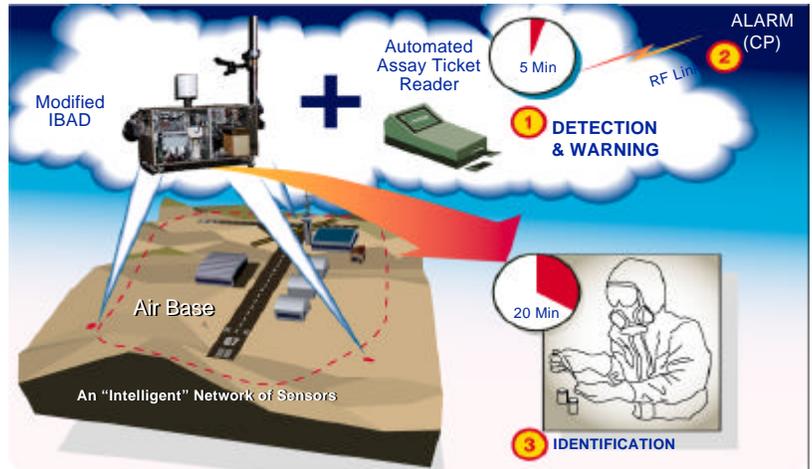
Key Requirements:

- Field an interim system to sponsoring CINCs that provides rapid, automated biological attack detection, identification and warning (in less than 20 min) to high value fixed sites (*e.g.*, ports and airfields)
- In addition to the biological detection system itself, provide the following “leave-behinds” or “residuals” to the fixed sites: an integrated command and control system to assist base personnel in rapid assessment, warning and dissemination of attack data; oral-nasal respirators for protection from any re-aerosolized agents after an attack, unmasking procedures; operational procedures
- Demonstrate candidate technologies and operational concepts that may both fill the CINCs immediate needs, and provide valuable “lessons learned” for future systems

Description:

While the BIDS and Long Range Biological Detection System (LR-BSDS) programs have made significant advances towards mitigating the effects of the worst case biological attack scenario (long line source releases— e.g., an aircraft spraying agent along a course tens of kilometers long), it has been recognized that we still have potential vulnerabilities in

protecting those high value fixed sites that will play critical roles in our force projection operations. Ports and airbases, by nature of their commonly known locations and high density of personnel, make lucrative targets for point source releases (e.g., theater ballistic missiles, covert spraying by land and sea vehicles, or even man-portable disseminators). JPO-BD proposed taking available technologies, and through the non-standard acquisition process called ACTD, provide a limited number of detection systems to warfighting CINCs. The concept has been to build an intelligent network of sensors based on the Navy's IBAD, but add to each sensor a generic biological detector module, location and meteorology modules. The detector network is able to both detect in near real time significant changes in background aerosol concentrations, but can also (less than 15 minutes) provide the operator located in the central command post (CP) a presumptive identification of the BW agent. Site personnel are then able to retrieve samples of the aerosol from the sensors for confirmatory identification of the BW agent. The ACTD will not only provide the detection and identification hardware and procedures, it will also provide leave-behinds for post attack actions, such as: inexpensive and light weight oral-nasal respirators to protect personnel from re-aerosolized BW agents but without all the stresses associated with full face respirators; decision aids and procedures for determining when it is safe to remove protective gear. Testing of small scale detector network prototypes is underway; full scale testing of an entire network and other leave behinds will be done during FY98. Full scale deployment of the ACTD to CENTCOM and PACOM will begin in FY98.



Joint Biological Point Detection System (JBPDS)

Rationale:

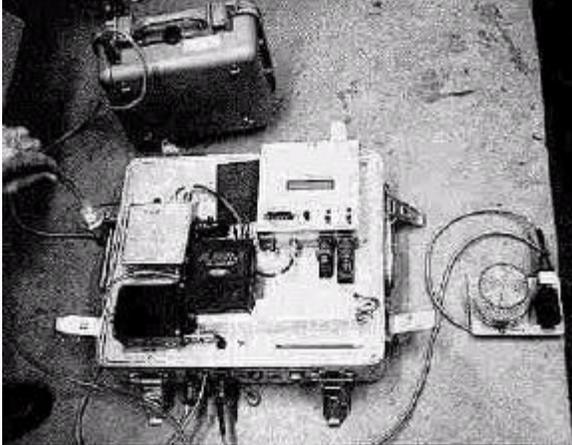
Army, Navy, Marine Corps and Air Force (Requirement)

Key Requirements:

- Automatically detect, identify and warn of the presence of aerosolized biological warfare agents at levels of sensitivity, speed and reliability equal to or better than currently fielded detection systems (to include the BIDS P3I)
- Provide a common suite of biological detection equipment that can be applied to all four services' designated platforms

- Provide a man-portable version (Marine Corps)
- Be operable while on the move (Navy and Air Force)

Description:



JBPDS is the joint biological detection program. This developmental system will replace all existing NDI systems (BIDS, IBAD and Air Base/Port ACTD), and provide biological detection capabilities throughout the services and throughout the battlespace. The common biological detection suite will consist of four functionalities: trigger (detects a significant change in the ambient aerosol in real time), collector (collects samples of the suspect aerosol for analysis by the JBPDS, and for analysis by supporting laboratories in the Communications Zone (COMMZ) and CONUS), detector (able to

broadly categorize the contents of the aerosol and lend confidence to the detection process; *e.g.*, biological material in the aerosol or not, bacteriological, spore, protein, *etc.*), and identification (provides presumptive identification of the suspect BW agent and increases confidence in the detection process). These four functionalities will be integrated to allow fully automatic operation, and warning of a positive BW detection. The JBPDS program consists of two phases (Block I and Block II) to allow fastest possible fielding of a joint biological detection system, while at the same time preparing to take advantage of the rapid advances taking place in the biological, information processing and engineering sciences. JPO-BD will award an Engineering and Manufacturing Development (EMD) contract this year for the development of Block I JBPDS prototypes for all four services. Production is anticipated to start in FY00, with first unit equipped in September, 2001. This joint acquisition strategy will allow for significant economies throughout the RDA process by eliminating duplicative efforts among the services, and greater logistic supportability in joint operations as each service will be able to support the other services' JBPDSs.

Critical Reagents Program (CRP)

Rationale:

Supports all Services detection programs

Key Requirements:

- Provide Total Life Cycle Management for the critical reagents (antibodies, and gene probes and primers) that are necessary to the operation of nearly all DoD biological detection systems.
- Ensure best quality reagents are available in time and in adequate quantities.
- Ensure adequate security and surge capability of critical reagents.
- Put in place a production program for the Handheld Immunochromatographic Assays (HHAs) that are critical to several bio detection programs.

Project Description:

The Critical Reagents Program will ensure the quality and availability of reagents that are critical to the successful development, test and operation of biological warfare detection systems and medical biological products managed by JPO-BD. The program will maintain an R&D effort to ensure the best possible reagents are available for use against both current and future threats. The program will institute a program wide quality assurance program and address relevant security issues. During the first four years of the program, the CRP will require the greatest level of effort and funding to ensure required reagents are available to support fielded systems (BIDS NDI, P3I and IBAD), and developmental systems (JBPDS Block I). The next three years require the development of 12 additional reagents to support the development and fielding of the JBPDS Block II. Outlying years will focus on the development of reagents to detect new and emerging threats and procurement of more effective reagents to replace older stocks

STAND-OFF DETECTION AND REMOTE/EARLY WARNING

Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD)

The JSLSCAD is a fully coordinated joint service RDTE program, chartered to develop a lightweight stand-off chemical detector for the quad-services. The JSLSCAD will utilize a passive infrared sensor with 360° scanning to satisfy requirements for:

Lightweight Stand-off Chemical Agent Detector (LSCAD)

M21 Moving Background

Chemical Agent Remote Detection System (CARDS)

Stand-off Detector for Armored System Modernization (SD/ASM)

Rationale:

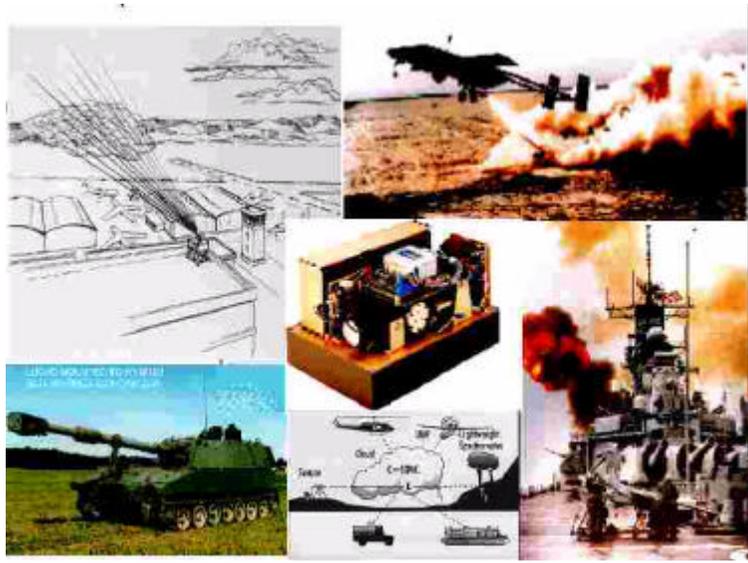
Army, Navy, Air Force, Marine Corps (Requirement), Army is lead Service

Key Requirements:

- Automatically detect nerve, blister, and blood agents at a distance up to 5 km
- Be lightweight and employed from manned and unmanned systems
- Be capable of being data-linked with centralized hazard information data collection center
- Be capable of remote operations; aerial and on-the-move operation

Description:

JSLSCAD will be capable of scanning 360° x 60°, and automatically detecting nerve or blister agents at a distance up to 5 km. The system will be light, compact and operate from a stationary position or on-the-move. The JSLSCAD Michelson interferometer employs a passive infrared system that will detect presence of chemical agents by completing a spectral analysis of target vapor agent chemical clouds. JSLSCAD is envisioned for employment on various platforms and in various roles, including fixed site defense, unmanned aerial vehicles, tanks and other vehicles, and on board ships.



Joint Service Chemical Warning and Identification LIDAR (JSCWILD)

JSCWILD is a fully coordinated joint service program, chartered to develop a chemical warning and identification system for the quad-services. JSCWILD will utilize an active LIDAR sensor to perform rapid agent identification and ranging to satisfy requirement for:

- Laser Stand-Off Chemical Detector (LSCD)***
- Area Detection System (ADS)***
- Stand-off Detector (SD)***
- CB Stand-off Detector (CBSD)***

Rationale:

Army, Air Force (Requirement)

Key Requirements:

- Automatically detect, range, and map CW agents at distances of up to 20 km
- Scan atmosphere and terrain to detect chemical vapors and airborne liquids and particles
- Provide stand-off capability for both fixed site and reconnaissance
- Provide rapid agent concentration mapping

Description:

JSCWILD will be a lightweight, vehicle-mountable, contamination monitoring system, which detects and quantifies all types of chemical agent contamination (including agent rain, vapors, and aerosols) in a stand-off mode from a distance of 20 kilometers. The

JSCWILD will operate from fixed sites and ground vehicles. The system has distance-ranging and contamination-mapping capabilities and transmits this information to a battlefield information network.

Biological Remote/Early Warning

The Army's Long Range Biological Standoff Detection System (LR-BSDS) is a legacy system that is being incorporated into what is envisioned to be a family of early warning systems

The Joint Biological Remote Early Warning System (JBREWS) program is intended to give the warfighting commander a significantly shortened decision cycle regarding biological attacks; that is, the commander will see and be able to react to a biological attack much faster, thereby allowing many more personnel to take protective measures before they become exposed to the biological warfare agents. This means that fewer people will become casualties, and fewer people will have to take post-attack medical treatments.

Long Range Biological Standoff Detection System (LR-BSDS) P3I

Rationale:

Army (Requirement)
Air Force, Navy (Interest)

Key Requirements:

- Stand-off detection of aerosol clouds out to a range of at least 50 km
- Provides relative concentration, range, location, and tracking of suspect aerosol clouds
- UH-60 helicopter-mounted

Description:

LRBSDS uses infrared light detection and ranging (IR-LIDAR) technology to detect, range and track aerosol clouds that are indicative of a BW attack; the LR-BSDS cannot discriminate biological from non-biological clouds. The system, which is approximately 800 pounds and three cubic meters, has three major components: a pulsed IR laser transmitter operating at infrared wavelengths; a receiver and telescope; and an information processor and display. This program, like the BIDS, has been designed in two phases; an NDI phase designed to rapidly field an interim capability, and a pre-planned product improvement (P3I) phase. Three NDI LR-BSDSs have already been fielded to the 310th Chemical Company (USAR). The NDI system is able to detect and track man-made aerosols out to 30 km, but is non-eyesafe out to about 5 km. The P3I LR-BSDS will be eyesafe, will have a longer operating range (50 km minimum), and will be easier to operate. The first P3I LR-BSDSs will be fielded in time for the second BIDS company's activation in 4Q FY99.

The Joint Program Office for Biological Defense is leveraging the benefits of the ACTD program to greatly accelerate the development of the next generation of remote/early warning systems (i.e., systems other than the LR-BSDS). This new generation of detectors is referred to as the Joint Biological Remote/Early Warning System (JBREWS). JPO-BD is managing a JBREWS ACTD that will address selected CINCs' needs, and will better refine our requirements and concepts regarding remote/early warning systems.

Joint Biological Remote/Early Warning System (JBREWS)

Rationale:

CENTCOM, EUCOM requirement (ACTD)
All services interest (ACTD and objective system)

Key Requirements:

- JPO-BD is currently sponsoring a series of concept studies with the Institute for Defense Analysis (IDA), and a Study Advisory Group (SAG) composed of CINC, service, and Joint NBC Defense Board representatives. This cooperative effort will define the requirements for the JBREWS ACTD
- The ACTD will formally start in FY98, with fielding of ACTD systems to selected CINCs around FY01
- Lessons learned from the JBREWS ACTD will assist the SAG in developing/refining its requirements document for the JBREWS objective system
- JBREWS objective system is expected to start fielding around FY03

Description:

JBREWS is planned to become a “system of systems.” That is, it will likely have legacy systems—BIDS, JBPDS, and standoff LIDAR systems such as the LR-BSDS—integrated with dense arrays of miniaturized, rugged point detectors into a distributed network of sensors. The miniature sensors will possess only one or two of the functionalities that the much more robust JBPDS will have. The point detectors may be employed in a variety of ways: carried on vehicles, emplaced by hand around unit/site perimeters, remotely emplaced by aircraft, or possibly even delivered by artillery or rocket systems to project the sensors into contested or enemy controlled areas. The systems need to be networked to provide the greatest confidence of accurate detection and rapid warning. They will need to be deployed and distributed widely and in high numbers to ensure point releases are not missed.

NBC RECONNAISSANCE

Joint Service NBC Reconnaissance System (JSNBCRS)

The Joint Service NBC Reconnaissance program is a coordinated Army and Marine Corps effort which will yield improved reconnaissance capabilities for both heavy and lightweight vehicle platforms. It will satisfy requirements for:

***M93A1 NBC Reconnaissance System (NBCRS)
System Improvement Phase (SIP) - Production
Light NBC Reconnaissance System (LNBCRS)
Lightweight Reconnaissance System (LWRS)***

Rationale:

Army, Marine Corps (Requirement)

Key Requirements:

- Armored vehicle with over-pressure collective protection and macro cooling
- Chemical agent stand-off and point detectors and monitors
- Radiation detector and monitor
- Integrate central data processor with all detectors and monitors; navigation and communications system; jam resistant communications system; and meteorological sensing system
- Integration of advanced NBC detection and analysis equipment suited for Marine Air-Ground Task Force (MAGTF) operations (LNBCRS)
- Standard Marine Corps host vehicle, transportable by C-130, CH-53E, and LCAV-30 (LNBCRS)

Description:

The LNBCRS (shown) will provide a premiere vehicle for accurate, rapid NBC combat hazard information by verifying the absence of, finding, mapping, and marking radiological, biological, and chemical hazards. The LNBCRS will be an integration of advanced NBC detection and analysis equipment suited for Marine Air-



Ground Team Force expeditionary operations and Army rapid deployment/light operations.

WARNING AND REPORTING

Joint Service Warning and Reporting Network (JWARN) (FUE FY 99)

Rationale:

Army, Air Force, Navy and Marine Corps (Requirement)

Key Requirements:

- Capable of interfacing with all NBC detectors and sensors
- Capable of interoperability with all service command and control systems
- Capable of generating NBC reports
- Capable of automatic transmission of NBC alarm and data
- Capable of vehicle operation

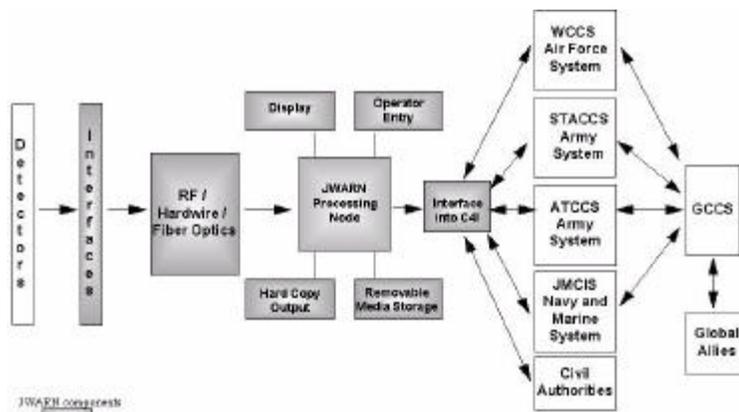
Description:



JWARN Computer

JWARN will provide the Joint Force a comprehensive analysis and response capability to minimize the effects of hostile NBC attacks or accidents/incidents. It will provide the operational capability to employ NBC warning technology that will collect, analyze, identify, locate, report and disseminate NBC threat and hazard information. JWARN will be compatible and integrated with Joint Service C⁴I systems. JWARN will be located in command and control centers at the appropriate level defined in Service-specific annexes and employed by

NBC defense specialists and other designated personnel. It will transfer data automatically from and to the actual detector/sensor and provide commanders with analyzed data for decisions for disseminating warnings to the lowest echelons on the battlefield. It will provide additional data processing, production of plans and reports, and access to specific NBC information to improve the efficiency of NBC personnel assets.



JWARN System Architecture Concept

ANNEX B

**NON-MEDICAL PROTECTION
PROGRAMS**

(INTENTIONALLY BLANK.)

SECTION 1: FIELDED AND PRODUCTION ITEMS

RESPIRATORY

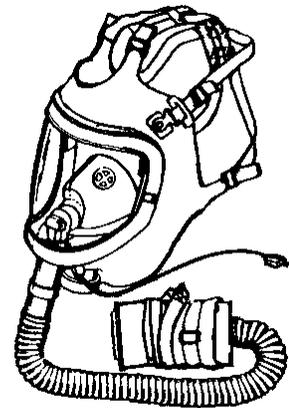
M17A2 Protective Mask



The M17A2 Protective Mask consists of a natural blend rubber face piece; two activated charcoal filters mounted within cheek pouches; a voicemitter to facilitate communications, a drinking tube; eyelens outserts to protect the mask's integral eyelens and reduce cold weather fogging; an impermeable hood; and a carrier for the mask, its components, and medical items (such as the Nerve Agent Antidote Kit). The Army and Marine Corps are replacing this mask with the M40 series protective mask. The Air Force and Navy have replaced it with the MCU-2A/P.

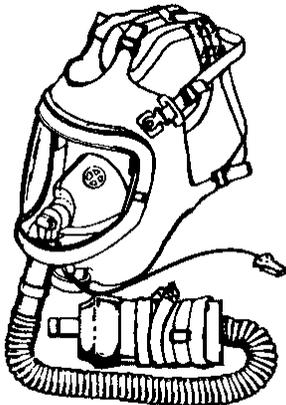
ABC-M24 Aircraft Protective Mask

This protective mask provides the wearer protection from NBC aerosols/vapors both in aircraft, and on the ground. The mask consists of: wide view, clear plastic lens embedded in a butyl rubber face blank; an integral microphone; eyelens outserts; carrying case; anti-fog kit; and a hose-mounted filter canister. The mask has a microphone connection to fit the aircraft communications systems. The M24 has an adapter that allows coupling to the aircraft's oxygen supply system. The M24 is being replaced by the M45 and M49 masks.



M25A1 Tank Protective Mask

This protective mask provides the wearer protection from NBC aerosols/vapors both in the vehicle/aircraft, and on the ground. The mask consists of: wide view, clear plastic lens embedded in a butyl rubber face blank; an integral microphone; eyelens outserts; carrying case; anti-fog kit; and a hose mounted filter canister. The mask has a microphone connection to fit the armored vehicle communications systems. The M25A1 has an adapter that allows it to be coupled to the tank's filtered and temperature controlled Gas Particulate Filtration Unit (GPFU). The M25A1 is being replaced by the M42/M42A1/M42A2 protective mask.



MCU-2A/P Protective Mask

The MCU-2A/P provides eye and respiratory protection from all chemical and biological agents as well as radioactive particulate material. The mask uses a replaceable, standard NATO filter canister which is mounted on either side of a wide-view optical quality visor. The mask provides improved fit, comfort, and visibility relative to earlier masks, and includes a drinking tube for attachment to the standard canteen, and voicemitter for improved communications.



M40/42 Series Protective Mask



M40 Mask

The M40/42 protective masks provide eye-respiratory face protection from tactical concentrations of CB warfare agents, toxins and radioactive fallout particles. Each mask consists of a silicone rubber face piece with an in-turned peripheral face seal and binocular rigid lens system. It accommodates NATO standard canisters, which can be worn on either cheek of the mask. The M40 is designed for the individual dismounted ground warrior, while the

M42 is designed for combat vehicle crewmen. Recent improvements include a universal second skin, making the mask compatible with JSLIST protective clothing, and laser-safe eye lens outserts. The mask faceblank has been made a spare part, which has resulted in a significant operation and support cost savings. Use of modular parts permits the M40 to be used in both the M40 and M42 configuration. This has resulted in significant operational and support cost savings.



M42 Mask

M43 Protective Mask



The M43 Aviator Mask consists of a form-fitting face piece with lenses mounted close to the eyes; an integral CB hood and skull-type suspension system; an inhalation air distribution assembly for air flow regulation, lenses and hood; and a portable motor/blower filter assembly which operates on either battery or aircraft power. The M43 Type I was developed

for the AH-64 aviator and is compatible with the AH-64 Integrated Helmet and Display Sight System and the Optical Relay Tube. The M43 Type II is intended for the general aviator.

M45 Aircrew Protective Mask (ACPM) (FUE FY98)

The M45 Air Crew Protective Mask is specially designed to meet the requirements of helicopter and special crews. It does not require power or forced air to provide CB protection; it provides compatibility with helicopter optical systems, aircraft displays and night vision devices; and has reduced weight, cost and logistical burden when compared to the M48/M49 series of mask. The ACPM has close fitting eyelenses mounted in a silicone rubber facepiece with an in-turned peripheral seal, a detachable hood system, and utilizes the standard NATO canister.



M48/49 Protective Masks - Production

The M48/M49 are third generation M43 series masks. The M48 mask replaces the M43 Type I mask and will be the only mask for the Apache aviator for the foreseeable future. The M49 mask, along with the M45 mask will replace the M24 and M43 Type II masks. The M48 and M49 masks consist of a lightweight motor blower, a new hose assembly, a web belt, the mask carrier, facepiece carrier, eyelens cushions, and the facepiece of the M43A1. The M49 mask will only be issued to the General Aviation population in Korea



M48 Mask



M49 Mask

Aircrew Eye/Respiratory Protection (AERP)

The AERP (replaces the MBU-13/P system for aircrews) is a protective mask which enables aircrews to conduct mission operations in a chemical-biological environment. The AERP system includes a protective hood assembly with a standard MBU-12/P mask, an intercom for ground communication, and a blower assembly that provides de-misting. The blower is stowed during flight operations on a bracket that is mounted inside the aircraft.



A/P22P-9(V) - Production

The A/P22P-9(V) provides head-eye-respiratory protection via the MCK-3/P respirator and CQK-8/P tactical ventilator for “helo” crews. The ensemble, which utilizes a blower to provide positive pressure, has anti-drown features and provides system compatibility with a large variety of aircraft. In FY96, the ensemble was upgraded with a rip away face plate, and improved tactical ventilator with a smaller man-mounted pusher fan.



ANCILLARY MASK EQUIPMENT

M41 Protection Assessment Test System



The M41 Protection Assessment Test System (PATS) enhances operational capability by validating proper fit of the mask to the face of the individual. The PATS is a new capability that provides a simple, rapid, and accurate means of validating the face piece fit and function of protective masks.



Voice Communication Adapter

The Voice Communication Adapter (VCA) is a low risk program providing additional capability to the M40/42 mask. The VCA is a joint program between the USMC and US Army.

Universal Second Skin



The Universal Second Skin is one of the components of a pre-planned product improvement (P3I) in the M40/M42 series mask. The second skin provides protection for the mask faceblank material. This program is a Joint U.S. Army/U.S. Marine Corps effort. Both Services developed prototype designs and, after field user and human engineer testing, the Marine Corps design was selected. The Air Force is developing a second skin for the MCU-2A/P.

BATTLEFIELD PROTECTIVE SUITS

Battle Dress Overgarment (BDO)

The BDO is a camouflage patterned (desert or woodland), two piece, air permeable overgarment typically worn over the duty uniform. The overgarment material consists of an outer layer of nylon cotton, and an inner layer of charcoal impregnated polyurethane foam. The BDO provides protection against chemical agent vapors and liquid droplets, biological agents (to include toxins), and radioactive alpha and beta particles. The BDO is issued in a sealed vapor-barrier bag that protects the garment from rain, moisture and sunlight. The BDO provides chemical protection for 22 days (extendible by commanders with increased risk to the wearer), and should be replaced within 24 hours of contamination by liquid chemical agents.



Chemical Protective (CP) Suit, OG MK-III (Navy Suit)



The Chemical Protective Overgarment (CPO) protects the wearer against all known chemical and biological agents which present a percutaneous hazard. The suit consists of a smock and separate pair of trousers, and is sized to accommodate the 5 percentile female through the 95 percent male ratio. This garment will be replaced Navy-wide beginning in calendar year 1997 by a superior suit developed under the auspices of the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. The Mark III chemical, biological, radiological (CBR) suit protects against chemical agent vapors, aerosols, droplets of liquid, and biological agents.

CP Suit, Saratoga (USMC)

Like the BDO, the SARATOGA CP Suit is an air permeable, camouflage patterned overgarment. Instead of carbon impregnated foam, SARATOGA uses spherical, activated carbon adsorbers immobilized in the liner fabric. This system allows for a lighter, cooler garment, which is launderable.





CWU-66/P Aircrew Ensemble - Production (FUE FY96)

The CWU-66/P, a one-piece flightsuit configuration, provides 24-hour protection against standard NATO threats. It is made with Von Blucher carbon spheres, and is less bulky than prior ensembles. It offers a reduced thermal load burden and is compatible with aircrew life support equipment.

Chemical Protective Undergarment (CPU)

The CPU is a two-piece lightweight undergarment made of a non-woven fabric containing activated charcoal. When worn under the combat vehicle crewmen (CVC) coverall or battle dress uniform (BDU), the CPU provides 12 hours of protection and is durable for 15 days.



SPECIALTY SUITS



Suit Contamination Avoidance Liquid Protection (SCALP)

The SCALP is worn over the BDU to provide 1 hour of protection from gross liquid contamination. The SCALP, which consists of a jacket with hood, trouser and booties, is made from a polyethylene-coated Tyvek™ material.

Interim-Self Contained Toxic Environment Protective Outfit (STEPO-I)

Approved as an interim system for 2-hour depot operations in Immediate Danger to Life and Health (IDLH) environments. It consists of encapsulating suit made of butyl rubber-coated nylon with a polycarbonate visor. Respiratory protection is provided by one of two options—tethered clean air supply or a self-contained rebreather worn as a back-pack. Cooling is provided by an ice vest worn underneath the suit.

Self-Contained Toxic Environment Protective Outfit (STEPO)

STEPO will provide OSHA level A (29 CFR Part 1910, 120 App A) protection for Army Chemical Activity/Depot (CA/D), Explosive Ordnance Disposal (EOD) and Technical Escort Unit (TEU) personnel against chemical warfare agents, industrial chemicals, rocket fuels, and oxidizers as well as oxygen deficient atmospheres for periods of up to four hours. The STEPO, a chemical protection system, consists of a totally encapsulating suit with gloves and booties, the standard Toxicological Agent Protective (TAP) boot, fresh-air breathing systems for both Self-Contained and tethered operations, a cooling system, and a communications system. The suit was designed to be worn five times against vapor agent contamination.



PROTECTIVE ACCESSORIES

Green/Black Vinyl Overboots (GVO/BVO)

The GVO/BVO are fitted vinyl overshoes that are worn over the combat boots to provide chemical and moisture protection during wet weather. The impermeable GVO/BVO provide protection against chemical agents for 12 hours and are durable for up to 14 days.

CP Gloves



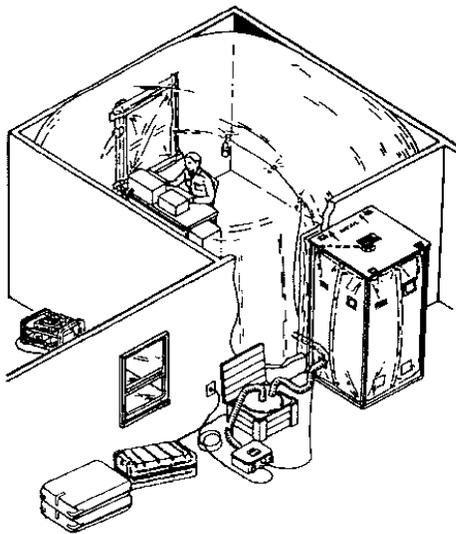
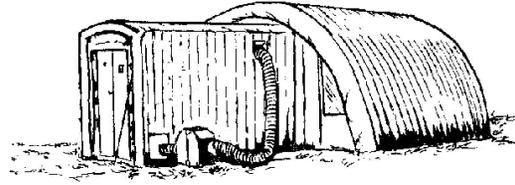
The CP glove set consists of a butyl-rubber outer glove for protection from chemical agents, and a cotton inner glove for perspiration absorption. CP outer gloves come in three thicknesses: 7, 14, and 25 mil. The 7 mil glove is used by personnel who require a high degree of tactility, such as medical and personnel engaged in electronic equipment repair. The 14 mil glove is used by personnel like aviators and mechanics, in cases when good tactility is necessary and stress to the glove is not too harsh.

The 25 mil glove is used by personnel who require a durable glove to perform close combat tasks and heavy labor. The 14 and 25 mil glove sets will provide protection for at least 24 hours. The 7 mil glove set should be replaced within 6 hours of exposure to a chemical agent.

COLLECTIVE PROTECTION EQUIPMENT

M51 Protective Shelter, CB

The M51 shelter is a trailer-mounted system that consists of the following major components: a 10 man shelter, a protective entrance, and a support system. The shelter and protective entrance support themselves through air filled ribs. The protective entrance minimizes carry-over of vapor contamination from outside to inside the shelter, and paces entries to the shelter to prevent loss of shelter over-pressure. The air handling system is permanently mounted in the trailer, and provides forced, filtered, and environmentally conditioned air to the shelter. The M51 is mostly used by battalion aid stations and other medical units. It can also be used as a temporary rest and relief shelter. The Marine Corps has recently fielded a stand-alone collective protection shelter (The Portable Collective Protection Shelter). This system can be erected and employed by 4-6 personnel in approximately one hour. This system provides heat stress relief from the effects of MOPP for 12-14 personnel.



M20 Simplified Collective Protective Equipment

The M20 SCPE is used to convert an interior room of an existing structure into a positive overpressure, NBC collective protection shelter where individuals can perform assigned missions without wearing the protective mask and overgarment. The system consists of a liner, protective entrance, filter canister, and support kit.

M20A1/M28 Simplified CPE (SCPE)

The SCPE is a low cost method of transforming a room of an existing structure into an NBC collective protection shelter for command, control and communication (C³) and soldier relief functions. M20A1 is a room liner for existing shelters; M28 is a liner for the TEMPER tent. Components include a CB vapor resistant polyethylene liner, which provides a protected area in an existing structure; a collapsible, protective entrance, which allows entry to/exit from the protected area; a hermetically sealed filter canister, which provides filtered air to both the liner and the protective entrance; and a support kit, which contains ducting, lighting, sealing and repair material and an electronically powered blower. A pre-planned product improvement (P³I) program to the SCPE (M20A1/M28) provides liquid agent resistant liners, protective liners for tents, interconnectors, and an interface with environmental control units. The improved SCPE also allows more people to enter at one time, and protects hospitals under tents.

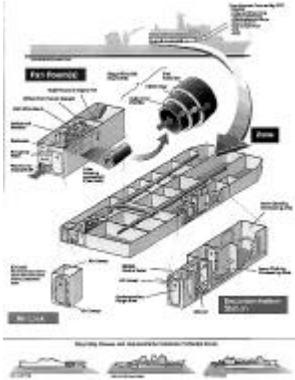


Chemically Protected Deployable Medical System (CP DEPMEDS) - Development/Production

The Army's CP DEPMEDS program is a joint effort with the Air Force to provide environmentally controlled collective protection into field hospitals in order to be able to sustain medical operation for 72 hours in a chemical contaminated environment.



Environmentally-controlled collective protection is provided through the integration of M28 SCPE, chemically protected air conditioners, heaters, water distribution and latrines, and alarms systems. M28 SCPE provides protection to existing TEMPER Tents and passageways within the hospital. DEPMEDS ISO shelters are protected through the replacement of existing shelter seals with those that are CB protected. The Field Deployable Environmental Control Unit will provide air conditioning; the Army Space Heater provides heating. Both are chemically protected through the addition of a kit. To sustain approximately 500 patients and staff, chemically protected latrines and water distribution systems are in development.

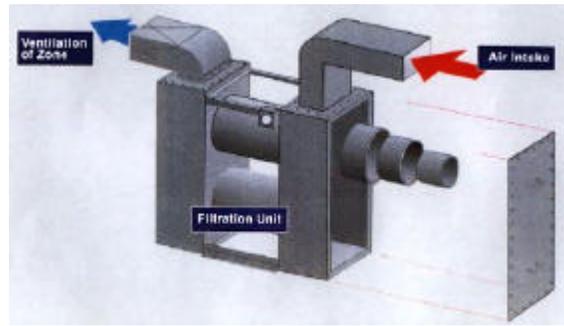


Shipboard Collective Protection System - Production

Shipboard CPS is an integral part of the HVAC systems on new construction ships. CPS provides each protected zone on the ship with filtered air at an overpressure of 2.0 inches Hg. CPS is modular and is based on a Navy-improved version of the 200 cfm M56 filter. CPS includes filters, filter housings, high pressure fans, airlocks, pressure control valves, low pressure alarm system, and personnel decontamination stations.

Selected Area Collective Protection System - Production

Selected Area CPS (SACPS) is designed to be easily adaptable to current ships to provide selected spaces (*i.e.*, command and control, berthing areas, *etc.*) with an affordable CPS system. SACPS is modular and is based on a Navy-improved version of the 200 cfm M56 filter. SACPS is easily integrated into the ship's existing HVAC system, and includes filters, filter housings, a high pressure fan, an airlock, a pressure control valve, and a low pressure alarm system.



CB Protected Shelter (CBPS) - Production



CBPS is a highly mobile, rapidly deployable shelter system designed to be used for Echelon I and II forward area medical treatment facilities. The system is self-contained and self-sustaining. The CBPS consists of a dedicated Heavy Variant HMMWV, a Lightweight Multipurpose Shelter (LMS) mounted onto the vehicle, a 300 square foot airbeam

support CB protected shelter, and a High Mobility Trailer with a 10kW tactical Quiet Generator Set. The HMMWV and LMS transports a crew of four and their gear. All medical equipment required for the shelter is transported in the LMS or on the trailer. The CB shelter is rolled and carried on the rear of the LMS during transport. The CBPS is operational within 20 minutes with a crew of four. All power required to support operations is provided by the HMMWV engine or with the 10kW generator for limited power. The system is environmentally conditioned by a hydraulically powered environmental support system, which provides filtered air, heating, air conditioning, and electrical power. The system is presently in production with fielding scheduled to initiate in 1QFY99.



Portable Collective Protection System



The transportability and ease of use of the Portable Collective Protection System (PCPS) permit mobility and flexibility in chemically and/or biologically contaminated areas. PCPS can be erected by four Marines within 30 minutes wearing MOPP 4 gear. The protective shelter is divided into a main area and two smaller compartments; the entry area, and the storage area. When

overpressure is applied, the protective shelter provides protection from liquid and vapor chemical and biological agent. An airlock (protective entrance) allows purging of possible chemical agent vapors and additional decontamination of personnel entering the main area.

GENERIC NBC FILTERS AND COLLECTIVE PROTECTION FILTRATION SYSTEMS

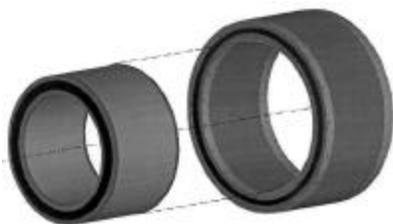
Generic, high volume air flow NBC filters, and CP filtration systems exist that are currently installed on a wide variety of applications. These CP systems are modular and have been applied to numerous vehicles, vans, mobile shelters, and fixed sites.

GENERIC NBC FILTERS

Gas particulate filters remove toxic gas and dust from air supplied to collective protection systems and armored vehicle overpressure systems.

M48/M48A1

The 100 cubic foot per minute (cfm) filter is used in the M1A1/A2 Abrams tank, M93 Modular Collective Protection Equipment (MCPE), and Paladin Self Propelled Howitzer.



M56

The 200 cfm filter is used as the basic filter set in the MCPE and in Naval applications. It can be stacked to obtain filtration of higher air flow rates.

600 cfm and 1200 cfm Stainless Steel Fixed Installation Gas Filters

These filters are used in fixed site applications where high volumes of air flow are required. They can be stacked to provide higher NBC filtered air flow rates. Particulate filter would be procured separately.

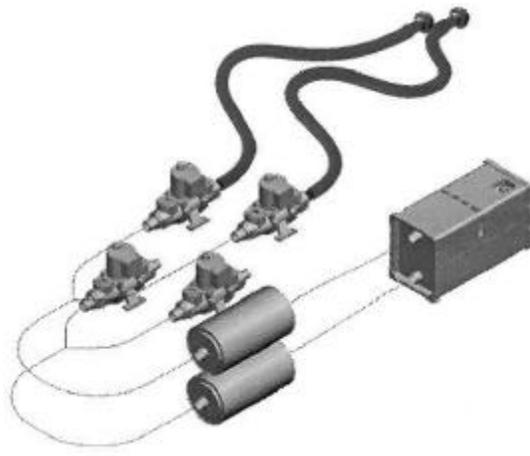
GENERIC NBC CP FILTRATION SYSTEMS

The following are modular NBC CP filtration systems which are applied to a wide variety of applications. They consist of an NBC filter, motor/blower unit, housings, and integration housings/ductwork. Some can be integrated into environmental control equipment.

M8A3 Gas Particulate Filter Unit (GPFU)

The 12 cfm system provides air to armored vehicle crewman ventilated facemasks, *i.e.*, M42A1/A2. Used in M113 Armored Personnel Carrier variants and USMC AAVP7A1 amphibious vehicle.

M13A1 GPFU



The 20 cfm system provides air to armored vehicle crewmen ventilated facemasks, *i.e.*, M42A1/A2. Used on the M1A1/A2 Abrams tanks, Bradley Fighting Vehicles, Multiple Launch Rocket System (MLRS), tank transporter, and other vehicles.

Modular Collective Protection Equipment (100, 200, 400, 600 cfm Systems)

Modular Collective Protection Equipment (MCPE) consists of a family of related end items from which modules can be chosen and combined to meet the unique demands of individual systems. These end items employ common parts and mountings and interchangeable connections and accessories to the greatest extent possible. MCPE provides collective overpressure to a wide variety of mobile shelters and vans. It uses the M48 NBC filter in the 100 cfm system and the M56 NBC filter in the others.

SECTION 2: RDTE ITEMS

INTEGRATED

Force XXI Land Warrior

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Protection from all threats for the individual, to include NBC threats
- Integrated vision, communication, and locator systems and enhanced equipment interface

Description:

The Force XXI Land Warrior (formerly, the 21st Century Land Warrior) is an integrated soldier defense system which will improve the warfighter's combat system interface and ability to detect, recognize, and destroy enemy soldiers and equipment. Monitor and protection systems are integrated into a full body ensemble along with advanced locations, communications, microcomputer, and vision systems to maximize the warfighter's battlefield awareness, survivability, and lethality.

RESPIRATORY

Joint Service General Purpose Mask (JSGPM)

Rationale:

Army, Air Force, Navy, Marine Corps (Requirement)

Key Requirements:

- 24-hour CB protection
- Lower breathing resistance
- Reduced weight and bulk

Description:

The JSGPM will be a lightweight protective mask system—consisting of mask, carrier, and accessories—incorporating state-of-the-art technology to protect U.S. forces from all future threats. The mask components will be designed to minimize its impact on the wearer's performance and to maximize its ability to interface with future Service equipment and protective clothing.

Joint Service Aviation Mask (JSAM)

Rationale:

Army, Air Force, Navy, Marine Corps (Requirement)

Key Requirements:

- Continuous CB protection
- Improved anti-G features
- Hypoxia protection up to 60,000 feet

Description:

JSAM will be a lightweight CB protective mask that can be worn as CB protection for all aircrew. With the addition of anti-G features, it can be worn as combined CB and anti-G protection for aircrews in high performance aircraft. It will be compatible with existing CB ensembles, provide flame and thermal protection, reduce heat stress imposed by current CB protective masks, and the CB portion will be capable of being donned in flight. JSAM must also be compatible with existing aircrew life support equipment.

CB Respiratory System (A/P23P-14(V)N) NDI

Rationale:

Navy, Marine Corps (Requirement)

Key Requirements:

- CB protection compatible with all aircraft system; integral respirator and protective ensemble

Description:

The A/P23P-14(V)N is a self contained protective ensemble designed for all forward deployed fixed wing (USN/USMC) and rotary wing (USN) aircrew. The design will incorporate a CB filter, dual air/oxygen supply and a cross-over manifold with ground flight selector switch to provide filtered air for hood ventilation, and filtered air for oxygen for breathing. The system will provide enhanced protection and offer anti-drown features.

BATTLEFIELD PROTECTIVE SUITS

Joint Service Lightweight Integrated Suit Technology (JSLIST)

The JSLIST program is a fully cooperative Joint Service RDTE effort chartered to develop new CB protective clothing for all Services. The program will yield a family of garments and ensembles, developed for Joint Service mission needs and tested to Joint Service standards. The JSLIST will provide enhanced CB protective ensembles with reduced physiological heat burden and will be generally lightweight and launderable. These garments will also integrate other types of protection. JSLIST is the first of a 3 phase program and supports a variety of Service suit and accessories. The following requirements are incorporated within the Joint ORD for JSLIST:

*Lightweight CB Protective Garment (LCBPG) – Army
Advanced Battledress Overgarment (ABDO) – Army
Vapor Protective Undergarment (VPU) – SOF
Advanced Chemical Protective Garment (ACPG) – Navy
Multi-purpose Overboot (MULO) – Army
Improved CB Protective Gloves – Army
Multi-purpose Protective Socks (MPS) – SOF*

There are five JSLIST clothing item requirements:

1) overgarment, 2) undergarment, 3) duty uniform, 4) boots and 5) gloves. Each of the Services' requirements are incorporated by these five JSLIST requirements.

In April 1997, the JSLIST program type classified the ABDO and MULO. The remaining items are being addressed in the JSLIST Pre-Planned Product Improvement (P3I) program, currently underway, with completion scheduled for late 1999. P3I is seeking new and advanced material candidates only. The garment design will be the JSLIST design with only minor design modifications allowed under a P3I.

Lightweight Chemical/Biological Protective Garment (LCBPG) P3I (FUE FY97) (JSLIST Overgarment)

Rationale:

Army (Requirement)
Navy, Air Force (Interest)

Key Requirements:

- Provide 6 hours protection against 10 g/m² liquid; 5000 CT vapor/aerosols
- Provide 7 days field wear (minimum) in all geographical areas (launderability not required)
- Weigh no more than 4 pounds (3 pounds desired)
- Have package volume for size medium no more than 500 in³ (300 desired)
- Reduce the physiological heat burden by at least 20% (30% desired) over that experienced when wearing the BDO.

Description:

In test conditions, the LCBPG provides 6 hours of protection against all CB agents after moderate periods of non-CB wear. The requirement has a trade-off of wear-time and protection-time in order to achieve a lightweight, low-bulk garment for short-term, high-risk missions. The LCBPG will be a two-piece suit designed with an integrated hood compatible with the M40 mask with second skin. It will be worn as an overgarment for the duty uniform or as primary garment over underwear depending upon the environment or mission.



Advanced Battle Dress Overgarment (ABDO) (FUE FY97)
(JSLIST Overgarment)

Rationale:

Army (Requirement)
Navy, Marine Corps (Interest)

Key Requirements:

- Provide 24 hours protection against 10 g/m² liquid agent; 5000 CT vapor/aerosols
- Provide 45 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings
- Weigh less than 4 lbs for a size medium-regular, packed garment
- Reduce physiological heat burden currently imposed by BDO

Description:

ABDO will provide 24 hour protection after extended wear and laundering. Liners currently are based upon activated carbon technology (carbon beads, thin carbon foam and others). ABDO will be a two-piece design with an integrated hood compatible with the M40 mask with second skin. It will be worn as an overgarment for the duty uniform or as a primary garment over underwear depending upon the environment and mission.

Advanced Battle Dress Overgarment (ABDO)
(JSLIST P3I Overgarment)

Rationale:

Army, Air Force, Navy, Marine Corps, SOF (Requirement)

Key Requirements:

- Provide 24 hours of protection against 10g/m² liquid agent, 5000 CT vapor/aerosols
- Provide 60 days field wear in all geographical areas
- Retain chemical protection after 8 launderings
- Weigh less than 4 lbs for a size medium-regular, packed garment
- Reduce physiological heat burden currently imposed by BDO

Description:

The ABDO will provide 24 hours protection after extended wear and laundering. Liner candidates are based upon activated carbon technology (carbon beads, thin carbon foam, and others). The ABDO will be a two-piece design with an integrated hood compatible with the M40 mask and second skin. The ABDO will be worn as an overgarment for the Battle Dress Uniform (BDU), or as a primary garment over personal underwear depending upon the environment and mission.

Advanced Chemical Protective Garment (ACPG) (FUE FY97)
(JSLIST Overgarment)

Rationale:

Navy (Requirement)

Key Requirements:

- Provide 24 hours protection against 10 g/m² liquid agent; 5000 CT vapor/aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings
- Weigh less than 4 lbs for a size medium-regular, packed garment
- Reduce physiological heat burden currently imposed by BDO

Description:

The ACPG will provide 24 hour protection after 30 days wear time and 4 launderings. Liners currently are based upon various activated carbon technologies (carbon beads, thin carbon foam and others). It will be two-piece suit with an integrated hood compatible with the MCU-2/P mask with second skin. The ACPG will be worn as an overgarment for the duty uniform or as a primary garment over underwear depending upon the environment and mission.

Vapor Protective Undergarment (VPU) (FUE FY97)
(JSLIST Undergarment)

Rationale:

SOF (Requirement)

Key Requirements: (When worn under the Nomex coveralls)

- Provide 12 hours protection (24 desired) against 10 g/m² liquid; 10,000 CT vapor/aerosols
- Provide 30 days field wear (minimum) in all geographical areas
- Retain chemical protection after 4 launderings (10 desired)
- Provide flash fire protection (10 watts/cm² for 6 seconds)
- Weigh less than 3 pounds (without coveralls)
- Reduce the physiological heat burden imposed by the CPU worn with coveralls

Description:

The VPU will provide 12 hour protection after extended wear and laundering. It will also offer a reduction for the heat stress burden when compared to the CPU. The VPU will be a one or two-piece undergarment with an integral hood compatible with the M42 series mask.

Groundcrew Ensemble (GCE)
(JSLIST Duty Uniform)

Rationale:

Air Force (Requirement)

Key Requirements.

- Enhance existing capability with lighter, less thermal burdening ensemble

Description:

The GCE provides chemical protection, from the neck down, to personnel while in an Air Base environment. It provides protection from liquid and vapor hazards while greatly reducing the level of physiological stress encountered with the current battle dress overgarment (BDO). The material, which will be lighter and will provide a reduction in heat stress, will be capable of being laundered and decontaminated.

Joint Firefighter Integrated Response Ensemble (JFIRE)
CB Protective Firefighter Ensemble (FFENS)
Fire Fighter Suit-Combat (FIS-C)

Rationale:

Army, Air Force (Requirement)

Key Requirements:

- Provide 24 hours of CB agent protection against 10 g/m² liquid agent

- Provide firefighters CB protection in both structural and crash fire fighting/rescue operations
- Allow firefighters to use mission essential tools and equipment
- Provide resistance to water and all standard fire fighting chemicals (foam, CO₂, aircraft POL)
- Capable of being donned in 8 minutes unassisted

Description:

JFIRE is a joint effort between the Air Force (lead agency) and the Army. JFIRE meets all requirements for the Air Force Firefighters Ensemble (FFENS) and the Army Firefighter's Integrated Suit-Combat (FIS-C). JFIRE has integrated the JSLIST to the fire protective equipment, both structural and proximity, along with the Interspiro CB Protective Mask. The Interspiro CB Protective Mask provides switchable filtered air utilizing the C2 Canister and a positive pressure Self-Contained Breathing Apparatus (SCBA) capability. The Air Force is also investigating the applicability of a Commercial-Off-The-Shelf (COTS) glove that can be used for both fire protection and CB protection.



JFIRE

Multipurpose Overboot (MULO)
(*JSLIST Boots*)

Rationale:

Army, Air Force, Marine Corps (Requirement)
Navy (Interest)

Key Requirements:

- Provide 24 hours protection against 10 g/m² liquid agent as well as environmental protection from water, snow and mud
- Provide 60 days wear in all environments without degradation of protection
- Provide resistance to incidental slashing by POL and self-extinguishing flame resistance
- Capable of being decontaminated to an operationally safe level using standard decontaminants

Description:

The MULO is a joint service program under the auspices of the JSLIST program. It will be made of an elastomer blend and will be produced by injection molding. It will be designed for wear over the combat boot, jungle boot and intermediate cold/wet boot. The MULO will be more durable, lighter weight and will provide more protection than the GVO/BVO. The sole will be designed to provide traction on various surfaces including dirt and metal.



Multipurpose Protective Sock (MPS) (JSLIST P3I)

Rationale:

SOF (Requirement)

Key Requirements:

- Provide 24 hours of protection against $10\text{g}/\text{m}^2$ liquid agent, ($5000\text{ mg}\cdot\text{min}/\text{m}^3$ vapor/aerosols if boot is made of permeable material)
- Provide 45 days field wear
- Must be comfortable, fit well and be compatible with all SOF footwear; *i.e.*, desert, jungle, assault boots, *etc.*
- Retain chemical Protection after 4 launderings

Description:

The MPS will provide 24 hours protection after extended wear and laundering when worn over the issue wool sock and under SOF footwear. The MPS must provide comfort, fit and compatibility when worn over the wool sock and under the various types of SOF footwear. The boots' composition and design will determine whether both liquid and vapor protection must be integrated into the sock material.

Improved CB Protective Glove JSLIST Gloves (JSLIST P3I)

Rationale:

Army (Requirement)

Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Provide 24 hours protection against $10\text{ g}/\text{m}^2$ liquid agent
- Provide protection against POL and standard decontaminants

- Provide self-extinguishing flame resistance
- Provide 15 days wear durability in all environments without degradation of protection
- Provide dexterity equal to or better than the standard 14 and 25 mil butyl gloves

Description:



The Improved CB Protective Glove will be a joint service program under the auspices of the JSLIST program. Candidate materials include a flame retardant (FR) butyl rubber; polyepichlorohydrin/FR butyl rubber; and an experimental, permeable material.

SPECIALTY SUITS

Improved Toxicological Agent Protective (ITAP)

Rationale:

Program is a Joint Service Program

Key Requirements:

- Provide splash and vapor protection against a potential exposure to liquid agent when worn as a system—requirements: 10g/m² HD, VX, GB, L agent challenge for 2 hours.
- Provide an optional Personal Ice Cooling System (PICS).
- Be functional as a system where temperatures range from 0° to 100°F when used with a cooling system.
- The suit and overhood are capable of being decontaminated for a minimum of 5 reuses, 2 hours per use (1 hour at IDLH), after vapor and particulate contamination. After liquid contamination ITAP suit will be decontaminated and held for disposal.
- Must have a minimum shelf life of 5 years.
- It is required that the fabric be self-extinguishing meeting NFPA 1991.
- It is required that the fabric be static dissipative and not hold a charge sufficient to set off munitions and explosives in accordance with current Explosive Safety Board requirements.
- The fabric should be light in color to reduce operator solar heat load. Capable of being stored within the temperature range of 0° to 120°F.

Description:

ITAP will replace the M3 TAP ensemble. ITAP will enhance existing capabilities by providing a less thermal burdening ensemble. ITAP will provide skin and respiratory protection during peacetime and wartime for short term operations in Immediately Dangerous to Life and Health (IDLH) toxic chemical agent (up to 1 hr), emergency life saving response, EOD incident response, routine chemical facility operations and initial entry monitoring. The ensemble must be capable of rapid employment and require reduced logistical support.



COLLECTIVE PROTECTION EQUIPMENT

**Advanced Integrated Collective Protection System (AICPS)
for Vehicles, Vans and Shelters (VVS)**

Rationale:

Army (Requirement)
Navy, Marine Corps (Interest)

Key Requirements:

- Integral NBC filtration power and environmental control for vehicles, vans and shelters
- Minimize filter changes and overall system logistics burden
- Reduced size, weight and energy requirements

Description:

The AICPS, which uses a deep-bed carbon vapor filter for extended gas filter life, is an NBC filtration system integrated with an environmental control unit and auxiliary power unit for combat systems. The combined components provide overall size, weight and energy reduction, and eliminate the need for additional electrical power from the host system.



**AICPS mounted to S788 Shelter
on M1097 HMMWV**

Shipboard Collective Protection Equipment

Rationale:

Navy (Service-Unique Requirement)

Key Requirements:

- Provides more efficient, long life filters
- Provides plans for backfitting existing non-CPS ships

Description:

Shipboard Collective Protection Equipment (CPE) provides a contamination-free environment within specified zone boundaries such that mission essential operations and life sustaining functions can be performed during or after a CB attack. The objective of this program is to provide Pre-Planned Product Improvements (P3I) to the current Shipboard CPS to decrease logistic costs by extending filter life, reducing shipboard maintenance requirements, and providing energy-efficient fans. The program develops improvements to existing shipboard HEPA and gas adsorber filters, supports long term shipboard testing of filter improvements to develop filter life database, and provides plans for backfitting existing non-CPS ships. Shipboard CPE is being installed on selected new construction ships.

(INTENTIONALLY BLANK.)

ANNEX C

**DECONTAMINATION
PROGRAMS**

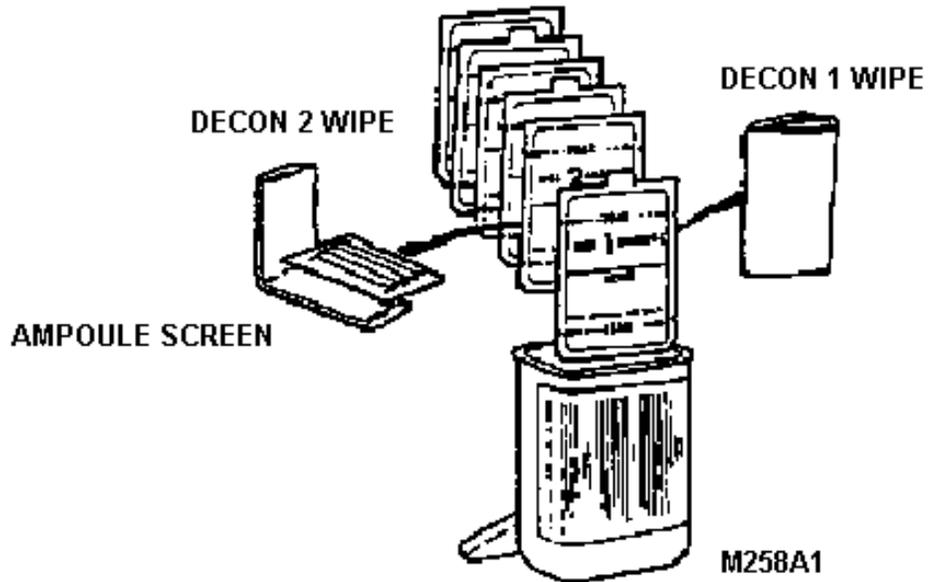
(INTENTIONALLY BLANK.)

SECTION 1: FIELDED AND PRODUCTION ITEMS

PERSONNEL

M258A1 Skin Decontamination Kit (SDK)

The M258A1 consists of a pocket-sized plastic case containing three sets of foil-packaged decontaminating wipes. The decontaminating sets consist of PACKET 1 containing an aqueous decon solution soaked gauze pad, and PACKET 2 containing a decon solution filled glass ampoule within a gauze pad. Personnel use the two wipes



successively to remove and neutralize liquid chemical agents from their skin, clothing, personal equipment and weapons. The M258A1 is being replaced by the M291 decon kit.

M291 Skin Decontamination Kit



The M291 consists of a wallet-like flexible carrying pouch containing individually packaged hermetically sealed foil packets. Each packet contains a folded nonwoven fiber applicator pad with an attached strap handle on one side. The pad contains a reactive and sorptive resin polymer mixture. The kit enables warfighters to remove, neutralize, and destroy chemical and

biological warfare agents on contaminated skin. The kit is carried in a pocket of the Battle Dress Overgarment (BDO).



M295 Equipment Decontamination Kit



The M295 consists of a pouch containing four individual wipedown mitts, each of which is within a soft, protective packet. The pouch assembly is designed to fit comfortably within the pocket of the BDO. Each individual wipedown mitt in the kit is comprised of adsorbent resin contained within a nonwoven polyester material and a polyethylene film backing. In use, resin from the mitt is allowed to flow freely through the non-woven polyester pad material. Decontamination is accomplished through sorption of contamination by both the non-woven polyester pad and by the resin. The M295 enables the

warfighter to perform basic decontamination to remove, neutralize, or destroy CB warfare agents and toxins on contaminated personal and load bearing equipment.

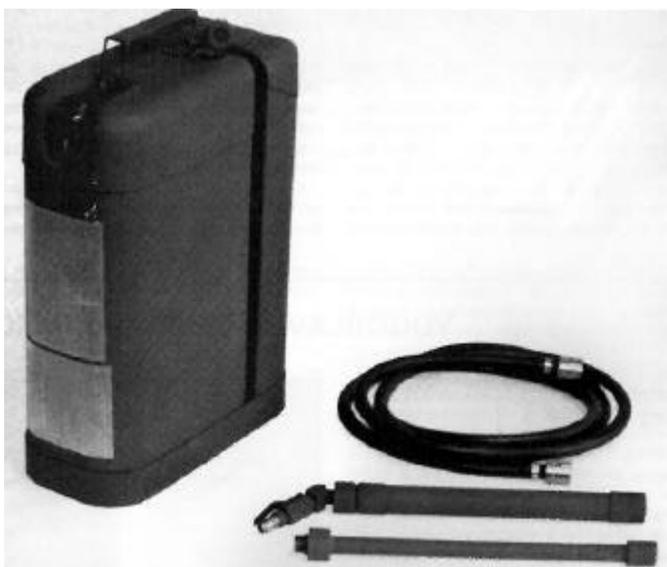
COMBAT EQUIPMENT, VEHICLES, AND AIRCRAFT

ABC-M11 Portable Decontaminating Apparatus

The 1-1/3 quart capacity M11 is used to spray DS2 decontaminating solution onto critical areas (*i.e.*, frequently used parts) of vehicles and crew served weapons. The M11 consists of a steel cylinder, a spray head assembly, and a small nitrogen cylinder (about 3" long). The refillable M11 can produce a spray 6 to 8 feet long, and cover an area of about 135 square feet. The M11 is currently used on tanks and other systems where the larger M13 Decontaminating Apparatus, Portable (DAP) cannot be effectively stowed.



M13 Decontaminating Apparatus, Portable (DAP)



The man portable M13 consists of a vehicle mounting bracket, a pre-filled fluid container containing 14 liters of DS2 decontaminating solution, and a brush-tipped pumping handle connected to the fluid container by a hose. The fluid container and brush head are both disposable. The M13 can decontaminate 1,200 square feet per fluid container. The combination of spray pump and brush allows personnel to decontaminate hard to reach surfaces, and remove thickened agent, mud, grease and other material.

ABC-M12A1 Power Driven Decontamination Apparatus (PDDA); Skid-Mounted

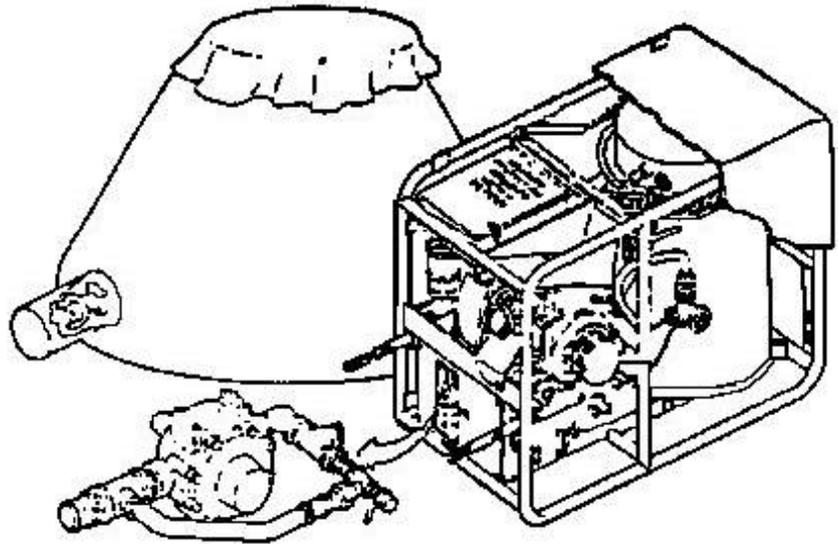


The M12A1 consists of three main components: a pump unit, a 500 gallon tank unit, and a 600 gallon per hour liquid fuel water heater. The M12A1 is a flexible system that can be used for purposes such as de-icing, fire fighting with water or foam, water pumping/transport, and personnel showering in addition to equipment and area decontamination. The M12A1 can pump 50 gallons of decontaminating solution per minute

through both of its two hoses. The integral shower assembly provides 25 shower heads. The M12A1 is typically mounted on a 5 ton truck for tactical mobility, but can be dismantled to facilitate air transport. The Marine Corps is replacing the M12A1 PDDA with the M17 series Lightweight Decontamination Apparatus.

M17 Series Lightweight Decontamination Apparatus

The M17 series Lightweight Decontamination System is a portable, lightweight, compact engine driven pump and water heating system. The system is used during decontamination operations. The LDS is capable of drawing water from any source and delivering it at moderate pressure and controlled temperatures. The system has an accessory kit with hoses, spray wands, and personnel shower hardware. It also includes a collapsible water bladder.



SECTION 2: RDTE ITEMS

COMBAT EQUIPMENT, VEHICLES, AND AIRCRAFT

Sensitive Equipment Decontamination System

Rationale:

Army (Requirement)
Navy, Air Force, Marine Corps (Interest)

Key Requirements:

- Non-aqueous based decontamination systems for sensitive equipment
- Capable of being used in both mobile and fixed-sites

Description:

Provide a first ever capability to decontaminate chemical and biological warfare agents and toxins from sensitive electronic, avionics, electro-optic equipment, and vehicle interiors. Its use must be compatible with and not degrade sensitive materials or equipment. It must be operator safe and offer protection from off-gassing and direct liquid exposure during decontamination.

Sorbent Decontamination System

Rationale:

Army, Marine Corps (Requirement)
Navy, Air Force (Interest)

Key Requirements:

- Effectively decontaminates all CB warfare agents from contaminated surfaces
- Easy-to use and possess no hazard to users
- Non-damaging and non-corrosive to military equipment
- Environmentally safe to store

Description:

The reactive sorbent decontamination system provides a simple, rapid, and efficient system to decontaminate small and individual issue items of equipment. It is effective in all environments, is less corrosive, and presents a lowered logistics burden through improved shelf life and reduced special handling and storage needs. The system uses a catalytic component that reacts with the chemical agents being sorbed; this eliminates the potential hazard created by the off-gassing of agents from used sorbents.

M21/M22 Modular Decontamination System (MDS)

Rationale:

Army (Requirement)

Navy, Air Force Marine Corps (Interest - No Imminent Requirement)

Key Requirements:

- Provide high pressure water for the primary wash process
- Mechanically dispense and scrub decontaminant
- Fit within the payload limits of a 3/4 ton trailer and a 1-1/2 ton trailer
- Use existing equipment to supplement the deliberate decontamination process
- Provide adapters to draw water from fire hydrants

Description:



The MDS will provide the soldier an improved capability to perform detailed equipment decontamination on the battle field. The system will replace current methods of decontamination application (*i.e.*, mops and brooms or with the portable M13 Decontamination Apparatus) which are both time consuming and labor intensive. The MDS improves effectiveness, re-

duces water usage, equipment processing time, and labor intensiveness. The MDS consists of a M21 decontaminant Pumper/Scrubber module, and M22 High Pressure/Hot Water module. The M22 delivers DS2 or liquid field expedient decontaminants and is capable of drawing the decontaminant directly from a container on the ground while mounted on a trailer. The M22 provides hot water up to 3000 psi at a rate of 5 gpm with the capability of high volume cold water and detergent injector. It will also be capable of drawing water from natural and urban water sources and delivering it at variable adjustable pressures, temperatures and flow rates. Each module (M21 or M22) may be transported or operated from a 3/4-ton trailer towed by a M1037 High Mobility Multipurpose Wheeled Vehicle.



M17 Diesel Lightweight Decontamination System (LDS)

Rationale:

Marine Corps (Service-Unique Requirement)
Air Force, Navy (Interest - No Imminent Requirement)

Key Requirements:

- Be capable of operation using Military Standard (MIL STD) fuels
- Have no component which cannot be moved by a four man crew
- Be capable of decontaminating both sides of a vehicle or aircraft simultaneously
- Generate no new manpower requirements

Description:

The Diesel LDS is a portable, lightweight, compact, engine-driven pump and multifuel-fired water heating system. The system will be capable of performing the same hasty and deliberate decontamination procedures as required of the M17 series LDS.

ANNEX D

**JOINT MEDICAL
CHEMICAL, BIOLOGICAL, AND
NUCLEAR DEFENSE RESEARCH
PROGRAMS**

(INTENTIONALLY BLANK)

JOINT MEDICAL CHEMICAL, BIOLOGICAL, AND NUCLEAR DEFENSE RESEARCH PROGRAMS

The joint medical chemical, biological, and nuclear (radiological) defense research programs are each addressed in the next three sections.

D.1 MEDICAL CHEMICAL DEFENSE RESEARCH PROGRAM

D.1.1 Fielded Products

Advances in medical research and development (R&D) significantly improve the warfighting mission by sustaining unit effectiveness through conserving the fighting strength of our forces and supporting the nation's global military strategy, which requires the ability to effectively deploy and operate. Medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past and presents the potential for future enhancement of military operational effectiveness. Some fielded materiel and non-materiel solutions by medical chemical defense R&D are:

Pharmaceuticals (See Figure D-1):

- Nerve Agent Antidote Kit (Mark I), 1983
- Skin Decontamination Kit (M291), 1990
- Nerve Agent Pretreatment (Pyridostigmine), (NAPP), 1985*
- Convulsant Antidote for Nerve Agent (CANAA), 1991*
- Medical Aerosolized Nerve Agent Antidote (MANAA), 1994*
- Test Mate® ChE (Cholinesterase) Kit, 1997

* Initial fielding of these medical products was funded under Low Rate Initial Production (LRIP) options in developmental contracts with RDT&E dollars. Therefore, the following FY96 actions were accomplished: (1) Proved long term extended stability of the medical aerosolized nerve agent antidote (MANAA), the convulsant antidote for nerve agent (CANAA), and the nerve agent pretreatment (pyridostigmine), (2) Completed one year follow-up to pyridostigmine gender study, and (3) Submitted new drug application (NDA) for pyridostigmine to the FDA.



MARK I, M291, NAPP, and CANA



Test Mate® ChE Kit

Figure D-1. Selected Fielded Pharmaceutical Products

Materiel (See Figure D-2):

- Resuscitation Device, Individual, Chemical, 1990
- Decontaminable Patient Litter (NSN 6530-01-380-7309), 1991
- Chemical Warfare (CW) Protective Patient Wrap (NSN 8415-01-311-7711), 1991
- Computer-Based Performance Assessment Battery, 1993
- M40 Protective Mask Vision Correction (optical inserts)



Figure D-2. Decontaminable Patient Litter and CW Patient Wrap

D.1.2 Medical Chemical Defense Research and Development Accomplishments

The medical chemical defense research and development technical barriers and accomplishments during FY97 are grouped by the classical chemical threat categories, which include the following:

- Vesicants or blister agents (*e.g.*, sulfur mustard [HD] and Lewisite),
- Nerve agents (*e.g.*, soman [GD], VX),
- Blood agents (*e.g.*, cyanide), and
- Respiratory agents (*e.g.*, phosgene).

The chemical threat, however, is not restricted to commonly accepted classical agents. Novel agents may be developed by potential adversaries. The ability to provide timely and effective medical countermeasures to new threats depends upon maintaining a high level of technological capability.

Countermeasures to these threats include pharmaceuticals, medical equipment, specialized materiel or medical procedures, and concepts for training, doctrine, and organization. Medical countermeasures are designed not only to prevent lethality but to preserve and sustain combat effectiveness in the face of combined threats from chemical and conventional munitions on the integrated battlefield by:

- Prevention of the effects of chemical agents (*e.g.*, pretreatments or prophylaxes),
- Far-forward treatment upon exposure to chemical warfare threats (*e.g.*, antidotes),
- Chemical casualty care (*e.g.*, therapy and management).

THREAT CATEGORY: VESICANT AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of vesicant agents are outlined below.

Countermeasures:

- Reactive topical skin protectant for blister agents.
- Products that prevent or moderate vesicant injury.

Technical Barriers:

- Appropriate model systems for testing treatment efficacy and safety in humans.
- Quick-acting and long-lasting antidotes that are easy to carry and use on the battlefield.

Accomplishments:

- Using artificial skin models and simulant to sulfur mustard (HD), determined that regulatory processes for cytokine antagonists are as critical as those for primary cytokines in biological responses to vesicant injury.
- Developed human whole blood model for assessing vesicant injury-induced changes in cytokine responses.
- Demonstrated that 7 of 33 compounds tested in the mouse ear screen provided significant reductions in HD-induced edema, histopathology, or both.
- Demonstrated that N-acetyl cysteine provided protection against HD vapor inhalation when assessed through biochemical changes in the rat bronchoalveolar lavage model.
- Showed that cytoprotection of keratinocytes against HD by the calcium chelator BAPTA appears to be related to inhibition of cellular metabolic processes and cell division.
- Demonstrated that pulsed CO₂ laser debridement of weanling pigskin exposed to HD vapor significantly improved viability and organization of the healing epidermis.

- Demonstrated elevations of inflammatory cytokine leukotriene B4; and the chemotactic complement component C5a in normal human fibroblasts exposed *in vitro* to HD, which could account for the inflammatory response to cutaneous HD exposures.
- Demonstrated elevation of Fc receptors and receptors for the complement component C1q in keratinocytes exposed *in vitro* to HD.
- Developed a single-cell comet electrophoresis assay that allowed time and concentration demonstrations of DNA strand breaks following *in vitro* exposure of lymphocytes to HD.
- Measured HD-specific changes in gene expression using the differential display polymerase chain reaction (DDPCR), which may allow detection of alteration in human keratinocytes exposed *in vitro* to HD.
- Found unexpectedly high levels (10-fold elevation) of the DNA repair enzyme methyl guanine methyltransferase (MGMT) in human keratinocytes as compared to levels seen in other human tissues.
- Developed a pulse field gel electrophoresis assay for measurement of DNA double-strand breaks following HD-exposure that revealed a necrotic pattern of DNA damage at 24 hours, suggesting that double-strand breaks are only evident at earlier time points.
- Found that exposure of cultured keratinocytes to HD failed to generate a change in intracellular calcium, but may result in transmembrane changes of the chelating indicator dyes.
- Determined that HD exposed keratinocytes produced an 80-Kd calcium-dependent serine protease that has been chromatographically purified and sequenced.
- Demonstrated that expression of keratin 14 is decreased within 1 hour of HD exposure in cultured keratinocytes.
- Developed methods for analysis of multiple biochemical markers, including serum amyloid A and myeloperoxidase, from a single punch biopsy following cutaneous exposure to HD.
- Showed that pretreatment of lymphocytes with L-oxothiozolidine-4-carboxylate, a cysteine precursor, provides a level of protection against HD cytotoxicity.
- Showed that anionic sulfur compounds interact directly with DNA, possibly changing the molecular topology, which could be the basis for their efficacy in protecting against cellular damage by HD.
- Identified three tissue fixatives, which allow qualitative measurement of the extent of injury following sulfur mustard (HD) exposure in the porcine model.
- Developed a procedure for measuring cessation of offgassing of HD following animal exposure experiments.
- Developed gas chromatographic-mass spectrometric (GC-MS) method to document lewisite exposure levels by detection, extraction and derivatization of 2-chlorovinylarsonous acid (CVAA) in the urine of guinea pigs exposed to lewisite.
- Installed atomic absorption (AA) instrumentation to measure total arsenic content of biological samples following lewisite exposure to complement the GC-MS procedure.
- Evaluated clinical endpoints utilized in human intensive care in the miniature swine inhalation model.
- Showed that exposure of keratinocytes to HD leads to cytotoxicity involving terminal differentiation and apoptosis via a calcium-calmodulin and caspase-dependent pathway

(Dr. M.E. Smulson, Georgetown University).

- Assessed the toxicokinetics of HD in the hairless guinea pig following I.V. administration of 0.3 LD₅₀ using gas chromatography coupled with pulsed flame photometric detection (PFPD); showed that half-lives of distribution and elimination were 0.7 and 152 minutes, respectively (Dr. J. Langenberg, TNO, The Netherlands).
- Observed dramatic increases in levels of the cytokines IL-1b, IL-6, TNF-alpha, and MIP-1a mRNA following cutaneous HD exposure in the mouse ear (Short Term Analytical Service [STAS], Casillas/Sabourin, Ohio State University).
- Found elevation of two precursor enzymes for substance P following cutaneous HD exposure in the mouse ear (STAS, Casillas/Cutler and Pollack, Mercer University, GA).

THREAT CATEGORY: NERVE AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of nerve agents are outlined below.

Countermeasures:

- Pretreatment regimen that protects against incapacitating effect.
- Medical countermeasures to minimize lethality, morbidity, and residual incapacitation.

Technical Barriers:

- Appropriate experimental model systems to predict pretreatment, drug or treatment efficacy and safety in humans.

Accomplishments:

- Accomplished Milestone Zero transition of potent centrally acting anticholinergic drugs as treatment for nerve agent-induced seizures.
- Identified three clinically used anticholinergic compounds for testing as advanced anticonvulsant in nonhuman primates.
- Performed pharmacokinetic/pharmacodynamic analysis of anticonvulsant drugs to determine blood levels necessary for clinical efficacy against nerve agent seizures.
- Determined that the mechanisms for seizure initiation and development of brain damage are essentially identical for all nerve agents.
- Evaluated utility of use of the enzyme troponin as a clinical marker for nerve agent-induced cardiac damage.
- Initiated preparation of new mutants of human butyrylcholinesterase to enhance their catalytic properties against nerve agents.
- Continued collaboration on mutants of human butyrylcholinesterase and acetylcholinesterase (USAMRICD, University Nebraska, Israeli Institute of Biological Research, and Centre Recherches du Service de Sante des Armees, France).
- Collaborated with the University of Michigan on the characterization of a paraoxonase from dog liver.

- Developed a physiologically based pharmacokinetic model for the stereoisomers of soman.
- Determined the concentration of the nerve agent bioscavenger, carboxylesterase, in liver and plasma of seven mammalian species. The pattern of the liver/plasma ratio of carboxylesterase suggested that plasma levels of carboxylesterase are regulated by liver secretion.
- Synthesized the peptide His-Ile-Glu-Leu and found it could induce complete displacement of carboxylesterase from liver microsomes at a concentration of 5×10^{-6} M.
- Determined by ^{14}C -soman binding to liver microsomes that the threefold lower level of soman binding in liver of rats vs. guinea pigs and monkeys may explain the threefold slower terminal elimination rate of soman in rats vs. these other species.
- Initiated development of immunoaffinity purification for carboxylesterase (CaE).
- Tested two more chiral capillary GC columns coated with 3-beta cyclodextrin derivatives for stereoisomer separation of soman, sarin, tabun and GF. The butyryl 3 gamma cyclodextrin remains the best column for separating soman stereoisomers.
- Characterized a monoclonal anti-soman antibody in an enzyme linked immunosorbant assay (ELISA) assay for binding sublethal concentrations of soman and optimized experimental parameters.
- Collaborated on a study of paraoxonase polymorphism in a population of farm workers in the state of Washington. Found two isozymes, one active against paraoxon, and one active against nerve agent.
- Produced a double mutant of CaE having a histidine near the active site and an altered C-terminal residue that retains CaE activity and is secreted in a transient expression system.
- Completed development of software for physiological-based pharmacokinetic model for all four soman stereoisomers and initiated determinations of stereospecific biochemical parameters for soman.
- Demonstrated that administration of equine butyrylcholinesterase at levels known to protect against 5 LD₅₀s of soman had no behavioral side effects in a nonhuman primate model.
- Optimized fetal bovine acetylcholinesterase (FB-AChE) and equine butyrylcholinesterase catalytic hydrolysis of organophosphorus compounds in the presence of an appropriate oxime by attachment to a solid support.
- Determined the subcutaneous median lethal doses of four classified novel agents in guinea pigs and rats.
- Identified the biochemical mechanism of action of the novel agents as inhibitors of acetylcholinesterase.
- Performed kinetic measurements of the inhibition of acetylcholinesterase by novel agents to rank-order these agents against standard chemical warfare agents.
- Determined the ability of current medical countermeasures (*i.e.*, atropine, oximes, pyridostigmine) to protect against the lethal effects of novel agents in guinea pigs.
- Published a report characterizing the toxicity and medical treatment of a novel agent that is a structural isomer of VX in the *Journal of American College of Toxicology*.
- Developed GC/MS method for detection and quantitation of diisopropylaminoethylol (DPAT), a metabolite of VX in plasma.

- Determined tissue/blood partition coefficients for soman in liver, kidney, lung, brain and muscle of rodents and nonhuman primates to aid in extrapolation of soman pharmacokinetics to humans (Dr. L. De Jong, TNO, The Netherlands).
- Implemented a Short Term Analytical Services (STAS) contract with The Catholic University of America for "Determination of the Origins of the Inhibition of Cholinesterase by Organophosphates" (Dr. Kovach).
- Determined that cholinesterase is involved in neuronal development, even when it may lack catalytic activity (Dr. H. Soreq, Hebrew University, Israel).
- Elucidated the role of Aspartate 70 in the binding and hydrolysis of succinylthiocholine by butyrylcholinesterase (BuChE), explaining why patients with an atypical variant of human BuChE respond abnormally to succinylcholine (Dr. O. Lockridge, University of Nebraska).
- Determined that the normal tetramerization of BuChE occurs at the C-terminus, that tetramerization is not essential for activity, and that the N-terminus cannot be altered without serious repercussions with respect to activity (Dr. O. Lockridge, University of Nebraska).
- Prepared and delivered to the Weizmann Institute for crystallographic studies more than 100 mg of pure human acetylcholinesterase (h-AChE). These crystals are diffractable at about 2.7 Å (Dr. A. Shafferman, IIBR, Israel).
- Cloned 2,6 sialyltransferase into human kidney-293 cells that express h-AChE so that the enzyme is fully capped at the glycosylation site. The capped enzyme has a significantly improved biological half-life in mice (Dr. A. Shafferman, IIBR, Israel).
- Determined that when soman-inhibited AChE undergoes aging, the pinacolyl group is lost and is not bound at some other site within the enzyme (Dr. A. Shafferman, IIBR, Israel).
- Crystallized mouse AChE without the use of fasciculin, a snake toxin peripheral site inhibitor. This is the first mammalian AChE to be crystallized without fasciculin and these crystals are now being used for crystallography studies in Grenoble (Dr. P. Taylor, University of California at San Diego, UCSD).
- Determined that differences in rates of reactivation of chiral inhibitors of AChE by oximes are due to the angle of attack on the phosphonate bond, which is dictated by side chains in the enzyme (Dr. P. Taylor, UCSD).
- Demonstrated that nerve agent-induced seizures alter the clearance of metabolic anions from the brain, which increases the oxidative stress on neural tissue and contributes to brain damage (Dr. T. Pazdernik, University of Kansas Education Center).
- Discovered a population of n-methyl-d-aspartate (NMDA) binding sites that are sensitive to homoquinolate and are insensitive to displacement by glutamate. These sites are selective to anatomical regions that suffer severe neural damage following nerve agent seizures (Dr. D. Monaghan, University of Nebraska Education Center).
- Developed molecular probes to anatomically localize different subtypes of NMDA receptors for use in labeling and anatomical localization of different receptor subtypes in areas of the brain involved in nerve agent seizures (Dr. D. Monaghan, University of Nebraska Education Center).

THREAT CATEGORY: BLOOD AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of blood agents are outlined below.

Countermeasures:

- Pretreatment compounds to protect against rapid action of these chemical agents

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans
- Pretreatments/antidotes with special characteristics, such as quick action, long-lasting, easy to carry and use

Accomplishments:

- Developed a prototype, noninvasive finger-cuff optical probe, under contract with Omeda Corp., to simultaneously monitor continuous measurements of oxyhemoglobin, deoxyhemoglobin, methemoglobin and carboxyhemoglobin for use in cyanide exposure.

THREAT CATEGORY: RESPIRATORY AGENTS

The countermeasures, technical barriers, and accomplishments in the chemical threat category of respiratory agents are outlined below.

Countermeasures:

- Short-term: Health risk criteria for emerging threat doctrine, care and treatment strategies
- Intermediate-term: Specific casualty management techniques to improve survival and minimize lost duty time
- Long-term: Pharmaceutical/biological pretreatments, antidotes, or decontaminants/protectants

Technical Barriers:

- Appropriate experimental model systems to predict drug or treatment efficacy and safety in humans
- Pretreatment/antidotes with special characteristics, such as quick action, long-lasting, and easy to carry

Accomplishments:

- Demonstrated significant reduction in pulmonary edema formation following treatment of mice with ibuprofen after exposure to phosgene.
- Prevented oxidation of glutathione in ibuprofen-treated phosgene-exposed mice.
- Reduced phosgene-induced pulmonary edema in mice by dietary pretreatment with butylated hydroxyanisole or n-propyl gallate.

D.1.3 Advanced Development Products

In advanced development, the goal is proof-of-principle and conducting all studies necessary to obtain FDA approval/licensure of drugs and vaccines. The medical R&D process links the materiel developer (U.S. Army Medical Research and Materiel Command (USAMRMC)) with the combat and training developer (Army Medical Department Center and School (AMEDDC&S)) and the logistician in addressing the threat and Department of Defense (DoD) requirements. Medical chemical defense products now in the advanced development phase are the following:

PRODUCT: TOPICAL SKIN PROTECTANT (TSP)

Concept:

- Use perfluorinated formulations.
- Form non-toxic, non-irritating barrier film layer on skin.
- Augments Mission Oriented Protective Posture (MOPP).
- Protection against vesicant and nerve agents.

Status:

- Two candidates transitioned to demonstration-validation phase.
- Candidates demonstrated efficacy against broad spectrum of threat agents; down-selected to one candidate.
- Investigational New Drug (IND) application submitted to the FDA.
- Demonstrated the human safety and technical performance of the topical skin protectant.
- Demonstrated extended stability of the topical skin protectant.
- Validated production/manufacturing capability for the topical skin protectant.
- Awarded a manufacturing development contract.
- New Drug Application is under preparation.

PRODUCT: MULTICHAMBERED AUTOINJECTOR

Concept:

- Speed administration of life-saving antidotes against nerve agents.
- Replace two Injector Mark I Nerve Agent Antidote Kit with single autoinjector.

Status:

- Engineering contract awarded in September 1993.
- Fielding will require full FDA approval.
- Demonstrated the human safety of the multi-chambered autoinjector.
- Engineering and development of final prototype completed.

PRODUCT: CYANIDE PRETREATMENT

Concept:

- Provide protection against incapacitation and lethality without performance degradation.
- Enhance soldier protection and sustainment.

Status:

- Completed pre-clinical toxicology and drug distribution studies.
- Developed dose parameters and performance assessments.
- Concluded animal toxicology studies for cyanide pretreatment.
- Completed preparation of Investigational New Drug Application.
- Initial efforts to conduct first human safety tests.
- Draft Engineering and Manufacturing Development Request For Proposals undergoing staffing.

D.2 MEDICAL BIOLOGICAL DEFENSE RESEARCH PROGRAM

D.2.1 Biological Defense Products

Advances in DoD medical R&D significantly impact the warfighting mission by sustaining unit effectiveness through conserving the fighting strength of our soldiers and supporting the nation's global military strategy which requires the ability to effectively deploy and operate. Medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past, and presents the potential for future enhancement on military operational effectiveness. Some of the solutions developed by medical biological defense R&D include the following:

Vaccines:

- Anthrax Vaccine (licensed)
- Botulinum Toxoid Vaccine, Pentavalent (IND #3723)
- Botulinum Type F Toxoid Vaccine (IND #5077)
- Botulism Antitoxin, Heptavalent Equine (Types A, B, C, D, E, F, and G) (IND #3703)
- Botulism Immune Globulin, Human (IND #1332)
- Eastern Equine Encephalitis Virus Vaccine (IND #266)
- Q Fever Vaccine, Purified Whole Cell, CM Residue, Formalin Inactivated, Gamma Irradiated (IND #3516)
- Tularemia Vaccine (IND #157)
- Vaccinia Virus Vaccine, Cell Cultured (IND #4984)
- Venezuelan Equine Encephalomyelitis Virus Vaccine, TC-83 (IND #142)
- Western Equine Encephalitis Virus Vaccine (IND #2013)



D.2.2 Biological Defense Research and Development Accomplishments

The biological defense research and development technical barriers and accomplishments during FY97 are grouped by biological threat category, which include the following:

- Bacterial (and rickettsial) agents,
- Protein toxins, and
- Viral agents.

In addition, research and development accomplishments in the area of confirmatory assays for biological warfare threat agents is presented at the end. The objective of this effort is to develop the capability to confirm in biological samples the initial field diagnosis of a biological warfare threat agent.

DARPA is pursuing multi-agent and broad-spectrum approaches, both to defend against current known threats and to anticipate potential future threats. Accomplishments of DARPA BWD programs for FY97 include the following:

Medical Countermeasures:

Demonstrated the feasibility of modified red blood cells to eliminate a model pathogen (bacteriophage) from the circulation. In an animal model, more than 99.9% clearance of circulating virus was achieved in less than 1 hour.

Demonstrated feasibility of transfecting stem cells *in vitro* to express new gene products, in order to develop modified stem cells to produce therapeutic products or provide automatic “booster” immunizations.

Consequence Management Tools:

ENCOMPASS (Enhanced Consequence Management Planning and Support System), an integrated set of consequence management tools, was developed and demonstrated with CBIRF (Marine Corps Chemical and Biological Incident Response Force). ENCOMPASS was used in Denver by CBIRF during the Summit of the Eight (June 1997) to provide plans, situational awareness and patient management in the event of a chemical or biological incident.

THREAT CATEGORY: BACTERIAL AGENTS

The countermeasures, technical barriers, and accomplishments in the biological threat category of bacterial agents are outlined below.

Countermeasures:

- Vaccines for immunity against threat agents
- Antibiotics for treatment of bacterial diseases
- Forward deployed diagnostic systems

Technical Barriers:

- Incomplete genetic information for all the threat agents
- Appropriate animal model systems for investigation of some bacterial threats and countermeasures
- Capability to produce Good Manufacturing Practice (GMP) pilot lots of vaccine candidates
- Inability to perform human clinical trials to prove efficacy of vaccines

- Difficulty in optimizing and comparing different expression vectors for recombinant products
- Difficulty in field testing rapid identification kits under natural conditions
- Defining surrogate markers of protection

Anthrax

Accomplishments:

- Prepared synthetic peptides and corresponding monoclonal antibodies for the antigenic region of protective antigen (PA), and used the antibodies to demonstrate that the neutralizing epitope on the PA protein is conformational, and located in the region of amino acid residues 168-237.
- Initiated study of the potency and stability of recombinant PA plus Alhydrogel over a 1 year time period, and found that inclusion of formaldehyde at permissible levels enhanced immunogenicity. Established the rabbit model for passive immunity studies in order to assess surrogate markers of immunity.
- Determined that immune serum derived from humans immunized with the licensed anthrax vaccine did not inhibit spore germination any more than did sera from non-immune individuals, suggesting that the vaccine does not elicit antibodies to spore-specific antigens.
- Successfully cloned and demonstrated the activity of a construct of the anthrax plasmid pXO2 origin of replication, which will facilitate construction of a shuttle vector for further study of genes for antigens in *Bacillus anthracis* vaccine strains. Demonstrated proof of principle by successfully cloning the non-toxic, immunogenic heavy chain C-terminal of botulinum toxin into a vaccine strain of *B. anthracis*.

Plague

Accomplishments:

- Determined that there are three distinct genetic classes of the F1-negative strains of *Yersinia pestis*, and identified and characterized the genetic basis for the different types of V antigen associated with different strains of *Yersinia* species and different strains of *Y. pestis*.
- Tested the ability of purified F1 protein, which bears biochemical similarities to the IL-1 receptor antagonist called IL-1ra, to activate mononuclear cells or regulate the inflammatory response, and found that F1 did not stimulate cells or affect cytokine production.
- Investigated the physiological basis of expression of the virulence factors Yop proteins and V antigen, and linked the expression of these factors to the organism's calcium and temperature sensitivities.
- Initiated efforts to refine the candidate V and F1-V fusion protein antigens, ensuring that the protein sequence of the V antigen is 100% correct and that the purification procedure eliminates unwanted components.

- Evaluated the immune response of mice which survived lethal *Y. pestis* challenge after antibiotic treatment, and found that presence or levels of antibodies to 6 of the 13 antigens screened produced positive results. This information may prove useful in selecting antigens for vaccine candidates and for development of improved serologic diagnostic assays.
- Developed *in vitro* and *in vivo* models with which to characterize the host immunosuppressive activity of the V antigen, a major virulence factor, and demonstrated a direct inhibitory effect of V protein on host cell chemotaxis.
- Identified six different plague virulence factors as suitable candidates for further cloning into a novel yeast expression system which will allow more refined study of the mechanism of action of these virulence factors.
- Established experimental approaches to characterization of the molecular mechanics of secretion of *Y. pestis* virulence factors, which, when fully defined, will facilitate development of candidate live, attenuated vaccine strains of plague.
- Demonstrated protection of mice from lethal aerosol challenge with *Y. pestis* for at least a year by immunizing them with a single dose of either recombinant F1 plus V antigens or the recombinant F1-V fusion protein.
- Determined that the beta-lactam antibiotic, ceftriaxone, accelerated mortality in mice with pneumonic plague when treatment was initiated late in the course of the disease, and showed that all beta-lactam antibiotics tested produced similar effects.

Glanders

Accomplishments:

- Determined the *in vitro* antibiotic sensitivities for *Burkholderia mallei* strains China 7 and Budapest, and identified tobramycin sulfate, doxycycline hyclate, ofloxacin, ciprofloxacin and amikacin sulfate to be effective.
- Initiated development of an ELISA for serodiagnosis of glanders and determined that the assay appears to be sensitive for identification of antibodies against *B. mallei*; specificity and other characteristics of the test remain to be determined.
- Characterized the mouse and hamster animal models of glanders infection, finding that less than 10 colony-forming units were required for lethal infection by injection of hamsters, whereas approximately a one hundred thousand-fold higher dose was required for lethal infection by injection of most mouse strains. One mouse strain appeared to be resistant to challenge; the *Burkholderia*-sensitive BALB/c mouse strain was chosen for further evaluation.
- Characterized the pathologic changes in hamsters after *B. mallei* infection, and noted that virtually all tissues were ultimately affected at later time points, particularly vascular tissues.
- Demonstrated that bacteria could be isolated from the liver within hours of experimental infection of animals, and that spleen, lung and blood were bacteremic over the course of the subsequent 24-48 hours.

Brucellosis

Accomplishments:

- Demonstrated that immunization with a purine auxotrophic mutant of *Brucella melitensis* protects mice against subsequent airway challenge with virulent brucellae.
- Established an oral immunization regimen in mice using the purine auxotrophic mutant of *B. melitensis*.
- Demonstrated that two new genetically defined mutants of *B. melitensis* are attenuated for growth in macrophages and mice and evoke an immune response in mice.
- Demonstrated that intranasal immunization with a complex of *Neisseria meningitidis* Group B outer membrane protein (GBOMP) and *Brucella* lipopolysaccharide (LPS) protects mice against subsequent airway challenge with virulent brucellae.
- Demonstrated that two new preparations of GBOMP-LPS complex are immunogenic via the intranasal route in mice.
- Developed a new whole cell protein preparation from rough brucellae and showed that it elicits TH1 cytokine production from cells from animals immunized with all three new mutants of *B. melitensis*.
- Raised polyclonal antibody against whole cell protein prepared from rough brucellae to detect brucellae in tissues and for use in ELISA.
- Developed improved methods to quantitate cytokine mRNA and protein in cells responding to *Brucella* infection.
- Developed improved immunohistochemical and DNA hybridization methods to detect brucellae in tissues.
- Established a protocol to challenge nonhuman primates with *B. melitensis*.

THREAT CATEGORY: TOXINS

The countermeasures, technical barriers, and accomplishments in the biological threat category of protein toxins are outlined below.

Countermeasures:

- Antibodies (antitoxins) directed against common antigens of protein toxin molecules
- Vaccines for immunity against protein toxin threat agents
- Confirmatory assays to identify protein toxins specifically or classes of protein toxins
- Drugs for supportive therapy of agent intoxication
- Pharmaceuticals to delay or antagonize toxin effects.

Technical Barriers:

- Capability to produce GMP pilot lots of vaccine candidates.
- Inability to perform human clinical trials to prove efficacy of vaccines and antitoxins.
- Difficulty in optimizing and comparing different expression vectors for recombinant products.

- Immunogenicity of vaccine and vaccine delivery technology.
- Difficulty in field testing diagnostic kits under natural conditions.
- Difficulty in producing polyvalent vaccines effective against classes of toxins.
- Lack of rapid confirmatory assays with “gold standard” sensitivity and specificity.
- Appropriate animal model systems for investigation of some protein toxin threats and countermeasures.
- Defining surrogate markers of protection.
- Appropriate model system for testing treatment efficacy and safety in humans.
- Lack of highly refined x-ray crystallographic structures of several protein toxins.

Botulinum Toxin

Accomplishments:

- Successfully produced and packaged in vials the first recombinant botulinum vaccine candidate, the Hc fragment from serotype B. Completed the genetic characterization of the Master Cell Bank and the Master Production Cell Bank, to include restriction enzyme mapping, copy number determination, DNA sequence analysis, etc.
- Produced monoclonal antibodies to botulinum neurotoxin serotype A that successfully protected experimental animals from the lethal effects of low levels of the toxin.
- Successfully identified a synthetic peptide based on a portion of serotype A toxin that protected mice against exposure to low levels of the toxin.
- Cloned the synthetic genes of the Hc region of botulinum neurotoxins serotypes C1, D, E, F and G into the yeast, *Pichia pastoris*, and initiated studies of the expression of these gene products and their ability to protect mice from lethal challenge with homologous serotypes of toxin.
- Cloned and expressed the light chains of botulinum neurotoxins A and B, purified the gene products and demonstrated that they retained their enzymatic activity, all as a prelude to ultimate determination of the structure of this portion of the botulinum neurotoxins.
- Studied the cellular immune response to botulinum toxoids by measuring transformation of peripheral lymphocytes from immunized and naive donors, and determined that a pattern of lymphocyte transformation correlated to the humoral immune response pattern.
- Demonstrated that the cleavage products of botulinum neurotoxin (BoNT) serotypes A and E have direct inhibitory actions on acetylcholine release when microinjected into *Aplysia californica* buccal ganglia.
- Determined that prolonged paralysis time following BoNT/A intoxication in mammalian skeletal muscle is due to long residence time of serotype A in the nerve terminal.
- Developed a novel biological membrane model for studying the ion channels formed by the heavy chains of BoNT/A and /E to test potential inhibitors of toxin internalization.
- Characterized the cytotoxic actions of zinc chelators on primary cortical neurons and clonal NG108-15 neuroblastoma-glioma hybrid cells. The membrane permeable chelator TPEN produced apoptosis followed by necrosis above, 5 μ M, but had no toxicity at

lower concentrations.

- Determined that SNARE motifs in SNAP-25 and synaptobrevin (10-12 amino acids containing 3-4 acidic residues) served as low-affinity binding sites for zinc. Molecular modeling revealed that SNARE motif peptides resemble metal binding sites of magnesium- and zinc-binding proteins.
- Developed probes for Northern and Western blot analysis of synaptobrevin, SNAP-25 and syntaxin to determine the time course for induction of new mRNA and protein after destruction by BoNT/B and /A.
- Demonstrated the utility of the phrenic nerve-hemidiaphragm preparation for studying epitopes on the binding domain of BoNT heavy chain. Three principal epitopes were identified by single chain F_v antibody fragments.
- Developed a novel method for stabilizing the isolated light chain of BoNT/B by biotinylating free cysteine SH groups and coupling the complex to soluble avidin. This modified light chain exhibited approximately 10-fold greater stability at 4°C.
- Developed a rapid fluorescent microplate assay for monitoring the catalytic activity of BoNT/E using a 42 amino acid peptide distributed symmetrically around the BoNT/E cleavage site with biotin on the N-terminus and a fluorescent tag on the C-terminus.
- Tested 15 new metalloprotease inhibitors obtained via Material Transfer Agreements (MTAs) and Small Business Initiative Research (SBIR) for inhibition of BoNT/B. Two compounds were promising, with inhibition constants of approximately 50 μM.
- Determined that phosphorylation of BoNT/A by protein kinase C increased stability and metalloprotease activity suggesting- that inhibitors of phosphorylation may be of therapeutic benefit (Dr. M Montal. UCSD).
- Determined preliminary structure-activity profile for captopril-based active site inhibitors of BoNT/B metalloprotease activity (Promag Corp., SBIR Phase I).
- Determined preliminary structure-activity profile for phosphoramidon-based active site inhibitors of BoNT/A metalloprotease activity (Hawaii Biotechnology, SBIR Phase I).

Staphylococcal Enterotoxin

Accomplishments:

- Identified interleukin-8 (IL-8) as the first cytokine to appear in human macrophages stimulated with Staphylococcal Enterotoxin A (SEA) and Staphylococcal Enterotoxin B (SEB) *in vitro*.
- Developed a novel computational method for the rapid prediction and assessment of protein-protein associations and applied this approach to characterization of binding of recombinant SEA (rSEA) and recombinant SEB (rSEB) proteins with target T-cell receptors.
- Initiated studies to evaluate vaccine candidates, both toxoid and recombinant proteins, for effectiveness in both lethal and incapacitation animal models.
- Initiated development of additional animal models for measuring SE incapacitation, and identified increased levels of IL-6 and IL-2 in sera of monkeys exposed to a non-lethal dose of SEB.

- Initiated production under GMP conditions of a pilot lot of recombinant SEB vaccine candidate, and standardized a potency assay for this material.
- Initiated a study of the duration of immunity of rSEB vaccine in nonhuman primates.
- Completed a study of the immunogenicity of a combination SEB plus SEA vaccine in nonhuman primates.

Ricin

Accomplishments:

- Used computational chemistry and molecular modeling to examine the structure of ricin bound to its naturally occurring molecular target to derive information on the structural regions within the ricin molecule that could serve as targets for inhibitory drugs.
- Characterized the molecular structure of the neutralizing epitope of ricin - that portion which binds to protective antibody - in support of efforts to design potential peptide vaccines for ricin and other related toxins.
- Determined the stability and other characteristics of the candidate deglycosylated ricin A chain vaccine, and found that it is stable and potent when stored at a range of temperatures for at least a year, and that it appears to be safe as well as effective in animal models.

Clostridium Perfringens

Accomplishments:

- Characterized the toxicity of *C. perfringens* toxin types A, B, C, D and E when administered to mice and rats by either the parenteral or aerosol routes and found that toxicity was highly dependent on the dose and route of administration as well as on other technical parameters of the exposure.

THREAT CATEGORY: VIRAL AGENTS

The countermeasures, technical barriers, and accomplishments in the biological threat category of viral agents are outlined below.

Countermeasures:

- Vaccines for immunity against viral threat agents
- Antibodies and antivirals for treatment of viral disease
- Devices and technologies for diagnosis of viral disease

Technical Barriers:

- Appropriate animal model systems for investigation of viral threats and countermeasures
- Capability to produce GMP pilot lots of vaccine candidates

- Inability to perform human clinical trials to prove efficacy of vaccines
- Production of multivalent vaccines against heterologous viral agents
- Difficulty in optimizing and comparing different expression vectors for recombinant products (vaccines and antibodies)
- Immune enhancement of disease
- Rapid virus identification technology
- Defining surrogate markers of protection

Encephalitis Viruses

Accomplishments:

- Evaluated oral and nasal routes of immunization in mice with live-attenuated TC-83 Venezuelan Equine Encephalitis (VEE) vaccine and the inactivated C-84 vaccine, and found that oral immunization did not induce immunity in the majority of mice, but that nasal delivery of the vaccine protected one strain of mice from aerosol or parenteral challenge with wild-type, virulent virus.
- Demonstrated conclusively that the VEE receptor protein in an insect cell line is the laminin receptor; cloned and expressed this receptor and demonstrated that antibody to the insect cell receptor does not cross-react with the receptor from vertebrate cells.
- Cloned, sequenced and expressed the complete structural protein regions of VEE 1A, 1E, Eastern Equine Encephalitis (EEE) and Western Equine Encephalitis (WEE) viruses; these regions include all known protective epitopes of these viruses and serve as the basis for evaluation of a multivalent encephalitis virus vaccine.
- Sequenced and analyzed 21 VEE 1E strains and 7 VEE III strains to determine the extent of genetic diversity, and found that a single vaccine for each type should be sufficient for protection against that serotype regardless of the geographic origin of the virus strain.
- Generated live-attenuated vaccine candidates for WEE and EEE viruses by site-directed mutagenesis of cDNA infectious clones.
- Tested genetically engineered WEE virus vaccine candidates in mice and found that they were avirulent, and induced protection against virulent virus strains.
- Tested EEE vaccine candidates in mice and determined that they were attenuated and immunogenic.
- Initiated GMP production of the selected VEE infectious clone vaccine candidate (V3526), and developed nucleotide sequencing and PCR assays to assist in quality assurance and monitoring of the production process.
- Created an infectious clone VEE IE vaccine prototype modeled on the IA vaccine candidate V3526, and determined that it was attenuated, highly immunogenic, and elicited protection against virulent challenge in animal models.

Variola, the Causative Agent of Smallpox

Accomplishments:

- Cloned individual vaccinia genes, expressed them in an RNA replicon vector, immunized animals and determined that high levels of neutralizing antibodies or cytolytic antibodies could be predicted from knowledge of the gene used for the immunization.
- Screened 18 antiviral drugs, which were selected to separately target six different functions involved in poxvirus replication, against a panel of orthopoxviruses, including monkeypox and smallpox (performed at the Centers for Disease Control and Prevention, Atlanta, GA), and selected the five most active compounds for *in vivo* studies.
- Developed an intranasal cowpox mouse model for use in drug evaluation, and characterized the disease pathogenesis in detail in order to compare to monkeypox and known characteristics of smallpox in humans.
- Assessed the value of the antiviral drug cidofovir (licensed for other indications) in the cowpox mouse model, and determined that one dose of drug prophylaxis was protective when begun as early as 12 days prior to infection; treatment was effective even when initiated as late as day 5 postinfection.
- Determined in nonhuman primates that cidofovir protected completely from clinical and laboratory signs of disease when animals were challenged by aerosol with monkeypox.
- Developed rapid, deployable PCR assays using real time fluorescence monitoring for orthopox viruses.
- Developed a computer-enhanced method to distinguish orthopoxvirus species and strains by long PCR RFLP analysis.
- Developed 5'-nuclease fluorogenic PCR assays which are capable of detecting single nucleotide differences in the hemagglutinin gene of orthopoxviruses using the ABI Prism 7700 sequence detector and a novel microchip device developed by Lawrence Livermore National Laboratory.

Filoviruses

Accomplishments:

- Determined that both the Marburg virus glycoprotein and nucleoprotein antigen are promising vaccine candidates that merit further testing in animal models.
- Initiated studies of the cell-mediated immune response to Ebola virus in mice in order to characterize the mechanisms by which T-cells may participate in protection from disease.
- Demonstrated protective efficacy of individual proteins or combinations of Ebola virus proteins in guinea pigs.
- Demonstrated in the mouse model of Ebola virus disease efficacy of a promising antiviral drug therapy.

Multi-agent Vaccines

Accomplishments:

- Using the RNA replicon vaccine vector system derived from infectious cDNA clones of Venezuelan equine encephalitis virus, constructed replicon vaccines containing genes from numerous filo- and bunya- viruses as well as for botulinum toxin Hc. These

vaccine constructs elicited protective immunity in animals when challenged with the corresponding agent.

- Constructed DNA plasmids suitable for “genetic immunization” for three viral agents and demonstrated protection from challenge in plasmid-immunized animals.

CONFIRMATORY ASSAYS FOR BIOLOGICAL WARFARE THREAT AGENTS

The accomplishments in the confirmatory assays for biological warfare threat agents are outlined below. The objective of this effort is to develop the capability to confirm in biological samples the initial field diagnosis of a biological warfare threat agent.

Accomplishments:

- Developed antigen capture ELISAs for SEA, B, C; botulinum toxin A and B.
- Developed sensitive and specific immunochromatographic hand-held assay for *Brucella spp.* and *F. tularensis*.
- Developed rapid, deployable PCR assays using real time fluorescence monitoring for *B. anthracis*, *Y. pestis*, and botulinum neurotoxin A and B.
- Developed recombinant antibodies to botulinum toxin A and B and to hemagglutinin. These reagents are being incorporated into assays including the immunochromatographic hand-held assay.
- Developed competitive ELISA for aflatoxin and T2 mycotoxin.
- Developed antigen capture ELISAs for Venezuelan equine encephalitis (VEE) and variola virus.
- Patented a novel multiple magnetic apparatus for processing of assay samples.
- Developed and demonstrated a high throughput, multi-well magnetic plate washing device for rapid sample preparation.
- Demonstrated an effective isolation procedure for biological threat agents from crude clinical specimens and environmental water samples.
- Developed solid phase fluorogenic and electrochemiluminescent immunoassays to comprehensively analyze the immune response of antibodies to bacterial spores and detection of toxins.
- Demonstrated low sample carry-over by multi-well immunomagnetic-fluorogenic assay system.
- Demonstrated 1-hour total assay time per 96 samples from sample-in to result read-out.
- Demonstrated 10- to 100-fold enhancements in immunoassay sensitivity for detecting biological threat agents.
- Demonstrated sensitive detection for various bacteria and toxins (*Bacillus anthrax* spores, Botulinum-type A, Ricin-A chain and Staphylococcal enterotoxin B).
- Developed rapid hand-held assays capable of detecting PCR products.
- Transitioned PCR biodetection capabilities to the Federal Bureau of Investigation.
- In collaboration with Lawrence Livermore National Laboratories developed a rapid, briefcase-sized PCR system.

- In collaboration with Battelle developed (breadboard) automated reader for hand-held immunochromatographic assays.
- Provided direct laboratory support, in-house or in the field, for: FBI, Secret Service, CBQRF, CBIRF, UNSCOM, and SOLIC.
- Provided technical assistance for hand-held assay construction to NATO and provided antibody reagents to NATO, and Joint Program Office.

D.2.3 Advanced Development Accomplishments

D.2.3.1 Botulism Antitoxin, Heptavalent, Equine, Types A, B, C, D, E, F, & G

- Studied and still being characterized as a replacement for the current IND treatment (IND #3703, Botulinum Immune Globulin, F(ab')₂, Heptavalent, Equine) in treating the illness of botulism.
- Completed manufacturing of the first GMP lot of this botulism antitoxin for treatment against all seven known botulinum toxins.
- In response to the FDA's request for adventitious agent testing, this product was assayed under GMP guidelines in three cell culture systems.
- Conducted quarterly Stability Testing of the GMP product.
- Conducted a Pre-Investigational New Drug (IND) submission meeting with the FDA for this new GMP product.
- Provided Botulinum Antitoxin Standards to Battelle Medical Research and Evaluation Facility to be used in the development of the Pentavalent Botulism vaccine.
- Submitted a protocol for a Phase I Safety and Pharmacokinetic clinical study of this Botulism Antitoxin for Institutional Review Board review.

D.2.3.2 Botulism Immune Globulin (Human), Pentavalent (IND #1332)

- Conducted storage stability testing on this IND product.
- The IND remains open to accommodate emergency treatment requirements for exposure or possible exposure to botulinum toxins type A, B, C, D, or E.

D.2.3.3 Botulinum Type F Toxoid Vaccine (IND #5077)

- Continued the Phase 2 Safety and Immunogenicity clinical study of Botulinum Type F Toxoid Vaccine. The purpose of this study is to identify a vaccination schedule for the vaccine that is safe and maximally immunogenic.
- The 12-month serology after the primary three-inoculation series of vaccinations has been drawn from the last cohort in the Phase 2 study.
- The one-year booster phase of the Phase 2 study is under way.

D.2.3.4 Diagnostic Kit for Biological Warfare Agents

The accomplishments in the diagnostic assays for biological warfare threat agents are outlined below. The objective of this effort is to develop a rapid screening system for use in a

field medical laboratory (Hospital Level) to initially identify biological warfare agents in clinical samples obtained from exposed personnel. The kit will provide rapid information to the medical care provider that can be later confirmed using confirmatory assays that are more sensitive and quantitative.

- Prepared a Draft Analysis of Alternatives to support the decision-making process for the Diagnostic Kit for biological Warfare Agents program.
- Performance criteria for selectivity and sensitivity cutoff were evaluated as the means of comparison between alternatives.
- Obtained FDA input on guidance for the clearance of several Premarket Notification 510(k)s for the detection of a series of biological warfare agents from clinical samples.

D.2.4 Joint Vaccine Acquisition Program Accomplishments

The development of vaccines under this program involves studies which demonstrate product safety and efficacy and which are required for product licensure by the FDA. The Joint Vaccine Acquisition Program is managed by the Joint Program Office for Biological Defense. During FY97, the following actions were accomplished:

- The Request for Proposal for the prime systems contract was evaluated by a formal Source Selection Evaluation Board. The basic contract consists of development and licensure of three biological defense vaccine products, with options to develop and license 15 others and production options for all 18 vaccines. Contract was awarded on 7 November 1997.
- Assisted the Michigan Biologic Products Institute in identifying and correcting FDA compliance issues to ensure an anthrax vaccine stockpile, product integrity and future manufacturing capability.
- Received FDA Advisory Committee acceptance of the DoD strategy to use a surrogate model in lieu of human efficacy studies to support licensure of botulinum pentavalent toxoid vaccine. Preclinical studies to identify an appropriate surrogate model are ongoing. Human safety and efficacy studies are scheduled pending approval for indemnification of the contractor conducting the clinical studies.
- Managing the effort to amend the anthrax vaccine license to reduce the doses required to fewer than six inoculations, and to include indication for use in protection against an aerosol exposure.

D.3 MEDICAL NUCLEAR (RADIOLOGICAL) DEFENSE RESEARCH PROGRAM

D.3.1 Fielded Products

Advances in medical R&D significantly impact the warfighting mission by sustaining unit effectiveness through conserving the fighting strength of our service members. The individual service member whose performance is decremented by disease symptoms is significantly more likely to become a traumatic casualty. In this era of small, but highly lethal forces, loss of only a few team members can dramatically diminish a unit's capability. Medical R&D products (materiel and non-materiel solutions) provide the foundation that ensures the fielding of a flexible, sustainable, modernized force across the spectrum of conflict and in the full breadth and depth of the battlefield. Overcoming medical threats and extending human performance has provided a significant increase in military effectiveness in the past and presents the potential for future enhancement on military operational effectiveness. Some of the fielded materiel and non-materiel solutions by medical radiological defense R&D are:

- *Advances in the Treatment of Radiologic Injuries*, a medical research symposium publication, Pergamon Press, Elsevier Science, Ltd.
- North Atlantic Treaty Organization (NATO) Handbook AMedP-6, *Medical Aspects of Nuclear, Biological, and Chemical (NBC) Defensive Operations*
- Medical Effects of Nuclear Weapons Course--Training for approximately 760 Medical Department personnel in FY96.
- Advanced treatment modalities for bone marrow injury, such as the cytokines, which were available for the Gulf War
- New generation antiemetics effective for prevention of early debilitating symptoms of moderate radiation injuries (now being inserted into NATO doctrine)

D.3.2 Nuclear Defense Research and Development Accomplishments

The nuclear (or radiological) defense research and development technical barriers and accomplishments during FY97 are grouped in the following threat categories:

- Prompt radiation from nuclear weapons,
- Protracted low level radiation from fallout and other sources
- Combined effects of radiation and other factors

“*Prompt radiation*” refers to the high level radiation released by a nuclear weapon detonation in the first 60 seconds after the explosion. Significant injury occurs within seconds of exposure. “*Protracted low level radiation*” refers to radiation from nuclear fallout, radiological dissemination devices, and other sources which contaminate an area with radioactive particles. The exposure time required to cause casualties in this environment is much longer than the instantaneous exposure of prompt radiation. The “*combined effects*” environment significantly

augments the casualty rate by amplifying the subclinical effects of traditional trauma, burns, wounds, and infection. Due to the likelihood of an enemy's simultaneous use of nuclear dissemination weapons and chemical/biological agents, combined injury effects now also must include the previously unresearched interactions of low level radiation and chemical-biological weapons.

THREAT CATEGORY: PROMPT RADIATION

The countermeasures, technical barriers, and accomplishments in the threat area of prompt radiation are outlined below.

Countermeasures:

- Advanced medical treatment strategies for radiation injuries
- Drugs designed to increase resistance of soldiers to radiation and protect the soldier against radiation injury without compromising performance
- Drugs designed to prevent the onset of radiation-induced performance decrements such as fatigue, nausea, vomiting
- Assessment of radiation injury by biological dosimetry techniques

Technical Barriers:

- Known drugs that provide some radiation protective effects have serious performance-degrading side effects at drug doses required for operational requirements
- Mechanisms of action of several known treatment and radioprotective drug strategies are not well understood
- Drug delivery system which allows extended bioavailability is not available for radioprotectants

Status:

- Research in collaboration with pharmaceutical companies using large and small animal models is ongoing
- Research using cellular systems and rodents has begun to investigate strategies to mitigate against late effects (*e.g.*, cancer) of radiation
- Research using cellular systems and rodents has begun to investigate strategies to mitigate infection in irradiated animals
- Combination of drugs administered at non-toxic levels which provides protection has been identified
- Biological dosimetry techniques based on cytogenetic techniques are being validated and developed for fielding
- Greater emphasis is being provided on molecular and cellular biology strategies to elucidate mechanisms of radiation damage and protection
- Developing effective preventive treatments (cytokine-based) for lethally irradiated individuals

Accomplishments:

- Demonstrated in animal models improved medical treatment strategy that relies on use of pre-exposure prophylactic medications.
- Established protocol for post-exposure cytokine-based treatments that enhance standard clinical support.

THREAT CATEGORY: PROTRACTED LOW LEVEL RADIATION

The countermeasures, technical barriers, and accomplishments in the threat area of protracted low level radiation from nuclear fallout, radiological explosive devices, *etc.*, are outlined below.

Countermeasures:

- Advanced medical treatment strategies for protracted radiation injuries from both external and internal sources of radioactivity
- Drugs designed to protect personnel from the early and late effects of ionizing radiation without compromising performance
- Improved techniques to detect and remove internal sources of radioactivity
- Improved drug delivery system to provide protection during the entire period of radiation exposure

Technical Barriers:

- Availability of suitable radiation sources to study the effects of chronic exposure at relevant dose levels
- Difficulty in manipulating cellular repair mechanisms
- Toxicity of chelating agents used to remove sources of radioactivity
- Brief periods in which traditional radioprotective drugs are active
- Toxicity of radioprotective drugs used over protracted periods of time
- Lack of sustained drug delivery system for radioprotectants
- Microbial resistance to antibiotics

Status:

- New facility to permit protracted radiation exposure experiments is being planned to model current and future threat scenarios
- New biological models for internal and external cellular and whole-body chronic exposure studies are being developed
- New programs have been instituted for the study of molecular biology approaches to study gene radiation damage and repair mechanisms

- Novel drug delivery systems (*e.g.*, transdermal patches) are being evaluated for efficacy in providing protection in chronic radiation environments
- Develop effective antimicrobial treatment regimens for post-exposure use in radiation and combined injuries.

Accomplishments:

- Developed preliminary treatment protocols utilizing immune system stimulators that effectively guard against radiation-associated infections.

THREAT CATEGORY: COMBINED EFFECTS

The countermeasures, technical barriers, and accomplishments in the threat area of combined effects of nuclear radiation and trauma, burns, and infection are outlined below.

Countermeasures:

- Radiotherapeutic agents designed to decrease morbidity and mortality from multi-organ system failure due to the combined effects of radiation, trauma, burns, and infection
- Radioprotective drugs designed to harden the soldier against the effects of radiation, trauma, burns, and infection
- Combined therapeutic agents designed to decrease morbidity and mortality from and to enhance innate immune responses
- Computer models for predicting casualties following combined exposure to low levels of ionizing radiation and BW/CW agent aerosols

Technical Barriers:

- Availability of reliable animal models to predict effects in humans
- Antimicrobial resistance to current antimicrobial therapeutic agents
- Different sensitivities of biological systems at all levels to neutrons and gamma rays
- Mechanism of action of cell-growth factors is not well understood
- Sensitivity of bone marrow progenitor cells to low doses of ionizing radiation

Status:

- Research in collaboration with pharmaceutical companies using small and large animal models continues
- Evaluations of radioprotective and radiotherapeutic agents ongoing in mixed-field irradiated animal models
- New antimicrobial products under evaluation for the treatment of gram-positive and gram-negative bacterial sepsis in irradiated rodents.
- New immunomodulators evaluated for enhancing innate immune responses against infections.

- Molecular biology techniques utilized to understand the effects of radiation, trauma, and combined effects
- Molecular biology techniques utilized to understand the beneficial effects of cell growth factors, immunomodulators, and antimicrobial agents

Accomplishments:

- Sublethal irradiation significantly decreased survival and increased loss of body weight of mice orally challenged with a bacterial agent.

D.3.3 Predevelopment Products

Technical developments in predevelopment products for medical radiological defense include the following:

- Medical Effects of Nuclear Weapons CD-ROM interactive training program for military health care personnel
- Pre-Transition Information Paper: *Radioprotection by a Combination of Iloprost/Misoprostol/3D-MPL/WR-3689*
- Automated biodosimetry capability based on lymphocyte dicentric analysis.

ANNEX E

**JOINT NUCLEAR,
CHEMICAL, AND BIOLOGICAL,
DEFENSE PROGRAM
FUNDING SUMMARY**

(INTENTIONALLY BLANK)

In accordance with 50 USC 1522, *Department of Defense Chemical and Biological Defense Program*, RDT&E for all DoD chemical and biological defense programs (with the exception of those conducted by the Defense Advanced Research Projects Agency, DARPA) are consolidated into six defense-wide program element (PE) funding lines plus procurement funds are consolidated. Detailed funding information previously contained in this annex is provided annually to Congress in the Joint Service Chemical and Biological Defense Program, President's Budget Submit, Descriptive Summaries of Research, Development, Test and Evaluation, and in the Department of Defense Extract found in the Budget of the United States. These budget submissions provide a detailed account of prior year accomplishments and planned activities for the budget request period. Table E-1 (and Figure E-1) provides a summary of appropriated and requested funding from FY96–FY03. FY96 was the first year in which all Service and Defense Agency CB defense programs were consolidated into defense-wide funding lines. Prior to FY96, funding was included in several separate Service and Defense Agency funding lines. Also, during FY96 approximately \$30 million was transferred to the CB Defense Program procurement line from Army operations and maintenance accounts for biodefense vaccine acquisition. Much of the growth in the program between FY96 and FY97 resulted from the transfer of funds between existing accounts rather than real growth in the overall CB Defense Program.

Table E-2 provides a summary of expenditures by the DoD Chemical and Biological Defense Program. Expenditures represent the amount of checks issued or other payments made (including advances to others), net of refunds and reimbursements. The term is frequently used interchangeably with the term “outlays,” which are the measure of government spending (*i.e.*, payments to liquidate obligations (other than the repayment of debt), net of refunds and offsetting collections. It is important to note that funds appropriated for a given year may be expended incrementally over a period of years. Thus, expenditures shown in Table E-2 will be updated in following years to show total expenditures of appropriated funds.

Table E-1. Chemical and Biological Defense Program Appropriations Summary

Program Element (PE)	(\$ millions)	FY96 ‡	FY97 ‡	FY98 ‡	FY99 *	FY00 **	FY01 **	FY02 **	FY03 **
0601384BP - Basic Research		26.488	28.374	26.336	25.281	26.054	26.531	28.180	28.156
0602384BP - Applied Research		68.209	70.829	72.181	57.681	59.232	59.962	65.254	64.749
0603384BP - Advanced Technology Development		33.727	41.714	48.349	42.731	36.571	36.514	38.977	41.073
0603884BP - Demonstration/Validation		29.184	45.133	53.362	60.345	40.815	54.749	43.362	29.481
0604884BP - Engineering & Manufacturing Development		87.329	96.403	126.302	125.403	156.606	141.603	109.942	100.645
0605884BP - Management Support		6.955	19.339	18.141	24.924	22.430	22.853	23.303	23.713
RDT&E Subtotal		251.892	301.792	344.722	336.365	341.708	342.212	309.018	287.817
Procurement		135.686	232.952	229.760	283.903	376.188	406.258	477.874	500.156
CB Defense Program Total		387.578	534.744	574.482	620.268	717.896	748.470	786.892	787.973

‡ Actual Appropriation

* President's Budget Request

** Estimated [from President's Budget]

Table E-2. Chemical and Biological Defense Program Expenditures Summary

Program Element (PE)	(\$ millions)	FY96 †	FY97 †
0601384BP - Basic Research		23.487	16.053
0602384BP - Applied Research		58.938	34.864
0603384BP - Advanced Technology Development		24.094	13.987
0603884BP - Demonstration/Validation		25.053	20.816
0604884BP - Engineering & Manufacturing Development		72.667	34.062
0605884BP - Management Support		1.401	8.995
RDT&E Subtotal		205.640	128.777
Procurement		53.653	23.733
CB Defense Program Total		259.293	152.510

† Expenditures as September 30, 1997.

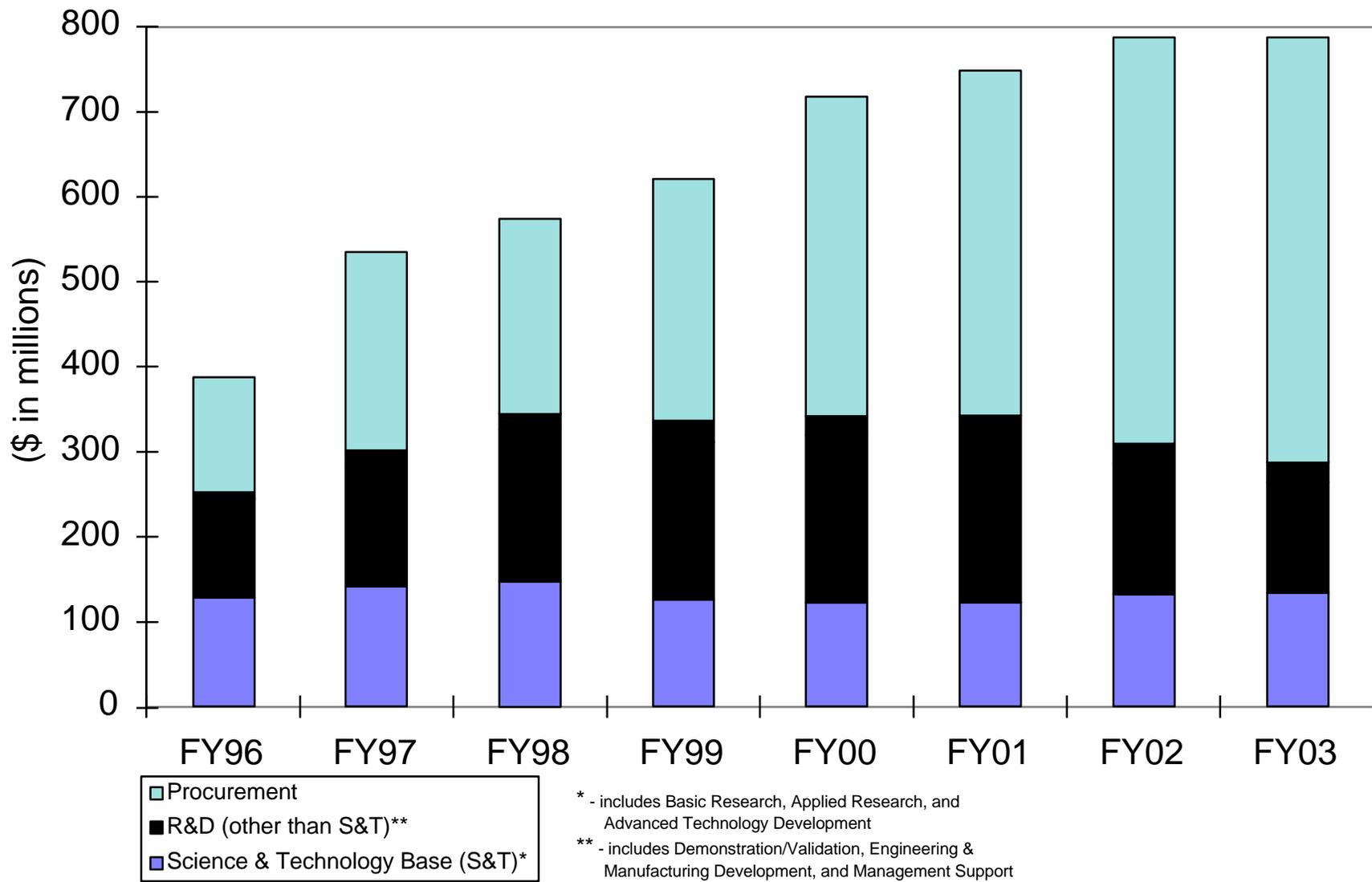


Figure E-1. Chemical and Biological Defense Program Appropriations Summary

(INTENTIONALLY BLANK.)

ANNEX F

**STATEMENT REGARDING CHEMICAL
AND BIOLOGICAL DEFENSE
PROGRAMS
INVOLVING HUMAN SUBJECTS**

(INTENTIONALLY BLANK.)

The reporting requirement (50 USC 1523) for the annual report to Congress on the DoD Chemical and Biological Defense Program was modified by Section 1086 of the FY98 National Defense Authorization Act. The amendment requires the following information:

A description of any program involving the testing of biological or chemical agents on human subjects that was carried out by the Department of Defense during the period covered by the report, together with a detailed justification for the testing, a detailed explanation of the purposes of the testing, the chemical or biological agents tested, and the Secretary's certification that informed consent to the testing was obtained from each human subject in advance of the testing on that subject.

Table F-1 provides a summary of prior and planned tests conducted by the Department of Defense, both directly or under contract, which involve the use of human subjects for the testing of chemical or biological agents. In summary, there has been no such testing since 1969 with biological agents, since 1975 for chemical agents, and no testing is planned.

Table F-1. Summary of Experiments and Studies with Human Subjects Involving the Use of Chemical or Biological Agents

November 25, 1969	– Human biological agent testing ended
July 28, 1975	– Human chemical agent testing ended
Since 1969/1975	– No activities with human subjects involving exposure to biological agents (since 1969) nor chemical agents (since 1975) have occurred since testing ended

The Department is in full compliance with the requirements of all laws regarding the use of human subjects involving chemical or biological agents. DoD is involved in no experimentation or any other efforts which involve the exposure of human subjects to chemical or biological agents.

As part of the DoD Chemical and Biological Defense Program, DoD requires the use of small quantities of chemical and biological agents in the research, development, test and evaluation (RDT&E) of detection, protection, and decontamination equipment and systems. Chemical and biological agents are also used in small quantities in training U.S. forces to operate in protective equipment and to operate detection and decontamination systems in a chemical or biological environment. However, no RDT&E nor training involves the exposure of human subjects to chemical or biological agents.

Medical chemical and biological defense programs involve the use of human subjects in controlled clinical trials to test and evaluate the safety, immunogenicity, and other effects of medical products (drugs, vaccines, therapies, *etc.*) to protect against chemical and biological agents. The use of human subjects in these trials involves volunteers who have provided informed consent. All use of human subjects in these trials is in full compliance with the "Common Rule," Federal Policy for the Protection of Human Subjects, Food and Drug Administration (FDA) regulations, Federal Acquisition Regulations (FAR), DoD Directives and

Instructions, and *all* other applicable laws, regulations, issuances, and requirements. No medical chemical or biological defense programs involving human subjects involves the exposure of these subjects to chemical or biological agents.

While DoD conducted tests involving the exposure of human subjects to chemical and biological agents in the past, all such tests and programs have been halted and disbanded. The United States formally renounced the “use of lethal biological agents and weapons, and all other methods of biological warfare” in National Security Decision 35, November 25, 1969. Human testing with lethal biological warfare agents was never done and testing with incapacitating biological warfare agents was ceased in 1969. The last human testing of chemical warfare agents occurred on July 25, 1975. Acting Secretary of Army Norman Augustine suspended testing of chemical compounds on human volunteers on July 28, 1975.

Tests involving the exposure of human subjects to chemical agents began in the 1940s and continued following World War II through the Cold War until the early 1970s. Such testing has been documented and reported to Congress. See for example, Department of Army, Inspector General Report, DAIG-IN 21-75, *Use of Volunteers in Chemical Agent Research*, March 1976. In addition, there was extensive Congressional testimony on this subject during 1975 and 1976. DoD has not conducted any experimentation since that time involving the exposure of human subjects to chemical warfare agents.

ANNEX G

**CONGRESSIONAL
REPORTING REQUIREMENT:
50 USC 1523**

(INTENTIONALLY BLANK.)

**Text of Public Law Mandating Report on The Department of Defense
Chemical and Biological Defense Program**

Title 50 of the U.S. Code, Sec. 1523. Annual report on chemical and biological warfare defense

Implemented by Public Law 103-160, The FY94 National Defense Authorization Act

(a) Report required

The Secretary of Defense shall include in the annual report of the Secretary under section 113(c) of title 10, a report on chemical and biological warfare defense. The report shall assess--

(1) the overall readiness of the Armed Forces to fight in a chemical-biological warfare environment and shall describe steps taken and planned to be taken to improve such readiness; and

(2) requirements for the chemical and biological warfare defense program, including requirements for training, detection, and protective equipment, for medical prophylaxis, and for treatment of casualties resulting from use of chemical or biological weapons.

(b) Matters to be included

The report shall include information on the following:

(1) The quantities, characteristics, and capabilities of fielded chemical and biological defense equipment to meet wartime and peacetime requirements for support of the Armed Forces, including individual protective items.

(2) The status of research and development programs, and acquisition programs, for required improvements in chemical and biological defense equipment and medical treatment, including an assessment of the ability of the Department of Defense and the industrial base to meet those requirements.

(3) Measures taken to ensure the integration of requirements for chemical and biological defense equipment and material among the Armed Forces.

(4) The status of nuclear, biological, and chemical (NBC) warfare defense training and readiness among the Armed Forces and measures being taken to include realistic nuclear, biological, and chemical warfare simulations in war games, battle simulations, and training exercises.

(5) Measures taken to improve overall management and coordination of the chemical and biological defense program.

(6) Problems encountered in the chemical and biological warfare defense program during the past year and recommended solutions to those problems for which additional resources or actions by the Congress are required.

(7) A description of the chemical warfare defense preparations that have been and are being undertaken by the Department of Defense to address needs which may arise under article X of the Chemical Weapons Convention.

(8) A summary of other preparations undertaken by the Department of Defense and the On-Site Inspection Agency to prepare for and to assist in the implementation of the convention, including activities such as training for inspectors, preparation of defense installations for inspections under the convention using the Defense Treaty Inspection Readiness Program, provision of chemical weapons detection equipment, and assistance in the safe transportation, storage, and destruction of chemical weapons in other signatory nations to the convention.

(9) A description of any program involving the testing of biological or chemical agents on human subjects that was carried out by the Department

of

Defense during the period covered by the report, together with a detailed justification for the testing, a detailed explanation of the purposes of the testing, the chemical or biological agents tested, and the Secretary's certification that informed consent to the testing was obtained from each

human subject in advance of the testing on that subject.

In addition HNSC H. Rpt 105-132 (pp. 236-237) added the following reporting requirements *for this edition* of the report only:

- 1) M-40 mask problems;
- 2) DARPA BW Defense program coordination with CBDP;
- 3) Anthrax vaccine production & stockpile issues;
- 4) Vaccine development issues;
- 5) Equipment for Chem/Bio Quick Reaction Force (CBQRF)

The complete language of the requirement is as follows:

FY98 National Defense Authorization Act, HNSC H. Rpt. 105-132, (pp. 236-237):

Stated that the Committee has been advised of problems in the manufacture and qualification of new production M-40 protective masks. The committee is concerned about the impact of these problems on the ability to meet acquisition objectives for the mask. Directed the SecArmy to review the M-40 mask procurement program and provide a report by 10/31/97, addressing the results of that review and the corrective actions needed.

Stated that the Committee notes that the CPRC's May 1997 Report states that the DARPA biological warfare defense program will no longer be incorporated into the CBD program management and oversight structure. Directed the SecDef to ensure that the DARPA biological warfare defense program is coordinated and integrated under the program management and oversight of the DoD CBD program.

Stated that the Committee understands that DoD's policies on anthrax vaccination of US Forces and support for Other Than US Forces are awaiting final approval and that these decisions will impact total funding, vaccine production, and storage requirements. Stated that the Committee also notes the impending award of a prime systems contract to develop new biological defense vaccines, pursue vaccine licensing, and produce stockpile vaccines to meet DoD requirements.

Increased Vaccine Advanced Development (PE 64384BP) by \$1.593M. Increased Vaccine Development by \$0.858M.

Increased PE63884BP by \$5.0M to support the on-going development efforts in detectors, decon equipment, and protective equipment for the Chemical-Biological Quick Reaction Force (CBQRF). (R - p. 237)

Directed the SecDef to address the above issues as specific areas of interest in the next annual report to Congress on the NBC defense program.

ANNEX H

**NUCLEAR, BIOLOGICAL, AND
CHEMICAL DEFENSE
ON THE INTERNET**

(INTENTIONALLY BLANK.)

Following is a list of selected locations on the World Wide Web (WWW) which provide information about nuclear, biological, and chemical defenses. This list is not intended to be exhaustive, but rather to aid those in the research and analysis of NBC defense issues. Identification of a site here does not represent an endorsement by the Department of Defense nor any of its subordinate organizations, nor any responsibility for the content or accuracy of information provided at each site. Site locations (URLs) may change or be deleted, but were accurate as of February 1, 1998.

DefenseLink

<http://www.defenselink.mil/>

The official home page of the Department of Defense. Includes numerous reports and links to DoD organizations.

Deputy Assistant to the Secretary of Defense for Counterproliferation/Chemical and Biological Defense (DATSD(CP/CBD))

<http://www.acq.osd.mil/cp>

Home page of the DATSD(CP/CBD). Includes summary of activities of the Counterproliferation Support Program, the DoD Chemical and Biological Defense Program, and downloadable versions of reports.

CBIAC (Chemical Warfare/Chemical Biological Defense (CW/CBD) Information Analysis Center)

<http://www.cbiac.apgea.army.mil/>

CBIAC serves as the DoD focal point for CW/CBD technology. The CBIAC serves to collect, review, analyze, synthesize, appraise and summarize information pertaining to CW/CBD. It provides a searchable database for authorized users and links to many other CW/CBD related sites.

The NBC Medical Defense Information Server

<http://www.nbc-med.org/>

The Nuclear Biological and Chemical Medical (Med-NBC) web page contains extensive medical documentation, training material, audio-video clips, a powerful search engine, and links to other related Internet sites.

The Army Medical Department Center and School

<http://www.armymedicine.army.mil/armymed/>

Provides extensive information about the Army's Medical Department. Includes information on doctrine development and the use of medical NBC defense products.

U.S. Army Chemical and Biological Defense Command Information Server

<http://www.cbdcom.apgea.army.mil/>

Home page of the U.S. Army Chemical and Biological Defense Command.

Edgewood Research, Development and Engineering Center (ERDEC) Home Page

<http://www.cbdcom.apgea.army.mil/RDA/erdec/>

ERDEC is the Army's principal R&D center for chemical and biological defense technology, engineering, and service. Provides technical and other information on ERDEC's products and services.

Joint Service Chemical Biological Information System (JSCBIS)

<http://www.sarda.army.mil/jscbis/jscbis.htm>

Provides financial and programmatic information for DoD's Chemical and Biological Defense Program. Requires user identification and password, which can be applied for through the home page.

Dugway Proving Ground Home Page

<http://www.atc.army.mil/~dugway/>

Home page of the U.S. Dugway Proving Ground, location of much of the field tests of chemical and biological defense equipment and repository of historical chemical and biological warfare information.

Chemical and Biological Weapons Nonproliferation Project

<http://www.stimson.org/cwc/>

This project serves as a problem-solver and an information clearinghouse in the general subject areas of CB treaties, chemical demilitarization (especially in Russia), CB terrorism, and related areas. Sponsored by The Stimson Center.

The PTS-OPCW-PrepCom Home Page

<http://www.opcw.nl/>

The home page of the Provisional Technical Secretariat, the Organization for the Prohibition of Chemical Weapons, and the Preparatory Commission of the Chemical Weapons Convention (CWC). Provides detailed information about the CWC, its implementation, and technical and background information on chemical weapons, chemical defenses, and related subjects.

United States Army Chemical School

<http://www.mcclellan.army.mil/>

Home Page for Fort McClellan, Alabama. Provides information on the U.S. Army Chemical School located at Fort McClellan, Alabama which is one of the most advanced and sophisticated training centers for chemical and biological defense. Also provides information on the Chemical Corps Museum.

Harvard Sussex Program on CBW Armament and Arms Limitation

<http://fas-www.harvard.edu/~hsp/>

Provides files that promote the global elimination of chemical and biological weapons and to strengthen the constraints against hostile uses of biomedical technologies.

Medical Chemical and Biological Defense

<http://mrmc-www.army.mil/>

Provides information on Medical Chemical Defense Overview, Nerve, Agents, Cyanide, Skin Decontamination and Protection, Performance Effects of Protectant Drugs, and Chemical Casualty Management. Linked to the Medical Research and Materiel Command Home Page and the U.S. Army Medical Research Institute for Chemical Defense Home Page (<http://chemdef.apgea.army.mil>). Also provides information on Medical Biological Defense Overview, Diagnostic Assays, Viruses, Bacteria, and Toxins, Drugs, Vaccines, and Biological Casualty Management.

United States Army Medical Research Institute of Infectious Diseases

<http://www.usamriid.army.mil>

Home Page of the U.S. Army Medical Research Institute of Infectious Diseases, location of much of the science and technology research efforts for medical biological defense.

Armed Forces Radiobiological Research Institute (Medical Radiological Defense)

<http://www.afri.usuhs.mil/>

Provides information on Medical Radiobiological research and education activities of the triservice Armed Forces Radiobiological Research Institute. The site includes information on the latest developments, products, resources, research approach, strategy, research teams/staff, outreach training, professional meetings, and links to related sites.

Defense Advanced Research Projects Agency (DARPA)

<http://www.darpa.mil/>

Home Page of DARPA describes basic and applied research and development projects being performed for DoD. Link to the Defense Sciences Office (DSO) provides a link to the Biological Warfare Defense (BWD) Program (<http://www.bwd.org/>).

Joint Service Tech Base Planning for CB Defense

<http://www.techbase.tasc.com/techbase/>

This site is the Internet Center for all FY98 CB Tech Base Planning. It provides technology roadmaps and information about the Joint Service tech base business areas, solicitations, and points of contact. Also links to the Joint Science and Technology Panel for Chemical/Biological Defense (JSTPCBD).

Defense Special Weapons Agency

<http://www.dna.mil/>

Provides information on DSWA's Mission, Director, Programs, Procurement Opportunities, and the Defense Nuclear Weapons School.

Program Manager for Chemical Demilitarization

<http://www-pmcd.apgea.army.mil/>

Provides information on the Chemical Stockpile Disposal Program, the Non-Stockpile Chemical Materiel Program, the Alternative Technologies Program, the Chemical Stockpile Emergency Preparedness Program, and the Cooperative Threat Reduction Office.

ACDA Home Page

<http://www.acda.gov/>

Home page of the Arms Control and Disarmament Agency. Provides information on nuclear, biological, and chemical weapons and how their delivery systems pose a major threat to our security and that of our allies.

Cal Poly CBW Page

<http://www.calpoly.edu/~drjones/chemwarf.html>

This page was developed by the students in Chem 450 at Cal Poly, SLO, during Spring, 1996. The goal is to provide an overview of chemical and biological warfare, weapons, and efforts to outlaw them. This site provides a comprehensive overview of numerous aspects of chemical and biological warfare and defenses.

NBC Industry Group

<http://www.erols.com/nbcgroup/>

Home page of the NBC Industry Group, an association of organizations supporting NBC defense, domestic preparedness, and the Chemical Weapons Convention.

(INTENTIONALLY BLANK.)

ANNEX I

ACRONYMS AND ABBREVIATIONS

(INTENTIONALLY BLANK.)

-A-

AARS - Advanced Airborne Radiac System
AAAV - Advanced Amphibious Assault Vehicle
ACADA - Automatic Chemical Agent Detector
ACPG - Advanced Chemical Protective Garment
ACPLA - agent containing particle per liter of air
ACPM - Aircrew Protective Mask
ACT - Arms Control Technology
ACTD - Advanced Concept Technology Demonstration
ADBO - Advanced Battle Dress Overgarment
ADCPE - Advance Deployable Collective Protective Equipment
ADP - Adenosine Diphosphate
ADS - Area Detection System
AERP - Aircrew Eye/Respiratory Protection
AFRRI - Armed Forces Radiobiology Research Institute
AG - Australia Group
AICPS - Advanced Integrated Collective Protective System
AIDECONS - Aircraft Interior Decontamination System
AIDET - Aircraft Interior Detector
AMAD - Automatic Mustard Agent Detector
AMC - U.S. Army Materiel Command
AMEDDC&S - Army Medical Department Center and School
AN/VDR-13 - Compact, digital whole body radiation meter
AN/VDR-2 - Portable dose-rate gamma/beta radiation meter
ANBACIS - Automatic Nuclear, Biological, and Chemical Information System
ARS - Acoustic Resonance Spectroscopy
ASA(RDA) - Assistant Secretary of the Army for Research, Development and Acquisition
ASBREM - Armed Services Biomedical Research Evaluation and Management
ASD(HA) - Assistant Secretary of Defense for Health Affairs
ATD - Advanced Technology Demonstration
ATP - Adenosine Triphosphate
ATSD(NCB) - Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs
AUIB - Aircrew Uniformed Integrated Battlefield
AVAD - Automatic Vapor Agent Detector

-B-

B. anthracis - *Bacillus anthracis*
BADs - Biological Agent Detection System
BD - biological detector (also, biological defense)

BDA - Bilateral Destruction Agreement
BDWS - Biological Detector and Warning System
BES - Budget Estimate Submission
BIDS - Biological Integrated Detection System
BMDO - Ballistic Missile Defense Organization
BNCOC - Basic Non-Commissioned Officer Course
BOG - Board of Governors
BoNT - Botulinum Neurotoxin
BoNT/A - Botulinum Neurotoxin A
BoNT/B - Botulinum Neurotoxin B
BRAC - Base Realignment and Closure
BW - biological warfare
BWC - Biological Weapons Convention

-C-

CAM - Chemical Agent Monitor
CAMIN - Chemical Agent Management Information Network
CANA - Convulsant Antidote, Nerve Agent autoinjector
CANE - Combined Arms in a Nuclear/Chemical Environment
CARDS- Chemical Agent Remote Detection System
CAWM - Chemical Agent Water Monitor
CB - chemical and biological (also C/B)
CBASK - Chemical Biological Agent Sample Kit
CBAWM - CB Agent Water Monitor
CBD - chemical and biological defense
CBDCOM - Chemical Biological Defense Command (U.S. Army)
CBMS - CB mass spectrometer
CBPS- CB Protective Shelter
CBR - chemical, biological, and radiological
CBR - chemical, biological, radiological
CBSD - Chemical Biological Stand-off Detector
CBW - chemical and biological warfare
CDE - Chemical Defense Equipment
CDEPAT - Chemical Defense Equipment Process Action Team
CD-ROM - Compact Disk - Read Only Memory
CDC - Centers for Disease Control and Prevention
CDTF - Chemical Defense Training Facility (at the U.S. Army Chemical School)
CFM - cubic feet per minute
CHATH - Chemically/Biologically Hardened Air Transportable Hospital
CIP - CANE Implementation Plan
CM - Chloroform-Methanol
CMAD - Chemical Miniature Agent Detector
CMR - Chloroform-Methanol Residue
CNS - Central Nervous System

CP - chemical protective (also, collective protection, or counterproliferation)
CPE - Collective Protection Equipment
CPS - Collective Protection System
CPU - Chemical Protective Undergarment
CRP - Critical Reagents Program
CTR - Cooperative Threat Reduction
CVAA - Chlorovinylarsenous Acid
CW - Chemical Warfare
CWC - Chemical Weapons Convention
CWCIMS - Chemical Weapons Convention Information Management System
CWCIWG - Chemical Weapons Convention Implementation Working Group
CWDD - Chemical Warfare Directional Detector (AN/KAS-1A)
CWDSO - Chemical Weapons Destruction Support Office
CWICS - Chemical Weapons Interior Compartment System

-D-

DAB - Defense Acquisition Board
DAP - Decontaminating Apparatus Portable
DARPA - Defense Advanced Research Projects Agency
DATSD (CP/CBD) - Deputy Assistant to the Secretary of Defense for Counterproliferation and Chemical/Biological Defense
DBOF - Defense Business Operations Fund
DCSOPS - U.S. Army Deputy Chief of Staff for Operations
DDR&E - Director, Defense Research and Engineering
DEPMEDS - CB Protected Deployable Medical Systems
DERP - Disposable Eye Respiratory Protection
DGA - Deglycosylated Ricin A-Chain
DISC/DIAL - Differential Scattering/Differential Absorption of Light
DIW - Detection, Identification and Warning
DLA - Defense Logistics Agency
DMARC - Defense Medical Acquisition Review Committee
DMROC - Defense Medical Requirements Oversight Committee
DNA - Deoxyribonucleic Acid
DoD - Department of Defense
DPG - Defense Planning Guidance; Also Dugway Proving Grounds
DPSC - Defense Personnel Support Center
DRB - Defense Review Board
DS - Distributed Simulation
DS2 - Decontamination Solution 2

DSTAG - Defense S&T Advisory Group
DSWA - Defense Special Weapons Agency
DTIRP - Defense Technical Inspection Readiness Program
DTO - Defense Technology Objective

-E-

E. coli - *Escherichia coli*
ECL - Electrochemiluminescence
EEE - Eastern Equine Encephalomyelitis
ELISA - Enzyme-Linked Immunosorbent Assay
EOD - Explosive Ordnance Disposal
ERDEC - Edgewood Research, Development, and Engineering Center (U.S. Army)

-F-

F1 - Fraction 1
F1-V - Fraction 1 - "V" Antigen
Fab - Fragment Antigen Binding
Fc - Fragment Crystallizable
FDA - Food and Drug Administration
FFENS - CB Protective Firefighter Ensemble
FIS-C - Firefighter Suit -Combat
FM - Field Manual
FUE - First Unit Equipped
FY - fiscal year
FY97 - Fiscal Year 1997
FYDP - Future Years Defense Plan

-G-

GA - tabun, a nerve agent
GB - sarin, a nerve agent
GC - Gas Chromatograph
GCE - Ground Crew Ensemble
GD - soman, a nerve agent
GMP - Good Manufacturing Practice
GPFU - Gas Particulate Filter Unit
GPM - gallons per minute

-H-

HAZWARN - NBC Hazardous Warning System
hBuChE - Human Butrylcholinesterase
Hc - Heavy Chain
hCaE - Human Carboxylesterase
HD - sulfur mustard, a blister agent
HMMWV - High Mobility Multipurpose Wheeled Vehicle

-I-

IBAD - Interim Biological Agent Detector
IBMC - Industrial Base Maintenance Contract
ICAM - Improved Chemical Agent Detector
ICDS - Improved Chemical Detection System
IDLH - Immediate Danger to Life and Health

IL CBDWS - In-Line Chemical Biological Defense Water System
IMS - Ion Mobility Spectroscopy
IND - Investigational New Drug
IPDS - Improved (chemical) Point Detection System
IPE - Individual Protective Equipment
ISD - Individual Soldier Detector
ITAP - Improved Toxicological Agent Protective Ensemble
IVD - Individual Vapor Detector

-J-

JBPDS - Joint Biological Point Detection System
JBREWS - Joint Biological Remote Early Warning System
JBUD - Joint Biological Universal Detector
JCHEMRATES - Joint Chemical Defense Equipment Consumption Rates
JCPI - Joint Collective Protection Improvement
JCS - Joint Chiefs of Staff
JDDAP - Joint Doctrine Development Action Plan
JFIRE - Joint CB Protective Firefighter Suit
JFOC - Joint Future Operational Capabilities
JMNS - Joint Mission Need Statement
JNBCDB - Joint NBC Defense Board
JORD - Joint Operational Requirements Document
JPACE - Joint Protective Aircrew Ensemble
JPCBD - Joint Panel for Chemical and Biological Defense
JPO-BD - Joint Program Office for Biological Defense
JSA - Joint Service Agreement
JSAM - Joint Service Aviation Mask
JSCBIS - Joint Service Chemical Biological Information System
JSCWILD - Joint Service Chemical Warning and Identification LIDAR Detector
JSGPM - Joint Service General Purpose Mask
JSIG - Joint Service Integration Group
JSLIST - Joint Service Lightweight Integrated Technology (individual protection)
JSTPCBD - Joint Science and Technology Panel for Chemical/Biological Defense
JSMG - Joint Service Materiel Group
JTC - Joint Training Council
JTCG - Joint Technology Coordinating Group
JWARN - Joint Warning and Reporting Network
JWCA - Joint Warfighting Capability Assessment

-L-

L - lewisite, a vesicant agent
LAM - Louisiana Maneuvers
LCBPG - Lightweight CB Protective Garment

LD₅₀ - Median Lethal Dose
LDS - Lightweight Decontamination System
LIDAR - LIght Detection And Ranging
LPS - Lipopolysaccharide
LRBSDS - Long-Range Biological Stand-off Detection System
LRIP - Low Rate Initial Production
LSCAD - Lightweight Stand-off Chemical Agent Detector
LSCD - Laser Stand-off Chemical Detector
LSP - Logistics Support Plan
LWRS - Lightweight Reconnaissance System

-M-

M&S - Modeling and Simulation
MACOM - Major Command
MAITS - Mobility Automated Inventory Tracking System
MAJCOM - Major Command
MANAA - Medical Aerosolized Nerve Agent Antidote
MBDRP - Medical Biological Defense Research Program
MBPI - Michigan Biologic Products Institute
MCDRP - Medical Chemical Defense Research Program
MCBDRP - Medical Chemical and Biological Defense Research Program
MCU-2A/P - a chemical protective mask
MDS - Modular Decontamination System
MED - Medical
METL - Mission Essential Task List
MFR - Multi-Function Radiac Set
MFVS - Mask Fit Validation System
MICAD - Multipurpose Integrated Chemical Agent Detector
MNDRP - Medical Nuclear Defense Research Program
MNS - Mission Needs Statement
MOP - Memorandum of Policy
MOPP - Mission Oriented Protective Posture
MOS - Military Occupational Specialist
MPSP - Medical Program Sub-Panel
MRC - Major Regional Conflict
MS - Mass Spectrometer
MULO - Multi-purpose Overboot

-N-

NAAK - Nerve Agent Antidote Kit
NAAS - Nerve Agent Antidote System
NAEDS - Non-Aqueous Equipment Decontamination System
NAPP - Nerve Agent Pyridostigmine Pretreatment
NATO - North Atlantic Treaty Organization

NBC - Nuclear, Biological, and Chemical
NBCRS - NBC Reconnaissance System (Fox
Vehicle)
NCO - Non-Commissioned Officer
NDA - New Drug Application
NDE - Non-Destructive Evaluation
NDI - Non-Developmental Item
NICP - National Inventory Control Points
NIEX - No-Notice Interoperability Exercise
NRDEC - Natick Research, Development, and
Engineering Center (U.S. Army)
NSN - National Stock Number

-O-

OMA - Operations & Maintenance, Army
OPA - Other Procurement, Army
OPCW - Organization for the Prohibition of
Chemical Weapons (in The Hague)
ORD - Operational Requirements Document
OSD - Office of the Secretary of Defense
OSIA - On-Site Inspection Agency

-P-

P3I - Pre-Planned Program Improvement
PA - Protective Antigen
PAC - physiologically active compound
PATS - Protective Assessment Test System
PB - President's Budget
PBT - pyridostigmine bromide tablets
PCR - polymerase chain reaction
PDDA - Power Driven Decontamination Apparatus
PDRR - Program Definition and Risk Reduction
PF - Positive Force Exercise
PICS - Personal Ice Cooling System
PL 130-160 - Public Law 103-160, The National
Defense Authorization Act of FY94
POM - Program Objectives Memorandum
PR - Positive Response Exercise

-Q-

QDR - Quadrennial Review
QRR - Qualitative Research Requirements
QSTAG - Quadripartite Standardization
Agreement

-R-

R&D - Research and Development
RAD - Radiological
RAM - Reliability, availability, and maintainability
RDA - Research, Development, and Acquisition
RDTE (Also, RDT&E) - Research, Development,
Test and Evaluation
RESPO21 - 21st Century Respiratory Protection
System

RF - Russian Federation
RMC - Regional Medical Commands
RSCAAL - Remote Sensing Chemical Agent
Alarm
rTSP - Reactive Topical Skin Protectant

-S-

S&T - Science and Technology
SACPS - Selected Area Collective Protection
System
SALAD - Shipboard Automatic Liquid Agent
Detector
Saratoga - a CB protective overgarment
SARDA - Assistant Secretary of the Army for
Research, Development, and Acquisition
SAW - Surface Acoustic Wave
SBDS - Strategic Bio-Detection System
SBSS - Standard Base Supply System
SCALP - Suit Contamination Avoidance Liquid
Protection
SCAMP - Shipboard Chemical Agent Monitor
Portable
SD - Stand-off Detector
SD/ASM - Stand-off Detector for Armor System
Modernization
SEA - Staphylococcal Enterotoxin A
SEB - Staphylococcal Enterotoxin B
SFAI - Swept Frequency Acoustic Interferometry
SICPS - Standardized Integrated Command Post
System and Tent
SOF - Special Operations Forces
SOF CAS - Special Operation Forces Chemical
Agent Detector
SORTS - Joint Status of Resources and Training
System
SPA - Surface Protein Antigen
SPR - Serial Probe Recognition
SRT - Specialty Response Team
STB - Supertropical Bleach
STEPO - Self-Contained Toxic Environment
Protective Outfit
STEPO-I - Interim Self-Contained Toxic
Environment Protective Outfit

-T-

TARA - Technology Area Review and Assessment
TAV - Total Asset Visibility
TB - Technical Bulletin
TRADOC - U.S. Army Training and Doctrine
Command
TSP - Topical Skin Protectant
TWA - Time Weighted Average

-U-

USAMMA - U.S. Army Medical Materiel Agency
USANCA - United States Army Nuclear and
Chemical Agency
USAMRICD - U.S. Army Medical Research
Institute of Chemical Defense
USAMRIID - U.S. Army Medical Research
Institute of Infectious Diseases
USAMRMC - U.S. Army Medical Research and
Materiel Command
USD(A&T) - Undersecretary of Defense
(Acquisition and Technology)
USMC - United States Marines Corps
USUHS - Uniformed Services University of the
Health Sciences

-V-

VCA - Voice Communication Adapter
VEE - Venezuelan equine encephalomyelitis
VPU - Vapor Protective Undergarment
VX - a nerve agent

-W-

WCF - Working Capital Fund
WEE - Western Equine Encephalomyelitis
WMD - weapons of mass destruction
WRAIR - Walter Reed Army Institute of Research
WRSI - War Reserves Secondary Items

(INTENTIONALLY BLANK)